



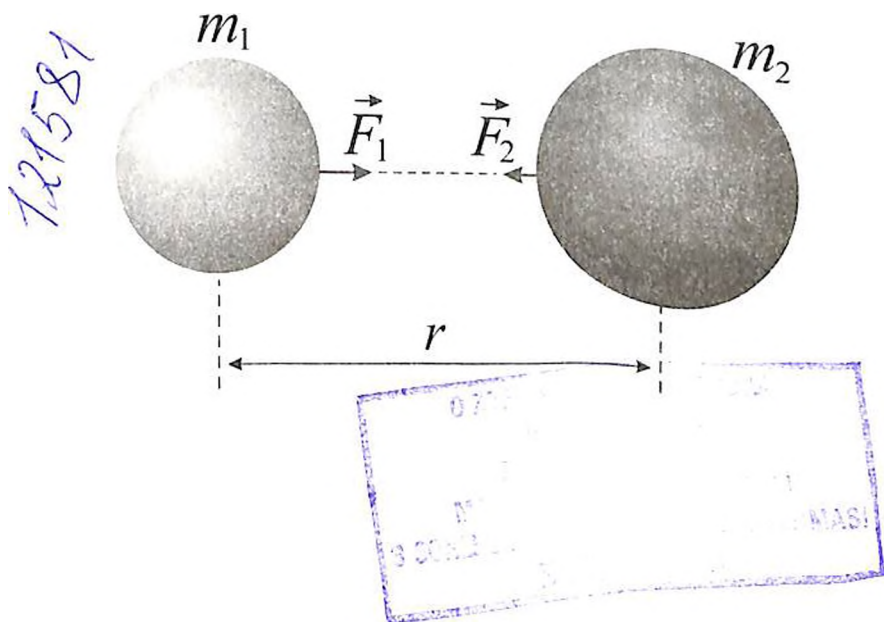
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✓ 22.3
M 96

FIZIKADAN TESTLAR VA ULARNING YECHIMI

*Oliy o'quv yurtlariga kiruvchi abituriyentlar
uchun qo'llanma*

(I qism)



TOSHKENT «O'ZBEKISTON» 2016

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Ushbu II qismdan iborat kitobda O'zbekiston Respublikasi Davlat test markazi tomonidan 1996–2003-yillarda chop etilgan «Axborotnoma» jurnalidagi fizika faniga tegishli test topshiriqlarining deyarli barchasi qamrab olingan. Qo'llanmada umumiy fizika kursidan Davlat ta'lim standarti va o'quv dasturiga mos keladigan testlar yechimlari bilan keltirilgan.

Mazkur kitob fizika fani o'qituvchilari va o'quvchilariga ayni fanni o'qitishda hamda o'rganishlarida har tomonlama amaliy yordam beradi.

SO'ZBOSHI

Ma'lumki, har qanday jamiyatda texnika taraqqiyoti kundalik turmush tarzidan tortib yuqori avtomatlashgan ishlab chiqarish jarayonlarini bajarishgacha fizika fani qonuniyatlarisiz amalga oshmaydi. Shu nuqtai nazardan olib qaraganda, fizika fanini alohida o'qitish, amaliyotga tatbiq etishga e'tibor berish shu kunning muhim vazifasi hisoblanadi.

Oliy o'quv yurtlariga kirish uchun fizikadan test sinovlari topshirayotgan abituriyentlarning aksariyati bu fandan yetarli ko'rsatkichlarga ega bo'lishi zarurligini ko'p yillik tahlillar tasdiqlaydi. Shunday ekan, fizika ham boshqa fanlar qatori abituriyentning ball to'plashida muhim ahamiyat kasb etadi. Biroq tan olib aytish kerakki, umumiy o'rta ta'lim, o'rta maxsus va kasb-hunar ta'limi kollejlarida fizika fanidan test topshiriqlarini bajarishda yordam beradigan to'laqonli va keng qamrovli o'quv metodik manbalar yetishmaydi. Shu sababli ham ushbu qo'llanmada o'quvchilarning bilim darajasi, tafakkur qobiliyati, mantiqiy fikrlash imkoniyatlari, fakt va ma'lumotlarni yaxlit, uzviy va uzluksiz tahlil qilish va fikr-mulohaza yuritish borasidagi faoliyatlarini aniqlashga yordam beruvchi test topshiriqlari keltirildi.

Ushbu qo'llanmada O'zbekiston Respublikasi Davlat test markazi tomonidan 1996–2003-yillarda chop etilgan «Axborotnoma» jurnalidagi fizika faniga tegishli test topshiriqlarining deyarli barchasi qamrab olingan. Qo'llanmada umumiy fizika kursidan Davlat ta'lim standarti va o'quv dasturiga mos keladigan testlar yechimlari bilan keltirilgan.

O'quv qo'llanmaga kiritilgan testlarning o'ziga xos va boshqa amaldagi qo'llanmalardan farqli jihati shundaki, tanlangan testlar to'rtta darajali (sodda, o'rtacha, qiyin, murakkab) bo'lib, bular o'quvchilarning yondashuvlarini xilma-xillashtirishga, ularning masalalar yechishga bo'lgan intilishlarini kuchaytirishga yordam beradi. O'quvchilarning mantiqiy fikrlashini faollashtirib, nazariy mazmundagi masalalarni amaliyotga tatbiq qilishga o'rgatadi.

Qo'llanmada mexanikaning kinematika va dinamika asoslari, mexanikada saqlanish qonunlari, molekular fizika, termodinamika, elektrodinamika, tebranish va to'liqlar, geometrik va to'liq optikasi, kvant optikasi, atom va yadro fizikasiga

doir testlar kiritilgan. Har bir bo'lim va mavzu uchun nazorat test topshiriqlarining yechimlari sodda tarzda izohlar bilan berilgan.

Qo'llanma ikki qismdan iborat, uning 1-qismida mexanika va molekular fizikaga doir testlar, 2-qismida esa elektrodinamika, tebranish va to'lqinlar, optika, atom va yadro fizikasiga doir test va masalalar izohli yechimlari bilan keltirilgan.

Masalalarni yechishda o'quvchilar, asosan Xalqaro birliklar sistemasi SI dan foydalanishlari nazarda tutilgan. Tanlangan masalalar hajmi va mazmuni jihatdan xalq xo'jaligining barcha tarmoqlarini qamrab olgan. Hozirgi zamon komputer, axborot-kommunikatsiya, nanotexnologiyalarini fizika fanining yutuqlarisiz tasavvur qilish qiyin. Fizika fanini o'quvchilarga o'rgatish saviyasini yuqori ko'tarishda asosiy jarayon, bu – berilgan testlarni qisqa muddatda aniq va to'g'ri yechish hisoblanadi. Shularni nazarga olgan holda bu ishda sizga omad tilaymiz.

Mualliflar

I bo'lim. MEXANIKA

I BOB. KINEMATIKA

1-§. Mexanik harakat.

Moddiy nuqta, ko'chish, yo'l tushunchalari

1.1. To'g'ri so'zni qo'yib, gapni to'ldiring: moddiy nuqtaning o'z harakati davomida qoldirgan izi deb ataladi.

- 1) ko'chish; 2) traektoriya; 3) yo'l
A) 1 B) 2 C) 3 D) 1, 2, 3

Moddiy nuqtaning o'z harakati davomida qoldirgan izi **trayektoriya** deb ataladi.

Javob: B) 2

1.2. Jumlaning mazmuniga mos so'zni qo'yib, gapni to'ldiring. Harakati o'rganilayotgan jismning o'lchami va shakli kuzatilayotgan sharoitda hech qanday ahamiyatga ega bo'lmasa, bunday jism deb aytiladi.

- A) qattiq jism B) moddiy nuqta
C) elastik jism D) qo'zg'almas jism

Harakati o'rganilayotgan jismning o'lchami va shakli kuzatilayotgan sharoitda hech qanday ahamiyatga ega bo'lmasa, bunday jism **moddiy nuqta** deb aytiladi.

Javob: B) moddiy nuqta

1.3. Poyezd Samarqanddan Toshkentga keldi. Bunda lokomotiv bosib o'tgan yo'l bilan oxirgi vagon bosib o'tgan yo'l baravarmi? Ushbu masalada poyezdni moddiy nuqta deb qarash mumkinmi?

- A) ha; mumkin B) yo'q; mumkin emas
C) yo'q; mumkin D) ha; mumkin emas

Lokomotiv va oxirgi vagon bosib o'tgan yo'li teng. Chunki lokomotiv va oxirgi vagon bir paytda bir xil tezlikda harakat boshlaydi va bir paytda to'xtaydi.

Poyezdning o'lchami Samarqanddan Toshkentgacha bo'lgan masofadan juda kichik bo'lganligi uchun uni moddiy nuqta deb qarash mumkin.

Javob: A) ha; mumkin.

1.4. Uzunligi 450 m ga teng bo'lgan passajir poyezdi 300 m uzunlikdagi ko'prikdan o'tdi. Bunda poyezdning bosib o'tgan yo'li nimaga teng?

- A) 450 m B) 300 m C) 150 m D) 750 m

Berilgan:

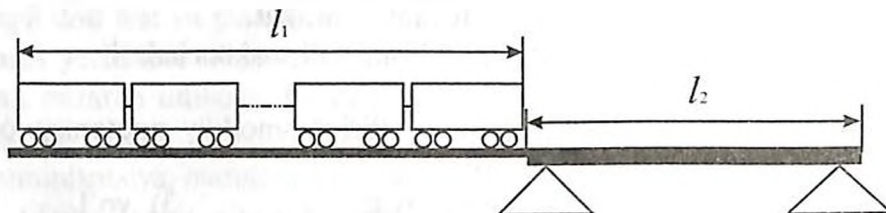
$$l_1 = 450 \text{ m}$$

$$l_2 = 300 \text{ m}$$

$$S = ?$$

Yechilishi: l_1 uzunlikdagi poyezd l_2 uzunlikdagi ko'prikdan to'liq o'tib olishi uchun $S = l_1 + l_2$ yo'lni bosib o'tishi kerak.

$$S = 450 + 300 = 750 \text{ m.}$$



Javob: D) 750 m.

1.5. Sportchi uzunligi 400 m bo'lgan yugurish yo'lakchasini 2 marta aylanib chiqib, start berilgan joyga qaytib keldi. Bu harakatda sportchining bosib o'tgan yo'li L (m) va uning ko'chish moduli S (m) nimaga teng?

A) $L = 800$; $S = 400$

B) $L = 400$; $S = 800$

C) $L = 800$; $S = 0$

D) $L = S = 800$

Berilgan:

$$l = 400 \text{ m}$$

$$n = 2$$

$$L = ? \quad S = ?$$

Yechilishi: bu masalada sportchi harakatni A nuqtadan boshlab, yana A nuqtaga yetib kelyapti. Demak, ko'chishi nolga teng:

$$|\vec{S}| = 0.$$

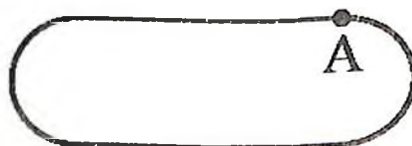
Sportchi harakati davomida 400 m uzunlikdagi yugurish yo'lakasini n marta aylanib o'tyapti. Umumiy bosib o'tgan yo'l quyidagicha bo'ladi.

$$L = n \cdot l$$

bu yerda n — aylanishlar soni.

$$L = 2 \cdot 400 = 800 \text{ m.}$$

Javob: C) $L = 800$; $S = 0$.



1.6. Jism gorizontga 60° burchak ostida harakatlanib, qiyalik bo'ylab 300 m yurib yuqoriga ko'tarildi. Jismning gorizonttal yo'nalishdagi ko'chishini aniqlang (m).

A) 70

B) 150

C) 280

D) 346

Berilgan:

$$\alpha = 60^\circ$$

$$S = 300 \text{ m}$$

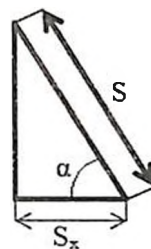
$$S_x = ?$$

Yechilishi: jism qiya tekislik bo'ylab harakatlanganda gorizonttal va vertikal bo'ylab, boshlang'ich vaziyatga nisbatan ko'chadi. Jismning gorizonttal ko'chishini to'g'ri burchakli uch-burchak uchun burchak kosinusi ta'rifiga asosan topamiz, ya'ni

$$\cos \alpha = \frac{S_x}{S} \rightarrow S_x = S \cdot \cos \alpha$$

$$S_x = 300 \cdot \cos 60^\circ = 300 \cdot 0,5 = 150 \text{ m}$$

Javob: B) 150.



1.7. Tennis koptogi 3 m balandlikdan yerga tushdi va yerdan qaytib ko'tarilayotganda, 70 sm balandlikda tutib olindi. Koptokning yo'li va ko'chishi-ning modulini toping.

- A) 3 m; 70 sm B) 3,7 m; 2,3 m C) 3,07 m; 2,03 m D) 3 m; 2,3 m

Berilgan:

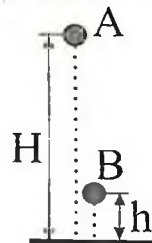
$$H = 3 \text{ m}$$

$$h = 70 \text{ sm} = 0,7 \text{ m}$$

$$L = ? \quad S = ?$$

Yechilishi: jism H balandlikdan pastga tushib, yana qaytib h balandlikka tepaga chiqyapti. Bu holat davomida umumiy bosib o'tilgan masofa

$$L = H + h = 3 + 0,7 = 3,7 \text{ m}$$



Boshlang'ich vaziyatda jism 3 m balandlikda turgan edi va keyin yerga urilib qaytishda yerdan 0,7 m balandlikda ushlab olindi. Bu ikki nuqtalar orasidagi masofa quyidagiga teng.

$$|\vec{S}| = H - h = 3 - 0,7 = 2,3 \text{ m}$$

Javob: B) 3,7 m; 2,3 m

1.8. Velosipedchi to'g'ri yo'l bo'ylab g'arbga tomon 7 km yurdi, so'ngra qaytib sharqqa tomon yana 3 km yo'l yurdi. Velosipedchining yurgan yo'li L(km) va ko'chish moduli S (km) nimaga teng?

- A) L = 10; S = 4 B) L = 10; S = 10
C) L = 3; S = 4 D) L = 4; S = 3

Berilgan:

$$S_1 = 7 \text{ km}$$

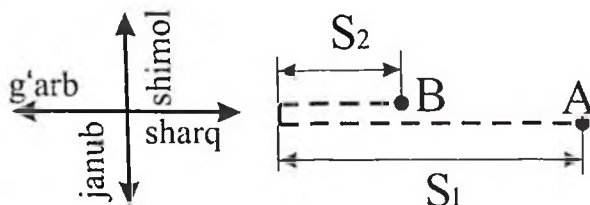
$$S_2 = 3 \text{ km}$$

$$L = ? \quad S = ?$$

Yechilishi: bundan keyingi shunga o'xshash masalalarni tasavvur qilish qiyin bo'lmasligi uchun dunyo tomonlariga belgilash kiritamiz.

Velosipedning jami o'tgan yo'li
 $L = S_1 + S_2 = 7 + 3 = 10 \text{ km}$ ga teng.
 Ko'chishi esa $S = S_1 - S_2 = 4 \text{ km}$

Javob: A) L = 10; S = 4



1.9. Qanday harakatda jismning o'tgan yo'li ko'chish moduliga teng bo'ladi?

- A) tekis harakatda B) egri chiziqli harakatda
C) aylanma harakatda D) to'g'ri chiziqli harakatda

Faqat to'g'ri chiziqli harakatda jismning bosib o'tgan yo'li, ko'chish moduliga teng bo'ladi.

Javob: D) to'g'ri chiziqli harakatda

1.10. Qaysi holda jismni moddiy nuqta deb qarash mumkin? 1. Poyezdni ko'prikdan o'tishida; 2. Elektronni yadro atrofidagi harakatida; 3. Raketani orbitaga ko'tarilishida.

- A) 2,3 B) 2 C) 3 D) 1,2,3

Harakati o'rganilayotgan jismning o'lchami va shakli kuzatilayotgan sharoitda hech qanday ahamiyatga ega bo'lmasa, bunday jism **moddiy nuqta** deb aytiladi.

1) Poyezdning uzunligi ko'prik uzunligiga yaqin bo'lgani uchun, bu holda poyezdni moddiy nuqta deb qarab bo'lmaydi.

2) yadroning o'lchami va massasi elektronning o'lchami va massasidan ancha katta bo'lganligi uchun, elektronni moddiy nuqta deb olish mumkin.

3) Raketaning orbitaga ko'tarilguncha bosib o'tgan masofasi uning o'lchamidan ancha katta bo'lganligi uchun, raketani bu yo'lda moddiy nuqta deb qarash mumkin.

Javob: A) 2,3

1.11. Chana gorizont bilan 45° burchak hosil qilgan tepalikda 100 m masofani bosib o'tdi. Chananing vertikal va gorizontalar yo'nalishlardagi ko'chishlarini toping (m).

- A) 71; 100 B) 71; 71 C) 100; 7,1 D) 50; 50

Berilgan:

$$\alpha = 45^\circ$$

$$S = 100 \text{ m}$$

$$\frac{S_x = ?}{S_y = ?}$$

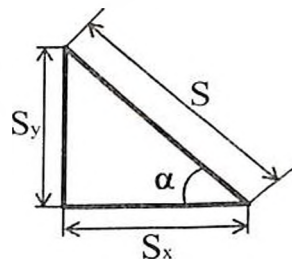
Yechilishi: masalani ishlashda to'g'ri burchakli uchburchak uchun burchak kosinusi va sinusi ifodalaridan foydalanamiz:

Burchakka yopishgan katet S_x ning gipatenuza S ga nisbati shu burchakning kosinusiga teng.

$$\cos \alpha = \frac{S_x}{S} \Rightarrow S_x = S \cdot \cos \alpha$$

Burchak qarshisidagi katet S_y ning gipatenuza S ga nisbati shu burchakning sinusiga teng.

$$\sin \alpha = \frac{S_y}{S} \Rightarrow S_y = S \cdot \sin \alpha$$



$$S_x = 100 \cdot \cos 45^\circ = 100 \cdot \frac{\sqrt{2}}{2} \approx 71 \text{ m}$$

$$S_y = 100 \cdot \sin 45^\circ = 100 \cdot \frac{\sqrt{2}}{2} \approx 71 \text{ m}$$

Javob: B) 71; 71

1.12. Havo shari qandaydir balandlikka vertikal ko'tarilgach, shamol uni gorizontaal yo'nalishda 600 m masofaga uchirib ketdi. Agar havo sharining ko'chishi 1 km bo'lsa, havo sharining o'tgan yo'lini aniqlang (m).

A) 1400

B) 400

C) 600

D) 1600

Berilgan:

$$l = 600 \text{ m}$$

$$S = 1 \text{ km} = 1000 \text{ m}$$

$$L = ?$$

Yechilishi: havo sharining bosib o'tgan masofasini hisoblab topish uchun, avval havo shari qanday balandlikka ko'tarilganini topish kerak. Buning uchun Pifagor teoremasidan foydalanamiz:

Katetlar kvadratlarining yig'indisi gipatenuzaning kvadratiga teng.

$$S^2 = l^2 + h^2 \Rightarrow h = \sqrt{S^2 - l^2}$$

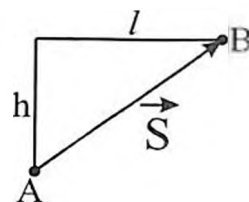
$$h = \sqrt{1000^2 - 600^2} = 800 \text{ m}$$

Havo sharining bosib o'tilgan yo'li L uning vertikal va gorizontaal yo'nalishlarda o'tgan masofalari h va l larning yig'indisiga tengdir.

$$L = h + l$$

$$L = 800 + 600 = 1400 \text{ m}$$

Javob: A) 1400.



1.13. Havo shari vertikal yo'nalishda 200 m balandlikka ko'tarilgach, shamol uni gorizontaal yo'nalishda 150 m masofaga eltib bordi. Havo sharining o'tgan yo'li (m) va ko'chish modulini (m) toping.

A) 350; 250

B) 350; 50

C) 350; 200

D) 200; 150

Berilgan:

$$h = 200 \text{ m}$$

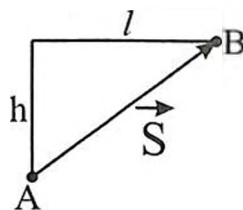
$$l = 150 \text{ m}$$

$$L = ? \quad S = ?$$

Yechilishi: Havo sharining bosib o'tgan yo'li L uning vertikal va gorizontaal yo'nalishlarda o'tgan masofalari h va l larning yig'indisiga tengdir. $L = h + l$

$$L = h + l = 150 + 200 = 350 \text{ m}$$

Havo sharining ko'chish modulini Pifagor teoremasidan foydalanib topamiz.



Ya'ni gipatenuza S ning kvadrati katetlar (h va l larning) kvadratlarining yig'indisiga teng.

$$S^2 = l^2 + h^2.$$

$$S = \sqrt{h^2 + l^2} = \sqrt{200^2 + 150^2} = 250 \text{ m}$$

Javob: A) 350; 250

1.14. Sportchi shimol tomon harakatlanib, 5 km masofani bosib o'tgach, sharq tomonga burilib 4 km yurdi. So'ngra janub tomonga burilib, yana 8 km masofani o'tdi. Sportchining o'tgan yo'lini (km) va ko'chish modulini (km) toping.

A) 17; 4

B) 17; 5

C) 17; 7

D) 9; 8

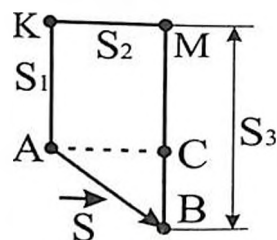
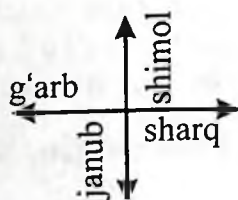
Berilgan:

$$S_1 = 5 \text{ km} = 5000 \text{ m}$$

$$S_2 = 4 \text{ km} = 4000 \text{ m}$$

$$S_3 = 8 \text{ km} = 8000 \text{ m}$$

$$L = ? \quad S = ?$$



Yechilishi: dunyo tomonlarini rasmda ko'rsatilgandek belgilab chizma chizamiz. Bunda yo'l quyidagicha topiladi:

$$L = S_1 + S_2 + S_3 = 5 + 4 + 8 = 17 \text{ km}$$

Ko'chish esa AB oraliqdagi S masofaga teng. AC oraliq S_2 ga teng bo'lsa, BC oraliq ($S_3 - S_1$) ga teng. Demak, S ni Pifagor teoremasiga asosan quyidagicha topamiz:

$$S = \sqrt{S_2^2 + (S_3 - S_1)^2} = \sqrt{4^2 + (8 - 5)^2} = 5 \text{ km}.$$

Javob: B) 17; 5.

1.15. Samolyot avval shimol tomonga 40 km, so'ngra sharq tomonga 30 km masofaga parvoz qildi. Uning ko'chishini toping.

A) 30 km

B) 40 km

C) 50 km

D) 70 km

Berilgan:

$$S_1 = 40 \text{ km} = 40000 \text{ m}$$

$$S_2 = 30 \text{ km} = 30000 \text{ m}$$

$$S = ?$$

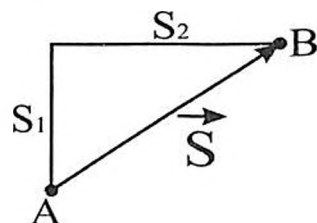
Yechilishi: ko'chishi Pifagor teoremasiga asosan

$$S = \sqrt{S_1^2 + S_2^2}$$

ga teng.

$$S = \sqrt{40000^2 + 30000^2} = 50000 \text{ m} = 50 \text{ km}$$

Javob: C) 50 km



1.16. Jism radiusi 5 m bo'lgan aylana trayektoriya bo'ylab o'zgarmas 8 m/s tezlik bilan harakatlanmoqda. Jismning o'tgan yo'li 314 m ga teng bo'lishi uchun u aylanani necha marta o'tishi kerak?

- A) 10 B) 5 C) 8 D) 6

Berilgan:

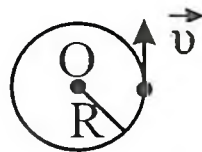
$$R = 5 \text{ m}$$

$$v = 8 \text{ m/s}$$

$$S = 314 \text{ m}$$

$$N = ?$$

Yechilishi: bizga ma'lumki, aylana uzunligi $l = 2\pi R$ ifodadan aniqlanadi. Demak, jism aylanani bir marta aylanganda shu masofani bosib o'tadi, ya'ni, $S_1 = l$. Agar jism aylanani N marta aylangan bo'lsa, $S = N \cdot l$ bo'ladi.



$$N = \frac{S}{l} = \frac{S}{2\pi R} = \frac{314}{2 \cdot 3,14 \cdot 5} = 10$$

$N=10$ marta aylanishi kerak.

Javob: A) 10.

1.17. Quyidagi hollarning qaysilarida jismlarni moddiy nuqta deb hisoblash mumkin: 1) Yer Quyosh atrofida orbita bo'ylab harakat qilmoqda; 2) poyezd ko'prik ustidan o'tmoqda; 3) tokar stanogida detal yasamoqda; 4) Toshkent-Moskva reysi bo'yicha samolyot uchmoqda; 5) Yer o'z o'qi atrofida aylanmoqda.

- A) 1; 5 B) 1; 4 C) 2; 3 D) 3; 4

Harakati o'rganilayotgan jismning o'lchami va shakli kuzatilayotgan sharoitda hech qanday ahamiyatga ega bo'lmasa, bunday jism **moddiy nuqta** deb aytiladi.

1) Yer Quyosh atrofiida orbita bo'ylab harakat qilganda, Yerni moddiy nuqta sifatida qarash mumkin. Chunki Yerning o'lchami uning Quyosh atrofida harakatlanish orbitasining o'lchamidan hisobga olinmaydigan darajada kichik.

2) poyezd ko'prik ustidan o'tyotganda, poyezdni moddiy nuqta sifatida qaray olmaymiz, chunki ko'prik va poyezd o'lchamlari deyarli bir xil bo'ladi.

3) tokar stanogida detal yasayotganda, detalni moddiy nuqta sifatida qaray olmaymiz, chunki bu holatda detalning o'lchami muhim ahamiyatga ega.

4) Toshkent-Moskva reysi bo'yicha samolyot uchganda somolyotni moddiy nuqta sifatida qarash mumkin. Chunki somolyotning o'lchamini Toshkentdan Moskvagacha bo'lgan masofadan hisobga olmaydigan darajada kichik.

5) Yer o'z o'qi atrofida aylanyotganda uni moddiy nuqta sifatida qaray olmaymiz. Chunki ekvator-dagi nuqtalarning chiziqli tezligini hisoblashda, yoki ekvator-dagi nuqtalarning markazga intilma tezlanishini hisoblashda Yer radiusi hisobga olinadi.

Javob: B) 1;4.

1.18. Oyning Yer atrofidagi harakatiga bog'liq masalalarda nima uchun Oyni moddiy nuqta deb hisoblash mumkin?

- A) Oy — yerning yo'ldoshi
- B) Oyning radiusi uning orbitasi radiusidan ancha kichik
- C) Oyda atmosfera yo'q
- D) Oy — shar shaklida

Oyning radiusi uning Yer atrofida aylanish orbitasi radiusidan ancha kichik bo'lganligi uchun bu holatda oyni moddiy nuqta sifatida qarash mumkin.

Javob: B) Oyning radiusi uning orbitasi radiusidan ancha kichik

1.19. Ertalab avtobus yo'lga chiqib, kechqurun avtobazadagi o'z o'rniga qaytib keldi. Shunda hisoblagichning ko'rsatkichi 600 km ga ortdi. Avtobusning yo'li (L) va ko'chish moduli (S) nimaga teng (km)?

- A) $L = S = 600$
- B) $L = 600, S = 300$
- C) $L = 600, S = 0$
- D) $L = 0, S = 600$

Berilgan:

$$\begin{array}{l} \Delta L = 600 \text{ km} \\ L = ? \quad S = ? \end{array}$$

Yechilishi: avtobusning bosib o'tgan yo'li hisoblagich ko'rsatkichining o'zgarishiga teng bo'ladi. $L = \Delta L = 600 \text{ km}$. Ko'chishi esa $S = 0$. Chunki harakatning boshi va oxiri bitta nuqtada bo'lyapti.

Javob: C) $L = 600, S = 0$

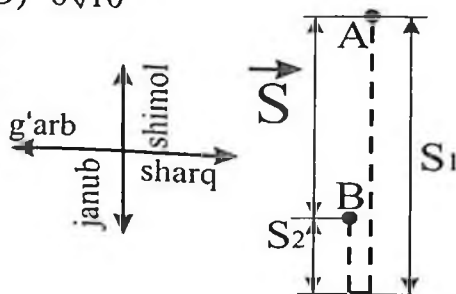
1.20. Turistlar guruhi avval janub tomonga 12 km, so'ngra shimol tomonga 4 km yo'l yurib to'xtadilar. Guruh necha km masofaga ko'chgan?

- A) 16
- B) 8
- C) $4\sqrt{10}$
- D) $6\sqrt{10}$

Berilgan:

$$\begin{array}{l} S_1 = 12 \text{ km} \\ S_2 = 4 \text{ km} \\ S = ? \end{array}$$

Yechilishi: dunyo tomonlarini rasmda ko'rsatilgandek belgilab chizma chizamiz. Bunda turistlar guruhining ko'chishi $S = S_1 - S_2 = 12 - 4 = 8 \text{ km}$ ga teng.



Javob: B) $S = 8 \text{ km}$.

1.21. Qo'l soati sekund milining uzunligi 1 sm ga teng. Bir soat davomida sekund mili uchidagi nuqtaning o'tgan yo'li qanchaga (m) teng bo'ladi?

- A) $0,6\pi$
- B) 2π
- C) $1,2\pi$
- D) $0,02\pi$

Berilgan:

$$R = 1 \text{ sm} = 0,01 \text{ m}$$

$$t = 1 \text{ soat} = 3600 \text{ s}$$

$$S = ?$$

Yechilishi: sekund milining uzunligi u chizayotgan aylananing radiusini ifodalaydi. Endi sekund mili 1 soat davomida necha marta aylanishini topishimiz kerak bo'ladi. Bizga ma'lumki, sekund mili 1 minutda bir marta to'liq aylanadi va bunda $l = 2\pi R$ masofani bosib o'tadi.

1 soatda 60 minut bor. Demak, sekund mili 1 soat davomida to'liq 60 marta aylanadi va uning bosib o'tgan yo'li

$$S = 60 \cdot l = 60 \cdot 2\pi R = 120\pi R$$

$$S = 120 \cdot \pi \cdot 0,01 = 1,2\pi \text{ m}$$

Javob: C) $1,2 \cdot \pi$

1.22. Radiusi 10 sm bo'lgan charxtosh chetidagi nuqta ma'lum vaqt ichida 5 marta to'liq aylanadi. Nuqtaning yo'li va ko'chishini toping (sm).

A) 314; 314

B) 314; 0

C) 62,8; 62,8

D) 0; 0

Berilgan:

$$R = 10 \text{ sm} = 0,1 \text{ m}$$

$$N = 5$$

$$L = ? \quad S = ?$$

Yechilishi: charxtosh to'liq bir marta aylanganda, uning chetidagi nuqta $l = 2\pi R$ masofani bosib o'tadi. Agar charxtosh N marta aylansa, uning chetidagi nuqta $L = N \cdot l$ masofani bosib o'tadi. Ko'chishi esa $S = 0$. Chunki aylanib harakat boshlagan joyiga qaytib keladi.

$$L = N \cdot l = N \cdot 2\pi R = 5 \cdot 2 \cdot 3,14 \cdot 0,1 = 3,14 \text{ m} = 314 \text{ sm}$$

Javob: B) 314; 0

1.23. Jism R radiusli aylana bo'ylab harakatlanmoqda. Aylananing $1/6$ qismini o'tganda, jismning o'tgan yo'li va ko'chish moduli qanday bo'ladi?

A) R ; R

B) $\pi R/6$; $R/6$

C) $\pi R/3$; $R/3$

D) $\pi R/3$; R

Berilgan:

$$R,$$

$$n = 1/6$$

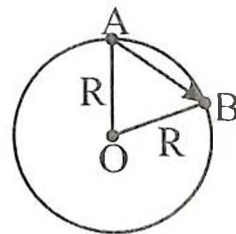
$$L = ? \quad S = ?$$

Yechilishi: aylananing to'liq uzunligi $l = 2\pi R$ ga teng. Masala shartiga ko'ra, jism aylananing $n = 1/6$ qismini o'tgan. Uning o'tgan yo'li

$$L = n \cdot l = \frac{1}{6} 2\pi R = \frac{\pi R}{3}$$

ga teng. Jism aylanani to'liq bir marta aylansa 2π radianga buriladi. Shartiga asosan u aylananing $n = 1/6$ qismini o'tgan, ya'ni, $\pi/3$ radianga burilgan. Bunda teng tomonli uchburchak hosil bo'ladi. $S = R$.

Javob: D) $\pi R/3$; R .



1.24. Jism R radiusli aylana bo'ylab harakatlanmoqda. Aylananing $1/2$ qismini bosib o'tganda, jismning o'tgan yo'li va ko'chish moduli qanday bo'ladi?

- A) R ; R B) $2R$; $2R$ C) $\pi \cdot R$; $2R$ D) $\pi \cdot R$; R

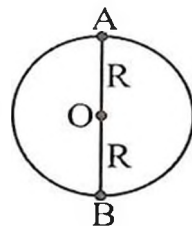
Berilgan:

R ,

$n = 1/2$

$L = ?$ $S = ?$

Yechilishi: aylananing to'liq uzunligi $l = 2\pi R$ ga teng. Masala shartiga ko'ra, jism aylananing $n = 1/2$ qismini bosib o'tgan. Uning o'tgan yo'li



$$L = n \cdot l = \frac{2\pi R}{2} = \pi R$$

Chizmadan ko'rinib turibdiki, ko'chish diametrga teng. $S = 2R$.

Javob: C) πR ; $2R$.

1.25. Turist qiya tekislik bo'ylab yuqoriga ko'tarilib, 200 m masofani bosib o'tdi. Turistning gorizontaal yo'nalishdagi ko'chishi 173 m ga teng bo'lgan bo'lsa, qiya tekislikning gorizont bilan tashkil qilgan burchagini toping.

- A) 60° B) 30° C) 45° D) 90°

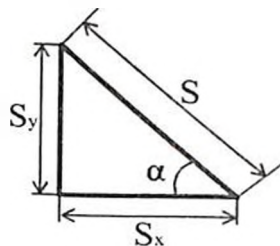
Berilgan:

$S = 200$ m

$S_x = 173$ m

$\alpha = ?$

Yechilishi: Burchakka yopishgan katet S_x ning gipotenuza S ga nisbati shu burchakning kosinusiga teng.



$$\cos \alpha = \frac{S_x}{S}$$

$$\cos \alpha = \frac{173}{200} = \frac{1,73}{2} \approx \frac{\sqrt{3}}{2} \Rightarrow \alpha = \arccos\left(\frac{\sqrt{3}}{2}\right) = 30^\circ$$

Javob: B) 30° .

1.26. Yo'lovchi qiya tekislik bo'ylab yuqoriga ko'tarilib, 200 m masofani bosib o'tdi. Uning vertikal yo'nalishdagi ko'chishi 141 m ga teng bo'lsa, qiya tekislikning gorizont bilan tashkil qilgan burchagini toping.

- A) 45° B) 30° C) 60° D) 90°

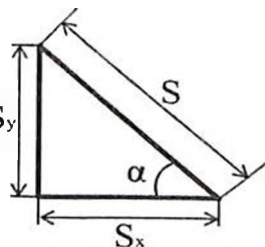
Berilgan:

$S = 200$ m

$S_y = 141$ m

$\alpha = ?$

Yechilishi: burchak qarshisidagi katet S_y ning gipotenuza S ga nisbati shu burchakning sinusiga teng.



$$\sin \alpha = \frac{S_y}{S} \Rightarrow \sin \alpha = \frac{141}{200} = \frac{1,41}{2} \approx \frac{\sqrt{2}}{2}$$

$$\alpha = \arcsin\left(\frac{\sqrt{2}}{2}\right) = 45^\circ$$

Javob: A) 45° .

1.27. Yo'lovchi qiya tekislik bo'ylab harakatlanib, 173 m balandlikka ko'tarildi. Uning gorizontal yo'nalishdagi ko'chishi 100 m ga teng bo'lsa, qiya tekislikning gorizont bilan tashkil qilgan burchagini toping.

- A) 30° B) 45° C) 60° D) 90°

Berilgan:

$$S_x = 100 \text{ m}$$

$$S_y = 173 \text{ m}$$

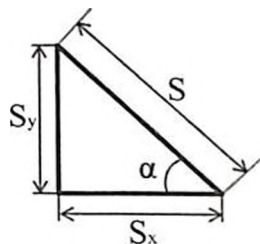
$$\alpha = ?$$

Yechilishi: burchak qarshisidagi katet S_y ning burchakka yopishgan katet S_x ga nisbati shu burchakning tangensiga teng.

$$\operatorname{tg} \alpha = \frac{S_y}{S_x} = \frac{173}{100} = 1,73 \approx \sqrt{3}$$

$$\alpha = \operatorname{arctg} \sqrt{3} = 60^\circ$$

Javob: C) 60° .



1.28. Qo'l soati sekund milining uzunligi 1 sm ga teng. 15 sekund o'tgach, sekund mili uchidagi nuqtaning ko'chish moduli qanchaga (sm) teng bo'ladi ?

- A) 2π B) 2 C) 1 D) $\sqrt{2}$

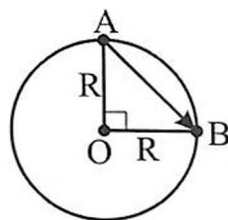
Berilgan:

$$R = 1 \text{ sm}$$

$$t = 15 \text{ s}$$

$$S = ?$$

Yechilishi: sekund mili boshlang'ich vaziyatda A nuqtada edi. 15 s dan keyin B nuqtaga boradi va u 90° ga buriladi. Bunda uning uchidagi nuqtaning ko'chishini Pifagor teoremasidan foydalanib topamiz.



$$S = \sqrt{R^2 + R^2} = R\sqrt{2} = \sqrt{2} \text{ sm}$$

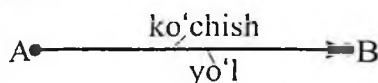
Javob: D) $\sqrt{2}$.

1.29. Qanday harakatda jismning ko'chish moduli uning bosib o'tgan yo'lga teng bo'ladi?

- A) Aylana bo'ylab tekis harakatda
B) To'g'ri chiziqli harakatda

- C) Gorizontol otilgan jismning harakatida
 D) To'g'ri chiziqli va aylana bo'ylab tekis harakatlarda

Faqat trayektoriyasi to'g'ri chiziqdan iborat bo'lgan harakatda jismning o'tgan yo'li va ko'chish moduli o'zaro teng bo'ladi.



Javob: B) to'g'ri chiziqli harakatda.

1.30. Faqat skalyar fizik kattaliklar keltirilgan to'g'ri javobni toping.

- A) massa, yo'l, tezlik, vaqt B) vaqt, yo'l, hajm, trayektoriya
 C) massa, vaqt, zichlik, yo'l D) massa, vaqt, yo'l, tezlanish

Faqat son qiymatga ega bo'ladigan fizik kattaliklar skalyar fizik kattaliklar deyiladi.

Javob: C) massa, vaqt, zichlik, yo'l.

1.31. Quyida keltirilgan javoblarning qaysi birida asosiy fizik kattaliklar keltirilgan?

- A) massa, vaqt, tezlik, yo'l B) massa, vaqt, ko'chish, tezlik
 C) massa, vaqt, tezlik, tezlanish D) vaqt, massa, uzunlik, temperatura

xalqaro birliklar sistemasida asosiy hisoblangan 7 ta birlik mavjud, bular quyidagilar:

- uzunlik birligi — metr
- vaqt birligi — sekund
- massa birligi — kilogramm
- modda miqdori birligi — mol
- absolyut temperatura birligi — Kelvin
- tok kuchi birligi — Amper
- yorug'lik kuchi birligi — kandela

Javob: D) vaqt, massa, uzunlik, temperatura.

1.32. Quyida keltirilgan fikrlardan to'g'ri tasdiqni toping.

- A) Ilgarilanma harakat qilayotgan jismning har xil nuqtalari har xil ko'chadi.
 B) Ilgarilanma harakat qilayotgan jismning barcha nuqtalari bir xilda ko'chadi.
 C) Aylanish o'qiga ega bo'lgan jismning aylanma harakatida uning barcha nuqtalari bir xilda ko'chadi.
 D) Ilgarilanma harakatda jism doimo tekis harakat qiladi.

Jism barcha nuqtalarining oldingi vaziyatiga nisbatan parallel ko'chishi ilgarilanma harakat deyiladi.

Javob: B) Ilgarilanma harakat qilayotgan jismning barcha nuqtalari bir xilda ko'chadi.

2- §. Sanoq sistemasi

Vektor kattaliklar va ular ustidagi amallar

2.1. Jumlaning mazmuniga mos soʻzni qoʻyib, gapni toʻldiring. Sanoq jism bilan bogʻlangan koordinatalar sistemasi va vaqt oʻlchaydigan asbob ... deyiladi.

- A) mexanik harakat B) sanoq sistemasi
C) soat D) sanoq jism

Sanoq jism bilan bogʻlangan koordinatalar sistemasi va vaqt oʻlchaydigan asbob sanoq sistemasi deyiladi.

Javob: B) sanoq sistemasi

2.2. Jism koordinatlari $x_1 = 0$ m, $y_1 = 2$ m boʻlgan nuqtadan koordinatlari $x_2 = 4$ m va $y_2 = -1$ m boʻlgan nuqtaga koʻchgan. Jism koʻchishining koordinata oʻqlaridagi proyeksiyalarini toping (m).

- A) 4; -3 B) 4; 2 C) 4; 3 D) 2; 4

Berilgan:

$$\begin{aligned} x_1 &= 0 \text{ m} \\ y_1 &= 2 \text{ m} \\ x_2 &= 4 \text{ m} \\ y_2 &= -1 \text{ m} \end{aligned}$$

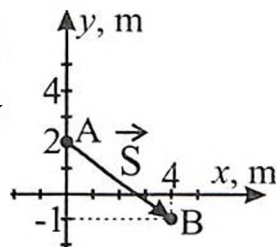
$$S_x = ? \quad S_y = ?$$

Yechilishi: Birinchi nuqtani A , ikkinchisini esa B orqali belgilasak, $\overline{AB}$ vektor koʻchishni beradi. Uning OX koordinata oʻqiga proyeksiyasi:

$$S_x = x_2 - x_1 = 4 \text{ m}$$

OY oʻqidagi proyeksiya:

$$S_y = y_2 - y_1 = -3 \text{ m}$$



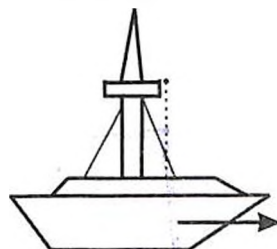
Javob: A) 4; -3

2.3. Tekis harakat qilayotgan kemaning machtasidan jism erkin tushmoqda. Agar havoning qarshiligi hisobga olinmasa, jismning kema bilan bogʻlangan sanoq tizimidagi trayektoriyasi qanday boʻladi?

- A) gorizontal toʻgʻri chiziq B) aylana
C) parabola D) vertikal toʻgʻri chiziq.

Jism kemada joylashgani uchun, unga tashqi taʼsir boʻlmasa, uning gorizontal tezligi kemaning tezligi bilan bir xil boʻladi, vertikal yoʻnalishda esa erkin tushadi. Shu sababli uning kema bilan bogʻlangan sanoq sistemasidagi trayektoriyasi vertikal toʻgʻri chiziqdan iborat boʻladi.

Javob: D) vertikal toʻgʻri chiziq.



2.4. Jism XOY koordinata tekisligida $x = 3 + 2t$ (m), $y = 6 - 3t$ (m) tenglamalarga muvofiq harakatlanmoqda. Jism OX o'qini koordinata boshidan qanday masofada (m) kesib o'tadi?

- A) 2 B) 7 C) -1,5 D) 4

Berilgan:

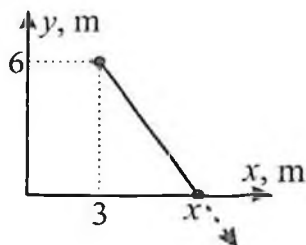
$$x = 3 + 2t$$

$$y = 6 - 3t$$

$$x = ?$$

Yechilishi: Tenglamalardan t ni topib olamiz:

$$t = \frac{x-3}{2} \quad t = \frac{y-6}{-3}$$



Bu ikkita ifodani bir-biriga tenglashtirib y ni topamiz:

$$\frac{x-3}{2} = \frac{y-6}{-3} \Rightarrow y = \frac{21-3x}{2}$$

Jism OX o'qini kesib o'tayotganda, uning y koordinatasi nolga teng bo'ladi. Unda:

$$\frac{21-3x}{2} = 0 \Rightarrow x = 7m$$

Javob: B) 7

2.5. Jism XOY koordinata tekisligida $x = -4 + 2t$ (m), $y = 5 - 4t$ (m) tenglamalarga muvofiq harakatlanmoqda. Jism OY o'qini koordinata boshidan qanday masofada (m) kesib o'tadi?

- A) 1 B) -3 C) 2 D) 5/4

Berilgan:

$$x = -4 + 2t$$

$$y = 5 - 4t$$

$$y = ?$$

Yechilishi: 2.4-masala yechimidan foydalanamiz, ya'ni jism OY o'qini kesganida $x = 0$ bo'ladi.

$$-4 + 2t = 0$$

$$2t = 4$$

$$t = 2s$$

$$y = 5 - 4 \cdot 2 = -3 m$$

Koordinata boshidan -3 m masofada kesib o'tadi. $y = -3 m$

Javob: B) -3.

2.6. Biror jismning tekislikdagi harakati davomida koordinatalari (6; 4) (m) dan (9; 8) (m) ga o'zgardi. Ko'chish modulini toping (m).

- A) 12 B) 14 C) 7 D) 5

Berilgan:

$$A (6; 4)$$

$$B (9; 8)$$

$$S = ?$$

Yechilishi: Jism A nuqtadan B nuqtaga ko'chganida, uning ko'chish moduli $\overline{AB}$ vektorining moduliga teng bo'ladi.

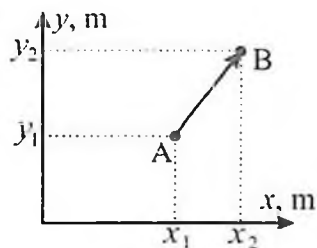
Chizmadan ko'rinib turibdiki, jism OX o'qi bo'ylab x_2

– x_1 , OY o'qi bo'ylab $y_2 - y_1$ masofaga ko'chgan. Buni hisobga olgan holda $\overline{AB}$ ning modulini Pifagor teoremasi yordamida aniqlaymiz:

$$S = AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$S = \sqrt{(9 - 6)^2 + (8 - 4)^2} = 5 \text{ m.}$$

Javob: D) 5.



2.7. Jism koordinatlari $x_1 = 0$ m, $y_1 = 2$ m bo'lgan nuqtadan koordinatlari $x_2 = 4$ m va $y_2 = -1$ m nuqtaga ko'chgan. Jismning ko'chish moduli nimaga teng.

A) 5 m

B) 4 m

C) 6 m

D) 7 m

Berilgan:

$$x_1 = 0 \text{ m}$$

$$y_1 = 2 \text{ m}$$

$$x_2 = 4 \text{ m}$$

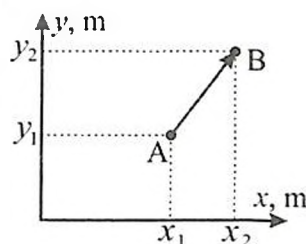
$$y_2 = -1 \text{ m}$$

$$S = ?$$

Yechilishi: Jism A nuqtadan B nuqtaga

ko'chganida, uning ko'chish moduli $\overline{AB}$ vektorning moduliga teng bo'ladi.

Chizmadan ko'rinib turibdiki, jism OX o'qi bo'ylab $x_2 - x_1$, OY o'qi bo'ylab $y_2 - y_1$ masofaga ko'chgan. Buni hisobga olgan holda $\overline{AB}$ ning modulini Pifagor teoremasi yordamida aniqlaymiz:



$$S = AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$S = \sqrt{(4 - 0)^2 + (-1 - 2)^2} = 5 \text{ m}$$

Javob: A) 5 m.

2.8. Jism koordinatalari (5; 4) (m) bo'lgan nuqtadan koordinatalari (9; 8) (m) bo'lgan nuqtaga ko'chdi. Uning ko'chish moduli qanday (m)?

A) 14

B) 12

C) $4\sqrt{2}$

D) $\sqrt{45}$

Berilgan:

$$A (5; 4)$$

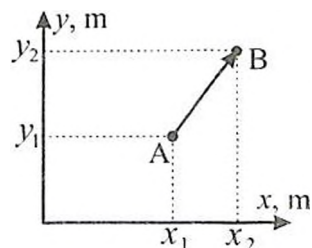
$$B (9; 8)$$

$$S = ?$$

Yechilishi: Jism A nuqtadan B nuqtaga

ko'chganida, uning ko'chish moduli $\overline{AB}$ vektorning moduliga teng bo'ladi.

Chizmadan ko'rinib turibdiki, jism OX o'qi bo'ylab $x_2 - x_1$, OY o'qi bo'ylab $y_2 - y_1$ masofaga ko'chgan. Buni hisobga olgan holda $\overline{AB}$ ning modulini Pifagor



teoremasi yordamida aniqlaymiz:

$$S = AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$S = AB = \sqrt{(9 - 5)^2 + (8 - 4)^2} = 4\sqrt{2}m.$$

Javob: C) $4\sqrt{2}m$.

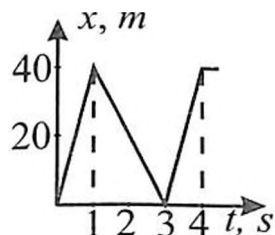
2.9. Quyida keltirilgan chizmada jismning x koordinata-sining vaqt bo'yicha o'zgarish grafigi tasvirlangan. Jismning harakat yo'nalishi o'zgargan vaqt daqiqalarini toping.

A) 1 s, 3 s, 4 s

B) 1 s, 3 s

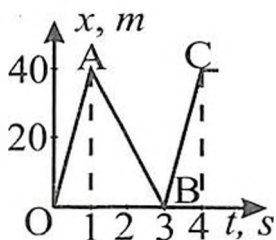
C) 1 s, 4 s

D) 3 s, 4 s



Jismning x koordinatasi OA oraliqda tekis ortib boryapti, AB oraliqda u bir tekis kamayadi, BC oraliqda yana ortib, C nuqtadan boshlab o'zgarmaydi. Agar jism harakatining yo'nalishi o'zgarsa, ortayotgan koordinata kamaya boshlaydi, kamayayotgani esa orta boshlaydi. Masalamizdagi jismning harakat yo'nalishining o'zgarishi A va B nuqtalarda, ya'ni 1 s va 3 s vaqt momentlarida ro'y beradi.

Javob: B) 1 s, 3 s



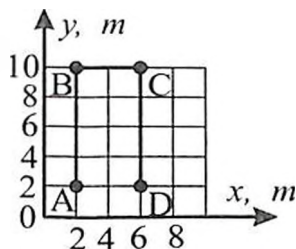
2.10. Quyidagi chizmada jismning A nuqtadan D nuqtaga harakatlanishdagi $ABCD$ trayektoriyasi berilgan. Jismning bosib o'tgan yo'li (m) va ko'chishining moduli (m) nimaga teng?

A) 12; 4

B) 20; 4

C) 4; 20

D) 16; 4



Bizga ma'lumki, jismning o'tgan yo'li uning trayektoriyasining uzunligiga teng. Demak, $L = AB + BC + CD$. Chizmaga asosan $A(2;2)$, $B(2;10)$, $C(6;10)$ va $D(6;2)$.

Ikki nuqta orasidagi masofani $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ ifodadan foydalanib topamiz.

$$AB = \sqrt{(2 - 2)^2 + (10 - 2)^2} = 8m$$

$$BC = \sqrt{(6 - 2)^2 + (10 - 10)^2} = 4m$$

$$CD = \sqrt{(6 - 6)^2 + (10 - 2)^2} = 8m$$

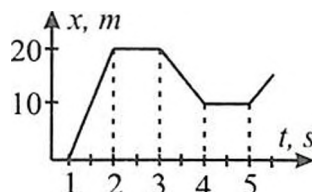
$$L = AB + BC + D = 8 + 4 + 8 = 20m$$

Jism A nuqtadan D nuqtaga ko'chganida, uning ko'chish moduli $\overline{AD}$ vektorning moduliga teng bo'ladi.

$$S = AD = \sqrt{(6-2)^2 + (2-2)^2} = 4m$$

Javob: B) 20; 4.

2.11. Quyida keltirilgan chizmada jismning x koordinatasining vaqt bo'yicha o'zgarish grafigi tasvirlangan. Jismning harakat yo'nalishi o'zgargan vaqt daqiqalarini toping.



A) 2 s, 3 s, 4 s, 5 s

B) 3 s, 4 s, 5 s

C) 3 s, 5 s

D) harakat yo'nalishi o'zgarmaydi

Agar jism harakatining yo'nalishi o'zgarsa, ortayotgan koordinata kamaya boshlaydi, kamayayotgani esa orta boshlaydi.

AB oraliqda jism koordinatasi tekis ortib boryapti;

BC oraliqda o'zgarmayapti, jism to'xtagan;

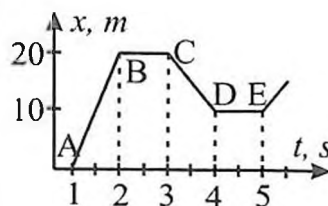
CD oraliqda kamayib boryapti, jism orqaga qaytgan;

DE oraliqda o'zgarmayapti, jism to'xtagan;

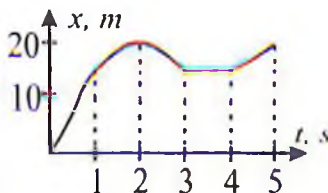
E nuqtadan boshlab yana ortayapti, demak, jism yo'nalishini yana o'zgartirgan.

Demak, jism harakat yo'nalishining o'zgarishi grafikdagi C va E nuqtalar, ya'ni 3 s va 5 s vaqt momentlariga mos keladi.

Javob: C) 3 s, 5 s.



2.12. Quyida keltirilgan chizmada jismning x koordinatasining vaqt bo'yicha o'zgarish grafigi tasvirlangan. Jismning harakat yo'nalishi o'zgargan vaqt daqiqalarini toping.



A) 2 s, 5 s

B) 1 s, 2 s, 3 s, 4 s

C) 2 s, 3 s, 4 s

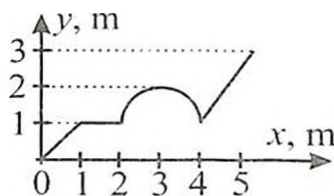
D) 2 s, 4 s

Agar jism harakatining yo'nalishi o'zgarsa, ortayotgan koordinata kamaya boshlaydi, kamayayotgani esa orta boshlaydi. Jism harakat yo'nalishining o'zgarishi 2 s va 4 s ga to'g'ri keladi.

Javob: D) 2 s, 4 s.

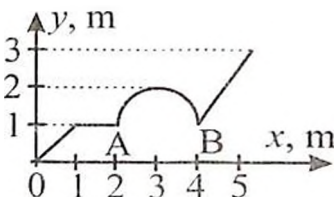
2.13. Quyidagi chizmada jismning XOY koordinata tekisligidagi harakat trayektoriyasi tasvirlangan. Jismning harakat yo'nalishi o'zgargan nuqtalarning ordinatalarini toping (m).

- A) 1,2 B) 1,2,3 C) 1, -2
D) harakat yo'nalishi o'zgarmagan



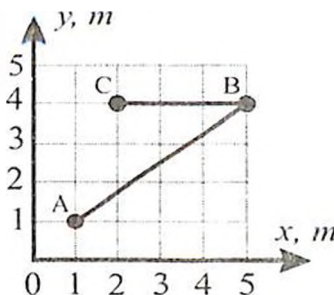
Grafikka asosan A va B nuqtalar orasida jism aylana yoyi bo'ylab harakatlangan. Aylana bo'ylab harakatlanayotgan jismning harakat yo'nalishi doimiy ravishda o'zgarib turadi. Demak, AB oralig'ida jismning harakat yo'nalishi uzluksiz ravishda o'zgarib turgan. Jism harakat yo'nalishi o'zgarishi ordinata o'qining 1–2 m oralig'iga mos keladi.

Javob: C) 1, -2.



2.14. Jism XOY koordinata tekisligida A nuqtadan C nuqtaga ABC trayektoriya bo'yicha ko'chdi. Jismning bosib o'tgan yo'li L (m) va natijaviy ko'chishining moduli S ni (m) toping.

- A) $L = 6$; $S = 4$ B) $L = 8$; $S = \sqrt{10}$
C) $L = 12$; $S = 8$ D) $L = 10$; $S = \sqrt{12}$



Bu masala ham 2.10-masalaga o'xshash, shuning uchun buni ham 2.10-masala yechimiga asoslanib yechamiz.

$$L = AB + BC$$

$$|\vec{S}| = AC$$

$$A(1;1), \quad B(5;4), \quad C(2;4)$$

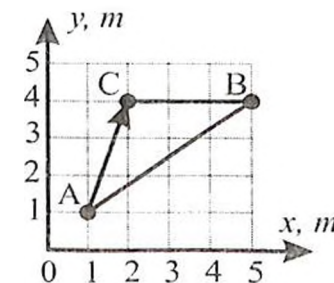
$$AB = \sqrt{(5-1)^2 + (4-1)^2} = 5m$$

$$BC = \sqrt{(2-5)^2 + (4-4)^2} = 3m$$

$$L = 5 + 3 = 8m$$

$$S = AC = \sqrt{(2-1)^2 + (4-1)^2} = \sqrt{10}m$$

Javob: B) $L = 8$; $S = \sqrt{10}$.



2.15. Jism XOY koordinata tekisligida A nuqtadan B nuqtaga ko'chdi. Jism ko'chishining OX va OY o'qlaridagi proyeksiyalarini toping.

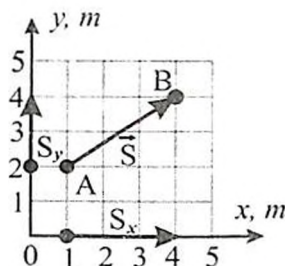
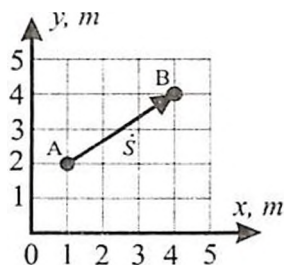
- A) $S_x = 4$; $S_y = 4$ B) $S_x = 4$; $S_y = 2$
 C) $S_x = 3$; $S_y = 2$ D) $S_x = 2$; $S_y = 4$

$A(x_1; y_1)$, $B(x_2; y_2)$. Chizmadan ko'rinib turibdiki, $x_1 = 1$ m, $y_1 = 2$ m, $x_2 = 4$ m, $y_2 = 4$ m. Jism OX o'qi bo'ylab $x_2 - x_1$, OY o'qi bo'ylab $y_2 - y_1$ masofaga ko'chgan.

$$S_x = x_2 - x_1 = 3\text{ m}$$

$$S_y = y_2 - y_1 = 2\text{ m}$$

Javob: C) $S_x = 3$; $S_y = 2$.



2.16. Jism XOY koordinata tekisligida A nuqtadan B nuqtaga ko'chdi. Jism ko'chishining OX va OY o'qlaridagi proyeksiyalarini toping.

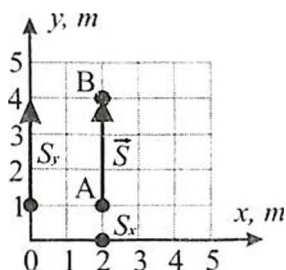
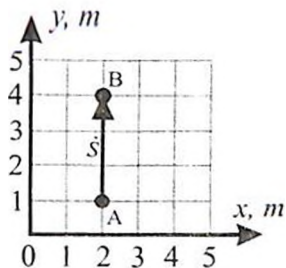
- A) $S_x = 2$; $S_y = 4$ B) $S_x = 2$; $S_y = 3$
 C) $S_x = 2$; $S_y = 1$ D) $S_x = 0$; $S_y = 3$

$A(x_1; y_1)$, $B(x_2; y_2)$. Chizmadan ko'rinib turibdiki, $x_1 = 2$ m, $y_1 = 1$ m, $x_2 = 2$ m, $y_2 = 4$ m. Jism OX o'qi bo'ylab $x_2 - x_1$, OY o'qi bo'ylab $y_2 - y_1$ masofaga ko'chgan.

$$S_x = x_2 - x_1 = 2 - 2 = 0\text{ m}$$

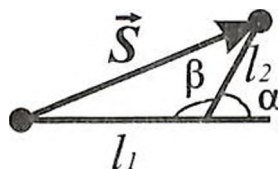
$$S_y = y_2 - y_1 = 4 - 1 = 3\text{ m}$$

Javob: D) $S_x = 0$; $S_y = 3$.



2.17. Moddiy nuqta to'g'ri yo'l bo'ylab harakatlanib, 3 m masofani bosib o'tdi, so'ngra harakat yo'nalishini 60° ga o'zgartirib, yana to'g'ri chiziqli trayektoriya bo'ylab 2 m masofani bosib o'tdi. Moddiy nuqtaning natijaviy ko'chishining modulini (m) toping.

- A) 1 B) $\sqrt{13}$
 C) 5 D) $\sqrt{19}$



Berilgan:

$$l_1 = 3 \text{ m}$$

$$\alpha = 60^\circ$$

$$l_2 = 2 \text{ m}$$

$$S = ?$$

Yechilishi: $\alpha + \beta = 180^\circ$

$$\beta = 180^\circ - \alpha = 120^\circ$$

Kosinuslar teoremasiga asosan:

$$S = \sqrt{l_1^2 + l_2^2 - 2l_1l_2 \cos \beta}$$

$$S = \sqrt{9 + 4 - 2 \cdot 3 \cdot 2 \cdot \left(-\frac{1}{2}\right)} = \sqrt{19} \text{ m}$$

Javob: D) $\sqrt{19}$.

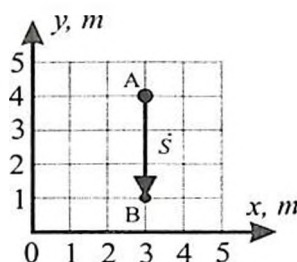
2.18. Jism XOY koordinata tekisligida A nuqtadan B nuqtaga ko'chdi. Jism ko'chishining OX va OY o'qlaridagi proyeksiyalarini toping (m).

A) $S_x = 3$; $S_y = 4$

B) $S_x = 0$; $S_y = -3$

C) $S_x = 3$; $S_y = -3$

D) $S_x = 3$; $S_y = -4$



A va B nuqtalarning koordinatalarini yozamiz:

A: $x_A = 3 \text{ m}$, $y_A = 4 \text{ m}$

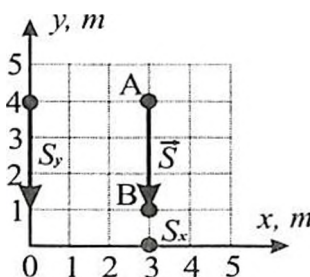
B: $x_B = 3 \text{ m}$, $y_B = 1 \text{ m}$

Ko'chishning OX va OY o'qlariga proyeksiyalarini topamiz:

$$S_x = x_B - x_A = 3 - 3 = 0 \text{ m.}$$

$$S_y = y_B - y_A = 1 - 4 = -3 \text{ m.}$$

Javob: B) $S_x = 0$; $S_y = -3$.



2.19. Jism XOY koordinata tekisligida A nuqtadan B nuqtaga ko'chdi. Jism ko'chishining OX va OY o'qlaridagi proyeksiyalarini toping (m).

A) $S_x = 4$; $S_y = -4$

B) $S_x = 5$; $S_y = 5$

C) $S_x = 1$; $S_y = 5$

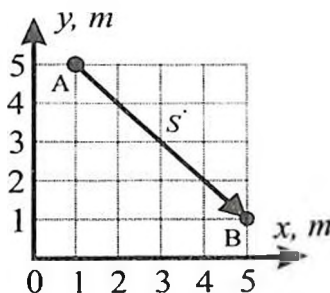
D) $S_x = 5$; $S_y = 1$

A va B nuqtalarning koordinatalarini yozamiz:

A: $x_A = 1 \text{ m}$, $y_A = 5 \text{ m}$

B: $x_B = 5 \text{ m}$, $y_B = 1 \text{ m}$

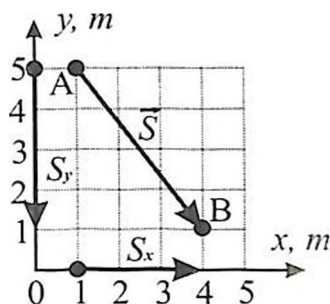
Ko'chishning OX va OY o'qlariga proyeksiyalarini topamiz:



$$S_x = x_B - x_A = 5 - 1 = 4 \text{ m.}$$

$$S_y = y_B - y_A = 1 - 5 = -4 \text{ m.}$$

Javob: A) $S_x = 4$; $S_y = -4$.



2.20. Jism to'g'ri yo'l bo'ylab harakatlanib 4 m masofaga ko'chdi, so'ngra harakat yo'nalishini 90° ga o'zgartirib, yana 2 m masofaga ko'chdi. Jismning natijaviy ko'chishining modulini (m) toping.

- A) 6 B) $2\sqrt{5}$
C) 2 D) $3\sqrt{2}$

Berilgan:

$$S_1 = 3 \text{ m}$$

$$\alpha = 60^\circ$$

$$S_2 = 2 \text{ m}$$

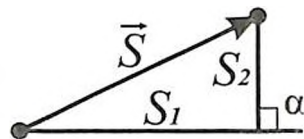
$$S = ?$$

Yechilishi: $\alpha = 90^\circ$ bo'lgani uchun, bu to'g'ri burchakli uchburchakka mos keladi. Demak, Pifagor teoremasidan foydalanamiz:

$$S^2 = S_1^2 + S_2^2 \quad S = \sqrt{S_1^2 + S_2^2}$$

$$S = \sqrt{16 + 4} = \sqrt{20} = 2\sqrt{5} \text{ m}$$

Javob: B) $2\sqrt{5}$



2.21. Moddiy nuqta to'g'ri yo'l bo'ylab harakatlanib, 1 m masofani bosib o'tdi, so'ngra harakat yo'nalishini 30° ga o'zgartirib, yana to'g'ri chiziqli trayektoriya bo'ylab 2 m masofani bosib o'tdi. Moddiy nuqtaning natijaviy ko'chishining modulini (m) toping.

- A) 2,91 B) 3 C) 1 D) $-\sqrt{5}$

Berilgan:

$$S_1 = 1 \text{ m}$$

$$\alpha = 30^\circ$$

$$S_2 = 2 \text{ m}$$

$$S = ?$$

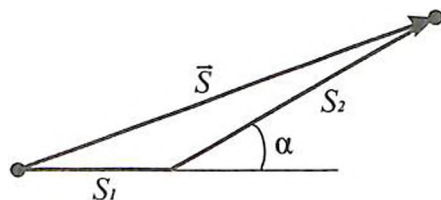
Yechilishi: Masalani ishlashda kosinuslar teoremasidan foydalanamiz.

$$S = \sqrt{S_1^2 + S_2^2 - 2S_1S_2 \cos(180^\circ - \alpha)}$$

$$S = \sqrt{1 + 4 + 2 \cdot 1 \cdot 2 \cdot \frac{\sqrt{3}}{2}} =$$

$$= \sqrt{5 + 2\sqrt{3}} = 2,91 \text{ m}$$

Javob: A) 2,91.



2.22. Moddiy nuqta to'g'ri yo'l bo'ylab harakatlanib 2 m masofani bosib o'tdi, so'ngra harakat yo'nalishini 45° ga o'zgartirib, yana to'g'ri chiziqli trayektoriya bo'ylab 2 m masofani o'tdi. Moddiy nuqtaning natijaviy ko'chishining modulini (m) toping.

A) 2,91

B) 3,7

C) 4

D) 2,8

Berilgan:

$$S_1 = 2 \text{ m}$$

$$\alpha = 45^\circ$$

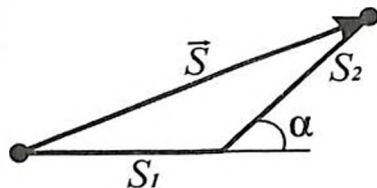
$$S_2 = 2 \text{ m}$$

$$S = ?$$

Yechilishi: bu masalani ishlashda ham kosinuslar teoremasidan foydalanamiz.

$$S^2 = S_1^2 + S_2^2 - 2S_1S_2 \cos(180^\circ - \alpha)$$

$$S = \sqrt{S_1^2 + S_2^2 + 2S_1S_2 \cos \alpha}$$



$$S = \sqrt{4 + 4 + 2 \cdot 2 \cdot 2 \cdot \frac{\sqrt{2}}{2}} = \sqrt{8 + 4\sqrt{2}} = 3,7 \text{ m}$$

Javob: B) 3,7.

3-§. To'g'ri chiziqli tekis harakat va uning tezligi

3.1. Jumlaning mazmuniga mos so'zni qo'yib, gapni to'ldiring. Trayektoriyasi to'g'ri chiziqdan iborat bo'lib, ixtiyoriy teng vaqt oraliqlarida ko'chishlari o'zaro teng bo'lgan harakatga ... deyiladi.

A) aylana bo'ylab tekis harakat

B) to'g'ri chiziqli tekis harakat

C) egri chiziqli harakat

D) ilgarilanma harakat

Trayektoriyasi to'g'ri chiziqdan iborat bo'lib, ixtiyoriy teng vaqt oraliqlarida ko'chishlari o'zaro teng bo'lgan harakatga **to'g'ri chiziqli tekis harakat** deyiladi.

Javob: B) to'g'ri chiziqli tekis harakat.

3.2. 21,6 km/soat necha m/s bo'ladi?

A) 6

B) 5

C) 4

D) 8

Tezlikning km/soat birligidan m/s birligiga o'tish uchun kilometrni metr ga va soatni sekundga o'tkazamiz.

$$21,6 \frac{\text{km}}{\text{soat}} = 21,6 \frac{1000\text{m}}{3600\text{s}} = 21,6 \frac{1}{3,6} \frac{\text{m}}{\text{s}} = 6 \frac{\text{m}}{\text{s}}$$

Demak, km/soat dan m/s ga o'tish uchun 3,6 ga bo'lish kerak ekan.

Javob: A) 6.

3.3. Jismning 35 m/s tezligini km/soat ga o'tkazing.

- A) 150 B) 145 C) 140 D) 126

Tezlikning m/s birligidan km/soat birligiga o'tish uchun metrni kilometr, sekundni soat orqali ifodalash kerak.

$$35 \frac{m}{s} = 35 \frac{0,001 km}{\frac{1}{3600} soat} = 35 \cdot 3,6 \frac{km}{soat} = 126 \frac{km}{soat}$$

Demak, m/s dan km/soat ga o'tish uchun 3,6 ga ko'paytirish kerak ekan.

Javob: D) 126.

3.4. 9 m uzunlikdagi ip boshidan jo'nagan chumoli ip oxiriga kelguncha 5 minut o'tdi. Chumolining tezligini toping (sm/s).

- A) 3 B) 3,5 C) 1,8 D) 2,9

Berilgan:

$$l = 9 \text{ m}$$

$$t = 5 \text{ min} = 300 \text{ s}$$

$$v = ?$$

Yechilishi: chumolining tezligi, ip uzunligining chumoli shu uzunlikni o'tishi uchun ketgan vaqtga nisbati bilan aniqlanadi.

$$v = \frac{l}{t} = \frac{9m}{300s} = \frac{900sm}{300s} = 3 \frac{sm}{s}$$

Javob: A) 3.

3.5. 1 m/s tezlik kattami yoki 1 km/soat tezlikmi? To'g'ri javobni aniqlang.

- A) ikkalasi teng B) ikkinchisi 3,6 marta katta
C) birinchisi 3,6 marta katta D) ikkinchisi 1000 marta katta

Berilgan:

$$v_1 = 1 \text{ m/s}$$

$$v_2 = 1 \text{ km/soat}$$

$$v_1/v_2 = ?$$

Yechilishi: Tezliklarni taqqoslash uchun oldin ularni bir xil birlikka keltiramiz:

$$v_1 = 1 \frac{m}{s} = 1 \cdot 3,6 \frac{km}{soat} = 3,6 \frac{km}{soat}$$

$$\frac{v_1}{v_2} = \frac{3,6 \frac{km}{soat}}{1 \frac{km}{soat}} = 3,6$$

Demak, $v_1 = 3,6 \cdot v_2$

Javob: C) birinchisi 3,6 marta katta.

3.6. 20 m/s tezlik necha km/soat ga teng?

- A) 30 B) 54 C) 18 D) 72

Tezlikning m/s birligidan km/soat birligiga o'tish uchun metrni kilometr, sekundni soat orqali ifodalash kerak.

$$20 \frac{m}{s} = 20 \cdot 3,6 \frac{km}{soat} = 72 \frac{km}{soat}.$$

Javob: D) 72.

3.7. Piyodaning tezligi 3,6 km/soat. Undan yarim soat keyin yo'lga chiqqan velosipedchi piyodani chorak soatdan so'ng quvib yetishi uchun qanday tezlik (m/s) bilan harakatlanishi kerak bo'ladi?

A) 6 B) 5 C) 4 D) 3

Berilgan:

$$v_1 = 3,6 \text{ km/soat}$$

$$\Delta t = 0,5 \text{ soat} =$$

$$= 1800 \text{ s}$$

$$t = 0,25 \text{ soat} =$$

$$= 900 \text{ s}$$

$$v_2 = ?$$

Yechilishi: velosipedchi t vaqt harakatlanganda, piyoda $t + \Delta t$ vaqt harakatlanadi. Chunki piyoda velosipedchidan Δt vaqt oldin yo'lga chiqqan. Ikkalasining ham harakat tenglamasini tuzamiz:

$$x_1 = v_1(t + \Delta t)$$

$$x_2 = v_2 t$$

Ular uchrashganda $x_1 = x_2$ bo'ladi.

$$v_1(t + \Delta t) = v_2 t$$

Bu yerdan v_2 ni topamiz.

$$v_2 = \frac{t + \Delta t}{t} \cdot v_1 = \left(1 + \frac{\Delta t}{t}\right) \cdot v_1 = \left(1 + \frac{1800}{900}\right) \cdot 1 = 3 \frac{m}{s}$$

Javob: D) 3

3.8. Reaktiv samolyot 340 m/s tezlik bilan tekis uchganligi ma'lum bo'lsa, uning to'g'ri chiziqli trayektoriya bo'ylab 0,2 soat ichidagi ko'chishi modulini toping (m).

A) $1,2 \cdot 10^5$

B) $1,4 \cdot 10^5$

C) $2,2 \cdot 10^5$

D) $2,4 \cdot 10^5$

Berilgan:

$$v = 340 \text{ m/s}$$

$$t = 0,2 \text{ soat} =$$

$$= 720 \text{ s}$$

$$S = ?$$

Yechilishi: shartda samolyot to'g'ri chiziqli trayektoriya bo'ylab harakatlanganligi aytilgan. To'g'ri chiziqli harakatda ko'chish moduli bosib o'tilgan yo'lga teng bo'ladi.

$$S = v \cdot t = 340 \cdot 720 = 244800 \text{ m}$$

Javob: D) $2,4 \cdot 10^5$.

3.9. Chizmada bola o'tgan yo'lining vaqtga bog'lanish grafigi keltirilgan. Bolaning 4 s va 5 s vaqt oralig'ida bosib o'tgan yo'lini aniqlang.

- A) 5 m B) 10 m C) 15 m D) 20 m

Berilgan:

$$t_1 = 4 \text{ s}$$

$$t_2 = 5 \text{ s}$$

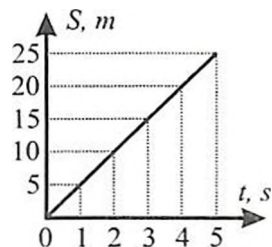
$$\Delta S = ?$$

Yechilishi: Chizmadan ko'rinib turibdiki, bola $t_1 = 4 \text{ s}$ da $S_1 = 20 \text{ m}$ va $t_2 = 5 \text{ s}$ da $S_2 = 25 \text{ m}$ yo'l o'tgan. Bola 4 s va 5 s vaqt oralig'ida

$$\Delta S = S_2 - S_1 = 25 - 20 = 5 \text{ m}.$$

Masofani o'tadi.

Javob: A) 5 m.



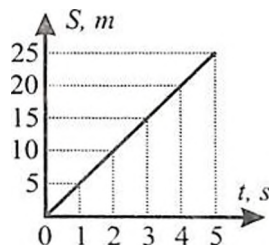
3.10. Chizmada bola bosib o'tgan yo'lining vaqtga bog'lanish grafigi keltirilgan. Bolaning tezligini (m/s) aniqlang.

- A) 10 m B) 5 m C) 25 m D) 20 m.

Yechilishi: chizmadan ixtiyoriy vaqtni tanlaymiz va unga mos yo'lni olib, to'g'ri chiziqli tekis harakat uchun tezlik formulasiga qo'yamiz.

$$v = \frac{S}{t} = \frac{15}{3} = 5 \frac{\text{m}}{\text{s}}$$

Javob: B) 5 m.



3.11. Uchta moddiy nuqta bosib o'tgan yo'lining vaqtga bog'lanish grafigi berilgan. Qaysi bir moddiy nuqtaning tezligi katta?

- A) 1 B) 2 C) 3 D) hammasi bir xil

Yechilishi: To'g'ri chiziqli tekis harakatda bosib o'tilgan yo'lining vaqtga bog'liqlik grafigida

$$\operatorname{tg} \alpha = \frac{S}{t}$$

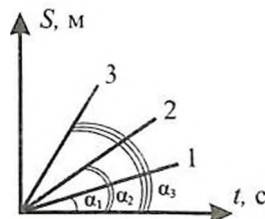
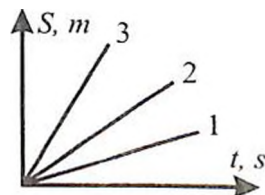
Ikkinchi tomondan

$$v = \frac{S}{t} \Rightarrow v = \operatorname{tg} \alpha$$

Chizmadan ko'rinib turibdiki,

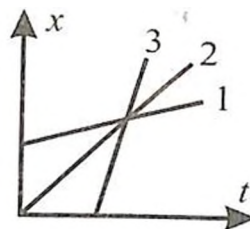
$$\alpha_1 < \alpha_2 < \alpha_3 \Rightarrow \operatorname{tg} \alpha_1 < \operatorname{tg} \alpha_2 < \operatorname{tg} \alpha_3 \Rightarrow v_1 < v_2 < v_3$$

Javob: C) 3.



3.12. Rasmda uchta moddiy nuqtaning harakat grafiklari berilgan. Ularning tezliklari haqida nima deyish mumkin?

- A) $v_1 < v_2 < v_3$ B) $v_1 > v_2 > v_3$
C) $v_1 = v_2 = v_3$ D) $v_1 = v_2 > v_3$



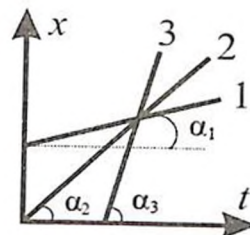
Yechilishi: 3.11-masala yechimidan foydalanamiz.

$$\alpha_1 < \alpha_2 < \alpha_3$$

$$\operatorname{tg} \alpha_1 < \operatorname{tg} \alpha_2 < \operatorname{tg} \alpha_3$$

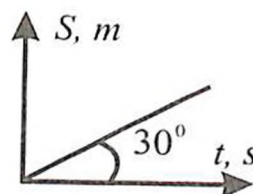
$$v_1 < v_2 < v_3$$

Javob: A) $v_1 < v_2 < v_3$.



3.13. Quyidagi grafikdan foydalanib, jismning harakat tezligini aniqlang (m/s).

- A) $\sqrt{3}/3$ B) $\sqrt{3}$ C) $1/3$ D) $1/2$



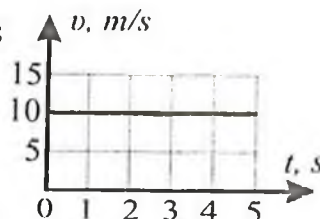
Yechilishi: 3.11-masala yechimiga asosan

$$v = \operatorname{tg} \alpha = \operatorname{tg} 30^\circ = \frac{\sqrt{3}}{3}$$

Javob: A) $\sqrt{3}/3$.

3.14. Grafikdan foydalanib, harakat boshlangandan 4 s o'tgandan keyingi jism tezligini toping (m/s).

- A) 50 B) 2,5
C) 10 D) 0



Yechilishi: Chizmadan ko'rinib turibdiki, vaqt o'tishi bilan tezlik o'zgarmagan.

$$v = 10 \text{ m/s}$$

Javob: C) 10.

3.15. Moddiy nuqta XOY koordinata tekisligida koordinatalari (3; 4) bo'lgan nuqtadan koordinatalari (7; 8) bo'lgan nuqtaga o'z vaziyatini $\sqrt{2}$ s da o'zgartirdi. Tezlik vektorining modulini toping (m/s).

- A) 6 B) 7 C) 8 D) 4

Berilgan:

A (3;4)

B (7;8)

$t = \sqrt{2}c$

$v = ?$

Yechilishi: Ikki nuqta orasidagi masofani topamiz:

$$S = AB = \sqrt{(7-3)^2 + (8-4)^2} = 4\sqrt{2}m$$

Endi quyidagi ifoda yordamida tezlikni hisoblaymiz.

$$v = \frac{S}{t} = \frac{4\sqrt{2}}{\sqrt{2}} = 4 \frac{m}{s}$$

Javob: D) 4.

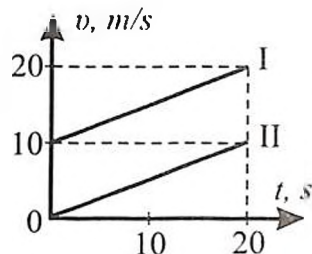
3.16. Quyidagi chizmada ikkita moddiy nuqta tezligining grafiklari berilgan. 10 s da ular bosib o'tgan yo'llar orasidagi farqni toping.

A) 200 m

B) 250 m

C) 300 m

D) 100 m



Chizmadan ko'rinib turibdiki, har ikkala jismning tezligi bir tekisda ortib boryapti. 10 s ichida I jism tezligini 10 m/s dan 15 m/s gacha, II jism tezligini 0 dan 5 m/s gacha o'zgartirgan. Tezlikning vaqtga bog'liqlik grafida grafik ostidagi yuza bosib o'tilgan yo'lga teng bo'ladi. Demak, jismlarning yo'llari orasidagi farq yuzalar farqiga teng bo'ladi. OABC trapetsiya yuzasidan ODC uchburchak yuzasini ayiramiz.

$$S_{OABC} = \frac{OA + BC}{2} \cdot OC$$

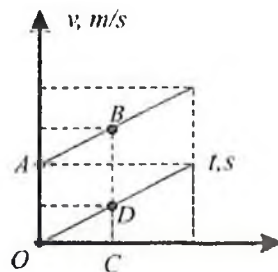
$$S_{ODC} = \frac{OC \cdot DC}{2}$$

$$S_{OABC} = \frac{10 + 15}{2} \cdot 10 = 125m$$

$$S_{ODC} = \frac{10 \cdot 5}{2} = 25m$$

$$\Delta S = 125 - 25 = 100 \text{ m}$$

Javob: D) 100 m.



3.17. Chizmada shtrixlab ko'rsatilgan yuza son jihatdan qanday fizik kattalikka teng?

A) yo'l

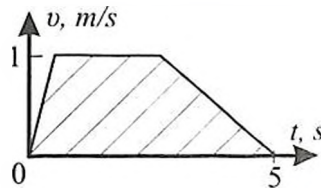
B) tezlik

C) tezlanish

D) kuch

Tezlikning vaqtga bog'liqlik grafida grafik ostidagi yuza bosib o'tilgan yo'lga teng bo'ladi.

Javob: A) yo'l.



3.18. $x_1 = 0,7 + 4t$, $x_2 = 0,5 + 0,4t$ qonuniyat bilan harakatlanayotgan moddiy nuqtalar qancha vaqtdan keyin uchrashadi (s)?

A) ular uchrashmaydi

B) 4

C) 5

D) 9

Berilgan:

$$x_1 = 0,7 + 4t$$

$$x_2 = 0,5 + 0,4t$$

$$t = ?$$

Yechilishi: Birinchi jism koordinatasi 0,7 m bo'lgan nuqtadan 4 m/s tezlik bilan tekis harakat qilmoqda. Ikkinchi jism uning orqasidan, ya'ni koordinatasi 0,5 m bo'lgan nuqtadan 0,4 m/s tezlik bilan harakatlanmoqda.

Ikkinchi jismning tezligi birinchi jismning tezligidan kichik bo'lganligi uchun ikkinchi jism birinchi jismni quvib yeta olmaydi. Demak, bu jismlar uchrashmaydilar.

Javob: A) ular uchrashmaydi.

3.19. Agar ikki jismning harakati tenglamasi mos ravishda $x_1 = 90 - t$, va $x_2 = 2t$ kabi yozilsa, ularning uchrashuv joyi va vaqti aniqlansin.

A) koordinatalar boshidan 60 m masofada, 30 s dan so'ng

B) koordinatalar boshidan 5 m masofada, 10 s dan so'ng

C) koordinatalar boshidan 65 m masofada, 40 s dan so'ng

D) koordinatalar boshidan 114 m masofada, 18 s dan so'ng

Berilgan:

$$x_1 = 90 - t$$

$$x_2 = 2t$$

$$t = ? \quad x = ?$$

Yechilishi: Jism uchrashgan vaqt momentida ularning koordinatalari bir xil bo'ladi, ya'ni $x_1 = x_2$. Buni hisobga olib jismlarning uchrashish vaqtini topamiz.

$$90 - t = 2t$$

$$90 = 3t$$

$$t = 30 \text{ s}$$

Jismlar 30 s dan keyin uchrashar ekan. Endi ularning uchrashish koordinatasini topamiz. Buning uchun ularning uchrashish vaqtini harakat tenglamasiga qo'yib, koordinatasini hisoblaymiz.

$$x = x_2 = 2 \cdot 30 = 60 \text{ m.}$$

Demak, jismlar koordinata boshidan 60 m masofada 30 s dan keyin uchrashadilar.

Javob: A) koordinata boshidan 60 m masofada 30 s dan so'ng.

3.20. Ikki jismning harakat qonunlari tinch turgan sanoq sistemasida $x_1 = 25 + t$, $x_2 = 85 - 0,5t$ ko'rinishda berilgan bo'lsa, ularning uchrashish vaqti va joyi qanday?

A) 30 s dan so'ng, koordinatalar boshidan 60 m masofada

B) 18 s dan so'ng, koordinatalar boshidan 114 m masofada

C) 10 s dan so'ng, koordinatalar boshidan 5 m masofada

D) 40 s dan so'ng, koordinatalar boshidan 65 m masofada

Berilgan:

$$x_1 = 25 + t$$

$$x_2 = 85 - 0,5t$$

$$t = ? \quad x = ?$$

Yechilishi: Jism uchrashgan vaqt momentida ularning koordinatalari bir xil bo'ladi, ya'ni $x_1 = x_2$. Buni hisobga olib, jismlarning uchrashish vaqtini topamiz.

$$25 + t = 85 - 0,5t$$

$$1,5t = 60$$

$$t = 40 \text{ s}$$

Jismlar 40 s dan keyin uchrashar ekan. Endi ularning uchrashish koordinatasini topamiz. Buning uchun ularning uchrashish vaqtini harakat tenglamasiga qo'yib, koordinatasini hisoblaymiz.

$$x = x_1 = 25 + 40 = 65 \text{ m}$$

Demak, jismlar koordinata boshidan 65 m masofada 40 s dan keyin uchrashadilar.

Javob: D) 40 s dan so'ng, koordinata boshidan 65 m masofada.

4-§. Tezliklarni qo'shish. Nisbiy harakat

4.1. Parashyutchi shamol bo'lmaganda, 5 m/s tezlik bilan yerga vertikal yo'nalishda tushadi. Lekin esayotgan shamol uning mo'ljalidan 160 m farq qiluvchi masofaga tushirdi. Agar parashyutchi 200 m balandlikdan sakragan bo'lsa, u gorizontal yo'nalishda qanday tezlik (m/s) bilan harakatlangan bo'ladi?

A) 3

B) 4

C) 5

D) 2,5

Berilgan:

$$S = 160 \text{ m}$$

$$h = 200 \text{ m}$$

$$v = 5 \text{ m/s}$$

$$u = ?$$

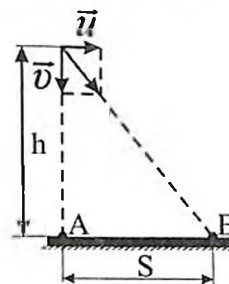
Yechilishi: Parashutchi aslida A nuqtaga tushishi kerak edi. Lekin esayotgan shamol tufayli u B nuqtaga tushadi. U vertikal yo'nalishda v tezlik bilan h masofani, gorizontal yo'nalishda esa u tezlik bilan S masofani bir xil vaqtda bosib o'tadi.

$$h = vt; \quad S = ut$$

$$\frac{S}{h} = \frac{u}{v} \Rightarrow u = \frac{S}{h} \cdot v$$

$$u = \frac{160}{200} \cdot 5 = 4 \text{ m/s}$$

Javob: B) 4.



4.2. Bir to'g'ri chiziq bo'ylab ikkita samolyot bir-biri tomon yerga nisbatan 1800 km/soat va 600 km/soat tezlik bilan uchmoqda. Birinchi samolyot bortidan turib o'lchangan ikkinchi samolyotning tezligini (km/soat) toping.

A) 2400

B) 3600

C) 1500

D) 1200

Berilgan:

$$v_1 = 1800 \text{ km/soat}$$

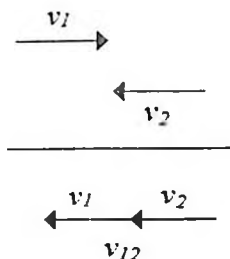
$$v_2 = 600 \text{ km/soat}$$

$$v_{12} = ?$$

Yechilishi: Bu masalani yechishda Galileyning nisbiylik prinsipidan foydalanamiz.

Agar jismlar bir-birlariga tomon harakatlanayotgan bo'lsalar, ulardan birining ikkinchisiga nisbatan tezligi har bir jismning erga nisbatan tezliklarining yig'indisiga teng bo'ladi.

$$v_{12} = v_1 + v_2 = 2400 \text{ km/soat}$$



Javob: A) 2400.

4.3. Harakat tezligining ikkita tashkil etuvchisi bir-biriga nisbatan 60° burchak ostida yo'nalgan bo'lib, modullari mos ravishda 4 va 6 m/s ga teng. Natijaviy tezlikni toping.

A) 7,7 m/s

B) 8,7 m/s

C) 5 m/s

D) 10 m/s

Berilgan:

$$\alpha = 60^\circ$$

$$v_1 = 4 \text{ m/s}$$

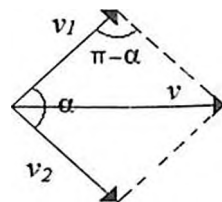
$$v_2 = 6 \text{ m/s}$$

$$v = ?$$

Yechilishi: Kosinuslar teoremasidan foydalanamiz:

$$v = \sqrt{v_1^2 + v_2^2 - 2v_1v_2 \cos(\pi - \alpha)}$$

$$v = \sqrt{16 + 36 + 2 \cdot 24 \cdot \frac{1}{2}} = 8,7 \text{ m/s}$$



Javob: B) 8,7 m/s

4.4. Harakat tezligining ikkita tashkil etuvchisi bir-biriga nisbatan 45° burchak ostida yo'nalgan bo'lib, modullari mos ravishda 4 va 6 m/s ga teng bo'lsa, natijaviy tezlikni toping.

A) 7,7 m/s

B) 8,7 m/s

C) 9,3 m/s

D) 12,8 m/s

Berilgan:

$$\alpha = 45^\circ$$

$$v_1 = 4 \text{ m/s}$$

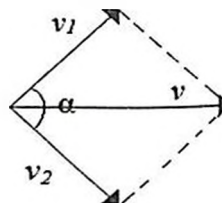
$$v_2 = 6 \text{ m/s}$$

$$v = ?$$

Yechilishi: $v = \sqrt{v_1^2 + v_2^2 + 2v_1v_2 \cos \alpha}$

$$v = \sqrt{16 + 36 + 2 \cdot 24 \cdot \frac{\sqrt{2}}{2}} = 9,3 \text{ m/s}$$

Javob: C) 9,3 m/s



4.5. G'oz suv oqimiga qarshi 3 m/s tezlik bilan 6,5 minut suzdi. Agar oqim tezligi 1 m/s bo'lsa, g'oz qancha masofaga suzgan bo'ladi?

- A) 720 m B) 680 m C) 780 m D) 810 m

Berilgan:

$$t = 390 \text{ s}$$

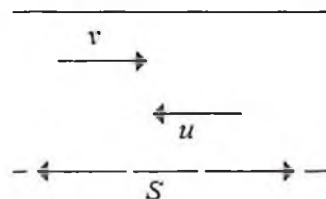
$$u = 1 \text{ m/s}$$

$$v = 3 \text{ m/s}$$

$$S = ?$$

Yechilishi: G'ozning yerga nisbatan tezligi: $v_n = v - u$ ga teng, chunki u oqim tezligiga qarama-qarshi suzmoqda.

$$S = v_n t = (v - u)t = 780 \text{ m}$$



Javob: C) 780 m.

4.6. Daryo suvining oqish tezligi 3 m/s, qayiqning suvga nisbatan tezligi 3 m/s va oqimga perpendikular yo'nalgan bo'lsa, qayiqning qirg'oqqa nisbatan tezligining yo'nalishini toping.

- A) 45° B) 60° C) 90° D) 30°

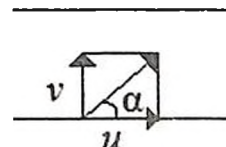
Berilgan:

$$u = 3 \text{ m/s}$$

$$v = 3 \text{ m/s}$$

$$\alpha = ?$$

Yechilishi: Qayiq qirg'oqqa nisbatan perpendikular v va daryoning u tezliklari natijalovchisi orqali harakat qiladi. α burchakni tangens funksiyasi orqali ifodalaymiz:



$$\operatorname{tg} \alpha = \frac{v}{u} = 1; \quad \alpha = 45^\circ$$

Javob: A) 45°.

4.7. Agar katerning oqim bo'yicha tezligi 72 km/soat, oqimga qarshi tezligi 50,4 km/soat bo'lsa, oqim tezligini (m/s) toping.

- A) 2 B) 3 C) 2,5 D) 4

Berilgan:

$$v_1 = 20 \text{ m/s}$$

$$v_2 = 14 \text{ m/s}$$

$$u = ?$$

Yechilishi: Kater oqim bo'ylab harakat qilganda, suvga nisbatan tezligiga oqim tezligi qo'shiladi va yerga nisbatan tezligi $v_1 = v + u$ ga teng. Oqimga qarshi harakat qilganda esa $v_2 = v - u$ ga teng.

$$\begin{cases} v_1 = v + u \\ v_2 = v - u \end{cases} \Rightarrow v_1 - v_2 = 2u; \quad u = \frac{v_1 - v_2}{2} = 3 \text{ m/s}$$

Javob: B) 3.

4.8. Uzunligi 129 m bo'lgan poyezd parallel yo'lda 9 km/soat tezlik bilan ketayotgan velosipedchini 6 s da quvib o'tgan bo'lsa, poyezdning tezligi (m/s) qanchaga teng bo'ladi?

- A) 22,5 B) 24 C) 20 D) 22

Berilgan:

$l = 129 \text{ m}$

$t = 6 \text{ s}$

$v = 2,5 \text{ m/s}$

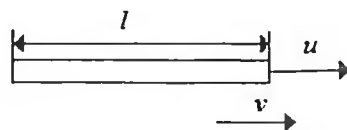
$u = ?$

Yechilishi: Poyezdning velosipedchiga nisbatan tezligi:

$v_n = u - v \text{ ga teng.}$

$l = v_n t = (u - v)t$

$u = \frac{l}{t} + v = 24 \text{ m/s}$

**Javob:** B) 24.

4.9. Daryo bo'yida joylashgan ikkita shahar orasidagi masofa 60 km ga teng. Kater oqim bo'yicha harakatlanganda, shu masofani 2 soatda, oqimga qarshi esa 6 soatda bosib o'tadi. Katerning turg'un suvga nisbatan tezligini (km/soat) aniqlang.

A) 18

B) 20

C) 16

D) 19

Berilgan:

$S = 60 \text{ km}$

$t_1 = 2 \text{ soat}$

$t_2 = 6 \text{ soat}$

$v = ?$

Yechilishi: v — katerning tezligi, u — oqim tezligi.

Kater oqim bo'ylab harakat qilganda yerga nisbatan tezligi:

$v_1 = v + u$

Oqimga qarshi harakat qilganda: $v_2 = v - u$

$$\begin{cases} S = v_1 t_1 = (u + v)t_1 \\ S = v_2 t_2 = (v - u)t_2 \end{cases} \quad \begin{cases} S = (u + v)t_1 \\ S = (v - u)t_2 \end{cases}$$

$$+ \begin{cases} \frac{S}{t_1} = v + u \\ \frac{S}{t_2} = v - u \end{cases} \Rightarrow v = \frac{S}{2} \left(\frac{1}{t_1} + \frac{1}{t_2} \right) = 20 \text{ km/soat}$$

Javob: B) 20.

4.10. Uzunligi 250 m bo'lgan, 36 km/soat tezlik bilan harakatlanayotgan mashinalar qatori 600 m uzunlikdagi ko'prikdan necha sekundda o'tib ketadi?

A) 80

B) 85

C) 60

D) 90

Berilgan:

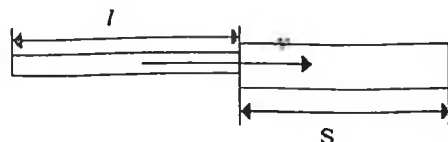
$l = 250 \text{ m}$

$S = 600 \text{ m}$

$v = 10 \text{ m/s}$

$t = ?$

Yechilishi: Mashinalar qatori ko'prikdan to'liq o'tib ketishi uchun t vaqtda $(l + S)$ masofani yurishi kerak.



$$l + S = vt \Rightarrow t = \frac{l + S}{v} = 85 \text{ s}$$

Javob: B) 85.

4.11. Uzunligi 480 m bo'lgan poyezd tekis harakatlanib, 240 m uzunlikdagi ko'prikdan 2 minutda o'tdi. Poyezdning tezligi qanday?

- A) 4 m/s B) 6 m/s C) 10 km/soat D) 36 km/soat

Berilgan:

$$l = 480 \text{ m}$$

$$S = 240 \text{ m}$$

$$t = 120 \text{ s}$$

$$v = ?$$

Yechilishi: poyezd ko'prikdan to'liq o'tishi uchun oldin lokomotiv ko'priq uzunligi S ni o'tishi va oxirgi vagon ko'prikdan to'liq tushishi uchun yana poyezd uzunligi l ga teng masofani o'tishi kerak. Demak, poyezd hammasi bo'lib $l + S$ masofani v tezlik bilan t vaqtda o'tadi, ya'ni:

$$l + S = vt \Rightarrow v = \frac{l + S}{t} = 6 \text{ m/s}$$

Javob: B) 6 m/s.

4.12. Har birining uzunligi 200 m bo'lgan ikki poyezd bir-biriga tomon bir xil 36 km/soat tezlik bilan harakatlanmoqda. Poyezdlar bir-birining yonidan qancha vaqtda o'tadi?

- A) 10 s B) 18 s C) 36 s D) 20 s

Berilgan:

$$l = 200 \text{ m}$$

$$v = 10 \text{ m/s}$$

$$t = ?$$

Yechilishi: $S_1 = S_2 = l, v_1 = v_2 = v$

Umumiy uzunlik: $S = S_1 + S_2 = 2l$

Nisbiy tezlik: $v_n + v_1 = 2v$

$$t = \frac{S}{v_n} = \frac{2l}{2v} = \frac{l}{v} = 20 \text{ s}$$

Javob: D) 20 s.

4.13. Havo sharini shamol janub tomon olib ketmoqda. Bunda shar ustiga o'rnatilgan bayroqcha qaysi tomonga hilpiraydi?

- A) janub tomonga B) shimol tomonga
C) sharq tomonga D) u hilpiramaydi

Bayroqcha inersiya tufayli shimol tomonga shamol tezligi bilan hilpirashi kerak. Lekin shimol tomondan ta'sir qilayotgan shamol ham bayroqqa ta'sir qiladi va u hilpiramay osilib qoladi.

Javob: D) u hilpiramaydi.

4.14. Vertolyot o'zgarmas 24 m/s tezlik bilan shimol tomon uchmoqda. G'arb tomondan 10 m/s tezlik bilan shamol essa, vertolyot qanday tezlik bilan uchadi (m/s)?

A) 13

B) 24

C) 26

D) 28

Berilgan:

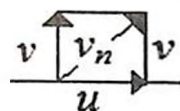
$u = 10 \text{ m/s}$

$v = 24 \text{ m/s}$

$v_n = ?$

Yechilishi: Vertolyot 2 ta tezlikning natijalovchisi bo'ylab harakat qiladi. Natijalovchi tezlikni Pifagor teoremasi orqali topamiz:

$$v_n^2 = v^2 + u^2 \Rightarrow v_n = \sqrt{v^2 + u^2} = 26 \text{ m/s}$$

*Javob:* C) 26.

4.15. Ikki avtomobil to'g'ri burchak ostida kesishuvchi ikki yo'l bo'ylab harakatlanmoqda. Ulardan biri chorrahaga 16 m/s tezlik bilan yaqinlashmoqda, ikkinchisi esa u yerdan 12 m/s tezlik bilan uzoqlashmoqda. 1 - avtomobilning 2 - avtomobilga nisbatan tezligining modulini toping.

A) 4 m/s

B) 12 m/s

C) 16 m/s

D) 20 m/s

Berilgan:

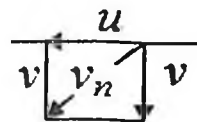
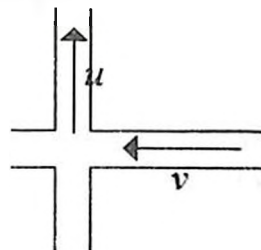
$u = 16 \text{ m/s}$

$v = 12 \text{ m/s}$

$v_n = ?$

Yechilishi: 2- avtomobilni tinch turibdi deb olib, 1- avtomobilning tezligiga qarshi uning tezligini qo'shamiz:

$$v_n^2 = v^2 + u^2 \Rightarrow v_n = \sqrt{v^2 + u^2} = 20 \text{ m/s}$$

*Javob:* D) 20 m/s

4.16. Sol daryoda 6 km/soat tezlik bilan suzib ketayapti. Sol ustidagi odam harakat yo'nalishiga tik ravishda 8 km/soat tezlik bilan harakatlanayapti. Qirg'oq bilan bog'langan sanoq sistemasiga nisbatan odamning tezligi qanchaga teng bo'ladi (km/soat)?

A) 2

B) 10

C) 7

D) 14

Berilgan:

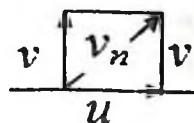
$u = 6 \text{ km/soat}$

$v = 8 \text{ km/soat}$

$v_n = ?$

Yechilishi: Sol daryo tezligi bilan harakat qiladi. Odam sol ustida harakat qilayotgani uchun uning yerga nisbatan tezligi quyidagicha topiladi:

$$v_n^2 = v^2 + u^2 \Rightarrow v_n = \sqrt{v^2 + u^2} = 10 \text{ km/soat}$$

*Javob:* B) 10.

4.17. Qayiqning daryo oqimi bo'ylab suzgandagi qirg'oqqa nisbatan tezligi 3 m/s, oqimga qarshi suzganda esa 2 m/s. Daryo oqimining tezligi (m/s) nimaga teng?

- A) 0,5 B) 1 C) 2,5 D) 5

Berilgan:

$$v_1 = 3 \text{ m/s}$$

$$v_2 = 2 \text{ m/s}$$

$$u = ?$$

Yechilishi: Kater oqim bo'ylab harakat qilganda, suvga nisbatan tezligiga oqim tezligi qo'shiladi va yerga nisbatan tezligi $v_1 = v + u$ ga teng. Oqimga qarshi harakat qilganda esa $v_2 = v - u$ ga teng.

$$\begin{cases} v_1 = v + u \\ v_2 = v - u \end{cases} \Rightarrow v_1 - v_2 = 2u; \quad u = \frac{v_1 - v_2}{2} = 0,5 \text{ m/s}$$

Javob: A) 0,5.

4.18. 200 m uzunlikdagi poyezd 10 m/s tezlik bilan tekis harakatlanib, uzunligi 300 m bo'lgan tunnelga kirib bormoqda. Qancha vaqtdan keyin poyezd tunneldan chiqib ketadi?

- A) 10 s B) 20 s C) 25 s D) 50 s

Berilgan:

$$l = 200 \text{ m}$$

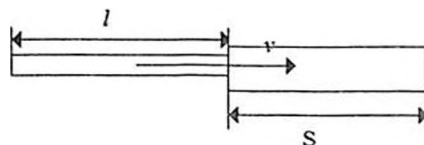
$$S = 300 \text{ m}$$

$$v = 10 \text{ m/s}$$

$$t = ?$$

Yechilishi: Poyezd tunneldan to'liq o'tib ketishi uchun t vaqtda $(l + S)$ masofani bosib o'tishi kerak.

$$l + S = vt \Rightarrow t = \frac{l + S}{v} = 50 \text{ s}$$



Javob: D) 50 s.

4.19. Bir nuqtadan o'zaro tik yo'nalishlarda harakat boshlaganlaridan 10 s o'tgach velosipedchi va mototsiklchi orasidagi masofa 150 m bo'ldi. Mototsiklchining tezligini toping (m/s). U velosipedchi tezligidan 3 marta katta.

- A) $\sqrt{10}$ B) $6\sqrt{10}$ C) $4,5\sqrt{10}$ D) $3\sqrt{10}$

Berilgan:

$$v = 3u$$

$$S = 150 \text{ m}$$

$$t = 10 \text{ s}$$

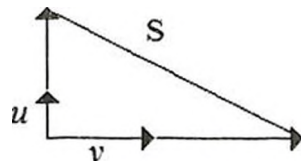
$$v = ?$$

Yechilishi:

$$\begin{cases} S_1 = vt = 3ut \\ S_2 = ut \end{cases}$$

$$S = \sqrt{S_1^2 + S_2^2}$$

$$S = \sqrt{(3ut)^2 + (ut)^2} = \sqrt{10(ut)^2} = \sqrt{10}ut$$



$$S = ut\sqrt{10} \Rightarrow u = \frac{S}{t\sqrt{10}} = \frac{150}{10\sqrt{10}} = 1,5\sqrt{10} \text{ m/s}$$

$$v = 3u = 4,5\sqrt{10} \text{ m/s}$$

Javob: C) $4,5\sqrt{10}$.

4.20. Ikki poyezd bir-biriga tomon 18 va 36 km/soat tezlik bilan harakatlanmoqda. Birinchi poyezddagi passajir ikkinchi poyezd uning yonidan 20 s davomida o'tganini aniqladi. Ikkinchi poyezdning uzunligi qancha bo'lgan?

- A) 100 m B) 200 m C) 300 m D) 400 m

Berilgan:

$$v_1 = 5 \text{ m/s}$$

$$v_2 = 10 \text{ m/s}$$

$$t = 20 \text{ s}$$

$$l_2 = ?$$

Yechilishi: 1-poyezdning 2-poyezdga nisbatan tezligi

$$v_{12} = v_1 + v_2 \text{ ga teng.}$$

$$l_2 = v_{12}t \Rightarrow l_2 = (v_1 + v_2)t = 300 \text{ m}$$

Javob: C) 300 m.

4.21. O'zgarmas 9 km/soat tezlik bilan ketayotgan velosipedchi yonidan 27 km/soat tezlik bilan qarshi yo'nalishda kelayotgan 540 m uzunlikdagi avtokolonna qancha vaqtda o'tadi?

- A) 10 s B) 15 s C) 36 s D) 54 s

Berilgan:

$$v_1 = 2,5 \text{ m/s}$$

$$v_2 = 7,5 \text{ m/s}$$

$$S = 540 \text{ m}$$

$$t = ?$$

Yechilishi: Avtokolonnaning velosipedchiga nisbatan tezligi

$$v_{12} = v_1 + v_2 \text{ ga teng.}$$

$$l = v_{12}t \Rightarrow l = (v_1 + v_2)t \Rightarrow t = \frac{S}{v_1 + v_2} = 54 \text{ s.}$$

Javob: D) 54 s.

4.22. Uzunligi 150 m va tezligi 36 km/soat bo'lgan poyezd 300 m uzunlikdagi tunnelni qancha vaqtda bosib o'tadi (s)?

- A) 45 B) 20 C) 10 D) 30

Berilgan:

$$l = 150 \text{ m}$$

$$S = 300 \text{ m}$$

$$v = 10 \text{ m/s}$$

$$t = ?$$

Yechilishi: Poyezd tunneldan to'liq o'tib ketishi uchun t vaqtda $(l + S)$ masofani bosib o'tishi kerak.

$$l + S = vt \Rightarrow t = \frac{l + S}{v} = 45 \text{ s}$$

Javob: A) 45.

4.23. Mototsiklchining yerga nisbatan tezligi 20 m/s, uning harakatiga qarshi esayotgan shamolning tezligi esa 72 km/soat. Mototsiklchiga nisbatan shamolning tezligi nimaga teng (m/s)?

- A) 20 B) 30 C) 40 D) 15

Berilgan:

$$u = 20 \text{ m/s}$$

$$v = 20 \text{ m/s}$$

$$u_n = ?$$

Yechilishi: Mototsiklchiga nisbatan shamolning tezligini topishda mototsiklchini tinch turibdi deb olamiz va uning tezligini shamol tezligiga beramiz. Bunda nisbiy tezlik ikkala tezlikning yig'indisi bo'lib keladi.

$$u_n = v + u = 40 \text{ m/s}$$

Javob: C) 40.

4.24. Vertikal tashlangan jism, shamol bo'lmaganda, yerga 8 m/s tezlik bilan tushadi. Agar g'arbdan 6 m/s tezlikda shamol esayotgan bo'lsa, jismning yerga tushishdagi tezligi qanday bo'ladi (m/s)?

- A) 5 B) 7 C) 1 D) 10

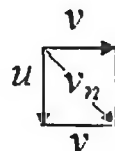
Berilgan:

$$v = 6 \text{ m/s}$$

$$u = 8 \text{ m/s}$$

$$v_n = ?$$

Yechilishi: agar shamol bo'lmasa jism $\bar{u}$ tezlik bilan vertikal tushar edi. $\bar{v}$ tezlik bilan esayotgan shamol jismning harakat yo'nalishini o'zgartiradi. Natijada jism bu ikki tezlik vektorlarining teng ta'sir etuvchisi bo'ylab harakat qiladi.



$$\bar{v}_n = \bar{v} + \bar{u}$$

v_n ni Pifagor teoremasiga asoslanib topamiz:

$$v_n = \sqrt{v^2 + u^2} = 10 \text{ m/s}$$

Javob: D) 10.

4.25. Biror kater daryoning bir qirg'og'idan ikkinchisiga tomon oqimga perpendikular ravishda suvga bog'langan sanoq sistemasiga nisbatan 5 m/s tezlik bilan suzmoqda. Agar daryoning kengligi 1000 m, oqim tezligi 2 m/s bo'lsa, kater suzib o'tguncha, oqim uni necha metrga surib ketadi?

- A) 500 B) 450 C) 400 D) 900

Berilgan:

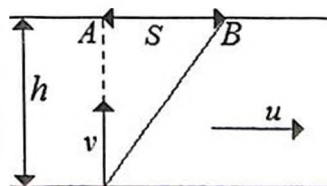
$$h = 1000 \text{ m}$$

$$u = 2 \text{ m/s}$$

$$v = 5 \text{ m/s}$$

$$S = ?$$

Yechilishi: Agar daryo tezligi bo'lmaganda, kater A nuqtadan chiqqan bo'lar edi. Lekin daryo oqimi katerni daryo bo'ylab $\bar{u}$ tezlik bilan surib ketadi va kater B nuqtadan chiqadi.



$$\begin{cases} h = vt \\ S = ut \end{cases} \Rightarrow \frac{S}{h} = \frac{u}{v} \Rightarrow S = \frac{u}{v} \cdot h = 400 \text{ m}$$

Javob: C) 400.

4.26. Kater daryoda manzilga yetib borish uchun 1,8 soat, qaytib kelish uchun esa 2,4 soat vaqt sarfladi. Agar sol jo'natilsa, manzilga necha soatda yetib boradi?

A) 14,4

B) 4,2

C) 2,1

D) 5,2

Berilgan:

$$t_1 = 1,8 \text{ soat}$$

$$t_2 = 2,4 \text{ soat}$$

$$t = ?$$

Yechilishi: v — katerning tezligi, u — oqim tezligi. Kater oqim bo'ylab harakat qilganda yerga nisbatan $v_1 = v + u$ tezlik bilan t_1 vaqtda manzilga, ya'ni S masofaga yetib borgan:

$$S = (v + u)t_1$$

Qaytishda esa oqimga qarshi harakat qilganda $v_2 = v - u$ tezlik bilan harakatlanib, shu masofani t_2 vaqtda bosib o'tadi:

$S = (v - u)t_2$. Sol jo'natilsa, bu masofani daryo tezligi, ya'ni u tezlik bilan bosib o'tadi: $S = ut$.

$$\begin{cases} S = (u + v) \cdot t_1 \\ S = (u - v) \cdot t_2 \\ S = u \cdot t \end{cases} \Rightarrow \begin{cases} u \cdot t = (v + u) \cdot t_1 \\ u \cdot t = (v - u) \cdot t_2 \end{cases}$$

$$\begin{cases} u \cdot (t - t_1) = v \cdot t_1 \\ u \cdot (t + t_1) = v \cdot t_2 \end{cases} \Rightarrow (t - t_1) \cdot t_2 = (t + t_2) \cdot t_1$$

$$t = \frac{2 \cdot t_1 \cdot t_2}{t_2 - t_1} = 14,4 \text{ soat}$$

Javob: A) 14,4.

4.27. Velosipedchi va yo'lovchi bir joydan bir-biriga tik ravishda 1 minut harakat qilganda, ular orasidagi masofa 150 m bo'ldi. Agar velosipedchining tezligi yo'lovchidan 3 marta katta bo'lsa, yo'lovchining tezligini toping (m/s).

A) $\sqrt{10}/3$

B) $\sqrt{10}/2$

C) $\sqrt{10}/4$

D) 1

Berilgan:

$$v = 3u$$

$$S = 150 \text{ m}$$

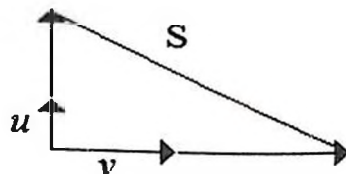
$$t = 60 \text{ s}$$

$$u = ?$$

Yechilishi:

$$S_1 = vt = 3ut$$

$$S_2 = ut$$



$$S = \sqrt{S_1^2 + S_2^2}$$

$$S = \sqrt{(3ut)^2 + (ut)^2} = \sqrt{10u^2t^2} = \sqrt{10}ut$$

$$u = \frac{S}{\sqrt{10} \cdot t} = \frac{\sqrt{10}}{4} \text{ m/s}$$

Javob: C) $\sqrt{10}/4$.

4.28. O'zgarmas 36 km/soat tezlik bilan harakatlanayotgan tramvay oynasidagi yomg'ir tomchisining izi vertikal bilan 45° burchak hosil qildi. Agar shamol esmayotgan bo'lsa, tomchining tezligini toping (m/s).

A) $5\sqrt{2}$

B) 6

C) 8

D) 10

Berilgan:

$$\alpha = 45^\circ$$

$$v = 10 \text{ m/s}$$

$$u = ?$$

Yechilishi: Tomchi tramvay oynasida gorizontali v tezlik oladi. O'zining tezligi vertikal bo'lib, u ga teng desak, natijalovchi harakat vertikal bilan α burchak tashkil qiladi.

$$\operatorname{tg} \alpha = \frac{v}{u} \Rightarrow u = \frac{v}{\operatorname{tg} \alpha} = 10 \text{ m/s}$$

Javob: D) 10.

4.29. Agar oqimga qarshi suzayotgan bolaning suvga nisbatan tezligi 1 m/s, suvning qirg'oqqa nisbatan tezligi 0,5 m/s bo'lsa, bolaning qirg'oqqa nisbatan tezligini aniqlang (m/s).

A) 0,5

B) 1

C) 1,5

D) 2

Berilgan:

$$u = 0,5 \text{ m/s}$$

$$v = 1 \text{ m/s}$$

$$v_n = ?$$

Yechilishi: Bola oqimga qarshi suzayotgani uchun bolaning yerga nisbatan tezligini topishda bolaning tezligidan oqimning tezligini ayiramiz.

$$v_n = v - u = 0,5 \text{ m/s}$$

Javob: A) 0,5.

4.30. Suvi qirg'oqqa nisbatan 3 m/s tezlik bilan oqayotgan daryoning kengligi 240 m. Tinch suvga nisbatan 4 m/s tezlik bilan harakatlana oladigan qayiq, qancha vaqtda (s) bu daryoni kesib o'tadi?

A) 20

B) 15

C) 12

D) 60

Berilgan:

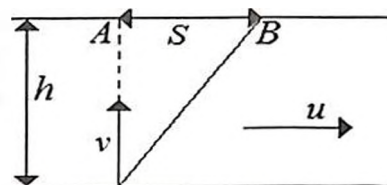
$$h = 240 \text{ m}$$

$$u = 3 \text{ m/s}$$

$$v = 4 \text{ m/s}$$

$$t = ?$$

Yechilishi: Qayiqning tezligi qirg'oqqa har doim perpendikular yo'nalgan bo'lsa, h masofani v tezlik bilan bosib o'tadi.



$$h = vt \Rightarrow t = \frac{h}{v} = 60 \text{ s}$$

Javob: D) 60.

4.31. Ikkita samolyot bir-biriga tomon 1800 km/soat va 600 m/s tezlik bilan harakatlanmoqda. Ularning nisbiy tezligi qancha (m/s)?

A) 900

B) 100

C) 2200

D) 2400

Berilgan:

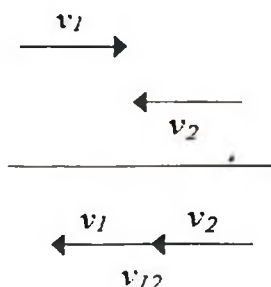
$$v_1 = 500 \text{ m/s}$$

$$v_2 = 600 \text{ m/s}$$

$$v_{12} = ?$$

Yechilishi: Demak, 1-samolyotga nisbatan 2-samolyotning tezligini topishimiz kerak. Tezlik qoidasiga asosan 1-samolyotni tinch turibdi deb olib, uning tezligini qarama-qarshi yo'nalishda 2-samolyotga beramiz.

$$v_{12} = v_1 + v_2 = 2400 \text{ m/s}$$



Javob: D) 2400.

4.32. Velosipedchi va yo'lovchi bir joydan bir tomonga harakat boshlaganda, bir minutdan keyin ular orasidagi masofa 240 m ni tashkil qildi. Ular qarama-qarshi tomonga harakat boshlaganda esa, ikki minutdan keyin masofa 720 m ga teng bo'ldi. Yo'lovchining tezligi velosipedchikidan necha marta kichik?

A) 6

B) 5

C) 4

D) 3,5

Berilgan:

$$t_1 = 60 \text{ s}$$

$$t_2 = 120 \text{ s}$$

$$S_1 = 240 \text{ m}$$

$$S_2 = 720 \text{ m}$$

$$v/u = ?$$

Yechilishi: Velosipedchi bilan yo'lovchi bir tomonga harakat qilganida nisbiy tezlik: $v_1 = v - u$

Qarama-qarshi yo'nalishda: $v_2 = v + u$

$$\begin{cases} S_1 = (v - u)t_1 \\ S_2 = (u + v)t_2 \end{cases}$$

$$\begin{cases} \frac{S_1}{t_1} = v - u \\ \frac{S_2}{t_2} = v + u \end{cases} \Rightarrow$$

$$+ \Rightarrow \frac{S_1}{t_1} + \frac{S_2}{t_2} = 2v$$

$$- \Rightarrow \frac{S_2}{t_2} + \frac{S_1}{t_1} = 2u$$

$$\frac{v}{u} = \frac{\frac{S_1}{t_1} + \frac{S_2}{t_2}}{\frac{S_2}{t_2} - \frac{S_1}{t_1}} = 5$$

Javob: B) 5.

4.33. Ikki velosipedchi bir joydan harakatni boshladi. Birinchi velosipedchi o'zgarmas 8 m/s tezlik bilan sharq tomonga, ikkinchi velosipedchi esa o'zgarmas 5 m/s tezlik bilan g'arb tomonga qarab harakatlanmoqda. Harakat boshidan 10 s o'tgach, ular orasidagi masofa necha metrga teng bo'ladi?

A) 80 B) 50 C) 130 D) 30

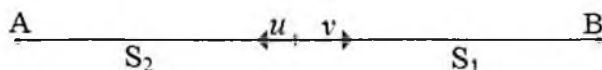
Berilgan:

$$t = 10 \text{ s}$$

$$u = 5 \text{ m/s}$$

$$v = 8 \text{ m/s}$$

$$S = ?$$



Yechilishi: 1-velosipedchi v tezlik bilan S_1 masofani bosib o'tib, B nuqtaga yetib borsin. 2-velosipedchi esa S_2 masofani bosib o'tib, A nuqtaga yetib keladi. t vaqtdan keyingi umumiy masofa quyidagiga teng:

$$S = S_1 + S_2$$

$$S_1 = vt; \quad S_2 = ut; \quad \Rightarrow \quad S = (v + u)t = 130m$$

Javob: C) 130.

4.34. Ikkita bir xil uzunlikdagi avtomobil bir-biriga tomon 60 va 90 km/soat tezlik bilan harakatlanmoqda. Ikkinchi avtomobil birinchi avtomobil yonidan 0,144 s davomida o'tganligi aniqlandi. Bitta avtomobilning uzunligi qancha?

A) 3 m B) 6 m C) 21,6 m D) 4,32 m

Berilgan:

$$v_1 = 16,7 \text{ m/s}$$

$$v_2 = 25 \text{ m/s}$$

$$t = 0,144 \text{ s}$$

$$l = ?$$

Yechilishi: Umumiy masofa: $S = 2l$

Qarama-qarshi harakatda nisbiy tezlik $v_n = v_1 + v_2$

$$S = v_n t \Rightarrow 2l = (v_1 + v_2)t \Rightarrow l = \frac{(v_1 + v_2)t}{2} = 3m$$

Javob: A) 3 m.

4.35. Bola qayiqni daryo qirg'og'iga perpendikular yo'nalishda haydamoqda, lekin suv oqimi uning yo'nalishini shunday o'zgartiryaptiki, natijaviy tezlik v vektori qirg'oq bilan α burchakni hosil qilyapti. Suv oqimining tezligi qancha?

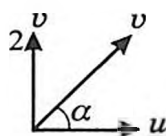
A) $v \cdot \cos \alpha$ B) $v \cdot \sin \alpha$ C) $v \cdot \operatorname{tg} \alpha$ D) $v \cdot \operatorname{ctg} \alpha$

Berilgan:
 $\alpha; v$
 $u = ?$

Yechilishi: Kosinus funksiyasidan foydalanamiz, chizmadan ko'rinadiki:

$$\cos \alpha = \frac{u}{v} \text{ ga teng}$$

$$u = v \cdot \cos \alpha$$



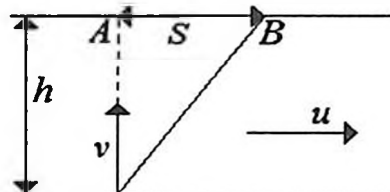
Javob: A) $v \cdot \cos \alpha$

4.36. Turg'un suvdagi harakat tezligi 3 m/s bo'lgan qayiq, kengligi 300 m va oqimining tezligi 1,8 m/s bo'lgan daryodan tik suzib o'tmoqda. Oqim qayiqni qancha masofaga surib ketadi (m)?

- A) 60 B) 150 C) 180 D) 125

Berilgan:
 $h = 300 \text{ m}$
 $u = 1,8 \text{ m/s}$
 $v = 3 \text{ m/s}$
 $S = ?$

Yechilishi: Agar daryo tezligi bo'lmaganda kater A nuqtadan chiqqan bo'lar edi. Lekin daryo oqimi katerni daryo bo'ylab u tezlik bilan surib ketadi va kater B nuqtadan chiqadi.



$$\begin{cases} h = vt \\ S = ut \end{cases} \Rightarrow \frac{S}{h} = \frac{u}{v} \Rightarrow S = \frac{u}{v} \cdot h = 180 \text{ m}$$

Javob: C) 180.

4.37. Ikki parallel temir yo'ldan uzunligi 80 m, tezligi 54 km/soat bo'lgan yuk poyezdi va uzunligi 140 m, tezligi 90 km/soat bo'lgan passajir poyezdi bir tomonga harakatlanmoqda. Qancha vaqt davomida ikkinchi poyezd birinchi poyezdni quvib o'tadi (s)?

- A) 10 B) 12,5 C) 15 D) 22

Berilgan:
 $l_1 = 80 \text{ m}$
 $l_2 = 140 \text{ m}$
 $v_1 = 10 \text{ m/s}$
 $v_2 = 25 \text{ m/s}$
 $t = ?$

Yechilishi: Umumiy yurish kerak bo'lgan masofa: $S = l_1 + l_2$
 Nisbiy tezlik: $v_n = v_2 - v_1$

$$S = v_n t \Rightarrow t = \frac{S}{v_n} \Rightarrow t = \frac{l_1 + l_2}{v_2 - v_1} = 22 \text{ s}$$

Javob: D) 22.

4.38. Ikki teploxod bir vaqtning o'zida A portdan B portga qarab jo'nadi. Ularning birinchisi borib-kelishi uchun 4 sutka, ikkinchisi 6 sutka sarflaydi. Necha sutkadan keyin ikkala teploxod A portda yana birga bo'lishini aniqlang.

- A) 12 B) 6 C) 9 D) 11

Berilgan:
$t_1 = 4$ sutka
$t_2 = 6$ sutka
$t = ?$

Yechilishi: 1-teploxod 3 marta, 2-teploxod esa 2 marta borib kelganidan keyin ular A nuqtada bo'lishadi.

$$t = 3t_1 = 2t_2 = 12 \text{ sutka}$$

Javob: A) 12.

4.39. A va B punktlardan bir-biriga qarab ikki velosipedchi yo'lga chiqdi. Ular B punktga 30 km qolganda uchrashishdi. Manzilga borib qaytishda esa A punktdan 18 km uzoqlikda uchrashishdi. Punktlar oralig'idagi masofani toping (km).

A) 60

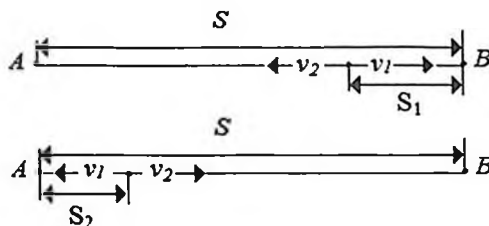
B) 48

C) 72

D) 78

Berilgan:
$S_1 = 30$ km
$S_2 = 18$ km
$S = ?$

Yechilishi:



1-uchrashuvdagi velosipedchilar bosib o'tgan masofalar bo'yicha

$$\begin{cases} S - S_1 = v_1 t_1 \\ S_1 = v_2 t_1 \end{cases} \Rightarrow \frac{S - S_1}{S_1} = \frac{v_1}{v_2}$$

2-uchrashuvda velosipedchilar manzilga borib kelishdagi masofalar bo'yicha:

$$\begin{cases} S_1 + S - S_2 = v_1 t_2 \\ S - S_1 + S_2 = v_2 t_2 \end{cases} \Rightarrow \frac{S - S_2 + S_1}{S - S_1 + S_2} = \frac{v_1}{v_2}$$

$$\begin{cases} \frac{S - S_1}{S_1} = \frac{v_1}{v_2} \\ \frac{S - S_2 + S_1}{S - S_1 + S_2} = \frac{v_1}{v_2} \end{cases} \Rightarrow \frac{S - S_1}{S_1} = \frac{S - S_2 + S_1}{S - S_1 + S_2} \Rightarrow S = 72 \text{ km}$$

Javob: C) 72.

4.40. O'zgarmas 5 m/s tezlik bilan esayotgan shamolga qarshi 72 km/soat tezlik bilan harakatlanayotgan avtomobilning shamolga nisbatan tezligi necha m/s ga teng?

A) 25

B) 20

C) 15

D) -30

Berilgan:
$u = 5 \text{ m/s}$
$v = 20 \text{ m/s}$
$v_n = ?$

Yechilishi: Harakatning qarama-qarshi ekanligi uchun nisbiy tezlik ikkala tezlikning yig'indisi bo'lib keladi.

$$v_n = v + u = 25 \text{ m/s}$$

Javob: A) 25.

4.41. Eskalator odamni 30 sekundda olib chiqadi. Agar odam va eskalator birgalikda harakat qilsa, 15 sekundda ko'tariladi. Eskalator tinch tursa, odam qancha vaqtda yuqoriga chiqadi?

A) 22,5

B) 10

C) 30

D) 15

Berilgan:
$t_1 = 30 \text{ s}$
$t = 15 \text{ s}$
$t_2 = ?$

Yechilishi: v — odamning tezligi, u — eskalator tezligi.

Faqat eskalator harakat qilsa: $S = ut_1$

Faqat odam harakat qilsa: $S = vt_2$

Ikkalasi bir vaqtda harakat qilsa: $S = (v + u)t$

$$\begin{cases} S = ut_1 \\ S = vt_2 \end{cases} \Rightarrow \begin{cases} ut_1 = (u + v)t \\ vt_2 = (u + v)t \end{cases}$$

$$\begin{cases} u(t_1 - t) = vt \\ ut = v(t_2 - t) \end{cases} \Rightarrow t = \frac{t_1 t_2}{t_1 + t_2} \Rightarrow t_2 = \frac{t_1 t}{t_1 - t} = 30 \text{ s}$$

Javob: C) 30.

4.42. 72 km/soat tezlik bilan harakatlanayotgan mototsiklchi 36 km/soat tezlik bilan harakatlanayotgan ikkinchi mototsiklchini quvib kelmoqda. Ular orasidagi masofa 350 m bo'lgan vaqtdan boshlab qancha vaqtdan so'ng birinchi mototsiklchi ikkinchi mototsiklchiga yetib oladi?

A) 20 s

B) 10 s

C) 72 s

D) 35 s

Berilgan:
$v_1 = 20 \text{ m/s}$
$v_2 = 10 \text{ m/s}$
$S = 350 \text{ m}$
$t = ?$

Yechilishi: 1-mototsiklchining 2-mototsiklchiga nisbatan tezligi $v_{12} = v_1 - v_2$ ga teng.

$$S = v_{12}t \Rightarrow S = (v_1 - v_2)t \Rightarrow t = \frac{S}{v_1 - v_2} = 35 \text{ s.}$$

Javob: D) 35 s.

4.43. Metro eskalatori tinch turgan yo'lovchini 1 minutda yuqoriga olib chiqadi. Harakatlanmayotgan eskalatoridan yo'lovchi 3 minutda yuqoriga ko'tariladi. Yo'lovchi harakatlanayotgan eskalator yuqoriga qarab yurib qancha vaqtda ko'tariladi?

A) 2 minut

B) 45 s

C) 1,5 minut

D) 40 s

Berilgan:

$$t_1 = 1 \text{ min}$$

$$t_2 = 3 \text{ min}$$

$$t = ?$$

Yechilishi: v — odamning tezligi, u — eskalator tezligi.

Faqat eskalator harakat qilsa: $S = ut_1$

Faqat odam harakat qilsa: $S = vt_2$

Ikkalasi bir vaqtda harakat qilsa: $S = (v + u)t$

$$\begin{cases} S = ut_1 \\ S = vt_2 \\ S = (v + u)t \end{cases} \Rightarrow \begin{cases} ut_1 = (u + v)t \\ vt_2 = (u + v)t \end{cases}$$

$$\begin{cases} u(t_1 - t) = vt \\ ut = v(t_2 - t) \end{cases} \Rightarrow t = \frac{t_1 t_2}{t_1 + t_2} = \frac{3}{4} \text{ min} = 45 \text{ s}$$

Javob: B) 45 s.

4.44. Moddiy nuqta bir vaqtda o'zaro 120° burchak hosil qilib yo'nalgan ikki tekis harakatda qatnashadi. Ikkala harakatning harakat tezliklari 6 m/s ga teng. Natijaviy tezlikni toping (m/s).

A) 0

B) 6

C) 1,5

D) 3

Berilgan:

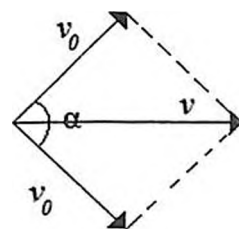
$$\alpha = 120^\circ$$

$$v_0 = 6 \text{ m/s}$$

$$v = ?$$

Yechilishi: $v = \sqrt{v_0^2 + v_0^2 + 2v_0v_0 \cos \alpha}$

$$v = \sqrt{36 + 36 - 2 \cdot 36 \cdot \frac{1}{2}} = 6 \text{ m/s}$$



Javob: B) 6.

4.45. Tokarlik stanogi keskichining bo'ylama tezligi 12 sm/min. , ko'ndalang tezligi 5 sm/min. Stanok korpusiga bog'langan sanoq sistemasida keskichning tezligi qanday (sm/min)?

A) 17

B) 8,5

C) 7

D) 13

Berilgan:

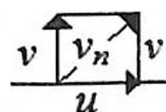
$$u = 12 \text{ sm/min}$$

$$v = 5 \text{ sm/min}$$

$$v_n = ?$$

Yechilishi: Natijalovchi tezlikni Pifagor teoremasi orqali topamiz:

$$v_n^2 = v^2 + u^2 \Rightarrow v_n = \sqrt{v^2 + u^2} = 13 \text{ sm/min.}$$



Javob: D) 13.

4.46. Jism bir vaqtda o'zaro 60° burchak hosil qilib yo'nalgan ikki tekis harakatda qatnashadi. Ikkala harakatning tezligi 1 m/s ga teng. Natijalovchi harakat tezligini toping (m/s).

A) 0

B) 10

C) $\sqrt{3}$

D) 2,5

Berilgan:

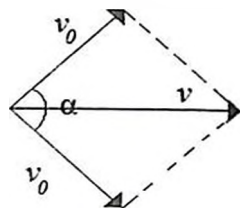
$$\alpha = 60^\circ$$

$$v_0 = 1 \text{ m/s}$$

$$v = ?$$

Yechilishi: $v = \sqrt{v_0^2 + v_0^2 + 2v_0v_0 \cos \alpha}$

$$v = \sqrt{1 + 1 + 2 \cdot 1 \cdot \frac{1}{2}} = \sqrt{3} \text{ m/s}$$



Javob: C) $\sqrt{3}$

4.47. Tovush shamolsiz havoda 340 m/s tezlik bilan tarqaladi. Havoning temperaturasi 0°C , shamolning tezligi 25 m/s bo'lsa, shamol yo'nalishi bo'ylab tovush qanday tezlikda tarqaladi (m/s)?

A) 365

B) 305

C) 178

D) 355

Berilgan:

$$u = 25 \text{ m/s}$$

$$v = 340 \text{ m/s}$$

$$v_n = ?$$

Yechilishi: Shamol tovush tezligi bilan bir xil yo'nalishda bo'lganida tovush tarqalishiga yordam beradi va natijalovchi tezlik quyidagicha aniqlanadi:

$$v_n = v + u = 365 \text{ m/s}$$

Javob: A) 365.

4.48. Tovush shamolsiz havoda 340 m/s tezlik bilan tarqaladi. Havoning temperaturasi 0°C , shamolning tezligi 25 m/s bo'lsa, tovush shamolga qarama-qarshi yo'nalishda qanday tezlik bilan tarqalishini toping (m/s).

A) 153

B) 178

C) 315

D) 355

Berilgan:

$$u = 25 \text{ m/s}$$

$$v = 340 \text{ m/s}$$

$$v_n = ?$$

Yechilishi: Shamol tovush tezligiga qarama-qarshi yo'nalishda bo'lganida tovush tarqalishiga xalaqit beradi va natijalovchi tezlik quyidagicha aniqlanadi:

$$v_n = v - u = 315 \text{ m/s}$$

Javob: C) 315.

4.49. Tezliklarining modullari bir xil 72 km/soat ga teng bo'lgan ikki jismning harakat yo'nalishlari orasidagi burchak 120° ga teng. Ikkinchi jismning birinchi jismga nisbatan tezligining modulini toping (m/s).

A) 17,3

B) 14,1

C) $20\sqrt{3}$

D) $10\sqrt{3}$

Berilgan:

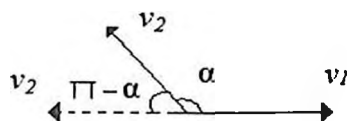
$$\alpha = 120^\circ$$

$$v_1 = v_2 = v = 20 \text{ m/s}$$

$$v = ?$$

Yechilishi: 1-jismni tinch deb olib, tezlikni ikkinchi jismga beramiz.

Endi tezliklarni qo'shamiz:



$$v = \sqrt{v^2 + v^2 - 2 \cdot v \cdot v \cdot \cos \alpha}$$

$$v = \sqrt{2v^2 - 2v^2 \cos \alpha} = \sqrt{2 \cdot 400 + 2 \cdot 400 \cdot \frac{1}{2}} = 20\sqrt{3} \text{ m/s}$$

Javob: C) $20\sqrt{3}$.

4.50. Velosiped g'arb tomonga qarab 8 m/s tezlik bilan harakatlanmoqda. Shimol tomondan esayotgan shamolning tezligi 2 m/s ga teng bo'lsa, velosipedning shamolga nisbatan tezligi qanchaga (m/s) teng bo'ladi?

A) $2\sqrt{17}$

B) 10

C) 6

D) $\sqrt{66}$

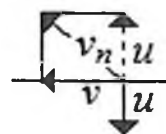
Berilgan:

$$u = 2 \text{ m/s}$$

$$v = 8 \text{ m/s}$$

$$v_n = ?$$

Yechilishi: Shamolga nisbatan aniq-lanayotgani uchun uning tezlik yo'nalishining qarama-qarshisi olinadi. Natijalovchi tezlikni Pifagor teoremasi orqali topamiz:



$$v_n^2 = v^2 + u^2 \Rightarrow v_n = \sqrt{v^2 + u^2} = 2\sqrt{17} \text{ m/s}$$

Javob: A) $2\sqrt{17}$

4.51. Ikki velosipedchi bir joydan harakatni boshladi. Birinchi velosipedchi o'zgarmas 3 m/s tezlik bilan shimol tomonga qarab, ikkinchi velosipedchi esa o'zgarmas 4 m/s tezlik bilan g'arb tomonga qarab harakatlanmoqda. Harakat boshidan 20 s o'tgach, ular orasidagi masofa necha metrga teng bo'ladi?

A) 140

B) 100

C) 80

D) 20

Berilgan:

$$v_1 = 3 \text{ m/s}$$

$$v_2 = 4 \text{ m/s}$$

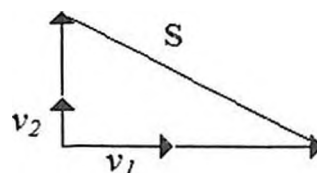
$$t = 20 \text{ s}$$

$$S = ?$$

Yechilishi: $\begin{cases} S_1 = v_1 t \\ S_2 = v_2 t \end{cases}$

$$S = \sqrt{S_1^2 + S_2^2}$$

$$S = \sqrt{(v_1 t)^2 + (v_2 t)^2} = 100 \text{ m}$$



Javob: B) 100.

4.52. Ikki jism to'g'ri burchak ostida kesishuvchi ikki yo'l bo'ylab harakatlanmoqda. Ulardan biri chorrahaga 2 m/s tezlik bilan yaqinlashmoqda, ikkinchisi esa u yerdan 4 m/s tezlik bilan uzoqlashmoqda. Birinchi jismning ikkinchi jismga nisbatan tezligining modulini toping (m/s).

A) $2\sqrt{5}$

B) 6

C) 2

D) 4

Berilgan:

$u = 2 \text{ m/s}$

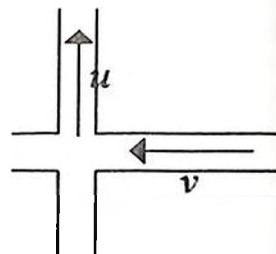
$v = 4 \text{ m/s}$

$v_n = ?$

Yechilishi: 2- jismni tinch turibdi deb olib, qarama-qarshi qo'shamiz:

$$v_n^2 = v^2 + u^2$$

$$v_n = \sqrt{v^2 + u^2} = 2\sqrt{5} \text{ m/s}$$

**Javob:** A) $2\sqrt{5}$

4.53. Ikki avtomobilning harakat yo'nalishlari orasidagi burchak 120° ga, tezliklarining modullari bir xil 36 km/soat bo'lsa, ikkinchi avtomobilning birinchi avtomobilga nisbatan tezligining moduli qanchaga (m/s) teng bo'ladi?

A) 14,1

B) 17,3

C) 16

D) 20

Berilgan:

$\alpha = 120^\circ$

$v = 10 \text{ m/s}$

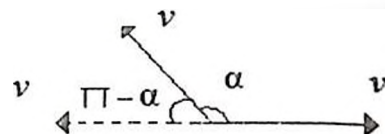
$v_n = ?$

Yechilishi:

$$v_n = \sqrt{v^2 + v^2 - 2vv \cos \alpha}$$

$$v_n = \sqrt{2v^2 - 2v^2 \cos \alpha}$$

$$v_n = \sqrt{2 \cdot 100 + 2 \cdot 100 \cdot \frac{1}{2}} = 10\sqrt{3} = 17,3 \text{ m/s}$$

Javob: B) 17,3.

4.54. Shimol tomondan 2 m/s tezlik bilan shamol esmoqda. Velosipedchi g'arb tomonga qarab 4 m/s tezlik bilan harakatlanayotgan bo'lsa, uning shamolga nisbatan tezligining moduli qanchaga (m/s) teng bo'ladi?

A) 8

B) 2

C) 6

D) $2\sqrt{5}$ **Berilgan:**

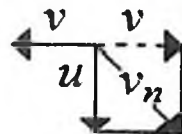
$u = 2 \text{ m/s}$

$v = 4 \text{ m/s}$

$v_n = ?$

Yechilishi:

$$v_n = \sqrt{v^2 + u^2} = 2\sqrt{5} \text{ m/s.}$$

**Javob:** D) $2\sqrt{5}$

4.55. Bir inersial sanoq tizimiga nisbatan OX o'qi bo'ylab harakatlanayotgan ikki jismning harakat tenglamalari XBS da $x_1 = 2 + 3t$ (m) va $x_2 = 1 + 2t$ (m) ko'rinishga ega. Ikkinchi jismning birinchi jismga bo'g'langan sanoq tizimidagi harakat tenglamasini toping.

A) $x = 1 - t$ B) $x = 3 + 5t$ C) $x = 1 + t$ D) $x = 2 + 3t$

Berilgan:	Yechilishi: 2-jism koordinatasidan 1-jismning koordinatasini ayiramiz.
$x_1 = 2 + 3t$	
$x_2 = 1 + 2t$	$x = x_2 - x_1 = 1 + 2t - 2 - 3t$
$x(t) = ?$	$x = -1 - t$

Javob: A) $x = -1 - t$

4.56. Bir inersial sanoq tizimiga nisbatan OX o'qi bo'ylab harakatlanayotgan ikki jismning harakat tenglamalari XBS da $x_1 = -1 + 2t$ (m) va $x_2 = 4 - 3t$ (m) ko'rinishga ega. Birinchi jismni ikkinchi jismga bo'g'langan sanoq tizimidagi harakat tenglamasini toping.

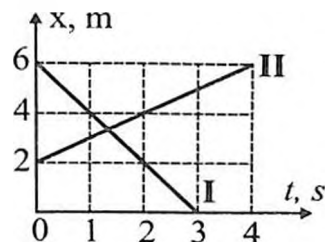
- A) $x = 3 - t$ B) $x = -5 + 5t$ C) $x = -1 + 2t$ D) $x = 4 - 3t$.

Berilgan:	Yechilishi: 1-jism koordinatasidan 1-jismning koordinatasini ayiramiz.
$x_1 = -1 + 2t$	
$x_2 = 4 - 3t$	$x = x_1 - x_2 = -1 + 2t - 4 + 3t$
$x(t) = ?$	$x = -5 + 5t$

Javob: B) $x = -5 + 5t$.

4.57. OX o'qi bo'ylab harakatlanayotgan ikki jism koordinatasining vaqtga bog'lanish grafigi keltirilgan. Birinchi jismning ikkinchi jismga nisbatan nisbiy tezligini toping (m/s).

- A) 2 B) 3 C) -3 D) -4



Grafikdan har bir jismning tezligini topamiz. Ixtiyoriy 2 ta vaqt oralig'ini olib, koordinata orqali tezlikni topamiz:

$$v_I = \frac{0 - 6}{3 - 0} = -2 \text{ m/s}; \quad v_{II} = \frac{6 - 2}{4 - 0} = 1 \text{ m/s}$$

Manfiy ishora tezlikning x o'qiga qarama-qarshi ekanini anglatadi.

Nisbiy tezlik: $v_n = v_I - v_{II} = -3 \text{ m/s}$

Javob: C) -3.

4.58. 120° burchak ostida joylashgan ikki yo'l bo'ylab ikki jism bir xil tezlikda bir-biriga yaqinlashmoqda. Kuzatish boshida jismlar yo'llarning kesishish joyidan bir xil uzoqlikda joylashgan bo'lib, ular orasidagi masofa 173 m ga teng. Mototsikllar $t = 10$ s dan keyin uchrashgan bo'lsa, ularning harakat tezligining modulini (m/s) toping.

- A) 17,3 B) 20 C) 10 D) 34,6

Berilgan:

$$\alpha = 120^\circ$$

$$S = 173 \text{ m}$$

$$t = 10 \text{ s}$$

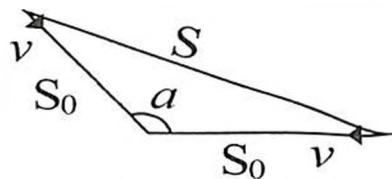
$$v = ?$$

Yechilishi: $S_0 = vt$

$$S = \sqrt{S_0^2 + S_0^2 - 2S_0S_0 \cos \alpha}$$

$$S = \sqrt{3S_0} = \sqrt{3vt}$$

$$v = \frac{S}{\sqrt{3t}} = 10 \text{ m/s}$$



Javob: C) 10.

5-§. O'zgaruvchan harakat. O'rtacha va oniy tezlik

5.1. Daryodagi qayiqning oqim bo'ylab va oqimga qarshi tezliklarining o'rtacha qiymati 3 km/soat, harakat vaqtlari esa bir-biridan ikki marta farq qiladi. Qayiqning turg'un suvdagi tezligi necha km/soat ga teng?

A) 6

B) 27/8

C) 9/8

D) 15/4

Berilgan:

$$v_{o'n} = 3 \text{ km/soat}$$

$$t_1 = 2t_2$$

$$v = ?$$

Yechilishi: v_0 — daryo oqimining tezligi;

v — qayiqning turg'un suvdagi tezligi;

Qayiqning manzilga borishdagi tezligi: $v_1 = v - v_0$

Qayiqning manzildan qaytishdagi tezligi: $v_2 = v + v_0$

Qayiq manzilga borishda S_1 masofani, qaytishda esa S_2 masofani bosib o'tgan va bu masofalar bir-biriga teng.

Qayiq bosib o'tgan umumiy masofa: $S = S_1 + S_2$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt: $t = t_1 + t_2$

$$\begin{cases} S_1 = v_1 t_1 = (v - v_0) t_1 \\ S_2 = v_2 t_2 = (v + v_0) t_2 \end{cases}$$

O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi.

$$v_{o'n} = \frac{S_{um}}{t_{um}} = \frac{S_1 + S_2}{t_1 + t_2} = \frac{(v - v_0)t_1 + (v + v_0)t_2}{2t_2 + t_2} = \frac{(v - v_0)2t_2 + (v + v_0)t_2}{3t_2}$$

$$v_{o'n} = \frac{3v - v_0}{3}$$

Ushbu ifodani yodda saqlaymiz.

$$S_1 = S_2 \text{ ekanidan foydalanamiz. } (v - v_0)t_1 = (v + v_0)t_2$$

$$(v - v_0)2t_2 = (v + v_0)t_2 \Rightarrow v_0 = \frac{v}{3}$$

$v_0 = \frac{v}{3}$ ekanini bilgan holda $v_{o'rt} = \frac{3v - v_0}{3}$ ifodani quyidagicha yozamiz:

$$v_{o'rt} = \frac{3v - \frac{v}{3}}{3} = \frac{8v}{9} \Rightarrow v = \frac{9}{8} v_{o'rt}$$

$$v = \frac{9}{8} \cdot 3 = \frac{27}{8} \text{ km/soat}$$

Javob: B) 27/8.

5.2. Poyezd yo'lining birinchi yarmini ikkinchi yarmiga nisbatan 8 marta katta tezlikda o'tdi. Agar poyezdning butun yo'l davomidagi o'rtacha tezligi 32 km/soat bo'lsa, yo'lining ikkinchi yarmidagi tezligi necha km/soat ga teng bo'lgan?

A) 18

B) 20

C) 22

D) 25

Berilgan:

$$v_{o'rt} = 32 \text{ km/soat}$$

$$v_1 = 8v_2$$

$$v_2 = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi.

$$\frac{S_1 = S/2}{v_1} \quad \frac{S_2 = S/2}{v_2}$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa: $S_{um} = S_1 + S_2 = S$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t = t_1 + t_2 = \frac{S_1}{v_1} + \frac{S_2}{v_2} = \frac{S}{2v_1} + \frac{S}{2v_2}$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{S}{\frac{S}{2v_1} + \frac{S}{2v_2}} = \frac{2v_1v_2}{v_1 + v_2}$$

Demak, jism yo'lining yarmini v_1 qolgan qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilar ekan:

$$v_{o'rt} = \frac{2v_1v_2}{v_1 + v_2}$$

Ushbu ifodadan v_2 ni topamiz:

$$v_2 = \frac{v_{o'rt} \cdot v_1}{2v_1 - v_{o'rt}}$$

$v_1 = 8v_2$ ekanidan foydalanib, v_2 tezlikni topish ifodasini quyidagicha o'zgartiramiz:

$$v_2 = \frac{9v_{o'rt}}{16} = \frac{9 \cdot 32}{16} = 18 \text{ km/soat}$$

Javob: A) 18.

5.3. Elektropoyezd yo'lining uchdan bir qismini 5 m/s tezlik bilan, qolgan qismini esa 72 km/soat tezlik bilan bosib o'tgan bo'lsa, uning o'rtacha tezligini toping (m/s).

A) 12,5

B) 10

C) 38,5

D) 18

Berilgan:

$$S_1 = S/3$$

$$v_1 = 5 \text{ m/s}$$

$$S_2 = 2S/3$$

$$v_2 = 20 \text{ m/s}$$

$$v_{o'rt} = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi:

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa:

$$S_{um} = S_1 + S_2 = \frac{S}{3} + \frac{2S}{3} = S$$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t = t_1 + t_2 = \frac{S_1}{v_1} + \frac{S_2}{v_2} = \frac{S}{3v_1} + \frac{2S}{3v_2}$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{S}{\frac{S}{3v_1} + \frac{2S}{3v_2}} = \frac{3v_1v_2}{v_2 + 2v_1}$$

Demak, jism yo'lining uchdan bir qismini v_1 , qolgan qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilar ekan:

$$v_{o'rt} = \frac{3v_1v_2}{v_2 + 2v_1}$$

$$v_{o'rt} = \frac{3 \cdot 5 \cdot 20}{20 + 2 \cdot 5} = 10 \text{ m/s.}$$

Javob: B) 10.

5.4. Poyezd yo'lining birinchi yarmini ikkinchi yarmidagiga qaraganda ikki marta katta tezlik bilan bosib o'tdi. Uning butun yo'l davomidagi o'rtacha tezligi 54 km/soat bo'lsa, birinchi yarmidagi tezligini aniqlang (m/s).

- A) 20 B) 21 C) 22 D) 22,5

Berilgan:

$$v_{o'r} = 54 \text{ km/soat}$$

$$v_1 = 2v_2$$

$$v_1 = ?$$

Yechilishi: O'rtacha tezlik

jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi.

$$\frac{S_1=S/2}{v_1} + \frac{S_2=S/2}{v_2}$$

$$v_{o'r} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa: $S_{um} = S_1 + S_2 = S$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t = t_1 + t_2 = \frac{S_1}{v_1} + \frac{S_2}{v_2} = \frac{S}{2v_1} + \frac{S}{2v_2}$$

$$v_{o'r} = \frac{S_{um}}{t_{um}} = \frac{S}{\frac{S}{2v_1} + \frac{S}{2v_2}} = \frac{2v_1v_2}{v_1 + v_2}$$

Demak, jism yo'lining yarmini v_1 , qolga qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilarkan:

$$v_{o'r} = \frac{2v_1v_2}{v_1 + v_2}$$

Ushbu ifodadan v_1 ni topamiz:

$$v_1 = \frac{v_{o'r} \cdot v_2}{2v_2 - v_{o'r}}$$

$v_1 = 2v_2$ ekanidan foydalanib, v_1 tezlikni topish ifodasini quyidagicha o'zgartiramiz:

$$v_1 = \frac{3v_{o'r}}{2} = \frac{3 \cdot 54}{2} = 81 \text{ km/soat} = 22,5 \text{ m/s}$$

Javob: D) 22,5.

5.5. Avtomobil dovonga ko'tarilishda 15 m/s, tushishda 20 m/s tezlik bilan harakatlandi. Tushish yo'li chiqish yo'lidan ikki marta uzun bo'lsa, avtomobilning butun yo'l davomidagi o'rtacha tezligi qancha bo'ladi?

- A) 20 m/s B) 18 m/s C) 15m/s D) 17,5m/s

Berilgan:

$$v_1 = 15 \text{ m/s}$$

$$S_2 = 2S_1$$

$$v_2 = 20 \text{ m/s}$$

$$v_{o'rt} = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi:

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa: $S_{um} = S_1 + S_2 = 3S_1$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t = t_1 + t_2 = \frac{S_1}{v_1} + \frac{S_2}{v_2} = \frac{S_1}{v_1} + \frac{2S_1}{v_2}$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{3S_1}{\frac{S_1}{v_1} + \frac{2S_1}{v_2}} = \frac{3v_1v_2}{v_2 + 2v_1} = 18 \text{ m/s}$$

Javob: B) 18 m/s.

5.6. Agar poyezd masofaning $1/4$ qismini v tezlik, yo'lining qolgan qismini $2v$ tezlik bilan o'tgan bo'lsa, uning shu yo'ldagi o'rtacha tezligi qanchaga teng?

A) v

B) $3v$

C) $1,6v$

D) $1,5v$

Berilgan:

$$S_1 = S/4$$

$$v_1 = v$$

$$S_2 = 3S/4$$

$$v_2 = 2v$$

$$v_{o'rt} = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi:

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa:

$$S_{um} = S_1 + S_2 = \frac{S}{4} + \frac{3S}{4} = S$$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t = t_1 + t_2 = \frac{S_1}{v_1} + \frac{S_2}{v_2} = \frac{S}{4v_1} + \frac{3S}{4v_2}$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{S}{\frac{S}{4v_1} + \frac{3S}{4v_2}} = \frac{4v_1v_2}{v_2 + 3v_1}$$

Demak, jism yo'lining uchdan bir qismini v_1 , qolgan qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilarkan:

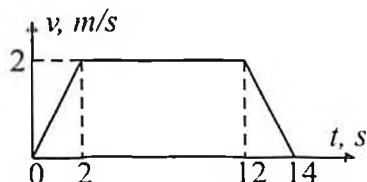
$$v_{o'rt} = \frac{4v_1v_2}{v_2 + 3v_1}$$

$$v_{o'rt} = \frac{4 \cdot v \cdot 2v}{2v + 3 \cdot v} = 1,6v$$

Javob: C) 1,6 v.

5.7. Liftning ko'tarilishdagi harakat tezligi grafigidan foydalanib, uning ko'tarilish balandligini va ko'tarilish davomidagi o'rtacha tezligini hisoblang.

- A) 24 m; 1,7m/s B) 24 m; 2 m/s
C) 24 m; 1 m/s D) 22 m; 1,6 m/s



Liftning harakat grafigidagi yuza, ya'ni trapetsiya yuzasi bizga liftning qancha balandlikka ko'tarilganini beradi:

$$S_{um} = \frac{a+b}{2} \cdot h = \frac{14+10}{2} \cdot 2 = 24m.$$

Lift bu balandlikka chiqish uchun $t_{um} = 14$ s vaqt sarflagan.
Demak, liftning o'rtacha tezligi quyidagicha:

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{24}{14} = 1,7 \text{ m/s}$$

Javob: A) 24 m; 1,7m/s

5.8. Agar jism t vaqtning birinchi yarmida 11 m/s, ikkinchi yarmida 5 m/s tezlik bilan harakat qilgan bo'lsa, uning o'rtacha tezligini (m/s) hisoblang.

- A) 7,5 B) 10 C) 8 D) 12

Berilgan:

$$\begin{aligned} t_1 &= t/2 \\ v_1 &= 11 \text{ m/s} \\ t_2 &= t/2 \\ v_2 &= 5 \text{ m/s} \\ v_{o'rt} &= ? \end{aligned}$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi:

$$v_{um} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa:

$$S_{um} = S_1 + S_2 = v_1 t_1 + v_2 t_2 = \frac{v_1 t}{2} + \frac{v_2 t}{2} = \left(\frac{v_1}{2} + \frac{v_2}{2} \right) \cdot t$$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t = t_1 + t_2 = t$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{\left(\frac{v_1}{2} + \frac{v_2}{2}\right) \cdot t}{t} = \frac{v_1 + v_2}{2}$$

Demak, jism harakatlanish vaqtining yarmini v_1 , qolgan qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilarkan:

$$v_{o'rt} = \frac{v_1 + v_2}{2}$$

$$v_{o'rt} = \frac{11 + 5}{2} = 8 \text{ m/s.}$$

Javob: C) 8.

5.9. Jism yo'lining birinchi yarmini 4 m/s, qolgan yarmini v_2 tezlik bilan bosib o'tdi. Agar o'rtacha tezlik 4,8 m/s bo'lsa, v_2 tezlikni hisoblang (m/s).

A) 5

B) 4

C) 6

D) 7

Berilgan:

$$v_{o'rt} = 4,8 \text{ m/s}$$

$$S_1 = S/2$$

$$v_1 = 4 \text{ m/s}$$

$$S_2 = S/2$$

$$v_2 = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi.



$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa: $S_{um} = S_1 + S_2 = S$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t = t_1 + t_2 = \frac{S_1}{v_1} + \frac{S_2}{v_2} = \frac{S}{2v_1} + \frac{S}{2v_2}$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{S}{\frac{S}{2v_1} + \frac{S}{2v_2}} = \frac{2v_1v_2}{v_1 + v_2}$$

Demak, jism yo'lining yarmini v_1 , qolgan qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilarkan:

$$v_{o'rt} = \frac{2v_1v_2}{v_1 + v_2}$$

Ushbu ifodadan v_2 ni topamiz:

$$v_2 = \frac{v_{o'rt} \cdot v_1}{2v_1 - v_{o'rt}} = \frac{4,8 \cdot 4}{2 \cdot 4 - 4,8} = 6 \text{ m/s}$$

Javob: C) 6.

5.10. Yengil avtomobil yo'lining birinchi yarmini 9 m/s tezlik bilan, ikkinchi yarmini 2 marta sekinroq o'tgan bo'lsa, uning butun harakat davomidagi o'rtacha tezligini aniqlang (m/s).

A) 6

B) 4

C) 8

D) 5

Berilgan:

$$v_1 = 9 \text{ m/s}$$

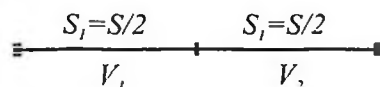
$$S_1 = S/2$$

$$v_2 = v_1/2 = 4,5 \text{ m/s}$$

$$S_2 = S/2$$

$$v_{o'rt} = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi.



$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa: $S_{um} = S_1 + S_2 = S$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t = t_1 + t_2 = \frac{S_1}{v_1} + \frac{S_2}{v_2} = \frac{S}{2v_1} + \frac{S}{2v_2}$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{S}{\frac{S}{2v_1} + \frac{S}{2v_2}} = \frac{2v_1v_2}{v_1 + v_2}$$

Demak, jism yo'lining yarmini v_1 , qolgan qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilarkan:

$$v_{o'rt} = \frac{2v_1v_2}{v_1 + v_2}$$

$$v_{o'rt} = \frac{2 \cdot 9 \cdot 4,5}{9 + 4,5} = 6 \text{ m/s}$$

Javob: A) 6.

5.11. Agar qayiqning manzilga borib kelishdagi o'rtacha tezligi 3 km/soat va manzilga borishdagi vaqti kelish vaqtidan 3 marta kichik bo'lsa, qayiqning turg'un suvdagi tezligini toping (km/soat).

A) 6

B) 5

C) 7

D) 4

Berilgan:

$$v_{o'r} = 3 \text{ km/soat}$$

$$t_2 = 3t_1$$

$$v = ?$$

Yechilishi: v_0 — daryo oqimining tezligi;

v — qayiqning turg'un suvdagi tezligi;

Qayiqning manzilga borishdagi tezligi: $v_1 = v + v_0$

Qayiqning manzildan qaytishdagi tezligi: $v_2 = v - v_0$

Qayiq manzilga borishda S_1 masofani, qaytishda esa S_2 masofani bosib o'tgan va bu masofalar bir-biriga teng.

Qayiq bosib o'tgan umumiy masofa: $S = S_1 + S_2$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt: $t = t_1 + t_2$

$$\begin{cases} S_1 = v_1 t_1 = (v + v_0) t_1 \\ S_2 = v_2 t_2 = (v - v_0) t_2 \end{cases}$$

O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi.

$$v_{o'r} = \frac{Sum}{tum} = \frac{S_1 + S_2}{t_1 + t_2} = \frac{(v + v_0) t_1 + (v - v_0) t_2}{t_1 + 3t_1} = \frac{(v + v_0) t_1 + (v - v_0) 3t_1}{4t_1}$$

$$v_{o'r} = \frac{4v - 2v_0}{4}$$

Ushbu ifodani yodda saqlaymiz!

$S_1 = S_2$ ekanidan foydalanamiz! $(v + v_0) t_1 = (v - v_0) t_2$

$$(v + v_0) t_1 = (v - v_0) 3t_1 \Rightarrow v_0 = \frac{v}{2}$$

$v_0 = \frac{v}{2}$ ekanini bilgan holda $v_{o'r} = \frac{4v - 2v_0}{4}$ ifodani quyidagicha yozamiz:

$$v_{o'r} = \frac{4v - 2 \cdot \frac{v}{2}}{4} = \frac{3}{4} v \Rightarrow v = \frac{4}{3} v_{o'r}$$

$$v = 4 \text{ km/soat.}$$

Javob: D) 4.

5.12. Agar poyezd yo'lining uchdan bir qismini v_1 tezlik bilan, qolgan qismini $v_2 = 50$ km/soat tezlik bilan o'tsa va butun yo'ldagi uning o'rtacha tezligi $v_{o'r} = 37,5$ km/soat ga teng bo'lsa, v_1 tezlik qanchaga teng bo'lgan (km/soat)?

A) 20

B) 30

C) 25

D) 35

Berilgan:

$$S_1 = S/3$$

$$v_2 = 50 \text{ km/soat}$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi:

$$\begin{array}{l} S_2 = 2S/3 \\ v_{o'rt} = 37,5 \text{ km/soat} \\ v_1 = ? \end{array}$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa:

$$S_{um} = S_1 + S_2 = \frac{S}{3} + \frac{2S}{3} = S$$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t = t_1 + t_2 = \frac{S_1}{v_1} + \frac{S_2}{v_2} = \frac{S}{3v_1} + \frac{2S}{3v_2}$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{S}{\frac{S}{3v_1} + \frac{2S}{3v_2}} = \frac{3v_1v_2}{v_2 + 2v_1}$$

Demak, jism yo'lining uchdan bir qismini v_1 qolgan qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilarkan:

$$v_{o'rt} = \frac{3v_1v_2}{v_2 + 2v_1}$$

Ushbu ifodadan v_1 ni topamiz:

$$v_1 = \frac{v_{o'rt} \cdot v_2}{3v_2 - 2v_{o'rt}} = \frac{37,5 \cdot 50}{3 \cdot 50 - 2 \cdot 37,5} = 25 \text{ m/s}$$

Javob: C) 25.

5.13. Mashina 3 minut ichida 36 km/soat, keyin 5 minut davomida 54 km/soat, so'ngra 10 minut ichida 72 km/soat tezlik bilan harakatlandi. Mashinaning o'rtacha tezligini (km/soat) toping.

A) 61

B) 60

C) 62

D) 54

Berilgan:

$$v_1 = 10 \text{ m/s}$$

$$t_1 = 180 \text{ s}$$

$$v_2 = 15 \text{ m/s}$$

$$t_2 = 300 \text{ s}$$

$$v_3 = 20 \text{ m/s}$$

$$t_3 = 600 \text{ s}$$

$$v_{o'rt} = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi.

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa:

$$S_{um} = S_1 + S_2 + S_3 = v_1t_1 + v_2t_2 + v_3t_3$$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t_{um} = t_1 + t_2 + t_3$$

$$v_{o'r} = \frac{S_{um}}{t_{um}} = \frac{v_1 t_1 + v_2 t_2 + v_3 t_3}{t_1 + t_2 + t_3} = 61 \text{ km/soat}$$

Javob: A) 61.

5.14. Avtomobil ma'lum yo'lni bosib o'tish uchun t vaqt sarfladi. U yo'lning birinchi yarmini o'zgaras 20 m/s tezlik bilan, ikkinchi yarmini 30 m/s tezlik bilan o'tdi. Avtomobilning butun yo'ldagi o'rtacha tezligini toping (m/s).

A) 25

B) 24

C) 10

D) 50

Berilgan:

$$v_1 = 20 \text{ m/s}$$

$$S_1 = S/2$$

$$v_2 = 30 \text{ m/s}$$

$$S_2 = S/2$$

$$v_{o'r} = ?$$

Yechilishi: O'rtacha tezlik jism

bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi.

$$\frac{S_1 = S/2}{v_1} + \frac{S_2 = S/2}{v_2}$$

$$v_{o'r} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa: $S_{um} = S_1 + S_2 = S$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t = t_1 + t_2 = \frac{S_1}{v_1} + \frac{S_2}{v_2} = \frac{S}{2v_1} + \frac{S}{2v_2}$$

$$v_{o'r} = \frac{S_{um}}{t_{um}} = \frac{S}{\frac{S}{2v_1} + \frac{S}{2v_2}} = \frac{2v_1 v_2}{v_1 + v_2}$$

Demak, jism yo'lning yarmini v_1 , qolgan qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilarkan:

$$v_{o'r} = \frac{2v_1 v_2}{v_1 + v_2}$$

$$v_{o'r} = \frac{2 \cdot 20 \cdot 30}{20 + 30} = 24 \text{ m/s}$$

Javob: B) 24

5.15. Mototsiklchi yo'lni teng uchga bo'lib, birinchi qismini v , ikkinchi qismini $2v$ va uchinchi qismida $3v$ tezlik bilan harakat qildi. Uning butun yo'ldagi o'rtacha tezligini aniqlang.

A) $5v/6$

B) $6v/5$

C) $18v/11$

D) $11v/18$

Berilgan:

$$S_1 = S_2 = S_3 = S/3$$

$$v_1 = v$$

$$v_2 = 2v$$

$$v_3 = 3v$$

$$v_{o'rt} = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi.

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa:

$$S_{um} = S_1 + S_2 + S_3 = S$$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t = t_1 + t_2 + t_3 = \frac{S_1}{v_1} + \frac{S_2}{v_2} + \frac{S_3}{v_3} = \frac{S}{3v_1} + \frac{S}{3v_2} + \frac{S}{3v_3}$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{S}{\frac{S}{3v_1} + \frac{S}{3v_2} + \frac{S}{3v_3}} = \frac{3v_1v_2v_3}{v_2v_3 + v_1v_3 + v_1v_2} = \frac{18}{11}v$$

Javob: C) $18v/11$.

5.16. Yo'lovchi yo'lining 6 km ni 12 km/soat tezlik bilan, qolgan 40 minutda 10 km yurdi. Yo'lovchining butun yo'ldagi o'rtacha tezligini toping (km/soat).

A) 19,2

B) 8,5

C) 7,5

D) 12

Berilgan:

$$v_1 = 12 \text{ km/soat}$$

$$S_1 = 6 \text{ km}$$

$$t_2 = 2/3 \text{ soat}$$

$$S_2 = 10 \text{ km}$$

$$v_{o'rt} = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi.

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa: $S_{um} = S_1 + S_2$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$S_{um} = 6 + 10 = 16 \text{ km}$$

$$t_{um} = t_1 + t_2 = \frac{S_1}{v_1} + t_2 = \frac{5}{6} \text{ soat}$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = 19,2 \frac{\text{km}}{\text{soat}}$$

Javob: A) 19,2.

5.17. Avtomobil butun yo'lining uchdan birini v_1 , qolgan qismini esa $v_2 = 50$ km/soat tezlik bilan o'tdi. Agar avtomobilning butun yo'l davomida o'rtacha tezligi $v_{o'rt} = 37,5$ km/soat bo'lsa, yo'lining birinchi qismida u qanday v_1 tezlik bilan harakatlangan (km/soat)?

A) 25

B) 20

C) 30

D) 7,5

Berilgan:

$$S_1 = S/3$$

$$v_2 = 50 \text{ km/soat}$$

$$S_2 = 2S/3$$

$$v_{o'rt} = 37,5 \text{ km/soat}$$

$$v_1 = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi:

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa:

$$S_{um} = S_1 + S_2 = \frac{S}{3} + \frac{2S}{3} = S$$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t = t_1 + t_2 = \frac{S_1}{v_1} + \frac{S_2}{v_2} = \frac{S}{3v_1} + \frac{2S}{3v_2}$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{S}{\frac{S}{3v_1} + \frac{2S}{3v_2}} = \frac{3v_1v_2}{v_2 + 2v_1}$$

Demak, jism yo'lining uchdan bir qismini v_1 , qolgan qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilarkan:

$$v_{o'rt} = \frac{3v_1v_2}{v_2 + 2v_1}$$

Ushbu ifodadan v_1 ni topamiz:

$$v_1 = \frac{v_{o'rt} \cdot v_2}{3v_2 - 2v_{o'rt}} = \frac{37,5 \cdot 50}{3 \cdot 50 - 2 \cdot 37,5} = 25 \text{ m/s}$$

Javob: A) 25.

5.18. Otliq 40 minutda 5 km yo'l bosdi. Keyingi 1 soatda 10 km/soat tezlik bilan yurdi. Otliqning butun yo'l davomidagi o'rtacha tezligini hisoblang (m/s).

A) 0,5

B) 1

C) 1,5

D) 2,5

Berilgan:

$$S_1 = 5 \text{ km}$$

$$t_1 = 2/3 \text{ soat}$$

$$t_2 = 1 \text{ soat}$$

$$v_2 = 10 \text{ km/soat}$$

$$v_{o'rt} = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi.

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa: $S_{um} = S_1 + S_2 = S_1 + v_2 t_2$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t_{um} = t_1 + t_2$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{S_1 + v_2 t_2}{t_1 + t_2} = 9 \text{ km/soat} = 2,5 \text{ m/s}$$

Javob: D) 2,5.

5.19. Yo'lovchi o'zgarmas 3 km/soat tezlik bilan harakatlanib, vaqtning uchdan ikki qismini sarfladi, qolgan vaqtda 6 km/soat tezlik bilan harakatlandi. Yo'lovchining o'rtacha tezligini hisoblang (km/soat).

A) 5

B) 4

C) 6

D) 4,5

Berilgan:

$$t_1 = 2t/3$$

$$v_1 = 3 \text{ km/soat}$$

$$t_2 = t/3$$

$$v_2 = 6 \text{ m/s}$$

$$v_{o'rt} = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi:

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa:

$$S_{um} = S_1 + S_2 = v_1 t_1 + v_2 t_2 = \frac{2v_1 t}{3} + \frac{v_2 t}{3} = \left(\frac{2v_1}{3} + \frac{v_2}{3} \right) \cdot t$$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t_{um} = t_1 + t_2 = t$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{\left(\frac{2v_1}{3} + \frac{v_2}{3} \right) \cdot t}{t} = \frac{2v_1 + v_2}{3}$$

Demak, jism harakatlanish vaqtining uchdan ikki qismini v_1 , qolgan qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilarkan:

$$v_{o'rt} = \frac{2v_1 + v_2}{3}$$

$$v_{o'rt} = \frac{2 \cdot 3 + 6}{3} = 4 \text{ km/soat.}$$

Javob: B) 4.

5.20. Agar avtomobil yo'lining $1/3$ qismini v tezlikda, qolgan qismini $2v$ tezlikda o'tsa, uning shu yo'ldagi o'rtacha tezligini toping.

A) $3v$

B) $2v$

C) $1,3v$

D) $1,5v$

Berilgan:

$$S_1 = S/3$$

$$v_1 = v$$

$$S_2 = 2S/3$$

$$v_2 = 2v$$

$$v_{o'rt} = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi:

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa:

$$S_{um} = S_1 + S_2 = \frac{S}{3} + \frac{2S}{3} = S$$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t_{um} = t_1 + t_2 = \frac{S_1}{v_1} + \frac{S_2}{v_2} = \frac{S}{3v_1} + \frac{2S}{3v_2}$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{S}{\frac{S}{3v_1} + \frac{2S}{3v_2}} = \frac{3v_1v_2}{v_2 + 2v_1}$$

Demak, jism yo'lining uchdan bir qismini v_1 , qolgan qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilarkan:

$$v_{o'rt} = \frac{3v_1v_2}{v_2 + 2v_1}$$

$$v_{o'rt} = \frac{3 \cdot v \cdot 2v}{2v + 2 \cdot v} = 1,5v$$

Javob: D) $1,5v$.

5.21. Velosportchi harakat vaqtining birinchi yarmida 36 km/soat tezlik bilan, ikkinchi yarmida esa 14 m/s tezlik bilan harakatlandi. Uning o'rtacha tezligini toping (m/s).

A) 25

B) 12

C) 36

D) 50

Berilgan:

$$t_1 = t/2$$

$$v_1 = 10 \text{ m/s}$$

$$t_2 = t/2$$

$$v_2 = 14 \text{ m/s}$$

$$v_{o'rt} = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi:

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa:

$$S_{um} = S_1 + S_2 = v_1t_1 + v_2t_2 = \frac{v_1t}{2} + \frac{v_2t}{2} = \left(\frac{v_1}{2} + \frac{v_2}{2}\right) \cdot t$$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t_{um} = t_1 + t_2 = t$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{\left(\frac{v_1}{2} + \frac{v_2}{2}\right) \cdot t}{t} = \frac{v_1 + v_2}{2}$$

Demak, jism harakatlanish vaqtining yarmini v_1 , qolgan qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilarkan:

$$v_{o'rt} = \frac{v_1 + v_2}{2}$$

$$v_{o'rt} = \frac{10 + 14}{2} = 12 \text{ m/s}$$

Javob: B) 12.

5.22. Jism avval 6 m/s tezlik bilan, so'ngra esa 2 marta katta tezlik bilan 3 minut davomida harakatlandi. Uning o'rtacha tezligi 36 km/soat ga teng bo'lsa, bosib o'tgan yo'lini toping (m).

- A) 1620 B) 1600 C) 1800 D) 920

Berilgan:

$$v_1 = 6 \text{ m/s}$$

$$v_{o'rt} = 10 \text{ m/s}$$

$$v_2 = 2v_1 = 12 \text{ m/s}$$

$$t_{um} = 180 \text{ s}$$

$$S_{um} = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi.

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

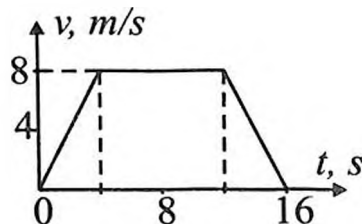
$$S_{um} = v_{o'rt} \cdot t_{um} = 1800 \text{ m}$$

Javob: C) 1800.

5.23. Jism tezligining vaqtga bog'lanish grafigi yordamida, uning 12 s harakatlanish vaqti davomidagi o'rtacha tezligini toping (m/s).

- A) 8 B) 20/3 C) 6 D) 4

Jismning harakat grafigidagi yuza, ya'ni trapetsiya yuzasi bizga liftning qancha balandlikka ko'tarilganini beradi:



$$S_{um} = \frac{a+b}{2} \cdot h = \frac{12+8}{2} \cdot 8 = 80 \text{ m}$$

Lift bu balandlikka chiqish uchun $t_{um} = 12 \text{ s}$ vaqt sarflagan.
Demak, liftning o'rtacha tezligi quyidagicha:

$$v_{o'rt} = \frac{Sum}{t_{um}} = \frac{80}{12} = \frac{20}{3} \text{ m/s}$$

Javob: B) 20/3.

5.24. Moddiy nuqta yo'lining 1/5 qismini 6 m/s tezlik bilan va qolgan qismini ikki marta katta tezkik bilan o'tgan bo'lsa, uning harakat vaqti davomidagi o'rtacha tezligini toping (m/s).

A) 12

B) 10

C) 8

D) 6

Berilgan:

$$S_1 = S/5$$

$$v_1 = 6 \text{ m/s}$$

$$S_2 = 4S/5$$

$$v_2 = 2v_1 = 12 \text{ m/s}$$

$$v_{o'rt} = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi:

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa:

$$S_{um} = S_1 + S_2 = \frac{S}{5} + \frac{4S}{5} = S$$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t_{um} = t_1 + t_2 = \frac{S_1}{v_1} + \frac{S_2}{v_2} = \frac{S}{5v_1} + \frac{4S}{5v_2}$$

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{S}{\frac{S}{5v_1} + \frac{4S}{5v_2}} = \frac{5v_1v_2}{v_2 + 4v_1}$$

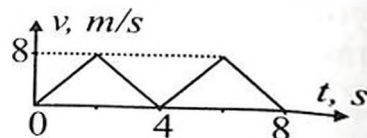
Demak, jism yo'lining beshdan bir qismini v_1 , qolgan qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilarkan:

$$v_{o'rt} = \frac{5v_1v_2}{v_2 + 4v_1}$$

$$v_{o'rt} = \frac{5 \cdot 6 \cdot 12}{12 + 4 \cdot 6} = 10 \text{ m/s}$$

Javob: B) 10.

5.25. To'g'ri chiziq bo'ylab harakatlanayotgan jism tezligining vaqtga bog'lanish grafigi asosida uning harakatlanish vaqti davomidagi o'rtacha tezligini toping (m/s).



- A) 1 B) 4 C) 8 D) 6

Jismning harakat grafigidagi yuza, ya'ni 2 ta uchburchak yuzasi bizga liftning qancha balandlikka ko'tarilganini beradi ($a = 4$; $h = 8$):

$$S_{um} = S_1 + S_2 = \frac{a}{2} \cdot h + \frac{a}{2} \cdot h = ah = 32 \text{ m.}$$

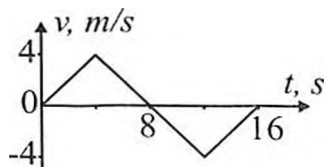
Lift bu balandlikka chiqish uchun $t_{um} = 8 \text{ s}$ vaqt sarflagan.
Demak, liftning o'rtacha tezligi quyidagicha:

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{32}{8} = 4 \text{ m/s}$$

Javob: B) 4.

5.26. Jism tezligining vaqtga bog'lanish grafigi yor-damida, uning 16 s harakatlanish vaqti davomidagi o'r-tacha tezligini toping (m/s).

- A) 2,4 B) 2 C) 4 D) 4,2



Jismning harakat grafigidagi yuza, ya'ni 2 ta uchburchak yuzasi bizga liftning qancha balandlikka ko'tarilganini beradi ($a = 8$; $h = 4$):

$$S_{um} = S_1 + S_2 = \frac{a}{2} \cdot h + \frac{a}{2} \cdot h = ah = 32 \text{ m}$$

Lift bu balandlikka chiqish uchun $t_{um} = 16 \text{ s}$ vaqt sarflagan.
Demak, liftning o'rtacha tezligi quyidagicha:

$$v_{o'rt} = \frac{S_{um}}{t_{um}} = \frac{32}{16} = 2 \text{ m/s}$$

Javob: B) 2.

5.27. Moddiy nuqta yo'lining 1/6 qismida 4 m/s tezlik bilan, qolgan qismida 10 m/s tezlik bilan harakatlandi. Uning harakat vaqti davomidagi o'rtacha tezligini toping (m/s).

- A) 10 B) 6 C) 8 D) 8/3

Berilgan:

$$S_1 = S/6$$

$$v_1 = 4 \text{ m/s}$$

$$S_2 = 5 S/6$$

$$v_2 = 10 \text{ m/s}$$

$$v_{o'rt} = ?$$

Yechilishi: O'rtacha tezlik jism bosib o'tgan umumiy masofaning shu masofani bosib o'tish uchun ketgan umumiy vaqtga nisbati bilan topiladi:

$$v_{o'rt} = \frac{S_{um}}{t_{um}}$$

Jism bosib o'tgan umumiy masofa:

$$S_{um} = S_1 + S_2 = \frac{S}{6} + \frac{5S}{6} = S$$

Shu masofani bosib o'tish uchun ketgan umumiy vaqt:

$$t_{um} = t_1 + t_2 = \frac{S_1}{v_1} + \frac{S_2}{v_2} = \frac{S}{6v_1} + \frac{5S}{6v_2}$$

$$v_{o'r} = \frac{S_{um}}{t_{um}} = \frac{S}{\frac{S}{6v_1} + \frac{5S}{6v_2}} = \frac{6v_1v_2}{v_2 + 5v_1}$$

Demak, jism yo'lining oltidan bir qismini v_1 , qolgan qismini v_2 tezlik bilan bosib o'tsa, jismning o'rtacha tezligi quyidagicha topilarkan:

$$v_{o'r} = \frac{6v_1v_2}{v_2 + 5v_1}$$

$$v_{o'r} = \frac{6 \cdot 4 \cdot 10}{10 + 5 \cdot 4} = 8 \text{ m/s}$$

Javob: C) 8.

6-§. To'g'ri chiziqli tekis o'zgaruvchan harakat

6.1. Jismning tezlik vektori va tezlanish vektori qarama-qarshi yo'nalgan bo'lishi mumkinmi?

A) faqat aylanma harakatda

B) faqat ellips bo'ylab harakatda

C) mumkin emas

D) faqat tekis sekinlanuvchan harakatda

Tekis sekinlanuvchan harakatda jismning tezlik va tezlanish vektorlarining yo'nalishlari qarama-qarshi yo'nalgan bo'ladi, ya'ni tekis sekinlanuvchan harakatda jismning tezlik vektorining yo'nalishi harakat yo'nalishida, tezlanish yo'nalishi esa jismning harakat yo'nalishiga teskari yo'nalgan bo'ladi.

Javob: D) faqat tekis sekinlanuvchan harakatda.

6.2. Agar samolyotning qo'nish tezligi 180 km/soat va qo'nish masofasi 750 m bo'lsa, u qancha vaqtda qo'nadi (s)?

A) 30

B) 32

C) 26

D) 28

Berilgan:

$v_0 = 50 \text{ m/s}$

$S = 750 \text{ m}$

$t = ?$

Yechilishi: Samolyot qo'nishni boshlagan paytda tezligi v_0 edi va butunlay qo'nib bo'lgunicha tekis sekinlanuvchan harakat qiladi va harakat oxirida samolyotning tezligi $v = 0$ bo'ladi.

Tekis o'zgaruvchan harakatda jismning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_{o'r} \cdot t \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'r} = \frac{v + v_0}{2} \quad (2)$$

Bu ifodadan foydalanib (1) ifodani quyidagicha yozishimiz mumkin:

$$S = \frac{v + v_0}{2} \cdot t \quad (3)$$

Biz qarayotgan masala tekis sekinlanuvchan harakat va harakat oxiridagi tezlik $v = 0$ bo'lgani uchun (3) ifodani quyidagicha ifodalaymiz:

$$S = \frac{v_0}{2} \cdot t \quad (4)$$

(4) ifodadan samolyotning qo'nish vaqti t ni topamiz:

$$t = \frac{2S}{v_0} = \frac{2 \cdot 750}{50} = 30 \text{ s}$$

Javob: A) 30.

6.3. 20 m/s tezlik bilan ketayotgan avtomobil tormozlanish natijasida 5 s da to'xtagan bo'lsa, uning tormozlanish yo'lini aniqlang.

A) 20 m B) 50 m C) 100 m D) 150 m

Berilgan:

$$v_0 = 20 \text{ m/s}$$

$$t = 5 \text{ s}$$

$$S = ?$$

Yechilishi: Avtomobil tormozlana boshlagan paytda tezligi v_0 edi va butunlay to'xtab bo'lgunicha tekis sekinlanuvchan harakat qiladi va harakat oxirida avtomobilning tezligi $v = 0$ bo'ladi.

Tekis o'zgaruvchan harakatda jismning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_{o'r} \cdot t \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'r} = \frac{v + v_0}{2} \quad (2)$$

Bu ifodadan foydalanib (1) ifodani quyidagicha yozishimiz mumkin:

$$S = \frac{v + v_0}{2} \cdot t \quad (3)$$

Biz qarayotgan masala tekis sekinlanuvchan harakat va harakat oxiridagi tezlik $v = 0$ bo'lgani uchun (3) ifodani quyidagicha ifodalaymiz va avtomobilning tormozlanish masofasini topamiz:

$$S = \frac{v_0}{2} \cdot t = \frac{20}{2} \cdot 5 = 50 \text{ m}$$

Javob: B) 50 m.

6.4. Ikki avtomobil bir punktdan bir tomonga, biri 72 km/soat tezlik bilan, ikkinchisi esa $0,4 \text{ m/s}^2$ tezlanish bilan harakat qila boshladi. Ikkinchi avtomobil birinchisini qancha vaqtdan (s) keyin quvib yetishini toping.

A) 100

B) 90

C) 80

D) 70

Berilgan:

$$v_1 = 20 \text{ m/s}$$

$$a_2 = 0,4 \text{ m/s}^2$$

$$t = ?$$

Yechilishi: Ikkinchi avtomobil birinchisini quvib yetishi uchun ikkinchi avtomobil birinchi avtomobilning bosib o'tgan yo'lini bosib o'tishi kerak, ya'ni 1-va 2-avtomobillarning bosib o'tgan yo'llari teng bo'lishi kerak $S_1 = S_2$.

Birinchi avtomobil v_1 tezlik bilan tekis harakat qilyapti, shuning uchun uning bosib o'tgan yo'li quyidagicha:

$$S_1 = v_1 t \quad (1)$$

Ikkinchi avtomobil boshlang'ich tezliksiz a tezlanish bilan tekis tezlanuvchan harakat qilyapti, shuning uchun uning bosib o'tgan yo'li quyidagicha:

$$S_2 = \frac{at^2}{2} \quad (2)$$

Shartga ko'ra (1) va (2) ifodalarni tenglashtiramiz va 2-avtomobil 1-avtomobilni qancha vaqtda quvib yetganini topamiz:

$$v_1 t = \frac{at^2}{2} \Rightarrow t = \frac{2v_1}{a} = \frac{2 \cdot 20}{0,4} = 100 \text{ s}$$

Javob: A) 100.

6.5. Ushbu chizmada 5 ta jism tezliklarining vaqtga bog'lanish grafiklari keltirilgan. Ularning qaysi biri tekis harakat qiladi?

A) 1, 4

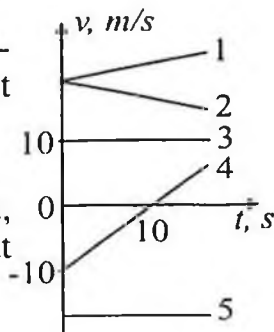
B) 3, 5

C) 2

D) 1, 2, 3

Tekis harakatda tezlik o'zgarmas bo'lishi kerakligini bilamiz, berilgan grafikda tezlik o'zgarmayotgan harakatlar: 3 va 5 harakat grafiklaridir!

Javob: B) 3, 5

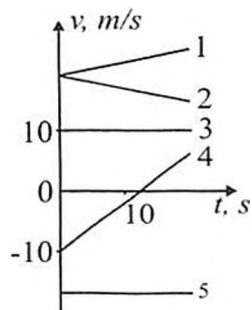


6.6. Rasmda beshta jism tezliklarining vaqtga bog'lanish grafiklari keltirilgan. Jismlarning qaysinisi tekis tezlanuvchan harakat qiladi?

- A) 1, 4 B) 3, 5 C) 2 D) 1, 2, 3

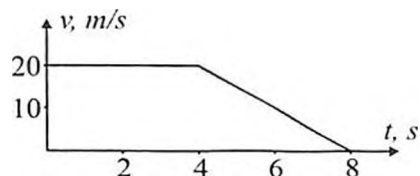
Tekis tezlanuvchan harakatda jism tezligi bir xil vaqt oralig'ida bir xil kattaliklarga ortib borishi kerak. Bunday ko'rinishni 1 va 4 harakat grafiklarida ko'rish mumkin.

Javob: A) 1, 4



6.7. Chizmada avtomobil tezligining vaqtga bog'lanish grafigi berilgan. Tormozlanish yo'lini hisoblang (m).

- A) 80 B) 60 C) 40 D) 20



Masalani grafik orqali yechamiz: tormozlanish jism tezligining tekis kamayishi bilan boshlanadi, (garafikka qarang). Avtomobilning tormozlanish yo'li uning harakatlanish vaqtining 4-sekundidan 8-sekundigacha davom etgan. Avtomobil 1- sekunddan 4-sekundigacha esa tekis harakat qilgan. Bizdan avtomobilning tormozlanish masofasi so'ralyapti, ya'ni avtomobil harakat vaqtining 4-sekundidan 8-sekundigacha bosib o'tgan masofasi. Ma'lumki, jism tezligining vaqtga bog'lanish grafigida hosil bo'lgan yuza jismning bosib o'tgan yo'liga teng. Shuning uchun, biz avtomobil harakat vaqtining 4-sekundidan 8-sekundigacha harakatlanganida hosil bo'lgan grafik yuzasini topib qo'yamiz, ya'ni to'g'ri burchakli uchburchakning yuzasi:

$$S = \frac{ab}{2} = \frac{4 \cdot 20}{2} = 40 \text{ m}$$

Javob: C) 40 m.

6.8. 20 m/s tezlik bilan harakatlanayotgan avtomobil tormozlanish natijasida 2 s da to'xtadi. Avtomobil tezlanishining modulini toping (m/s²).

- A) 20 B) 10 C) 5 D) 4

Berilgan:

$$v_0 = 20 \text{ m/s}$$

$$t = 2 \text{ s}$$

$$a = ?$$

Yechilishi: Tezlanish, bu — jism tezligining vaqt birligi ichida o'zgarishidir:

$$a = \frac{v - v_0}{t} \quad (1)$$

Avtomobil tormozlana boshlaganda tezligi v_0 edi, to'xtaganda esa $v = 0$ bo'ladi, bundan foydalanib (1) formulani quyidagicha yozamiz:

$$a = \frac{-v_0}{t} \quad (2)$$

Biz avtomobil tezlanishining modul qiymatini topayotganimiz bois (2) ifodaning, modul qiymatini quyidagicha yozamiz va avtomobil tezlanishining modul qiymatini topamiz:

$$a = \left| \frac{-v_0}{t} \right| = \frac{v_0}{t} = \frac{20}{2} = 10 \text{ m/s}^2$$

Javob: B) 10.

6.9. Ushbu $v = 10 - 2t$, tenglamaga muvofiq harakatlanayotgan moddiy nuqtaning tezlik vektorining yo'nalishi qancha vaqtdan so'ng o'zgaradi (s)?

A) 2 B) o'zgarmaydi C) 5 D) 3

Berilgan:

$$\frac{v = 10 - 2t}{t = ?}$$

Yechilishi: Tezlik vektori avval nolga teng bo'ladi, undan so'ng harakat yo'nalishi, ya'ni tezlik vektori qarama-qarshi tomonga o'zgaradi:

$$10 - 2t = 0 \Rightarrow t = 5s$$

Demak, jism 5 sekunddan keyin o'z harakat yo'nalishini qarama-qarshisiga o'zgartirar ekan!

Javob: C) 5.

6.10. Jismning boshlang'ich tezligi 10 m/s, tezlanishi esa 2 m/s² bo'lsa, jism tezligini ikki marta orttirishi uchun qancha masofani bosib o'tishi kerak bo'ladi (m)?

A) 75 B) 150 C) 50 D) 80

Berilgan:

$$v_0 = 10 \text{ m/s}$$

$$a = 2s$$

$$v = 2v_0 = 20 \text{ m/s}$$

$$S = ?$$

Yechilishi: Tekis o'zgaruvchan harakatda jismning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_{o'rt} \cdot t \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'rt} = \frac{v + v_0}{2} \quad (2)$$

$a = \frac{v - v_0}{t}$ ushbu formuladan t ni topsak, quyidagicha bo'ladi:

$$t = \frac{v - v_0}{a} \quad (3)$$

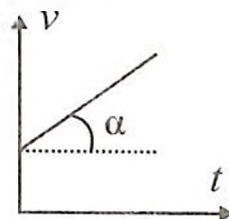
(2) va (3) ifodani (1) ifodaga qo'ysak, quyidagi ko'rinish hosil bo'ladi va biz undan jism a tezlanish bilan harakatlanib, tezligini 2 barobar oshirishi uchun qancha masofa bosib o'tganini topamiz:

$$S = v_{o'rt} \cdot t = \frac{v + v_0}{2} \cdot \frac{v - v_0}{a} = \frac{v^2 - v_0^2}{2a} = \frac{20^2 - 10^2}{2 \cdot 2} = 75 \text{ m}$$

Javob: A) 75.

6.11. Chizmadagi grafik burchagining tangensi qanday fizik ma'noga ega?

- A) tezlanish o'zgarishi
- B) tezlik o'zgarishi
- C) tezlik
- D) tezlanish



Chizmadagi grafik burchagining tangensi tezlanishni ifodalaydi.

Chunki burchak tangensi burchak qarshisidagi katetning shu burchakka yopishgan katetga nisbati bilan topiladi, bu yerda burchak qarshisidagi katet tezlikning o'zgarishiga to'g'ri kelyapdi, shu burchakka yopishgan katet esa tezlikning o'zgarishi uchun ketgan vaqtiga to'g'ri kelyapti, ya'ni:

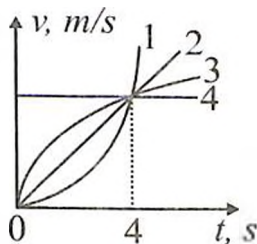
$$\operatorname{tg} \alpha = \frac{v - v_0}{t} = a$$

Javob: D) tezlanish.

6.12. Quyidagi rasmda 4 ta jism uchun tezliklarning vaqtga bog'lanish grafiklari keltirilgan. Qaysi jism vaqtning 0 va 4 s oralig'ida eng ko'p yo'l yurgan?

- A) 1
- B) 2
- C) 3
- D) 4

Qaysi jismning harakat grafigi eng katta yuza chizgan bo'lsa, o'sha jism eng ko'p masofani bosib o'tgan bo'ladi: bu grafikda eng katta yuza 4 ga tegishli.



Javob: D) 4.

6.13. Sharcha uzunligi 9 m bo'lgan qiya tekislikdan ishqalanishsiz dumalab tushmoqda. Agar sharcha 3 sekund davomida tushgan bo'lsa, sharchaning qiya tekislik oxiridagi tezligini toping (m/s).

- A) 27
- B) 6
- C) 12
- D) 8

Berilgan:

$$S = 9 \text{ m}$$

$$t = 3 \text{ s}$$

$$v = ?$$

Yechilishi: Sharcha harakatlana boshlagan paytda tezligi $v_0 = 0$ edi va S masofani tekis tezlanuvchan harakatlanib bosib o'tganida u qandaydir v tezlikka erishadi. Biz sharchaning qanday tezlikka erishganini topishimiz kerak.

Tekis o'zgaruvchan harakatda jismning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_{o'r} \cdot t \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'r} = \frac{v + v_0}{2} \quad (2)$$

Bu ifodadan foydalanib (1) ifodani quyidagicha yozishimiz mumkin:

$$S = \frac{v + v_0}{2} \cdot t \quad (3)$$

Biz qarayotgan masalada sharcha boshlang'ich tezliksiz ($v_0 = 0$) tekis tezlanuvchan harakat bo'lgani uchun (3) ifodani quyidagicha ifodalaymiz va sharchaning harakat oxirida qanday tezlikka erishganini topamiz:

$$S = \frac{v}{2} \cdot t \Rightarrow v = \frac{2S}{t} = \frac{2 \cdot 9}{3} = 6 \text{ m/s}$$

Javob: B) 6.

6.14. Boshlang'ich tezligi 6 m/s bo'lgan jism tekis sekinlanuvchan harakatlanmoqda. Agar uning tezligi 30 s dan keyin 3 m/s ga teng bo'lsa, tezlanishi nimaga teng (m/s^2)?

- A) 0,1 B) -0,1 C) 0,2 D) -0,2

Berilgan:

$$v_0 = 6 \text{ m/s}$$

$$t = 30 \text{ s}$$

$$v = 3 \text{ m/s}$$

$$a = ?$$

Yechilishi: Tezlanish, bu — jism tezligining vaqt birligi ichida o'zgarishidir, u quyidagicha topiladi:

$$a = \frac{v - v_0}{t} = \frac{3 - 6}{30} = -0,1 \text{ m/s}^2$$

Tezlanishning manfiy qiymati jismning tekis sekinlanuvchan harakat qilganligini bildiradi.

Javob: B) -0,1.

6.15. Tekis tezlanuvchan harakatlanayotgan jism 2,5 s davomida tezligini 30 sm/s ga oshirdi. Jism tezlanishi qanchaga teng (m/s^2) bo'ladi?

- A) 0,24 B) 24 C) 0,12 D) 12

Berilgan:

$$v - v_0 = 0,3 \text{ m/s}$$

$$t = 2,5 \text{ s}$$

$$a = ?$$

Yechilishi: Tezlanish, bu — jism tezligining vaqt birligi ichida o'zgarishidir:

$$a = \frac{v - v_0}{t} = \frac{0,3}{2,5} = 0,12 \text{ m/s}^2$$

Javob: C) 0,12.

6.16. O'qning miltiq stvoli o'rtasidagi tezligi uchib chiqishdagi tezligidan necha marta kichik bo'ladi?

A) 4

B) $2\sqrt{2}$

C) 2

D) $\sqrt{2}$

Berilgan:

$v_1; v_2$

$v_2/v_1 = ?$

Yechilishi: Tekis o'zgaruvchan harakatda jismning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_{o'rt} \cdot t \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'rt} = \frac{v + v_0}{2} \quad (2)$$

$a = \frac{v - v_0}{t}$ ushbu formuladan t ni topsak, quyidagicha bo'ladi:

$$t = \frac{v - v_0}{a} \quad (3)$$

(2) va (3) ifodani (1) ifodaga qo'ysak, quyidagi ko'rinish hosil bo'ladi va biz undan jism a tezlanish bilan harakatlanib, tezligini 2 barobar oshirishi uchun qancha masofa bosib o'tganini topamiz:

$$S = v_{o'rt} \cdot t = \frac{v + v_0}{2} \cdot \frac{v - v_0}{a} = \frac{v^2 - v_0^2}{2a}$$

Boshlang'ich tezlikni nol deb qarasak va jismning ixtiyoriy vaqtdagi tezligi v ni topsak, quyidagi ko'rinish hosil bo'ladi:

$$S = \frac{v^2}{2a} \Rightarrow v = \sqrt{2aS}$$

Miltiq stvolining uzunligini S deb olsak, miltiq stvolining yarmidagi o'qning tezligi quyidagicha:

$$v_1 = \sqrt{2a \frac{S}{2}} = \sqrt{aS}$$

O'qning miltiq stvolining oxiridagi tezligi esa quyidagicha:

$$v_2 = \sqrt{2aS}$$

Endi nisbat olamiz va tezliklar nisbatini topamiz:

$$\frac{v_2}{v_1} = \frac{\sqrt{2aS}}{\sqrt{aS}} = \sqrt{2}$$

Javob: D) $\sqrt{2}$.

6.17. Quyidagi tenglamalar orasidan to'g'ri chiziqli tekis sekinlanuvchan harakat tenglamasini toping.

A) $x = x_0 + vt$

B) $x = A \sin \omega t$

C) $x = x_0 + v_0 t - \frac{at^2}{2}$

D) $x = \frac{at^2}{2}$

Tekis sekinlanuvchan harakatda jismning tezlanish yo'nalishi uning harakat yo'nalishiga teskari yo'nalgan bo'ladi, shuning uchun jismning tezlanishi manfiy qiymat oladi:

$$x = x_0 + v_0 t - \frac{at^2}{2}$$

Javob: C) $x = x_0 + v_0 t - \frac{at^2}{2}$.

6.18. Qiya nov bo'yicha ishqalanishsiz dumalayotgan sharcha harakatining birinchi sekundida 3,6 m yo'l o'tdi. U harakatining uchinchi sekundida qancha yo'l bosib o'tishini toping.

A) 18 m

B) 12 m

C) 6 m

D) 10,8 m

Berilgan:

$t = 1 \text{ s}$

$S = 3,6 \text{ m}$

$n = 3$

$S_n = ?$

Yechilishi: Jismning 3 sekundda bosib o'tgan yo'l bilan 3-sekundda bosib o'tgan yo'lining farqi bor. Jismning 3 sekundda bosib o'tgan yo'li bu: jismning 1, 2 va uchinchi sekundlarda bosib o'tgan yo'llar yig'indisi yoki harakat boshlanganidan to 3 sekund o'tganicha bosib o'tgan masofasidir.

Jismning 3-sekundda bosib o'tgan yo'li esa jismning aynan 3-sekundda bosib o'tgan masofasi, xolos! Buni biz n -sekundda bosib o'tilgan yo'l deymiz va quyidagi formula orqali topamiz:

$$S_n = v_0 + \frac{a}{2}(2n-1) \quad (1)$$

Jism boshlang'ich tezliksiz harakatlanayotgani uchun (1) ifodani quyidagicha yozishimiz mumkin:

$$S_n = \frac{a}{2}(2n-1) \quad (2)$$

Bizga jismning tezlanishi noma'lum, shuning uchun, quyidagi ifodadan jismning tezlanishini topib, uni (2) ifodaga keltirib qo'yamiz:

$$S = \frac{at^2}{2} \Rightarrow a = \frac{2S}{t^2}$$

$$S_n = \frac{S}{t^2}(2n-1) = \frac{3,6}{1^2}(2 \cdot 3 - 1) = 18 \text{ m}$$

Javob: A) 18 m.

6.19. Gorizontal sirtidagi jismga 5 m/s boshlang'ich tezlik berildi. U -1 m/s^2 tezlanish bilan harakat qilgan bo'lsa, 5 s da qancha masofani o'tadi (m)?

A) 5

B) 10

C) 12,5

D) 15

Berilgan:

$$v_0 = 5 \text{ m/s}$$

$$a = -1 \text{ m/s}^2$$

$$t = 5 \text{ s}$$

$$S = ?$$

Yechilishi: Bu masalada jism tekis sekinlanuvchan harakat qilayotganini tezlanishning manfiy qiymati ko'rsatib turibdi!

Bunda jismning qancha masofani bosib o'tganini topish uchun, jismning bosib o'tgan masofasini jismning boshlang'ich tezligi, tezlanishi va harakatlanish vaqtiga bog'lanish formulasini keltirib chiqaramiz!

Tekis o'zgaruvchan harakatda jismning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_{o'rt} \cdot t \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'rt} = \frac{v + v_0}{2} \quad (2)$$

Bu ifodadan foydalanib (1) ifodani quyidagicha yozishimiz mumkin:

$$S = \frac{v + v_0}{2} \cdot t \quad (3)$$

$a = \frac{v - v_0}{t}$ ushbu formuladan v ni topsak, quyidagicha bo'ladi:

$$v = v_0 + at \quad (4)$$

(4) ifodani (3) ifodaga qo'ysak, quyidagi ifoda hosil bo'ladi va biz undan jismning qancha masofani bosib o'tganini topamiz:

$$S = \frac{v_0 + at + v_0}{2} \cdot t = \frac{2v_0t + at^2}{2} = v_0t + \frac{at^2}{2} = 5 \cdot 5 + \frac{(-1) \cdot 5^2}{2} = 12,5 \text{ m}$$

Javob: C) 12,5.

6.20. Tekis yo'lda 20 m/s tezlik bilan harakatlanayotgan avtomobil tormozlanganda 4,5 s dan so'ng to'xtadi. Tormozlanish yo'lini hisoblab toping.

A) 144 m

B) 80 m

C) 40 m

D) 45 m

Berilgan:

$$v_0 = 20 \text{ m/s}$$

$$t = 4,5 \text{ s}$$

$$S = ?$$

Yechilishi: Avtomobil tormozlana boshlagan paytda tezligi v_0 edi va butunlay to'xtab bo'lgunicha tekis sekinlanuvchan harakat qiladi va harakat oxirida avtomobilning tezligi $v = 0$ bo'ladi.

Tekis o'zgaruvchan harakatda jismning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_{o'rt} \cdot t \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'rt} = \frac{v + v_0}{2} \quad (2)$$

Bu ifodadan foydalanib (1) ifodani quyidagicha yozishimiz mumkin:

$$S = \frac{v + v_0}{2} \cdot t \quad (3)$$

Biz qarayotgan masala tekis sekinlanuvchan harakat va harakat oxiridagi tezlik $v = 0$ bo'lgani uchun (3) ifodani quyidagicha ifodalaymiz va avtomobilning tormozlanish masofasini topamiz:

$$S = \frac{v_0}{2} \cdot t = \frac{20}{2} \cdot 4,5 = 45 \text{ m}$$

Javob: D) 45 m.

6.21. Sportchi $0,2 \text{ m/s}^2$ tezlanish bilan harakatlanib, uzunligi 60 m bo'lgan qiyalikni 10 s da o'tdi. Uning qiyalik boshidagi tezligi qanday bo'lgan?

A) 2 m/s B) 3 m/s C) 4 m/s D) 5 m/s

Berilgan:

$$S = 60 \text{ m}$$

$$a = 0,2 \frac{\text{m}}{\text{s}^2}$$

$$t = 10 \text{ s}$$

$$v_0 = ?$$

Yechilishi: Bu masalada sportchi tekis tezlanuvchan harakat qilmoqda. Bunda sportchi harakatni qanday v_0 tezlik bilan boshlaganini topish uchun sportchining bosib o'tgan masofasini boshlang'ich tezligi, tezlanishi va harakatlanish vaqtiga bog'lanish formulasini keltirib chiqaramiz!

Tekis o'zgaruvchan harakatda jismning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_{o'rt} \cdot t \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'rt} = \frac{v + v_0}{2} \quad (2)$$

Bu ifodadan foydalanib (1) ifodani quyidagicha yozishimiz mumkin:

$$S = \frac{v + v_0}{2} \cdot t \quad (3)$$

$a = \frac{v - v_0}{t}$ ushbu formuladan v ni topsak, quyidagicha bo'ladi:

$$v = v_0 + at \quad (4)$$

(4) ifodani (3) ifodaga qo'ysak, quyidagi ifoda hosil bo'ladi va biz undan jismning qancha masofani bosib o'tganini topamiz:

$$S = \frac{v_0 + at + v_0}{2} \cdot t = \frac{2v_0t + at^2}{2} = v_0t + \frac{at^2}{2}$$

$$S = v_0t + \frac{at^2}{2} \quad (5)$$

(5) ifodadan v_0 ni topamiz.

$$v_0 = \frac{2S - at^2}{2t} = \frac{2 \cdot 60 - 0,2 \cdot 10^2}{2 \cdot 10} = 5 \text{ m/s.}$$

Javob: D) 5 m/s.

6.22. Agar avtomobil tekis tezlanuvchan harakat qila boshlab, 1 s da 30 m yo'l bosgan bo'lsa u qanday tezlikka erishgan?

A) 15 m/s B) 25 m/s C) 30 m/s D) 60 m/s

Berilgan:

$$S = 30 \text{ m}$$

$$t = 1 \text{ s}$$

$$v = ?$$

Yechilishi: Avtomobil harakatlana boshlagan paytda tezligi $v_0 = 0$ edi va S masofani tekis tezlanuvchan harakatlanib bosib o'tganida u qandaydir v tezlikka erishadi. Biz sharchaning qanday tezlikka erishganini topishimiz kerak.

Tekis o'zgaruvchan harakatda jismning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_{o'rt} \cdot t \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'rt} = \frac{v + v_0}{2} \quad (2)$$

Bu ifodadan foydalanib (1) ifodani quyidagicha yozishimiz mumkin:

$$S = \frac{v + v_0}{2} \cdot t \quad (3)$$

Biz qarayotgan masalada avtomobil boshlang'ich tezliksiz ($v_0 = 0$) tekis tezlanuvchan harakat bo'lgani uchun (3) ifodani quyidagicha ifodalaymiz va avtomobilning harakat oxirida qanday tezlikka erishganini topamiz:

$$S = \frac{v}{2} \cdot t \Rightarrow v = \frac{2S}{t} = \frac{2 \cdot 30}{1} = 60 \text{ m/s}$$

Javob: D) 60 m/s.

6.23. Gorizontal yo'lda 10 m/s tezlik bilan harakatlanayotgan mashina tormoz berilgach 2 s da to'xtadi. Mashinaning tormozlanish yo'lini toping (m).

- A) 10 B) 12 C) 9 D) 13

Berilgan:

$$v_0 = 10 \text{ m/s}$$

$$t = 2 \text{ s}$$

$$S = ?$$

Yechilishi: Avtomobil tormozlana boshlagan paytda tezligi v_0 edi va butunlay to'xtab bo'lgunicha tekis sekinlanuvchan harakat qiladi va harakat oxirida avtomobilning tezligi $v = 0$ bo'ladi.

Tekis o'zgaruvchan harakatda jismning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_{o'rt} \cdot t \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'rt} = \frac{v + v_0}{2} \quad (2)$$

Bu ifodadan foydalanib (1) ifodani quyidagicha yozishimiz mumkin:

$$S = \frac{v + v_0}{2} \cdot t \quad (3)$$

Berilgan masalada tekis sekinlanuvchan harakat va harakat oxiridagi tezlik $v = 0$ bo'lgani uchun (3) ifodani quyidagicha ifodalaymiz va avtomobilning tormozlanish masofasini topamiz:

$$S = \frac{v_0}{2} \cdot t = \frac{10}{2} \cdot 2 = 10 \text{ m}$$

Javob: A) 10.

6.24. Jismning harakati $x = 10 + 6t^2 + 4t$ (m) tenglama bo'yicha ro'y bermoqda. Uning tezlanishi qanday bo'ladi (m/s^2)?

- A) 10 B) 6 C) 4 D) 12

Berilgan:

$$x = 10 + 6t^2 + 4t$$

$$a = ?$$

Yechilishi: Tekis o'zgaruvchan harakatda harakat tenglamasining asl ko'rinishi quyidagicha:

$$x = x_0 + v_0 t + \frac{a}{2} \cdot t^2$$

Bu masalada ayniyat qonunlaridan foydalanamiz, ya'ni t va t^2 koeffitsient oldida turgan son qiymatlar bir-biriga teng:

$$v_0 = 4 \text{ m/s}; \quad \frac{a}{2} = 6 \Rightarrow a = 12 \text{ m/s}^2$$

Javob: D) 12.

6.25. Jism harakatlana boshlagandan keyin harakatning 8 - sekundida 30 m masofani bosib o'tsa, u qanday tezlanish (m/s^2) bilan harakatlanadi?

A) 1

B) 2

C) 4

D) 8

Berilgan:

$$S = 30 \text{ m}$$

$$n = 8$$

$$a = ?$$

Yechilishi: Jismning n sekundda bosib o'tgan yo'li bilan n -sekundda bosib o'tgan yo'lining farqi bor. Jismning n sekundda bosib o'tgan yo'li bu: jismning 1, 2 va... n -sekundlarda bosib o'tgan yo'llar yig'indisi yoki harakat boshlanganidan to n sekund o'tganicha bosib o'tgan masofasidir.

Jismning n -sekundda bosib o'tgan yo'li esa jismning aynan n - sekundda bosib o'tgan masofasi, xolos! Buni biz n -sekundda bosib o'tilgan yo'l deymiz va quyidagi formula orqali topamiz:

$$S_n = v_0 + \frac{a}{2}(2n - 1) \quad (1)$$

Jism boshlang'ich tezliksiz harakatlanayotgani uchun (1) ifodani quyidagicha yozishimiz mumkin:

$$S_n = \frac{a}{2}(2n - 1) \quad (2)$$

(2) ifodadan a ni topamiz:

$$a = \frac{2S}{2n - 1} = \frac{2 \cdot 30}{2 \cdot 8 - 1} = 4 \text{ m/s}^2$$

Javob: C) 4.

6.26. 5 m/s boshlang'ich tezlikka ega bo'lgan jism tekis tezlanuvchan harakat qilib 12 s da 150 m yo'lni bosib o'tdi. Yo'l oxirida u qanday tezlikka ega bo'lgan?

A) 20 m/s

B) 30 m/s

C) 40 m/s

D) 36 km/soat

Berilgan:

$$v_0 = 5 \text{ m/s}$$

$$t = 12 \text{ s}$$

$$S = 150 \text{ m}$$

$$v = ?$$

Yechilishi: Tekis o'zgaruvchan harakatda jismning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_{o'rt} \cdot t \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'rt} = \frac{v + v_0}{2} \quad (2)$$

Bu ifodadan foydalanib (1) ifodani quyidagicha yozishimiz mumkin:

$$S = \frac{v + v_0}{2} \cdot t \quad (3)$$

(3) ifodadan jismning harakat oxirida qanday tezlikka erishganini topamiz:

$$v = \frac{2S}{t} - v_0 = \frac{2 \cdot 150}{12} - 5 = 20 \text{ m/s}$$

Javob: A) 20 m/s.

6.27. Jism tezligining vaqtga bog'lanishi $v = 7 + 4t$ (m/s) ko'rinishga ega. Vaqtning birinchi sekundida bosib o'tilgan yo'lni (m) hisoblab toping.

A) 9 B) 4,5 C) 5 D) 7

Berilgan:

$$v = 7 + 4t$$

$$n = 1$$

$$n = ?$$

Yechilishi: Jismning n sekundda bosib o'tgan yo'li bilan n -sekundda bosib o'tgan yo'lining farqi bor. Jismning n sekundda bosib o'tgan yo'li bu: jismning 1, 2 va... n -sekundlarda bosib o'tgan yo'llar yig'indisi yoki harakat boshlanganidan to n sekund o'tganicha bosib o'tgan masofasidir.

Jismning n -sekundda bosib o'tgan yo'li esa jismning aynan n -sekundda bosib o'tgan masofasi, xolos! Buni biz n -sekundda bosib o'tilgan yo'l deymiz va quyidagi formula orqali topamiz:

$$S_n = v_0 + \frac{a}{2}(2n - 1) \quad (1)$$

Bu masalada jismning boshlang'ich tezligi va tezlanishi berilmagan, ularni tezlikning vaqtga bog'lanish tenglamasidan topamiz, ya'ni tezlikning o'zgarish tenglamasining asl ko'rinishini yozsak va ayniyat qonunidan foydalansak, tezlanishni topamiz. Tezlikning o'zgarish tenglamasi:

$$v = v_0 + at$$

Jismning harakat tenglamasi:

$$v = 7 + 4t$$

Demak: $v_0 = 7 \text{ m/s}$; $a = 4 \text{ m/s}^2$.

Bularni bilgan holda (1) ifodaga qo'yib jismning n -sekundda bosib o'tgan yo'lini topamiz:

$$S_n = 7 + \frac{4}{2}(2 \cdot 1 - 1) = 9 \text{ m}.$$

Javob: A) 9.

6.28. Jism v_0 boshlang'ich tezlik va o'zgarmas a tezlanish bilan tekis sekinlanuvchan harakat qilmoqda. Qancha masofani bosib o'tgandan keyin jismning tezligi ikki marta kamayadi?

A) $\frac{v_0^2}{2a}$

B) $\frac{3v_0^2}{8a}$

C) $\frac{2v_0^2}{a}$

D) $\frac{3v_0^2}{4a}$

Berilgan:

$$v_0;$$

$$a$$

$$v = v_0/2$$

$$S = ?$$

Yechilishi: Tekis o'zgaruvchan harakatda jismning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_{o'rt} \cdot t \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'rt} = \frac{v + v_0}{2} \quad (2)$$

$a = \frac{v - v_0}{t}$ ushbu formuladan t ni topsak, quyidagicha bo'ladi:

$$t = \frac{v - v_0}{a} \quad (3)$$

(2) va (3) ifodani (1) ifodaga qo'yib, jism a tezlanish bilan harakatlanib, v tezligi 2 barobar kamayishi uchun qancha masofa bosib o'tganini topamiz:

$$\begin{aligned} S &= v_{o'rt} \cdot t = \frac{v + v_0}{2} \cdot \frac{v - v_0}{a} = \frac{v^2 - v_0^2}{2a} \\ S &= \frac{v^2 - v_0^2}{2a} \end{aligned} \quad (4)$$

Jism tekis sekinlanuvchan harakat qilayotgani uchun tezlanish manfiy qiymat oladi:

$$S = \frac{\left(\frac{v_0}{2}\right)^2 - v_0^2}{-2a} = \frac{3v_0^2}{8a}$$

Javob: B) $\frac{3v_0^2}{8a}$.

6.29. Moddiy nuqta $S = 5t - 0,25t^2$ qonuniyat bilan harakatlanadi. Uning dastlabki 4s ichida bosib o'tgan yo'lini toping.

A) 5 m B) 10 m C) 16 m D) 20 m

Berilgan:

$$S = 5t - 0,25t^2$$

$$t = 4s$$

$$S = ?$$

Yechilishi: Masalada jismning vaqt birligi ichida bosib o'tgan yo'lining tenglamasi berilgan, biz xohlagan t vaqtdagi bosib o'tilgan yo'lni topa olamiz:

$$S = 5t - 0,25t^2 = 5 \cdot 4 - 0,25 \cdot 4^2 = 16m$$

Javob: C) 16 m.

6.30. Berilgan gapga to'g'ri jumlani qo'ying: «To'g'ri chiziqli tekis tezlanuvchan harakatda tezlik vektorining ...».

- A) moduli va yo'nalishi o'zgarmay qoladi
- B) moduli tekis oshib, yo'nalishi o'zgarmay qoladi
- C) moduli tekis kamayib, yo'nalishi o'zgarmay qoladi
- D) moduli va yo'nalishi uzluksiz o'zgarib turadi

To'g'ri chiziqli tekis tezlanuvchan harakatda tezlik vektorining «moduli tekis oshib, yo'nalishi o'zgarmay qoladi».

Javob: B) moduli tekis oshib, yo'nalishi o'zgarmay qoladi.

6.31. Avtomobil tekis tezlanuvchan harakat boshlab, 5 s da 25 m yo'l bosgan bo'lsa, u 100 m masofani qancha vaqtda bosib o'tadi?

- A) 20 s
- B) 10 s
- C) 7 s
- D) 15 s

Berilgan:

$$S = 25 \text{ m}$$

$$t = 5 \text{ s}$$

$$S_1 = 100 \text{ m}$$

$$t_1 = ?$$

Yechilishi: Bu masalani yechishda jism bir xil tezlanish bilan harakat qilganiga e'tiborimizni qaratamiz! Jism S_1 masofani qancha vaqtda bosib o'tganini bilishimiz uchun jismning qanday tezlanish bilan harakatlanganini bilishimiz kerak va biz bu tezlanishni jism S masofani bosib o'tish uchun t vaqt sarflaganligidan topib olamiz.

Tekis o'zgaruvchan harakatda jismning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_{o'r} \cdot t \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'r} = \frac{v + v_0}{2} \quad (2)$$

Bu ifodadan foydalanib (1) ifodani quyidagicha yozishimiz mumkin:

$$S = \frac{v + v_0}{2} \cdot t \quad (3)$$

$a = \frac{v - v_0}{t}$ ushbu formuladan v ni topsak, quyidagicha bo'ladi:

$$v = v_0 + at \quad (4)$$

(4) ifodani (3) ifodaga qo'ysak, quyidagi ifoda hosil bo'ladi va biz undan jismning qancha masofani bosib o'tganini topamiz:

$$S = \frac{v_0 + at + v_0}{2} \cdot t = \frac{2v_0t + at^2}{2} = v_0t + \frac{at^2}{2}$$

$$S = v_0t + \frac{at^2}{2} \quad (5)$$

Jism boshlang'ich tezliksiz harakatlanayotgani uchun (5) ifodani quyidagicha yozamiz va undan jismning qanday tezlanish bilan harakatlanganini topib olamiz:

$$S = \frac{at^2}{2} \Rightarrow a = \frac{2S}{t^2}$$

Jismning qanday tezlanish bilan harakatlangani endi bizga ma'lum va endi biz jism S_1 masofani qancha vaqtda bosib o'tishini topamiz!

$$S_1 = \frac{at_1^2}{2} \Rightarrow t_1 = \sqrt{\frac{2S_1}{a}} = \sqrt{\frac{S_1 \cdot t^2}{S}} = 10s$$

Javob: B) 10 s.

6.32. Ikkita avtomobilning harakat tenglamalari $x_1 = 2t^2 + 4t$ va $x_2 = 8t + 6$ ko'rinishga ega. Ular qayerda va qachon uchrashadi?

A) $x = 30$ m, $t = 3$ s

B) $x = 18$ m, $t = 3$ s

C) $x = 16$ m, $t = 4$ s

D) $x = 48$ m, $t = 6$ s

Berilgan:

$$x_1 = 2t^2 + 4t$$

$$x_2 = 8t + 6$$

$$x = ? \quad t = ?$$

Yechilishi: Mashinalar uchrashishi uchun bir joyga kelishi kerak. Bir joyga kelganlarida esa ularning koordinatalari teng bo'ladi, ya'ni: $x_1 = x_2$

Ularning koordinata tenglamalarini tenglashtiramiz:

$$2t^2 + 4t = 8t + 6$$

$$2t^2 - 4t - 6 = 0$$

Ushbu kvadrat tenglamani yechsak, mashinalar $t = 3s$ dan keyin uchrashgani ma'lum bo'ladi. Endi bu vaqtni koordinata tenglamalariga qo'ysak, qayerda uchrashishlari kelib chiqadi:

$$\begin{cases} x_1 = 2t^2 + 4t = 2 \cdot 3^2 + 4 \cdot 3 = 30 \text{ m} \\ x_2 = 8t + 6 = 8 \cdot 3 + 6 = 30 \text{ m} \end{cases}$$

Demak, avtomobillar $t = 3$ s dan keyin $x = 30$ m koordinatada uchrashar ekan!

Javob: A) $x = 30$ m, $t = 3$ s.

6.33. Agar avtomobil harakati $S = 2t^2$ tenglama bilan ifodalansa, uning tezlanishi nimaga teng bo'ladi (m/s^2).

A) 0,4

B) 0,2

C) 2

D) 4

Berilgan:

$$S = 2t^2$$

$$a = ?$$

Yechilishi: Tekis o'zgaruvchan harakatda jism bosib o'tgan yo'lning vaqtga bog'lanish tenglamasining asl ko'rinishi quyidagicha:

$$S = v_0 t + \frac{a}{2} \cdot t^2$$

Bu masalada ayniyat qonunlaridan foydalanamiz, ya'ni t^2 koeffitsiyent oldida turgan son qiymatlar bir-biriga teng:

$$\frac{a}{2} = 2 \Rightarrow a = 4 m/s^2$$

Javob: D) 4.

6.34. Jism v_0 boshlang'ich tezlik va o'zgarmas a tezlanish bilan tekis sekinlanuvchan harakat qilmoqda. Jismning tezligi qancha vaqtdan keyin 2 marta kamayadi?

A) $\frac{v_0}{a}$

B) $\frac{v_0}{2a}$

C) $\frac{v_0}{3a}$

D) $\frac{2v_0}{a}$

Berilgan:

$$v_0, a$$

$$v = v_0/2$$

$$a = ?$$

Yechilishi: jismning tezlanishi quyidagicha topiladi!

$$a = \frac{v - v_0}{t} \quad (1)$$

(1) Ifodadan jism tezligining o'zgarish vaqtini topamiz, jism tekis sekinlanuvchan harakat qilgani uchun tezlanish manfiy qiymat oladi:

$$t = \frac{v - v_0}{-a} = \frac{\frac{v_0}{2} - v_0}{-a} = \frac{v_0}{2a}$$

Javob: B) $\frac{v_0}{2a}$.

6.35. Grafikdan foydalanib jismning tezlanishi topilsin (m/s^2).

A) 0,5

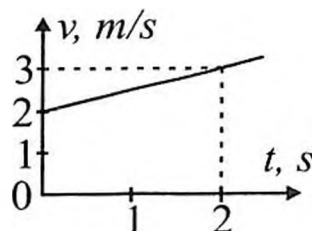
B) 1

C) 1,5

D) 2

Tezlanish, bu — jism tezligining vaqt birligi ichida o'zgarishidir:

$$a = \frac{v - v_0}{t}$$



Grafikdan foydalanib jismning tezlanishini topishimiz uchun, kerakli kattaliklarni bilib olamiz:

1. Jismning boshlang'ich tezligi: $v_0 = 2\text{ m/s}$.
2. Jism $t = 2\text{ s}$ da o'z tezligini $v = 3\text{ m/s}$ gacha oshirgan.

$$a = \frac{3 - 2}{2} = 0,5 \text{ m/s}^2$$

Javob: A) 0,5.

6.36. Avtomobil o'z harakatining ikkinchi sekundida 9 m masofani bosib o'tgan bo'lsa, uning tezlanishini toping (m/s^2). Boshlang'ich tezligini nolga teng deb oling.

- A) 10 B) 7 C) 8 D) 6

Berilgan:

$$S = 9\text{ m}$$

$$n = 2$$

$$a = ?$$

Yechilishi: Avtomobilning n sekundda bosib o'tgan yo'li bilan n sekundda bosib o'tgan yo'lining farqi bor. Avtomobilning n sekundda bosib o'tgan yo'li bu: jismning 1, 2 va... n -sekundlarda bosib o'tgan yo'llar yig'indisi yoki harakat boshlanganidan to n sekund o'tganicha bosib o'tgan masofasidir.

Jismning n - sekundda bosib o'tgan yo'li esa jismning aynan n - sekundda bosib o'tgan masofasi, xolos! Buni biz n -sekundda bosib o'tilgan yo'l deymiz va quyidagi formula orqali topamiz:

$$S_n = v_0 + \frac{a}{2}(2n - 1) \tag{1}$$

Mashina boshlang'ich tezliksiz harakatlanayotgani uchun (1) ifodani quyidagicha yozish mumkin:

$$S_n = \frac{a}{2}(2n - 1) \tag{2}$$

(2) ifodadan a ni topamiz:

$$a = \frac{2S_n}{2n - 1} = \frac{2 \cdot 9}{2 \cdot 2 - 1} = 6 \text{ m/s}^2$$

Javob: D) 6.

6.37. Harakat boshlangandan keyin jismning 8 sekundda bosib o'tgan yo'li 3 sekundda bosib o'tgan yo'ldan 3 marta katta bo'lsa, u qanday tezlanish bilan harakatlangan (m/s^2)?

- A) 1 B) 2 C) 3

D) Tezlanishning istalgan qiymatida 8-sekundda bosib o'tilgan yo'l, 3-sekunddagi yo'ldan 3 marta katta bo'ladi.

Berilgan:

$$S_8 = 3S_3$$

$$n_1 = 8$$

$$n_2 = 3$$

$$a = ?$$

Yechilishi: Jismning n sekundda bosib o'tgan yo'li bilan n -sekundda bosib o'tgan yo'lining farqi bor. Jismning n sekundda bosib o'tgan yo'li bu: jismning 1, 2 va... n -sekundlarda bosib o'tgan yo'llar yig'indisi yoki harakat boshlanganidan to n sekund o'tganicha bosib o'tgan masofasidir.

Jismning n -sekundda bosib o'tgan yo'li esa jismning aynan n -sekundda bosib o'tgan masofasi, xolos! Buni biz n -sekundda bosib o'tilgan yo'l deymiz va quyidagi formula orqali topamiz:

$$S_n = v_0 + \frac{a}{2}(2n - 1) \quad (1)$$

Jism boshlang'ich tezliksiz harakatlanayotgani uchun (1) ifodani quyidagicha yozishimiz mumkin:

$$S_n = \frac{a}{2}(2n - 1) \quad (2)$$

Endi jismning 8-sekundda bosib o'tgan yo'lining 3-sekundda bosib o'tgan yo'liga nisbatini olamiz:

$$\frac{S_8}{S_3} = \frac{\frac{a}{2}(2n_1 - 1)}{\frac{a}{2}(2n_2 - 1)} = \frac{(2n_1 - 1)}{(2n_2 - 1)}$$

Ko'rib turganingizdek, har ikkala ifodada jism tezlanishi qisqarib ketdi. Demak, tezlanishning har qanday qiymatida jismning 8-sekundda bosib o'tgan yo'li 3-sekundda bosib o'tgan yo'ldan 3 marta katta bo'lar ekan:

$$\frac{S_8}{S_3} = \frac{(2n_1 - 1)}{(2n_2 - 1)} = 3$$

Javob: D) Tezlanishning istalgan qiymatida 8-sekundda bosib o'tilgan yo'l, 3-sekunddagi yo'ldan 3 marta katta bo'ladi.

6.38. 20 m/s tezlik bilan harakatlanayotgan avtomobilga tormoz berilgach, tezligi 30 m masofada 10 m/s gacha kamaydi. Avtomobil tekis sekinlanuvchan harakat qilgan deb hisoblab, tezlanishning moduli va tormozlanish vaqtini aniqlang.

A) 5 m/s², 5 s

B) 2 m/s², 5 s

C) 5 m/s², 2 s

D) 2 m/s², 2 s

Berilgan:

$$v_0 = 20 \text{ m/s}$$

$$v = 10 \text{ m/s}$$

$$S = 30 \text{ m}$$

$$t = ? \quad a = ?$$

Yechilishi: Tekis o'zgaruvchan harakatda avtomobilning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_0 \cdot t + \frac{a}{2} t^2 \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'it} = \frac{v + v_0}{2} \quad (2)$$

Bu ifodadan foydalanib (1) ifodani quyidagicha yozishimiz mumkin:

$$S = \frac{v + v_0}{2} \cdot t \quad (3)$$

(2) ifodadan jismning tezligi kamayguncha ketgan t vaqtni topamiz:

$$t = \frac{2S}{v + v_0} = 2s.$$

Tezlanish bu — jism tezligining vaqt birligi ichida o'zgarishidir:

$$a = \frac{|v - v_0|}{t} = 5 \text{ m/s}^2$$

Javob: C) 5 m/s^2 , 2 s .

6.39. Ko'lda birinchi kater boshlang'ich tezliksiz $0,25 \text{ m/s}^2$ tezlanish bilan tekis tezlanuvchan, ikkinchi kater $0,5 \text{ m/s}^2$ tezlanish va $7,5 \text{ m/s}$ boshlang'ich tezlik bilan tekis sekinlanuvchan harakat qilmoqda. Necha sekunddan keyin katerlarning tezliklari bir xil bo'ladi?

- A) 10 B) 15 C) 20 D) 25

Berilgan:

$$\begin{array}{l} v_{01} = 0 \\ a_1 = 0,25 \text{ m/s}^2 \\ a_2 = -0,5 \text{ m/s}^2 \\ v_{02} = 7,5 \text{ m/s} \\ t = ? \end{array}$$

Yechilishi: Jismlar tezliklarining o'zgarish tenglamasini nazarda tutgan holda jismlarning tezligi qancha vaqtdan keyin modul jihatdan teng bo'lishini topib olamiz:

$$v = v_0 + at$$

$$\begin{cases} v_1 = v_{01} + a_1 t \\ v_2 = v_{02} + a_2 t \end{cases}$$

$$v_{01} + a_1 t = v_{02} + a_2 t \Rightarrow t = \frac{v_{01} - v_{02}}{a_2 - a_1} = 10 \text{ s}$$

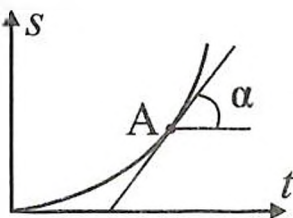
Javob: A) 10.

6.40. Jism harakatining yo'l-vaqt grafigidagi A nuqtadan rasmdagidek urinma o'tkazildi va $\text{tg} \alpha = 3$ ekanligi aniqlandi. Jismning A nuqtadagi tezligini toping (m/s).

- A) 2 B) $1/3$ C) 4 D) 3

Jism bosib o'tgan yo'lning vaqtga bog'lanish grafigidagi A nuqtadan o'tkazilgan urinmaning gorizontaal bilan tashkil qilgan burchagining tangensi tezlikni beradi: $v = \text{tg} \alpha = 3 \text{ m/s}$.

Javob: D) 3.



6.41. Boshlang'ich tezliksiz tekis tezlanuvchan harakat qilayotgan jismning 29- va 48- sekundlardagi ko'chishlari nisbatini toping.

A) 29/48

B) 59/99

C) 9/25

D) 3/5

Berilgan:

$$n_1 = 29$$

$$n_2 = 48$$

$$S_{29}/S_{48} = ?$$

Yechilishi: Jismning n sekundda bosib o'tgan yo'l bilan n -sekundda bosib o'tgan yo'lining farqi bor. Jismning n sekundda bosib o'tgan yo'li bu: jismning 1, 2 va... n -sekundlarda bosib o'tgan yo'llar yig'indisi yoki harakat boshlanganidan to n sekund o'tganicha bosib o'tgan masofasidir.

Jismning n -sekundda bosib o'tgan yo'li esa jismning aynan n -sekundda bosib o'tgan masofasi, xolos! Buni biz n -sekundda bosib o'tilgan yo'l deymiz va quyidagi formula orqali topamiz:

$$S_n = v_0 + \frac{a}{2}(2n - 1) \quad (1)$$

Jism boshlang'ich tezliksiz harakatlanayotgani uchun (1) ifodani quyidagicha yozish mumkin:

$$S_n = \frac{a}{2}(2n - 1) \quad (2)$$

Endi jismning 29-sekundda bosib o'tgan yo'lining 48-sekundda bosib o'tgan yo'lga nisbatini olamiz:

$$\frac{S_{29}}{S_{48}} = \frac{\frac{a}{2}(2n_1 - 1)}{\frac{a}{2}(2n_2 - 1)} = \frac{(2n_1 - 1)}{(2n_2 - 1)} = \frac{3}{5}$$

Javob: D) 3/5.

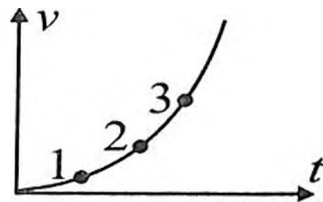
6.42. Jism tezligining vaqtga bog'lanish grafigi rasmdagidek bo'lsa, uning 1, 2, 3 nuqtalardagi tezlanishlarini taqqoslang.

A) $a_1 = a_2 = a_3$

B) $a_1 > a_2 > a_3$

C) $a_2 > a_1 > a_3$

D) $a_1 < a_2 < a_3$



Jism kam vaqt ichida tezligini ko'proq kattalikka oshira olsa, o'shanda jism tezlanishi eng katta bo'ladi:

$$a_1 < a_2 < a_3$$

Javob: D) $a_1 < a_2 < a_3$

6.43. Ikki poyezd bir xil masofani bir vaqtda bosib o'tdi. Birinchi poyezd joyidan qo'zg'algach, yo'lining hammasida $0,3 \text{ m/s}^2$ tezlanish bilan harakatlandi.

Ikkinchisi yoʻlning birinchi yarmida 18 km/soat va ikkinchi yarmida 54 km/soat tezlik bilan tekis harakatlangan. Har bir poyezd qancha yoʻl bosib oʻtgan?

A) 600 m

B) 155 m

C) 250 m

D) 375m

Berilgan:

$$v_{01} = 0$$

$$a = 0,3 \text{ m/s}^2$$

$$v_1 = 5 \text{ m/s}$$

$$v_2 = 15 \text{ m/s}$$

$$S = ?$$

Yechilishi:

Tekis oʻzgaruvchan harakatda jismning bosib oʻtgan yoʻli quyidagicha topiladi:

$$S = v_{o'r} \cdot t \quad (1)$$

Tekis oʻzgaruvchan harakatda oʻrtacha tezlikni topish uchun quyidagi ifoda har doim oʻrinli:

$$v_{o'r} = \frac{v + v_0}{2} \quad (2)$$

Bu ifodadan foydalanib (1) ifodani quyidagicha yozishimiz mumkin:

$$S = \frac{v + v_0}{2} \cdot t \quad (3)$$

$a = \frac{v - v_0}{t}$ ushbu formuladan v ni topsak, quyidagicha boʻladi:

$$v = v_0 + at \quad (4)$$

(4) ifodani (3) ifodaga qoʻysak, quyidagi ifoda hosil boʻladi va biz undan jismning qancha masofani bosib oʻtganini topamiz:

$$S = \frac{v_0 + at + v_0}{2} \cdot t = \frac{2v_0t + at^2}{2} = v_0t + \frac{at^2}{2}$$

$$S = v_0t + \frac{at^2}{2} \quad (5)$$

(1) Ifoda orqali 2-jismning harakatlanish vaqtini topamiz:

$$t_2 = \frac{S}{v_{o'r}}; \quad v_{o'r} = \frac{2v_1v_2}{v_1 + v_2} \Rightarrow t_2 = \frac{S(v_1 + v_2)}{2v_1v_2}$$

(5) ifoda orqali 1-jismning harakatlanish vaqtini topamiz:

$$t_1 = \sqrt{\frac{2S}{a}}$$

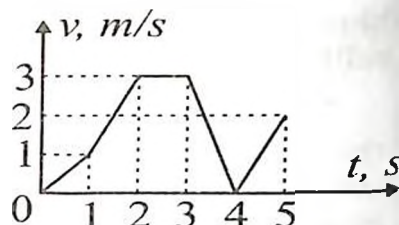
Endi $t_1 = t_2$ ekanidan foydalanamiz:

$$\frac{S(v_1 + v_2)}{2v_1v_2} = \sqrt{\frac{2S}{a}} \Rightarrow S = \frac{8(v_1v_2)^2}{a \cdot (v_1 + v_2)^2} = 375 \text{ m}$$

Javob: D) 375 m.

6.44. Rasmda ko'rsatilgan jism tezligining vaqtga bog'lanish grafigidan foydalanib, harakatning nechanchi sekundida uning tezlanishi modul jihatdan eng katta bo'lganini aniqlang.

- A) 1-sekundda B) 2-sekundda
C) 3-sekundda D) 4-sekundda

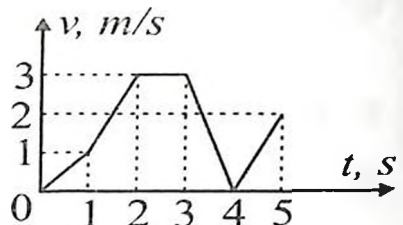


Jism kam vaqt ichida tezligini ko'proq kattalikka o'zgartira olsa, o'shanda jism tezlanishi eng katta bo'ladi, javob 4!

Javob: D) 4-sekundda.

6.45. Berilgan grafikdan foydalanib, jism harakatining nechanchi sekundida uning tezlanishi modul jihatdan eng kichik bo'lganini aniqlang.

- A) 5-sekundda B) 2-sekundda
C) 4-sekundda D) 3-sekundda



Jism kam vaqt ichida tezligini ko'proq kattalikka o'zgartira olsa, o'shanda jism tezlanishi eng katta bo'ladi, javob 3!

Javob: D) 3-sekundda.

6.46. Birinchi velosipedchi 10 m/s boshlang'ich tezlik bilan tekis sekinlanuvchan, ikkinchisi esa 2 m/s boshlang'ich tezlik bilan tekis tezlanuvchan harakat qilib bir-birlariga yaqinlashmoqda. Ular tezlanishlarining absolut qiymati bir xil bo'lib, 80 s o'tgach uchrashishdi. Velosipedchilar orasidagi boshlang'ich masofani toping (m).

- A) 1080 B) 1000 C) 980 D) 960

Berilgan:

$$v_{01} = 10 \text{ m/s}$$

$$v_{02} = 2 \text{ m/s}$$

$$t = 80 \text{ s}$$

$$S = ?$$

Yechilishi: jismlar orasidagi masofani topish uchun jismlarning bosib o'tgan yo'llarining yig'indisini olishimiz kerak!

$$S = S_1 + S_2$$

Tekis o'zgaruvchan harakatda jismning bosib o'tgan yo'li quyidagicha topiladi:

$$S = v_{o'n} \cdot t \quad (1)$$

Tekis o'zgaruvchan harakatda o'rtacha tezlikni topish uchun quyidagi ifoda har doim o'rinli:

$$v_{o'rt} = \frac{v + v_0}{2} \quad (2)$$

Bu ifodadan foydalanib (1) ifodani quyidagicha yozishimiz mumkin:

$$S = \frac{v + v_0}{2} \cdot t \quad (3)$$

$a = \frac{v - v_0}{t}$ ushbu formuladan v ni topsak quyidagicha bo'ladi:

$$v = v_0 + at \quad (4)$$

(4) ifodani (3) ifodaga qo'ysak, quyidagi ifoda hosil bo'ladi va biz undan jismning qancha masofani bosib o'tganini topamiz:

$$S = \frac{v_0 + at + v_0}{2} \cdot t = \frac{2v_0t + at^2}{2} = v_0t + \frac{at^2}{2}$$

$$S = v_0t + \frac{at^2}{2} \quad (5)$$

$$\begin{cases} S_1 = v_{01}t - \frac{at^2}{2} \\ S_2 = v_{02}t + \frac{at^2}{2} \end{cases}$$

$$S = S_1 + S_2 = v_{01}t - \frac{at^2}{2} + v_{02}t + \frac{at^2}{2} = t(v_{01} + v_{02}) = 960 \text{ m}$$

Javob: D) 960.

6.47. Jismning harakat tezligi $v = 5 + 2t$ tenglama bilan berilgan. Jismning boshlang'ich koordinatasi 20 m bo'lganda, uning harakat tenglamasi qanday ko'rinishda yoziladi?

A) $x = 5 + 20t + 2t^2$

B) $x = 20 + 5t + t^2$

C) $x = 20 + 5t - 2t^2$

D) $x = 20 - 5t + 2t^2$

Berilgan:

$$v = 5 + 2t$$

$$x_0 = 20 \text{ m}$$

$$x = ?$$

Yechilishi: Tekis tezlanuvchan harakatda jismning harakat tenglamasi quyidagicha:

$$x = x_0 + v_0t + \frac{at^2}{2}$$

Tezlikning o'zgarish tenglamasi esa quyidagicha:

$$v = v_0 + at$$

Bundan foydalanib, biz jismning boshlang'ich tezligi va tezlanishini bilib olishimiz mumkin, albatta ayniyat qonuni orqali:

$$v_0 = 5 \text{ m/s}; \quad a = 2 \text{ m/s}^2$$

Endi bu jismning harakat tenglamasini tuza olamiz!

$$x = 20 + 5t + \frac{2 \cdot t^2}{2} \Rightarrow x = 20 + 5t + t^2$$

Javob: B) $x = 20 + 5t + t^2$

7-§. Jismlarning erkin tushishi. Yuqoriga tik otilgan jism harakati

7.1. Erkin tushish boshlanganidan 4 s o'tgan paytda jism tezligi necha m/s bo'ladi?

- A) 40 B) 30 C) 20 D) 10

Berilgan:

$$t_1 = 4 \text{ s}$$

$$v = ?$$

Yechilishi: erkin tushishda jismning tezligi $v = v_0 + gt$ qonuniyat bo'yicha o'zgaradi. Lekin bu masalada jism boshlang'ich tezliksiz tashlab yuborilgani uchun, biz bu qonuniyatni $v = gt$ deb yozib olamiz:

$$v = 10 \cdot 4 = 40 \text{ m/s}$$

Javob: A) 40.

7.2. Erkin tushayotgan jismning 2- va 5-sekundlar oxiridagi tezliklari nisbatini toping.

- A) 0,216 B) 0,4 C) 0,6 D) 1

Berilgan:

$$t_1 = 2 \text{ s}$$

$$t_2 = 5 \text{ s}$$

$$v_1/v_2 = ?$$

Yechilishi: erkin tushishda jismning tezligi $v = v_0 + gt$ qonuniyat bo'yicha o'zgarishi bizga ma'lum. Ushbu masalani quyidagi nisbat orqali yechamiz:

$$\frac{v_1}{v_2} = \frac{gt_1}{gt_2} = \frac{t_1}{t_2} = 0,4$$

Javob: B) 0,4.

7.3. Erkin tushayotgan jismning boshlang'ich tezligi 6 m/s bo'lsa, uning 1 s dan keyingi tezligi necha m/s bo'ladi?

- A) 12 B) 20 C) 16 D) 7

Berilgan:

$$v_0 = 6 \text{ m/s}$$

$$t = 1 \text{ s}$$

$$v = ?$$

Yechilishi: erkin tushishda jismning tezligi $v = v_0 + gt$ qonuniyat bo'yicha o'zgaradi.

$$v = 6 + 10 \cdot 1 = 16 \text{ m/s}$$

Javob: C) 16.

7.4. Erkin tushayotgan jism 7 m/s boshlang'ich tezlikka ega bo'lsa, u 2 s dan keyin qanday tezlikka (m/s) erishadi? $g = 9,8 \text{ m/s}^2$

- A) 14 B) 28 C) 19,6 D) 26,6

Berilgan:

$$v_0 = 7 \text{ m/s}$$

$$t = 2 \text{ s}$$

$$v = ?$$

Yechilishi: erkin tushishda jismning tezligi $v = v_0 + gt$ qonuniyat bo'yicha o'zgaradi.

$$v = 7 + 9,8 \cdot 2 = 26,6 \text{ m/s}$$

Javob: D) 26,6.

7.5. 20 m/s boshlang'ich tezlik bilan erkin tushayotgan jismning harakat boshidan 4 s o'tgan paytdagi tezligi qanday (m/s) bo'ladi? $g = 10 \text{ m/s}^2$.

- A) 20 B) 40 C) 80 D) 60

Berilgan:

$$v_0 = 20 \text{ m/s}$$

$$t = 4 \text{ s}$$

$$v = ?$$

Yechilishi: erkin tushishda jismning tezligi $v = v_0 + gt$ qonuniyat bo'yicha o'zgaradi.

$$v = 20 + 10 \cdot 4 = 60 \text{ m/s}$$

Javob: D) 60.

7.6. 20 m/s ga teng boshlang'ich tezlik bilan erkin tushayotgan jismning harakat boshidan 5 s o'tgan paytdagi tezligi qanday (m/s) bo'ladi?

- A) 4 B) 20 C) 50 D) 70

Berilgan:

$$v_0 = 20 \text{ m/s}$$

$$t = 5 \text{ s}$$

$$v = ?$$

Yechilishi: erkin tushishda jismning tezligi $v = v_0 + gt$ qonuniyat bo'yicha o'zgaradi.

$$v = 20 + 10 \cdot 5 = 70 \text{ m/s}$$

Javob: D) 70.

7.7. 30 m/s boshlang'ich tezlik bilan erkin tushayotgan jismning harakat boshidan 5 s o'tgan paytdagi tezligi qanday (m/s) bo'ladi? $g = 10 \text{ m/s}^2$.

- A) 30 B) 50 C) 80 D) 150

Berilgan:

$$v_0 = 30 \text{ m/s}$$

$$t = 5 \text{ s}$$

$$v = ?$$

Yechilishi: erkin tushishda jismning tezligi $v = v_0 + gt$ qonuniyat bo'yicha o'zgaradi.

$$v = 30 + 10 \cdot 5 = 80 \text{ m/s}$$

Javob: C) 80.

7.9. Balkondan boshlang'ich tezliksiz tashlangan jism 2 s da yerga tushdi. Jism necha metr balandlikdan tashlangan? $g=10 \text{ m/s}^2$.

- A) 5 B) 10 C) 20 D) 25

Berilgan:

$$v_0 = 0$$

$$t = 2 \text{ s}$$

$$h = ?$$

Yechilishi: erkin tushishda jismning tushish balandligi

$h = v_0 t + \frac{gt^2}{2}$ formula orqali topiladi. Boshlang'ich tezlik nolga tengligidan bu formulani quyidagicha yozish mumkin.

$$h = \frac{gt^2}{2} \quad h = \frac{10 \cdot 2^2}{2} = 20 \text{ m}$$

Javob: C) 20.

7.10. Erkin tushayotgan jism harakatining boshlang'ich 3 sekundida necha metr ko'chadi? $g = 10 \text{ m/s}^2$.

- A) 60 B) 75 C) 50 D) 45

Berilgan:

$$v_0 = 0$$

$$t = 3 \text{ s}$$

$$h = ?$$

Yechilishi: erkin tushishda jismning tushish balandligi

$h = v_0 t + \frac{gt^2}{2}$ formula orqali topiladi. Boshlang'ich tezlik nolga tengligidan bu formulani quyidagicha yozish mumkin.

$$h = \frac{gt^2}{2} \quad h = \frac{10 \cdot 3^2}{2} = 45 \text{ m}$$

Javob: D) 45.

7.11. Qandaydir sayyorada jism 50 m balandlikdan 5 s da tushgan. Bu sayyorada erkin tushish tezlanishi qanday (m/s^2)?

- A) 50 B) 25 C) 10 D) 4

Berilgan:

$$h = 50 \text{ m}$$

$$t = 5 \text{ s}$$

$$g = ?$$

Yechilishi: erkin tushishda jismning tushish balandligi

$h = v_0 t + \frac{gt^2}{2}$ formula orqali topiladi. Boshlang'ich tezlik nolga teng bo'lganligi uchun bu formulani quyidagicha yozish mumkin.

$$h = \frac{gt^2}{2}$$

bu ifodadan erkin tushish tezlanishi ifodasini topib olamiz.

$$g = \frac{2h}{t^2} \quad g = \frac{2 \cdot 50}{5^2} = 4 \text{ m/s}^2$$

Javob: D) 4.

7.12. Boshlang'ich tezliksiz erkin tushayotgan birinchi jism ikkinchi jismga qaraganda 3 marta ko'p vaqt uchgan. Ularning ko'chishlari necha marta farq qiladi?

- A) 2 B) 8 C) 6 D) 9

Berilgan:

$$t_1/t_2 = 3$$

$$h_1/h_2 = ?$$

Yechilishi: erkin tushayotgan jismning tushish balandligini boshlang'ich tezlik bo'lmagan holda

$$h = \frac{gt^2}{2}$$

ifoda orqali topar edik. Har ikkala jismning tushish balandliklari nisbatini olsak, quyidagi ko'rinish hosil bo'ladi:

$$\frac{h_1}{h_2} = \frac{t_1^2}{t_2^2} = \left(\frac{t_1}{t_2}\right)^2 = 3^2 = 9$$

Javob: D) 9.

7.13. Tik erkin tushayotgan jismning harakat boshidan 3 va 5 s da bosib o'tgan yo'llarini taqqoslang.

- A) 9:25 B) 5:3 C) 3:5 D) 27:125

Berilgan:

$$t_1 = 3 \text{ s}$$

$$t_2 = 5 \text{ s}$$

$$h_1/h_2 = ?$$

Yechilishi: erkin tushayotgan jismning tushish balandligini

boshlang'ich tezlik bo'lmagan holda $h = \frac{gt^2}{2}$ ifoda orqali topar edik. Har ikkala jismning tushish balandliklari nisbatini olsak, quyidagi korinish hosil bo'ladi:

$$\frac{h_1}{h_2} = \frac{t_1^2}{t_2^2} \text{ bu ifodadan } \frac{h_1}{h_2} = \frac{9}{25} \text{ ekani ko'rinish turibdi.}$$

Javob: A) 9:25

7.14. Jism boshlang'ich tezliksiz erkin tushmoqda. Uning dastlabki 3 va 7 s vaqt davomida o'tgan yo'llarining nisbatini toping.

- A) 3:7 B) 6:14 C) 9:49 D) 5:10

Berilgan:

$$t_1 = 3 \text{ s}$$

$$t_2 = 7 \text{ s}$$

$$h_1/h_2 = ?$$

Yechilishi: erkin tushayotgan jismning tushish balandligini

boshlang'ich tezlik bo'lmagan holda $h = \frac{gt^2}{2}$ ifoda orqali topar edik. Har ikkala jismning tushish balandliklari nisbatini olsak, quyidagi korinish hosil bo'ladi:

$$\frac{h_1}{h_2} = \frac{t_1^2}{t_2^2} \text{ bu ifodadan } \frac{h_1}{h_2} = \frac{9}{49} \text{ ekani ko'rinish turibdi.}$$

Javob: C) 9:49

7.18. Erkin tushayotgan jismning $(n + 1)$ - sekunddagi ko'chishi qanday?

- A) $\frac{g(n+1)}{2}$ B) $\frac{g(2n+1)}{2}$ C) $\frac{3g(n-1)}{2}$ D) $2g(n-1)$

Berilgan:
 $\frac{n+1}{\Delta h_n = ?}$

Yechilishi: bu masalani erkin tushayotgan jismning n -sekundda bosib o'tgan masofasini topish formulasidan topamiz.

$$\Delta h_n = v_0 + \frac{g}{2}(2n-1)$$

Boshlang'ich tezlik yo'q ekanidan biz bu formulani

$$\Delta h_n = \frac{g}{2}(2n-1) \text{ deb yozsak bo'ladi.}$$

$$\Delta h_n = \frac{g}{2}(2(n+1)-1) = \frac{g(2n+1)}{2}$$

Javob: B) $\frac{g(2n+1)}{2}$.

7.19. Biror balandlikdan erkin tushayotgan (boshlang'ich tezliksiz) jism yo'l-ning birinchi $1/4$ qismi oxirida v tezlikka erishgan bo'lsa, yo'l oxiridagi tezligi qanday bo'ladi?

- A) $8v$ B) $4v$ C) $3v$ D) $2v$

Berilgan:
 $\frac{h/4; v}{v_1 = ?}$

Yechilishi: bu masalani yechishda dastlab $h = \frac{v^2 - v_0^2}{2g}$ formula orqali jism erishgan tezligining balandlikka bog'lanish ifodasini keltirib chiqaramiz.

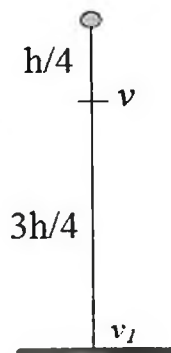
$\frac{h}{4} = \frac{v^2}{2g} \Rightarrow h = \frac{2v^2}{g}$ bu ifoda jismning tushish balandligi va $h/4$ balandlikda jism erishgan tezligi orasidagi bog'lanish ifodasi.

Jismning tushish balandligini oxirgi tezligi bilan bog'lasak, quyidagicha bo'ladi:

$$h = \frac{v_1^2}{2g} \text{ bu ifodalarni tenglashtiramiz:}$$

$$\frac{2v^2}{g} = \frac{v_1^2}{2g} \text{ bundan } v_1 = 2v \text{ ekani kelib chiqadi.}$$

Javob: D) $2v$.



7.20. Jism 45 m balandlikdan erkin tushmoqda. Tushishning oxirgi sekundidagi ko'chishi qanday (m)?

A) 20

B) 2,5

C) 5

D) 25

Berilgan:

$$h = 45\text{m}$$

$$h_n = ?$$

Yechilishi: Bu masalani erkin tushayotgan jismning n -sekundda bosib o'tgan masofasini topish formulasidan topamiz.

$$h_n = v_0 + \frac{g}{2}(2n - 1)$$

Ammo biz bu jismning qancha vaqtda yerga tushgani va uning harakatining oxirgi sekundi nechanchi sekund ekanini bilmaymiz, shuning uchun bu jismning

qancha vaqtda yerga tushganini $t = \sqrt{\frac{2h}{g}}$ formula orqali topib olamiz.

$t = \sqrt{\frac{2 \cdot 45}{10}} = 3\text{s}$ demak, biz jismning 3-sekundda bosib o'tgan balandligini topishimiz kerak ekan.

Boshlang'ich tezlik yo'q ekanidan biz bu formulani

$$\Delta h_n = \frac{g}{2}(2n - 1) \text{ deb yozsak bo'ladi.}$$

$$\Delta h_n = \frac{10}{2}(2 \cdot 3 - 1) = 25\text{ m}$$

Javob: D) 25.

7.21. 180 m balandlikdan erkin tushayotgan jism harakatining oxirgi sekundida necha metr yo'l o'tadi? $g = 10 \text{ m/s}^2$.

A) 160

B) 150

C) 40

D) 55

Berilgan:

$$h = 180\text{m}$$

$$h_n = ?$$

Yechilishi: Bu masalani erkin tushayotgan jismning n -sekundda bosib o'tgan masofasini topish formulasidan topamiz.

$$\Delta h_n = v_0 + \frac{g}{2}(2n - 1)$$

Ammo biz bu jismning qancha vaqtda yerga tushgani va uning harakatining oxirgi sekundi nechanchi sekund ekanini bilmaymiz, shuning uchun bu jismning

qancha vaqtda yerga tushganini $t = \sqrt{\frac{2h}{g}}$ formula orqali topib olamiz.

$t = \sqrt{\frac{2 \cdot 180}{10}} = 6\text{s}$ demak, biz jismning 6- sekundda bosib o'tgan balandligini topishimiz kerak ekan.

Boshlang'ich tezlik yo'q ekanidan biz bu formulani

$$h_n = \frac{g}{2}(2n - 1) \text{ deb yozsak bo'ladi.}$$

$$h_n = \frac{10}{2}(2 \cdot 6 - 1) = 55 \text{ m}$$

Javob: D) 55.

7.22. 500 m li televizion minoraning uchidan 1 s farq bilan uzilgan ikki tomchi orasidagi masofa ko'pi bilan necha metr bo'ladi?

A) 95

B) 100

C) 105

D) 90

Berilgan:

$$h = 500 \text{ m}$$

$$h_n = ?$$

Yechilishi: Bir sekund oralatib tashlangan jismlar orasidagi eng katta masofa birinchi jismning oxirgi sekundda bosib o'tgan yo'lga teng bo'ladi. Bu masalani ham erkin tushayotgan jismning n-sekundda bosib o'tgan masofasini topish formulasidan topamiz.

$$h_n = v_0 + \frac{g}{2}(2n - 1)$$

Ammo biz bu jismning qancha vaqtda yerga tushgani va uning harakatining oxirgi sekundi nechanchi sekund ekanini bilmaymiz, shuning uchun, bu jismning

qancha vaqtda yerga tushganini $t = \sqrt{\frac{2h}{g}}$ formula orqali topib olamiz.

$t = \sqrt{\frac{2 \cdot 500}{10}} = 10 \text{ s}$ demak, biz jismning 10- sekundda bosib o'tgan balandligini topishimiz kerak ekan.

Boshlang'ich tezlik yo'q ekanidan biz bu formulani

$$h_n = \frac{g}{2}(2n - 1) \text{ deb yozsak bo'ladi.}$$

$$h_n = \frac{10}{2}(2 \cdot 10 - 1) = 95 \text{ m}$$

Javob: A) 95.

7.23. Jism H balandlikdan boshlang'ich tezliksiz tushmoqda. U harakatining oxirgi sekundida $3H/4$ ga teng yo'l bosib o'tadi. H qanday (m)? $g = 10 \text{ m/s}^2$.

A) 15

B) 20

C) 25

D) 30

Berilgan:

$$h_n = 3H/4$$

$$H = ?$$

Yechilishi: Bu masalani yechish uchun biz eng avvalo jismning qancha vaqtda yerga tushganini bilib olishimiz kerak bo'ladi. Jismning oxirgi sekundda bosib o'tgan balandligi ifoda-

sidan $h_n = \frac{g}{2}(2n-1)$ jismning qancha vaqtda yerga tushganini bilib olamiz va $H = \frac{gt^2}{2}$ formula orqali jismning tushgan balandligini topib olamiz.

Jismning qancha vaqtda yerga tushganini topish uchun $h_n = \frac{g}{2}(2n-1)$ va $h_n = \frac{3H}{4}$ ekanini bilgan holda n ni topamiz, bu jismning H balandlikdan tushish vaqtiga teng.

$\frac{g}{2}(2n-1) = \frac{3H}{4}$ bu tenglikdan jismning tushish vaqti $n = \frac{3H+20}{40}$ ekanini bilib olamiz.

$H = \frac{g\left(\frac{3H+20}{40}\right)^2}{2}$ bu ifodani soddalashtirsak, $9H^2 - 200H + 400 = 0$ kvadrat tenglama kelib chiqadi, kvadrat tenglamani yechsak, $H = 20$ m ekani kelib chiqadi.

Javob: B) 20.

7.24. H balandlikdan boshlang'ich tezliksiz tushayotgan jism harakat vaqtining oxirgi sekundida $3H/4$ masofani bosib o'tdi. U necha sekunda tushgan?

- A) 2 B) 3 C) 4 D) 5

Berilgan:

$$h_n = 3H/4$$

$$t = ?$$

Yechilishi: Jismning qancha vaqtda yerga tushganini bilishimiz uchun, oldin uning qanday balandlikdan tushganini bilib olishimiz kerak. Biz buni 33-masalada topgan edik, jism tushgan

balandlik $H = 20$ m chiqqan edi. Bizning qiladigan ishimiz $t = \sqrt{\frac{2h}{g}}$ formula orqali jismning qancha vaqda yerga tushishini topishdan iborat.

$$t = \sqrt{\frac{2 \cdot 20}{10}} = 2s$$

Javob: A) 2.

7.25. Jism 180 m balandlikdan boshlang'ich tezliksiz erkin tushmoqda. Jismning oxirgi sekunddagi ko'chishi birinchi sekunddagi ko'chishidan necha marta ortiq? $g=10$ m/s².

- A) 11 B) 10 C) 9 D) 8

Berilgan:

$$h = 180 \text{ m}$$

$$h_{n_1}/h_{n_2} = ?$$

Yechilishi: Bu masalani erkin tushayotgan jismning n -sekunda bosib o'tgan masofasini topish formulasidan topamiz.

$$h_n = v_0 + \frac{g}{2}(2n-1)$$

Ammo biz bu jismning qancha vaqtda yerga tushgani va uning harakatining oxirgi sekundi nechanchi sekund ekanini bilmaymiz, shuning uchun, bu jismning qancha vaqtda yerga tushganini $t = \sqrt{\frac{2h}{g}}$ formula orqali topib olamiz.

$t = \sqrt{\frac{2 \cdot 180}{10}} = 6s$, demak, biz jismning 6- sekundda bosib o'tgan balandligini topishimiz kerak ekan.

Boshlang'ich tezlik yo'q ekanidan, biz bu formulani $h_n = \frac{g}{2}(2n-1)$ deb yozsak bo'ladi.

$$h_{n_1} = \frac{10}{2}(2 \cdot 6 - 1) = 55 \text{ m}$$

$$h_{n_2} = \frac{10}{2}(2 \cdot 1 - 1) = 5 \text{ m}$$

$$\frac{h_{n_1}}{h_{n_2}} = 11$$

Javob: A) 11.

7.26. Boshlang'ich tezliksiz erkin tushayotgan jism oxirgi 35 metrni 1 s davomida bosib o'tdi. Tushish balandligi qanday (m).

A) 80 B) 120 C) 150 D) 135

Berilgan:

$$\left. \begin{array}{l} h_n = 35 \text{ m} \\ h = ? \end{array} \right\}$$

Yechilishi: Jismning oxirgi 1 sekundda bosib o'tgan yo'li oxirgi sekundda bosib o'tgan balandligi h_n ekanini bilgan holda, oldin

jismning qancha vaqtda yerga tushganini $h_n = \frac{g}{2}(2n-1)$ formula

orqali topib olamiz va $h = \frac{gt^2}{2}$ formula orqali jismning tushgan balandligini topib olamiz.

$$h_n = \frac{g}{2}(2n-1) \Rightarrow n = \frac{2h_n + g}{2g}$$

$$n = \frac{3 \cdot 35 + 10}{20} = 4s, \quad h = \frac{10 \cdot 4^2}{2} = 80 \text{ m}$$

Javob: A) 80.

7.27. Erkin tushayotgan jism oxirgi 2 sekundda 160 m masofani bosib o'tgan bo'lsa, u qancha vaqtda tushgan (s)? $g = 10 \text{ m/s}^2$.

- A) 9 B) 6 C) 3 D) 12

Berilgan:

$$h_1 = 160 \text{ m}$$

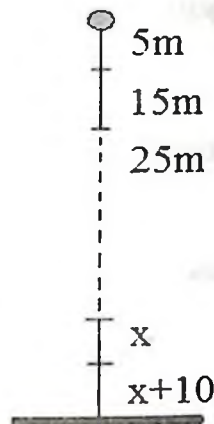
$$t_1 = 2 \text{ s}$$

$$t = ?$$

Yechilishi: Erkin tushayotgan jism 1-sekundda 5m, 2-sekundda 15m, 3-sekundda 25m va hokazo, shu tariqa har sekundda bosib o'tgan yo'li 10m ga

ortib borishini $h_n = \frac{g}{2}(2n-1)$ formula orqali tekshirib ko'rishingiz mumkin va oxirgi $(n-1)$ -sekundda x metr, oxirgi n -sekundda esa $x+10$ metr masofani bosib o'tishini bilib olishimiz mumkin.

Oxirgi $t_1 = 2 \text{ s}$ da bosib o'tgan yo'li $h_1 = 160 \text{ m}$ va bu $2x + 10$ ga tengligidan foydalanib, jismning



oxirgi sekundda bosib o'tgan $h_n = x + 10$ masofasini topib olamiz va $h_n = \frac{g}{2}(2n-1)$ formula orqali jismning qancha vaqtda tushishini bilib olamiz.

$$h_1 = 2x + 10$$

$$160 = 2x + 10$$

$$x = 75 \text{ m dan } h_n = x + 10 = 85 \text{ m kelib chiqadi.}$$

Endi $h_n = \frac{g}{2}(2n-1)$ formuladan jismning qancha vaqtda tushganini topamiz, u quyidagicha:

$$n = \frac{2h_n + g}{2g}$$

$$n = \frac{2 \cdot 85 + 10}{20} = 9.$$

Javob: A) 9.

7.28. 35 m balandlikdan boshlang'ich tezliksiz erkin tushayotgan jismning tezligi 10 m/s bo'lganda, u yerdan qanday (m) balandlikda bo'ladi?

- A) 20 B) 25 C) 30 D) 10

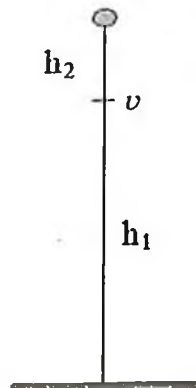
Berilgan:

$$h = 35 \text{ m}$$

$$v = 10 \text{ m/s}$$

$$h_1 = ?$$

Yechilishi: Bu masalada biz h_2 balandlikni topolsak, $h_1 + h_2 = h$ ekanidan foydalanib h_1 balandlikni topamiz.



h_2 balandlikni $h = \frac{v^2}{2g}$ formuladan topamiz.

$$h_2 = \frac{10^2}{2 \cdot 10} = 5 \text{ m.}$$

$$h_1 + h_2 = h \Rightarrow h_1 = h - h_2$$

$$h_1 = 35 + 5 = 30 \text{ m}$$

Javob: C) 30.

7.29. Jism $h = 45 \text{ m}$ balandlikdan erkin tushmoqda. Uning tezligi 10 m/s ga yetganda u yerdan qanday (m) balandlikda bo'ladi? $g = 10 \text{ m/s}^2$.

A) 20 B) 25 C) 30 D) 40

Berilgan:

$$h = 45 \text{ m}$$

$$v = 10 \text{ m/s}$$

$$h_1 = ?$$

Yechilishi: Bu masalada biz h_2 balandlikni topolsak, $h_1 + h_2 = h$ ekanidan foydalanib h_1 balandlikni topamiz.

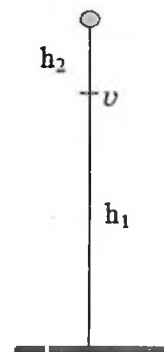
h_2 balandlikni $h = \frac{v^2}{2g}$ formuladan topamiz.

$$h_2 = \frac{10^2}{2 \cdot 10} = 5 \text{ m.}$$

$$h_1 + h_2 = h \Rightarrow h_1 = h - h_2$$

$$h_1 = 45 - 5 = 40 \text{ m}$$

Javob: D) 40.



7.30. Ikkinchi tomchi uzilgandan 2 s o'tgach, tomchilar orasidagi masofa 25 m ga teng bo'lgan bo'lsa, tomchilar necha sekund vaqt intervali bilan uzilgan?

A) 0,5 B) 0,25 C) 1,5 D) 1

Berilgan:

$$t = 2 \text{ s}$$

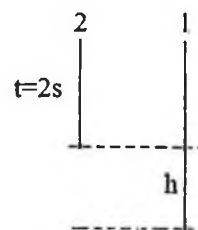
$$h = 25 \text{ m}$$

$$\Delta t = ?$$

Yechilishi: Bu holda 1- va 2- tomchilarning tushgan balandliklari ayirmasi $h = 25 \text{ m}$ ekanidan foydalanamiz. 2-jism $t = 2 \text{ s}$ harakatlangan, 1- jism esa $t + \Delta t$ vaqt harakatda bo'ldi.

$$h_1 - h_2 = h$$

$$\frac{g(t + \Delta t)^2}{2} - \frac{gt^2}{2} = h$$



Ushbu tenglamani yechsak, $\Delta t = 1 \text{ s}$ ekanligi kelib chiqadi.

Javob: D) 1.

7.31. Bir xil balandlikdan 2 s vaqt intervali bilan ikkita jism erkin tusha boshladi. 2-jism tusha boshlagandan necha sekund o'tgach, ular orasidagi masofa 40 m bo'ladi?

A) 0,2

B) 1

C) 0,5

D) 2

Berilgan:

$$\Delta t = 2 \text{ s}$$

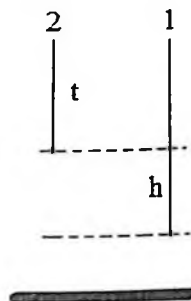
$$h = 40 \text{ m}$$

$$t = ?$$

Yechilishi: Bu holda 1- va 2- tomchilarning tushgan balandliklari ayirmasi $h = 40 \text{ m}$ ekani-dan foydalanamiz. 2-jism t vaqt harakatlangan, 1- jism esa $t + \Delta t$ vaqt harakatlangan.

$$h_1 - h_2 = h$$

$$\frac{g(t + \Delta t)^2}{2} - \frac{gt^2}{2} = h$$



Ushbu tenglamani yechsak, $t = 1 \text{ s}$ ekani kelib chiqadi.

Javob: B) 1.

7.32. Boshlang'ich tezliksiz erkin tushayotgan jismning biror balandlik-dagi tezligi 20 m/s bo'lsa, undan 25 m pastda joylashgan nuqtadagi tezligi qanday (m/s) bo'ladi?

A) 20

B) 30

C) 25

D) 35

Berilgan:

$$h = 25 \text{ m}$$

$$v_0 = 0$$

$$v_1 = 20 \text{ m/s}$$

$$v_2 = ?$$

Yechilishi: Bu masalani $h = \frac{v_2^2 - v_1^2}{2g}$ formula orqali yechamiz.

Bu formuladan jismning yerga tushgandagi tezligi v_2 ni topamiz:

$$v_2 = \sqrt{v_1^2 + 2gh}$$

$$v_2 = \sqrt{20^2 + 2 \cdot 10 \cdot 25} = 30 \text{ m/s}$$

Javob: B) 30.

7.33. Balandligi 20 m li binodan tushayotgan jismning boshlang'ich tezligi 15 m/s. Yerga tushish paytida uning tezligi qanday bo'ladi (m/s)? $g = 10 \text{ m/s}^2$.

A) 80

B) 40

C) 30

D) 25

Berilgan:

$$h = 20 \text{ m}$$

$$v_0 = 15 \text{ m/s}$$

$$v = ?$$

Yechilishi: Bu masalani $h = \frac{v^2 - v_0^2}{2g}$ formula orqali yechamiz.

Bu formuladan jismning yerga tushgandagi tezligi v ni topamiz:

$$v = \sqrt{v_0^2 + 2gh}, \quad v = \sqrt{15^2 + 2 \cdot 10 \cdot 20} = 25 \text{ m/s}$$

Javob: D) 25.

7.34. Boshlang'ich tezliksiz tashlangan jism 4 s da yerga tushdi. Agar jism shu balandlikdan 30 m/s boshlang'ich tezlik bilan tashlansa, u qancha vaqtda yerga tushadi (s)?

- A) 1 B) 1,5 C) 2 D) 2,5

Berilgan:

$$t = 4 \text{ s}$$

$$v_0 = 30 \text{ m/s}$$

$$t_1 = ?$$

Yechilishi: Bu masalada eng avvalo jism qanday balandlik-

dan tushganini $h = \frac{gt^2}{2}$ formula orqali topamiz va $h = v_0 t_1 + \frac{gt_1^2}{2}$ formuladan jism h balandlikdan v_0 tezlik bilan pastga otilganda qancha vaqtda tushishi t_1 ni topib olamiz.

$$h = \frac{10 \cdot 4^2}{2} = 80 \text{ m}$$

Jism tushgan balandlikni topdik. Biz buni bilgan holda quyidagi kvadrat tenglamani yozamiz:

$$t_1^2 + 6t_1 - 16 = 0$$

Ushbu kvadrat tenglamani yechsak, t_1 ning ikki qiymati 2 va -8 degan javobni olamiz. Vaqt manfiy bo'lmashligini bilgan holda bu masalaning javobi $t_1 = 2 \text{ s}$ ekanini bilib olamiz.

Javob: C) 2.

7.35. 5 m/s boshlang'ich tezlik bilan erkin tushayotgan jismning 3- va 5-sekundlardagi ko'chishlari nisbatini toping.

- A) 29/48 B) 9/25 C) 3/5 D) 29/49

Berilgan:

$$v_0 = 5 \text{ m/s}$$

$$n_1 = 3 \text{ s}$$

$$n_2 = 5 \text{ s}$$

$$h_1/h_2 = ?$$

Yechilishi: Bu masalani erkin tushayotgan jismning n -sekundda bosib o'tgan masofasini topish formulasidan foydalanib yechamiz.

Erkin tushayotgan jismning n -sekundda bosib o'tgan balandligi $h_n = v_0 + \frac{g}{2}(2n-1)$ formula orqali topilishini bilgan holda quyidagi nisbatni hosil qilamiz.

$$\frac{h_1}{h_2} = \frac{v_0 + \frac{g}{2}(2n_1-1)}{v_0 + \frac{g}{2}(2n_2-1)} \text{ bu nisbatdan olingan natija quyidagicha: } \frac{h_1}{h_2} = \frac{3}{5}$$

Javob: C) 3/5.

7.36. 1 s dan so'ng suvga tegishi uchun toshni balandligi 25 m li ko'prikdan qanday boshlang'ich tezlik bilan tashlash kerak (m/s)?

- A) 15 B) 30 C) 25 D) 20

Berilgan:

$$\begin{array}{l} t = 1 \text{ s} \\ h = 25 \text{ m} \\ g = 10 \text{ m/s}^2 \\ v_0 = ? \end{array}$$

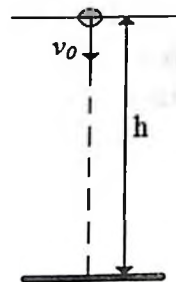
Yechilishi: Og'irlik kuchi ta'siridagi vertikal tezlanuvchan harakatda balandlikni topish formulasidan foydalanamiz.

$$h = v_0 t + \frac{gt^2}{2}$$

$$v_0 t = h - \frac{gt^2}{2}$$

$$v_0 = \frac{h}{t} - \frac{gt}{2} = \frac{25}{1} - \frac{10 \cdot 1}{2} = 25 - 5 = 20 \text{ m/s}$$

Javob: D) 20.



7.37. Bir jism 80 m balandlikdan boshlang'ich tezliksiz, ikkinchi jism 100 m balandlikdan qandaydir boshlang'ich tezlik bilan bir vaqtda tusha boshladi. Ikkala jism bir vaqtda yerga urildi. 2-jismning boshlang'ich tezligi qanday (m/s) bo'lgan?

- A) 3 B) 4 C) 5 D) 7

Berilgan:

$$\begin{array}{l} t_1 = t_2 = t \\ h_1 = 80 \text{ m} \\ h_2 = 100 \text{ m} \\ v_{01} = 0 \\ g = 10 \text{ m/s}^2 \\ v_{02} = ? \end{array}$$

Yechilishi: g tezlanish bilan tekis tezlanuvchan harakat formulasidan foydalanamiz.

$$h_1 = v_{01} t_1 + \frac{gt_1^2}{2}$$

$$h_2 = v_{02} t_2 + \frac{gt_2^2}{2}$$

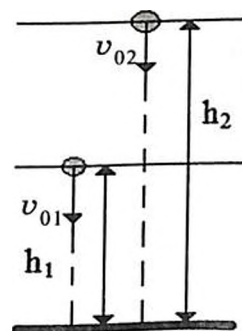
$t_1 = t_2 = t$; $v_{01} = 0$ dan foydalanamiz.

$$h = \frac{gt^2}{2}; \quad h = v_{02} t + \frac{gt^2}{2}; \quad t = \sqrt{\frac{2h_1}{g}} \Rightarrow h_2 = v_{02} \sqrt{\frac{2h_1}{g}} + h_1$$

$$h_2 - h_1 = v_{02} \sqrt{\frac{2h_1}{g}} \Rightarrow v_{02} = (h_2 - h_1) \sqrt{\frac{g}{2h_1}}$$

$$v_{02} = (100 - 80) \sqrt{\frac{10}{2 \cdot 80}} = 5 \text{ m/s}$$

Javob: C) 5.



7.38. 30 m balandlikdan 5 m/s boshlang'ich tezlik bilan tik pastga otilgan jismning tezligi yerdan qanday (m) balandlikda 3 marta oshadi?

- A) 25 B) 10 C) 15 D) 20

Berilgan:

$$H = 30 \text{ m}$$

$$v_0 = 5 \text{ m/s.}$$

$$v = 3v_0$$

$$g = 10 \text{ m/s}^2$$

$$h = ?$$

Yechilishi: Og'irlik kuchi ta'siridagi harakat uchun tezliklarga bog'liq balandlik formulasini yozamiz.

$$H - h = \frac{v^2 - v_0^2}{2g}$$

$$H - h = \frac{9v_0^2 - v_0^2}{2g} = \frac{8v_0^2}{2g} = \frac{4v_0^2}{g} \Rightarrow h = H - \frac{4v_0^2}{g}$$

$$h = 30 - \frac{4 \cdot 25}{10} = 30 - 10 = 20 \text{ m}$$

Javob: $h = 20 \text{ m}$.

7.39. Jism erkin tushmoqda. Tushish balandligining birinchi yarmini o'tish uchun ketadigan vaqt butun balandlikni o'tish uchun ketadigan vaqtning qanday qismini tashkil etadi?

- A) $1/\sqrt{2}$ B) $1/2$ C) $\sqrt{2}$ D) $1/4$

Berilgan:

$$v_0 = 0$$

$$h_1 = h/2$$

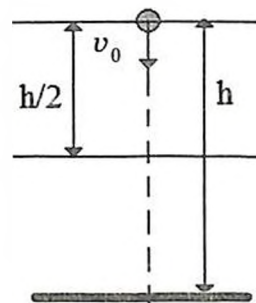
$$g = 10 \text{ m/s}^2$$

$$t_1/t = ?$$

Yechilishi: Erkin tushishda balandlik formulasini masofaning yarmi uchun va butun balandlik uchun yozamiz.

$$\frac{h}{2} = \frac{gt_1^2}{2}; \quad h = \frac{gt^2}{2} \Rightarrow t_1 = \sqrt{\frac{h}{g}}; \quad t = \sqrt{\frac{2h}{g}}$$

$$\frac{t_1}{t} = \sqrt{\frac{h}{g}} \cdot \sqrt{\frac{g}{2h}} = \frac{1}{\sqrt{2}}$$



Javob: A) $1/\sqrt{2}$.

7.40. Jism ma'lum bir balandlikdan erkin tushishi uchun 2 s vaqt ketdi. O'sha balandlikning birinchi yarmini o'tish uchun qanday vaqt ketgan (s)?

- A) 0,5 B) 1,2 C) 1 D) 1,4

Berilgan:

$$v_0 = 0$$

$$h_1 = h/2$$

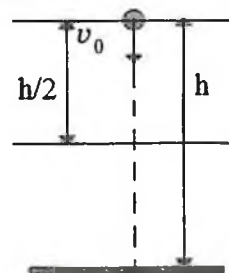
$$t = 2 \text{ s}$$

$$g = 10 \text{ m/s}^2$$

$$t_1 = ?$$

Yechilishi: Erkin tushishda balandlik formulasini masofaning yarmi uchun va butun balandlik uchun yozamiz.

$$\frac{h}{2} = \frac{gt_1^2}{2}; \quad h = \frac{gt^2}{2} \Rightarrow t_1 = \sqrt{\frac{h}{g}}; \quad t = \sqrt{\frac{2h}{g}}$$



$$t_1 = \frac{t}{\sqrt{2}} = \frac{2\sqrt{2}}{2} = 1,4 \text{ s}$$

Javob: $t_1 = 1,4 \text{ s}$

Javob: D) 1,4.

7.41. Erkin tushayotgan jism oxirgi ikki sekundda 90 m yo'l bosib o'tdi. Jism qancha vaqtda tushgan (s)?

- A) 11 B) 10 C) 4,6 D) 5,5

Berilgan:

$$v_0 = 0$$

$$\Delta h = 90 \text{ m}$$

$$\Delta t = 2 \text{ s}$$

$$g = 10 \text{ m/s}^2$$

$$t = ?$$

Yechilishi: $\Delta h = H - h$ ga teng ekanligi chizmadan ma'lum. Erkin tushish uchun balandlik formulasidan foydalanib quyidagilarni yozamiz:

$$H = \frac{gt^2}{2}; \quad t - \text{umumiy vaqt.}$$

$$h = \frac{g(t - \Delta t)^2}{2}$$

$$\Delta h = \frac{gt^2}{2} - \frac{g(t - \Delta t)^2}{2} = \frac{g}{2}(t^2 - t^2 + 2t\Delta t - \Delta t^2)$$

$$\Delta h = \frac{g}{2}(2t\Delta t - \Delta t^2) \Rightarrow t = \frac{\Delta h}{g\Delta t} + \frac{\Delta t}{2}$$

$$t = \frac{90}{10 \cdot 2} + \frac{2}{2} = 5,5 \text{ s}$$

Javob: D) 5,5.

7.42. Ikkita jism bir nuqtadan 2 s vaqt oralig'i bilan erkin tusha boshladi. Ular orasidagi masofaning eng katta qiymati 80 m bo'lsa, jismlarning yerga tushish vaqti qanday (s)?

- A) 5 B) 6 C) 9 D) 4

Berilgan:

$$v_0 = 0$$

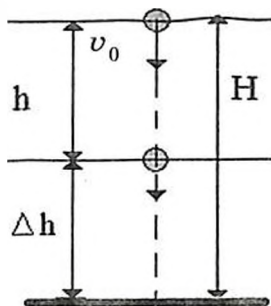
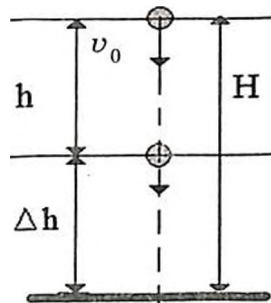
$$\Delta h = 80 \text{ m}$$

$$\Delta t = 2 \text{ s}$$

$$g = 10 \text{ m/s}^2$$

$$t = ?$$

Yechilishi: Ikkala jism ham erkin tushayotgani uchun, ular orasidagi masofa ortib boradi va 1-jism yerga tekkan paytda jismlar orasidagi masofa eng katta bo'ladi va 80 m ga teng. Masalani ishlashda ikkita jism harakatini bitta jism harakatiga ko'chiramiz va oxirgi 2s da 80m ni o'tgan bo'lsa, tushish vaqtini topamiz. $\Delta h = H - h$.



$$H = \frac{gt^2}{2}; t - \text{umumiy vaqt}$$

$$h = \frac{g(t - \Delta t)^2}{2}$$

$$\Delta h = \frac{gt^2}{2} - \frac{g(t - \Delta t)^2}{2} = \frac{g}{2}(t^2 - t^2 + 2t\Delta t - \Delta t^2)$$

$$\Delta h = \frac{g}{2}(2t\Delta t - \Delta t^2) \Rightarrow t = \frac{\Delta h}{g\Delta t} + \frac{\Delta t}{2}$$

$$t = \frac{80}{10 \cdot 2} + \frac{2}{2} = 5s$$

Javob: A) 5.

7.43. Jism h balandlikdan erkin tushmoqda. Uning yo'lining ikkinchi yarmidagi o'rtacha tezligi qanday?

A) $\sqrt{gh(\sqrt{2} - 1)}$; B) $\frac{\sqrt{gh}(\sqrt{2} - 1)}{2}$; C) $\frac{\sqrt{gh}(\sqrt{2} + 1)}{2}$; D) $\frac{\sqrt{gh}(\sqrt{2} + 1)}{4}$.

Berilgan:

$$v_0 = 0$$

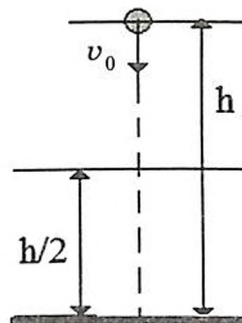
$$g = 10 \text{ m/s}^2$$

$$v_{o'rt} = ?$$

Yechilishi: O'rtacha tezlik umumiy yo'l-ning (S_u) umumiy vaqtga (t_u) nisbatiga teng.

$$v_{o'rt} = \frac{S_u}{t_u}; S = \frac{h}{2}$$

Jism tushish balandligining 2-yarmini bosib o'tish uchun ketgan vaqtini aniqlaymiz:



$$t = \sqrt{\frac{2h}{g}} \Rightarrow \text{umumiy vaqt}$$

$$t_1 = \sqrt{\frac{2h}{g}} \Rightarrow 1 \text{ yarmini bosib o'tish uchun ketgan vaqt}$$

$$t_u = t - t_1 \Rightarrow \text{balandlikning ikkinchi yarmini bosib o'tish uchun ketgan vaqt}$$

$$t_u = \sqrt{\frac{2h}{g}} - \sqrt{\frac{h}{g}} = \sqrt{\frac{h}{g}}(\sqrt{2} - 1)$$

$$v_{o'rt} = \frac{h}{2} \cdot \sqrt{\frac{g}{h}} \cdot \frac{1}{\sqrt{2} - 1} = \frac{\sqrt{gh}}{2(\sqrt{2} - 1)} = \frac{\sqrt{gh}(\sqrt{2} + 1)}{2(\sqrt{2} - 1)(\sqrt{2} + 1)} = \frac{\sqrt{gh}(\sqrt{2} + 1)}{2}$$

Javob: C) $\frac{\sqrt{gh}(\sqrt{2} + 1)}{2}$.

7.44. Vertolyot 500 m balandlikdan o'zgaras 10 m/s tezlik bilan tusha boshlagan paytda undan biror jism tashlandi. Jism vertolyotdan necha sekund oldin tushadi?

A) 50

B) 25

C) 38

D) 4

Berilgan:

$$v_0 = 10 \text{ m/s.}$$

$$h = 500 \text{ m}$$

$$\Delta t = ?$$

Yechilishi: Vertolyot tekis harakat qilib t_1 vaqtdan keyin yerga tushadi.

$$t_1 = \frac{h}{v_0} = 50 \text{ s}$$

Tosh esa vertolyotning v_0 tezligini oladi va vertikal pastga otilgan jism kabi harakatlanadi.

$$h = v_0 t_2 + \frac{gt_2^2}{2} \Rightarrow 500 = 10t_2 + 5t_2^2 \Rightarrow t_2^2 + 2t_2 - 100 = 0$$

$$t_2 = 9 \text{ s; } \Delta t = t_1 - t_2 = 41 \text{ s}$$

Javob: E) 41.

7.45. Shaxtaga tushib ketgan toshning shaxta tubiga urilgandagi tovushi 9 s dan keyin eshitildi. Shaxtaning chuqurligi qanday (m)? Tovushning tezligi 320 m/s, $g = 10 \text{ m/s}^2$. Havoning qarshiligini hisobga olmang.

A) 16

B) 32

C) 160

D) 320

Berilgan:

$$v_0 = 0$$

$$t = 9 \text{ s}$$

$$v = 320 \text{ m/s}$$

$$h = ?$$

Yechilishi: Toshning tushish vaqti

$$t_1 = \sqrt{\frac{2h}{g}}$$

Tovush havoda v tezlik bilan harakatlangani uchun uning shaxtadan

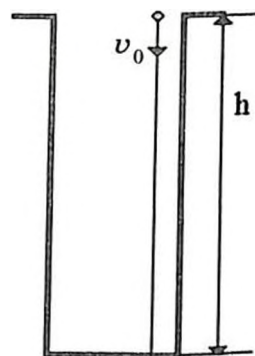
$$\text{chiqish vaqti } t_2 = \frac{h}{v}$$

$$\text{Umumiy vaqt } t = t_1 + t_2$$

$$t = \sqrt{\frac{2h}{g}} + \frac{h}{v} \Rightarrow t - \frac{h}{v} = \sqrt{\frac{2h}{g}}$$

$$(vt - h)^2 = \left(v \sqrt{\frac{2h}{g}} \right)^2 \Rightarrow (vt)^2 - 2vth + h^2 = \frac{2v^2 h}{g}$$

$$h^2 - \left(2vt + \frac{2v^2}{g} \right) h + (vt)^2 = 0$$



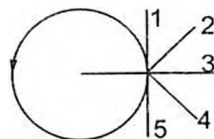
$$h^2 - \left(2 \cdot 320 \cdot 9 + \frac{2 \cdot 320^2}{10} \right) h + (320 \cdot 9)^2 = 0$$

$$h^2 - 26240h + 829400 = 0$$

$$h = 320 \text{ m.}$$

Javob: D) 320.

7.46. Ipga bog'langan va vertikal tekislikda aylanayotgan jism aylanish o'qi bilan bir xil balandlikda bo'lgan paytda ip uzib yuborildi. U rasmda ko'rsatilgan trayektoriyalarning qaysi biri bo'ylab harakat qiladi?



- A) 5 B) 4 C) 3 D) 1

O'z inersiyasi bilan aylanish tezligi yo'nalishida harakat qiladi, ya'ni 1 yo'nalishda.

Javob: D) 1.

7.47. Tosh yuqoriga vertikal otildi. Tosh trayektoriyaning qaysi nuqtalarida eng katta tezlanishga ega bo'ladi? Havoning qarshiligi hisobga olinmasin.

- A) trayektoriyaning eng yuqori nuqtasida
B) tezlanish hamma joyda birday va g ga teng
C) trayektoriyaning eng quyi nuqtasida
D) trayektoriyaning o'rtasida.

Yuqoriga tik otilgan jism, havoning qarshiligi hisobga olinmasa, faqat og'irlik kuchi ta'sirida harakat qiladi va trayektoriyaning hamma nuqtasida tezlanish bir xil va g ga teng.

Javob: B) tezlanish hamma joyda birday va g ga teng.

7.48. Yuqoriga tik otilayotgan jismning otish tezligi 2 marta oshirilsa, uning harakatlanish vaqti qanday o'zgaradi?

- A) 2 marta kamayadi B) 2 marta ortadi
C) 4 marta ortadi D) 4 marta kamayadi

Berilgan:

$$v_{02} = 2v_{01}$$

$$t_2/t_1 = ?$$

Yechilishi: Yuqoriga tik otilgan jism tezligining o'zgarish qonuni:

$$v = v_0 - gt$$

Ko'tarilish balandligining eng yuqori nuqtasida $v = 0$

$$v_0 = gt \Rightarrow t = \frac{v_0}{g}$$

$$t_1 = \frac{v_{01}}{g}, \quad t_2 = \frac{v_{02}}{g} \Rightarrow \frac{t_1}{t_2} = \frac{v_{02}}{g} \cdot \frac{g}{v_{01}} = \frac{2v_{01}}{v_{01}} = 2$$

Javob: B) 2 marta ortadi.

7.49. Yuqoriga otilgan to'pning ko'tarilish vaqtini 5 marta orttirish uchun uning boshlang'ich tezligini qanday o'zgartirish kerak? Havoning qarshiligini hisobga olmang.

- A) 2,5 marta orttirish
C) 10 marta orttirish

- B) 5 marta kamaytirish
D) 5 marta orttirish

Yuqoriga tik otilgan jismning ko'tarilish vaqti $t = \frac{v_0}{g}$. $t : v_0$ bo'lgani sababli t ni 5 marta orttirish uchun v_0 ni ham 5 marta orttirish kerak.

Javob: D) 5 marta orttirish.

7.50. Yuqoriga tik otilgan jismning trayektoriyaning eng yuqori nuqtasidagi tezligi qanday?

A) $v = gt$

B) $v = v_0 - gt$

C) 0

D) $v = v_0 + gt$

Yuqoriga tik otilgan jism tezligi $v = v_0 - gt$ qonuniyat bo'yicha kamayib boradi va eng yuqori nuqtada to'xtaydi, ya'ni $v = 0$ bo'ladi.

Javob: C) 0.

7.51. Jism 40 m/s tezlik bilan tik yuqoriga otildi. Shundan 5 s o'tgan paytda uning tezligining yuqoriga yo'nalishga proyeksiyasi qanday (m/s) bo'ladi? $g = 10 \text{ m/s}^2$.

A) -10

B) -20

C) -5

D) 5

Berilgan:

$v_0 = 40 \text{ m/s}$

$t = 5 \text{ s}$

$v_y = ?$

Yechilishi: Yuqoriga tik otilgan jism tezligining OY o'qdagi tezlik o'zgarish tenglamasini yozamiz:

$$v_y = v_{0y} + a_y t$$

$$v_{0y} = v_0,$$

$$a_y = -g \Rightarrow v_y = v_0 - gt = 40 - 50 = -10 \text{ m/s}$$

Javob: A) -10.

7.52. 40 m/s tezlik bilan yuqoriga tik otilgan jism 4 s o'tgach qanday tezlikka ega bo'ladi (m/s)?

A) 5

B) 10

C) 15

D) 0

Berilgan:

$$v_0 = 40 \text{ m/s}$$

$$t = 4 \text{ s}$$

$$v = ?$$

Yechilishi: Yuqoriga tik otilgan jism tezligining o'zgarish tenglamasidan foydalanamiz:

$$v = v_0 - gt = 40 - 40 = 0$$

Javob: D) 0.

7.53. 4 m/s tezlik bilan yuqoriga tik otilgan jismning tezligi necha metr balandlikda 2 marta kamayadi?

A) 8

B) 4

C) 0,4

D) 0,6

Berilgan:

$$v_0 = 4 \text{ m/s}$$

$$v = v_0/2$$

$$h = ?$$

Yechilishi: Yuqoriga tik otilgan jism balandligini topish formulasidan foydalanamiz:

$$h = \frac{v^2 - v_0^2}{2g} = \frac{16 - 4}{20} = 0,6 \text{ m}$$

Javob: D) 0,6.

7.54. Jism qanday boshlang'ich tezlik (m/s) bilan yuqoriga tik otilganda, u 5 s o'tgach, 10 m/s tezlik bilan pastga harakat qiladi?

A) 40

B) 30

C) 20

D) 10

Berilgan:

$$v = 10 \text{ m/s}$$

$$t = 5 \text{ s}$$

$$v_0 = ?$$

Yechilishi: Yuqoriga tik otilgan jism tezligining oy o'q-dagi tezlik o'zgarish tenglamasini yozamiz:

$$v_y = v_{oy} + a_y t$$

$$v_{oy} = v_0, \quad v_y = -v, \quad a_y = -g \Rightarrow -v = v_0 - gt$$

$$v_0 = gt - v = 50 - 10 = 10 \text{ m/s}$$

Javob: A) 40.

7.55. Jismni qanday (m/s) boshlang'ich tezlik bilan yuqoriga tik otganimizda, u 10 s o'tgach, 20 m/s tezlik bilan pastga harakat qiladi? $g = 10 \text{ m/s}^2$

A) 65

B) 75

C) 80

D) 85

Berilgan:

$$v = 20 \text{ m/s}$$

$$t = 10 \text{ s}$$

$$v_0 = ?$$

Yechilishi: Yuqoriga tik otilgan jism tezligining y o'q-dagi tezlik o'zgarish tenglamasini yozamiz:

$$v_y = v_{oy} + a_y t$$

$$v_{oy} = v_0, \quad v_y = -v, \quad a_y = -g \Rightarrow -v = v_0 - gt$$

$$v_0 = gt - v = 100 - 20 = 80 \text{ m/s}$$

Javob: C) 80.

7.56. Jism vertikal yuqoriga 30 m/s tezlik bilan otildi. Qancha vaqtdan so'ng uning tezligi 2 marta kamayadi (s)?

- A) 0,5 B) 1 C) 3 D) 1,5

Berilgan:

$$v_0 = 20 \text{ m/s}$$

$$v = v_0/2$$

$$t = ?$$

Yechilishi: Yuqoriga tik otilgan jism tezligining o'zgarish

tenglamasidan foydalanamiz: $v = v_0 - gt$

$$t = \frac{v_0 - v}{g} = \frac{v_0 - \frac{v_0}{2}}{g} = \frac{v_0}{2g} = \frac{30}{20} = 1,5 \text{ s}$$

Javob: D) 1,5.

7.57. Jism 40 m/s tezlik bilan yuqoriga tik otilgan. U 2 s da necha metr balandlikka erishadi? Havoning qarshiligini hisobga olmang.

- A) 80 B) 60 C) 800 D) 0,8

Berilgan:

$$v_0 = 40 \text{ m/s}$$

$$g = 10 \text{ m/s}^2$$

$$t = 2 \text{ s}$$

$$h = ?$$

Yechilishi: Yuqoriga tik otilgan jism balandligini topish formulasidan foydalanamiz:

$$h = v_0 t - \frac{gt^2}{2}$$

$$h = 10 \cdot 2 - 5 \cdot 4 = 60 \text{ m}$$

Javob: B) 60.

7.58. Jism 50 m/s tezlik bilan vertikal yuqoriga otildi. Jismning maksimal ko'tarilish balandligi qanday (m)?

- A) 25 B) 50 C) 125 D) 250

Berilgan:

$$v_0 = 50 \text{ m/s}$$

$$g = 10 \text{ m/s}^2$$

$$h_{\max} = ?$$

Yechilishi: Yuqoriga tik otilgan jism balandligini topish formulasidan foydalanamiz:

$$h = \frac{v_0^2 - v^2}{2g}$$

Eng tepada jismning tezligi $v = 0$ bo'lgani uchun:

$$h_{\max} = \frac{v_0^2}{2g} = \frac{50^2}{20} = 125 \text{ m}$$

Javob: C) 125.

7.59. Yuqoriga tik otilgan jism 20 m balandlikka ko'tarildi. Jism tezligi moduli-ning butun uchish vaqti davomidagi o'rtacha qiymati qanday (m/s)?

- A) 40 B) 30 C) 20 D) 10

Berilgan:

$$h = 20 \text{ m}$$

$$v_{o'rt} = ?$$

Yechilishi: Butun yo'l davomidagi o'rtacha tezlik

$$v_{o'rt} = \frac{S_u}{t_u}; \quad S_u = 2h; \quad t_u = 2\sqrt{\frac{2h}{g}}$$

$$v_{o'rt} = \frac{2h}{2\sqrt{\frac{2h}{g}}} = h\sqrt{\frac{g}{2h}} = \sqrt{\frac{gh}{2}} = \sqrt{\frac{10 \cdot 20}{2}} = 10 \text{ m/s}$$

Javob: D) 10.

7.60. Jism 40 m/s tezlik bilan tik yuqoriga otildi. U 5 s davomida qancha (m) yo'l bosib o'tadi? $g=10 \text{ m/s}^2$.

A) 85

B) 75

C) 100

D) 120

Berilgan:

$$v_0 = 40 \text{ m/s}$$

$$t = 5 \text{ s}$$

$$S = ?$$

Yechilishi: Bu jism $t_1 = 4 \text{ s}$ da maksimal ko'tariladi va $t_2 = 1 \text{ s}$ pastga harakatlanadi.

$$S = h_1 + h_2 = \frac{v_0^2}{2g} + \frac{gt_2^2}{2} = \frac{40^2}{20} + \frac{10 \cdot 1^2}{2} = 85 \text{ m}$$

Javob: A) 85.

7.61. Jism tik yuqoriga 15 m/s boshlang'ich tezlik bilan otildi. Qanday balandlikda (m) jismning tezligi 3 marta kamayadi?

A) 15

B) 10

C) 7,5

D) 7

Berilgan:

$$v_0 = 15 \text{ m/s}$$

$$v = v_0/3$$

$$h = ?$$

Yechilishi: Yuqoriga tik otilgan jism balandligini topish formulasidan foydalanamiz:

$$h = \frac{v^2 - v_0^2}{2g} = \frac{225 - 25}{20} = 10 \text{ m}$$

Javob: B) 10.

7.62. Jism 40 m/s tezlik bilan yuqoriga tik otildi. Qancha vaqtdan (s) so'ng u 60 m balandlikda bo'ladi?

A) 1,5

B) 2 va 6

C) faqat 6

D) 4

Berilgan:

$$v_0 = 40 \text{ m/s}$$

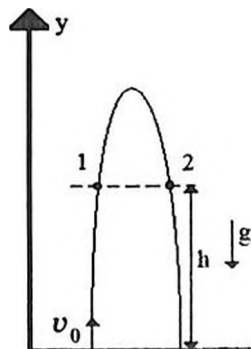
$$h = 60 \text{ m}$$

$$t = ?$$

Yechilishi: Bu jism h balandlikda ikki marta bo'ladi. Chiqishda va tushishda.

Harakat tenglamasini topamiz.

$$y = y_0 + v_{0y}t + \frac{a_y t^2}{2}$$



$$y_0 = 0, \quad v_{0y} = v_0$$

$$a_y = -g$$

$$h = v_0 t - \frac{gt^2}{2}$$

$$gt^2 - 2v_0 t + 2h = 0$$

Kvadrat tenglamani yechsak, $t_1 = 2s$ va $t_2 = 6s$ degan javoblarni olamiz. Demak, yuqoriga otilgan jism 2- va 6- sekundlarda h balandlikda bo'lgan.

Javob: B) 2 va 6.

7.63. Tik yuqoriga otilgan jism yo'lining ikkinchi yarmini 1 s da bosib o'tsa, u qanday (m) balandlikka ko'tariladi?

- A) 10 B) 40 C) 30 D) 20

Berilgan:

$$t_0 = 1 \text{ s}$$

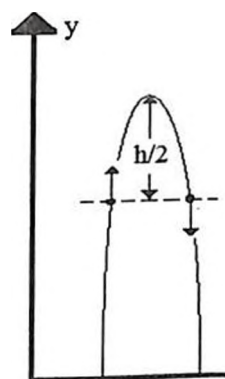
$$h_0 = t/2$$

$$h = ?$$

Yechilishi: Bu masalani jism tepadan tashlangan deb hisoblab, ko'tarilish vaqti tushish vaqtiga tengligidan foydalanamiz.

$$\frac{h}{2} = \frac{gt_0^2}{2}; \quad h = gt_0^2 = 10 \text{ m}$$

Javob: A) 10.



7.64. Vertikal yuqoriga otilgan jism yo'lining oxirgi 1/4 qismini 1 s da bosib o'tsa, u necha sekund davomida ko'tariladi?

- A) 4 B) 1 C) 2,5 D) 2

Berilgan:

$$t_0 = 1 \text{ s}$$

$$h_0 = h/4$$

$$t = ?$$

Yechilishi: Bu masalani jism tepadan tashlangan deb hisoblab, ko'tarilish vaqti tushish vaqtiga tengligidan foydalanamiz.

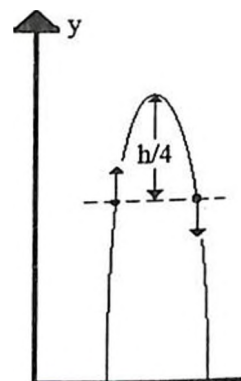
$$\frac{h}{4} = \frac{gt_0^2}{2}; \quad h = 2gt_0^2$$

$$h = \frac{gt^2}{2}$$

$$2gt_0^2 = \frac{gt^2}{2} \quad 4t_0^2 = t^2 \quad t = 2t$$

$$t = 2 \cdot 1 = 2 \text{ s}$$

Javob: D) 2.



7.65. Ancha baland bo'lgan nuqtadan modullari bir xil va 5 m/s ga teng bo'lgan tezliklar bilan ikki jism bir paytda otildi: biri tik yuqoriga, ikkinchisi tik pastga. 2 s dan so'ng ular orasidagi masofa qanday (m) bo'ladi?

- A) 10 B) 40 C) 20 D) 50

Berilgan:

$$v_{01} = v_{02} = 5 \text{ m/s}$$

$$t = 2 \text{ s}$$

$$S = ?$$

Yechilishi: $v_{01} = v_{02} = v_0$

1- va 2- jismlar uchun harakat tenglamalarini yozamiz.

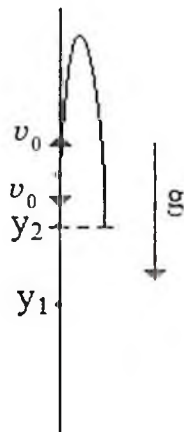
$$y_1 = y_{01} + v_{0y}t + \frac{a_y t^2}{2}; \quad y_0 = 0, \quad v_{0y} = v_0,$$

$$a_y = -g$$

$$y_1 = -v_0 t - \frac{gt^2}{2}; \quad y_2 = v_0 t - \frac{gt^2}{2}$$

$$S = y_2 - y_1 = v_0 t - \frac{gt^2}{2} + v_0 t + \frac{gt^2}{2} = 2v_0 t$$

$$S = 20 \text{ m}$$



Javob: C) 20.

7.66. Bir nuqtadan ikki jism bir vaqtda harakat qila boshladi: ulardan biri 40 m/s tezlik bilan vertikal yuqoriga otildi, ikkinchisi esa erkin tus..a boshladi. Necha sekunddan so'ng ular orasidagi masofa 120 m bo'ladi?

- A) 9 B) 0,33 C) 1,5 D) 3

Berilgan:

$$v_{01} = 40 \text{ m/s}$$

$$v_{02} = 0$$

$$S = 120 \text{ m}$$

$$t = ?$$

Yechilishi: Harakat tenglamasini ikkala jism uchun yozamiz.

$$y_1 = y_{01} + v_{0y}t + \frac{a_y t^2}{2}; \quad y_0 = 0, \quad v_{0y} = v_0,$$

$$a_y = -g$$

$$y_1 = v_{01}t - \frac{gt^2}{2}; \quad y_2 = y_{02} + v_{02}t + \frac{gt^2}{2}$$

$$y_{02} = 0, \quad v_{02} = 0, \quad a_y = -g \Rightarrow y_2 = -\frac{gt^2}{2}$$

$$S = y_1 - y_2 = v_{01}t - \frac{gt^2}{2} + \frac{gt^2}{2} = v_{01}t$$

$$t = \frac{S}{v_{01}} = 3 \text{ s}$$

Javob: D) 3.

7.67. Bir xil balandlikdan birinchi jism 10 m/s tezlik bilan yuqoriga otildi, ikkinchisi esa erkin tusha boshladi. Birinchi jism boshlang'ich holatga kelganda, ikkinchisi yerga tushgan bo'lsa, jismlar boshida qanday (m) balandlikda bo'lgan?

- A) 20 B) 30 C) 22,5 D) 15

Berilgan:

$$v_{01} = 10 \text{ m/s}$$

$$v_{02} = 0$$

$$h = ?$$

Yechilishi: 1- jismning harakatlanish vaqti

$$t_k = \frac{v_{01}}{g} = \frac{10}{10} = 1 \text{ s}; \quad t = 2 \text{ s}$$

2 s da jism yerga tushgan bo'lsa:

$$h = \frac{gt^2}{2} = 20 \text{ m}$$

Javob: A) 20.

7.68. Havo shari yuqoriga 5 m/s tezlik bilan ko'tarilmoqda. Yerdan 100 m balandlikda shardan 20 kg massali ballast tashlansa, u yerga necha sekundda tushadi?

- A) 1 B) 2 C) 3 D) 5

Berilgan:

$$v_0 = 5 \text{ m/s}$$

$$h = 100 \text{ m}$$

$$m = 20 \text{ kg}$$

$$t = ?$$

Yechilishi: Harakat tenglamasini yozamiz.

$$y = y_0 + v_{0y}t + \frac{a_y t^2}{2}; \quad y_0 = 0, \quad v_{0y} = v_0,$$

$$a_y = -g$$

Biz $y = 0$ bo'lgandagi t ni topishimiz kerak.

$$0 = h + v_0 t - \frac{gt^2}{2}$$

$$t^2 - t + 20 = 0 \Rightarrow t = 5 \text{ m/s}$$

Javob: D) 5.

7.69. Har bir qavatning balandligi 2,5 m bo'lsa, 11 qavatning balkonidan 20 m/s tezlik bilan yuqoriga tik otilgan jism yerga qancha vaqtda tushadi?

- A) 2 s B) 4 s C) 8 s D) 5 s

Berilgan:

$$v_0 = 20 \text{ m/s}$$

$$h = 2,5 \text{ m}$$

$$n = 11$$

$$t = ?$$

Yechilishi: Harakat tenglamasini yozamiz:

$$y = y_0 + v_{0y}t + \frac{a_y t^2}{2}; \quad y_0 = (n-1)h$$

$$0 = (n-1)h + v_0 t - \frac{gt^2}{2} \Rightarrow t^2 - 4t - 5 = 0$$

$$t = 5 \text{ s}$$

Javob: D) 5 s

7.70. Yuqoriga 10 m/s o'zgarmas tezlik bilan tik ko'tarilayotgan havo shari savatidan tushib ketgan jism yerga 6 s da tushgan bo'lsa, jism yerga tekkan vaqtda havo shari yerdan qanday (m) balandlikda bo'lgan?

- A) 75 B) 100 C) 180 D) 150

Berilgan:

$$v_0 = 10 \text{ m/s}$$

$$t = 6 \text{ s}$$

$$H = ?$$

Yechilishi: Jism o'z inersiyasi tufayli sharning v_0 tezligini oladi. Trayektoriya tenglamasini jismning yerga tushgan holi uchun yozamiz.

$$y = y_0 + v_{0y}t + \frac{a_y t^2}{2}; \quad y_0 = h, \quad v_{0y} = v_0,$$

$$a_y = -g; \quad y = 0$$

$$0 = h + v_0 t - \frac{gt^2}{2} \Rightarrow h = \frac{gt^2}{2} - v_0 t = 120 \text{ m}$$

Demak, tosh tashlanganda havo shari yerdan 120 m balandlikda ekan. Toshning 6 s uchganini hisobga olib, havo sharini keyingi ko'tarilishini hisoblaymiz.

$$h' = v_0 t = 60 \text{ m}$$

$$H = h + h' = 180 \text{ m}$$

Javob: C) 180.

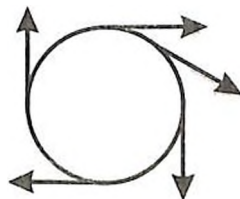
8-§. Egri chiziqli harakatda ko'chish va tezlik

8.1. Aylana bo'ylab tekis harakatda chiziqli tezlik vektorining ...

- A) moduli o'zgarmas bo'lib, yo'nalishi uzluksiz o'zgarib turadi
B) moduli tekis oshib, yo'nalishi o'zgarmas qoladi
C) moduli tekis kamayib, yo'nalishi o'zgarmaydi
D) moduli va yo'nalishi uzluksiz o'zgarib turadi

Yechilishi: jism harakatining tekis yoki notekisligi uning tezligi bilan xarakterlanadi. Agar jismning tezligi vaqt o'tishi bilan o'zgarmasa, bu jismning harakati tekis, aks holda, notekis harakat hisoblanadi. Aylana bo'ylab tekis harakat qilayotgan jismning tezlik vektorining moduli o'zgarmas bo'ladi, lekin yo'nalishi doimiy ravishda o'zgarib turadi.

Javob: A) moduli o'zgarmas bo'lib, yo'nalishi uzluksiz o'zgarib turadi.



8.2. Egri chiziqli notekis harakatda tezlik vektori ...

- A) moduli va yo'nalishi o'zgarib turadi
- B) $a_v > 0$ holda moduli va yo'nalishi o'zgarmaydi
- C) $a_v > 0$ holda moduli va yo'nalishi o'zgarmaydi
- D) moduli o'zgarmas bo'lib, yo'nalishi uzluksiz o'zgarib turadi

Yechilishi: jism harakatining egri chiziqli yoki to'g'ri chiziqli ekanligi uning trayektoriyasiga qarab aniqlanadi. Agar jism trayektoriyasi to'g'ri chiziqdan iborat bo'lsa, to'g'ri chiziqli harakat, aks holda, egri chiziqli harakat deyiladi. Egri chiziqli harakatda jism tezlik vektorining yo'nalishi o'zgarib turadi. Harakat notekis bo'lishi uchun esa tezlik vektorining moduli ham o'zgarib turishi kerak. Demak, egri chiziqli notekis harakatda tezlik vektorining moduli va yo'nalishi o'zgarib turadi.



Javob: A) moduli va yo'nalishi o'zgarib turadi.

8.3. G'ildirak sirpanmasdan, $v = 2,0$ m/s tezlik bilan dumalaydi. G'ildirak gardishidagi A , B va C nuqtalarning yo'lga nisbatan tezligi qanday (m/s)?

- A) $v_A = 2$, $v_B = 4$, $v_C = 2,8$
- B) $v_A = 0$, $v_B = 4$, $v_C = 2,8$
- C) $v_A = 0$, $v_B = 2$, $v_C = 3$
- D) $v_A = 0$, $v_B = 4$, $v_C = 3,5$

Berilgan:

$$v = 2 \text{ m/s}$$

$$u = ?$$

Yechilishi: A nuqada g'ildirakning yerga nisbatan tezligi

$v_A = v - v = 0$ bo'ladi. C nuqtada jismning aylanish tezligi yuqori tarafga, ya'ni g'ildirak yuqori tarafga v tezlik bilan aylanmoqda.

Shuning uchun g'ildirak o'ng tarafga v tezlik bilan harakatlanadi,

g'ildirakning harakat tezligi va aylanish tezliklari bir-biriga tik yo'nalib qolganligi uchun, C nuqtada jismning yerga nisbatan tezligi Pifagor teoremasidan $v_0 = \sqrt{v^2 + v^2} = \sqrt{2}v = 2,8$ bo'ladi.

B nuqtada jismning aylanish tezligi o'ng tarafga, ya'ni g'ildirak o'ng tarafga v tezlik bilan aylanmoqda. Shuning uchun g'ildirak o'ng tarafga v tezlik bilan harakatlanadi, g'ildirakning harakat tezligi va aylanish tezliklari bir xil yo'nalib qolganligi uchun B nuqtada jismning yerga nisbatan tezligi $v_B = v + v = 2v = 4$ m/s bo'ladi.

Javob: B) $v_A = 0$, $v_B = 4$, $v_C = 2,8$.

8.4. Egri chiziqli harakatda oniy tezlik vektorining yo'nalishi qanday?

- A) bunday harakatda oniy tezlik yo'nalishini aniqlab bo'lmaydi
- B) trayektoriyaga o'tkazilgan urinma bo'ylab
- C) egri chiziq radiusiga urinma bo'ylab
- D) egri chiziq radiusi bo'yicha markazdan

Egri chiziqli harakatda jism tezligining vektori trayektoriyaga o'tkazilgan urinma bo'ylab yo'nalgan bo'ladi.

Javob: B) trayektoriyaga o'tkazilgan urinma bo'ylab.

8.5. Moddiy nuqtaning aylana bo'ylab kattaligi o'zgarmas tezlik bilan harakatini qanday harakat deb hisoblash kerak?

- A) tekis sekinlanuvchan B) tekis
C) notekis tezlanuvchan D) tekis tezlanuvchan

Yechilishi: aylana bo'ylab harakatda tezlik vektorining yo'nalishi doimiy ravishda o'zgarib turadi. Agar aylana bo'ylab harakatlanayotgan jismning tezlik vektorining moduli vaqt o'tishi bilan o'zgarmasa, bunday harakat aylana bo'ylab tekis harakat deyiladi.

Javob: B) tekis.

8.6. Egri chiziqli tekis harakatda quyidagi kattaliklarning qaysi biri o'zgarmaydi?

- A) oniy tezlik moduli B) tezlanish moduli
C) o'rtacha tezlik vektori D) tezlanish vektori

Yechilishi: harakat tekis bo'lishi uchun har doim tezlik moduli o'zgarmas bo'lishi kerak. Egri chiziqli tekis harakatda oniy tezlik moduli o'zgarmas saqlanadi.

Javob: A) oniy tezlik moduli.

9-§. Aylana bo'ylab tekis harakatdagi tezlanish

9.1. Jismning AB trayektoriya bo'ylab harakatlanishi natijasida uning tezligi $\vec{v}_1$ dan $\vec{v}_2$ gacha o'zgaradi. Berilgan chizmada B nuqtadagi $\vec{v}_2$ tezlik vektori A nuqtaga o'ziga parallel ko'chgan. O'rtacha tezlanish vektori qanday yo'nalgan bo'ladi?

- A) $\vec{v}_1$ vektor yo'nalishiga mos yo'nalgan
B) $\vec{v}_2$ vektor yo'nalishiga mos yo'nalgan
C) $\vec{v}_2$ vektor uchidan $\vec{v}_1$ vektor uchiga yo'nalgan
D) $\vec{v}_1$ vektor uchidan $\vec{v}_2$ vektor uchiga yo'nalgan

Vaqt birligida tezlik vektorining o'zgarishiga teng bo'lgan vektor kattalikka tezlanish deyiladi. Bu ta'rifga asoson tezlanish vektori va vektorlarning ayirmasiga teng bo'ladi. Harakat egri chiziqli bo'lganligi uchun markazga intilma tezlanish ham vujudga keladi. Bu ikkala tezlanishning natijaviysi vektor uchidan vektor uchiga yo'nalgan vektor bilan mos keladi.

Javob: D) $\vec{v}_1$ vektor uchidan $\vec{v}_2$ vektor uchiga yo'nalgan.

9.2. Egri chiziqli tekis harakatda tezlanish vektorining yo'nalishi qanday?

- A) trayektoriyaning egrilik radiusi bo'yicha markazga
- B) harakat trayektoriyasi bo'yicha
- C) egri chiziqli radiusi bo'yicha markazdan
- D) trayektoriyaga urinma bo'yicha

Egri chiziqli tekis harakatda tezlanish vektorining yo'nalishi trayektoriyaning egrilik radiusi bo'yicha markazga yo'nalgan bo'ladi.

Javob: A) trayektoriyaning egrilik radiusi bo'yicha markazga.

9.3. Jism qanday holatlarda tezlanishga ega bo'lmaydi?

- A) to'g'ri chiziqli trayektoriya bo'ylab notekis harakatlanganda
- B) faqat tinch holatda
- C) tinch holatda va to'g'ri chiziqli tekis harakatda
- D) aylana bo'ylab tekis harakat va to'g'ri chiziqli tekis tezlanuvchan harakat qilayotganda

Jism tinch holatda va to'g'ri chiziqli tekis harakatda bo'lganda tezlanishga ega bo'lmaydi.

Javob: C) tinch holatda va to'g'ri chiziqli tekis harakatda.

9.4. Aylana bo'ylab tekis harakatda tezlanish vektori ...

- A) moduli o'zgarmas bo'lib, yo'nalishi uzluksiz o'zgarib turadi
- B) nolga teng
- C) $a_v < 0$ bo'lgan holda moduli va yo'nalishi o'zgarmaydi
- D) $a_v > 0$ bo'lgan holda moduli va yo'nalishi o'zgarmaydi

Aylana bo'ylab tekis harakatda jismning tezlanishi $a_v > 0$ bo'lgan holda moduli va yo'nalishi o'zgarmaydi.

Javob: A) moduli o'zgarmas bo'lib, yo'nalishi uzluksiz o'zgarib turadi.

9.5. Moddiy nuqta aylana bo'ylab tekis harakat qilmoqda. Bunda tangensial (a_t) va normal (a_n) tezlanishlar qanday bo'ladi?

- A) $a_t = 0$; $a_n = 0$
- B) $a_t \neq 0$; $a_n \neq 0$
- C) $a_t = a_n \neq 0$
- D) $a_t = 0$; $a_n \neq 0$

Moddiy nuqta aylana bo'ylab tekis harakat qilganda, tangensial tezlanish $a_t = 0$ bo'ladi, normal, ya'ni markazga intilma tezlanish esa $a_n \neq 0$.

Javob: D) $a_t = 0$; $a_n \neq 0$.

9.6. Moddiy nuqta aylana bo'ylab tekis harakatlanmoqda. Uning tezligi va tezlanish vektorlari orasidagi burchak qanday?

- A) π
- B) $\pi/2$
- C) $\pi/3$
- D) $\pi/6$

Moddiy nuqta aylana bo'ylab tekis harakatlanganda, tezlik va tezlanish orasidagi burchak $\pi/2$ bo'ladi.

Javob: B) $\pi/2$.

9.7. Agar jismning tezlik va tezlanish vektori istalgan paytda o'zaro to'g'ri burchak hosil qilsa, jism qanday harakatda bo'ladi?

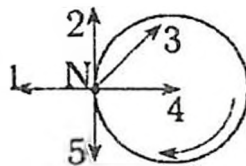
- A) tinch turadi B) aylana bo'ylab tekis
C) to'g'ri chiziqli tekis D) to'g'ri chiziqli tekis tezlanuvchan

Agar jismning tezlik va tezlanish vektori istalgan paytda o'zaro to'g'ri burchak hosil qilsa, jism aylana bo'ylab tekis harakatlanayotgan bo'ladi.

Javob: B) aylana bo'ylab tekis.

9.8. Soat strelkasi bo'yicha doimiy tezlik bilan aylanayotgan jismning N nuqtadagi tezlanish vektori rasmdagi yo'nalishlarning qaysi biri bilan mos tushadi?

- A) 1 B) 2 C) 3 D) 4



Aylana bo'ylab tekis harakatda markazga intilma tezlanish vujudga keladi va u har doim aylana radiusi bo'ylab aylana markazi tomon yo'nalgan bo'ladi. Bu chizmadagi 4 yo'nalish bilan mos keladi.

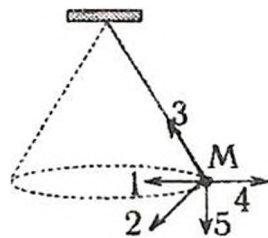
Javob: D) 4.

9.9. Ipga osilgan yuk gorizontaal tekislikda aylana bo'ylab tekis harakatlanmoqda. Yukning M nuqtadagi tezlanish yo'nalishi qanday?

- A) 5 B) 4 C) 3 D) 1

Aylana bo'ylab harakatda jism tezlanishi har doim radius bo'ylab aylana markaziga yo'nalgan bo'ladi, ya'ni 1 yo'nalishda.

Javob: D) 1.



9.10. Jismning tangensial tezlanishi 6 m/s^2 , markazga intilma tezlanishi 8 m/s^2 ga teng bo'lsa, uning natijaviy tezlanishi qanday (m/s^2)?

- A) 2 B) 7 C) 10 D) 14

Berilgan:

$$a_t = 6 \text{ m/s}^2;$$

$$a_n = 8 \text{ m/s}^2;$$

$$a_{um} = ?$$

Yechilishi: Jismning tangensial va normal tezlanishlari bir-biriga perpendikular yo'nalgan bo'ladi, shuning uchun, umumiy tezlanishni Pifagor teoremasi orqali topamiz:

$$a_{um} = \sqrt{a_t^2 + a_n^2} = 10$$

Javob: C) 10.

9.11. Jism aylana bo'ylab tekis harakat qilmoqda. Agar aylana radiusi o'zgarmasdan, jism tezligi 3 marta kamaysa, markazga intilma tezlanish qanday o'zgaradi?

- A) 9 marta kamayadi
C) 3 marta kamayadi

- B) 3 marta ortadi
D) 9 marta ortadi

Berilgan:

$$R = \text{const}$$

$$v_2 = v_1/3$$

$$a_2/a_1 = ?$$

Yechilishi: Markazga intilma tezlanish quyidagicha topiladi:

$$a = \frac{v^2}{R}$$

Har ikkala holdagi markazga intilma tezlanishlar esa quyidagicha:

$$a_1 = \frac{v_1^2}{R}; \quad a_2 = \frac{v_2^2}{R}$$

Endi tezlanishlar nisbatini olamiz:

$$\frac{a_2}{a_1} = \frac{\frac{v_2^2}{R}}{\frac{v_1^2}{R}} = \frac{v_2^2}{v_1^2} = \frac{v_1^2}{9v_1^2} = \frac{1}{9} \Rightarrow a_2 = \frac{a_1}{9}$$

Jismning markazga intilma tezlanishi 9 marta kamayar ekan.

Javob: A) 9 marta kamayadi.

9.12. Avtomobil moduli o'zgarmas tezlik bilan rasmda ko'rsatilgan trayektoriya bo'ylab harakatlanmoqda. Trayektoriyaning qaysi nuqtasida avtomobilning markazga intilma tezlanishi eng katta bo'ladi?

A) 1

B) 2

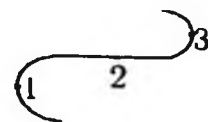
C) 3

D) hamma nuqtalarda bir xil

Jism tekis harakat qilayotganda markazga intilma tezlanish faqat yo'lning egrilik

radiusiga bog'liq bo'lib qoladi, $a_n = \frac{v^2}{R}$. Ya'ni, yo'lning egrilik radiusi kichik bo'lgan joyda markazga intilma tezlanish eng katta bo'ladi. Chizmadagi 3 nuqtaning egrilik radiusi eng kichik. Demak, shu nuqtada tezlanish eng katta bo'ladi.

Javob: C) 3.



9.13. Jism aylana bo'ylab tekis harakat qilmoqda. Agar harakat tezligi o'zgarmasdan, aylana radiusi 9 marta ortsa, markazga intilma tezlanish qanday o'zgaradi?

A) 3 marta kamayadi

B) 9 marta ortadi

C) 9 marta kamayadi

D) 3 marta ortadi

Berilgan:

$$v = \text{const}$$

$$R_2 = 9R_1$$

$$a_2/a_1 = ?$$

Yechilishi: Markazga intilma tezlanish quyidagicha topiladi:

$$a = \frac{v^2}{R}$$

Har ikkala holdagi markazga intilma tezlanishlar esa quyidagicha:

$$a_1 = \frac{v^2}{R_1}; \quad a_2 = \frac{v^2}{R_2}$$

Endi tezlanishlar nisbatini olamiz:

$$\frac{a_2}{a_1} = \frac{\frac{v^2}{R_2}}{\frac{v^2}{R_1}} = \frac{R_1}{R_2} = \frac{R_1}{9R_1} = \frac{1}{9} \Rightarrow a_2 = \frac{a_1}{9}$$

Jismning markazga intilma tezlanishi 9 marta kamayar ekan.

Javob: C) 9 marta kamayadi.

9.14. Aylananing radiusi 2 marta orttirilib, tezlik o'zgartirilmasa, jismning markazga intilma tezlanishi qanday o'zgaradi?

A) 2 marta kamayadi

B) 4 marta ortadi

C) 4 marta kamayadi

D) 2 marta ortadi

Berilgan:

$$v = \text{const}$$

$$R_2 = 2R_1$$

$$a_2/a_1 = ?$$

Yechilishi: Markazga intilma tezlanish quyidagicha topiladi:

$$a = \frac{v^2}{R}$$

Har ikkala holdagi markazga intilma tezlanishlar esa quyidagicha:

$$a_1 = \frac{v^2}{R_1}; \quad a_2 = \frac{v^2}{R_2}$$

Endi tezlanishlar nisbatini olamiz:

$$\frac{a_2}{a_1} = \frac{\frac{v^2}{R_2}}{\frac{v^2}{R_1}} = \frac{R_1}{R_2} = \frac{R_1}{2R_1} = \frac{1}{2} \Rightarrow a_2 = \frac{a_1}{2}$$

Jismning markazga intilma tezlanishi 2 marta kamayar ekan.

Javob: A) 2 marta kamayadi.

9.15. Aylana bo'ylab tekis harakat qilayotgan jismning tezligi o'zgarmasdan, trayektoriya radiusi 2 marta ortsa, uning markazga intilma tezlanishi qanday o'zgaradi?

- A) o'zgarmaydi
C) 4 marta ortadi

- B) 4 marta kamayadi
D) 2 marta kamayadi

Berilgan:

$$v = \text{const}$$

$$R_2 = 2R_1$$

$$a_2 / a_1 = ?$$

Yechilishi: Markazga intilma tezlanish quyidagicha topiladi:

$$a = \frac{v^2}{R}$$

Har ikkala holdagi markazga intilma tezlanishlar esa quyidagicha:

$$a_1 = \frac{v^2}{R_1}; \quad a_2 = \frac{v^2}{R_2}$$

Endi tezlanishlar nisbatini olamiz:

$$\frac{a_2}{a_1} = \frac{\frac{v^2}{R_2}}{\frac{v^2}{R_1}} = \frac{R_1}{R_2} = \frac{R_1}{2R_1} = \frac{1}{2} \Rightarrow a_2 = \frac{a_1}{2}$$

Jismning markazga intilma tezlanishi 2 marta ortar ekan.

Javob: D) 2 marta kamayadi.

9.16. Trayektoriyasi radiusi 2 marta kichiklashib, tezligi o'zgarmasa, jismning markazga intilma tezlanishi qanday o'zgaradi?

- A) o'zgarmaydi
C) 2 marta kamayadi

- B) 4 marta, ortadi
D) 2 marta ortadi

Berilgan:

$$v = \text{const}$$

$$R_2 = R_1 / 2$$

$$a_2 / a_1 = ?$$

Yechilishi: Markazga intilma tezlanish quyidagicha topiladi:

$$a = \frac{v^2}{R}$$

Har ikkala holdagi markazga intilma tezlanishlar esa quyidagicha:

$$a_1 = \frac{v^2}{R_1}; \quad a_2 = \frac{v^2}{R_2}$$

Endi tezlanishlar nisbatini olamiz:

$$\frac{a_2}{a_1} = \frac{\frac{v^2}{R_2}}{\frac{v^2}{R_1}} = \frac{R_1}{R_2} = \frac{2R_1}{R_1} = 2 \Rightarrow a_2 = 2a_1$$

Jismning markazga intilma tezlanishi 2 marta ortar ekan.

Javob: D) 2 marta ortadi.

9.17. Jism R radiusli aylana bo'ylab v tezlik bilan aylanmoqda. Agar u radiusi $2R$ bo'lgan aylana bo'ylab v tezlik bilan aylansa, uning markazga intilma tezlanishi o'zgaradimi, o'zgarsa qanday?

- A) 4 marta ortadi B) 2 marta kamayadi
C) 2 marta ortadi D) 4 marta kamayadi

Berilgan:

$$v = \text{const}$$

$$R_2 = 2R_1$$

$$a_2 / a_1 = ?$$

Yechilishi: Markazga intilma tezlanish quyidagicha topiladi:

$$a = \frac{v^2}{R}$$

Har ikkala holdagi markazga intilma tezlanishlar esa quyidagicha:

$$a_1 = \frac{v^2}{R_1}; \quad a_2 = \frac{v^2}{R_2}$$

Endi tezlanishlar nisbatini olamiz:

$$\frac{a_2}{a_1} = \frac{\frac{v^2}{R_2}}{\frac{v^2}{R_1}} = \frac{R_1}{R_2} = \frac{R_1}{2R_1} = \frac{1}{2} \Rightarrow a_2 = \frac{a_1}{2}$$

Jismning markazga intilma tezlanishi 2 marta kamayar ekan.

Javob: B) 2 marta kamayadi.

9.18. Egrilik radiusi 225 m bo'lgan burilishda 30 m/s tezlik bilan harakatlana-yotgan avtomobilning markazga intilma tezlanishini aniqlang (m/s^2).

- A) 75 B) 67,5 C) 17 D) 4

Berilgan:

$$v = 30 \text{ m/s}$$

$$R = 225 \text{ m}$$

$$a = ?$$

Yechilishi: Markazga intilma tezlanish quyidagicha topiladi:

$$a = \frac{v^2}{R} = 4 \text{ m/s}^2$$

Javob: D) 4.

9.19. Shossening burilgan joyida avtomobil modul bo'yicha o'zgarmas 10 m/s tezlik bilan harakatlanmoqda. Agar avtomobil trayektoriyasining egrilik radiusi 50 m bo'lsa, uning markazga intilma tezlanishi qanday (m/s^2)?

- A) 2 B) 0,2 C) 0,5 D) 2,5

Berilgan:

$$v = 10 \text{ m/s}$$

$$R = 50 \text{ m}$$

$$a = ?$$

Yechilishi: Markazga intilma tezlanish quyidagicha topiladi:

$$a = \frac{v^2}{R} = 2 \text{ m/s}^2$$

Javob: A) 2.

9.20. Yo'lning egrilik radiusi 160 m bo'lgan qismida 72 km/soat tezlik bilan harakatlanayotgan poyezdning markazga intilma tezlanishini toping (m/s^2).

A) 2,5

B) 4

C) 2

D) 5

Berilgan:

$$v = 20 \text{ m/s}$$

$$R = 160 \text{ m}$$

$$a = ?$$

Yechilishi: Markazga intilma tezlanish quyidagicha topiladi:

$$a = \frac{v^2}{R} = 2,5 \text{ m/s}^2$$

Javob: A) 2,5.

9.21. Velosipedchi egrilik radiusi 48 m bo'lgan burilishda 12 m/s tezlikda harakatlanmoqda. Markazga intilma tezlanishni toping (m/s^2).

A) 4

B) 3

C) 0,25

D) 0,5

Berilgan:

$$v = 12 \text{ m/s}$$

$$R = 48 \text{ m}$$

$$a = ?$$

Yechilishi: Markazga intilma tezlanish quyidagicha topiladi:

$$a = \frac{v^2}{R} = 3 \text{ m/s}^2$$

Javob: B) 3.

9.22. Zarracha aylana bo'ylab 10 m/s tezlik bilan harakat qiladi. Agar markazga intilma tezlanish 4 m/s^2 bo'lsa, aylana radiusi qanday (m)?

A) 125

B) 25

C) 20

D) 12,5

Berilgan:

$$v = 10 \text{ m/s}$$

$$a = 4 \text{ m/s}^2$$

$$R = ?$$

Yechilishi: Aylana radiusi markazga intilma tezlanishni topish formulasi orqali quyidagicha topiladi:

$$a = \frac{v^2}{R} \Rightarrow R = \frac{v^2}{a} = 25 \text{ m}$$

Javob: B) 25.

9.23. Tramvay vagoni radiusi 50 m bo'lgan burilishda harakatlanmoqda. Agar markazga intilma tezlanish $0,5 \text{ m/s}^2$ bo'lsa, tramvayning tezligi qanday (m/s)?

A) 5

B) 0,5

C) 50

D) 0,05

Berilgan:

$$R = 50 \text{ m}$$

$$a = 0,5 \text{ m/s}^2$$

$$v = ?$$

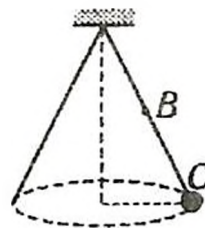
Yechilishi: Tramvayning tezligi markazga intilma tezlanishni topish formulasi orqali quyidagicha topiladi:

$$a = \frac{v^2}{R} \Rightarrow v = \sqrt{aR} = 5 \text{ m/s}$$

Javob: A) 5.

9.24. Ipga osilgan S yuk gorizonta tekislikda aylanma harakat qilmoqda. S nuqtaning va ip o'rtasidagi B nuqtaning markazga intilma tezlanishlari nisbati a_C/a_B ni aniqlang.

- A) 1/4 B) 1/2 C) 2 D) 4



Berilgan:

$$v = \text{const}$$

$$a_C/a_B = ?$$

Yechilishi: Bitta o'qqa mahkamlangan aylanish davri, aylanish chastotasi va burchak tezliklari teng bo'ladi. Buni hisobga olib markazga intilma tezlanish ifodasini quyidagicha yozamiz:

$$a = \omega^2 \cdot R$$

Har ikkala holdagi markazga intilma tezlanishlar esa quyidagicha:

$$a_C = \omega^2 \cdot R_C; \quad a_B = \omega^2 \cdot R_B$$

Chizmadan foydalanib uchburchaklar o'xshashligiga asosan quyidagini yozamiz:

$$\frac{RB}{\frac{l}{2}} = \frac{R_C}{l} \Rightarrow 2R_B = R_C$$

Endi tezlanishlar nisbatini olamiz:

$$\frac{a_C}{a_B} = \frac{\omega^2 \cdot R_C}{\omega^2 \cdot R_B} = \frac{R_C}{R_B} = \frac{2R_B}{R_B} = 2$$

Javob: C) 2.

9.25. Velosiped 10 m/s o'zgarmas tezlik bilan harakatlanmoqda. Uning g'il-diragi diametri 80 sm. G'il-dirakning pastki nuqtasi yerga nisbatan qanday (m/s^2) tezlanish bilan harakatlanadi?

- A) 0 B) 1,25 C) 250 D) 125

Berilgan:

$$v = 10 \text{ m/s}$$

$$R = 0,8 \text{ m}$$

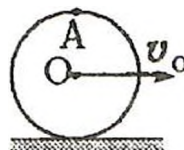
$$a = ?$$

Yechilishi: Markazga intilma tezlanish quyidagicha topiladi:

$$a = \frac{v^2}{R} = 125 \text{ m/s}^2$$

Javob: D) 125.

9.26. Radiusi R bo'lgan disk gorizonta tekislikda sirpanmasdan g'il-diramoqda. O nuqtaning tezligi v_0 . Yer bilan bog'langan sanoq tizimiga nisbatan A nuqtaning tezligi va tezlanishi qanday?



- A) $v_0; \frac{v_0^2}{R}$ B) $2v_0; \frac{2v_0^2}{R}$ C) $2v_0; \frac{v_0^2}{R}$ D) $2v_0; \frac{4v_0^2}{R}$

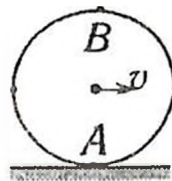
A nuqtada jismning aylanish tezligi o'ng tarafga, ya'ni g'ildirak o'ng tarafga v_0 tezlik bilan aylanmoqda. Shuning uchun g'ildirak o'ng tarafga v_0 tezlik bilan harakatlanadi, g'ildirakning harakat tezligi va aylanish tezliklari bir xil yo'nalib qolganligi uchun A nuqtada jismning yerga nisbatan tezligi $v_0 = v + v = 2v_0$ bo'ladi.

Aylanma harakatda yer bilan bog'langan sanoq tizimida markazga intilma tezlanish bir xil bo'ladi:

$$a = \frac{v_0^2}{R}$$

Javob: C) $2v_0; \frac{v_0^2}{R}$.

9.27. Radiusi R bo'lgan g'ildirak gorizontall tekislikda doimiy v tezlik bilan sirpanmasdan g'ildiramoqda. A va B nuqtalarning yerga nisbatan tezlanishlari qanday?



- A) $a_A = \frac{2v^2}{R}; a_B = \frac{\sqrt{2}v^2}{R}$ B) $a_A = \frac{2v^2}{R}; a_B = \frac{v^2}{\sqrt{2}R}$
 C) $a_A = \frac{v^2}{R}; a_B = \frac{v^2}{\sqrt{2}R}$ D) $a_A = \frac{v^2}{R}; a_B = \frac{v^2}{R}$

Aylanma harakatda yer bilan bog'langan sanoq tizimida markazga intilma tezlanish aylananing hamma nuqtasida bir xil bo'ladi:

$$a_A = \frac{v^2}{R}; a_B = \frac{v^2}{R}$$

Javob: D) $a_A = \frac{v^2}{R}; a_B = \frac{v^2}{R}$.

10-§. Aylanish davri va chastotasi

10.1. Moddiy nuqta aylana bo'ylab 25 m/s tezlik bilan tekis aylanmoqda. Davrning to'rtidan bir qismida moddiy nuqta tezligi o'zgarishining modulini toping (m/s).

- A) 0 B) 5 C) 25 D) $25\sqrt{2}$

Berilgan:

$$v = 25 \text{ m/s}$$

$$\Delta v = ?$$

Yechilishi: Aylanish davrining to'rtidan bir qismida jism-

ning aylanish tezligi past tarafga, ya'ni g'ildirak past tarafga v tezlik bilan aylanadi. Shuning uchun jism o'ng tarafga v tezlik bilan aylanadi, jismning aylanish tezligi bir-biriga tik yo'nalib

qolganligi uchun davrning to'rtidan bir qismidagi tezlikning o'zgarish moduli Pifagor teoremasidan $\Delta v = \sqrt{v^2 + v^2} = \sqrt{2}v = 25\sqrt{2} \text{ m/s}$ bo'ladi.

Javob: D) $25\sqrt{2}$.

10.2. Moddiy nuqta aylana bo'ylab 4 m/s tezlik bilan tekis aylanmoqda. Davrning to'rtidan uch qismida jism tezligi o'zgarishining modulini toping (m/s).

A) 0

B) 1

C) 4

D) $4\sqrt{2}$

Berilgan:

$$v = 4 \text{ m/s}$$

$$\Delta v = ?$$

Yechilishi: Aylanish davrining to'rtidan uch qismida jism-

ning aylanish tezligi past tarafga, ya'ni g'ildirak past tarafga v tezlik bilan aylanadi. Shuning uchun, jism o'ng tarafga v tezlik bilan aylanadi, jismning aylanish tezligi bir-biriga tik yo'nalib

qolganligi uchun davrning tortdan bir qismidagi tezlikning o'zgarish moduli Pifagor teoremasidan $\Delta v = \sqrt{v^2 + v^2} = \sqrt{2}v = 4\sqrt{2} \text{ m/s}$ bo'ladi.

Javob: D) $4\sqrt{2}$.

10.3. Minutiga 1200 marta aylanayotgan ventilyator parragining aylanish davrini toping (s).

A) 0,05

B) 0,5

C) 5

D) 20

Berilgan:

$$t = 60 \text{ s}$$

$$N = 1200$$

$$T = ?$$

Yechilishi: Aylanish davri — bir marta aylanish uchun ketgar vaqt:

$$T = \frac{t}{N} = 0,05 \text{ s}$$

Javob: A) 0,05.

10.4. Vaqt birligidagi aylanishlar soni 80 marta ortsa, aylanish davri qanday o'zgaradi?

A) 40 marta ortadi

B) 40 marta kamayadi

C) 80 marta ortadi

D) 80 marta kamayadi

Berilgan:

$$v_2 = 80v_1$$

$$T_2/T_1 = ?$$

Yechilishi: Vaqt birligidagi aylanishlar soni, bu — aylanish chastotasi demakdir:

$$v = \frac{N}{t} \Rightarrow T = \frac{1}{v}$$

Bundan quyidagicha foydalanamiz:

$$\frac{T_2}{T_1} = \frac{v_1}{v_2} = \frac{v_1}{80v_1} = \frac{1}{80} \Rightarrow T_2 = \frac{T_1}{80}$$

Demak, aylanish davri 80 marta kamayar ekan.

Javob: D) 80 marta kamayadi.

10.5. Diskning aylanish davri 8 s. Aylanish o'qidan 4 m uzoqlikdagi nuqtaning tezligi qanday (m/s)?

- A) 2 B) 3,14 C) 4 D) 6,28

Berilgan: $T = 8 \text{ s}$
 $R = 4 \text{ m}$
 $v = ?$ | **Yechilishi:** Aylanma harakatda chiziqli tezlik quyidagicha topiladi:

$$v = \frac{2\pi R}{T} = 3,14 \text{ m/s}$$

Javob: B) 3,14.

10.6. Bolalar aravachasi g'ildiragining radiusi 1 sm bo'lib, uning aylanish davri 2 s bo'lsa, aravachaning tezligi qanday (sm/s) bo'ladi?

- A) 0,314 B) 0,628 C) 3,14 D) 6,28

Berilgan: $T = 2 \text{ s}$
 $R = 1 \text{ sm}$
 $v = ?$ | **Yechilishi:** Aylanma harakatda chiziqli tezlik quyidagicha topiladi:

$$v = \frac{2\pi R}{T} = 3,14 \text{ sm/s}$$

Javob: C) 3,14.

10.7. Yer radiusi 6400 km. Yerning o'z o'qi atrofida aylanishida ekvatoridagi nuqtaning chiziqli tezligi qanday bo'ladi (m/s)?

- A) 64 B) 128 C) 225 D) 465

Berilgan: $T = 24 \text{ soat}$
 $R = 6400 \text{ km}$
 $v = ?$ | **Yechilishi:** Aylanma harakatda chiziqli tezlik quyidagicha topiladi:

$$v = \frac{2\pi R}{T} \approx 1674,7 \text{ km/soat} \approx 465 \text{ m/s}$$

Javob: D) 465.

10.8. Yerning Quyosh atrofida aylanishining chiziqli tezligi qanday (m/s)?
 $t = 365 \text{ sutka}$, $r = 150 \cdot 10^6 \text{ km}$.

- A) $2,99 \cdot 10^5$ B) $3,5 \cdot 10^4$ C) $2,99 \cdot 10^4$ D) $2,99 \cdot 10^6$

Berilgan:

$$\begin{array}{l} T = 8760 \text{ soat} \\ R = 150 \cdot 10^6 \text{ km} \\ \hline v = ? \end{array}$$

Yechilishi: Aylanma harakatda chiziqli tezlik quyidagicha topiladi:

$$v = \frac{2\pi R}{T} \approx 10753 \text{ km/soat} \approx 2,99 \cdot 10^4 \text{ m/s}$$

Javob: C) $2,99 \cdot 10^4$.

10.9. Soatning sekund strelkasi minut strelkasidan 2 marta qisqa. Strelkalar uchlarining chiziqli tezliklari nisbati qanday?

A) 120

B) 90

C) 60

D) 30

Berilgan:

$$\begin{array}{l} T_s = 60 \text{ s} \\ T_m = 3600 \text{ s} \\ R_s = R_m/2 \\ \hline v_s/v_m = ? \end{array}$$

Yechilishi: Aylanma harakatda chiziqli tezlik quyidagicha topiladi:

$$v = \frac{2\pi R}{T}$$

Bizga ma'lumki, soatning sekund strelkasi bir minutda bir marta aylanib chiqadi. Minut strelkasi esa bir soatda bir marta aylanib chiqadi. Bularni hisobga olib, quyidagilarni yozamiz:

$$v_s = \frac{2\pi R_s}{T_s}; \quad v_m = \frac{2\pi R_m}{T_m}$$

$$\frac{v_s}{v_m} = \frac{\frac{2\pi R_s}{T_s}}{\frac{2\pi R_m}{T_m}} = \frac{R_s T_m}{R_m T_s} = 30; \quad \frac{v_s}{v_m} = 30$$

Demak, soatning sekund strelkasining tezligi minut strelkasining tezligidan 30 marta katta ekan.

Javob: D) 30.

10.10. Radiusi 2 m bo'lgan aylana bo'ylab harakatlanayotgan moddiy nuqta 3,14 s ichida aylananing yarmini bosib o'tdi. Moddiy nuqtaning chiziqli tezligi qanday (m/s).

A) 2

B) 3,14

C) 4

D) 6

Berilgan:

$$\begin{array}{l} t = 3,14 \text{ s} \\ R = 2 \text{ m} \\ S = \frac{l}{2} \\ \hline v = ? \end{array}$$

Yechilishi: tekis harakatda bosib o'tilgan yo'l $S = v \cdot t$ ifodadan aniqlanadi. Masala shartiga ko'ra $S = l/2$ ga teng. Demak,

$$vt = \frac{l}{2} \Rightarrow v = \frac{l}{2t} = \frac{2\pi R}{2t} = \frac{\pi R}{t}$$

$$v = \frac{3,14 \cdot 2}{3,14} = 2 \text{ m/s}$$

2-usul. Agar aylana bo'ylab tekis harakat qilayotgan jism aylananing yarmini t vaqtda bosib o'tgan bo'lsa, aylanani to'liq o'tishi uchun $2t$ vaqt ketadi. Aylanani to'liq bir marta o'tish uchun ketgan vaqt esa aylanish davri deyiladi. Demak, $T = 2t = 6,28$ s. Aylana bo'ylab tekis harakatda chiziqli tezlik quyidagi ifodadan aniqlanadi.

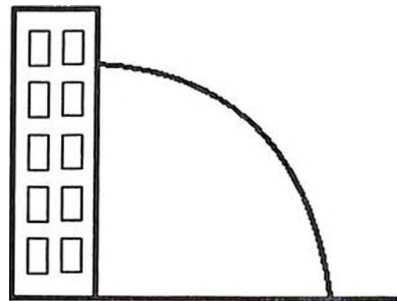
$$v = \frac{2 \cdot 3,14 \cdot 2}{6,28} = 2 \text{ m/s}$$

Javob: A) 2.

11-§. Gorizontaal otilgan jism harakati

11.1. Biror balandlikdan gorizontaal otilgan jism qanday trayektoriya bo'ylab harakatlanadi? Havoning qarshiligini hisobga olmang.

- A) giperbola bo'ylab
- B) to'g'ri chiziq bo'ylab
- C) aylana yoyi bo'ylab
- D) tarmog'i pastga yo'nalgan parabola bo'ylab



Ushbu chizmada ko'rib turganingizdek, biror balandlikdan gorizontaal otilgan jism tarmog'i pastga yo'nalgan parabola bo'ylab harakatlanadi.

Javob: D) tarmog'i pastga yo'nalgan parabola bo'ylab.

11.2. Rasmda gorizontga α burchak ostida v tezlik bilan otilgan jismning harakat trayektoriyasi ko'rsatilgan. Rasmda ko'rsatilgan vektorlardan qaysi biri jismning A nuqtadagi tezlanishi yo'nalishini ko'rsatadi?



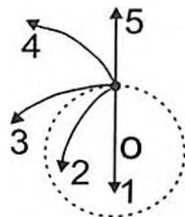
- A) a
- B) b
- C) c
- D) d

Gorizontaal va gorizontga burchak ostida g tezlanish bilan harakatlanadi va u har doim vertikal pastga yo'nalgan bo'ladi. Chizmadagi b yo'nalishga mos keladi.

Javob: B) b.

11.3. Vertikal tekislikda aylanayotgan ipga bog'langan jism trayektoriyasining eng yuqori nuqtasida bo'lganida (ipning taranglik kuchi nolga teng) ip uzib yuborilsa, u rasmda ko'rsatilgan trayektoriyalarning qaysi biri bo'ylab harakat qiladi?

- A) 1
- B) 2
- C) 3
- D) 4



Eng yuqori nuqtada jismning tezlik vektori gorizontaal yo'nalgan bo'ladi. Gorizontaal otilgan jism tarmog'i pastga qaragan parabola

trayektoriya bo'ylab harakatlanadi. Chizmadagi 2-va 3-trayektoriyalar tarmog'i pastga qaragan parabola. Jism 3-trayektoriya bo'yicha yo'nalishi harakatlanishi uchun ipda taranglanish bo'lishi kerak. Shartga ko'ra taranglik yo'q. Demak, jism 2-trayektoriya bo'yicha harakatlanadi.

Javob: B) 2.

11.4. To'g'ri chiziqli va tekis harakatlanayotgan vagon oynasidan buyum tushib ketdi. Yer bilan bog'langan sanoq sistemada buyum trayektoriyasi qanday bo'ladi?

- A) to'g'ri chiziq
- B) giperbola
- C) ellips yoyi
- D) parabola

Vagon v tezlik bilan harakat qilayotgani uchun, uning vagonida turgan jism ham v tezlikka ega bo'ladi. Agar bu jism vagondan tushib ketsa, u yerga nisbatan h balandlikdan gorizontol otilgan jismga o'xshab harakatlanadi, ya'ni, trayektoriyasi paraboladan iborat bo'ladi.

Javob: D) parabola.

11.5. Shamolsiz havoda yomg'ir tomchilari avtobus derazalari oynasida qanday shakldagi iz qoldiradi: 1) avtobus tekis harakatlanganda; 2) tekis tezlanuvchan harakatlanganda?

- A) 1-parabola; 2-parabola
- B) 1-parabola; 2-to'g'ri chiziq
- C) 1-to'g'ri chiziq; 2-to'g'ri chiziq
- D) 1-to'g'ri chiziq; 2-parabola

Avtobus tekis harakatlanganda hech qanday tezlanishga ega emas va tomchi o'z og'irligi ta'sirida to'g'ri chiziqli harakatlanadi. Avtobus tezlanish bilan harakatlanganda esa avtobus harakatiga teskari yo'nalishda tomchini itaruvchi kuch paydo bo'ladi va tomchi avtobus oynasida parabolasimon iz qoldiriladi.

Javob: D) 1-to'g'ri chiziq; 2-parabola.

11.6. Avtomobil derazasidan tushib ketgan buyum qaysi holda yerga oldinroq tushadi: avtomobil joyida turgandami yoki u harakatlanayotgandami?

- A) avtomobil harakatlanayotganida
- B) avtomobil joyida tinch turganida
- C) ikkala holda ham bir xil vaqtda tushadi
- D) avtomobil harakatiga bog'liq

Biror balandlikdan gorizontol otilgan (har qanday tezlik bilan) jism va shu balandlikdan erkin tashlab yuborilgan jism ikkalasi bir paytda yerga tushadi. Shu sababli ikkala holda ham avtomobildan tushib ketgan jism bir vaqtda yerga tushadi.

Javob: C) ikkala holda ham bir xil vaqtda tushadi.

11.7. Ma'lum bir balandlikdan bir vaqtda 1-tosh erkin tashlandi, 2-tosh gorizontaal otildi, 3-tosh vertikal yuqoriga otildi. Toshlardan qaysi biri yerga oldin tushadi?

- A) uchalasi bir vaqtda tushadi B) 1 va 2 C) 1 D) 2

Birinchi va ikkinchi jismlar bir xil vaqtda yerga tushadi, 3-jism esa ulardan keyin tushadi, sababi 3-jism yuqoriga otilgan.

Javob: B) 1 va 2.

11.8. Biror balandlikdan gorizontaal otilayotgan jismning otilish tezligi 2 marta oshirilsa, uning harakatlanish vaqti qanday o'zgaradi?

- A) 2 marta ortadi B) 2 marta kamayadi
C) o'zgarmaydi D) 4 marta kamayadi

Biror balandlikdan gorizontaal otilgan jismning uchish vaqti uning otilish tezligiga bog'liq emas. U faqat qanday balandlikdan otilganiga bog'liq $t = \sqrt{\frac{2h}{g}}$.

Javob: C) o'zgarmaydi.

11.9. 5 m balandlikdan gorizontaal yo'nalishda 2 m/s tezlik bilan otilgan jism necha sekunddan so'ng yerga tushadi? $g = 10 \text{ m/s}^2$.

- A) 2 B) 1,5 C) 1 D) 2,5

Berilgan:

$$h = 5 \text{ m}$$

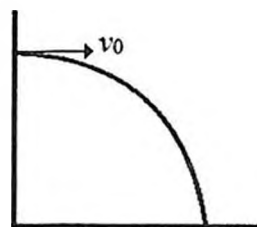
$$v_0 = 2 \text{ m/s}$$

$$g = 10 \text{ m/s}^2$$

$$t = ?$$

Yechilishi: Biz bu jismni xuddi h balandlikdan erkin tushayotgan jism deb faraz qilamiz va uning tushish vaqtini quyidagicha topamiz:

$$t = \sqrt{\frac{2h}{g}}; \quad t = \sqrt{\frac{2 \cdot 5}{10}} = 1 \text{ s}$$



Javob: C) 1.

11.10. Tepalikdan gorizontaal otilgan jism 5 s dan so'ng yerga tushgan bo'lsa, tepalik balandligi qanday (m)?

- A) 250 B) 12,5 C) 25 D) 125

Berilgan:

$$t = 5 \text{ s}$$

$$h = ?$$

Yechilishi: Biz bu jismni xuddi h balandlikdan erkin tushayotgan jism deb faraz qilamiz va uning tushish balandligini erkin tushish formulalari asosida topishimiz mumkin.

$$h = \frac{gt^2}{2} \quad h = \frac{10 \cdot 25}{2} = 125 \text{ m}$$

Javob: D) 125.

11.11. 500 m balandlikda 180 km/soat tezlik bilan gorizontol uchayotgan vertolyotdan Yerga yuk tashlandi. U necha sekundda yerga tushadi?

- A) 12 B) 36 C) 30 D) 10

Berilgan:

$$h = 500 \text{ m}$$

$$v_0 = 50 \text{ m/s}$$

$$t = ?$$

Yechilishi:

Samolyot v tezlik bilan uchayotgan bo'lsa, yuk ham xuddi shu tezlikka ega bo'ladi. Yuk tashlangan paytda xuddi biror balandlikdan v tezlik bilan gorizontga otilgan jism deb faraz qilamiz.

$$t = \sqrt{\frac{2h}{g}} \quad t = \sqrt{\frac{2 \cdot 500}{10}} = 10 \text{ s}$$

Javob: D) 10.

11.12. 180 m balandlikdan 10 m/s boshlang'ich tezlik bilan gorizontol otilgan jism tezligi vertikal tashkil etuvchisining o'rtacha qiymatini toping (m/s).

- A) 45 B) 30 C) 18 D) 10

Berilgan:

$$h = 180 \text{ m}$$

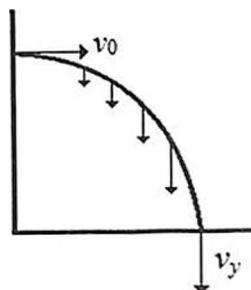
$$v_0 = 10 \text{ m/s}$$

$$v_{yo'rt} = ?$$

Yechilishi: Tekis o'zgaruvchan harakatda

$$\text{o'rtacha tezlikni topish uchun } v = \frac{v + v_0}{2}$$

formuladan foydalanar edik. Bu yerda ham jism tekis o'zgaruvchan harakat qilayotgani uchun, uning vertikal yo'nalishdagi tezligining o'rtacha qiymati shu formulaga tayangan holda topiladi.



$v_{yo'rt} = \frac{v_{y0} + v_y}{2}$ vertikal yo'nalishdagi boslang'ich tezlik $v_{y0} = 0$ bo'ladi va bu tezlik jism yerga tushgunicha davom etib, jism yerga tushganda eng katta v_y tezlikka ega bo'ladi. $v_y = gt$ ekanidan foydalanib, $v_{yo'rt} = \frac{v_{y0} + v_y}{2}$ formulani $v_{yo'rt} = \frac{v_{y0} + gt}{2}$

qilib yozish mumkin. Ammo bizda jismning yerga tushish vaqti yo'q, uni $t = \sqrt{\frac{2h}{g}}$

formula orqali topamiz va $v_{y0} = 0$ ekanini e'tiborga olgan holda jismning vertikal yo'nalishdagi tezligining o'rtacha qiymatini topish formulasini keltirib chiqaramiz:

$$v_{yo'rt} = \sqrt{\frac{gh}{2}} \quad v_{yo'rt} = \sqrt{\frac{10 \cdot 180}{2}} = 30 \text{ m/s}$$

Javob: B) 30.

11.13. Tosh gorizontaal yo'nalishda otiladi. 3 s dan keyin tezlik vektori yer sirti bilan 60° burchak hosil qilgan bo'lsa, toshning boshlang'ich tezligi qanday (m/s)?

- A) 15 B) 30 C) $60/\sqrt{3}$ D) $30/\sqrt{3}$

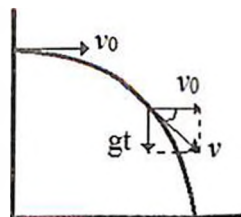
Berilgan:

$$t = 3 \text{ s}$$

$$\alpha = 60^\circ$$

$$v_0 = ?$$

Yechilishi: Biror balandlikdan gorizontaal otilgan jismning 3 s dan keyingi vertikal yo'nalishdagi tezligi $v_y = gt$ bo'ladi. Biz bu tezlik vektorini proyeksiyalaymiz va u bizga boshlang'ich tezlikni topishimizda yordam beradi:



$$\frac{gt}{v_0} = \tan \alpha; \quad v_0 = \frac{gt}{\tan \alpha}; \quad v_0 = \frac{10 \cdot 3}{\sqrt{3}} = \frac{30}{\sqrt{3}} \text{ m/s}$$

Javob: D) $30/\sqrt{3}$.

11.14. Tosh gorizontaal yo'nalishda otilgan. 4 s dan keyin tezlik vektori yer sirti bilan 45° burchak hosil qilgan bo'lsa, toshning boshlang'ich tezligi qanday (m/s)?

- A) 40 B) $\frac{80}{\sqrt{2}}$ C) 20 D) $\frac{120}{\sqrt{2}}$

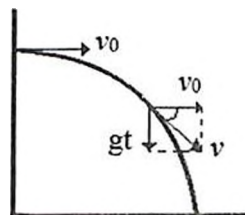
Berilgan:

$$t = 4 \text{ s}$$

$$\alpha = 45^\circ$$

$$v_0 = ?$$

Yechilishi: Biror balandlikdan gorizontga otilgan jismning 4s dan keyingi vertikal yo'nalishdagi tezligi $v_y = gt$ bo'ladi. Biz bu tezlik vektorini proyeksiyalaymiz va u bizga boshlang'ich tezlikni topishimizda yordam beradi.



$$\frac{gt}{v_0} = \tan \alpha; \quad v_0 = \frac{gt}{\tan \alpha}; \quad v_0 = \frac{10 \cdot 4}{1} = 40 \text{ m/s}$$

Javob: A) 40.

11.15. Jism v_0 tezlik bilan gorizontaal otilgan. Uning oniy tezligini qaysi formuladan aniqlash mumkin bo'ladi?

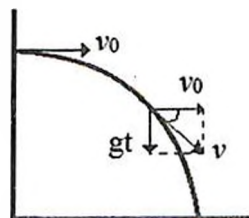
- A) $v = v_0 + gt$ B) $v = v_0 - gt$
C) $v = gt$ D) $v = \sqrt{v_0^2 + (gt)^2}$

Berilgan:

$$v_0$$

$$v = ?$$

Yechilishi: Biror balandlikdan gorizontga otilgan jism ikki yo'nalishda tezlikka ega bo'ladi, ya'ni gorizontaal va vertikal. Jismning



gorizontal tezligi uning gorizontga otilish tezligiga, ya'ni v_0 ga teng. Vertikal yonalishdagi tezlik esa vaqt o'tishi bilan ortib boruvchi $v_y = gt$ tezlikka ega va bu tezliklar bir-biriga 90° burchak ostida yo'nalgani uchun, gorizontga otilgan jismning oniy tezligini Pifagor teoremasi orqali topamiz.

$$v = \sqrt{v_0^2 + (gt)^2}$$

Javob: D) $v = \sqrt{v_0^2 + (gt)^2}$.

11.16. h balandlikdan v_0 boshlang'ich tezlik bilan gorizontal otilgan jism borib tushgan nuqtaga tushishi uchun uni $h/2$ balandlikdan qanday gorizontal tezlik bilan otish kerak?

A) $1,5 v_0$

B) $2v_0$

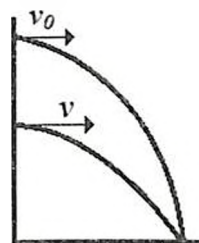
C) $\sqrt{2}v_0$

D) $\sqrt{3}v_0$

Berilgan:
 $h, v_0; h/2$
 $v = ?$

Yechilishi: h balandlikdan otilgan jismning borib tushgan joyiga boshqa bir jismni $h/2$ balandlikdan otib tushirish uchun uni kattaroq tezlik bilan otish kerak. Biz bu

masalada ikkala balandlikdan otilgan jismlarning ham uchish uzoqliklari bir xil ekanini bilgan holda, ikkinchi jismni qanday tezlik bilan otsak, birinchi jismning yoniga tushishini bilib olamiz.



Birinchi jismning uchish uzoqligi $S = v_0 \cdot \sqrt{\frac{2h}{g}}$ ifoda bilan topiladi. Ikkinchi jism-

ning uchish uzoqligi esa $S = v \cdot \sqrt{\frac{2 \cdot \frac{h}{2}}{g}}$ ifoda bilan topiladi. Ikkala ifoda bir-biriga teng.

Bundan foydalanib quyidagi natijani olamiz:

$$v_0 \cdot \sqrt{\frac{2h}{g}} = v \cdot \sqrt{\frac{2 \cdot \frac{h}{2}}{g}}; \quad v = \sqrt{2}v_0$$

Javob: C) $\sqrt{2}v_0$.

11.17. Gorizontal yo'nalishda 800 m/s tezlik bilan otilgan o'q 600 m masofadagi nishonga borib yetguncha, vertikal yo'nalishda qanchaga pasayadi (m)?

A) 0,75

B) 1,5

C) 2,8

D) 3,75

Berilgan:

$v_0 = 800 \text{ m/s}$
 $S = 600 \text{ m}$
 $h = ?$

Yechilishi: $S = v_0 \cdot \sqrt{\frac{2h}{g}}$ ifodadan h ni topamiz.

U quyidagicha: $h = \frac{S^2 \cdot g}{2v_0^2}; \quad h = \frac{600^2 \cdot 10}{2 \cdot 800^2} = 2,8 \text{ m}$

Javob: C) 2,8.

11.18. 500 m balandlikda gorizontal uchayotgan vertolyotdan yerga yuk tashlandi. Agar vertolyotning tezligi 180 km/soat bo'lsa, yuk gorizontal yo'nalishda qancha (m) masofa bosib o'tadi?

A) 500

B) 1000

C) 1800

D) 2000

Berilgan:

$$v_0 = 50 \text{ m/s}$$

$$h = 500 \text{ m}$$

$$S = ?$$

Yechilishi: h balandlikda uchib ketayotgan samolyot qanday tezlikka ega bo'lsa, undagi jism ham xuddi shu tezlikka ega bo'ladi va bu jismni samolyotdan tashlab yuborishsa, jism gorizontga v_0 tezlik bilan otilgan jism kabi harakatlanadi.

$$S = v_0 \cdot \sqrt{\frac{2h}{g}} \quad S = 50 \cdot \sqrt{\frac{2 \cdot 500}{10}} = 500 \text{ m}$$

Javob: A) 500.

11.19. Balandligi 80 m bo'lgan minoradan jism 600 m/s tezlik bilan gorizontal yo'nalishda otiladi. Havoning qarshiligi hisobga olinmasa, jismning uchish uzoqligi qanday (km) bo'ladi?

A) 0,6

B) 1,2

C) 2,0

D) 2,4

Berilgan:

$$v_0 = 600 \text{ m/s}$$

$$h = 80 \text{ m}$$

$$S = ?$$

Yechilishi: biror balandlikdan gorizontal otilgan jismning uchish uzoqligi quyidagi ifoda yordamida aniqlanadi:

$$S = v_0 \cdot \sqrt{\frac{2h}{g}}$$

$$S = 600 \cdot \sqrt{\frac{2 \cdot 80}{10}} = 2,4 \text{ km}$$

Javob: D) 2,4.

11.20. 80 m balandlikdan 15 m/s tezlik bilan gorizontal otilgan jismning uchish uzoqligini toping (m).

A) 80

B) 40

C) 45

D) 60

Berilgan:

$$v_0 = 15 \text{ m/s}$$

$$h = 80 \text{ m}$$

$$S = ?$$

Yechilishi: $S = v_0 \cdot \sqrt{\frac{2h}{g}}$

$$S = 15 \cdot \sqrt{\frac{2 \cdot 80}{10}} = 60 \text{ m}$$

Javob: D) 60.

11.21. Samolyot gorizontal yo'nalishda 8 km balandlikda 720 km/soat tezlik bilan uchmoqda. Uchuvchi bombani nishonga aniq tushirishi uchun nishonga qanday masofa (gorizontal yo'nalishda) qolganda tashlashi kerak bo'ladi (km)? Havoning qarshiligini hisobga olmang.

A) 2

B) 4

C) 4,5

D) 8

Berilgan:

$$v_0 = 200 \text{ m/s}$$

$$h = 8000 \text{ m}$$

$$S = ?$$

Yechilishi:
$$S = v_0 \cdot \sqrt{\frac{2h}{g}}$$

$$S = 200 \cdot \sqrt{\frac{2 \cdot 8000}{10}} = 8 \text{ km}$$

Javob: D) 8.

11.22. 360 km/soat tezlik bilan uchayotgan samolyotdan tashlangan yuk 1000 m uzoqlikka borib tushgan bo'lsa, samolyotning uchish balandligi qanday (m)?

A) 1360

B) 1000

C) 640

D) 500

Berilgan:

$$v_0 = 100 \text{ m/s}$$

$$S = 1000 \text{ m}$$

$$h = ?$$

Yechilishi:

$$h = \frac{S^2 \cdot g}{2v_0^2}$$

$$h = \frac{1000^2 \cdot 10}{2 \cdot 100^2} = 500 \text{ m}$$

Javob: D) 500.

11.23. Gorizontaal yo'nalishda 180 km/soat tezlik bilan uchayotgan vertolyotdan tashlangan yuk 10 s da yerga tushdi. Vertolyot qanday balandlikda uchmoqda (m).

A) 180

B) 360

C) 500

D) 1000

Berilgan:

$$v_0 = 50 \text{ m/s}$$

$$t = 10 \text{ s}$$

$$h = ?$$

Yechilishi:

$$h = \frac{gt^2}{2}$$

$$h = \frac{10 \cdot 10^2}{2} = 500 \text{ m}$$

Javob: C) 500.

11.24. 500 m balandlikda gorizontaal uchib borayotgan samolyotdan tashlangan jism 1 km masofaga borib tushgan bo'lsa, samolyotning tezligi qanday (m/s)?

A) 120

B) 100

C) 150

D) 200

Berilgan:

$$h = 500 \text{ m}$$

$$S = 1000 \text{ m}$$

$$v_0 = ?$$

Yechilishi:

$$S = v_0 \cdot \sqrt{\frac{2h}{g}}$$

Ushbu ifodadan v_0 ni topamiz: $v_0 = \sqrt{\frac{S^2 g}{2h}}$

$$v_0 = \sqrt{\frac{1000^2 \cdot 10}{2 \cdot 500}} = 100 \text{ m/s}$$

Javob: B) 100.

11.25. Jism 20 m balandlikdan 15 m/s tezlik bilan gorizontal otildi. Uning yerga urilish paytidagi tezligi qanday (m/s)?

- A) 25 B) 35 C) 27 D) 20

Berilgan:

$$h = 20 \text{ m}$$

$$v_0 = 15 \text{ m/s}$$

$$v = ?$$

Yechilishi: Bu masalani yechishda 15-

masaladagi $v = \sqrt{v_0^2 + (gt)^2}$ formuladan foydalanamiz. Ammo biz bu jismning qancha vaqtda yerga tushganini bilmaymiz.

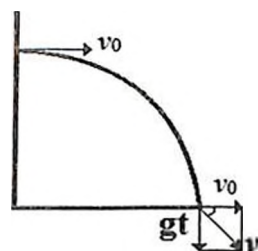
Bu jismning qancha vaqtda yerga tushish

vaqtini topib olamiz. $t = \sqrt{\frac{2h}{g}}$

Bundan: $v = \sqrt{v_0^2 + 2gh}$ kelib chiqadi.

$$v = \sqrt{15^2 + 2 \cdot 10 \cdot 20} = 25 \text{ m/s}$$

Javob: A) 25.



11.26. Balandligi 105 m bo'lgan qoya chetida turgan bola qo'lidagi toshni 20 m/s tezlik bilan gorizontal otdi. Toshning yerga urilish paytidagi tezligi qanday (m/s)? $g = 10 \text{ m/s}^2$.

- A) 20 B) 40 C) 45 D) 50

Berilgan:

$$h = 105 \text{ m}$$

$$v_0 = 20 \text{ m/s}$$

$$v = ?$$

Yechilishi: 26-masaladan foydalaning: $v = \sqrt{v_0^2 + 2gh}$

$$v = \sqrt{20^2 + 2 \cdot 10 \cdot 105} = 50 \text{ m/s}$$

Javob: D) 50.

11.27. Qoyadan 20 m/s tezlik bilan (gorizontal) otilgan tosh yerga 45° burchak ostida tushsa, uning oxirgi tezligi qanday (m/s) bo'ladi?

- A) 24 B) 28 C) 30 D) 32

Berilgan:

$\alpha = 45$

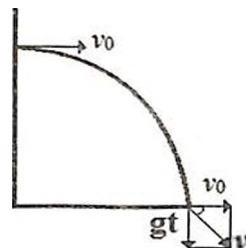
$v_0 = 20 \text{ m/s}$

$v = ?$

Yechilishi:

$$v = \frac{v_0}{\cos \alpha}$$

$$v = \frac{20}{\frac{\sqrt{2}}{2}} = 28 \text{ m/s.}$$

**Javob:** B) 28.

11.28. Gorizontaal otilgan jismning uchish uzoqligi va tushish balandliklari teng bo'lib, 2 sekunda yerga tushsa, u qanday (m/s) tezlik bilan otilgan? $g=10 \text{ m/s}^2$.

A) 16

B) 12

C) 14

D) 10

Berilgan:

$h = S$

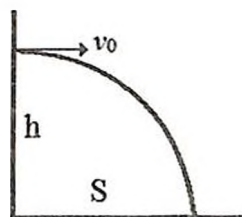
$t = 2 \text{ s}$

$v_0 = ?$

Yechilishi: Uchish uzoqligining tushish balandligiga teng ekanidan foydalanamiz.

$$h = \frac{gt^2}{2}; S = v_0 t \text{ Bu holda jismning}$$

tushish balandligi va uning uchish uzoqligini tenglashtiramiz.



$$v_0 t = \frac{gt^2}{2}; v_0 = \frac{gt}{2}$$

$$v_0 = \frac{10 \cdot 2}{2} = 10 \text{ m/s}$$

Javob: D) 10.

11.29. Biror balandlikdan 10 m/s tezlik bilan gorizontaal otilgan jismning uchish uzoqligi shu balandlikka teng bo'lsa, jism qanday balandlikdan otilgan bo'ladi (m)?

A) 200

B) 160

C) 100

D) 20

Berilgan:

$v_0 = 10 \text{ m/s}$

$S = h$

$h = ?$

Yechilishi: Bu masalada jismning tushish vaqtini ikki xil usulda topib, ularni tenglashtiramiz.

$$t = \sqrt{\frac{2h}{g}}; t = \frac{S}{v_0}$$

 $S = h$ ekanligidan foydalanib quyidagi ifodani topamiz:

$$h = \frac{2 \cdot v_0^2}{g} \quad h = \frac{2 \cdot 10^2}{10} = 20 \text{ m}$$

Javob: D) 20.

11.30. Agar 9 m balandlikdan gorizontal otilgan jismning uchish uzoqligi ham 9 m ga teng bo'lsa, jismning yerga tushgan paytidagi tezligi qanday (m/s)?

- A) 15 B) 8 C) 4 D) 10

Berilgan:

$$S = h = 9 \text{ m}$$

$$v = ?$$

Yechilishi: Gorizontal otilgan jismning yerga tushgan paytdagi tezligini topamiz:

$$v = \sqrt{v_0^2 + 2gh}. \text{ Ammo jism qanday tezlik bilan otilgani}$$

noma'lum. Biz uni $v_0 = S \cdot \sqrt{\frac{g}{2h}}$ formulamiz orqali topib olamiz. Bu yerda $S = h$

ekanini bilgan holda, boshlang'ich tezlikni topish ifodasini $v_0 = \sqrt{\frac{gh}{2}}$ deb yozishimiz mumkin.

Natijada gorizontal otilgan jismning yerga urilishdagi tezligini topish ifodasi quyidagi ko'rinishga keladi.

$$v = \sqrt{\left(\sqrt{\frac{gh}{2}}\right)^2 + 2gh} \quad v = \sqrt{\frac{5gh}{2}}$$

$$v = \sqrt{\frac{5 \cdot 10 \cdot 9}{2}} = 15 \text{ m/s}$$

Javob: A) 15.

11.31. Ikkita jism bir xil balandlikdan boshlang'ich tezliksiz tashlab yuborildi. Ikkinchi jism yo'l yarmida gorizontga 45° burchak ostida o'rnatilgan maydonchaga elastik urildi va harakatini davom ettirdi. Jismlarning yerga tushish vaqtlarining nisbati t_1/t_2 qanday?

- A) 1 B) 2 C) $\sqrt{2}/2$ D) $2\sqrt{2}$

Berilgan:

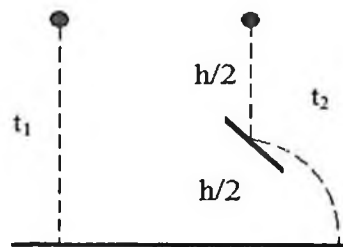
$$\alpha = 45^\circ$$

$$\frac{t_1}{t_2} = ?$$

Yechilishi: Birinchi jismning tushish vaqti $t_1 = \sqrt{\frac{2h}{g}}$ ekanini bilamiz.

Ikkinchi jism ikki xil harakat qilib yerga tushgan. Demak, u yo'lning yarmigacha erkin tushib, qolgan yarmida

45° li to'siqqa urilgach, xuddi gorizontal otilgan jismga o'xshab harakatlangani sababli tushish vaqtini ikki xil harakat uchun alohida topib, so'ngra ularni qo'shamiz:



$$t_2 = \sqrt{\frac{2 \cdot \frac{h}{2}}{g}} + \sqrt{\frac{2 \cdot \frac{h}{2}}{g}} = 2\sqrt{\frac{h}{g}}$$

Bundan: $\frac{t_1}{t_2} = \frac{1}{\sqrt{2}}$ ekani kelib chiqadi.

Javob: C) $\sqrt{2}/2$.

11.32. Jism tog' cho'qqisidan 50 m/s tezlik bilan gorizontol otilgan. Uning harakat boshidan 4 s o'tgan paytdagi markazga intilma tezlanishi qanday (m/s²)? $g = 10 \text{ m/s}^2$.

A) 10,3

B) 16,7

C) 25

D) 7,8

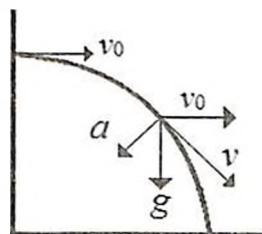
Berilgan:

$$v_0 = 50 \text{ m/s}$$

$$t = 4 \text{ s}$$

$$a = ?$$

Yechilishi: Bu masalada ikkita o'xshash to'g'ri burchakli uchburchaklar paydo bo'ladi. $\vec{v}_0$ va $\vec{g}$ hamda $\vec{v}$ va $\vec{a}$ vektorlarga e'tibor bersangiz, ular o'zaro tik yo'nalgan bo'ladi. Uchburchaklarning o'xshashlik qonunidan quyidagi ifodani keltirib chiqaramiz:



$$\frac{v_n}{v} = \frac{a}{g}; \text{ bu}$$

Javob: D) 7,8.

11.33. Poldan h balandlikda o'rnatilgan prujinali pistoletdan gorizontol yo'nalishda o'q uzildi. Agar o'qning uchish uzoqligi S bo'lsa, uning boshlang'ich tezligi qanday?

A) $S\sqrt{2gh}$

B) $S\sqrt{\frac{2h}{g}}$

C) $\frac{S}{\sqrt{2gh}}$

D) $S\sqrt{\frac{g}{2h}}$

Berilgan:

$$h, S$$

$$v_0 = ?$$

Yechilishi:

$$S = v_0 \cdot \sqrt{\frac{2h}{g}}$$

Ushbu ifodadan v_0 ni topamiz: $v_0 = S\sqrt{\frac{g}{2h}}$

Javob: D) $S\sqrt{\frac{g}{2h}}$.

12-§. Gorizontga burchak ostida otilgan jism harakati

12.1. Gorizontga burchak ostida otilgan jismning trayektoriyasi qanday bo'ladi? Havoning qarshiligini hisobga olmang.

- A) ellips
B) gorizontga qiya to'g'ri chiziq
C) gorizont to'g'ri chiziq
D) parabola

Ushbu chizmada gorizontga burchak ostida otilgan jismning harakatlanish trayektoriyasi tasvirlangan. Ko'rib turganingizdek, jism gorizontga burchak bilan otilsa, uning trayektoriyasi parabola bo'ladi.



Javob: D) parabola.

12.2. Gorizontga burchak ostida otilgan jismning tezlanishi qanday bo'ladi?

- A) nolga teng
B) g, pastga yo'nalgan
C) g, yuqoriga yo'nalgan
D) tezlik vektori bo'ylab yo'nalgan

Gorizontga burchak ostida otilgan jismning tezlanishi g ga teng va u pastga yo'nalgan. Sababi jism havoda payti erkin holatda bo'ladi, uning vazni ham bo'lmaydi.

Javob: B) g, pastga yo'nalgan.

12.3. Gorizontga burchak ostida otilgan jismning tezlanishi trayektoriyaning eng yuqori nuqtasida qanday bo'ladi?

- A) g/2, pastga yo'nalgan
B) g, yuqoriga yo'nalgan
C) g, pastga yo'nalgan
D) g, trayektoriya bo'ylab yo'nalgan

Gorizontga burchak ostida otilgan jism trayektoriyasining hamma nuqtalari uchun tezlanish g ga teng va vertikal pastga yo'nalgan.

Javob: C) g, pastga yo'nalgan.

12.4. Sharcha gorizontga 30° burchak ostida 30 m/s boshlang'ich tezlik bilan otildi. Boshlang'ich tezlik vektorining gorizont va vertikal tashkil etuvchilari qanday (m/s)?

- A) 26; 15
B) 15; 26
C) 15; 15
D) 26; 26

Berilgan:

$$v_0 = 30 \text{ m/s}$$

$$\alpha = 30^\circ$$

$$v_x = ?$$

$$v_y = ?$$

Yechilishi: Gorizontga burchak ostida

otilgan jismning gorizont va vertikal yo'nalishdagi tezliklari quyidagicha

topiladi: $v_x = v_0 \cdot \cos \alpha$; $v_y = v_0 \sin \alpha$



$$v_x = 30 \cdot \frac{\sqrt{3}}{2} = 15\sqrt{3} \text{ m/s}; \quad v_y = 30 \cdot \frac{1}{2} = 15 \text{ m/s}$$

Javob: A) 26; 15.

12.5. Jism gorizontga 30° burchak ostida 20 m/s boshlang'ich tezlik bilan otildi. Boshlang'ich tezlik vektorining gorizont va vertikal tashkil etuvchilari qanday (m/s)? $\sin 30^\circ = 0,50$; $\cos 30^\circ = 0,87$.

- A) 10 va 17,3 B) 10 va 10 C) 17,3 va 17,3 D) 17,3 va 10

Berilgan:

$$v_0 = 20 \text{ m/s}$$

$$\alpha = 30^\circ$$

$$v_x = ? \quad v_y = ?$$

Yechilishi:

$$v_x = v_0 \cdot \cos \alpha; \quad v_y = v_0 \sin \alpha$$

$$v_x = 20 \cdot \frac{\sqrt{3}}{2} = 10\sqrt{3} \text{ m/s}$$

$$v_y = 20 \cdot \frac{1}{2} = 10 \text{ m/s}$$



Javob: D) 17,3 va 10.

12.6. Jism gorizontga 30° burchak ostida 20 m/s boshlang'ich tezlik bilan otildi. Harakatning 1-sekundi oxiridagi tezlik vektorining gorizont va vertikal tashkil etuvchilari qanday (m/s)? $\sin 30^\circ = 0,50$; $\cos 30^\circ = 0,87$.

- A) 10 va 17,3 B) 17,3 va 10 C) 17,3 va 0 D) 17,3 va 17,3

Berilgan:

$$v_0 = 20 \text{ m/s}$$

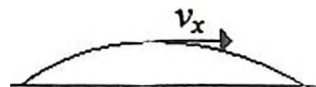
$$\alpha = 30^\circ$$

$$t = 1 \text{ s}$$

$$v_x = ? \quad v_y = ?$$

Yechilishi: Bu masalada eng avvalo jism qancha vaqt uchadi degan savolga javob topolsak, jismning bizga berilgan vaqtdagi vaziyatini topishimiz mumkin. Uni quyidagi formula orqali topamiz:

$$t = \frac{2v_0 \sin \alpha}{g}$$



ushbu formula bo'yicha hisoblaganimizda, uning uchish vaqti 2s ga teng ekan. kelib chiqadi va bundan jism 1-sekundda trayektorianing eng yuqori tepasida ekan degan xulosa chiqaramiz.

Trayektorianing eng yuqorisidagi vertikal tezligi bo'lmaydi, jism aynan shuning uchun pastga qulay boshlaydi. Gorizontga burchak ostida otilgan jismning gorizont tezligi esa butun trayektoriya davomida o'zgarmaydi.

$$v_x = v_0 \cdot \cos \alpha; \quad v_y = 0$$

$$v_x = 20 \cdot \frac{\sqrt{3}}{2} = 10\sqrt{3} \text{ m/s}$$

Javob: C) 17,3 va 0.

12.7. Kamalakdan modullari bir xil tezliklar bilan gorizontga har xil burchak ostida 4 o'q otildi: birinchisi 90° , ikkinchisi 60° , uchinchisi 45° va to'rtinchisi 30° burchak ostida. O'qlardan qaysi biri yerga boshqalaridan oldin qaytib tushadi?

- A) 4 B) 3 C) 2 D) 1

Berilgan:

$$\alpha_1 = 90^\circ$$

$$\alpha_2 = 60^\circ$$

$$\alpha_3 = 45^\circ$$

$$\alpha_4 = 30^\circ$$

$$t = ?$$

Yechilishi: 12.6-masalada foydalangan formulamiz orqali jismlarning uchish vaqtini topamiz.

$$t = \frac{2v_0 \sin \alpha}{g}$$

$$t_1 = \frac{2v_0}{g}; \quad t_2 = \frac{\sqrt{3}v_0}{g}; \quad t_3 = \frac{\sqrt{2}v_0}{g}; \quad t_4 = \frac{v_0}{g}$$

Eng avval 4-jism yerga tushadi.

Javob: A) 4.

12.8. Tosh gorizontga 30° burchak ostida 10 m/s tezlik bilan otildi. U yerga necha sekunddan so'ng qaytib tushadi?

- A) 0,5 B) 1 C) 2 D) 3

Berilgan:

$$v_0 = 10 \text{ m/s}$$

$$\alpha = 30^\circ$$

$$t = ?$$

Yechilishi: 12.6-masaladan foydalaning.

$$t = \frac{2v_0 \sin \alpha}{g}$$

$$t = \frac{2 \cdot 10 \cdot \frac{1}{2}}{10} = 1 \text{ s}$$

Javob: B) 1.

12.9. Jism 20 m balandlikdan gorizontga 30° burchak ostida 30 m/s tezlik bilan otildi. Jism necha sekund uchgan?

- A) 2 B) 3 C) 4 D) 5

Berilgan:

$$v_0 = 30 \text{ m/s}$$

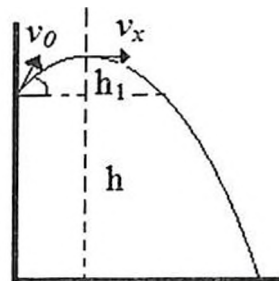
$$\alpha = 30^\circ$$

$$h = 20 \text{ m}$$

$$t = ?$$

Yechilishi: Bu joyda jismning harakat trayektoriyasini ikkiga bo'lamiz! Gorizontga burchak ostida otilgan jism harakat trayektoriyasining yarmi va v_x tezlik bilan gorizont otilgan jism harakati.

Gorizontga qiya otilgan jismning uchish vaqtining yarim qiymati va $h + h_1$ balandlikdan v_x tezlik bilan otilgan jismning



uchish vaqtlari yig'indisi bizga h balandlikdan burchak ostida otilgan jismning yerga tushish vaqtini beradi.

$$t = t_1 + t_2$$

$$t_1 = \frac{v_0 \sin \alpha}{g}$$

t_2 ni topish uchun, avvalo, h_1 balandlikni $h_1 = \frac{v_0^2 \sin^2 \alpha}{2g}$ formula orqali topib olamiz.

$$t_2 = \sqrt{\frac{2(h + h_1)}{g}}$$

$$t_1 = \frac{30 \cdot \frac{1}{2}}{10} = 1,5s$$

$$h_1 = \frac{30^2 \cdot \left(\frac{1}{2}\right)^2}{2 \cdot 10} = 11,25 \text{ m}$$

$$t_2 = \sqrt{\frac{2(20 + 11,25)}{10}} = 2,5s$$

$$t = 1,5 + 2,5 = 4 \text{ s}$$

Javob: C) 4.

12.10. Gorizontga burchak ostida 10 m/s tezlik bilan otilgan jismning uchish davomidagi minimal tezligi 6 m/s bo'lsa, uning uchish vaqti qanday (s) bo'ladi?
 $g = 10 \text{ m/s}^2$.

A) 1,6

B) 0,8

C) 0,6

D) 1,2

Berilgan:

$$v_0 = 10 \text{ m/s}$$

$$v_{\min} = 6 \text{ m/s}$$

$$t = ?$$

Yechilishi: Bu holda minimal tezlik trayektoriyaning eng yuqori nuqasida bo'ladi va u gorizonttal yo'nalishdagi $v_{\min} = v_x$ tezlikka teng. $v_x = v_0 \cdot \cos \alpha$ ekanidan foydalanib jismning gorizontga qanday burchak ostida otilganligini topib olamiz va

$t = \frac{2v_0 \sin \alpha}{g}$ formula orqali jismning uchish vaqtini topib olamiz.

$$\cos \alpha = \frac{6}{10} = \frac{3}{5}$$

Triginometrik $\sin \alpha = \sqrt{1 - \cos^2 \alpha}$ ayniyati orqali $\sin \alpha$ ni topib olamiz.

$$\sin \alpha = \sqrt{1 - \frac{9}{25}} = \frac{4}{5}$$

$$t = \frac{2 \cdot 10 \cdot \frac{4}{5}}{10} = 1,6s$$

Javob: A) 1,6.

12.11. Zambarakdan gorizontga burchak ostida otilgan snaryad 20 m balandlikka ko'tarildi. Uning uchish vaqtini toping (s). $g = 10 \text{ m/s}^2$.

A) 10

B) 20

C) 1

D) 4

Berilgan:

$$h = 20 \text{ m}$$

$$t = ?$$

Yechilishi: Biz bu holatda $t_t = \sqrt{\frac{2h}{g}}$ formuladan foydalan-

sak bo'ladi. $t = t_k + t_t = 2t_t$

$$t_t = \sqrt{\frac{2 \cdot 20}{10}} = 2s \quad t = 2t_t = 4s.$$

Javob: D) 4.

12.12. Zambarakdan gorizontga burchak ostida uchib chiqqan snaryad 12 s uchgan. Snaryad ko'tarilgan eng yuqori balandlik qanday (m)?

A) 170

B) 180

C) 190

D) 200

Berilgan:

$$t = 12 \text{ s}$$

$$h = ?$$

Yechilishi: Biz bu holatda $h = \frac{gt_k^2}{2}$ formuladan foydalansak

bo'ladi. t_k — snaryadning ko'tarilish vaqti, u uchish vaqtining

yarmiga teng: $t_k = \frac{t}{2}$

$$t_k = \frac{12}{2} = 6 \text{ s}$$

$$h = \frac{10 \cdot 6^2}{2} = 180 \text{ m}$$

Javob: B) 180.

12.13. Ikki o'quvchi bir-biriga to'p otib o'ynamoqda. Agar to'p birinchi o'quvchidan ikkinchi o'quvchiga 2 s vaqt mobaynida yetib borsa, to'p o'yin vaqtida qanday eng yuqori balandlikka (m) erishadi? $g = 10 \text{ m/s}^2$.

A) 1

B) 2

C) 3

D) 5

Berilgan:

$$t = 2 \text{ s}$$

$$h = ?$$

Yechilishi: Biz bu holatda $h = \frac{gt_k^2}{2}$ formuladan foydalansak

bo'ladi. t_k — snaryadning ko'tarilish vaqti, u uchish vaqtining yarmiga teng:

$$t_k = \frac{t}{2}$$

$$t_k = \frac{2}{2} = 1 \text{ s}$$

$$h = \frac{10 \cdot 1^2}{2} = 5 \text{ m}$$

Javob: D) 5.

12.14. Koptok 10 m/s tezlik bilan gorizontga 30° qiyalatib otildi. U qanday (m) balandlikka ko'tariladi?

A) 1,25 B) 2,5 C) 5 D) 10

Berilgan: $v_0 = 10 \text{ m/s}$ $\alpha = 30^\circ$ $h = ?$	Yechilishi: Biz bu holatda $h = \frac{v_0^2 \sin^2 \alpha}{2g}$ formuladan foydalansak bo'ladi. $h_1 = \frac{10^2 \cdot \left(\frac{1}{2}\right)^2}{2 \cdot 10} = 1,25 \text{ m}$
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Javob: A) 1,25.

12.15. Koptok 20 m/s boshlang'ich tezlik bilan gorizontga 30° burchak ostida otildi. Koptokning maksimal ko'tarilish balandligi qanday (m)?

A) 2,5 B) 5 C) 7,5 D) 10

Berilgan: $v_0 = 20 \text{ m/s}$ $\alpha = 30^\circ$ $h = ?$	Yechilishi: Biz bu holatda $h = \frac{v_0^2 \sin^2 \alpha}{2g}$ formuladan foydalansak bo'ladi. $h_1 = \frac{20^2 \cdot \left(\frac{1}{2}\right)^2}{2 \cdot 10} = 5 \text{ m}$
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Javob: B) 5.

12.16. Gorizontga burchak ostida otilgan jism 10 s uchgan. Jism ko'tarilgan eng yuqori balandlik qanday (m)?

A) 100 B) 225 C) 125 D) 500

Berilgan: $t = 10 \text{ s}$ $h = ?$	Yechilishi: $h = \frac{gt_k^2}{2}$ $t_k = \frac{t}{2} = 5 \text{ s.}$ $h = \frac{10 \cdot 5^2}{2} = 125 \text{ m}$
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Javob: C) 125.

12.17. Zambarakdan 500 m/s tezlik bilan uchib chiqqan snaryad 10 s uchgan. U qanday balandlikka ko'tarilgan?

A) 500 m

B) 5 km

C) 1,25 km

D) 125 m

Berilgan:

$$t = 10 \text{ s}$$

$$v_0 = 500 \text{ m/s}$$

$$h = ?$$

Yechilishi:

$$h = \frac{gt_k^2}{2} \quad t_k = \frac{t}{2} = 5 \text{ s.}$$

$$h = \frac{10 \cdot 5^2}{2} = 125 \text{ m}$$

Javob: D) 125 m.

12.18. Gorizontga burchak ostida 25 m/s tezlik bilan otilgan jism 4 s da yerga qaytib tushdi. Uning uchish davomidagi minimal tezligi qanday (m/s)?

A) 15

B) 10

C) 20

D) 25

Berilgan:

$$t = 4 \text{ s}$$

$$v_0 = 25 \text{ m/s}$$

$$v_{\min} = ?$$

Yechilishi: Minimal tezlikni topish uchun

$$v_{\min} = \sqrt{v_0^2 - (gt_k)^2} \text{ formuladan foydalanamiz!}$$

$$t_k = \frac{t}{2}$$

$$t_k = \frac{4}{2} = 2 \text{ s}$$

$$v_{\min} = \sqrt{25^2 - (10 \cdot 2)^2} = 15 \text{ m/s}$$

Javob: A) 15.

12.19. 20 m/s tezlik bilan gorizontga burchak ostida otilgan jismning maksimal ko'tarilish balandligi 15 m bo'lsa, uning uchish davomidagi minimal tezligi qanday (m/s) bo'lgan?

A) 20

B) 15

C) 10

D) 5

Berilgan:

$$h = 15 \text{ m}$$

$$v_0 = 20 \text{ m/s}$$

$$v_{\min} = ?$$

Yechilishi: Minimal tezlikni topish uchun

$$v_{\min} = \sqrt{v_0^2 - (gt_k)^2} \text{ formuladan foydalanamiz!}$$

Ko'tarilish vaqtini esa $h = \frac{gt_k^2}{2}$ formula orqali topamiz.

$$t_k = \sqrt{\frac{2h}{g}} \text{ bu ifodani } v_{\min} = \sqrt{v_0^2 - (gt_k)^2} \text{ formulaga}$$

qo'ysak, quyidagi formula hosil bo'ladi:

$$v_{\min} = \sqrt{v_0^2 - 2gh}$$

$$v_{\min} = \sqrt{20^2 - 2 \cdot 10 \cdot 15} = 10 \text{ m/s}$$

Javob: C) 10.

12.20. Gorizontga burchak ostida otilgan jismning uchish davomidagi minimal tezligi 16 m/s, uchish vaqti esa 2,4 s bo'lsa, u qanday (m/s) tezlik bilan otilgan?

- A) 35 B) 30 C) 24 D) 20

Berilgan:

$$t = 2,4 \text{ s}$$

$$v_{\min} = 16 \text{ m/s}$$

$$v_0 = ?$$

Yechilishi: Minimal tezlikni topish uchun

$v_{\min} = \sqrt{v_0^2 - (gt_k)^2}$ formuladan foydalanar edik. Bu formuladan v_0 boshlang'ich tezlikni topib olamiz.

$$v_0 = \sqrt{v_{\min}^2 + (gt_k)^2}$$

$$v_0 = \sqrt{16^2 + (10 \cdot 1,2)^2} = 20 \text{ m/s}$$

Javob: D) 20.

12.21. Bir vaqtning o'zida ikkita jism bir nuqtadan bir xil 10 m/s boshlang'ich tezlik bilan biri vertikal va ikkinchisi gorizontga nisbatan 30° burchak ostida yuqoriga otildi. 1 s dan keyin jismlar orasidagi masofa qanday bo'ladi (m)?

- A) 5 B) 7,4 C) 10 D) 12,5

Berilgan:

$$v = 10 \text{ m/s}$$

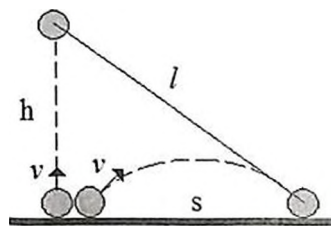
$$\alpha = 30^\circ$$

$$t = 1 \text{ s}$$

$$h = ?$$

Yechilishi: Rasmda ko'rib turganingizday biz l masofani topishimiz kerak. Uning uchun, avvalo, jismlarning t vaqtdan keyingi vaziyatlarini topishimiz kerak.

Birinchi jismning qancha vaqt davomida yuqoriga ko'tarilishini



$t = \frac{v}{g}$ formula orqali topsak, 1 sekund chiqishi, ya'ni maksimal ko'tarilish balandligida ekani ayon bo'ladi. Ikkinchi jismning uchish vaqtini $t = \frac{2v \sin \alpha}{g}$ formula

orqali topsak, 1 sekund chiqadi, ya'ni biz bundan jism allaqachon yerga tushganini xulosa qilamiz.

Ikki jism orasidagi l masofa esa $l = \sqrt{h^2 + S^2}$ Pifagor teoremasi orqali topiladi. S va h masofalar esa quyidagicha topiladi:

$$S = \frac{v^2 \sin 2\alpha}{g}$$

$$h = \frac{v^2}{2g}$$

$$S = \frac{10^2 \cdot \frac{\sqrt{3}}{2}}{10} = 5\sqrt{3} \text{ m}$$

$$h = \frac{10^2}{2 \cdot 10} = 5 \text{ m}$$

$$l = \sqrt{25 + 75} = 10 \text{ m.}$$

Javob: C) 10.

12.22. Ikki jism bir nuqtadan bir xil tezlik bilan gorizontga nisbatan α va $\pi/2 - \alpha$ burchak ostida otildi. Bu jismlarning eng yuqoriga ko'tarilish balandliklarining nisbatini aniqlang.

A) $h_1/h_2 = \operatorname{tg}^2 \alpha$

B) $h_1/h_2 = \operatorname{ctg}^2 \alpha$

C) $h_1/h_2 = 1$

D) $h_1/h_2 = \sin^2 \alpha$

Berilgan:

$$\alpha_1 = \alpha$$

$$\alpha_2 = \frac{\pi}{2} - \alpha$$

$$h_1/h_2 = ?$$

Yechilishi: Ko'tarilish balandliklarini $h = \frac{v_0^2 \sin^2 \alpha}{2g}$ formula orqali topib nisbat olamiz:

$$h_1 = \frac{v_0^2 \sin^2 \alpha_1}{2g}; \quad h_2 = \frac{v_0^2 \sin^2 \alpha_2}{2g}$$

$$\frac{h_1}{h_2} = \frac{\frac{v_0^2 \sin^2 \alpha}{2g}}{\frac{v_0^2 \sin^2 \left(\frac{\pi}{2} - \alpha\right)}{2g}} = \frac{\sin^2 \alpha}{\sin^2 \left(\frac{\pi}{2} - \alpha\right)} = \frac{\sin^2 \alpha}{\cos^2 \alpha} = \operatorname{tg}^2 \alpha$$

$$\frac{h_1}{h_2} = \operatorname{tg}^2 \alpha$$

Javob: A) $h_1/h_2 = \operatorname{tg}^2 \alpha$.

12.23. Yerdagi uch naydan bir xil tezlikda suv otilib chiqmoqda: ular gorizontga nisbatan 60° , 45° va 30° burchak ostida otilib chiqadi. Har bir naydan otilib chiqayotgan suv balandliklari nisbatini va suvning yerga tushish uzoqliklari nisbatini toping. Havoning suv oqimiga qarshiligini hisobga olmang.

A) $h_1 : h_2 : h_3 = 1 : 2 : 3$; $l_1 : l_2 : l_3 = \sqrt{3} : \sqrt{3} : 2$

B) $h_1 : h_2 : h_3 = 3 : 1 : 2$; $l_1 : l_2 : l_3 = 3 : 2 : 3$

C) $h_1 : h_2 : h_3 = 3 : 2 : 1$; $l_1 : l_2 : l_3 = \sqrt{3} : 2 : \sqrt{3}$

D) $h_1 : h_2 : h_3 = 4 : 2 : 3$; $l_1 : l_2 : l_3 = \sqrt{3} : 4 : \sqrt{3}$

Berilgan:

$$\alpha_1 = 60^\circ$$

$$\alpha_2 = 45^\circ$$

$$\alpha_3 = 30^\circ$$

$$h_1 : h_2 : h_3 = ?$$

$$l_1 : l_2 : l_3 = ?$$

Yechilishi: Ko'tarilish balandliklarini $h = \frac{v_0^2 \sin^2 \alpha}{2g}$ formula

orqali, uchish uzoqliklarini esa $S = \frac{v^2 \sin 2\alpha}{g}$ formula orqali topib nisbat olamiz: $h_1 : h_2 : h_3 = 3 : 2 : 1$; $l_1 : l_2 : l_3 = \sqrt{3} : 2 : \sqrt{3}$

Javob: C) $h_1 : h_2 : h_3 = 3 : 2 : 1$; $l_1 : l_2 : l_3 = \sqrt{3} : 2 : \sqrt{3}$.

12.24. Havoning qarshiligini hisobga olmaganida, gorizontga 45° burchak ostida otilgan jism uchish uzoqligining ko'tarilish balandligiga nisbati qanday?

A) 2

B) 3

C) 4

D) 5

Berilgan:

$$\alpha = 45^\circ$$

$$S/h = ?$$

Yechilishi: Ko'tarilish balandligini $h = \frac{v_0^2 \sin^2 \alpha}{2g}$ formula

orqali, uchish uzoqligini esa $S = \frac{v_0^2 \sin 2\alpha}{g}$ formula orqali topib nisbat olamiz:

$$\frac{S}{h} = \frac{\frac{v_0^2 \sin 2\alpha}{g}}{\frac{v_0^2 \sin^2 \alpha}{2g}} = \frac{2 \cdot \sin 2\alpha}{\sin^2 \alpha} = \frac{2}{\frac{1}{2}} = 4 \quad \frac{S}{h} = 4$$

Javob: C) 4.

12.25. Gorizontga 45° burchak ostida otilgan jismning uchish uzoqligi ko'tarilish balandligidan necha marta katta?

A) 4

B) 3

C) 2

D) 1,5

Berilgan:

$$\alpha = 45^\circ$$

$$S/h = ?$$

Yechilishi: Ko'tarilish balandligini $h = \frac{v_0^2 \sin^2 \alpha}{2g}$ formula

orqali, uchish uzoqligini esa $S = \frac{v_0^2 \sin 2\alpha}{g}$ formula orqali topib nisbat olamiz:

$$\frac{S}{h} = \frac{\frac{v_0^2 \sin 2\alpha}{g}}{\frac{v_0^2 \sin^2 \alpha}{2g}} = \frac{2 \cdot \sin 2\alpha}{\sin^2 \alpha} = \frac{2}{\frac{1}{2}} = 4 \quad \frac{S}{h} = 4$$

Javob: A) 4.

12.26. To'pning uchish uzoqligi uning maksimal ko'tarilish balandligidan 4 marta katta. To'p gorizontga qanday burchak ostida otilgan?

- A) 30° B) 45° C) 60° D) 75°

Berilgan:

$$S = 4h$$

$$\alpha = ?$$

Yechilishi: Ko'tarilish balandligini $h = \frac{v_0^2 \sin^2 \alpha}{2g}$ formula

orqali, uchish uzoqligini esa $S = \frac{v_0^2 \sin 2\alpha}{g}$ formula orqali topib nisbat olamiz:

$$\frac{S}{h} = \frac{\frac{v_0^2 \sin 2\alpha}{g}}{\frac{v_0^2 \sin^2 \alpha}{2g}} = \frac{2 \cdot \sin 2\alpha}{\sin^2 \alpha} = \frac{4 \sin \alpha \cdot \cos \alpha}{\sin^2 \alpha} = 4 \operatorname{ctg} \alpha$$

$S = 4h$ ekanidan foydalanamiz:

$$\frac{4h}{h} = 4 \operatorname{ctg} \alpha; \quad 4 \operatorname{ctg} \alpha = 4; \quad \operatorname{ctg} \alpha = 1; \quad \alpha = 45^\circ$$

Javob: B) 45° .

12.27. Gorizontga 45° burchak ostida otilgan disk 20 m ko'tarildi. Uning uchish uzoqligi qanday (m)?

- A) 20 B) 40 C) 80 D) 160

Berilgan:

$$\alpha_2 = 45^\circ$$

$$h = 20 \text{ m}$$

$$S = ?$$

Yechilishi: Ko'tarilish balandligini $h = \frac{v_0^2 \sin^2 \alpha}{2g}$ formulasidan jism qanday tezlik bilan otilganini topib olamiz va

$S = \frac{v_0^2 \sin 2\alpha}{g}$ formula orqali jismning uchish uzoqligini topamiz.

$$v_0 = \frac{\sqrt{2gh}}{\sin \alpha};$$

$$v_0 = \frac{\sqrt{2 \cdot 10 \cdot 20}}{\frac{\sqrt{2}}{2}} = 20\sqrt{2} \text{ m/s}; \quad S = \frac{800 \cdot 1}{10} = 80 \text{ m/s}$$

Javob: C) 80.

12.28. Uchish uzoqligi ko'tarilish balandligidan 4 marta ortiq bo'lishi uchun jism gorizontga qanday burchak ostida otilishi kerak?

- A) $\arctg 3$ B) $\arctg 2$ C) 30° D) 45°

$$\begin{array}{l} \text{Berilgan:} \\ S = 4h \\ \alpha = ? \end{array}$$

Yechilishi: Ko'tarilish balandligini $h = \frac{v_0^2 \sin^2 \alpha}{2g}$ formula orqali,

uchish uzoqligini esa $h = \frac{v_0^2 \sin^2 \alpha}{2g}$ formula orqali topib nisbat olamiz:

$$\frac{S}{h} = \frac{\frac{v_0^2 \sin 2\alpha}{g}}{\frac{v_0^2 \sin^2 \alpha}{2g}} = \frac{2 \cdot \sin 2\alpha}{\sin^2 \alpha} = \frac{4 \sin \alpha \cdot \cos \alpha}{\sin^2 \alpha} = 4 \operatorname{ctg} \alpha$$

$S = 4h$ ekanidan foydalanamiz:

$$\frac{4h}{h} = 4 \operatorname{ctg} \alpha; 4 \operatorname{ctg} \alpha = 4; \operatorname{ctg} \alpha = 1; \alpha = 45^\circ$$

Javob: D) 45° .

12.29. To'pning uchish uzoqligi uning maksimal ko'tarilish balandligidan $4\sqrt{3}$ marta katta bo'lishi uchun to'pni gorizontga nisbatan qanday burchak ostida otish kerak?

- A) 15° B) 75° C) 60° D) 30°

$$\begin{array}{l} \text{Berilgan:} \\ S = 4\sqrt{3}h \\ \alpha = ? \end{array}$$

Yechilishi: Ko'tarilish balandligini $h = \frac{v_0^2 \sin^2 \alpha}{2g}$ formula

orqali, uchish uzoqligini esa $S = \frac{v_0^2 \sin 2\alpha}{g}$ formula orqali topib nisbat olamiz:

$$\frac{S}{h} = \frac{\frac{v_0^2 \sin 2\alpha}{g}}{\frac{v_0^2 \sin^2 \alpha}{2g}} = \frac{2 \cdot \sin 2\alpha}{\sin^2 \alpha} = \frac{4 \sin \alpha \cdot \cos \alpha}{\sin^2 \alpha} = 4 \operatorname{ctg} \alpha$$

$S = 4\sqrt{3}h$ ekanidan foydalanamiz!

$$\frac{4\sqrt{3}h}{h} = 4 \operatorname{ctg} \alpha; 4\sqrt{3} = 4 \operatorname{ctg} \alpha; \operatorname{ctg} \alpha = \sqrt{3}; \alpha = 30^\circ$$

Javob: D) 30° .

12.30. Ko'tarilish balandligi uchish uzoqligidan 2 marta katta bo'lishi uchun jismni gorizontga qanday burchak ostida otish kerak?

- A) 45° B) $\arctg 8$ C) $\arctg 2$ D) 60°

Berilgan:

$$h = 2S$$

$$\alpha = ?$$

Yechilishi: Ko'tarilish balandligini $h = \frac{v_0^2 \sin^2 \alpha}{2g}$ formula

orqali, uchish uzoqligini esa $S = \frac{v_0^2 \sin 2\alpha}{g}$ formula orqali topib nisbat olamiz:

$$\frac{h}{S} = \frac{\frac{v_0^2 \sin^2 \alpha}{2g}}{\frac{v_0^2 \sin 2\alpha}{g}} = \frac{\sin^2 \alpha}{2 \cdot \sin 2\alpha} = \frac{\sin^2 \alpha}{4 \sin \alpha \cdot \cos \alpha} = \frac{1}{4 \operatorname{ctg} \alpha}$$

$h = 2S$ ekanidan foydalanamiz!

$$\frac{2S}{S} = \frac{1}{4 \operatorname{ctg} \alpha}; \quad \operatorname{ctg} \alpha = \frac{1}{8}; \quad \operatorname{tg} \alpha = 8 \quad \alpha = \operatorname{arctg} 8$$

Javob: B) $\operatorname{arctg} 8$.

12.31. Gorizontga α burchak ostida v tezlik bilan otilgan snaryad yerga tushguncha qancha vaqt uchadi?

A) $t = \frac{v \sin \alpha}{g}$

B) $t = \frac{v^2 \sin \alpha}{g}$

C) $t = \frac{v^2 \sin \alpha}{2g}$

D) $t = \frac{2v \sin \alpha}{g}$

Berilgan:

$$v; \alpha$$

$$t = ?$$

Yechilishi: Gorizontga burchak ostida otilgan jismning uchish vaqti ifodadan topiladi.

$$t = \frac{2v \sin \alpha}{g}$$

Javob: D) $t = \frac{2v \sin \alpha}{g}$

12.32. Gorizontga 45° burchak ostida 10 m/s tezlik bilan otilgan tosh qanday (m) uzoqlikka borib tushadi?

A) 2,5

B) 5

C) 10

D) 8,7

Berilgan:

$$\alpha = 45^\circ$$

$$v = 10 \text{ m/s}$$

$$S = ?$$

Yechilishi: Bu masalani $S = \frac{v_0^2 \sin 2\alpha}{g}$ formula orqali yechamiz.

$$S = \frac{10^2 \cdot 1}{10} = 10 \text{ m}$$

Javob: C) 10.

12.33. Jism gorizontga 60° burchak ostida 20 m/s tezlik bilan otildi. Jism maksimal balandlikka ko'tarilgan nuqtada trayektoriya egrilik radiusi qanday bo'ladi (m)?

- A) 5 B) 10 C) 20 D) 40

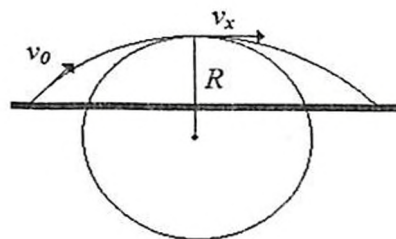
Berilgan:

$$\alpha = 60^\circ$$

$$v_0 = 20 \text{ m/s}$$

$$R = ?$$

Yechilishi: Bu masalani yechishda markazga intilma tezlanish formulalaridan foydalanamiz. Markazga intilma tezlanish bu holatda erkin tushish tezlanishiga teng bo'ladi.



$$g = \frac{v_x^2}{R} \Rightarrow R = \frac{v_x^2}{g};$$

$$v_x = v_0 \cos \alpha \text{ ekanidan foydalanamiz. } R = \frac{v_0^2 \cos^2 \alpha}{g} = 10 \text{ m}$$

Javob: B) 10.

12.34. Gorizontga burchak ostida otilgan jismning ko'tarilish balandligi 3 m, trayektoriya eng yuqori nuqtasidagi egrilik radiusi 2 m bo'lsa, jism gorizontga qanday burchak ostida otilgan?

- A) 45° B) 75° C) 60° D) 80°

Berilgan:

$$h = 3 \text{ m}$$

$$R = 2 \text{ m}$$

$$\alpha = ?$$

Yechilishi: $R = \frac{v_0^2 \cos^2 \alpha}{g}$ va $h = \frac{v_0^2 \sin^2 \alpha}{2g}$ formulalardagi

jismning boshlang'ich tezligini topib, tenglashtiramiz.

$$v_0^2 = \frac{gR}{\cos^2 \alpha}; \quad v_0^2 = \frac{2gh}{\sin^2 \alpha}$$

$$\frac{gR}{\cos^2 \alpha} = \frac{2gh}{\sin^2 \alpha}; \quad \text{tg}^2 \alpha = \frac{2h}{R}$$

$$\text{tg} \alpha = \sqrt{\frac{2h}{R}}; \quad \text{tg} \alpha = \sqrt{\frac{2 \cdot 3}{2}} = \sqrt{3} \quad \alpha = 60^\circ$$

Javob: C) 60° .

II bob. DINAMIKA ASOSLARI

13-§. Nyutonning birinchi va ikkinchi qonunlari

13.1. Kuch deb nimaga aytiladi?

- A) jismlarning o'zaro ta'sirini miqdor va yo'nalish jihatdan xarakterlaydigan kattalikka
- B) jismlarning o'zaro ta'sirini faqat miqdor jihatdan xarakterlaydigan kattalikka
- C) jismlarning o'zaro ta'sirini faqat yo'nalish jihatdan xarakterlaydigan kattalikka
- D) jismning inertlik xossasini xarakterlaydigan kattalikka

Kuch — vektor kattalik bo'lib, jismga boshqa jismlar va maydonlar tomonidan ko'rsatilayotgan mexanik ta'sirning o'lchovi hisoblanadi. Bu ta'sir natijasida jism tezlanish olishi, o'zining shakli yoki o'lchamlarini o'zgartirishi mumkin.

Javob: A) jismlarning o'zaro ta'sirini miqdor va yo'nalish jihatdan xarakterlaydigan kattalikka.

13.2. Quyidagilarning qaysi biri Nyutonning birinchi qonuniga zid emas?

- A) agar jismga tashqi kuchlar ta'siri o'zaro muvozanatlashgan bo'lsa, u boshqa har qanday jismga nisbatan o'zining to'g'ri chiziqli tekis harakatini saqlaydi
- B) tashqi kuchlar ta'sir etmaydigan jism boshqa har qanday jismlarga nisbatan to'g'ri chiziqli tekis harakat holatini saqlaydi
- C) tashqi ta'sirlar o'zaro muvozanatlashgan yoki tashqi kuchlar ta'sir etmaydigan jismlar bir-birlariga nisbatan hamisha to'g'ri chiziqli tekis harakat qiladilar
- D) jismga ta'sir etayotgan tashqi kuchlar yig'indisi nolga teng bo'lsa, bu jism boshqa har qanday jismga nisbatan o'zining tinchlik holatini yoki to'g'ri chiziqli tekis harakatini saqlaydi

Nyutonning birinchi qonuni quyidagicha ta'riflanadi: har qanday jismga boshqa jismlar ta'sir qilmasa yoki ta'sirlar kompensatsiyalangan bo'lsa, u o'zining tinch yoki to'g'ri chiziqli tekis harakat holatini saqlaydi.

Javob: C) tashqi ta'sirlar o'zaro muvozanatlashgan yoki tashqi kuchlar ta'sir etmaydigan jismlar bir-birlariga nisbatan hamisha to'g'ri chiziqli tekis harakat qiladilar.

13.3. Jismga ta'sir etuvchi kuchlarning teng ta'sir etuvchisi nolga teng. U inersial sanoq sistemada qanday harakat qiladi?

- A) tezligi o'zgarmas bo'ladi
- B) tezligi oshib boradi
- C) tezligi kamayib boradi
- D) tezligi albatta nolga teng bo'ladi

Agar jismga ta'sir etuvchi kuchlarning teng ta'sir etuvchisi nolga teng bo'lsa, Nyutonning birinchi qonuniga asosan bu jism tinch yoki to'g'ri chiziqli tekis harakt holatini saqlaydi.

Javob: A) tezligi o'zgarmas bo'ladi.

13.4. Jismga ta'sir qilayotgan hamma kuchlarning vektor yig'indisi nolga teng bo'lsa, jism qanday harakat qiladi?

- A) tezligi ortib boradi
- B) aylana bo'ylab doimiy tezlik bilan
- C) to'g'ri chiziq bo'ylab doimiy tezlik bilan
- D) tezligi kamayib boradi

Agar jismga ta'sir etuvchi kuchlarning teng ta'sir etuvchisi nolga teng bo'lsa, Nyutonning birinchi qonuniga asosan, bu jism tinch yoki to'g'ri chiziqli tekis harakt holatini saqlaydi.

Javob: C) to'g'ri chiziq bo'ylab doimiy tezlik bilan.

13.5. Agar inersial sanoq tizimiga nisbatan harakatdagi jismga ta'sir etuvchi kuchlarning vektor yig'indisi nolga teng bo'lsa, jismning harakat trayektoriyasi qanday bo'ladi?

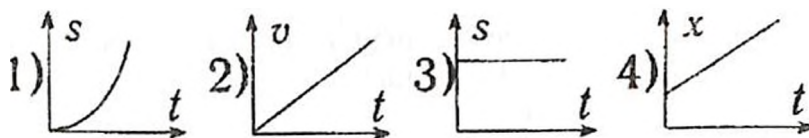
- A) parabola
- B) nuqta
- C) to'g'ri chiziq
- D) aylana

Agar jismga ta'sir etuvchi kuchlarning teng ta'sir etuvchisi nolga teng bo'lsa, Nyutonning birinchi qonuniga asosan, bu jism tinch yoki to'g'ri chiziqli tekis harakt holatini saqlaydi.

Javob: C) to'g'ri chiziq.

13.6. Moddiy nuqtaga ta'sir etuvchi kuchlar muvozanatda bo'lgandagi harakatlar qaysi grafiklarda tasvirlangan?

- A) 1, 2 B) 2, 3 C) 3, 4 D) 2, 4



Agar jismga ta'sir etuvchi kuchlarning teng ta'sir etuvchisi nolga teng bo'lsa, Nyutonning birinchi qonuniga asosan, bu jism tinch yoki to'g'ri chiziqli tekis harakt holatini saqlaydi. Demak, uning tezligi vaqt o'tishi bilan o'zgarmasligi kerak. Yo'lning vaqtga bog'liqlik grafigida esa vaqt o'tishi bilan yo'l o'zgarmasligi yoki bir tekisda ortishi kerak. Uchinchi va to'rtinchi grafiklar mos keladi.

Javob: C) 3, 4.

13.7. Nyutonning birinchi qonunini tavsiflovchi ifodani ko'rsating.

- A) $v = \text{const}$, $F = 0$ B) $F = \text{const}$, $v = at$
C) $F = \text{const}$, $v = v_0 + at$ D) $F = 0$, $S = \text{const}$

Nyutonning birinchi qonuniga asosan, jismga ta'sir etuvchi kuchlarning teng ta'sir etuvchisi nolga teng bo'lsa, jism tinch turishi kerak yoki o'zgarmas tezlik bilan to'g'ri chiziqli trayektoriya bo'ylab harakatlanishi kerak.

Javob: A) $v = \text{const}$, $F = 0$

13.8. Avtomobil yo'lning to'g'ri chiziqli gorizontal qismida doimiy tezlik bilan harakat qilmoqda. Avtomobilga qo'yilgan kuchlarning teng ta'sir etuvchisi qanday yo'nalgan?

- A) $F=0$ B) yuqoriga
C) pastga D) oldinga

Avtomobil gorizontal yo'lda to'g'ri chiziqli tekis harakat qilishi uchun Nyutonning birinchi qonuniga asosan, unga ta'sir qiluvchi kuchlarning teng ta'sir etuvchisi nolga teng bo'lishi kerak.

Javob: A) $F = 0$.

13.9. Avtomobil to'g'ri gorizontal yo'lda o'zgarmas tezlik bilan harakatlanmoqda. Unga ta'sir qilayotgan kuchlarning teng ta'sir etuvchisi haqida nima deyish mumkin?

- A) qarshilik kuchiga teng va harakat yo'nalishida
B) og'irlik va ishqalanish kuchlari yig'indisiga teng

- C) og'irlik kuchiga teng va yuqoriga yo'nalgan
D) TJY

Avtomobilning tortish kuchi qarshilik kuchiga teng bo'lganda u yo'lning gorizontal qismida o'zgarmas tezlik bilan to'g'ri chiziqli trayektoriya bo'ylab harakatlanadi.

Javob: D) TJY.

13.10. To'g'ri chiziqli tekis tezlanuvchan harakatda bo'lgan jismga ta'sir etuvchi kuch yoki kuchlar teng ta'sir etuvchisining ...

- A) moduli va yo'nalishi o'zgaradi
B) yo'nalishi va moduli o'zgarmaydi
C) moduli o'zgarmaydi, yo'nalishi uzluksiz o'zgaradi
D) moduli o'zgaradi, yo'nalishi o'zgarmay qoladi

Jism to'g'ri chiziqli trayektoriya bo'ylab harakatlanishi uchun unga ta'sir qiluvchi kuchlarning teng ta'sir etuvchisining yo'nalishi o'zgarmasligi kerak. Tekis tezlanuvchan harakatlanishi uchun esa teng ta'sir etuvchi kuchning moduli ham o'zgarmasligi kerak.

Javob: B) yo'nalishi va moduli o'zgarmaydi.

13.11. Avtomobil gorizontal yo'lda tekis harakatlanmoqda. Qarshilik koeffitsiyenti 2 marta ortsa, tezligi o'zgarmay qolishi uchun avtomobilning tortish kuchi nini qanday o'zgartirish kerak?

- A) 2 marta orttirish
B) 2 marta kamaytirish
C) 4 marta orttirish
D) 4 marta kamaytirish

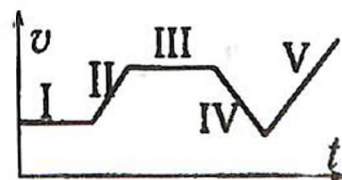
Avtomobil gorizontal yo'lda tekis harakatlanishi uchun tortish kuchi qarshilik kuchiga teng bo'lishi kerak. Qarshilik koeffitsiyenti ikki marta ortsa, qarshilik kuchi ham ikki marta ortadi. Avtomobilning tezligi o'zgarmasligi uchun uning tortish kuchi ham ikki marta ortishi kerak.

Javob: A) 2 marta orttirish.

13.12. Chizmadagi qaysi qismlarda ishqalanish kuchi tortish kuchiga teng? (v — harakat tezligi, t — vaqt)

- A) III B) I, III C) II D) IV

Jismga ikkita kuch ta'sir qilyapti va ular qarama-qarshi yo'nalganlar. Bu kuchlar teng bo'lganda teng ta'sir etuvchi kuch nolga teng bo'ladi, jism esa tekis harakat



qiladi. Ya'ni, tezlik o'zgarmas bo'ladi. Chizmadagi I va III chiziqlar o'zgarmas tezlikka mos keladi.

Javob: B) I, III.

13.13. Teng ta'sir etuvchi kuch yoki natijalovchi kuch deb qanday kuchga aytiladi?

A) ishqalanish kuchidan tashqari jismga qo'yilgan barcha kuchlarning algebraik yig'indisiga teng bo'lgan kuch

B) jismga qo'yilgan kuchlarning biror o'qdagi proyeksiyalarining yig'indisiga teng bo'lgan kuch

C) jismga qo'yilgan kuchlarning geometrik yig'indisiga teng bo'lgan kuch

D) jismga qo'yilgan kuchlarning algebraik yig'indisiga teng bo'lgan kuch

Kuch vektor kattalik bo'lganligi uchun uning yo'nalishini ham hisobga olish kerak. Ya'ni, jismga ta'sir qiluvchi kuchlarning vektor (geometrik) yig'indisi shu kuchlarning teng ta'sir etuvchisi deyiladi.

Javob: C) jismga qo'yilgan kuchlarning geometrik yig'indisiga teng bo'lgan kuch.

13.14. Modullari 6 N va 8 N bo'lgan o'zaro perpendikular ikki kuch jismning bir nuqtasiga qo'yilgan. Bu kuchlar teng ta'sir etuvchisining moduli qanday (N)?

A) 14

B) 2

C) 7

D) 10

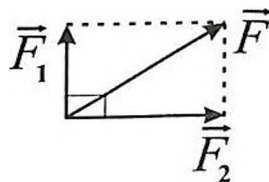
Berilgan:

$$F_1 = 6 \text{ N}$$

$$F_2 = 8 \text{ N}$$

$$F = ?$$

Yechilishi: chizmadan ko'rinib turibdiki, teng ta'sir etuvchi F kuch gipatenusa bo'lyapti, uni Pifagor teoremasidan foydalanib topamiz:



$$F^2 = F_1^2 + F_2^2 \Rightarrow F = \sqrt{F_1^2 + F_2^2}$$

$$F = \sqrt{36 + 64} = 10 \text{ N}$$

Javob: D) 10.

13.15. Jismning bir nuqtasiga 3 N dan bo'lgan ikkita kuch bir-biriga 120° burchak ostida ta'sir etmoqda. Shu kuchlarning teng ta'sir etuvchisi qanday (N)?

A) 9

B) 6

C) 4,5

D) 3

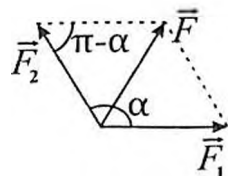
Berilgan:

$$F_1 = F_2 = F_0 = 3 \text{ N}$$

$$\alpha = 120^\circ$$

$$F = ?$$

Yechilishi: teng ta'sir etuvchi kuchni kosinuslar teoremasidan foydalanib topamiz.



$$F^2 = F_1^2 + F_2^2 - 2 \cdot F_1 \cdot F_2 \cdot \cos(\pi - \alpha)$$

Masala shartiga ko'ra, $F_1 = F_2 = F_0$ buni va $\cos(\pi - \alpha) = -\cos \alpha$ ekanligini inobatga olib, quyidagini yozamiz:

$$F^2 = F_0^2 + F_0^2 + 2 \cdot F_0 \cdot F_0 \cdot \cos \alpha$$

$$F = \sqrt{F_0^2 + F_0^2 + 2 \cdot F_0 \cdot F_0 \cdot \cos \alpha} = F_0 \cdot \sqrt{2 \cdot (1 + \cos \alpha)} = 3 \cdot \sqrt{2 \cdot \left(1 - \frac{1}{2}\right)} = 3N$$

Javob: D) 3.

13.16. Jismning bir nuqtasiga 2 ta 10 N dan bo'lgan kuchlar o'zaro 60° burchak ostida ta'sir etmoqda. Shu kuchlarning teng ta'sir etuvchisini toping (N).

$$\cos 60^\circ = 0,5; \quad \sqrt{3} = 1,73$$

A) 20

B) 17,3

C) 15,3

D) 10

Berilgan:

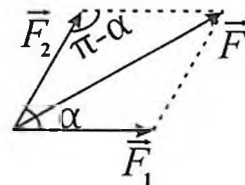
$$F_1 = F_2 = F_0 = 10 \text{ N}$$

$$\alpha = 60^\circ$$

$$F = ?$$

Yechilishi: teng ta'sir etuvchi kuchni kosinuslar teoremasidan foydalanib topamiz.

$$F^2 = F_1^2 + F_2^2 - 2 \cdot F_1 \cdot F_2 \cdot \cos(\pi - \alpha)$$



Masala shartiga ko'ra, $F_1 = F_2 = F_0$ buni va $\cos(\pi - \alpha) = -\cos \alpha$ ekanligini inobatga olib, quyidagini yozamiz:

$$F^2 = F_0^2 + F_0^2 + 2 \cdot F_0 \cdot F_0 \cdot \cos \alpha$$

$$F = \sqrt{F_0^2 + F_0^2 + 2 \cdot F_0 \cdot F_0 \cdot \cos \alpha} = F_0 \cdot \sqrt{2 \cdot (1 + \cos \alpha)} = 10 \cdot \sqrt{2 \cdot \left(1 - \frac{1}{2}\right)} \approx 17,3 \text{ N}$$

Javob: B) 17,3.

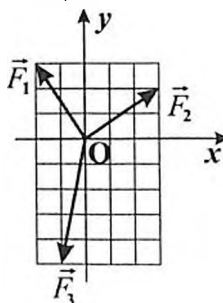
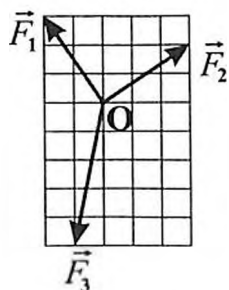
13.17. Rasmdagi O nuqtaga qo'yilgan kuchlarning teng ta'sir etuvchisi qanday (N)?

A) $2\sqrt{26}$

B) $2\sqrt{13}$

C) 0

D) $\sqrt{13}$



Berilgan uchta kuchning o'qlardagi proyeksiyalarini topamiz. Bunda har bir katakni 1 N kuchga to'g'ri keladi deb olamiz.

$$F_x = F_{1x} + F_{2x} + F_{3x} = -2 + 3 - 1 = 0$$

$$F_y = F_{1y} + F_{2y} + F_{3y} = 3 + 2 - 5 = 0$$

Natijaviy kuch $F = \sqrt{F_x^2 + F_y^2} = 0$

Javob: C) 0.

13.18. Agar nuqtaga ta'sir qilayotgan ikkita $F_1 = F_2 = 5\text{ N}$ kuchlarning teng ta'sir etuvchisi $5\sqrt{3}\text{ N}$ ga teng bo'lsa, kuchlar orasidagi burchak qanday?

- A) 90° B) 60° C) 45° D) 30°

Berilgan:

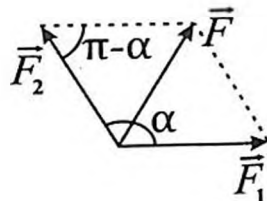
$$F_1 = F_2 = 5\text{ N}$$

$$F = 5\sqrt{3}\text{ N}$$

$$\alpha = ?$$

Yechilishi: teng ta'sir etuvchi kuchni kosinuslar teoremasidan foydalanib topamiz.

$$F^2 = F_1^2 + F_2^2 - 2 \cdot F_1 \cdot F_2 \cdot \cos(\pi - \alpha)$$



$\cos(\pi - \alpha) = -\cos \alpha$ ekanligini inobatga olib quyidagini yozamiz:

$$F^2 = F_0^2 + F_0^2 + 2 \cdot F_0 \cdot F_0 \cdot \cos \alpha \Rightarrow \cos \alpha = \frac{F^2 - F_1^2 - F_2^2}{2 \cdot F_1 \cdot F_2} = \frac{1}{2}$$

$$\alpha = \arccos\left(\frac{1}{2}\right) = 60^\circ$$

Javob: B) 60° .

13.19. Kuch birligini ko'rsating.

- A) $\text{kg} \cdot \text{m/s}^2$ B) $\text{kg} \cdot \text{m/s}$
C) $\text{kg} \cdot \text{m}^2/\text{s}^2$ D) $\text{kg}^2 \cdot \text{m/s}^2$

Nyutonning ikkinchi qonuniga asosan $F = ma$

$$[F] = [m] \cdot [a] = 1\text{ kg} \cdot 1 \frac{\text{m}}{\text{s}^2} = 1\text{ N}$$

Javob: A) $\text{kg} \cdot \text{m/s}^2$.

13.20. Bir xil kuch ta'sirida harakatlanayotgan uchta jismning tezlanishlari $a_1 > a_2 > a_3$ munosabatda bo'lsa, ularning qaysi biri eng inert?

- A) barchasi bir xil B) birinchisi
C) ikkinchisi D) uchinchisi

Berilgan:

$$a_1 > a_2 > a_3 \\ F_1 = F_2 = F_3 = F$$

Yechilishi: inertlik, bu jismlarning boshlang'ich holatini saqlashga intilishidir. Jismlarning inertligini xarakterlovchi kattalik, bu massa hisoblanadi. Agar jismning massasi qancha katta bo'lsa, bu jism shuncha inert hisoblanadi.

Uchala jism harakati uchun Nyutonning ikkinchi qonunini tatbiq qilamiz:

$$a_1 = \frac{F}{m_1}; \quad a_2 = \frac{F}{m_2}; \quad a_3 = \frac{F}{m_3}$$

Bu ifodalardan ko'rinib turibdiki, jismning tezlanishi massaga teskari proporsional. Ya'ni, bir xil kuch ta'sir qilayotgan jismlarning qaysi birining massasi katta bo'lsa, kichik tezlanish oladi. Masala shartiga ko'ra, 3-jismning tezlanishi kichik. Demak, uning massasi katta va u qolgan ikkitasiga nisbatan inertliroqdir.

Javob: D) uchinchi.

13.21. Jismning inertligi nima bilan xarakterlanadi?

- A) hajm B) og'irlik
C) zichlik D) massa

Jismlarning inertligini xarakterlovchi kattalik, bu massa hisoblanadi. Agar jismning massasi qancha katta bo'lsa, bu jism shuncha inert hisoblanadi.

Javob: D) massa.

13.22. Bir xil hajmli to'rtta jismning zichliklari $\rho_1 < \rho_2 < \rho_3 < \rho_4$ munosabatda bo'lsa, ulardan qaysi birining inertligi eng katta?

- A) 1 B) 2 C) 3 D) 4

Jismning inertlik o'lchovi sifatida massa qaraladi. Jismning massasi uning hajmi va zichligining ko'paytmasiga teng: $m = \rho \cdot V$. Masala shartiga ko'ra, jismlarning hajmlari bir xil, lekin zichliklari har xil. Demak, bir xil hajmli jismlarda qaysi birining zichligi katta bo'lsa, o'sha jism massasi katta va inert bo'lar ekan.

$$m_1 < m_2 < m_3 < m_4$$

Javob: D) 4.

13.23. O'zgarmas bir xil kuch ta'sirida to'g'ri chiziqli harakat qilayotgan jismlarning harakat tenglamalari $x_1 = 5t^2$ va $x_2 = 2t^2$ bo'lsa, ularning massalari necha marta farq qiladi?

- A) 2,5 B) 3 C) 4 D) 5

Berilgan:

$$x_1 = 5t^2$$

$$x_2 = 2t^2$$

$$F_1 = F_2 = F$$

$$m_1/m_2 = ?$$

Yechilishi: Nyutonning ikkinchi qonuniga asosan quyidagilarni yozamiz:

$$\begin{cases} F = m_1 a_1 \\ F = m_2 a_2 \end{cases} \Rightarrow m_1 a_1 = m_2 a_2 \Rightarrow \frac{m_2}{m_1} = \frac{a_1}{a_2}$$

Tezlanishlarini harakat tenglamalaridan aniqlaymiz. Harakat tenglamasining ko'rinishi quyidagicha:

$$x = x_0 + v_{0x} \cdot t + \frac{a_x}{2} t^2$$

Bu tenglama bilan masala shartida berilgan tenglamalarni solishtirib, jismlarning tezlanishlarini topamiz. t^2 ning oldida turgan ifoda $\frac{a_x}{2}$ birinchi tenglamada 5 ga teng (ya'ni $a_1/2 = 5$), ikkinchi tenglamada esa 2 ga teng (ya'ni $a_2/2 = 2$). Demak, $a_1 = 10 \text{ m/s}^2$ va $a_2 = 4 \text{ m/s}^2$

$$\frac{m_2}{m_1} = \frac{a_1}{a_2} = 2,5$$

Javob: A) 2,5.

13.24. Massasi 6 t bo'lgan, yuk ortilmagan avtomobil $0,6 \text{ m/s}^2$ tezlanish bilan harakatlana boshladi. Agar u o'sha tortish kuchida joyidan $0,4 \text{ m/s}^2$ tezlanish bilan qo'zg'alsa, unga ortilgan yukning massasi necha tonna?

A) 9

B) 4

C) 2

D) 3

Berilgan:

$$m_1 = 6 \text{ t}$$

$$a_1 = 0,6 \text{ m/s}^2$$

$$a_2 = 0,4 \text{ m/s}^2$$

$$F = \text{const}$$

$$\Delta m = ?$$

Yechilishi: Nyutonning ikkinchi qonuniga asosan quyidagilarni yozamiz:

$$\begin{cases} F = m_1 \cdot a_1 \\ F = m_2 \cdot a_2 \end{cases} \Rightarrow m_1 \cdot a_1 = m_2 \cdot a_2 \Rightarrow m_2 = \frac{a_1}{a_2} \cdot m_1$$

$$\Delta m = m_2 - m_1 = m_1 \cdot \left(\frac{a_1}{a_2} - 1 \right) = 6 \cdot \left(\frac{0,6}{0,4} - 1 \right) = 3 \text{ t}$$

Javob: D) 3.

13.25. 6 N kuch ta'sir etayotgan jismning harakat tenglamasi $x = 5 + 2t + 3t^2$ (m) ko'rinishda bo'lsa, jismning massasi qanday (kg)?

A) 1

B) 2

C) 6

D) 12

Berilgan:

$$F = 6 \text{ N}$$

$$x = 5 + 2t + 3t^2$$

$$m = ?$$

Yechilishi: Harakat tenglamasining ko'rinishi quyidagicha:

$$x = x_0 + v_{0x} \cdot t + \frac{a_x}{2} t^2$$

Bu tenglama bilan masala shartida berilgan tenglama $x = 5 + 2t + 3t^2$ ni solishtirib, jismning tezlanishini topamiz.

$$\frac{a}{2} = 3 \text{ m/s}^2 \Rightarrow a = 6 \text{ m/s}^2$$

Nyutonning ikkinchi qonuniga asosan

$$m = \frac{F}{a} = \frac{6}{6} = 1 \text{ kg}$$

Javob: A) 1.

13.26. Moddiy nuqtaga 6 N kuch ta'sir etadi. Uning harakat tezligi $v_x = 10 + 2t$ qonun bo'yicha o'zgaradi. Nuqtaning massasi qanday (kg)?

A) 0,6

B) 3

C) 6

D) 12

Berilgan:

$$F = 6 \text{ N}$$

$$v = 10 + 2t$$

$$m = ?$$

Yechilishi: tezlikning o'zgarish tenglamasidan tezlanishni topamiz.

$$\begin{cases} v = v_0 + at \\ v = 10 + 2t \end{cases} \Rightarrow a = 2 \text{ m/s}^2$$

Nyutonning ikkinchi qonuniga asosan

$$a = \frac{F}{m} \Rightarrow m = \frac{F}{a} = \frac{6}{2} = 3 \text{ kg}$$

Javob: B) 3.

13.27. O'zgarmas kuch ta'sirida harakat boshlagan jism birinchi sekundda 0,5 m yo'l bosdi. Agar jismning massasi 25 kg bo'lsa, bu kuch qanday (N) bo'lgan?

A) 6,25

B) 12,5

C) 20

D) 25

Berilgan:

$$n = 1 \text{ s}$$

$$\Delta S_n = 0,5 \text{ m}$$

$$m = 25 \text{ kg}$$

$$F = ?$$

Yechilishi: n -sekundda bosib o'tilgan yo'l tezlanishini topamiz.

$$\Delta S_n = \frac{a \cdot (2 \cdot n - 1)}{2} \Rightarrow a = \frac{2 \cdot \Delta S_n}{2 \cdot n - 1} = \frac{2 \cdot 0,5}{2 \cdot 1 - 1} = 1 \text{ m/s}^2$$

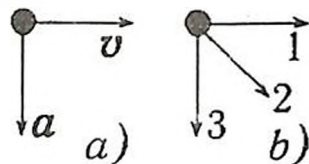
Nyutonning ikkinchi qonunidan kuchni aniqlaymiz.

$$F = m \cdot a = 25 \cdot 1 = 25 \text{ N}$$

Javob: D) 25.

13.28. Jismning tezlik v va tezlanish a vektorlari a -rasmda ko'rsatilgan. b -rasmdagi qaysi yo'nalishlar teng ta'sir etuvchi kuch yo'nalishiga to'g'ri keladi?

- A) 1, 3 B) 3 C) 2 D) 1



Teng ta'sir etuvchi kuch har doim tezlanish yo'nalishida bo'ladi. Demak, chizmadagi 3 yo'nalish bilan mos keladi.

Javob: B) 3.

13.29. 10 sm radiusli po'lat sharga $0,2 \text{ m/s}^2$ tezlanish beradigan kuchni aniqlang (N). $\rho_p = 7800 \text{ kg/m}^3$.

- A) 6,5 B) 3,9 C) 5 D) 7,8

Berilgan:

$$R = 10 \text{ sm} = 0,1 \text{ m}$$

$$a = 0,2 \text{ m/s}^2$$

$$\rho_p = 7800 \text{ kg/m}^3$$

$$F = ?$$

Yechilishi: Nyutonning ikkinchi qonunidan foydalanamiz

$$F = ma; \quad m = \rho V; \quad V = \frac{4}{3} \pi R^3$$

$$F = \frac{4}{3} \pi R^3 \cdot \rho \cdot a = \frac{4}{3} \cdot 3,14 \cdot 10^{-3} \cdot 7,8 \cdot 10^3 \cdot 0,2 = 6,5 \text{ N}$$

Javob: A) 6,5.

13.30. Rasmda ko'rsatilgan, massalari $m_1 = 0,4 \text{ kg}$ va $m_2 = 0,6 \text{ kg}$ bo'lgan ikkita brusok $F = 2 \text{ N}$ kuch ta'sirida ishqalanishsiz tekis tezlanuvchan harakat qilmoqda. m_2 massali brusokka qanday (N) kuch ta'sir qilmoqda?

- A) 0,6 B) 0,3 C) 0,9 D) 1,2



Berilgan:

$$m_1 = 0,4 \text{ kg}$$

$$m_2 = 0,6 \text{ kg}$$

$$F = 2 \text{ N}$$

$$T = ?$$

Yechilishi: Nyutonning ikkinchi qonuniga asosan, jismga ta'sir etuvchi kuchlarning teng ta'sir etuvchisi shu jismga tezlanish berishi kerak.

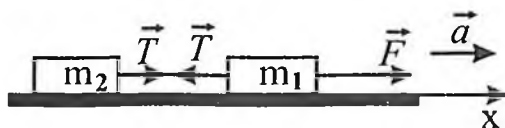
$$\text{1-jism uchun: } \vec{F} + \vec{T} = m_1 \vec{a}$$

$$\text{2-jism uchun: } \vec{T} = m_2 \vec{a}$$

barcha kuchlarni x o'qiga proyeksiyalaymiz:

$$\text{1-jism uchun: } F - T = m_1 a$$

$$\text{2-jism uchun: } T = m_2 a$$



Bu ikkita tenglamani sistema qilib yechib, ikkinchi jismga ta'sir qilayotgan kuch, ya'ni ipning taranglik kuchi T ni topamiz:

$$F - T + T = m_1 a + m_2 a \Rightarrow F = (m_1 + m_2) a \Rightarrow a = \frac{F}{m_1 + m_2}$$

$$T = m_2 a = \frac{m_2}{m_1 + m_2} \cdot F \quad T = \frac{0,6}{0,4 + 0,6} \cdot 2 = 1,2 \text{ N}$$

Javob: D) 1,2.

13.31. Massasi 20 g bo'lgan jism 0,2 m radiusli aylana bo'ylab 90 m/s tezlik bilan tekis harakatlanmoqda. Markazga intilma kuch qanday (N)?

A) 405

B) 81

C) 8100

D) 810

Berilgan:

$$m = 20 \text{ g} = 0,02 \text{ kg}$$

$$R = 0,2 \text{ m}$$

$$v = 90 \text{ m/s}$$

$$F_{m.i.} = ?$$

Yechilishi: markazga intilma kuch ifodasidan foydalanamiz:

$$F_{m.i.} = m \cdot a_{m.i.} = m \frac{v^2}{R} = 0,02 \cdot \frac{8100}{0,2} = 810 \text{ N}$$

Javob: D) 810.

13.32. Chizmada keltirilgan sistemaning tezlanishini toping. Ishqalanish kuchini hisobga olmang.

A) $g/4$

B) $g/3$

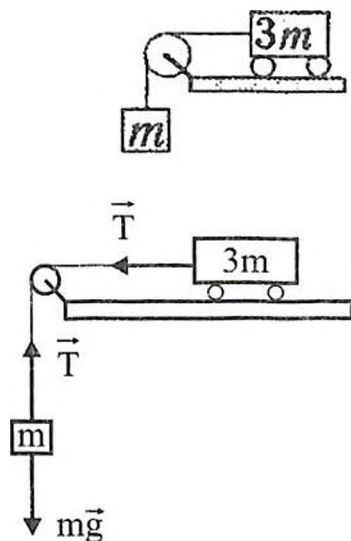
C) $g/2$

D) $2g/3$

Yechilishi: Ikkala jismga ta'sir qiluvchi kuchlar bo'yicha Nyutonning ikkinchi qonunini yozamiz. Jismlar o'zaro bog'langanligi uchun, bir xil tezlanish bilan harakat qiladilar.

$$\begin{cases} mg - T = ma \\ T = 3ma \end{cases} \Rightarrow mg = 4ma \Rightarrow a = \frac{g}{4}$$

Javob: A) $g/4$.



13.33. Traktor yuk ortilmagan pritsepga $0,4 \text{ m/s}^2$, yuk ortilganiga esa $0,1 \text{ m/s}^2$ tezlanish beradi. Bir-biriga ulangan bu pritseplarga traktor qanday tezlanish beradi (m/s^2)?

A) 0,3

B) 0,25

C) 0,1

D) 0,08

Berilgan:

$a_1 = 0,4 \text{ m/s}^2$

$a_1 = 0,4 \text{ m/s}^2$

$a = ?$

Yechilishi: bu masalada traktorning tortish kuchi hamma holda bir xil.

1-hol:	2-hol:	3-hol:
$F = m_1 a_1$	$F = m_2 a_2$	$F = (m_1 + m_2) a$
$a_1 = \frac{F}{m_1}$	$a_2 = \frac{F}{m_2}$	$F = \left(\frac{F}{a_1} + \frac{F}{a_2} \right) a$

$$a = \frac{a_1 a_2}{a_1 + a_2} = 0,08 \text{ m/s}^2$$

Javob: D) 0,08.

13.34. 100 g massali jismga 1 N kuch ta'sir qila boshladi. Bu jism 5 s da necha metr yo'l bosib o'tadi? $v_0 = 0$.

A) 50

B) 95

C) 100

D) 125

Berilgan:

$m = 100 \text{ g}$

$F = 1 \text{ N}$

$t = 5 \text{ s}$

$v_0 = 0$

Yechilishi: Nyutonning ikkinchi qonunidan tezlanishni topamiz:

$$a = \frac{F}{m} = 10 \text{ m/s}^2$$

Tekis tezlanuvchan harakatda bosib o'tilgan yo'l formula-sidan foydalanamiz.

$$S = v_0 t + \frac{at^2}{2} = \frac{at^2}{2} \quad S = \frac{10 \cdot 25}{2} = 125 \text{ m}$$

Javob: D) 125.

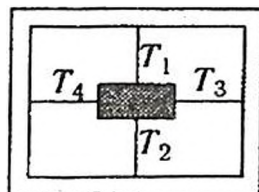
13.35. Jism vagon devorlariga arqon yordamida rasmda ko'rsatilgandek bog'langan. $T_1 = 15 \text{ N}$, $T_2 = 7 \text{ N}$, $T_3 = 1,6 \text{ N}$ va $T_4 = 0,6 \text{ N}$ bo'lsa, vagon tezlanishi qanday (m/s^2)?

A) 1,2

B) 1,25

C) 1,5

D) 2,5

**Berilgan:**

$T_1 = 15 \text{ N}$

$T_2 = 7 \text{ N}$

$T_3 = 1,6 \text{ N}$

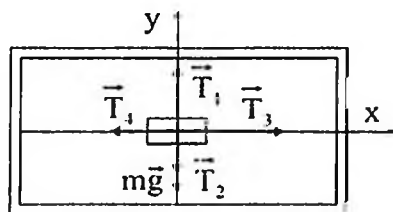
$T_4 = 0,6 \text{ N}$

$a = ?$

Yechilishi: X va Y o'qlariga kuchlarni proyeksiyalaymiz:

X o'qi uchun $T_3 - T_4 = ma$

Y o'qi uchun bu o'qda tezlanish nolga teng. $T_1 - T_2 = mg$



$$\begin{cases} T_3 - T_4 = ma \\ T_1 - T_2 = mg \end{cases} \Rightarrow \frac{T_3 - T_4}{T_1 - T_2} = a = \frac{T_3 - T_4}{T_1 - T_2} g$$

$$a = \frac{1,6 - 0,6}{15 - 7} \cdot 10 = 1,25 \text{ m/s}^2$$

Javob: B) 1,25.

13.36. Agar jismga faqat markazga intilma kuch ta'sir etsa, u qanday harakatda bo'ladi?

- A) to'g'ri chiziqli tekis harakatda
- B) to'g'ri chiziqli tekis tezlanuvchan harakatda
- C) aylana bo'ylab tekis harakatda
- D) to'g'ri chiziqli tekis sekinlanuvchan harakatda

Agar jismga faqat markazga intilma kuch ta'sir etsa, jism aylana bo'ylab tekis harakat qiladi.

Javob: C) aylana bo'ylab tekis harakatda.

13.37. Quyidagi formulalarning qaysilari markazdan qochma kuchni ifodalaydi?

- | | | |
|--------------|-----------------|----------------------|
| 1) $F = -kx$ | 2) $F = mv^2/R$ | 3) $F = m\omega^2 R$ |
| 4) $F = mg$ | 5) $F = \mu N$ | 6) $F = \rho S$ |
| A) 1, 2, 6 | B) 4, 5 | C) 2, 3 |
| | | D) 2 |

Markazdan qochma kuch moduli jihatdan markazga intilma kuchga (ya'ni, jism massasining markazga intilma tezlanishiga ko'paytmasiga) teng bo'ladi.

$$F_{m.q.} = F_{m.i.} = ma_{m.i.} = m \frac{v^2}{R} = m\omega^2 R$$

Javob: C) 2, 3.

13.38. Mototsiklchi radiusi 40 m bo'lgan yoy bo'ylab 20 m/s o'zgarmas tezlik bilan harakatlanmoqda. U muvozanatni saqlash uchun mototsiklni gorizontga nisbatan qanday burchakka qiyalatishi kerak?

- A) 90° B) 75° C) 60° D) 45°

Berilgan:

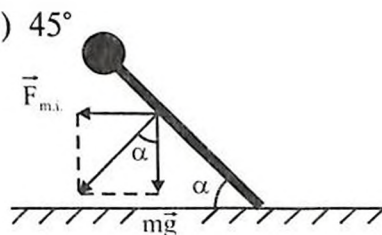
$$h = 40 \text{ m}$$

$$v = 20 \text{ m/s}$$

$$\alpha = ?$$

Yechilishi: chizmadan foydalanib quyidagilarni yozamiz:

$$\operatorname{tg} \alpha = \frac{F_{m.i.}}{mg} = \frac{ma_{m.i.}}{mg} = \frac{a_{m.i.}}{g}$$



$$a_{m.i.} = \frac{v^2}{R} \quad \operatorname{tg} \alpha = \frac{v^2}{gR}$$

$$\operatorname{tg} \alpha = \frac{400}{400} = 1 \Rightarrow \alpha = 45^\circ$$

Javob: D) 45° .

14-§. Nyutonning uchinchi qonuni

14.1. Nyutonning 3-qonunining eng to'g'ri yozilgan ta'rifini ko'rsating.

A) ikki jismning o'zaro ta'sir kuchlari miqdor jihatdan teng va bir to'g'ri chiziq bo'ylab qarama-qarshi yo'nalgan

B) ikki jismning o'zaro ta'sir kuchlari miqdor jihatdan o'zaro teng

C) ikki jismning o'zaro ta'sir kuchlari bir to'g'ri chiziq bo'ylab qarama-qarshi yo'nalgan.

D) ikki jism bir-biri bilan miqdor jihatidan teng va bir to'g'ri chiziq bo'ylab qarama-qarshi yo'nalgan kuchlar bilan tortishadi

Javob: A) ikki jismning o'zaro ta'sir kuchlari miqdor jihatdan teng va bir to'g'ri chiziq bo'ylab qarama-qarshi yo'nalgan.

14.2. Nyutonning uchinchi qonuni ifodasini toping.

A) $F = ma$

B) $F = \mu P_n$

C) $F = G \frac{m_1 m_2}{r_2}$

D) $F_1 = -F_2$

Ikki jismning o'zaro ta'sir kuchlari miqdor jihatdan teng va bir to'g'ri chiziq bo'ylab qarama-qarshi yo'nalgan. $F_1 = -F_2$.

Javob: D) $F_1 = -F_2$.

14.3. Oy massasi Yer massasidan 81 marta kichik. Yer tomonidan Oyga ta'sir etuvchi gravitatsion kuch F_1 ning Oy tomonidan Yerga ta'sir etuvchi gravitatsion kuch F_2 ga bo'lgan nisbati qanday?

A) 1/81

B) 1/9

C) 1

D) 9

Nyutonning 3-qonuniga asosan Oy Yerni qanday kuch bilan tortsa, Yer ham Oyni shunday kuch bilan tortadi, ya'ni, kuchlar bir-biriga teng. Ularning nisbati esa 1 ga teng.

$$F_1 = F_2 \quad \frac{F_1}{F_2} = 1$$

Javob: C) 1.

14.4. Bola chanani o'zgarmas tezlik bilan tortib ketyapti. Tortish kuchi 100 N ga teng bo'lib, harakat yo'nalishi bilan 30° li burchak hosil qiladi. Bunda ishqalanish kuchi qanday (N) bo'ladi? $\sin 30^\circ = 0,5$; $\cos 30^\circ = 0,87$.

- A) 8,7 B) 50 C) 77 D) 87

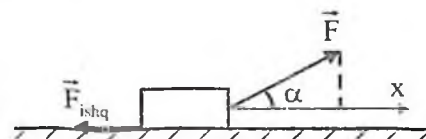
Berilgan:

$$F = 100 \text{ N}$$

$$\alpha = 30^\circ$$

$$F_{\text{ishq}} = ?$$

Yechilishi: Nyutonning 3-qonuniga asosan, F kuchning X o'qqa proyeksiyasi F_{ishq} ga teng bo'ladi.



$$F_{\text{ishq}} = F \cdot \cos \alpha = 100 \cdot \cos 30^\circ = 100 \cdot 0,87 = 8,7 \text{ N}$$

Javob: A) 8,7.

14.5. Ikki odam arqonni qarama-qarshi tomonga har biri 60 N kuch bilan tortmoqda. Arqonning taranglik kuchi qanday (N) bo'ladi?

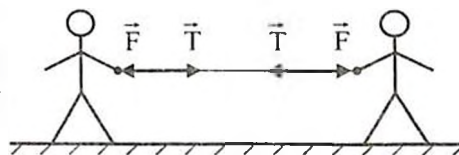
- A) 30 B) 60 C) 120 D) 0

Berilgan:

$$F = 60 \text{ N}$$

$$T = ?$$

Yechilishi: Nyutonning 3-qonuniga asosan, odam arqonni qanday kuch bilan tortsa, shunday kuch bilan unga tortiladi.



$$F = T = 60 \text{ N}$$

Javob: B) 60.

14.6. Taroziining bir pallasiga suvli idish, ikkinchi pallasiga esa yelkasiga ipga bog'langan va og'irligi P bo'lgan jism osilgan shtativ qo'yib muvozanatga keltirilgan. Ipni uzaytirib, jismni suvga to'la botgunicha (idish tubiga tekkizmay) tushirildi. Taroziini yana muvozanatga keltirish uchun qanday og'irlikdagi yukni qaysi pallaga qo'yish kerak? ρ_c — suv zichligi, ρ — jism zichligi.

A) $2P \rho_c / \rho$, shtativli pallaga

B) P , shtativli pallaga

C) $2P$, shtativli pallaga

D) $P/2$, suvli idish qo'yilgan pallaga

Berilgan:

$$P, \rho, \rho_s,$$

$$P_0 = ?$$

Yechilishi: Jism suvga tushirilgandan keyin unga Arximed kuchi ta'sir qiladi va shtativ turgan tarafi F_A ga yengillashadi. Aksincha, Nyutonning 3-qonuniga asosan, suvli



idish turgan tarafi F_A ga og'irlashadi. Demak, $P_0 = 2F_A$ kuchni shtativ turgan tarafga qo'yish lozim.

$$F_A = \rho S V g \quad P = \rho V g$$

$$F_A = \rho S \frac{P}{\rho} \quad P_0 = 2 \frac{\rho_s}{\rho} P$$

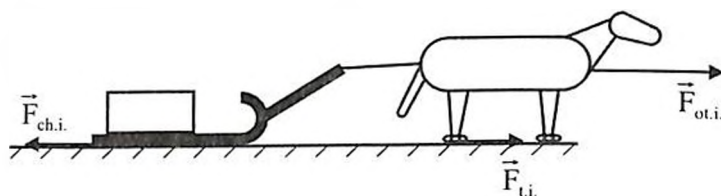
Javob: A) $2P \rho_c / \rho$, shtativli pallaga.

14.7. Tekis yo'lda chana tortib ketayotgan otning tortish kuchi F_{ot} , ot tuyoqlarining yo'lga ishqalanish kuchi F_{ti} va chananing yo'lga ishqalanish kuchi F_{chi} orasida qaysi munosabat bajarilganda chana tezlanish bilan harakatlanadi?

- A) $F_{ti} > F_{ot} > F_{chi}$ B) $F_{ot} > F_{ti} + F_{chi}$
 C) $F_{ot} = F_{ti} + F_{chi}$ D) $F_{chi} > F_{ot} > F_{ti}$

Berilgan:

F_{ot} , F_{ti} , F_{chi}



Yechilishi: Ot tuyoqlari orasidagi kuch qancha katta bo'lsa, u shuncha og'ir yukni tortishi mumkin. Masalan, muzda va yo'lda. Muzda ishqalanish kam, shuning uchun ham u yerda harakat qilish qiyin. Demak, $F_{ti} > F_{chi}$ Nyutonning 3-qonuniga asosan $F_{ot} < F_{ti}$ bo'lishi shart

$$F_{ti} > F_{ot} > F_{chi}$$

Javob: A) $F_{ti} > F_{ot} > F_{chi}$.

15-§. Elastiklik kuchi

15.1. Elastiklik kuchi ifodasini toping.

- A) $F = ma$ B) $F = mv^2/r$
 C) $F_x = -kx$ D) $F = \mu P_n$

Javob: C) $F_x = -kx$.

15.2. Elastiklik kuchining proyeksiyasi qanday ifoda bilan aniqlanadi?

- A) $-k\Delta l$ B) $k\Delta l$ C) $k/\Delta l$ D) $k\Delta l/l_0$

Elastiklik kuchi deformatsiya kattaligiga teskari yo'nalgan bo'ladi. Shuning uchun uning proyeksiyasi manfiy bo'ladi.

Javob: A) $-k\Delta l$.

15.3. Bikrligi 10 N/m bo'lgan prujina necha Nyuton kuch ta'sirida 0,1 m ga cho'ziladi?

A) 100

B) 1

C) 10

D) 0,1

Berilgan:

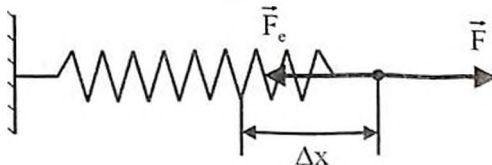
$$k = 10 \text{ N/m}$$

$$\Delta x = 0,1 \text{ m}$$

$$F = ?$$

Yechilishi: $F = F_e = k\Delta x$

$$F = 10 \cdot 0,1 = 1 \text{ N}$$



Javob: B) 1.

15.4. Rasmda ko'rsatilgan, bikrligi 600 N/m bo'lgan vaznsiz prujina 9 sm ga cho'zilishi uchun aravacha qanday (m/s^2) tezlanish bilan harakat qilishi kerak? (ishqalanish hisobga olinmasin).

A) 15

B) 1,67

C) 2,4

D) 0,42

Berilgan:

$$k = 600 \text{ N/m}$$

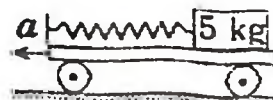
$$\Delta x = 2 \text{ sm}$$

$$m = 5 \text{ kg}$$

$$a = ?$$

Yechilishi: Inersiya kuchi ta'sirida prujina cho'zilib elastiklik kuchi hosil bo'ladi. $F_{el} = ma = k\Delta x$

$$a = \frac{k\Delta x}{m} = \frac{600 \cdot 2 \cdot 10^{-2}}{5} = 2,4 \text{ m/s}^2$$



Javob: C) 2,4.

15.5. Prujina 2 N kuch ta'sirida 0,2 m ga cho'zildi. Prujina-ning bikrligini aniqlang (N/m).

A) 100

B) 50

C) 10

D) 1

Berilgan:

$$F = 2 \text{ N}$$

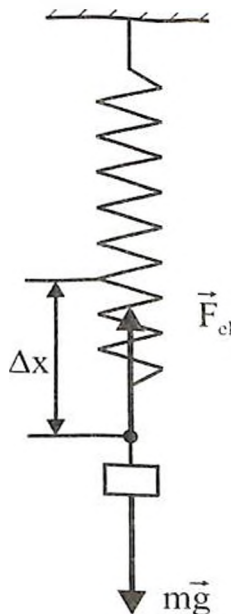
$$\Delta x = 0,2 \text{ m}$$

$$k = ?$$

Yechilishi: F kuch elastiklik kuchi hosil qiladi va u elastiklik kuchiga teng bo'ladi.

$$F = F_{el} = k\Delta x$$

$$k = \frac{F}{\Delta x} = \frac{2}{0,2} = 10 \text{ N/m}$$



Javob: C) 10.

15.6. 2 kg massali yuk osilganda, 5 sm uzunlikdagi prujina 1 sm uzaydi. Prujinaning bikrligi qanday (N/m).

- A) 2000 B) 100
C) 200 D) 400

Berilgan:

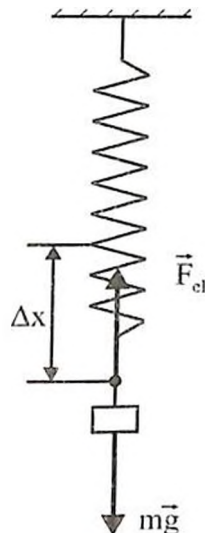
$$\begin{array}{l} m = 1 \text{ kg} \\ x_0 = 5 \text{ sm} \\ \Delta x = 1 \text{ sm} \\ k = ? \end{array}$$

Yechilishi: Bu masalada og'irlik kuchi elastiklik kuchi hosil qiladi.

$$F = F_{el} = k \Delta x$$

$$k = \frac{mg}{\Delta x} = \frac{2}{10^{-2}} = 2000 \text{ N/m}$$

Javob: A) 2000.



15.7. Tik turgan prujina ustiga massasi 2 kg bo'lgan yuk qo'yilganda, u 2 sm ga siqildi. Prujinaning bikrligini toping (N/m).

- A) 1000 B) 200
C) 100 D) 10

Berilgan:

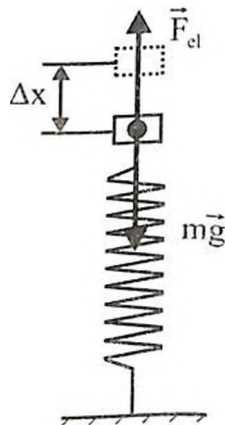
$$\begin{array}{l} m = 2 \text{ kg} \\ \Delta x = 2 \text{ sm} \\ k = ? \end{array}$$

Yechilishi: Jismning og'irligi natijasida prujina siqiladi. Nyutonning 3-qonuniga asosan, bu kuchlar bir-biriga teng bo'ladi

$$mg = F_{el} = k \Delta x$$

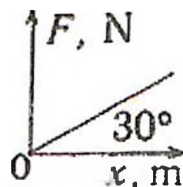
$$k = \frac{mg}{\Delta x} = \frac{20}{2 \cdot 10^{-2}} = 1000 \text{ N/m}$$

Javob: A) 1000.



15.8. Rasmdagi grafikdan foydalangan holda prujinaning bikrligini toping (N/m).

- A) $\sqrt{3}/3$ B) $\sqrt{3}/2$
C) $\sqrt{3}$ D) 1



Yechilishi: Tangens funksiyani qaraymiz.

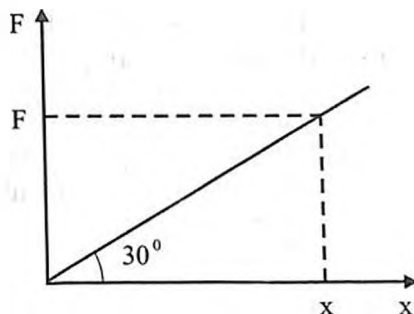
$$\operatorname{tg} \alpha = \frac{F}{x}$$

Bu 2-tarafdan birlikka ham teng.

$$\frac{F}{x} = k = \operatorname{tg} \alpha$$

$$k = \operatorname{tg} \alpha = \operatorname{tg} 30^\circ = \frac{\sqrt{3}}{3}$$

Javob: A) $\sqrt{3}/3$.



15.9. Berilgan sim bo'lagining birligi k ga teng. Shu sim bo'lagi yarmining birligi nimaga teng?

- A) $k/4$ B) $k/2$ C) k D) $2k$

Berilgan:

k

$$l_0 = \frac{l}{2}$$

$$k_0 = ?$$

Yechilishi: Prujinaning birligi formulasi: $k = \frac{ES}{l_0}$ uzunlikni 2 marta qisqartirsak, birlilik 2 marta ortar ekan.

$$k = \frac{ES}{l} \quad k_0 = \frac{ES}{l_0}$$

$$\frac{k_0}{k} = \frac{l}{l_0} = 2 \quad k_0 = 2k$$

Javob: D) $2k$.

15.10. Birligi 64 N/m bo'lgan ikkita prujina ketma-ket ulansa, umumiy birlilik qanday bo'ladi (N/m)?

- A) 8 B) 16 C) 32 D) 64

Berilgan:

$$k_1 = k_2 = 64 \text{ N/m}$$

$$k_{k-k} = ?$$

Yechilishi: F kuch Nyutonning 3-qonuniga asosan, F_{el1} ga teng va u ham o'z navbatida F_{el2} teng bo'ladi. Har bir elastik kuchning formulasini yozamiz.

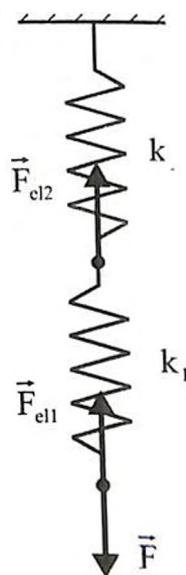
$$F_{el1} = k_1 \Delta x_1 \quad F_{el2} = k_2 \Delta x_2$$

$$F_{el1} = F_{el2} = F_{el} = F \quad F_{el} = k_{k-k} (\Delta x_1 + \Delta x_2)$$

$$F = k_{k-k} \left(\frac{F}{k_1} + \frac{F}{k_2} \right) \quad \frac{1}{k_{k-k}} = \frac{1}{k_1} + \frac{1}{k_2}$$

$$k_{k-k} = \frac{k_1 k_2}{k_1 + k_2} = \frac{k_1}{2} = 32 \text{ N/m}$$

Javob: C) 32.



15.11. Har birining bikrligi k bo'lgan 3 ta bir xil prujinalarni ketma-ket ulash natijasida hosil bo'lgan prujinaning bikrligini toping.

- A) k B) $k/2$ C) $k/3$ D) $3k$

Berilgan:

$$k_1 = k_2 = k_3 = k$$

$$k_{k-k} = ?$$

Yechilishi: Ketma-ket ulashda umumiy bikrlikni topish formulasidan foydalanamiz.

$$\frac{1}{k_{k-k}} = \frac{1}{k_1} + \frac{1}{k_2} + \frac{1}{k_3} = \frac{3}{k} \quad k_{k-k} = \frac{k}{3}$$

Javob: C) $k/3$.

15.12. Har birining bikrligi k bo'lgan ikkita bir xil prujina bir-biriga yonma-yon ulangan. Hosil bo'lgan sistemaning bikrligi qanday?

- A) $k/2$ B) $2k$ C) k D) $4k$

Berilgan:

$$k_1 = k_2 = k$$

$$k_{p-l} = ?$$

Yechilishi: Bunda prujinalar parallel ulanadi va cho'zilish bir xil bo'ladi. Bundan kuchlar orasidagi munosabatni yozamiz.

$$\Delta x_1 = \Delta x_2 = \Delta x$$

$$F = F_{el1} + F_{el2}$$

$$F_{el1} = k_1 \Delta x_1, \quad F_{el2} = k_2 \Delta x_2 \quad F = k \Delta x$$

$$k_{p-l} = k_1 + k_2 = 2k$$

Javob: B) $2k$.

16-§. Butun olam tortishish kuchi

16.1. Ikki jismdan har birining massasi 2 marta oshirilsa va ular orasidagi masofa 2 marta kamaytirilsa, ularning o'zaro tortishish kuchi qanday o'zgaradi?

- A) 4 marta ortadi B) 4 marta kamayadi
C) 8 marta ortadi D) 16 marta ortadi

Berilgan:

$$m'_1 = 2m_1$$

$$m'_2 = 2m_2$$

$$R' = R/2$$

$$\frac{F'}{F} = ?$$

Yechilishi: Ikkala hol uchun ham tortishish kuchini yozamiz.

$$F = \frac{\gamma m_1 m_2}{R^2}$$

$$F' = \frac{\gamma m'_1 m'_2}{R'^2}$$

$$\frac{F'}{F} = \frac{m'_1 m'_2}{(R')^2} \frac{R^2}{m_1 m_2} = \left(\frac{R}{R'} \right)^2 \frac{m'_1 m'_2}{m_1 m_2} = 4 \cdot \frac{2m_1 2m_2}{m_1 m_2} = 4 \cdot 4 = 16$$

$F' = 16 F$, 16 marta ortar ekan.

Javob: D) 16 marta ortadi.

16.2. Ikki jism orasidagi tortishish kuchi 36 marta oshgan va jismlardan birining massasi shuncha marta kamaygan bo'lsa, ular orasidagi masofa qanday o'zgargan?

- A) 6 marta ortgan
B) 6 marta kamaygan
C) o'zgarmagan
D) 36 marta kamaygan

Berilgan: $F' = 36F$
 $m_1 = 36m'_1$
 $\frac{R'}{R} = ?$

Yechilishi: $F = \frac{\gamma m_1 m_2}{R^2}$ $F' = \frac{\gamma m_1 m_2}{(R')^2}$
 $\frac{R'}{R} = \sqrt{\frac{\gamma m'_1 m'_2}{F'} \frac{F}{\gamma m_1 m_2}} = \sqrt{\frac{m'_1 F}{m_1 F'}}$ $\frac{R'}{R} = \sqrt{\frac{1}{36} \cdot \frac{1}{36}} = \frac{1}{36}$
 $R = 36R'$. Ular orasidagi masofa 36 marta kamayadi.

Javob: D) 36 marta kamaygan.

16.3. Quyidagi gapni to'g'ri mazmunda to'ldiruvchi javobni aniqlang:

« $F = G \frac{Mm}{R^2}$ formula ... ifodalaydi».

- A) orasidagi R masofa o'lchamlaridan juda katta bo'lgan M va m massali ikki jismning gravitatsion ta'sirlashuvini
- B) ixtiyoriy jismning Yer bilan ta'sirlashuvini
- C) sayyoralarning o'zaro ta'sirlashuvlarini
- D) o'ta katta M massali jism bilan uning atrofidagi nisbatan juda kichik m massali jism ta'sirlashuvini

Javob: A) orasidagi R masofa o'lchamlaridan juda katta bo'lgan M va m massali ikki jismning gravitatsion ta'sirlashuvini.

16.4. Massalari M va m bo'lgan ikki jism orasidagi gravitatsiyaviy ta'sirlashuv kuchi uchun yozilgan $F = G \frac{Mm}{R^2}$ ifodadagi R kattalik nimani ifodalaydi?

- A) Yer radiusini
B) sayyoraning aylanish radiusini (orbita radiusini)
C) ta'sirlashuvchi jismlarning bir-biriga eng yaqin joylashgan nuqtalari oraliqini
D) jismlar massa markazlari orasidagi masofani (agar jismlarni moddiy nuqta deb hisoblash mumkin bo'lsa)

Javob: D) jismlar massa markazlari orasidagi masofani (agar jismlarni moddiy nuqta deb hisoblash mumkin bo'lsa).

16.5. Butun olam tortishish qonunidagi gravitatsion doimiyning ma'nosini tushuntiring.

A) massalari 1 kg dan va oralaridagi masofa 10 m bo'lgan ikki jism orasidagi tortishish kuchiga teng kattalik

B) massalari 1 kg dan bo'lgan ikkita jismning og'irlik kuchlari yig'indisiga teng kattalik

C) massalari 1 kg dan va oralaridagi masofa 1 m bo'lgan ikki jism orasidagi tortishish kuchiga teng kattalik

D) massalari 10 kg dan va oralaridagi masofa 1 m bo'lgan ikki jism orasidagi tortishish kuchiga teng kattalik

Javob: C) massalari 1 kg dan va oralaridagi masofa 1 m bo'lgan ikki jism orasidagi tortishish kuchiga teng kattalik.

16.6. Gravitatsiya doimiysining birligini ko'rsating.

A) $I/N \cdot m^2$

B) $N \cdot kg^2/m^2$

C) N/m^2

D) $N \cdot m^2/kg^2$

$$[G] = \frac{[F] \cdot [R]^2}{[m_1] \cdot [m_2]} = \frac{1N \cdot 1m^2}{1kg \cdot 1kg} = 1 \frac{N \cdot m^2}{kg^2}$$

Javob: D) $N \cdot m^2/kg^2$.

16.7. Jismning inert massasi va gravitatsion massasi qanday farq qiladi?

A) inert massa nolga teng

B) inert massa katta

C) gravitatsion massa katta

D) farq qilmaydi

Javob: D) farq qilmaydi.

17-§. Og'irlik kuchi

17.1. Radiusi va massasi Yernikidan 3 marta katta bo'lgan sayyora sirtida jismning og'irlik kuchi Yer sirtidagidan qanday farq qiladi?

A) farq qilmaydi

B) 3 marta kam bo'ladi

C) 3 marta ko'p bo'ladi

D) 9 marta kam bo'ladi

Berilgan:

$$R = 3R_{yer}$$

$$M = 3M_{yer}$$

$$\frac{P}{P_{yer}} = ?$$

Yechilishi: Har bir sayyora uchun og'irlik kuchi formulasini yozamiz:

$$P_{yer} = mg_{yer} = m \frac{\gamma M_{yer}}{R_{yer}^2}$$

$$P = m \frac{\gamma M}{R^2}$$

$$\frac{P}{P_{yer}} = \frac{m\gamma M}{R^2} \frac{R_{yer}^2}{m\gamma M_{yer}} = \left(\frac{R_{yer}}{R}\right)^2 \frac{M}{M_{yer}} = \left(\frac{1}{3}\right)^2 \cdot 3 = \frac{1}{3}$$

$P_{yer} = 3P$ Yerdagidan 3 marta kichik bo'lar ekan.

Javob: B) 3 marta kam bo'ladi.

17.2. Qandaydir sayyoraning radiusi Yer radiusining 0,5 qismiga, massasi esa Yer massasining 0,1 qismiga teng. Shu sayyoradagi erkin tushish tezlanishi qanday (m/s^2)? Yerdagi $g_{yer} = 10 \text{ m/s}^2$ deb hisoblang.

A) 0,5

B) 4

C) 2

D) 1

Berilgan:

$$R = 0,5 R_{yer}$$

$$M = 0,1 M_{yer}$$

$$g_{yer} = 10 \text{ m/s}^2$$

$$g = ?$$

Yechilishi: Har bir sayyora uchun erkin tushish tezlanishining formulasini yozamiz.

$$g = \frac{\gamma M}{R^2} \quad g_{yer} = \frac{\gamma M_{yer}}{R_{yer}^2}$$

$$\frac{g}{g_{yer}} = \frac{\gamma M}{R^2} \frac{R_{yer}^2}{\gamma M_{yer}} = \left(\frac{R_{yer}}{R}\right)^2 \frac{M}{M_{yer}} = 2^2 \cdot 0,1 = 0,4$$

$$g = 0,4 g_{yer} = 4 \text{ m/s}^2$$

Javob: B) 4.

17.3. Agar Quyoshning radiusi Yer radiusidan 108 marta katta, zichligi esa Yer zichligidan 4 marta kichik bo'lsa, Quyosh sirtida og'irlik kuchining tezlanishi qanday bo'ladi (m/s^2)? Yer uchun $g = 10 \text{ m/s}^2$ deb hisoblang.

A) 10,8

B) 21

C) 67,5

D) 270

Berilgan:

$$R_q = 108 R_{yer}$$

$$\rho_{yer} = 4 \rho_q$$

$$g_{yer} = 10 \text{ m/s}^2$$

$$g_q = ?$$

Yechilishi: Quyosh va Yer sayyorasi uchun erkin tushish tezlanishlari formulalarini yozamiz (zichlikka bog'liqligi)

$$g = \gamma \frac{M}{R^2} \quad M = \rho \cdot \frac{4}{3} \pi R^3 \quad g = \gamma \frac{\frac{4}{3} \pi R^3 \rho}{R^2} = \frac{4}{3} \pi \gamma R \rho$$

$$g_{yer} = \frac{4}{3} \pi \gamma R_{yer} \rho_{yer} \quad g_q = \frac{4}{3} \pi \gamma R_q \rho_q$$

$$\frac{g_q}{g_{yer}} = \frac{R_q \rho_q}{R_{yer} \rho_{yer}} \quad g_q = \frac{R_q \rho_q}{R_{yer} \rho_{yer}} \cdot g_{yer} = \frac{108}{4} \cdot 10 = 270 \text{ m/s}^2 \quad g_q = 270 \text{ m/s}^2$$

Javob: D) 270.

17.4. Bola Yerda og'irligi 160 N bo'lgan toshni ko'tara olsa, u Oyda turib qanday og'irlikdagi va qanday massali toshni ko'tara oladi? $g_{yer} = 10 \text{ m/s}^2$; $g_{oy} = 1,6 \text{ m/s}^2$.

- A) 250 N, 27 kg B) 160 N, 16 kg
C) 160 N, 100 kg D) 16 N, 16 kg

Berilgan:

$$\begin{array}{l} P_{yer} = 160 \text{ N} \\ g_{yer} = 10 \text{ m/s}^2 \\ g_{oy} = 1,6 \text{ m/s}^2 \end{array}$$

$$\begin{array}{l} P_{oy} = ? \\ m_{oy} = ? \end{array}$$

Yechilishi: Odamning yerda ham oyda ham ko'tarish kuchi bir xil bo'ladi. $P_{oy} = P_{yer} = 160 \text{ N}$. Lekin erkin tushish tezlanishi har xil bo'lgani uchun, u ko'tara oladigan yuk massasi ham o'zgaradi:

$$P_{oy} = m_{oy} \cdot g_{oy} = P_{yer} \quad m_{oy} = \frac{P_{yer}}{g_{oy}} = \frac{160}{1,6} = 100 \text{ kg}$$

Javob: C) 160 N, 100 kg.

17.5. Yer radiusiga teng balandlikda erkin tushish tezlanishi qanday bo'ladi? Yer sirti yaqinidagi erkin tushish tezlanishi g_0 .

- A) $g = g_0/2$ B) $g = g_0/2,5$ C) $g = g_0/4$ D) $g = g_0/3$

Berilgan:

$$h = R$$

$$\begin{array}{l} g_0 \\ g_h = ? \end{array}$$

Yechilishi: Yer sirtidan h balandlikdagi erkin tushish tezlanishini hisoblash formulasini aniqlaymiz:

$$F_0 = \frac{\gamma M m}{R^2} = m g_0 \quad g_0 = \frac{\gamma M}{R^2}$$

$$F = \frac{\gamma M m}{(R + h)^2} = m g_h \quad g_h = \frac{\gamma M}{(R + h)^2}$$

$$\frac{g_h}{g_0} = \frac{\gamma M}{(R + h)^2} \frac{R^2}{\gamma M} \quad g_h = \left(\frac{R}{R + h} \right)^2 g_0 = \left(\frac{R}{2R} \right)^2 g_0 = \frac{g_0}{4}$$

Javob: C) $g = g_0/4$.

17.6. Uch Yer radiusiga teng balandlikda erkin tushish tezlanishi Yer sirtidagiga nisbatan qanday bo'ladi?

- A) 16 marta katta B) 4 marta katta
C) 16 marta kichik D) 4 marta kichik

Berilgan:

$$h = 3R$$

$$\begin{array}{l} g_h \\ g_0 = ? \end{array}$$

Yechilishi: h balandlikdagi erkin tushish tezlanishi formulasidan foydalanamiz.

$$g_h = \left(\frac{R}{R + h} \right)^2 \cdot g_0 = \left(\frac{R}{4R} \right)^2 \cdot g_0 = \frac{g_0}{16}$$

3R balandlikdagi erkin tushish tezlanishi yer sirtidagi erkin tushish tezlanishidan 16 marta kichik ekan.

Javob: C) 16 marta kichik.

17.7. Yer sirtidan qanday balandlikda jismning og'irligi Yer sirtidagi og'irligidan 4 marta kichik bo'ladi? R — Yerning radiusi.

- A) 0,5 R B) R C) 1,5 R D) 2 R

Berilgan: $P = 4P_h$
Yechilishi: Og'irlik kuchi erkin tushish tezlanishiga mos holda o'zgaradi.

$$\begin{aligned} P &= mg & P_h &= mg_h \\ P_h &= P \left(\frac{R}{R+h} \right)^2 & \frac{1}{4} &= \left(\frac{R}{R+h} \right)^2 \\ \frac{R}{R+h} &= \frac{1}{2} & 2R &= R+h \quad h = R \end{aligned}$$

Javob: B) R .

17.8. Qanday balandlikda jismning og'irligi Yer sirtidagiga qaraganda n marta kichik bo'ladi?

- A) $R(\sqrt{n}-1)$ B) $R(n-1)$ C) $\frac{R}{n-1}$ D) $R\sqrt{n-1}$

Berilgan: $P = nP_h$
Yechilishi: Og'irlik kuchi erkin tushish tezlanishiga mos holda o'zgaradi.

$$\begin{aligned} P_h &= \left(\frac{R}{R+h} \right)^2 P & \frac{P}{n} &= \left(\frac{R}{R+h} \right)^2 P & \frac{R}{R+h} &= \frac{1}{\sqrt{n}} \\ R+h &= \sqrt{n}R & h &= (\sqrt{n}-1)R \end{aligned}$$

Javob: A) $R(\sqrt{n}-1)$.

17.9. Prujinali tarozi jism og'irligini planeta ekvatorida qutbdagiga qaraganda 10 foiz kam ko'rsatsa, planetaning o'rtacha zichligi qanday bo'ladi? Sutkaning davomiyligi T ga, butun olam tortishish doimiysi γ ga teng.

- A) $\frac{\gamma T^2}{30\pi}$ B) $\frac{30\pi}{\gamma T^2}$ C) $\frac{33\pi}{\gamma T^2}$ D) $\frac{30T^2}{\gamma\pi}$

Berilgan:

$$P_e = 0,9 P_q$$

$$T, \gamma$$

$$\rho = ?$$

Yechilishi: Sayyoraning ekvatoridagi va qutbdagi og'irligi formulasini yozamiz. Sayyora o'z o'qi atrofida aylanishi hisobiga ekvatorida markazdan qochma kuch vujudga keladi.

$$P_q = mg \quad P_e = m(g - a)$$

$$m(g - a) = 0,9mg \quad g - a = 0,9g \quad 0,1g = a$$

$$g = \frac{\gamma M}{R^2} \quad \frac{\gamma M}{R^2} = 0,1 \cdot \frac{4\pi^2 R}{T^2} \quad M = \frac{4}{3} \pi R^3 \rho$$

$$\frac{\gamma \rho}{3} = \frac{10\pi}{T^2} \quad \rho = \frac{30\pi}{\gamma T^2}$$

Javob: B) $\frac{30\pi}{\gamma T^2}$.

18-§. Vazn. Vaznsizlik

18.1. Jismning vazni (og'irligi) deb nimaga aytiladi? Jismning vazni deb, jismning Yerga tortilish kuchi tufayli ...

A) tayanch yoki osmaga ...

B) faqat tayanchga ...

C) yonida turgan jismga ...

D) faqat osmaga ...

... ko'rsatadigan ta'sir kuchiga aytiladi.

Jismning yerga tortilishi tufayli tayanchga yoki osmaga ko'rsatadigan ta'siri jismning vazni (og'irligi) deyiladi.

Javob: A) tayanch yoki osmaga ...

18.2. «Jismning vazni (og'irligi) va og'irlik kuchi bir narsadir» degan gap to'g'rimi?

A) to'g'ri, chunki vazn va og'irlik kuchi bir narsadir.

B) noto'g'ri, chunki vazn — jismning massadorligini (massa ko'p yoki kamligini) aniqlaydi.

C) noto'g'ri, chunki vazn va og'irlik kuchi boshqa-boshqa jismlarga qo'yilgan. Ular miqdoran teng bo'lishi ham, teng bo'lmasligi ham mumkin.

D) to'g'ri, agar gap jismning shimoliy yoki janubiy qutbdagi vazni va og'irlik kuchi haqida bo'lsa.

Jismni yerga tortilishi tufayli tayanchga yoki osmaga ko'rsatadigan ta'siri jismning vazni (og'irligi) deyiladi.

Jismni yerga tortuvchi kuch og'irlik kuchi deyiladi.

Demak, og'irlik kuchi va jism og'irligi boshqa-boshqa jismlarga qo'yiladi. Ularning modullari teng bo'lishi ham mumkin, teng bo'lmasligi ham mumkin.

Javob: C) noto'g'ri, chunki vazn va og'irlik kuchi bosha-boshqa jismlarga qo'yilgan. Ular miqdoran teng bo'lishi ham, teng bo'lmasligi ham mumkin.

18.3. Agar jism ... ta'sirida harakatlansa, u vaznsizlik holatida bo'ladi.

- | | |
|------------------------------------|---------------------------|
| A) faqat og'irlik kuchi | B) faqat elastiklik kuchi |
| C) elastiklik va og'irlik kuchlari | D) markazga intilma kuch |

Tezlanish bilan harakatlanayotgan jism vaznining nolga teng bo'lishiga vaznsizlik deyiladi.

$$P = m(g - a)$$

Agar $a = g$ bo'lsa, (ya'ni erkin tushayotgan bo'lsa) $P = 0$ bo'ladi. Demak, erkin tushayotgan jism vaznsizlik holatida bo'lar ekan. Jismning faqat og'irlik kuchi ta'siridagi vertikal harakatiga erkin tushish deyiladi.

Javob: A) faqat og'irlik kuchi.

18.4. Quyidagi jumlaning mazmuniga mos keladigan so'z yoki birikmani tanlab, to'liq gap hosil qiling. ... vaznsizlik holati hosil bo'ladi.

- | | |
|-------------------------------------|----------------------|
| A) erkin tushishda | B) tinchlik holatida |
| C) to'g'ri chiziqli tekis harakatda | D) muvozanatda |

Jism faqat og'irlik kuchi ta'sirida harakatlenganda (erkin tushganda) vaznsizlik holatida bo'ladi.

Javob: A) erkin tushishda.

18.5. Ichida toshi bor koptok otilganda tik yuqoriga harakat qiladi, trayektoriya-ning yuqori nuqtasiga chiqadi va so'ngra pastga tushadi. Trayektoriyaning qaysi qismida toshning koptokka bosim kuchi nolga teng bo'ladi? Havoning qarshiligini hisobga olmang.

- | | |
|-----------------------------------|-----------------------------------|
| A) faqat yuqorigi nuqtada | B) trayektoriyaning hamma qismida |
| C) faqat yuqoriga harakat vaqtida | D) faqat pastga harakat vaqtida |

Agar havoning qarshilik kuchi hisobga olinmasa, vertikal yuqoriga otilgan jism $a = g$ tezlanish bilan harakatlanadi. Uning og'irligi esa quyidagiga teng:

$$P = m(g - a) = m(g - g) = 0$$

Demak, vertikal yuqoriga otilgan jism trayektoriyaning barcha nuqtasida vaznsizlik holatida bo'ladi, ya'ni uning bosim kuchi nolga teng.

Javob: B) trayektoriyaning hamma qismida.

18.6. Bir g'ishtni ikkinchisining ustiga qo'yib, yuqoriga otishdi. Yuqoridagi g'ishtning pastdagi g'ishtga bosim kuchi qachon nolga teng bo'ladi? Havoning qarshiligini hisobga olmang.

- A) uchish vaqtining hammasida
- C) faqat pastga harakat vaqtida

- B) faqat yuqoriga harakat vaqtida
- D) faqat yuqoriga nuqtada

Agar havoning qarshilik kuchi hisobga olinmasa, vertikal yuqoriga otilgan jism $a = g$ tezlanish bilan harakatlanadi. Uning og'irligi esa quyidagiga teng:

$$P = m(g - a) = m(g - g) = 0$$

Demak, vertikal yuqoriga otilgan jism trayektoriyani barcha nuqtasida vaznsizlik holatida bo'ladi, ya'ni uning bosim kuchi nolga teng.

Javob: A) uchish vaqtining hammasida.

18.7. Dvigateli o'chirilgandan so'ng kosmik kema yuqoriga tik harakatini davom ettiradi va eng yuqori nuqtaga yetgach, yerga qaytib tushadi. Trayektoriyani qaysi qismida kosmonavtning tayanchga bosim kuchi eng katta bo'ladi? Havoning qarshiligini hisobga olmang.

- A) yuqoriga harakatlanganda
- B) trayektoriyani eng cho'qqisida
- C) uchish vaqtining hammasida bosim kuchi nolga teng
- D) uchish vaqtining hammasida bosim kuchi bir xil bo'ladi va nolga teng emas

Dvigateli o'chirilgandan keyin kosmik kema faqat og'irlik kuchi ta'sirida harakatlanadi. Natijada unda vaznsizlik holati yuzaga keladi. Vaznsizlik holatida kosmonavtning bosim kuchi nolga teng bo'ladi. Demak, dvigatel o'chirilgandan keyingi uchish vaqtining hammasida kosmonavtning tayanchga bosim kuchi nolga teng bo'ladi.

Javob: C) uchish vaqtining hammasida bosim kuchi nolga teng.

18.8. Havoning qarshiligi bo'lmaganda, gorizontga nisbatan burchak ostida otilgan jism harakat trayektoriyasining qaysi qismida vaznsizlik holatida bo'ladi?

- A) faqat ko'tarilayotgan qismida
- B) faqat tushayotgan qismida
- C) trayektoriyani eng yuqori nuqtasidan o'tayotganda
- D) butun harakati davomida

Gorizontga nisbatan burchak ostida otilgan jism, havoning qarshiligi hisobga olinmasa, faqat og'irlik kuchi ta'sirida $a = g$ tezlanish bilan harakatlanadi.

$$P = m(g - a) = m(g - g) = 0$$

Demak, gorizontga nisbatan burchak ostida otilgan jism butun uchish vaqti davomida vaznsizlik holatida bo'ladi.

Javob: D) butun harakati davomida.

18.9. Kosmik kema o'zgarmas v tezlik bilan Yer atrofida R radiusli doiraviy orbita bo'ylab aylanmoqda. Bunda m massali kosmonavtga o'tirgich — kreslo tomondan qanday reaksiya kuchi ta'sir qiladi?

- A) $F = 0$
B) $F = m(g + v^2/R)$
C) $F = m(g - v^2/R)$
D) $F = mg$

Kosmik kema o'zgarma v tezlik bilan Yer atrofiga harakatlanayotganda kema ichidagi barcha jismlar va kosmonavt vaznsizlik holatida bo'ladilar. Vaznsizlik holatida kosmonavt kresloni bosmaydi va o'z navbatida kresloni ham kosmonavtga aks ta'sir ko'rsatmaydi, ya'ni reaksiya kuchi nolga teng.

Javob: A) $F = 0$.

18.10. Torichelli tajribasida ishlatiladigan simobli barometr (bir uchi berk shisha nay va simobli idish) biror balandlikdan vertikal tashlab yuborilsa, nay ichidagi simob sathi qanday o'zgaradi?

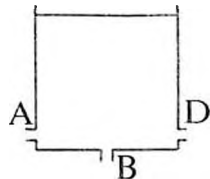
- A) o'zgarmaydi B) simob nayni butunlay to'ldiradi
C) nay ichidagi simob butunlay oqib chiqadi
D) avval ko'tariladi, so'ngra o'zgarmaydi

Biror balandlikdan vertikal tashlab yuborilgan (ya'ni erkin tushayotgan) jism vaznsizlik holatida bo'ladi. Vaznsizlik holatida nay ichidagi simob bosim hosil qilmaydi. Keng idishdagi simob esa atmosfera bosimi tufayli nay ichiga uni butunlay to'ldirguncha kiradi.

Javob: B) simob nayni butunlay to'ldiradi.

18.11. Silindr shaklidagi idishda uchta — A, B, D teshiklar bor. Agar idishni suvga to'ldirib, vertikal holatda tashlab yuborilsa, qaysi teshikdan suv oqadi?

- A) hech qaysisidan B) A va B teshiklardan
C) A, B, D teshiklardan D) B teshikdan



Teshikdan suv oqishining sababi suv ustining og'irligi tufayli bosim hosil qiladi. Erkin tushayotganda esa vaznsizlik holatida bo'ladi va bunda bosim nolga teng bo'ladi. Natijada hech bir teshikdan suv oqmaydi.

Javob: A) hech qaysisidan.

18.12. To'ng'arilgan shisha idishdan suv oqib chiqmoqda. Agar idish tashlab yuborilsa, erkin tushish vaqtida suv ...

- A) oqmaydi
B) sekinroq oqadi
C) tezroq oqadi
D) avvalgidek oqadi

Erkin tushish vaqtida vaznsizlik holatida bo'lganligi uchun suv oqmay qoladi.

Javob: A) oqmaydi.

18.13. Jism idishdagi suvga botirilgan. Vaznsizlik holatiga o'tganda itarib chiqaruvchi kuch qanday o'zgaradi?

- A) avval kamayadi, so'ng ortadi B) kamayadi
C) nolga teng bo'ladi D) ortadi

Vaznsizlik holatidagi jismning og'irligi nolga teng bo'ladi. Shu jumladan, suv ham vaznsizlik holatida bo'ladi va u jismga itarib chiqaruvchi kuch ta'sir ko'rsatmaydi.

Javob: C) nolga teng bo'ladi.

19-§. Tezlanish bilan harakatlanayotgan jism vazni

19.1. 5 m/s o'zgaras tezlik bilan harakat qilayotgan liftidagi massasi 70 kg bo'lgan odamning og'irligini (vaznini) aniqlang (N).

- A) 1050 B) 700 C) 500 D) 350

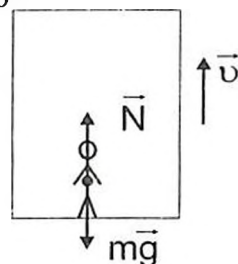
Berilgan:

$$v = 5 \text{ m/s}$$

$$m = 70 \text{ kg}$$

$$P = ?$$

Yechilishi: liftda turgan odamga ta'sir qiluvchi kuchlar rasmda ko'rsatilgan. Nyutonning ikkinchi qonuniga asosan, $N - mg = ma$ bo'lishi kerak, lekin lift tekis harakatlanayotganligi uchun $a = 0$ bo'ladi. U holda $N = mg$ bo'ladi.



Bu yerda odamning og'irligi P Nyutonning uchinchi qonuniga asosan reaksiya kuchi N ga tengdir.

$$P = N = mg = 70 \cdot 10 = 700 \text{ N}$$

Javob: B) 700.

19.2. 0,4 g tezlanish bilan yuqoridan tik tushirilayotgan m massali jismning og'irligi (vazni) qanday?

- A) 1,6 mg B) 0,4 mg C) 1,4 mg D) 0,6 mg

Berilgan:

$$a = 0,4 \text{ g}$$

$$m$$

$$T = ?$$

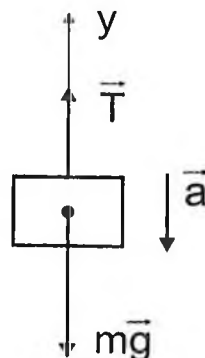
Yechilishi: Nyutonning 2- qonuniga asosan kuchlarni yozamiz. Bunda ipning taranglik kuchi jismning og'irligini ifodalaydi:

$$\overline{T} + \overline{mg}_y = m\overline{a}_y$$

$$T + mg = -ma$$

$$T = m(g - a) = m(g - 0,4g) = 0,6 \text{ mg}$$

$$T = 0,6 \text{ mg}$$



Javob: D) 0,6 mg.

19.3. Agar lift 1 m/s^2 tezlanish bilan pastga harakatlansa, undagi 60 kg massali odam lift polini qanday kuch bilan bosadi (N)?

- A) 60 B) 660 C) 600 D) 540

Berilgan:

$$a = 1 \text{ m/s}^2$$

$$m = 60 \text{ kg}$$

$$N = ?$$

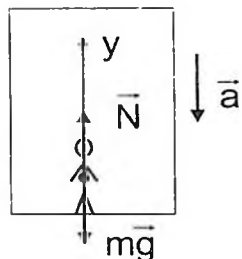
Yechilishi: Odamga ta'sir qilayotgan kuchlar asosida Nyutonning 2-qonuniga asosan kuchlarni yozamiz. Bunda odamning polga bosim kuchi reaksiya kuchiga teng bo'ladi.

$$\overline{N} + m\overline{g}_y = m\overline{a}_y$$

$$N - mg = -ma$$

$$N = m(g - a)$$

$$N = 60(10 - 1) = 540 \text{ N}$$



Javob: D) 540 N.

19.4. Lift yuqoriga ko'tarilmoqda. Uning 3 m/s^2 ga teng tezlanishi pastga yo'nalgan. Liftda 70 kg massali odam bor. Uning vazni (og'irligi) qanday (N)?

- A) 210 B) 490 C) 700 D) 910

Berilgan:

$$a = 3 \text{ m/s}^2$$

$$m = 70 \text{ kg}$$

$$N = ?$$

Yechilishi:

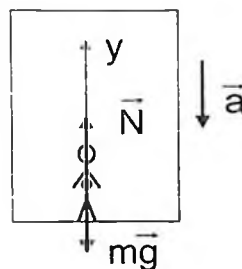
Kuchlarning y o'qidagi proyeksiyasini yozamiz.

$$\overline{N} + m\overline{g}_y = m\overline{a}_y$$

$$N - mg = -ma$$

$$N = m(g - a)$$

$$N = 70(10 - 3) = 490 \text{ N}$$



Javob: B) 490 N.

19.5. Massasi 30 kg bo'lgan bola liftida 1 m/s^2 tezlanish bilan ko'tarilmoqda. Uning og'irligi (vazni) qanday (N)? ($g = 10 \text{ m/s}^2$).

- A) 30 B) 31 C) 300 D) 330

Berilgan:

$$a = 1 \text{ m/s}^2$$

$$m = 30 \text{ kg}$$

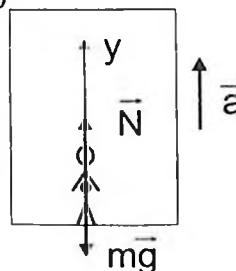
$$g = 10 \text{ m/s}^2$$

$$N = ?$$

Yechilishi:

Bolaga ta'sir qiluvchi kuchlarni Nyutonning 2-qonuni bo'yicha yozamiz. Bunda reaksiya kuchi uning og'irligini ifodalaydi.

$$\overline{N} + m\overline{g}_y = m\overline{a}_y$$



$$N - mg = ma$$

$$N = m(g + a)$$

$$N = 30(10 + 1) = 330 \text{ N}$$

$$N = 330 \text{ N}$$

Javob: D) 330 N.

19.6. Massasi 7 kg bo'lgan jismni 2 m/s^2 tezlanish bilan vertikal ko'tarish uchun qanday (N) kuch kerak bo'ladi?

A) 3,5

B) 14

C) 28

D) 84

Berilgan:

$$a = 2 \text{ m/s}^2$$

$$m = 7 \text{ kg}$$

$$F = ?$$

Yechilishi:

$$\vec{F} + m\vec{g}_y = m\vec{a}_y$$

$$F - mg = ma$$

$$F = m(g + a)$$

$$F = 7(10 + 2) = 84 \text{ N}$$

Javob: D) 84 N.

19.7. Suv quyilgan chelak yuqoriga 2 m/s^2 tezlanish bilan ko'tarilmoqda. Agar chelakdagi suv ustunining balandligi 30 sm bo'lsa, suvning chelak tubiga bosimi qanday (kPa) bo'ladi?

A) 1,1

B) 2,2

C) 3

D) 3,6

Berilgan:

$$a = 2 \text{ m/s}^2$$

$$h = 30 \text{ sm} = 0,3 \text{ m}$$

$$P = ?$$

Yechilishi:

Bunda suvning og'irligi ortadi.

$$\vec{N} + m\vec{g}_y = m\vec{a}_y$$

$$N + mg = ma$$

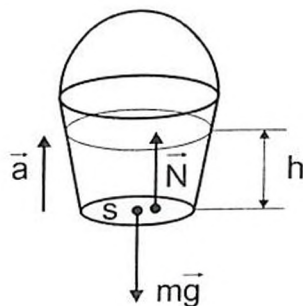
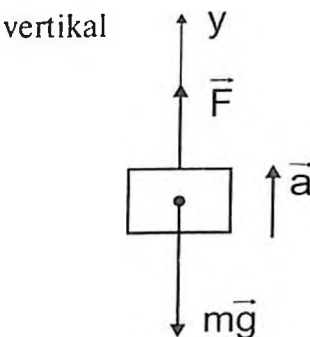
$$N = m(g + a)$$

Bosimni yozamiz:

$$P = \frac{N}{S} = \frac{m(g + a)}{S} = \frac{\rho \cdot S \cdot h(g + a)}{S}$$

$$P = \rho(g + a)h = 10^3 \cdot 12 \cdot 0,3 = 3,6 \text{ kPa}$$

Javob: D) 3,6.



19.8. Massasi m bo'lgan jism: 1) tezlanish bilan; 2) tekis; 3) sekinlanish bilan ko'tarilayotgan hollar uchun ipning taranglik kuchlarini taqqoslang.

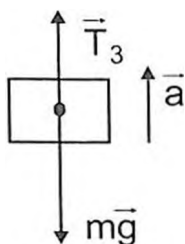
A) $T_1 < T_2 < T_3$

B) $T_1 > T_2 > T_3$

C) $T_1 > T_2 < T_3$

D) $T_1 = T_2 < T_3$

Yechilishi:



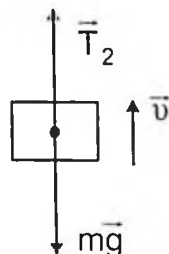
Tezlanish bilan:

$$T_1 + mg = ma$$

$$T_1 = m(g + a)$$

Taqqoslaymiz: $T_1 > T_2 > T_3$

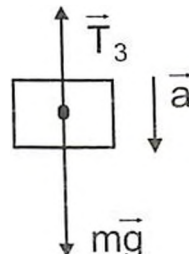
Javob: B)



Tekis:

$$T_2 + mg = 0$$

$$T_2 = mg$$



Sekinlanish bilan:

$$T_3 - mg = -ma$$

$$T_3 = m(g - a)$$

19.9. Ipga bog'langan, massasi 2 kg bo'lgan jism 5 m/s^2 tezlanish bilan ko'tarilmoqda. Ipning taranglik kuchi qanday (N)? $g = 10 \text{ m/s}^2$.

A) 5

B) 10

C) 20

D) 30

Berilgan:

$$a = 5 \text{ m/s}^2$$

$$m = 2 \text{ kg}$$

$$g = 10 \text{ m/s}^2$$

$$T = ?$$

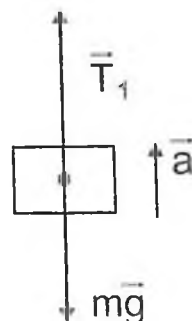
Yechilishi:

Y o'qqa proyeksiyani topamiz.

$$\overline{T}_y + \overline{mg}_y = \overline{ma}_y$$

$$T - mg = ma$$

$$T = m(g + a) = 2(10 + 5) = 30 \text{ N}$$



Javob: D) 30 N.

19.10. Massasi 1 t bo'lgan lift tekis tezlanuvchan harakat qilib, 10 s da 20 m masofaga tushdi. Lift kabinasini ko'taruvchi arqonning taranglik kuchi qanday (kN)? ($g = 10 \text{ m/s}^2$.)

A) 10

B) 9,6

C) 9,8

D) 9

Berilgan:

$$t = 10 \text{ s}$$

$$m = 1 \text{ t} = 1000 \text{ kg}$$

$$S = 20 \text{ m}$$

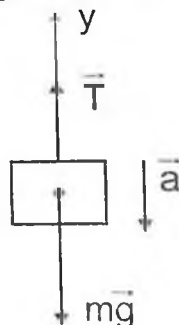
$$T = ?$$

Yechilishi:

$$\overline{T}_y + \overline{mg}_y = \overline{ma}_y$$

$$T - mg = ma$$

$$T = m(g - a)$$



Tezlanishni tekis tezlanuvchan harakatda yo'l formulasidan topamiz.

$$S = v_0 \cdot t + \frac{a \cdot t^2}{2} = \frac{at^2}{2} \quad a = \frac{2S}{t^2}$$

$$T = m \left(g - \frac{2S}{t^2} \right) = 10^3 \left(10 - \frac{2 \cdot 20}{100} \right) = 9,6 \text{ kN}$$

Javob: B) 9,6 kN

19.11. v tezlik bilan harakatlanayotgan avtomobilning qabariq ko'priikka bosim kuchini toping.

A) $F = ma$. B) $F = mg$. C) $F = \frac{mv^2}{r}$ D) $F = mg - \frac{mv^2}{r}$.

Berilgan:

v, r, m

$F = ?$

Yechilishi:

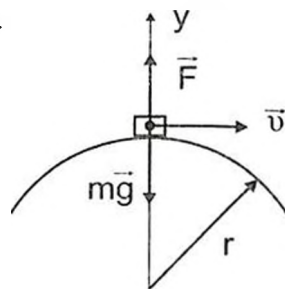
Nyutonning 2-qonunini qo'llab kuchlarning y o'qiga proyeksiyasini yozamiz.

$$\vec{F} + m\vec{g}_y = m\vec{a}_y \quad a_{m.i.} = \frac{v^2}{r}$$

$$F - mg = -ma$$

$$F = m(g - a)$$

$$F = m \left(g - \frac{v^2}{r} \right)$$



Javob: D) $F = m \left(g - \frac{v^2}{r} \right)$

19.12. Avtomobil egrilik radiusi 150 m bo'lgan qavariq ko'prikdan 30 m/s tezlikda o'tayotganda, haydovchining og'irligi (vazni) ko'prikning eng yuqori nuqtasida necha marta kamayadi?

A) 1,25 B) 2,5 C) 3 D) 4

Berilgan:

$v = 30 \text{ m/s}$

$R = 150 \text{ m}$

$\frac{P}{N} = ?$

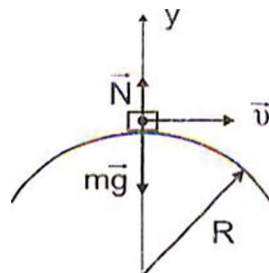
Yechilishi:

Avtomobilning yer o'rtasidagi vazni.

$$P = mg$$

Qavariq ko'prikdagi vaznini topamiz.

$$\vec{N} + m\vec{g}_y = m\vec{a}_{m.i.y} \quad a_{m.i.} = \frac{v^2}{r}$$



$$N - mg = -m \frac{v^2}{R}$$

$$N = m \left(g - \frac{v^2}{R} \right)$$

$$\frac{P}{N} = \frac{mg}{m \left(g - \frac{v^2}{R} \right)} = \frac{g}{g - \frac{v^2}{R}} = 2,5 \text{ marta}$$

Javob: B) 2,5 marta

19.13. Yo'lning qavariq, botiq va gorizontaal qismlarida harakatlanayotgan avtomobilning yo'lga ko'rsatadigan bosim kuchlari qanday munosabatda bo'ladi?

A) $F_1 = F_2 = F_3$

B) $F_1 > F_2 > F_3$

C) $F_2 > F_1 > F_3$

D) $F_1 < F_3 < F_2$

Yechilishi:

Qavariq qismidagi bosim kuchi

$$\bar{F}_{1y} + m\bar{g}_y = m\bar{a}_{m.i.y}$$

$$F_1 = mg = -m \frac{v^2}{R}$$

$$F_1 = m \left(g - \frac{v^2}{R} \right)$$

Botiq qismidagi bosim kuchi

$$\bar{F}_2 + m\bar{g}_y = m\bar{a}_{m.i.y}$$

$$F_2 - mg = m \frac{v^2}{R}$$

$$F_2 = m \left(g + \frac{v^2}{R} \right)$$

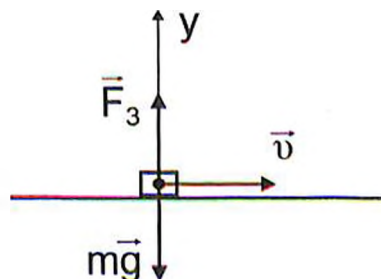
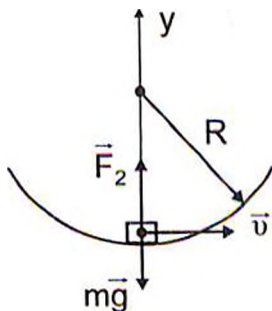
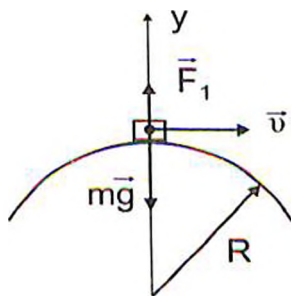
Gorizontaal qismidagi bosim kuchi

$$\bar{F}_3 + m\bar{g}_y = m\bar{a}_y = 0$$

$$F_3 - mg = 0$$

$$F_3 = mg$$

Taqqoslaymiz: $F_1 < F_3 < F_2$



Javob: D) $F_1 < F_3 < F_2$.

19.14. 50 kg massali bola uzunligi 5 m bo'lgan arg'imchoqda uchmoqda. Muvozanat vaziyatidan 5 m/s tezlik bilan o'tayotganda, u o'rindiqqa qanday (N) kuch bilan ta'sir qiladi?

A) 600

B) 650

C) 400

D) 750

Berilgan:

$$v = 5 \text{ m/s}$$

$$m = 50 \text{ kg}$$

$$l = 50 \text{ m}$$

$$N = ?$$

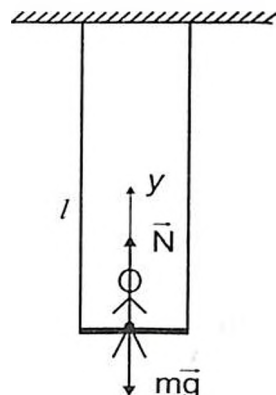
Yechilishi:

Bu masalada tezlanish sifatida markazga intilma tezlanish olinadi va radius arqonning uzunligi bo'ladi.

$$\vec{N} + m\vec{g}_y = m\vec{a}_y$$

$$N - mg = m \frac{v^2}{l}$$

$$N = m \left(g + \frac{v^2}{l} \right) = 50 \left(10 + \frac{25}{5} \right) = 750 \text{ N}$$



Javob: D) 750 N.

19.15. Massasi m bo'lgan jism l uzunlikdagi chilvirga bog'langan. Shu jism vertikal tekislikda doimiy tezlik bilan aylanayotgan bo'lsa, chilvirning jism eng quyi va eng yuqori nuqtalarda bo'lgandagi taranglik kuchlari nisbati F_1/F_2 qanday bo'ladi?

A) 1

B) $\frac{v^2 + gl}{v^2 - gl}$

C) $\frac{gl - v^2}{gl + v^2}$

D) $\frac{gl + v^2}{gl - v^2}$

Berilgan:

$$m, l, v$$

$$\frac{F_1}{F_2} = ?$$

Yechilishi:

Ikkala holatda ipning taranglik kuchlarini yozamiz.

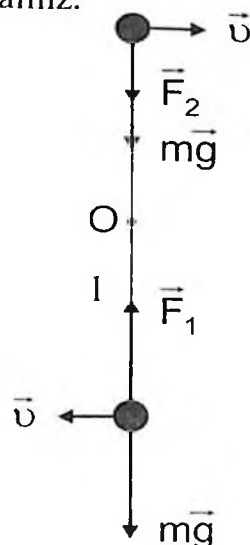
$$F_1 - mg = m \frac{a^2}{l} \quad F_2 + mg = m \frac{v^2}{l}$$

$$F_1 = m \left(g + \frac{v^2}{l} \right) \quad F_2 = \frac{mv^2}{l} - mg$$

$$F_2 = m \left(\frac{v^2}{l} - g \right)$$

$$\frac{F_1}{F_2} = \frac{m \left(\frac{v^2}{l} + g \right)}{m \left(\frac{v^2}{l} - g \right)} = \frac{v^2 + gl}{v^2 - gl}$$

Javob: B) $\frac{v^2 + gl}{v^2 - gl}$.



19.16. Egrilik radiusi 80 m bo'lgan qavariq ko'prikdan o'tayotgan avtomobilning tezligi necha m/s bo'lganda, uning eng yuqori nuqtadagi og'irligi gorizontall yo'ldagi og'irligidan 2 marta kichik bo'ladi?

- A) 5 B) 10 C) 15 D) 20

Berilgan:

$$R = 80 \text{ m}$$

$$P = mg/2$$

$$v = ?$$

Yechilishi:

Avtomobilning yo'lining gorizontall qismidagi qavariq ko'priknining eng yuqori nuqtadagi og'irliklarini yozamiz.

$$P_0 = mg$$

$$N = m \left(g - \frac{v^2}{R} \right)$$

$$P = mg/2 \text{ shartidan } N = P$$

$$mg = 2m \left(g - \frac{v^2}{R} \right)$$

$$\frac{g}{2} = g - \frac{v^2}{R}$$

$$v = \sqrt{\frac{gR}{2}} = \sqrt{\frac{10 \cdot 80}{2}} = 20 \text{ m/s}$$

Javob: D) 20 m/s.

19.17. Uzunligi 40 sm li ipga osilgan suv to'ldirilgan chelakcha vertikal tekislikda aylanmoqda. Chelakdagi suv to'kilmassligi uchun uning eng kichik tezligi qanday (m/s) bo'lishi kerak?

- A) 1,2 B) 2 C) 3 D) 4

Berilgan:

$$l = 40 \text{ sm} = 0,4 \text{ m}$$

$$v = ?$$

Yechilishi:

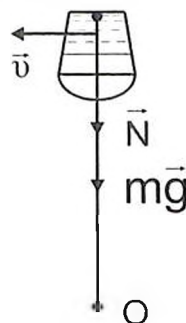
Suv to'kilmassligi uchun suvning chelak tubiga bosim kuchi 0 ga teng bo'lishi kerak. (Eng kichik tezlikda)

$$N + mg = ma_{m.i.} = m \frac{v^2}{l}$$

$$N = 0$$

$$mg = m \frac{v^2}{l}$$

$$v = \sqrt{gl} = \sqrt{10 \cdot 0,4} = 2 \text{ m/s.}$$



Javob: B) 2m/s.

19.18. Massasi 70 kg li kosmonavt kosmik kemada uchishi vaqtida yuklanish 4 ga teng bo'ldi. Kosmonavtning og'irligini toping.

A) 700 N

B) 1400 N

C) 4,2 N

D) 2,8 kN

Berilgan:

$$n = 4$$

$$m = 70 \text{ kg}$$

$$N = ?$$

Yechilishi:

Yuklanish jismning harakati davomida necha marotaba og'irlashganini ko'rsatib berar edi.

Shunga asosan og'irlikni topamiz.

$$n = \frac{N}{mg}$$

$$N = n \cdot mg = 4 \cdot 700 = 2,8 \text{ kN}$$

Javob: D) 2,8 kN.

19.19. m massali sharcha aravachaga o'rnatilgan ustunga osilgan. Aravacha gorizontaal yo'nalishda a tezlanish bilan harakatlanadi. Sharcha ipi bilan vertikal orasidagi α burchakni va ipning T taranglik kuchini toping.

A) $\alpha = \arctg \frac{g}{a}$; $T = m\sqrt{a^2 + g^2}$ B) $\alpha = \arctg \frac{a}{g}$; $T = m\sqrt{a^2 + g^2}$

C) $\alpha = \arctg \frac{a}{g}$; $T = \infty$

D) $\alpha = 0$; $T = mg$

Berilgan:

$$m, a$$

$$\alpha = ?$$

$$T = ?$$

Yechilishi:

Kuchlarning x va y o'qlaridagi proyeksiyalarini olamiz.

$$T \cos \alpha = mg \quad y \text{ o'qiga}$$

$$T \sin \alpha = ma \quad x \text{ o'qiga}$$

$$\operatorname{tg} \alpha = \frac{a}{g}$$

$$\alpha = \arctg \frac{a}{g}$$

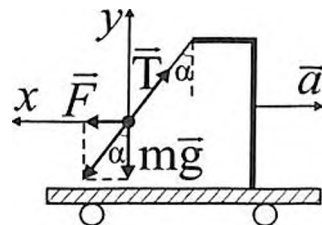
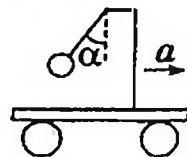
$$(T \cos \alpha)^2 + (T \sin \alpha)^2 = (mg)^2 + (ma)^2$$

$$T^2 (\cos^2 \alpha + \sin^2 \alpha) = m^2 (g^2 + a^2)$$

$$\cos^2 \alpha + \sin^2 \alpha = 1$$

$$T = m\sqrt{a^2 + g^2}$$

Javob: B) $\alpha = \arctg \frac{a}{g}$ $T = m\sqrt{a^2 + g^2}$



20-§. Yerning sun'iy yo'ldoshlari. Birinchi kosmik tezlik

20.1. Oyning Yer atrofida orbita bo'ylab aylanishidagi tezlanishi qanday (m/s^2)? Yer va Oy markazlari orasidagi masofa 60 Yer radiusiga teng. $g = 10 \text{ m/s}^2$.

- A) 1 B) $1/3600$ C) $1/36$ D) $1/360$

Berilgan:

$$\begin{array}{l} R = 60 R_0 \\ g_0 = 10 \text{ m/s}^2 \\ g = ? \end{array}$$

Yechilishi:

Butun olam tortishish qonunidan foydalanamiz.

Bunda yer sirtidagi
jism tezlanishi

Oyning tezlanishi
(yer atrofidagi)

$$\frac{G \cdot M m_0}{R_0^2} = m_0 g_0$$

$$\frac{G m M}{R^2} = m g$$

$$g_0 = \frac{GM}{R_0^2} \Rightarrow GM = g_0 R_0^2$$

$$\frac{GM}{R^2} = g \quad GM = g R^2$$

$$g_0 R_0^2 = g R^2 \quad R = 60 R_0$$

$$g_0 R_0^2 = g \cdot 3600 R_0^2$$

$$g = \frac{g_0}{3600} = \frac{10}{3600} = \frac{1}{360} \text{ m/s}^2$$

Javob: D) $1/360$.

20.2. Yer massasi m , Quyosh massasi M , Yer markazidan Quyosh markazigacha bo'lgan masofa R . Yerning Quyosh atrofidagi doiraviy orbita bo'ylab harakatidagi tezligi nimaga teng? Gravitatsion doimiy G .

- A) $\sqrt{\frac{GM}{R}}$ B) $\sqrt{\frac{GM}{2R}}$ C) $\sqrt{\frac{2GM}{R}}$ D) $\sqrt{\frac{GM}{2R}}$

Berilgan:

$$\begin{array}{l} m, M, R, G \\ v = ? \end{array}$$

Yechilishi:

Bunda o'zaro tortishish kuchi yerga markazga intilma tezlanish beradi.

$$\frac{GMm}{R^2} = m a_{m.i.} = m \frac{v^2}{R}$$

$$\frac{GM}{R^2} = \frac{v^2}{R}$$

$$v = \sqrt{\frac{GM}{R}}$$

Javob: A) $\sqrt{\frac{GM}{R}}$.

20.3. Birinchi samoviy (kosmik) tezlik necha km/s ga teng?

- A) 7,9 B) 8,9 C) 9,8 D) 6,9

Berilgan:

$$R = 6400 \text{ km}$$

$$v_1 = ?$$

Yechilishi:

Jism yer sirtidan uzilib, yerning sun'iy yo'ldoshi bo'lib qolishi uchun I-kosmik tezlikka ega bo'lishi kerak.

$$\frac{GMm}{R^2} = m \frac{v^2}{R}$$

$$v_1 = \sqrt{\frac{GM}{R}} \quad g = \frac{GM}{R^2} \Rightarrow GM = gR^2$$

$$v_1 = \sqrt{\frac{gR^2}{R}} = \sqrt{gR}$$

$$v_1 = \sqrt{g \cdot R} = \sqrt{9,8 \cdot 64 \cdot 10^5} = 7,9 \text{ km/s}$$

Javob: A) 7,9.

20.4. Sun'iy yo'ldosh orbitasining radiusi 9 marta ortsa, uning doiraviy orbita bo'ylab aylanish davri qanday o'zgaradi?

- A) 9 marta kamayadi B) 9 marta ortadi
C) 27 marta kamayadi D) 27 marta ortadi

Berilgan:

$$R_2 = 9R_1$$

$$\frac{T_2}{T_1} = ?$$

Yechilishi:

Kepler qonuniga asosan radius va aylanish davrlarini yozamiz.

$$\left(\frac{T_2}{T_1}\right)^2 = \left(\frac{R_2}{R_1}\right)^3 = \left(\frac{9R_1}{R_1}\right)^3 = 9^3$$

$$\frac{T_2}{T_1} = \sqrt{9^3} = 3^3 = 27$$

$$T_2 = 27T_1$$

Javob: D) 27 marta ortadi.

20.5. Massasi va radiusi yernikidan 2 marta katta bo'lgan planeta uchun birinchi kosmik tezlik qanday (km/s)? Yerda birinchi kosmik tezlik 8 km/s.

- A) 16 B) 8 C) 4 D) $8\sqrt{2}$

Berilgan:

$$m = 2 M_y$$

$$R = 2R_y$$

$$v_1 = ?$$

Yechilishi:

$$\frac{v_{Iyer} = 8 \text{ m/s}}{v_I = ?} \quad v_1 = \sqrt{\frac{GM}{R}} \quad v_{Iyer} = \sqrt{\frac{GM_{yer}}{R_{yer}}}$$

$$\frac{v_{Iyer}}{v_I} = \sqrt{\frac{GM_{yer}}{R_{yer}} \cdot \frac{R}{GM}} = \sqrt{\frac{M_{yer}}{R_{yer}} \cdot \frac{2R_{yer}}{2M_{yer}}} = 1$$

$$v_{Iyer} = v_I = 8 \text{ km/s}$$

Javob: B) 8.

20.6. Zichligi Yerning zichligi bilan birday, radiusi esa Yerning radiusidan 2 marta kichik bo'lgan planeta uchun birinchi kosmik tezlik qanday bo'ladi (km/s)? Yer uchun birinchi kosmik tezlik 8 km/s ga teng.

A) 2 B) 4 C) 8 D) 16

Berilgan:

$$\begin{aligned}\rho &= \rho_y \\ v_{Iy} &= 8 \text{ km/s} \\ R_y &= 2R \\ v_I &= ?\end{aligned}$$

Yechilishi:

$$v_I = \sqrt{\frac{GM}{R}} = \sqrt{M \cdot \rho \cdot V}$$

Sharning hajmini olamiz.

$$M = \rho \cdot \frac{4}{3} \pi R^3$$

$$v_I = \sqrt{\frac{G \cdot \rho \cdot \frac{4}{3} \pi R^3}{R}} = \sqrt{\frac{4}{3} \pi G \rho R^2}$$

$$v_I : R$$

$$\frac{v_I}{v_{Iy}} = \frac{R}{R_y} = \frac{R}{2R} = \frac{1}{2} \quad v_I = \frac{v_{Iy}}{2} = 4 \text{ km/s}$$

Javob: B) 4.

20.7. Jismlar ekvatorida vaznsiz bo'lishi uchun Yer sutkasi qanday davomiylikka ega bo'lishi kerak (min.)? Yer radiusini 6400 km deb oling.

A) 14 B) 42 C) 52 D) 84

Berilgan:

$$\begin{aligned}N &= 0 \\ R &= 6400 \text{ km} \\ T &= ?\end{aligned}$$

Yechilishi:

Yerning ekvatoridagi vazni.

$$N = m(g - a_{m.i.}) = 0$$

$$m(g - a_{m.i.}) = 0$$

$$g = a_{m.i.} = \omega^2 R$$

$$\frac{g}{R} = \omega^2$$

$$\omega = \sqrt{\frac{g}{R}} = \frac{2\pi}{T}$$

$$T = 2\pi \sqrt{\frac{R}{g}} = 2 \cdot 3,14 \sqrt{\frac{64 \cdot 10^5}{10}} = 84 \text{ min.}$$

Javob: D) 84.

20.8. Planeta atrofida kichik balandlikda aylana orbita bo'ylab harakatlanayotgan sun'iy yo'ldoshning aylanish davri T planetaning o'rtacha zichligiga qanday bog'langan?

- A) $T : \rho^2$ B) $T : \rho$ C) $T : 1/\sqrt{\rho}$ D) $T : 1/\rho$

Yechilishi:

Sun'iy yo'ldosh butun olam tortishish qonuniga asosan planetaga tortilib turadi va aylanma harakat qiladi, ya'ni shu kuch unga $a_{m.i.}$ tezlanishni beradi.

$$\frac{GMm}{R^2} = ma_{m.i.} \quad M = \rho \cdot v = \rho \cdot \frac{4}{3} \pi R^3$$

$$\frac{GM}{R^2} = a_{m.i.} = \omega^2 \cdot R \quad \omega = \frac{2\pi}{T}$$

$$G\rho \cdot \frac{4}{3} \pi R^3 = \omega^2 \cdot R^3$$

$$G\rho \cdot \frac{4}{3} \pi = \frac{4\pi^2}{T^2}$$

$$T = \sqrt{\frac{3\pi}{G\rho}} \quad T : \frac{1}{\sqrt{\rho}}$$

Javob: C) $T : 1/\sqrt{\rho}$.

21- §. Ishqalanish kuchi. Tinchlikdagi ishqalanish

21.1. Gorizontol stol ustida og'irligi 10 N bo'lgan brusok turibdi. Brusok bilan stol orasidagi ishqalanish koeffitsiyenti 0,1 ga teng bo'lsa, brusokka ta'sir etayotgan ishqalanish kuchi qanday (N)?

- A) 0 B) 1 C) 5 D) 10

Berilgan:

$$P = 10 \text{ N}$$

$$\mu = 0,1$$

$$F_{\text{ishq}}$$

Yechilishi:

Brusok harakatsiz holatda bo'lgani uchun ishqalanish kuchi 0 ga teng.

Javob: A) 0.

21.2. Massasi 1 kg bo'lgan taxta bo'lagi iskanjada 500 N kuch bilan siqib qo'yilgan. Taxt bilan iskanja orasidagi ishqalanish koeffitsiyenti $\mu = 0,4$. Shu vaziyatda taxtaga ta'sir etuvchi ishqalanish kuchi qanday (N)? $g = 10 \text{ m/s}^2$.

A) 200

B) 400

C) 40

D) 10

Berilgan:

$$m = 1 \text{ kg}$$

$$F = 500 \text{ N}$$

$$\mu = 0,4$$

$$F_{\text{ishq}}$$

Yechilishi:

Taxta shu holatda turishi uchun ishqalanish kuchi og'irlik kuchiga teng bo'lishi kerak.

$$F_{\text{ishq}} = mg = 1 \cdot 10 = 10 \text{ N}$$

$$F_{\text{ishq}} = 10 \text{ N}$$

Javob: D) 10.

21.3. Qiyalik burchaklari α_1 va α_2 bo'lgan qiya tekisliklarda tinch turgan m_1 va m_2 massali jismlarga ta'sir etuvchi ishqalanish kuchlari teng bo'lishi uchun qanday shart bajarilishi kerak?

A) $\frac{m_1}{m_2} = \frac{\cos \alpha_2}{\cos \alpha_1}$

B) $\frac{m_1}{m_2} = \frac{\sin \alpha_2}{\sin \alpha_1}$

C) $\frac{m_1}{m_2} = \text{tg } \alpha_1$

D) $\frac{m_1}{m_2} = \text{ctg } \alpha_1$

Berilgan:

$$\alpha_1, \alpha_2, m_1, m_2$$

$$F_{\text{ishq1}} = F_{\text{ishq2}}$$

$$\frac{m_1}{m_2} = ?$$

Yechilishi:

Jismlar qiya tekislikda turishi uchun $F_{\text{ishq}} = P_x$ bo'lishi lozim.

$$P_x = mg \sin \alpha$$

Yuqoridagi ifodani ikkala holat uchun yozamiz.

$$F_{\text{ishq}} = m_1 g \sin \alpha_1$$

$$F_{\text{ishq}} = m_2 g \sin \alpha_2$$

$$m_1 g \sin \alpha_1 = m_2 g \sin \alpha_2$$

$$\frac{m_1}{m_2} = \frac{\sin \alpha_2}{\sin \alpha_1}$$

Javob: B) $\frac{m_1}{m_2} = \frac{\sin \alpha_2}{\sin \alpha_1}$.

21.4. Balandligi 30 sm va uzunligi 50 sm bo'lgan qiya tekislikda 5 kg massali g'olacha muvozanatda qolishi uchun uni qanday (N) kuch bilan tekislikka tik bosib turish kerak bo'ladi? G'olacha bilan tekislik orasidagi ishqalanish koeffitsiyenti 0,4 ga teng.

A) 115

B) 75

C) 70

D) 35

Berilgan:

$$h = 30 \text{ sm}$$

$$l = 50 \text{ sm}$$

$$m = 5 \text{ kg}$$

$$\mu = 0,4$$

$$F = ?$$

Yechilishi:

G'olacha muvozanatda bo'lishi uchun $F_{ishq} = P_x = mg \sin \alpha$ bo'lishi lozim.

$$F_{ishq} = \mu N$$

$$\sin \alpha = \frac{h}{l} = \frac{3}{5} = 0,6$$

y o'qiga proyeksiya olamiz.

$$\cos \alpha = \sqrt{1 - \sin^2 \alpha} = 0,8$$

$$N - F - mg \cos \alpha = 0$$

$$N = F + mg \cos \alpha$$

$$F_{ishq} = \mu(mg \cos \alpha + F)$$

$$\mu(mg \cos \alpha + F) = mg \sin \alpha$$

$$F = \frac{mg \sin \alpha}{\mu} - mg \cos \alpha$$

$$F = mg \left(\frac{\sin \alpha}{\mu} - \cos \alpha \right)$$

$$F = 50 \left(\frac{0,6}{0,4} - 0,8 \right) = 35 N$$

Javob: D) 35 N.

21.5. Gorizontaal sirtida har birining massasi 4 kg bo'lgan va bir-biriga ip yordamida tutashtirilgan ikki jism yotibdi. Jismlar va sirt orasidagi ishqalanish koeffitsiyenti 0,3. Ulardan birini 10 N kuch bilan tortishmoqda. Ipning taranglik kuchi qanday (N)?

A) 0

B) 2

C) 3

D) 4

Berilgan:

$$m_1 = m_2 = m$$

$$m = 4 \text{ kg}$$

$$\mu = 0,3$$

$$F = 10 \text{ N}$$

$$T = ?$$

Yechilishi:

1-jismga ta'sir qiluvchi ishqalanish kuchini topamiz.

$$F_{ishq} = \mu N \quad N = mg$$

$$F_{ishq} = \mu mg = 0,3 \cdot 4 \cdot 10 = 12 \text{ N}$$

Bu yerda $F_{ishq} > F$ bo'lyapti. Demak, F qo'yilgan kuch brusokni qo'zg'ata olmaydi. Bundan $T = 0$ ekanligi kelib chiqadi.

Javob: A) 0.

21.6. Qiya tekislikda tinch yotgan 5 kg massali jismga ta'sir etayotgan ishqalanish kuchi qanday (N)? $\sin 30^\circ = 0,5$; $g = 10 \text{ m/s}^2$.

- A) 2 B) 2,5 C) 20 D) 25

Berilgan:

$$m = 5 \text{ kg}$$

$$g = 10 \text{ m/s}^2$$

$$F_{ishq} = ?$$

Yechilishi:

Jism qiya tekislikda tinch turishi uchun og'irlik kuchining x o'qidagi proyeksiyasi ishqalanish kuchiga teng bo'lishi kerak.

$$F_{ishq} = P_x = mg \sin \alpha$$

$$F_{ishq} = mg \sin \alpha = 5 \cdot 10 \cdot 0,5 = 25 \text{ N}$$

Javob: D) 25.

22-§. Sirpanish ishqalanish kuchi

22.1. Gorizontaal sirt bo'ylab sirpanayotgan jismning normal bosim kuchi 4 marta orttirilsa, ishqalanish kuchi qanday o'zgaradi?

- A) 2 marta ortadi B) o'zgarmaydi
C) 4 marta ortadi D) 16 marta ortadi

Berilgan:

$$N_2 = 4 N_1$$

$$g = 10 \text{ m/s}^2$$

$$\frac{F_{ishq2}}{F_{ishq1}} = ?$$

Yechilishi:

$$F_{ishq} = \mu N$$

Ishqalanish kuchi bosim kuchiga to'g'ri proporsional.
Demak, 4 marta ortadi.

$$\frac{F_{ishq2}}{F_{ishq1}} = \frac{\mu N_2}{\mu N_1} = 4$$

Javob: C) 4 marta ortadi.

22.2. Tekis yo'lda tormozlanayotgan avtomobilga ta'sir etuvchi ishqalanish kuchi og'irlik kuchining $1/4$ qismini tashkil etsa, shu yo'ldagi ishqalanish koeffitsiyenti qanday?

- A) 0,5 B) 0,25 C) 0,4 D) 0,05

Berilgan:

$$F_{ishq} = \frac{mg}{4}$$

$$\mu = ?$$

Yechilishi:

$$F_{ishq} = \mu N$$

$$N = mg$$

$$F_{ishq} = \mu mg$$

$$\mu = \frac{F_{ishq}}{mg} = \frac{1}{4} = 0,25$$

Javob: B) 0,25.

22.3. Og'irligi 180 kN bo'lgan beton plita yer sirtida tekis sudralmoqda. Tortish kuchi 54 kN bo'lib, gorizontal yo'nalgan. Ishqalanish ko'effitsiyentini toping.

A) 0,003

B) 0,1

C) 0,0003

D) 0,3

Berilgan:

$$P = 180 \text{ kN}$$

$$F = 54 \text{ kN}$$

$$\mu = ?$$

Yechilishi:

$$F - F_{ishq} = ma$$

Beton tekis harakatlanayotgani uchun $a = 0$ bo'ladi.

$$F = F_{ishq} = \mu N \quad N = P$$

$$F = \mu P$$

$$\mu = \frac{F}{P} = \frac{54}{180} = 0,3$$

Javob: D) 0,3.

22.4. Stolda yotgan 7 kg g'o'lani 0,5 m masofaga surish uchun 14 J ish bajarildi. G'o'la bilan stol orasidagi ishqalanish ko'effitsiyentini toping.

A) 0,1

B) 0,2

C) 0,25

D) 0,4

Berilgan:

$$m = 70 \text{ kg}$$

$$S = 0,5 \text{ m}$$

$$A = 14 \text{ J}$$

$$\mu = ?$$

Yechilishi:

Bu masalani ishqalanish kuchini bajargan ishi formulasi-dan foydalanib ishlaymiz.

$$A = F_{ishq} \cdot S$$

$$F_{ishq} = \mu mg$$

$$A = \mu mgS$$

$$\mu = \frac{A}{mgS} = \frac{14}{70 \cdot 0,5} = 0,4$$

Javob: D) 0,4.

22.5. Har birining massasi 4 kg bo'lgan uchta g'isht ustma-ust qo'yilgan. O'r-tadagi g'ishtni sug'urib olish uchun kamida necha nyuton kuch kerak bo'ladi? G'ishtning orasidagi ishqalanish ko'effitsiyenti 0,4.

A) 16

B) 24

C) 48

D) 50

Berilgan:

$$M = 4 \text{ kg}$$

$$\mu = 0,4$$

$$F = ?$$

Yechilishi:

Tortilish kuchi ikkita ishqalanish kuchining yig'indisiga teng bo'lishi kerak.

$$F = F_{i1} + F_{i2}$$

$$F_{i1} = \mu N_1 \quad N_1 = 2 mg$$

$$F_{i2} = \mu N_2 \quad N_2 = mg$$

$$F = \mu 2mg + \mu mg = 3\mu mg$$

$$F = 3 \cdot 0,4 \cdot 4 \cdot 10 = 48 \text{ N}$$

Javob: C) 48.

22.6. Gorizont bilan α burchak tashkil qiluvchi qiya tekislikdan sirpanib tushayotgan m massali jismga ta'sir etuvchi ishqalanish kuchining ifodasini toping.

- A) $\mu mg \cos \alpha$ B) μmg C) mg D) $\mu mg \sin \alpha$

Berilgan:

α, m

$F_{\text{ishq}} = ?$

Yechilishi:

Ishqalanish kuchi ifodasi:

$$F_{\text{ishq}} = \mu N$$

N ni topish uchun kuchlarning y o'qiga proyeksiyasini topamiz.

$$\bar{N}_y + \bar{P}_y = m\bar{a}_y$$

$$N - mg \cos \alpha = 0 \quad N = mg \cos \alpha$$

$$F_{\text{ishq}} = \mu mg \cos \alpha$$

Javob: A) $\mu mg \cos \alpha$.

22.7. Jism qiya tekislikdan sirpanib tushmoqda. Ishqalanish koeffitsiyenti μ ning qanday qiymatida jism tekis harakat qiladi?

- 1) $\mu > \operatorname{tg} \alpha$ 2) $\mu < \operatorname{tg} \alpha$ 3) $\mu = \operatorname{tg} \alpha$
A) 1 B) 2 C) 3 D) 1; 3

Yechilishi:

Kuchlarning x va y o'qlariga proyeksiyalarini olamiz.

O x o'qiga:

$$\bar{P}_x + F_{\text{ishqx}} = m\bar{a}_x$$

$$mg \sin \alpha - \mu N = ma$$

$$mg \sin \alpha - \mu mg \cos \alpha = ma$$

$$a = 0$$

O y o'qiga:

$$\bar{N}_y + \bar{P}_y = m\bar{a}_y = 0$$

$$N - mg \cos \alpha = 0$$

Tekis harakat bo'lgani uchun $g(\sin \alpha - \mu \cos \alpha) = 0$

$$\mu = \operatorname{tg} \alpha$$

Javob: C) $\mu = \operatorname{tg} \alpha$.

22.8. Massasi 30 kg bo'lgan g'o'laga qiyalik burchagi 60° bo'lgan qiya tekislik bo'ylab ko'tarilishda 30 N ishqalanish kuchi ta'sir qiladi. Ishqalanish koeffitsiyentini toping.

A) 0,03

B) 0,05

C) 0,15

D) 0,2

Berilgan:

$$m = 30 \text{ kg}$$

$$\alpha = 60^\circ$$

$$F_{\text{ishq}} = 30 \text{ N}$$

$$\mu = ?$$

Yechilishi:

$$F_{\text{ishq}} = \mu mg \cos \alpha$$

$$\mu = \frac{F_{\text{ishq}}}{mg \cos \alpha} = \frac{30}{300 \cdot 0,5} = 0,2$$

Javob: D) 0,2.

22.9. Qiya tekislikning balandligi uzunligining yarmiga teng bo'lsa, jism qiya tekislikdan sirpanib tushmasligi uchun ishqalanish koeffitsiyenti kamida qanday bo'lishi kerak?

A) 0,64

B) 0,48

C) 0,58

D) 0,7

Berilgan:

$$h = \frac{l}{2}$$

$$\mu = ?$$

Yechilishi:

Qiya tekislikda jism sirpanmasligi uchun $\mu = \operatorname{tg} \alpha$ bo'lishi kerak.

$$\mu = \operatorname{tg} \alpha = \frac{h}{\sqrt{l^2 - h^2}}$$

$$\mu = \operatorname{tg} \alpha = \frac{h}{\sqrt{4h^2 - h^2}} = \frac{h}{\sqrt{3}h} = \frac{\sqrt{3}}{3} = 0,58$$

$$\mu = 0,58$$

Javob: C) 0,58.

22.10. Qiyaligi 45° bo'lgan qiya tekislikda jismni ushlab turish uchun 3 N, uni yuqoriga tekis tortish uchun 7 N kuch talab qilinsa, ishqalanish koeffitsiyenti qanday?

A) 0,4

B) 0,5

C) 0,55

D) 0,45

Berilgan:

$$\alpha = 45^\circ$$

$$F_1 = 3 \text{ N}$$

$$F_2 = 7 \text{ N}$$

$$\mu = ?$$

Yechilishi:

Ushlab turish uchun (a-rasm) talab qilinadigan kuch:

$$F_1 + \mu mg \cos \alpha - mg \sin \alpha = 0$$

$$F_1 = mg(\sin \alpha - \mu \cos \alpha)$$

Yuqoriga tekis tortilgandagi (b-rasm) kuch:

$$F_2 = \mu mg \cos \alpha + mg \sin \alpha = 0$$

$$F_2 = mg(\sin \alpha + \mu \cos \alpha)$$

$$F_1 = mg(\sin \alpha - \mu \cos \alpha)$$

$$F_2 = mg(\sin \alpha + \mu \cos \alpha)$$

$$F_1 \cdot \sin \alpha + F_1 \mu \cos \alpha = F_2 \sin \alpha - F_2 \mu \cos \alpha$$

$$(F_1 + F_2) \mu \cos \alpha = (F_2 - F_1) \sin \alpha$$

$$\mu = \frac{F_2 - F_1}{F_2 + F_1} \operatorname{tg} \alpha$$

$$\mu = \frac{7 - 3}{10} \cdot 1 = 0,4$$

Javob: A) 0.4

22.11. Disk gorizontal tekislikda 15 ayl/min chastota bilan aylanmoqda. Aylanish o'qidan 10 sm masofada disk ustida kichik jism yotibdi. Ishqalanish koeffitsiyentining qanday eng kichik qiymatida jism disk ustidan sirpanib tushib ketmaydi?

A) 0,01

B) 0,025

C) 0,1

D) 0,25

Berilgan:

$$v = 0,25 \text{ ayl/s}$$

$$R = 0,1 \text{ m}$$

$$\mu = ?$$

Yechilishi:

Jism diskdan sirpanib ketmasligi uchun markazdan qochma kuch ishqalanish kuchiga teng bo'lishi kerak.

$$\mu mg = m4\pi^2 v^2 R$$

$$\mu = \frac{4\pi^2 v^2 R}{g}$$

$$\mu = \frac{4 \cdot 10 \cdot 625 \cdot 10^{-5}}{10} = 0,025$$

Javob: B) 0,025.

22.12. Avtomobilning tezligi 60 foizga ortsa, tezlik kvadratiga to'g'ri proporsional bo'lgan havoning qarshilik kuchi necha marta ortadi?

A) 2,56

B) 3,6

C) 8,6

D) 36

Berilgan: $v_2 = 1,6 \text{ } v$ $\frac{F_2}{F_1} = ?$

Yechilishi: Shartga ko'ra havoning qarshilik kuchi tezlik kvadratiga to'g'ri proporsional:

$$F_1 = k \cdot v_1^2$$

$$F_2 = k v_2^2$$

$$\frac{F_2}{F_1} = \frac{k v_2^2}{k v_1^2} = \left(\frac{v_2}{v_1} \right)^2 = \left(\frac{1,6 v_1}{v_1} \right)^2 = 2,56$$

$$\frac{F_2}{F_1} = 2,56$$

Javob: A) 2,56.

23-§. Ishqalanish kuchi ta'siridagi harakat

23.1. Gorizontal harakatlanayotgan jismga qo'yilgan tortish kuchi ishqalanish kuchidan kichik bo'lib qolsa, jism qanday harakat qiladi?

- A) ixtiyoriy harakatlanishi mumkin B) tekis sekinlanuvchan
C) tekis tezlanuvchan D) to'g'ri chiziqli tekis

Tortishuv kuchi ishqalanish kuchidan kichik bo'lib qolsa, natijaviy kuch orqaga yo'nalib qoladi va u tekis sekinlanuvchan harakat qilishni boshlaydi.

Javob: B) tekis sekinlanuvchan.

23.2. Qaysi shart bajarilganda jism suyuqlikda tekis cho'ka boshlaydi? (mg — og'irlik kuchi, F_A — Arximed kuchi, F — qarshilik kuchi).

- A) $mg = F$; B) $mg > F + F_A$; C) $mg = F_A + F$; D) $mg < F + F_A$.

Suyuqlikda harakat qilayotgan jismga og'irlik kuchi, qarshilik kuchi, arximed kuchi ta'sir qiladi. Tekis harakat qilganda $a = 0$ bo'lishi kerak.

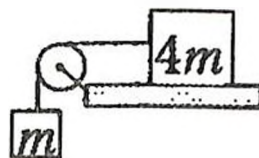
$$F_A + F - mg = ma = 0$$

$$F_A + F = mg$$

Javob: C) $F_A + F = mg$.

23.3. Rasmda tasvirlangan va o'zaro bog'langan jismlar o'zgarmas tezlik bilan harakatlanmoqda. Stol sirti bilan jism orasidagi ishqalanish koeffitsiyenti qanday? Blokdagi ishqalanishni hisobga olmang.

- A) 0,25 B) 0,5 C) 0,20 D) 0,15



Jismga ta'sir qiluvchi kuchlar bo'yicha Nyutonning 2-qonunini yozamiz.

$$mg - T = ma \quad v = \text{const}$$

$$T - \mu N = 4ma \quad a = 0$$

$$N = 4mg$$

$$mg - T = ma$$

$$T - \mu \cdot 4mg = 4ma$$

$$mg - 4\mu mg = 5ma = 0$$

$$\mu = \frac{1}{4} = 0,25$$

Javob: A) 0,25.

23.4. Massasi 4 kg bo'lgan jism gorizontaal sirtida turibdi. Unga 2 m/s² tezlanish berish uchun qanday (N) kuch bilan ta'sir etish kerak? Sirt bilan jism orasidagi ishqalanish koeffitsiyenti 0,2 ga teng.

A) 160

B) 1,6

C) 8

D) 16

Berilgan:

$$m = 4 \text{ kg}$$

$$\alpha = 2 \text{ m/s}^2$$

$$\mu = 0,2$$

$$F = ?$$

Yechilishi:

Nyutonning 2- qonuniga asosan, Ox va Oy o'qlariga proyeksiyalarni yozamiz.

$$F_i = \mu N$$

$$F - F_i = ma \quad F - \mu mg = ma$$

$$N - mg = 0 \quad F = m(a + \mu g) = 4 \cdot (2 + 10 \cdot 9^2) = 16 \text{ N}$$

Javob: D) 16.

23.5. Qiyaligi 60° bo'lgan qiya tekislikda sirpanib tushayotgan jismning tezlanishi qanday (m/s²)? Jism bilan qiya tekislik orasidagi ishqalanish koeffitsiyenti 0,2.

A) 4,5

B) 5,7

C) 6,5

D) 7,7

Berilgan:

$$\alpha = 60^\circ$$

$$\mu = 0,2$$

$$a = ?$$

Yechilishi:

Kuchlarning ox va oy o'qlariga proyeksiyalari bo'yicha Nyutonning 2 qonunini yozamiz.

$$\begin{cases} P_x - F_i = ma \\ N - P_y = 0 \end{cases}$$

$$\begin{cases} mg \sin \alpha - \mu N = ma \\ N = mg \cos \alpha \end{cases}$$

$$mg \sin \alpha - \mu mg \cos \alpha = ma$$

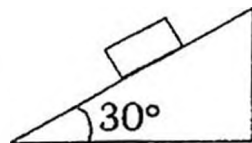
$$a = g(\sin \alpha - \mu \cos \alpha)$$

$$a = 10 \left(\frac{\sqrt{3}}{2} - 0,2 \cdot 0,5 \right) \approx 7,7 \text{ m/s}^2$$

Javob: D) 7,7 m/s².

23.6. Rasmda ko'rsatilgan qiya tekislikdagi 5 kg massali jismga 25 N ishqalanish kuchi ta'sir etmoqda. Jismning tezlanishi qanday (m/s²)? $g = 10 \text{ m/s}^2$; $\sin 30^\circ = 0,5$.

A) 6,25 B) 0,625 C) 2,5 D) 0



Berilgan:

$$m = 5 \text{ kg}$$

$$F_i = 25 \text{ N}$$

$$\alpha = 30^\circ$$

$$a = ?$$

Yechilishi:

$$P_x - \mu N = ma$$

$$mg \sin \alpha - \mu mg \cos \alpha = ma$$

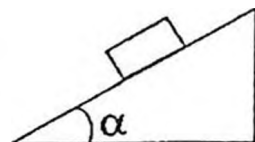
$$P_x = mg \sin \alpha = 50 \cdot \frac{1}{2} = 25 \text{ N}$$

$P_x = F_i$ ekan, demak, jismning tezlanishi 0 ga teng.
 $a = 0$

Javob: D) 0.

23.7. Chizmada ko'rsatilgan qiya tekislikdagi jismga 25 N ishqalanish kuchi ta'sir etmoqda. Jismning tezlanishi qanday (m/s²)? $\mu = \text{tg} \alpha$.

A) 0,625 B) 0 C) 2,5 D) 5



Berilgan:

$$F_i = 25 \text{ N}$$

$$\mu = \text{tg} \alpha$$

$$a = ?$$

Yechilishi:

$$P_x - \mu N = ma$$

$$mg \sin \alpha - \mu mg \cos \alpha = ma$$

$$mg(\sin \alpha - \mu \cos \alpha) = ma$$

$$a = g(\sin \alpha - \mu \cos \alpha) = 0$$

$$a = 0$$

Javob: B) 0.

23.8. Biror balandlikdan α burchakli qiya tekislik bo'ylab ishqalanish bilan tushayotgan jismning tezlanishi erkin tushish tezlanishining qanday qismini tashkil etadi?

A) $\cos \alpha - \mu \sin \alpha$ B) $\mu \cos \alpha$ C) $\mu \sin \alpha$ D) $\sin \alpha - \mu \cos \alpha$

Berilgan: α, μ

$$\frac{a}{g} = ?$$

Yechilishi:

Qiya tekislikda harakatlangan jismning tezlanishi $a = g(\sin \alpha - \mu \cos \alpha)$ ga teng.

Bu tezlanishni g bilan solishtiramiz.

$$\frac{a}{g} = \frac{g(\sin \alpha - \mu \cos \alpha)}{g} = \sin \alpha - \mu \cos \alpha$$

Javob: D) $\sin \alpha - \mu \cos \alpha$.

23.9. Gorizontal muz ustida inersiyasi bilan sirpanayotgan shaybaning tezlanishi $0,3 \text{ m/s}^2$ bo'lsa, ishqalanish koeffitsiyenti qanday? $g = 10 \text{ m/s}^2$.

A) 0,6

B) 0,3

C) 0,27

D) 0,09

Berilgan:

$$a = 3 \text{ m/s}^2$$

$$g = 10 \text{ m/s}^2$$

$$\mu = ?$$

Yechilishi:

Jism faqat ishqalanish kuchi ta'sirida harakat qilmoqda.

$$F_i = ma \quad N = mg$$

$$\mu N = ma \quad \mu mg = ma$$

$$a = \mu g \quad \mu = \frac{a}{g} = \frac{3}{10} = 0,3$$

Javob: D) 0,3.

23.10. Gorizontal joylashgan stol ustiga qo'yilgan brusokka 2 m/s boshlang'ich tezlik berilganda, u 1 s da to'xtadi. Brusok qanday yo'l bosib o'tgan (m)?

A) 0,25

B) 0,5

C) 0,75

D) 1

Berilgan:

$$v = 2 \text{ m/s}$$

$$t = 1 \text{ s}$$

$$S = ?$$

Yechilishi:

Jismga ishqalanish kuchi ta'sir qilyapti va u shu kuch ta'sirida tezlanish olib to'xtaydi.

$$F_i = ma$$

$$\mu mg = ma$$

$$a = \mu g$$

$$S = v_0 t - \frac{at^2}{2} \quad a = \frac{v_0}{t}$$

$$S = v_0 t - \frac{v_0 t}{2} = \frac{v_0 t}{2} \quad S = \frac{v_0 t}{2} = \frac{2 \cdot 1}{2} = 1 \text{ m}$$

Javob: D) 1.

23.11. Gorizontal stol sirtida turgan jism turtib yuborilgach, 1 sekundda 1 m yo'l yurib to'xtadi. Ishqalanish koeffitsiyentini toping.

A) 0,5

B) 0,4

C) 0,25

D) 0,2

Berilgan:

$g = 10 \text{ m/s}$

$t = 1 \text{ s}$

$S = 1 \text{ m}$

$\mu = ?$

Yechilishi:

Ishqalanish kuchi ta'siridagi tezlanish $a = \mu g$ ga teng.

$$S = v_0 t - \frac{at^2}{2} \quad a = \frac{v_0}{t}$$

$$S = \frac{v_0 t}{2} \quad a = \mu g = \frac{v_0}{t}$$

$$S = \frac{\mu g t^2}{2} \quad \mu = \frac{2S}{g t^2} = \frac{2 \cdot 1}{10 \cdot 1} = 0,2$$

Javob: D) 0,2.

23.12. Tezligi 5 m/s bo'lgan 20 kg massali jism ishqalanish kuchi ta'sirida 25 m yo'l yurib to'xtadi. Ishqalanish kuchi qanday (N)? $g = 10 \text{ m/s}^2$.

A) 2

B) 5

C) 10

D) 20

Berilgan:

$v_0 = 5 \text{ m/s}$

$m = 20 \text{ kg}$

$g = 10 \text{ m/s}^2$

$S = 25 \text{ m}$

$F_i = ?$

Yechilishi:

Jism faqat ishqalanish kuchi ta'sirida harakat qilayotgani uchun: $F_i = ma$ bo'ladi.

$$S = \frac{v_0^2}{2a}$$

$$2aS = v_0^2 \quad 2 \frac{F_i}{m} S = v_0^2$$

$$F_i = \frac{mv_0^2}{2S} = \frac{20 \cdot 25}{2 \cdot 25} = 10 \text{ N}$$

Javob: C) 10 N.

23.13. Keskin tormozlangan avtomobilning tormozlanish yo'lini 10 marta kamaytirish uchun avtomobilning boshlang'ich tezligini qanday o'zgartirish kerak? Tormozlanish vaqti bir xil.

A) 10 marta orttirish

B) $\sqrt{10}$ marta kamaytirish

C) $\sqrt{10}$ marta orttirish

D) 10 marta kamaytirish

Berilgan:

$S_1 = 10 S_2$

$t_1 = t_2$

$$\frac{v_{01}}{v_{02}} = ?$$

Yechilishi:

Tekis sekinlanuvchan harakat uchun yo'l formulasini keltirib chiqaramiz.

$$S = v_0 t - \frac{at^2}{2} \quad a = \frac{v_0}{t}$$

$$S = v_0 t - \frac{v_0 t}{2} = \frac{v_0 t}{2}$$

$$v_0 = \frac{2S}{t}$$

$$v_{01} = \frac{2S_1}{t_1} \quad v_{02} = \frac{2S_2}{t_2}$$

$$\frac{v_{01}}{v_{02}} = \frac{2S_1}{t_1} \cdot \frac{t_2}{2S_2} = \frac{S_1}{S_2} = 10$$

Javob: D) 10 marta kamaytirish.

23.14. M massali yuk avtomobilining tormozlanish yo'li S ga teng. Unga M massali yuk oritilgandagi tormozlanish yo'lini toping.

- A) $2S$ B) $1,5S$ C) S D) $2,5S$

Berilgan:

$$M, S_1 = S$$

$$S_2 = ?$$

Yechilishi:

$$F_i = ma$$

$$\mu mg = ma$$

$$a = \mu g$$

$$S = \frac{v_0^2}{2a} = \frac{v_0^2}{2\mu g} \quad S = \frac{v_0^2}{2\mu g}$$

Ko'ryapmizki, tormozlanish yo'li M massaga bog'liq bo'lmayapti, demak, javob S ga teng.

Javob: C) S .

23.15. Gorizontall yo'lda 72 km/soat tezlik bilan borayotgan avtomobilning tormozlanish vaqti necha sekund? Avtomobil g'ildiragi bilan yo'l orasidagi sirpanish ishqalanish ko'effitsiyenti $0,5$ ga teng.

- A) 4 B) $7,2$ C) 10 D) $14,4$

Berilgan:

$$v_0 = 20 \text{ m/s}$$

$$v = 0$$

$$\mu = 0,5$$

$$t = ?$$

Yechilishi:

Ishqalanish kuchi ta'siridagi tezlanish $a = \mu g$ ga teng.

$$a = \frac{v - v_0}{t} = -\frac{v_0}{t}$$

Minus ishora tezlanish harakat yo'nalishiga qarama-qarshi bo'lishi bilan kompensatsiyalanadi:

$$\frac{v_0}{t} = \mu g$$

$$t = \frac{v_0}{\mu g} = \frac{20}{0,5 \cdot 10} = 4s$$

Javob: A) 4 .

23.16. 72 km/soat tezlik bilan ketayotgan avtomobilga tormoz berilgach, u 25 m yo'li bosib to'xtadi. G'ildiraklar bilan yer orasidagi ishqalanish koeffitsiyenti qanday?

A) 0,25

B) 0,4

C) 0,5

D) 0,8

Berilgan:

$$v_0 = 20 \text{ m/s}$$

$$g = 10 \text{ m/s}^2$$

$$S = 25 \text{ m}$$

$$\mu = ?$$

Yechilishi:

$$a = \mu g$$

$$S = \frac{v_0^2}{2a} = \frac{v_0^2}{2\mu g}$$

$$\mu = \frac{v_0^2}{2gS} = \frac{400}{20 \cdot 25} = 0,8$$

Javob: D) 0,8.

23.17. Uzunligi L bo'lgan avtomobilning tezligi qanday bo'lganda, tormozlanish yo'li avtomobil uzunligidan 2 marta katta bo'ladi? Ishqalanish koeffitsiyenti $\mu = 0,25$.

A) $2\sqrt{Lg}$

B) $0,25\sqrt{Lg}$

C) $\sqrt{Lg}$

D) $4\sqrt{Lg}$

Berilgan:

$$L$$

$$S = 2L$$

$$\mu = 0,25$$

$$v_0 = ?$$

Yechilishi:

$$a = \mu g$$

$$S = \frac{v_0^2}{2a} = \frac{v_0^2}{2\mu g} = 2L$$

$$v_0^2 = 4 \cdot \mu g L = 4 \cdot 0,25 g L = g L$$

$$v_0 = \sqrt{g L}$$

Javob: C) $\sqrt{Lg}$.

23.18. Gorizontaal tekislikda harakatlanayotgan 6 kg massali jism qanday kuch ta'sirida 1 s da 2 m/s tezlikka erishadi (N)? Jismga ta'sir etayotgan ishqalanish kuchi 4 N ga teng.

A) 18

B) 16

C) 12

D) 8

Berilgan:

$$m = 6 \text{ kg}$$

$$v = 2 \text{ m/s}$$

$$v_0 = 0$$

$$F_i = 4 \text{ N}$$

$$F = ?$$

Yechilishi:

$$F - F_i = ma$$

$$a = \frac{v - v_0}{t} = \frac{v}{t}$$

$$a = \frac{v}{t}$$

$$F = F_i + m \cdot \frac{v}{t} = 4 + 6 \cdot \frac{2}{1} = 16 N$$

Javob: B) 16.

23.19. Avtomobil tortish kuchining og'irlik kuchiga nisbati k ga va qarshilik koeffitsienti μ ga teng bo'lsa, u qanday tezlanish bilan harakatlanadi? (g — erkin tushish tezlanishi).

A) $(k + \mu)g$ B) $(k - \mu)g$ C) $\frac{g}{k + \mu}$ D) $\frac{g(k - \mu)}{2}$

Berilgan:

$$k = \frac{F}{P}$$

$$\mu, g$$

$$a = ?$$

Yechilishi:

Jismga ta'sir qilayotgan kuchlarning ox va oy o'qlariga proyeksiyalarini olamiz.

$$F - F_i = ma \quad F_i = \mu N$$

$$N - P = 0 \quad N = P$$

$$F - \mu P = ma = \frac{P}{g} a \quad \frac{F}{P} = \mu + \frac{a}{g}$$

$$F = P \left(\mu + \frac{a}{g} \right) \quad k = \mu + \frac{a}{g}$$

$$k - \mu = \frac{a}{g}$$

$$a = g(k - \mu)$$

Javob: B) $(k - \mu) \cdot g$.

23.20. Poyezd $1,5 \text{ m/s}^2$ tezlanish bilan harakatlanmoqda. Elektrovozning tortish kuchi 1550 kN , qarshilik koeffitsiyenti $0,005$. Poyezdning massasi qanday (t)?

A) 500 B) 1000 C) 775 D) 3000

Berilgan:

$$a = 1,5 \text{ m/s}^2$$

$$F = 1550 \text{ kN}$$

$$\mu = 0,005$$

$$m = ?$$

Yechilishi:

$$F - \mu N = ma$$

$$N = mg$$

$$F - \mu mg = ma$$

$$F = m(a + \mu g)$$

$$m = \frac{F}{a + \mu g} = \frac{1550 \cdot 10^3}{1,5 + 0,005 \cdot 10} = 1000 \text{ t}$$

Javob: B) 1000 t.

23.21. Avtomobil 5 m/s^2 tezlanish bilan harakat qilishi uchun uning tortish koeffitsiyenti (tortish kuchining og'irlik kuchiga nisbati) qanday bo'lishi kerak? Qarshilik koeffitsiyenti 0,08.

A) 0,08

B) 0,16

C) 0,58

D) 0,3

Berilgan:

$$a = 5 \text{ m/s}^2$$

$$\mu = 0,08$$

$$k = \frac{F}{P} = ?$$

Yechilishi:

$$F - \mu P = ma \quad P = mg$$

$$F - \mu P = \frac{P}{g} a$$

$$F = P \left(\mu + \frac{a}{g} \right)$$

$$\frac{F}{P} = \mu + \frac{a}{g} = k$$

$$k = \mu + \frac{a}{g} = 0,08 + \frac{5}{10} = 0,58$$

Javob: C) 0,58.

23.22. Stolning gorizontaal sirtida yotgan yog'och bo'lagiga (brusokka) 5 m/s tezlik berildi. Agar u ishqalanish kuchi ta'sirida 1 m/s^2 tezlanish bilan harakat qilgan bo'lsa, 6 s da qanday yo'l bosadi (m).

A) 21

B) 6

C) 12

D) 12,5

Berilgan:

$$v_0 = 5 \text{ m/s}$$

$$a = 1 \text{ m/s}^2$$

$$t = 6 \text{ s}$$

$$S = ?$$

Yechilishi: Jismning harakat vaqti $t = v_0/a = 5 \text{ s}$.

Tekis sekinlanuvchan harakat uchun bosib o'tilgan yo'l formulasini yozamiz.

$$S = v_0 t - \frac{at^2}{2} = 5 \cdot 5 - \frac{1 \cdot 25}{2} = 12,5 \text{ m}$$

$$S = 12,5 \text{ m}$$

Javob: D) 12,5.

23.23. m massali jism gorizontaal tekislikda tekislikka α burchak ostida yuqoriga ta'sir etuvchi F kuch bilan tortib ketilmoqda. Agar jism bilan tekislik orasidagi ishqalanish koeffitsiyenti μ bo'lsa, ishqalanish kuchining ifodasi qanday bo'ladi?

A) $\mu mg - F \cos \alpha$

B) $\mu(mg + F \sin \alpha)$

C) $\mu(mg - F \cos \alpha)$

D) $\mu(mg - F \sin \alpha)$

Berilgan:

$$m, \alpha, F, \mu$$

$$F_i = ?$$

Yechilishi:

Jismga ta'sir etuvchi kuchlarning ox va oy o'qlariga proyeksiyalarini olamiz.

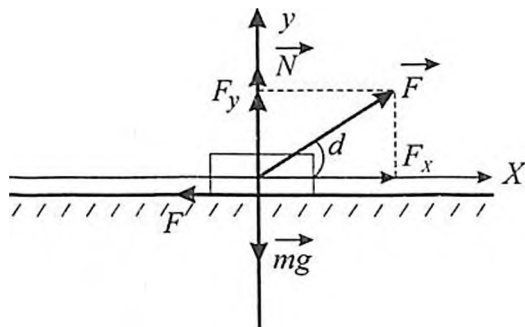
$$F \cos \alpha - F_i = ma \quad F_i = \mu N$$

$$N + F \sin \alpha - mg = 0$$

$$N = mg - F \sin \alpha$$

$$F_i = \mu(mg - F \sin \alpha)$$

D) $\mu(mg - F \sin \alpha)$.



23.24. Uzunligi l va qiyalik burchagi α bo'lgan qiya tekislikdan jism sirpanib tushmoqda. Agar ishqalanish koeffitsiyenti μ bo'lsa, tekislikning asosiga yetganda jismning tezligi qanday bo'ladi?

A) $\sqrt{2gl(\sin \alpha - \mu \cos \alpha)}$

B) $\sqrt{gl(\cos \alpha - \mu \sin \alpha)}$

C) $\sqrt{2gl(\sin \alpha + \mu \cos \alpha)}$

D) $\sqrt{gl(\mu \cos \alpha - \sin \alpha)}$

Berilgan:

l, μ, α

$v = ?$

Yechilishi:

Qiya tekislikda harakat qilayotgan jismga ta'sir qilayotgan kuchlarni yozib, uning qiya tekislikdagi tezlanishini topamiz.

$$P_x - F_i = ma$$

$$N = P_y = 0$$

$$mg \sin \alpha - \mu N = ma$$

$$N = mg \cos \alpha$$

$$mg \sin \alpha - \mu \cos \alpha = ma$$

$$a = g(\sin \alpha - \mu \cos \alpha)$$

Boshlang'ich tezliksiz tekis tezlanuvchi harakat uchun bosib o'tilgan yo'l formulasidan v ni topamiz.

$$l = \frac{v^2 - v_0^2}{2a} = \frac{v^2}{2a}$$

$$v^2 = 2al = 2g(\sin \alpha - \mu \cos \alpha)l$$

$$v = \sqrt{2gl(\sin \alpha - \mu \cos \alpha)}$$

Javob: A) $\sqrt{2gl(\sin \alpha - \mu \cos \alpha)}$.

24-§. Bir necha kuch ta'siridagi harakat

24.1. Suv ostidan yuqoriga ko'tarilayotgan havo pufakchasiga ta'sir etuvchi kuchlar orasidagi munosabat qanday bo'lganida pufakcha tekis harakatlanadi?

- A) Arximed kuchi qarshilik kuchiga teng bo'lganida
 B) og'irlik kuchi bilan harakatga qarshilik kuchining yig'indisi Arximed kuchiga teng bo'lganida
 C) og'irlik kuchi Arximed kuchiga teng bo'lganida
 D) qarshilik kuchi bilan Arximed kuchining yig'indisi og'irlik kuchiga teng bo'lganida

Yechilishi:

$$F_A - mg - F = 0$$

$$F_A = mg + F$$

Arximed kuchi og'irlik kuchi va qarshilik kuchlari yig'indisiga teng.

Javob: B) og'irlik kuchi bilan harakatga qarshilik kuchining yig'indisi Arximed kuchiga teng.

24.2. Hajmi 2 sm^3 bo'lgan havo pufagi o'zgarmas tezlik bilan ko'l tubidan ko'tarilyapti. Suvning qarshilik kuchi qanday (N)?

- A) 0,02 B) 0,05 C) 0,06 D) 0,08

Berilgan:

$$V = 2 \text{ sm}^3$$

$$\rho_0 = 10^3 \text{ kg/m}^3$$

$$F = ?$$

Yechilishi:

Og'irlik kuchini hisobga olmasak, qarshilik kuchi (F) Arximed kuchiga (F_A) teng bo'lib qoladi:

$$F = F_A = \rho_0 V g = 10^3 \cdot 2 \cdot 10^{-6} \cdot 10 = 0,02 \text{ N}$$

Javob: A) 0,02

24.3. Hajmi $0,5 \text{ m}^3$ bo'lgan vaznsiz shar $0,4 \text{ m}^3$ hajmli yukni ko'l tubidan yuqoriga tezlanishsiz ko'tarayotgan bo'lsa, yukning massasi qanday (kg)?

- A) 900 B) 500 C) 400 D) 90

Berilgan:

$$V_0 = 0,5 \text{ m}^3$$

$$V = 0,4 \text{ m}^3$$

$$g = 10 \text{ v/s}^2$$

$$m = ?$$

Yechilishi:

Bu shart bo'yicha pufakka va jismga ta'sir qiluvchi Arximed kuchi jismning og'irlik kuchiga teng bo'lishi kerak.

$$F_A - mg = ma = 0$$

$$F_A = mg$$

$$\rho_0 (V_0 + V) g = mg$$

$$m = \rho_0(V_0 + V)$$

$$m = 10^3(0,5 + 0,4) = 900 \text{ kg}$$

Javob: A) 900

24.4. Massasi 80 kg li parashutchi o'zgaras tezlik bilan tushmoqda. Unga ta'sir qilayotgan qarshilik kuchi qanday (N).

A) 800

B) 160

C) 80

D) 1600

Berilgan:

$$m = 80 \text{ kg}$$

$$g = 10 \text{ m/s}^2$$

$$F = ?$$

Yechilishi:

Parashutchi tekis tushayotganligi uchun $a = 0$ bo'ladi.

$$mg - F = ma = 0$$

$$F = mg = 80 \cdot 10 = 800 \text{ N}$$

Javob: A) 800.

24.5. Qiya tekislikning uzunligi 200 sm, balandligi esa 20 sm. Ishqalanish bo'lmaganda, jism qiya tekislikda qanday tezlanish bilan sirpanadi (m/s^2)?

A) 0,001

B) 0,1

C) 10

D) 1

Berilgan:

$$l = 200 \text{ sm}$$

$$h = 20 \text{ sm}$$

$$\mu = 0$$

$$a = ?$$

Yechilishi:

Qiya tekislikda jismning tezlanishi:

$$a = g(\sin \alpha - \mu \cos \alpha)$$

$$\sin \alpha = \frac{h}{l} = \frac{20}{200} = 0,1$$

$$a = g \sin \alpha = 10 \cdot 0,1 = 1 \text{ m/s}^2$$

Javob: D) 1.

24.6. Chana uzunligi 10 m bo'lgan tepalikdan 2 s ichida ishqalanishsiz sirpanib tushdi. Tepalikning qiyalik burchagini toping.

A) 30°

B) 45°

C) 60°

D) 75°

Berilgan:

$$l = 10 \text{ m}$$

$$t = 2 \text{ s}$$

$$\mu = 0$$

$$\alpha = ?$$

Yechilishi:

Qiya tekislikda ishqalanishsiz sirpanib tushgan jismning tezlanishi:

$$a = g \sin \alpha$$

Boshlang'ich tezliksiz tekis tezlanuvchan harakatda bosib o'tilgan yo'l formulasi:

$$l = \frac{at^2}{2} = \frac{g \sin \alpha t^2}{2}$$

$$\sin \alpha = \frac{2l}{gt^2} = \frac{2 \cdot 10}{10 \cdot 4} = \frac{1}{2}$$

$$\sin \alpha = \frac{1}{2}$$

$$\alpha = 30^\circ$$

Javob: A) 30° .

24.7. Qiyalik burchagi 45° bo'lgan qiya tekislikdan ishqalanishsiz sirpanib tushayotgan jism qanday tezlanish bilan harakat qiladi (m/s^2)?

A) $\frac{5\sqrt{2}}{2}$

B) $\frac{\sqrt{2}}{2}$

C) $10\sqrt{2}$

D) $5\sqrt{2}$

Berilgan:

$$\alpha = 45^\circ$$

$$g = 10 \text{ m/s}^2$$

$$a = ?$$

Yechilishi:

Qiya tekislikdan sirpanib tushayotgan jismning tezlanishi formulasi $a = g(\sin \alpha - \mu \cos \alpha)$

$\mu = 0$ bo'lsa, $a = g \sin \alpha$ bo'ladi.

$$a = 10 \cdot \frac{\sqrt{2}}{2} = 5\sqrt{2} \text{ m/s}^2$$

Javob: D) $5\sqrt{2}$.

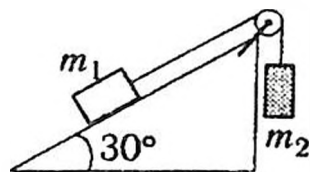
24.8. $m_1 = 10 \text{ kg}$, $m_2 = 15 \text{ kg}$ massali yuklar qo'zg'almas vaznsiz blok orqali rasmdagidek ipga bog'langan. Sistemaning tezlanishini toping (m/s^2). Ishqalanishni hisobga olmang.

A) 1

B) 2

C) 4

D) 5



Berilgan:

$$m_1 = 10 \text{ kg}$$

$$m_2 = 15 \text{ kg}$$

$$\mu = 0$$

$$a = ?$$

Yechilishi:

$$P_x = m_1 g \sin \alpha$$

Har bir jismga ta'sir qiluvchi kuchlarni Nyutonning 2-qonuniga asosan yozamiz.

$$m_2 g - T = m_2 a$$

$$T - m_1 g \sin \alpha = m_1 a$$

$$m_2 g - m_1 g \sin \alpha = (m_1 + m_2) a$$

$$a = \frac{(m_2 - m_1 \sin \alpha) g}{m_1 + m_2} = \frac{(15 - 10 \cdot \frac{1}{2}) \cdot 10}{10 + 15}$$

$$a = \frac{100}{25} = 4 \text{ m/s}^2$$

Javob: C) 4.

24.9. Jismning og'irlik kuchi havoning o'rtacha qarshilik kuchiga teng bo'lganda, jism 30 m balandlikdan necha sekundda tushadi? Jismning yerga urilish vaqtidagi tezligi 10 m/s.

- A) 1,5 B) $\sqrt{6}$ C) 3 D) $\frac{\sqrt{6}}{2}$

Berilgan:

$$\begin{array}{l} P = F_2 \\ h = 30 \text{ m} \\ v = 10 \text{ m/s} \\ t = ? \end{array}$$

Yechilishi:

Og'irlik kuchi qarshilik kuchiga teng bo'lganda, jism tekis harakat qiladi. Tekis harakatdagi yo'l formulasidan t ni topamiz.

$$h = vt$$

$$t = \frac{h}{v} = \frac{30}{10} = 3s$$

$$t = 3s$$

Javob: C) 3.

24.10. Yuqoriga tik otilgan jismning tezlanishi 1,2 g ga teng bo'lsa, jismga ta'sir etayotgan havoning qarshilik kuchining og'irlik kuchiga nisbati qanday bo'ladi?

- A) 0,2 B) 0,4 C) 0,8 D) 1

Berilgan:

$$\begin{array}{l} a = 1,2 \text{ g} \\ \frac{F_q}{P} = ? \end{array}$$

Yechilishi:

$$\bar{P} + \bar{F}_q = m\bar{a}$$

$$F_q = P \left(\frac{a}{g} - 1 \right)$$

$$P + F_q = \frac{P}{g} a$$

$$\frac{F_q}{P} = \frac{a}{g} - 1 = \frac{1,2g}{g} - 1 = 0,2$$

Javob: A) 0,2.

24.11. Massasi 3 kg bo'lgan jism 8 m/s² tezlanish bilan tik tushayotgan bo'lsa, havoning qarshilik kuchi qanday (N)?

- A) 54 B) 24 C) 18 D) 6

Berilgan:

$$\begin{array}{l} m = 3 \text{ kg} \\ a = 8 \text{ m/s}^2 \\ F_q = ? \end{array}$$

Yechilishi:

$$mg - F_q = ma$$

$$F_q = m(g - a)$$

$$F_q = 3(10 - 8) = 6N$$

Javob: D) 6.

24.12. Massasi 4 kg bo'lgan jism havoda $8,5 \text{ m/s}^2$ tezlanish bilan tushmoqda. Havoning qarshilik kuchini toping (N).

- A) 34 B) 24 C) 17 D) 6

Berilgan:

$$\begin{array}{l} m = 4 \text{ kg} \\ a = 8,5 \text{ m/s}^2 \\ \hline F_q = ? \end{array}$$

Yechilishi:

$$mg - F_q = ma$$

$$F_q = m(g - a)$$

$$F_q = 4 \cdot (10 - 8,5) = 4 \cdot 1,5 = 6 \text{ N}.$$

Javob: D) 6.

24.13. Yuqoriga tik otilgan 80 g massali jismga havoning 0,8 N qarshilik kuchi ta'sir etayotgan bo'lsa, jismning tezlanish moduli necha m/s^2 ga teng?

- A) 25 B) 20 C) 15 D) 10

Berilgan:

$$\begin{array}{l} m = 80 \text{ g} \\ F_q = 0,8 \text{ N} \\ \hline a = ? \end{array}$$

Yechilishi:

$$\bar{P} + F_q = ma$$

$$mg + F_q = ma$$

$$a = g + \frac{F_q}{m} = 10 + \frac{0,8}{0,08} = 20 \text{ m/s}^2$$

Javob: B) 20.

24.14. Blokka rasmdagidek osilgan va massalari bir xil bo'lgan 3 ta yuk qanday (m/s^2) tezlanish bilan harakatlanadi? Ishqalanish hisobga olinmasin.

- A) 1 B) 2 C) 3,3 D) 5

Berilgan:

$$\begin{array}{l} m_1 = 2 \text{ m} \\ m_2 = m \\ \hline a = ? \end{array}$$

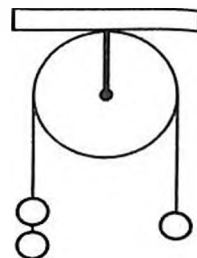
Yechilishi:

$$T - mg = ma \quad mg = 3ma$$

$$2mg - T = 2ma \quad a = \frac{g}{3} = 3,3 \text{ m/s}^2$$

$$2mg - mg = 3ma$$

Javob: C) 3,3.



24.15. Vaznsiz qo'zg'almas blok orqali o'tkazilgan chilvirga massalari 6 va 4 kg yuklar osilgan. Ular qanday (m/s^2) tezlanish bilan harakatlanadilar? $g=10 \text{ m/s}^2$.

- A) 6 B) 5 C) 2,4 D) 2

Berilgan:

$$m_1 = 6 \text{ kg}$$

$$m_2 = 4 \text{ kg}$$

$$g = 10 \text{ m/s}^2$$

$$a = ?$$

Yechilishi:

Jismlarning tezlanishini topish uchun har bir jismga ta'sir qilayotgan kuchlar uchun Nyutonning 2- qonunini yozamiz.

$$m_1 g - T = m_1 a$$

$$T - m_2 g = m_2 a$$

$$(m_1 - m_2) g = (m_1 + m_2) a$$

$$a = \frac{(m_1 - m_2)}{m_1 + m_2} g = \frac{(6 - 4) \cdot 10}{6 + 4} = 2 \text{ m/s}^2$$

Javob: D) 2.

24.16. Massalari m_1 va m_2 bo'lgan ikki jism qo'zg'almas blok orqali o'tgan vaznsiz va cho'zilmaydigan ip bilan o'zaro bog'langan. Ularning tezlanishlari qanday ifoda bilan aniqlanadi?

$$\text{A) } a = g \frac{m_2}{m_2 - m_1}$$

$$\text{B) } a = g \frac{m_1 + m_2}{m_2 - m_1}$$

$$\text{C) } a = g \frac{m_2 + m_1}{m_1 - m_2}$$

$$\text{D) } a = g \frac{m_2 - m_1}{m_1 + m_2}$$

Berilgan:

$$m_1, m_2$$

$$g$$

$$a = ?$$

Yechilishi:

Har bir jismga ta'sir qilayotgan kuchlar bo'yicha Nyutonning 2-qonuni ifodasini yozamiz. Shartli ravishda $m_2 > m_1$ deb olamiz.

$$m_2 g - T = m_2 a$$

$$T - m_1 g = m_1 a$$

$$(m_2 - m_1) g = (m_2 + m_1) a$$

$$a = \frac{m_2 - m_1}{m_2 + m_1} g$$

$$\text{Javob: D) } a = g \frac{m_2 - m_1}{m_1 + m_2}.$$

24.17. Qo'zg'almas blokka ilingan chilvirning ikki uchiga M va m massali yuklar osilgan. M/m nisbat qanday bo'lganida yuklarning harakat tezlanishi erkin tushish tezlanishidan katta bo'ladi? Chilvirning cho'zilishi hisobga olinmasin.

$$\text{A) } M/m = 10$$

$$\text{B) } M/m > 1$$

$$\text{C) } M/m < 1$$

$$\text{D) } \text{hech qachon}$$

Berilgan:

$$M, m$$

$$a > g$$

$$\frac{M}{m} = ?$$

Yechilishi:

$$Mg - T = Ma \quad \text{Matematik ifoda sifatida qarab masalani}$$

$$T - mg = ma \quad \text{yechemiz.}$$

$$(M - m)g = (M + m)a$$

$$\frac{a}{g} = \frac{\frac{M}{m} - 1}{\frac{M}{m} + 1} > 1$$

$$\left(\frac{M}{m} - 1\right)g = \left(\frac{M}{m} + 1\right)a$$

$$\frac{M}{m} - 1 > \frac{M}{m} + 1$$

$$a = \frac{\frac{M}{m} - 1}{\frac{M}{m} + 1} g$$

$-1 > +1$ bu ifoda to'g'ri emas.

$$a > g \quad \frac{a}{g} > 1$$

Javob: D) hech qachon.

24.18. Qo'zg'almas blok orqali o'tkazilgan ipga 3 va 5 kg massali yuklar osilgan. Ipning taranglik kuchi qanday (N)?

A) 40,5

B) 39

C) 37,5

D) 36

Berilgan:

$$m_1 = 3 \text{ kg}$$

$$m_2 = 5 \text{ kg}$$

$$g = 10 \text{ m/s}^2$$

$$T = ?$$

Yechilishi:

Ip cho'zilmas bo'lgani uchun hamma qismida taranglik kuchi bir xil bo'ladi.

$$m_2g - T = m_2a$$

$$T - m_1g = m_1a$$

a ni yo'qotish uchun ikkita hadni bo'lamiz.

$$\frac{m_2g - T}{T - m_1g} = \frac{m_2}{m_1}$$

$$m_1m_2g - Tm_1 = m_2T - m_1m_2g$$

$$2m_1m_2g = m_2T + m_1T = T(m_1 + m_2)$$

$$T = \frac{2m_1m_2g}{m_1 + m_2}$$

$$T = \frac{2 \cdot 3 \cdot 5 \cdot 10}{3 + 5} = 37,5 \text{ N}$$

Javob: C) 37,5.

24.19. Massalari m_1 va m_2 bo'lgan, qo'zg'almas blok orqali o'tgan vaznsiz va cho'zilmas ip bilan o'zaro bog'langan jismlar tezlanish bilan harakatlanmoqda. Ipning taranglik kuchi qanday?

A) $F = m_2g$ B) $F = (m_2 - m_1)g$ C) $F = \frac{m_1m_2g}{m_1 + m_2}$ D) $F = \frac{2m_1m_2g}{m_1 + m_2}$

Berilgan:

$$m_1, m_2$$

$$g$$

$$F = ?$$

Yechilishi:

$$m_2g - F = m_2a$$

$$F - m_1g = m_1a$$

$$(m_2g - F)m_1a = (F - m_1g)m_2a$$

$$m_1m_2g - Fm_1 = Fm_2 - m_1m_2g$$

$$2m_1m_2g = F(m_1 + m_2)$$

$$F = \frac{2m_1m_2g}{m_1 + m_2} \Rightarrow \text{ipdagi taranglik kuchi.}$$

Javob: D) $F = \frac{2m_1m_2g}{m_1 + m_2}$.

24.20. Qo'zg'almas blok orqali o'tkazilgan chilvir uchlariga $m_1 = 3$ kg va $m_2 = 2$ kg yuklar osilganida, tizim tinch holatdan boshlab harakatga kelsa va ishqalanish hisobga olinmasa 2 s dan so'ng yuklar tezligi qanday (m/s) bo'ladi?

A) 1 B) 2 C) 3 D) 4

Berilgan:

$$m_1 = 3 \text{ kg}$$

$$m_2 = 2 \text{ kg}$$

$$t = 2 \text{ s}$$

$$v = ?$$

Yechilishi:

$$m_1g - T = m_1a$$

$$T - m_2g = m_2a$$

$$(m_1 - m_2)g = (m_1 + m_2)a$$

$$a = \frac{(m_1 - m_2)g}{m_1 + m_2} \Rightarrow \text{jismlarning harakat tezlanishlari.}$$

Harakat tinch holatdan boshlanganligi uchun $v_0 = 0$ bo'ladi. Oniy tezlik formulasidan tezlikni topamiz.

$$v = v_0 + at \quad v = at$$

$$v = \frac{(m_1 - m_2)gt}{m_1 + m_2}$$

$$v = \frac{(3 - 2)10 \cdot 2}{3 + 2} = 4 \text{ m/s}$$

Javob: D) 4.

24.21. Qo'zg'almas blokka ip yordamida 5 va 3 kg massali yuklar osilgan. Yuklar harakatlana boshlagan paytdan 12 s o'tgan paytdagi blok aylanishining oniy chastotasi qanday (ayl/s) bo'ladi? Blok radiusi 2 sm. $\pi = 3$ deb hisoblang.

A) 125

B) 144

C) 180

D) 250

Berilgan:

$$t = 12s$$

$$m_1 = 5 \text{ kg}$$

$$m_2 = 3 \text{ kg}$$

$$R = 2 \text{ sm}$$

$$\pi = 3$$

$$v = ?$$

Yechilishi:

Blokdagi jismlarning harakat tezlanishi:

$$a = \frac{(m_1 + m_2)g}{m_1 + m_2}$$

t vaqtdan keyingi tezlikni topamiz ($v_0 = 0$).

$$v = v_0 + at = at$$

$$v = \frac{(m_1 - m_2)gt}{m_1 + m_2}$$

Harakat tezlikni chastotaga bog'laymiz.

$$v = \omega R = 2\pi \nu R$$

$$\nu = \frac{v}{2\pi R} = \frac{(m_1 - m_2)gt}{2\pi R(m_1 + m_2)} = \frac{(5 - 3)10 \cdot 12}{2 \cdot 3 \cdot 2 \cdot 10^{-2}(5 + 3)}$$

$$\nu = 250 \text{ ayl/s}$$

Javob: D) 250.

24.22. Rasmda ko'rsatilgan sistemadagi I va II iplarning taranglik kuchlarini toping (N). $m = 10 \text{ kg}$, $m_1 = 4 \text{ kg}$, $m_2 = 6 \text{ kg}$. Ishqalanish kuchini hisobga olmang.

A) 54; 54

B) 44; 54

C) 44; 44

D) 50; 42

Berilgan:

$$m = 10 \text{ kg}$$

$$m_1 = 4 \text{ kg}$$

$$m_2 = 6 \text{ kg}$$

$$T_1 = ?$$

$$T_2 = ?$$

Yechilishi:

$$m_2 g - T_2 = m_2 a$$

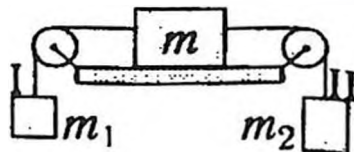
$$T_2 - T_1 = m a$$

$$T_1 - m_1 g = m_1 a$$

$$m_1 g - T_2 + T_2 - T_1 + T_1 - m_1 g = (m_1 + m_2 + m)a$$

$$(m_2 - m_1)g = (m_1 + m_2 + m)a$$

$$a = \frac{(m_2 - m_1)}{m_1 + m_2 + m} g$$



$$m_1 g - T_2 = \frac{m_2(m_2 - m_1)g}{m_1 + m_2 + m}$$

$$T_2 = m_2 g - \frac{m_2(m_2 - m_1)g}{m_1 + m_2 + m}$$

$$T_2 = (1 - \frac{m_2 - m_1}{m_1 + m_2 + m})m_2 g$$

$$T_2 = \frac{(2m_1 + m)m_2 g}{m_1 + m_2 + m}$$

$$T_2 = \frac{(24 + 10) \cdot 6 \cdot 10}{10 + 4 + 6} = 54 \text{ N}$$

$$T_2 = 44 \text{ N}$$

$$T_1 = \frac{(2m_2 + m)m_1 g}{m_1 + m_2 + m}$$

$$T_1 = \frac{(2 \cdot 6 + 10) \cdot 4 \cdot 10}{6 + 4 + 10} = 44 \text{ N}$$

$$T_1 = 54 \text{ N}$$

Javob: B) 44; 54.

24.23. Poldagi 10 kg massali yukni 120 N kuch gorizontga 30° burchak ostida pastga ta'sir etib, joyidan siljitgan bo'lsa, pol bilan jism orasidagi ishqalanish koeffitsiyenti qanday?

A) 0,4

B) 0,6

C) 0,5

D) 0,65

Berilgan:

$$m = 10 \text{ kg}$$

$$F = 120 \text{ N}$$

$$\alpha = 30^\circ$$

$$\mu = ?$$

Yechilishi:

Jismga ta'sir qilayotgan kuchlarning Ox Oy o'qlariga proyeksiyalarini yozamiz. Joyidan qo'zg'alangani uchun $a = 0$ bo'ladi.

$$F \cos \alpha - F_i = 0 \quad F_i = \mu N$$

$$N - F \sin \alpha - mg = 0$$

$$N = F \sin \alpha + mg$$

$$F \cos \alpha = \mu N$$

$$\mu = \frac{F \cos \alpha}{N} = \frac{F \cos \alpha}{F \sin \alpha + mg}$$

$$\mu = \frac{120 \cdot 0,867}{120 \cdot 0,5 + 10 \cdot 10} = 0,65$$

Javob: D) 0,65.

24.24. Zichligi $2,5 \cdot 10^3 \text{ kg/m}^3$ bo'lgan plastmassa bo'lagi suvda qanday tezlanish bilan pastga tushadi (m/s^2)? Qarshilik kuchini hisobga olmang.

A) 6

B) 5

C) 2,5

D) 1

Berilgan:

$$\rho = 2,5 \cdot 10^3 \frac{\text{kg}}{\text{m}^3}$$

$$g = 10 \frac{\text{m}}{\text{s}^2}$$

$$\rho_0 = 10^3 \frac{\text{kg}}{\text{m}^3}$$

$$a = ?$$

Yechilishi:

Jismga ta'sir qilayotgan kuchlar bo'yicha oniy tezlanishni yozamiz.

$$mg - F_A = ma$$

$$m = \rho V, \quad F_A = \rho_0 Vg$$

$$\rho Vg - \rho_0 Vg = \rho Va$$

$$a = \frac{\rho - \rho_0}{\rho} g = \frac{(2,5 - 1) \cdot 10^3}{2,5 \cdot 10^3} \cdot 10 = 6 \text{ m/s}^2$$

$$a = 6 \text{ m/s}^2$$

Javob: A) 6.

24.25. Shisha parchasi suvda 6 m/s^2 tezlanish bilan tushmoqda. Shishaning zichligini toping (kg/m^3). Harakatga qarshilik kuchini hisobga olmang.

A) 1200

B) 1500

C) 1600

D) 2500

Berilgan:

$$a = 6 \text{ m/s}^2$$

$$g = 10 \text{ m/s}^2$$

$$\rho = ?$$

Yechilishi:

$$mg - F_A = ma$$

$$\rho Vg - \rho_0 Vg = \rho Va$$

$$\rho g - \rho_0 g = \rho a$$

$$\rho g - \rho a = \rho_0 g$$

$$\rho(g - a) = \rho_0 g$$

$$\rho = \frac{g}{g - a} \rho_0 = \frac{10}{10 - 6} \cdot 10^3 = 2500 \text{ kg/m}^3$$

$$\rho = 2500 \text{ kg/m}^3$$

Javob: D) 2500.

24.26. Zichligi suvnikidan 2 marta katta 50 kg li buyumni suvda 2 m/s^2 tezlanish bilan ko'tarish uchun unga kamida qanday kuch qo'yish kerak (N)?

A) 50

B) 100

C) 350

D) 400

Berilgan:

$$\rho = 2 \rho_0$$

$$m = 50 \text{ kg}$$

$$a = 2 \text{ m/s}^2$$

$$F = ?$$

Yechilishi:

Oy o'qi bo'yicha proyeksiyalarni yozamiz.

$$F + F_A - mg = ma$$

$$m = \rho V = 2\rho_0 V$$

$$F + \rho_0 Vg - mg = ma$$

$$V = \frac{m}{2\rho_0}$$

$$F = m(a + g) - \rho_0 \cdot \frac{m}{2\rho_0} g$$

$$F = m \left(a + \frac{g}{2} \right)$$

$$F = m \left(a + \frac{g}{2} \right) = 50 \left(2 + \frac{10}{2} \right) = 350 N$$

$$F = 350 N$$

Javob: C) 350.

24.27. Massasi 5 t avtomobil qiyaligi 0,01 ga teng tepalikdan tormozlangan holda o'zgaras tezlik bilan tushmoqda. Ishqalanish kuchi qanday (N)?

A) 500

B) 1000

C) 100

D) 10

Berilgan:

$$M = 5 t$$

$$\sin \alpha = 0,01$$

$$F_i = ?$$

Yechilishi:

Avtomobilga tekislik bo'yicha ta'sir qilayotgan og'irlik kuchining proyeksiyasi ishqalanish kuchiga teng. Shuning uchun ham avtomobil tekis harakat qiladi. Bu yerda qiyaligi degani qiyalik burchagining sinusi bo'ladi.

$$F_i = P \sin \alpha = Mg \sin \alpha$$

$$F_i = Mg \sin \alpha = 5 \cdot 10^4 \cdot 10^{-2} = 500 N$$

$$F_i = 500 N$$

Javob: A) 500.

24.28. Qiya tekislikning qiyalik burchagini oshirib, 30° ga yetkazilganda, undagi 1 kg massali jism sirpana boshladi. Shu jismni qiya tekislik bo'ylab yuqoriga tekis tortish uchun qanday (N) kuch kerak bo'ladi?

A) 20

B) 10

C) 15

D) 30

Berilgan:

$$\alpha = 30^\circ$$

$$m = 1 \text{ kg}$$

$$F = ?$$

Yechilishi:

1. Boshlang'ich holatda $P_x = F_i$ bo'lganda, jism sirpanishni boshlaydi.

$$P_x = F_i \quad P_x = mg \sin \alpha \quad F_i = \mu mg \cos \alpha$$

$$mg \sin \alpha = \mu mg \cos \alpha$$

$$\mu = \tan \alpha$$

2. Yuqoriga tekis tortish uchun kerak bo'ladigan kuch $a = 0$

$$F - mg \sin \alpha - \mu mg \cos \alpha = ma = 0$$

$$F = mg(\sin \alpha + \mu \cos \alpha) = mg(\sin \alpha + \tan \alpha \cdot \cos \alpha) = 2mg \sin \alpha$$

$$F = 2mg \sin \alpha = 2 \cdot 10 \cdot \frac{1}{2} = 10 N$$

$$F = 10 N$$

Javob: B) 10.

24.29. Massasi 50 kg aravacha qiyalik burchagi 45° bo'lgan qiya tekislik bo'y-lab 1 m/s^2 tezlanish bilan ko'tarilmoqda. Agar ishqalanish koeffitsiyenti 0,2 bo'lsa, aravachani tortuvchi kuch qanday (N)? $g=10 \text{ m/s}^2$, $\sin 45^\circ = \cos 45^\circ = 0,7$ deb oling.

A) 500

B) 10

C) 100

D) 470

Berilgan:

$$m = 50 \text{ kg}$$

$$\alpha = 15^\circ$$

$$a = 1 \text{ m/s}^2$$

$$\mu = 0,2$$

$$F = ?$$

Yechilishi:

Aravachaga ta'sir qilayotgan kuchlarning Ox va Oy o'qla-riga proyeksiyalarini olamiz.

$$F - mg \sin \alpha - \mu N = ma$$

$$N - mg \cos \alpha = 0$$

$$N = mg \cos \alpha$$

$$F = mg \sin \alpha + \mu mg \cos \alpha + ma$$

$$F = m[g \sin \alpha + \mu g \cos \alpha + a]$$

$$F = 50[10 \cdot 0,7(1 + 0,2) + 1] = 470 \text{ N}$$

$$F = 470 \text{ N}$$

Javob: D) 470.

24.30. Massasi 1 kg jism qiya tekislik bo'y-lab 5 m/s^2 tezlanish bilan ishqala-nishsiz sirpanib tushmoqda. Shu jismni qiya tekislik bo'y-lab yuqoriga shunday tezlanish bilan tortish uchun qanday (N) kuch kerak bo'ladi?

A) 10

B) 6

C) 5

D) 20

Berilgan:

$$m = 1 \text{ kg}$$

$$a = 5 \text{ m/s}^2$$

$$\mu = 0,2$$

$$F = ?$$

Yechilishi:

1. Jism boshlang'ich holatda og'irlik kuchining proyeksiyasi ta'sirida sirpanib tushyapti:

$$mg \sin \alpha = ma$$

$$a = g \sin \alpha$$

$$2. F = mg \sin \alpha + ma$$

$$F = mg \sin \alpha + ma = 2mg \sin \alpha = 2ma$$

$$F = 2ma = 2 \cdot 1 \cdot 5 = 10 \text{ N}$$

Javob: A) 10.

24.31. Qiyaligi 30° bo'lgan qiya tekislikdagi 2 kg massali jismni 10 N kuch bilan ushlab turish mumkin. Agar jism qo'yib yuborilsa, u qanday tezlanish bilan sirpanib tushadi (m/s^2)?

A) 0,4

B) 2,5

C) 5

D) 10

Berilgan:

$\alpha = 30^\circ$

$m = 2 \text{ kg}$

$F = 10 \text{ N}$

$a = ?$

Yechilishi:

$F - mg \sin \alpha + \mu mg \cos \alpha = 0$ — ushlab turish uchun

$\mu mg \cos \alpha = mg \sin \alpha - F$

$mg \sin \alpha - \mu mg \cos \alpha = ma$ — qo'yib yuborilganda

$mg \sin \alpha + F - mg \sin \alpha = ma$

$F = ma$

$a = \frac{F}{m} = \frac{10}{2} = 5 \text{ m/s}^2$

Javob: C) 5.

24.32. Jism ipga bog'langan holda gorizonta tekislikda $r = 0,4 \text{ m}$ radiusli aylana bo'ylab harakat qilmoqda. Bunda ip vertikal bilan $\alpha = 45^\circ$ burchak tashkil qiladi. Jismning harakat tezligi qanday (m/s).

A) 0,2

B) 2

C) 4

D) 0,4

Berilgan:

$r = 0,4 \text{ m}$

$\alpha = 45^\circ$

$v = ?$

Yechilishi:

$T \cos \alpha = mg$

$g \cdot \tan \alpha = \frac{v^2}{r}$

$T \sin \alpha = ma$

$v = \sqrt{g \cdot r \cdot \tan \alpha}$

$\tan \alpha = \frac{a}{g} \quad a = \frac{v^2}{r}$

$v = \sqrt{10 \cdot 0,4 \cdot 1} = 2 \text{ m/s}$

$v = 2 \text{ m/s}$

Javob: B) 2.

24.33. 10 m/s tezlik bilan harakatlanayotgan konkichining muzga qiyaligi 45° bo'lganda, uning aylanish radiusi qanday (m) bo'ladi?

A) 5

B) 10

C) 15

D) 21

Berilgan:

$v = 10 \text{ m/s}$

$\alpha = 45^\circ$

$R = ?$

Yechilishi:

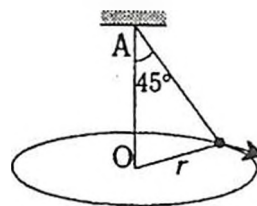
$\tan \alpha = \frac{a}{g}$

$a = \frac{v^2}{R}$

$g \cdot \tan \alpha = \frac{v^2}{R}$

$R = \frac{v^2}{g \cdot \tan \alpha} = \frac{100}{10 \cdot 1} = 10 \text{ m}$

Javob: B) 10.



24.34. Uzunligi 80 sm ipga osilgan sharcha vertikal bilan 60° burchak hosil qilib, gorizontal tekislikda aylanmoqda. Sharchaning aylanish davri qanday (s). $\pi = 3$.

- A) 1,2 B) 1,4 C) 1,6 D) 2

Berilgan:

$$l = 0,8 \text{ m}$$

$$\alpha = 60^\circ$$

$$\pi = 3$$

$$T = ?$$

Yechilishi:

$$F \cos \alpha = mg \quad \sin \alpha = \frac{R}{l}$$

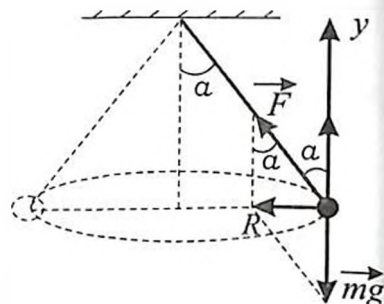
$$F \sin \alpha = ma \quad R = l \sin \alpha$$

$$\operatorname{tg} \alpha = \frac{a}{g}$$

$$a = \frac{4 \cdot \pi^2}{T^2} \cdot R$$

$$g \cdot \operatorname{tg} \alpha = \frac{4 \cdot \pi^2}{T^2} \cdot l \cdot \sin \alpha$$

$$T = 2 \cdot \pi \cdot \sqrt{\frac{l \cdot \sin \alpha}{g \cdot \operatorname{tg} \alpha}}$$



$$T = 2 \cdot \pi \cdot \sqrt{\frac{l \cdot \cos \alpha}{g}}$$

$$T = 2 \cdot 3 \cdot \sqrt{\frac{0,8 \cdot 0,5}{10}} = 1,2 \text{ s.}$$

Javob: A) 1,2.

24.35. Og'irligi P bo'lgan aerostat doimiy tezlik bilan tushmoqda. Qanday og'irlikdagi yuk tashlab yuborilsa, aerostat xuddi shunday tezlik bilan yuqoriga ko'tarila boshlaydi? Arximed kuchi Q ga teng, havoning qarshilik kuchi tezlikka mutanosib.

- A) $2(P - Q)$; B) $P - 2Q$; C) $P - Q$; D) $2P - Q$.

Berilgan:

$$P, Q, F_q \sim v$$

$$P_0 = ?$$

Yechilishi:

$$1) F_q = kv \text{ havoning qarshilik kuchi. } 2) Q - F_q - (P - P_0) = 0$$

$$P - F_q - Q = 0$$

$$P - kv - Q = 0$$

$$kv = P - Q$$

$$Q - kv - P + P_0 = 0$$

$$Q - P + Q - P + P_0 = 0$$

$$2Q - 2P + P_0 = 0$$

$$P_0 = 2(P - Q)$$

Javob: A) $2(P - Q)$.

24.36. Stol ustida uzunligi 1 m bo'lgan bir jinsli zanjir yotibdi. Zanjir bilan stol orasidagi ishqalanish ko'effitsiyenti 0,6 ga teng. Stoldan sirpanib tushib ketmasligi uchun, uning osilib turgan qismining maksimal uzunligi qanday (sm) bo'lishi kerak?

- A) 37,5 B) 42,5 C) 52,5 D) 36

Berilgan:

$$l = 1 \text{ m}$$

$$m = 0,6$$

$$x = ?$$

Yechilishi:

Zanjir sirpanishni boshlashi uchun, uning stoldan osilib turgan qismining og'irligi stol ustida turgan qismiga ta'sir qiluvchi ishqalanish kuchiga teng bo'lishi kerak.

$$F_i = m_1 g$$

 m_1 — osilib turgan qismning massasi

$$\mu m_2 g = m_1 g$$

 m_2 — stol ustidagi qismning massasi

$$\mu m_2 = m_1$$

 m — umumiy massa

$$m_1 = \frac{m}{l} \cdot x$$

$$m_2 = \frac{m}{l} \cdot (l - x)$$

$$\mu \frac{m}{l} \cdot (l - x) = \frac{m}{l} \cdot x$$

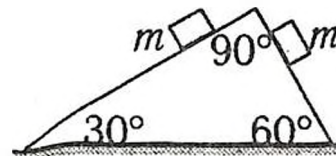
$$\mu(l - x) = x$$

$$\mu l - \mu x = x \quad \mu l = x(\mu + 1)$$

$$x = \frac{\mu}{\mu + 1} l = \frac{0,6 \cdot 1}{0,6 + 1} = 37,5 \text{ sm}$$

Javob: A) 37,5.

24.37. Massalari bir xil ikki jism rasmda ko'rsatilganidek tepalikdan ishqalanishsiz sirpanib tushmoqda. Tepalik bilan u turgan gorizont tekislik orasida ishqalanish bo'lmasa, jismlarning tushish vaqtida tepalikning o'zi qanday harakatlanadi?



A) o'ngga, tezlanish bilan

B) chapga, tezlanish bilan

C) o'ngga, tezlanishsiz

D) qo'zg'almaydi

Berilgan:

$$\alpha_1 = 30^\circ$$

$$\alpha_2 = 60^\circ$$

$$m$$

Yechilishi: F_1 va F_2 tekislikka bo'layotgan bosim kuchlarini topamiz.

$$1. N_1 = mg \cos \alpha_1$$

$$2. N_2 = mg \cos \alpha_2$$

$$F_1 = N_1 \cdot \sin \alpha_1$$

$$F_2 = N_2 \cdot \sin \alpha_2$$

$$F_1 = mg \sin \alpha_1 \cdot \cos \alpha_1 \quad F_2 = mg \sin \alpha_2 \cdot \cos \alpha_2 \quad \alpha_1 + \alpha_2 = 90^\circ$$

$$F_2 = mg \sin(90 - \alpha_1) \cos(90 - \alpha_1) = mg \cos \alpha_1 \sin \alpha_1$$

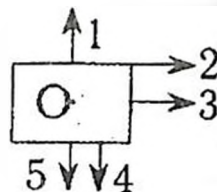
Bundan: $F_1 = F_2$. Demak, tekislik harakatlanmaydi.**Javob:** D) qo'zg'almaydi.

III bob. STATIKA

25- §. Jismning og'irlik markazi

25.1. Rasmda keltirilgan kuchlarning qaysilari jismni faqat ilgariylanma harakatga keltiradi? (O-massalar markazi.)

- A) 1, 4, 5 B) 1, 3, 5 C) 4, 5 D) 1, 2



Davomi massalar markazi bilan tutashadigan kuchlar uni ilgariylanma harakatga keltiradi.

Javob: B) 1, 3, 5.

25.2. Bir jinsli uzun sterjenning bir uchidan 40 sm qirqib olinsa, uning og'irlik markazi ikkinchi uchi tomon qancha (sm) siljiydi?

- A) 30 B) 20 C) 15 D) 10

Berilgan:

$$l = 40 \text{ sm}$$

$$x = ?$$

Yechilishi:

Bir jinsli ekanligidan.

$$\frac{L-l}{2} = \frac{L}{2} - x$$

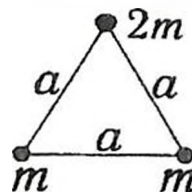
$$\frac{L}{2} - \frac{l}{2} = \frac{L}{2} - x$$

$$x = \frac{l}{2} = 20 \text{ sm}$$

Javob: B) 20.

25.3. Sistemaning og'irlik markazi 2m massali sharchadan qanday masofada yotadi (rasmga q.)?

- A) $a/3$ B) $a/2$ C) $\frac{\sqrt{3}}{2} a$ D) $\frac{\sqrt{3}}{4} a$



Berilgan:

$$2m$$

$$a$$

$$b = ?$$

Yechilishi:

Sistema koordinata markaziga 2 m massali yukni joylashtirgan holda kirgizamiz. Ox va Oy o'qlaridagi og'irlik markazi koordinatalarini topamiz.

$$x = \frac{m_1 x_1 + m_2 x_2 + m_3 x_3}{m_1 + m_2 + m_3} = \frac{m \cdot \left(\frac{a}{2}\right) - m \left(\frac{a}{2}\right) + 2m \cdot 0}{m + m + 2m}$$

$$x = 0$$

$$y = \frac{m_1 y_1 + m_2 y_2 + m_3 y_3}{m_1 + m_2 + m_3} = \frac{-m \cdot \frac{\sqrt{3}}{2} a + m \left(-\frac{\sqrt{3}}{2}\right) a + 2m \cdot 0}{m + m + 2m}$$

$$y = -\frac{\sqrt{3}}{4} a$$

$$b = \sqrt{x^2 + y^2} = \sqrt{0^2 + \left(-\frac{\sqrt{3}}{4}\right)^2 a^2} = \frac{\sqrt{3}}{4} a$$

$$b = \frac{\sqrt{3}}{4} a$$

$$\text{Javob: D) } \frac{\sqrt{3}}{4} a.$$

25.4. Quyida berilgan gaplarga to'g'ri javobni topib yozing.

1. Jism muvozanat holatidan bir oz chetlatilganda, muvozanat holatiga qaytaruvchi kuch paydo bo'lsa, uning muvozanati ... bo'ladi.

2. Jism muvozanat holatidan bir oz chetlatilganda, hech qanday qo'shimcha kuch paydo bo'lmasa, jismning muvozanati ... bo'ladi.

3. Jism muvozanat holatidan bir oz chetlatilganda, muvozanat holatidan uzoqlashtiruvchi kuch paydo bo'lsa, jismning muvozanati ... bo'ladi.

A) 1-farqsiz, 2-turg'unmas, 3-turg'un

B) 1-turg'unmas, 2-turg'un, 3-farqsiz

C) 1-turg'un, 2-farqsiz, 3-turg'unmas

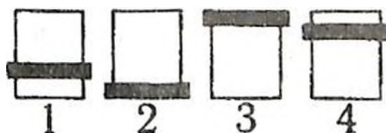
D) 1-turg'un, 2-turg'unmas, 3-farqsiz

Javob: C) 1-turg'un, 2-farqsiz, 3-turg'unmas.

26-§. Statika elementlari

26.1. Rasmda metall halqalar kiydirilgan 4 ta bir xil yog'och silindr tasvirlangan. Ularning qaysi biri turg'unroq?

A) 1 B) 2 C) 3 D) 4



Qaysi kiygizilgan halqa yerga yaqin bo'lsa, shu yog'ochda turg'unlik yuqori bo'ladi.

Javob: B) 2.

26.2. Modullari teng va o'zaro 120° burchak ostida yo'nalgan uchta kuchning teng ta'sir etuvchisi qanday (N)? Bunday kuchlar ostida jism muvozanatda bo'la oladimi?

- A) 15; bo'ladi B) 12; bo'ladi C) 0; bo'lmaydi D) 0; bo'ladi
Kosinuslar tenglamasi orqali 2 ta kuchni qo'shamiz.

$$F_1^2 = F^2 + F^2 + 2F^2 \cdot \cos 120^\circ$$

$$F_1^2 = F^2 + F^2 - F^2 = F^2$$

$$F_1 = F$$

Natijaviy kuch: $F_{nat} = F - F = 0$

$F_{nat} = 0$, muvozanat saqlanadi.

Javob: D) 0; bo'ladi.

26.3. 80 kg massali jism 30° li qiya tekislikda turibdi. Uni muvozanatda saqlash uchun kamida qanday kuch kerak bo'ladi (N)? Ishqalanish kuchini hisobga olmang.

- A) 400 B) 250 C) 200 D) 80

Berilgan:

$$m = 80 \text{ kg}$$

$$\alpha = 30^\circ$$

$$F = ?$$

Yechilishi:

Aylanish o'qiga ega bo'lmagan jismlarning muvozanat shartiga ko'ra, natijaviy kuch 0 ga teng bo'lishi kerak. $F - P_x = 0$

$$F = mg \sin \alpha = 80 \cdot 10 \cdot \frac{1}{2} = 400 \text{ N}$$

Javob: A) 400.

26.4. Agar OA masofa ma'lum bo'lsa, richakka α burchak ostida ta'sir etayotgan kuch yelkasi qanday bo'ladi? Aylanish o'qi O nuqtadan chizma tekisligiga tik ravishda o'tgan.

- A) $OA \sin \alpha$ B) $AB \sin \alpha$ C) AB D) 20

Berilgan:

$$\alpha, OA$$

$$OB = ?$$

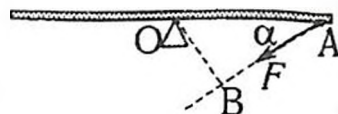
Yechilishi:

Kuch yelkasi: aylanish o'qidan kuchning ta'sir chizig'iga tushirilgan perpendikular (eng yaqin masofa). Rasmda OB masofa:

$$\sin \alpha = \frac{OB}{OA}$$

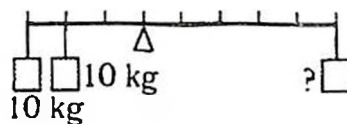
$$OB = OA \sin \alpha$$

Javob: A) $OA \sin \alpha$.



26.5. Rasmda ko'rsatilgan richag muvozanatda turishi uchun ikkinchi yelkaga qanday (kg) massali yuk osish kerak? (Richag massasi hisobga olinmasin).

- A) 30 B) 25 C) 15 D) 10



Berilgan:

$$m = 10 \text{ kg}$$

$$m_x = ?$$

Yechilishi:

Sistema muvozanatda bo'lish sharti:

$$\overline{M}_1 + \overline{M}_2 + \overline{M}_3 = 0 \quad a - \text{har bir oraliq uzunligi}$$

$$M_1 = m_2 a \cdot g; \quad M_2 = m_3 a \cdot g; \quad M_3 = 5m_x a \cdot g$$

$$-2ma - 3ma + 5m_x a = 0$$

$$m_x = m = 10 \text{ kg}$$

Javob: D) 10.

26.6. Massasi 6 kg li bir jinsli xoda muvozanatda qolishi uchun F kuch qanday (N) bo'lishi kerak?

- A) 6 B) 12 C) 15 D) 20

Berilgan:

$$m = 6 \text{ kg}$$

$$F = ?$$

Yechilishi:

Har bir oraliq uzunligini a ga teng deb olamiz.

$$\overline{M}_1 + \overline{M}_2 = 0$$

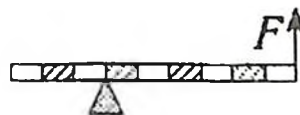
$$M_1 = -mg1,5a$$

$$M_2 = F \cdot 6a$$

$$F6a - mg1,5a = 0 \quad 6F = 1,5mg$$

$$F = \frac{mg}{4} = \frac{60}{4} = 15 \text{ N}$$

$$F = 15 \text{ N}$$



Javob: C) 15.

26.7. Rasmdagi richagning l_1 uzunlikdagi qismi qalaydan, l_2 uzunlikdagi qismi yog'ochdan yasalgan. Agar $l_1 = 20$ sm bo'lsa, richag muvozanatda qolishi uchun l_2 qanday bo'lishi kerak (sm)? Qalayning zichligi $7,2 \text{ g/sm}^3$, yog'ochniki $0,8 \text{ g/sm}^3$.

- A) 120 B) 30 C) 60 D) 90

Berilgan:

$$l_1 = 20 \text{ sm}$$

$$\rho_1 = 7,2 \text{ g/sm}^3$$

$$\rho_2 = 0,8 \text{ g/sm}^3$$

$$l_2 = ?$$

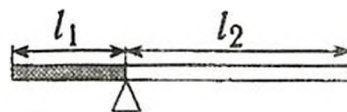
Yechilishi:

Muvozanat shartini yozamiz.

$$\overline{M}_1 + \overline{M}_2 = 0$$

$$M_1 = -m_1 g \cdot \frac{l_1}{2} \quad M_2 = m_2 g \cdot \frac{l_2}{2}$$

$$m_1 = \rho_1 \cdot S l_1 \quad m_2 = \rho_2 \cdot S l_2$$



$$m_1 g \frac{l_1}{2} = m_2 g \frac{l_2}{2}$$

$$\rho_1 S \frac{l_1^2}{2} = \rho_2 S \frac{l_2^2}{2}$$

$$l_2 = l_1 \sqrt{\frac{\rho_1}{\rho_2}} = 20 \sqrt{\frac{7,2}{0,8}} = 60 \text{ sm}$$

$$l_2 = 60 \text{ sm}$$

Javob: C) 60.

26.8. Bir xil R radiusli ikkita po'lat va aluminiy sharlar bir-biriga tegib turgan nuqtasida biriktirib qo'yilgan. Sistemaning og'irlik markazi topilsin. Po'latning zichligi $7,8 \text{ g/sm}^3$ aluminiyniki $2,7 \text{ g/sm}^3$.

- A) po'lat shar markazidan $0,51 R$ masofada
 B) aluminiy shar markazidan $0,51R$ masofada
 C) po'lat shar markazidan $0,29R$ masofada
 D) aluminiy shar markazidan $0,29R$ masofada

Berilgan:

R

$$\rho_p = 7,8 \text{ g/sm}^3$$

$$\rho_a = 2,7 \text{ g/sm}^3$$

$$x = ?$$

Yechilishi:

Og'irlik markaziga tayanch qo'yganda, sistema muvozanatda bo'ladi. Muvozanat shartini yozamiz.

$$\overline{M_p} + \overline{M_a} = 0 \quad m_p = \rho_p \cdot \frac{4}{3} \pi R^3$$

$$M_p = -m_p g \cdot x \quad m_a = \rho_a \cdot \frac{4}{3} \pi R^3$$

$$M_a = m_a g (2R - x)$$

$$m_p g \cdot x = m_a g (2R - x)$$

$$\rho_p \cdot x = 2\rho_a R - \rho_a x$$

$$x = \frac{2R\rho_a}{\rho_a + \rho_p} = \frac{2 \cdot R \cdot 2,7}{2,7 + 7,8} = 0,51 R$$

$$x = 0,51 R$$

Javob: A) po'lat shar markazidan $0,51 R$ masofada.

26.9. Uchlariga $m_1 = 5,5 \text{ kg}$ va $m_2 = 1 \text{ kg}$ yuklar osilgan l uzunlikdagi sterjen uchidan $l/5$ masofada qo'yilgan tayanch ustida muvozanatda turibdi. Sterjenning massasi qanday (kg)?

- A) 1 B) 2 C) 3 D) 4

Berilgan:

$$m_1 = 5,5 \text{ kg}$$

$$m_2 = 1 \text{ kg}$$

$$l/5$$

$$m = ?$$

Yechilishi:

Aylanish o'qiga ega bo'lgan sistema uchun muvozanat shartini yozamiz.

$$\overline{M}_1 + \overline{M}_2 + \overline{M}_3 = 0$$

$$M_1 = -m_1 g \cdot l_1; \quad M_2 = m_2 g l_2; \quad M_3 = m g l_3$$

$$m_1 g l_1 = m_2 g l_2 + m g l_3$$

$$l_1 = \frac{l}{5}; \quad l_2 = l - \frac{l}{5} = \frac{4l}{5}; \quad l_3 = \frac{l}{2} - \frac{l}{5} = \frac{3l}{10}$$

$$m_1 \cdot \frac{l}{5} = m_2 \cdot \frac{4l}{5} + m \cdot \frac{3l}{10}$$

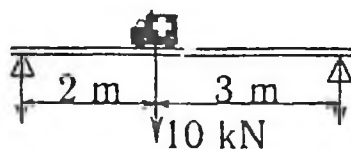
$$2m_1 = 8m_2 + 3m$$

$$m = \frac{2m_1 - 8m_2}{3} = \frac{2 \cdot 5,5 - 8 \cdot 1}{3} = 1 \text{ kg}$$

$$m = 1 \text{ kg}$$

Javob: A) 1.

26.10. Avtomobil rasmda ko'rsatilgandek ko'prik ustida turibdi. Avtomobilning ko'prik tayanchlariga bosim kuchlarini aniqlang.



A) 4 va 6 kN

B) 5 va 5 kN

C) 3 va 7 kN

D) 6 va 4 kN

Berilgan:

$$l_1 = 2 \text{ m}$$

$$l_2 = 3 \text{ m}$$

$$P = 10 \text{ kN}$$

$$N_1 = ?$$

$$N_2 = ?$$

Yechilishi:

2 — tayanchga bosim kuchini topish uchun 1 — tayanchni aylanish o'qi deb olamiz.

$$M_1 = P \cdot l_1 \quad M_2 = -N_2 \cdot (l_1 + l_2)$$

$$\overline{M}_1 + \overline{M}_2 = 0$$

$$P l_1 = N_2 (l_1 + l_2)$$

$$N_2 = \frac{P l_1}{l_1 + l_2} = \frac{10 \cdot 2}{2 + 3} = 4 \text{ kN}$$

$$N_2 = 4 \text{ kN}$$

1 — tayanchga bosim kuchini topish uchun 2 — tayanchni aylanish o'qi deb muvozanat shartini 2 ta kuch uchun yozamiz.

$$P l_2 = N_1 (l_1 + l_2)$$

$$N_1 = \frac{P l_2}{l_1 + l_2} = \frac{10 \cdot 3}{2 + 5} = 6 \text{ kN} \quad N_1 = 6 \text{ kN}$$

Javob: D) 6 va 4 kN.

26.11. Bir uchi devorga sharnirli mahkamlangan, og'irligi $P=50\text{ N}$ bo'lgan sterjenning ikkinchi uchiga $F=50\text{ N}$ kuch rasmdagidek ta'sir etmoqda. Sterjen gorizontol holatda muvozanatda turishi uchun O nuqtaga og'irligi Q necha nyuton bo'lgan yuk osish kerak?

- A) 60 B) 50 C) 40 D) 30

Berilgan:

$$P = 50\text{ N}$$

$$F = 50\text{ N}$$

Yechilishi:

Davomi aylanish o'qi sifatida qarab, momentlarini yozamiz:

$$(P + Q) \cdot 2a = F \cdot 4a$$

$$F = \frac{P + Q}{2} = \frac{50 + 50}{2} = 50\text{ N}$$

$$F = 50\text{ N}$$

Javob: B) 50.

26.12. Rasmda ko'rsatilgan muvozanat holati yuzaga kelishi uchun bir jinsli AB xodaning massasi qanday (kg) bo'lishi kerak?

- A) 16 B) 28 C) 52 D) 32

Berilgan:

$$m_1 = 10\text{ kg}$$

$$m_2 = 4\text{ kg}$$

$$m = ?$$

Yechilishi:

Har birini a ga teng deb olamiz.

$$T = m_2 g$$

$$m_1 g 4a = m g \cdot a + T \cdot 6a$$

$$4m_1 g = m g + 6m_2 g$$

$$m = 4m_1 - 6m_2 = 4 \cdot 10 - 6 \cdot 4 = 16\text{ kg}$$

$$m = 16\text{ kg}$$

Javob: A) 16.

26.13. Massasi $m = 10\text{ kg}$ bo'lgan yuk AC va BC iplarga rasmdagidek osilgan. AC ipning taranglik kuchini toping (N).

- A) 100 B) 200 C) 50 D) 20

Berilgan:

$$m = 10\text{ kg}$$

$$\alpha = 60^\circ$$

$$T_{AC} = ?$$

Yechilishi:

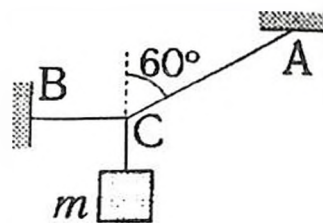
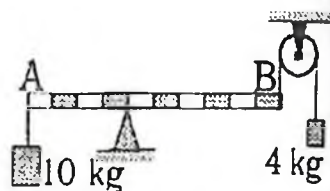
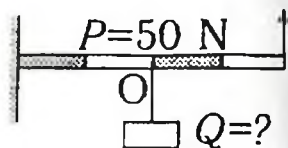
Kuchlarning Oy o'qiga proyeksiyalarini olamiz:

$$T_{AC} \cos \alpha - mg = 0$$

$$T_{AC} = \frac{mg}{\cos \alpha} = \frac{10 \cdot 10}{0,5} = 200\text{ N}$$

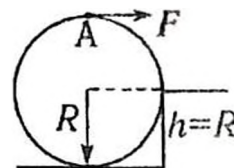
$$T_{AC} = 200\text{ N}$$

Javob: B) 200.



26.14. m massali g'ildirakni balandligi g'ildirak radiusiga teng pog'onaga chiqarish uchun A nuqtaga kamida qanday gorizontal F kuch qo'yish kerak?

- A) $2\ mg$ B) $\sqrt{2}mg$ C) mg D) $mg/\sqrt{2}$



Berilgan:

$m, h = R$

$F = ?$

Yechilishi:

F kuch va mg og'irlik kuchining momentlarini yozamiz.

$$FR - mg \cdot R = 0$$

$$F = mg$$

Javob: C) mg .

26.15. Massasi m , radiusi R bo'lgan shar vertikal silliq devorga uzunligi $L = R$ ip yordamida rasmdagidek osilgan bo'lsa, ipning taranglik kuchi qanday bo'ladi?

- A) $2mg/\sqrt{3}$ B) $mg/2$ C) mg D) $\sqrt{3}mg/2$

Berilgan:

$m, R, L = R$

$T = ?$

Yechilishi:

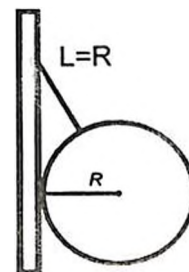
O nuqtani aylanish markazi deb $T \cos \alpha$ va mg moment yozamiz.

$$M_1 = mgR \quad M_2 = -T \cos \alpha R$$

$$\cos \alpha = \frac{\sqrt{(L+R)^2 - R^2}}{L+R} = \frac{\sqrt{4R^2 - R^2}}{2R} = \frac{\sqrt{3}}{2}$$

$$mgR = T \cos \alpha R$$

$$mg = T \cdot \frac{\sqrt{3}}{2} \quad T = \frac{2mg}{\sqrt{3}}$$



Javob: A) $2mg/\sqrt{3}$.

IV bob. MEXANIKADA SAQLANISH QONUNLARI

27-§. Kuch va impuls

27.1. Agar jismning massasi 3 marta ortib, tezligi 2 marta kamaysa, uning impulsi qanday o'zgaradi?

- A) 1,5 marta kamayadi B) 1,5 marta ortadi
C) 3 marta ortadi D) 6 marta ortadi

Berilgan:

$$m_2 = 3m_1$$

$$v = \frac{v_1}{2}$$

$$\frac{p_2}{p_1} = ?$$

Yechilishi:

Bizga ma'lumki, jism impulsi $p = mv$ ifodadan aniqlanadi. Dastlabki holatda jismning impulsi $p_1 = m_1 v_1$ edi. Massasi va tezligi o'zgargandan keyin esa $p_2 = m_2 v_2$ bo'ladi.

$$\frac{p_2}{p_1} = \frac{m_2 v_2}{m_1 v_1} = \frac{3m_1 \frac{v_1}{2}}{m_1 v_1} = \frac{3}{2} = 1,5 \Rightarrow p_2 = 1,5 p_1$$

Javob: B) 1,5 marta ortadi.

27.2. Jism impulsining xalqaro birliklar sistemasidagi birligi qanday nomlanadi?

- A) nyuton B) joul C) $\text{kg} \cdot \text{m/s}$ D) nyuton/sekund

$$[p] = [m] \cdot [v] = 1\text{kg} \cdot \frac{1\text{m}}{\text{s}} = 1\text{kg} \cdot \frac{\text{m}}{\text{s}}$$

Javob: C) $\text{kg} \cdot \text{m/s}$.

27.3. Jism yuqoriga tik otilgan. Qaysi grafik jism impulsining vaqtga bog'lanishini ifodalaydi?



- A) 3 B) 2 C) 1 D) 4

Vertikal yuqoriga otilgan jism ko'tarilayotganida tekis sekinlanuvchan, tushayotganida esa tekis tezlanuvchan harakat qiladi. Demak, uning impulsi dastlab nol-gacha kamayadi va tushayotganda yana orta boshlaydi.

Javob: C) 1.

27.4. Massasi 2 kg bo'lgan tinch holatdagi jism 2 m/s^2 tezlanish oldi. 2 s dan so'ng jism impulsini nimaga teng bo'ladi ($\text{kg} \cdot \text{m/s}$)?

- A) 4 B) 8 C) 16 D) 12

Berilgan:

$$\begin{aligned} m &= 2 \text{ kg} \\ v_0 &= 0 \\ a &= 2 \text{ m/s}^2 \\ t &= 2 \text{ s} \\ p &= ? \end{aligned}$$

Yechilishi: Jism tekis tezlanuvchan harakat qilyapti. Uning 2 s dan keyingi tezligini quyidagicha topamiz.

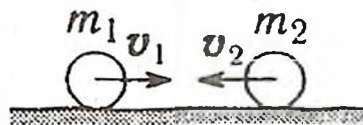
$$v = v_0 + at = at = 2 \cdot 2 = 4 \text{ m/s}$$

Endi impulsini hisoblaymiz: $p = mv = 2 \cdot 4 = 8 \text{ kg} \cdot \text{m/s}$

Javob: B) 8.

27.5. Chizmadagi jismlar sistemasining impulsini toping ($\text{kg} \cdot \text{m/s}$). $m_1 = m_2 = 2 \text{ kg}$ va $v_1 = 2v_2 = 8 \text{ m/s}$

- A) 4 B) 8 C) 10 D) 20



Berilgan:

$$\begin{aligned} m_1 &= m_2 = 2 \text{ kg} \\ v_1 &= 2v_2 = 8 \text{ m/s} \\ p &= ? \end{aligned}$$

Yechilishi: Sistemaning impulsini uni tashkil qiluvchi jismlar impulslarining yig'indisiga teng bo'ladi. Ya'ni,

$$\bar{p} = \bar{p}_1 + \bar{p}_2$$

Birinci jism yo'nalishida x o'qini yo'naltiramiz va unga jism impulslarini proyeksiyalaymiz:

$$p = p_1 - p_2 = m_1 v_1 - m_2 v_2 = 2 \cdot 4 = 8 \text{ kg} \cdot \text{m/s}$$

Javob: B) 8.

27.6. Bir xil m massali ikkita avtomobil bir yo'nalishda v va $3v$ tezlik bilan harakatlanmoqda. Birinchi avtomobil bilan bog'langan sanoq tizimida ikkinchi avtomobilning impulsini qanday?

- A) $6mv$ B) $4mv$ C) $3mv$ D) $2mv$

Berilgan:

$$\begin{aligned} m_1 &= m_2 = m \\ v_1 &= v \\ v_2 &= 3v \\ p_{21} &= ? \end{aligned}$$

Yechilishi: Avtomobillar bir tomonga harakatlanyapti. Birinchi avtomobil bilan bog'langan sanoq sistemasiga nisbatan ikkinchi avtomobilning tezligi $v_{21} = v_2 - v_1 = 2v$ ga teng. Impulsi esa $p_{21} = m \cdot v_{21} = 2mv$ ga teng bo'ladi.

Javob: D) $2mv$

27.7. Massasi bir xil m bo'lgan ikkita avtomobil qarama-qarshi yo'nalishlarda v va $3v$ tezlikda harakatlanmoqda. Birinchi avtomobil bilan bog'langan sanoq sistemada ikkinchi avtomobilning impulsi qanday?

- A) $6mv$ B) $4mv$ C) $3mv$ D) $2mv$

Berilgan:

$$m_1 = m_2 = m$$

$$v_1 = v$$

$$v_2 = 3v$$

$$p_{21} = ?$$

Yechilishi: Avtomobillar qarama-qarshi tomonga harakatlanayapti. Birinchi avtomobil bilan bog'langan sanoq sistemaga nisbatan 2-avtomobilning tezligi $v_{21} = v_2 + v_1 = 4v$ ga teng. Impulsi esa $p_{21} = m \cdot v_{21} = 4mv$ ga teng bo'ladi.

Javob: B) $4mv$

27.8. Massasi m bo'lgan sharcha gorizontaal sirtga erkin tushdi. Sirtga tegish vaqtidagi tezligi v . Agar sharchaning tekislikka urilishi absolut elastik bo'lsa, sharcha impulsi o'zgarishi qanday bo'ladi?

- A) 0 B) $0,5mv$ C) mv D) $2mv$

Berilgan:

$$m; v$$

$$v_1 = v$$

$$\Delta p = ?$$

Yechilishi: Absolut elastik to'qnashuvda qanday $\bar{v}$ tezlik bilan urilsa, $\bar{v}$ shunday tezlik bilan qaytadi. Yo'qini vertikal yuqoriga yo'naltirib olamiz: jismning sirtga urilayotgandagi impulsi $p_1 = -mv$, qaytayotganda esa $p_2 = mv$ bo'ladi. Impulsning o'zgarishi $\Delta p = p_2 - p_1 = 2mv$.

Javob: D) $2mv$.

27.9. Massasi 1 kg moddiy nuqtaning harakat qonuni $x = 4t + 2t^2$ ko'rishga ega. Uning impulsining 5- va 10-sekundlar orasidagi o'zgarishini aniqlang (kg · m/s).

- A) 0 B) 5 C) 10 D) 20

Berilgan:

$$m = 1 \text{ kg}$$

$$x = 4t + 2t^2$$

$$t_1 = 5 \text{ s}$$

$$t_2 = 10 \text{ s}$$

$$\Delta p = ?$$

Yechilishi: Jismning bizga berilgan harakat tenglamasidan foydalanib, tezlik tenglamasini tuzamiz.

$$\begin{cases} x = x_0 + v_{0x}t + \frac{a_x t^2}{2} \Rightarrow x_0 = 0; v_{0x} = 4 \frac{m}{s}; a_x = 4 \frac{m}{s^2}. \\ x = 4t + 2t^2 \end{cases}$$

$$x = 4t + 2t^2$$

$$v_x = v_{0x} + a_x t \quad v = 4 + 4t.$$

$$v_1 = 4 + 4t_1 = 24 \text{ m/s.}$$

$$v_2 = 4 + 4t_2 = 44 \text{ m/s.}$$

Impulsning o'zgarishi quyidagiga teng: $\Delta p = mv_2 - mv_1 = m(v_2 - v_1)$

$$\Delta p = 1(44 - 24) = 20 \text{ kg} \cdot \text{m/s}$$

Javob: D) 20 kg · m/s.

27.10. Kuch impulsining birligini ko'rsating.

- A) $N \cdot s^2$ B) $kg \cdot m/s^2$ C) $N \cdot m$ D) $N \cdot s$

Kuch impulsining birligi $[I] = [F][t] = 1N \cdot 1s = 1N \cdot s$

Javob: D) $N \cdot s$.

27.11. Jismga biror kuch 6 s davomida ta'sir qilib, uning impulsini $30 \text{ kg} \cdot \text{m/s}$ ga o'zgartirdi. Ta'sir etuvchi kuchni aniqlang (N).

- A) 5 B) 10 C) 30 D) 3

Berilgan:

$$t = 6 \text{ s}$$

$$\Delta p = 30 \text{ kg} \cdot \text{m/s}$$

$$F = ?$$

Yechilishi: Jismga ta'sir qiluvchi kuch Nyutonning ikkinchi qonuniga asosan $F = ma$ ga teng. Bizga ma'lumki,

$$a = \frac{v_2 - v_1}{t}. \text{ Buni hisobga olib quyidagini yozamiz:}$$

$$F = m \frac{v_2 - v_1}{t} \Rightarrow F \cdot t = mv_2 - mv_1$$

Demak, jism impulsining o'zgarishi kuch impulsiga teng bo'lar ekan.

$$F = \frac{\Delta p}{t} = \frac{30}{6} = 5N$$

Javob: A) 5 N.

27.12. Jism impulsining koordinata o'qlariga proyeksiyalari 2 s da 0 dan $p_x = 6 \text{ kg} \cdot \text{m/s}$ va $p_y = 8 \text{ kg} \cdot \text{m/s}$ gacha o'zgardi. Jismga ta'sir qilgan kuch impulsini toping ($N \cdot s$).

- A) 5 B) 10 C) 20 D) 24

Berilgan:

$$t = 2 \text{ s}$$

$$p_x = 6 \text{ kg} \cdot \text{m/s}$$

$$p_y = 8 \text{ kg} \cdot \text{m/s}$$

$$p_0 = 0$$

$$I = ?$$

Yechilishi: Bizga ma'lumki, jism impulsining o'zgarishi kuch impulsiga teng.

$I = \Delta p = p - p_0$ Masala shartiga ko'ra, $p_0 = 0$. Chizmadan ko'rinib turibdiki, $p = \sqrt{p_x^2 + p_y^2}$

$$I = p = \sqrt{p_x^2 + p_y^2} = \sqrt{36 + 64} = 10N \cdot s$$

Javob: B) 10 $N \cdot s$.

27.13. Erkin tushayotgan 2 kg massali tosh impulsining dastlabki 5 m masofadagi o'zgarishi qanday bo'ladi ($kg \cdot m/s$)? Toshning boshlang'ich tezligi nolga teng.

- A) 5 B) 10 C) 20 D) 40

Berilgan:

$$m = 2 \text{ kg}$$

$$h = 5 \text{ m}$$

$$v_0 = 0$$

$$\Delta p = ?$$

Yechilishi: erkin tushayotgan jismning tushish balandligi

$h = \frac{v^2 - v_0^2}{2g}$ ifodadan aniqlanadi. Bu ifodadan tezlikni topamiz:

$2gh = v^2 - v_0^2$ $v_0 = 0$ bo'lganligi uchun $v = \sqrt{2gh}$. Impulsning o'zgarishi $\Delta p = m(v - v_0) = mv$.

$$\Delta p = m\sqrt{2gh} = 2\sqrt{2 \cdot 10 \cdot 5} = 20 \text{ kg} \cdot \text{m/s}$$

Javob: C) $20 \text{ kg} \cdot \text{m/s}$.

27.14. Massalari $m_1 > m_2 > m_3$ bo'lgan uchta jismga bir xil kuch bir xil vaqt davomida ta'sir etsa, qaysi jismning impulsi eng ko'p o'zgaradi?

A) barchasiniki bir xil o'zgaradi

B) impulslar o'zgarmaydi

C) birinchisiniki

D) ikkinchisiniki

Berilgan:

$$m_1 > m_2 > m_3$$

$$F_1 = F_2 = F_3 = F$$

$$t_1 = t_2 = t_3 = t$$

Yechilishi: Jism impulsining o'zgarishi katta bo'lishi kerak $\Delta p = m\Delta v$. Agar jismning tezlanishi katta bo'lsa, uning

tezligining o'zgarishi katta bo'ladi. $a = \frac{\Delta v}{t}$; $\Delta p = mat$

Nyutonning ikkinchi qonuniga asosan, jismning tezlanishi ta'sir qiluvchi kuchga to'g'ri, massasiga esa teskari proporsional:

$$a = \frac{F}{m}; \Delta p = m \frac{F}{m} \cdot t = F \cdot t$$

$$\text{Demak, } \Delta p_1 = F_1 t_1 = Ft, \Delta p_2 = F_2 t_2 = Ft, \Delta p_3 = F_3 t_3 = Ft$$

$$\Delta p_1 = \Delta p_2 = \Delta p_3$$

Javob: A) Barchasiniki bir xil o'zgaradi.

27.15. 10 m/s tezlik bilan yuqoriga tik otilgan 1 kg massali jism $1,8 \text{ m}$ balandlikdagi gorizontal to'siq bilan mutlaq elastik to'qnashib qaytdi. To'qnashishdagi kuch impulsini toping ($\text{N} \cdot \text{s}$).

A) 16

B) 18

C) 1,8

D) 0,8

Berilgan:

$$v_0 = 10 \text{ m/s}$$

$$m = 1 \text{ kg}$$

$$h = 1,8 \text{ m}$$

$$I = ?$$

Yechilishi: Kuch impulsi jism impulsining o'zgarishiga teng. $I = \Delta p$ jismning to'siqqa urilishdagi impulsi $p_1 = mv$ urilib, qaytishdagi impulsi esa $p_2 = -mv$ ga teng. U holda jism impulsining o'zgarish moduli $\Delta p = 2mv$ ga teng bo'ladi.

$$h = \frac{v_0^2 - v^2}{2g} \Rightarrow v = \sqrt{v_0^2 - 2gh} = \sqrt{100 - 2 \cdot 10 \cdot 1,8} = 8 \text{ m/s}$$

$$I = \Delta p = 2mv = 2 \cdot 1 \cdot 8 = 16 \text{ N} \cdot \text{s}$$

Javob: A) $16 \text{ N} \cdot \text{s}$.

27.16. Massasi 40 g koptok devorga 30° burchak ostida urildi va tezligining qiymatini o'zgartirmay qaytdi. Zarbning o'rtacha kuchi 4 N, ta'sir vaqti 0,04 s bo'lsa, tezlikning moduli qanday (m/s)?

- A) 8 B) 6 C) 5 D) 4

Berilgan:

$$m = 40 \text{ g}$$

$$\alpha = 30^\circ$$

$$F = 4 \text{ N}$$

$$t = 0,04 \text{ s}$$

$$v = ?$$

Yechilishi: Jism impulsining o'zgarishi kuch impulsiga teng, ya'ni, $Ft = \Delta p$ to'qnashuv absolut elastik bo'lgani uchun qanday burchak ostida urilsa, xuddi shu burchak ostida qaytadi.

$$\alpha + \beta = 90^\circ; \beta = 60^\circ.$$

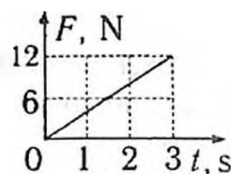
$$\text{Jism impulsining o'zgarishi } \Delta p = 2mv \cos \beta$$

$$Ft = 2mv \cos \alpha \Rightarrow v = \frac{Ft}{2m \cos \beta} = \frac{4 \cdot 0,04}{2 \cdot 0,04 \cdot 0,5} = 4 \text{ m/s}$$

Javob: D) 4 m/s

27.17. Grafikda jismga ta'sir etuvchi kuchning vaqtga bog'lanishi ifoda etilgan. Massasi 2 kg jism tezligining 3 s dagi o'zgarishini (m/s) toping.

- A) 60 B) 36 C) 18 D) 9



Berilgan:

$$m = 2 \text{ kg}$$

$$t = 3 \text{ s}$$

$$\Delta v = ?$$

Yechilishi: Chizmadan ko'rinib turibdiki, vaqt o'tishi bilan kuchning qiymati ortib boryapti. Kuch o'zgarayotganligi uchun,

$$\text{uning o'rtacha qiymatidan foydalanamiz. } F_{o'rt} = \frac{F_1 + F_2}{2} = \frac{0 + 12}{2} = 6 \text{ N.}$$

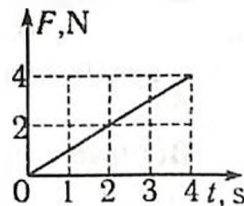
Jism impulsining o'zgarishi kuch impulsiga teng bo'lganligidan foydalanib, tezlik o'zgarishini topamiz.

$$F_{o'rt} \cdot t = m \Delta v \Rightarrow \Delta v = \frac{F_{o'rt} \cdot t}{m} = \frac{6 \cdot 3}{2} = 9 \text{ m/s}$$

Javob: D) 9 m/s.

27.18. Qarshilik koeffitsiyenti k bo'lganda P og'irlikka ega avtomobilning tezligi t vaqtda v qiymatga erishishi uchun dvigatelning tortish kuchi qanday bo'lishi kerak?

- A) $P \frac{vk}{gt}$ B) $\frac{P}{g} \left(\frac{v}{t} + k \right)$ C) $\frac{Pv}{gk}$ D) $P \left(\frac{v}{gt} + k \right)$



Berilgan:

$$k; p; t; v$$

$$F = ?$$

Yechilishi: Nyutonning ikkinchi qonuniga asosan, jismga ta'sir etuvchi kuchlarning teng ta'sir etuvchisi unga tezlanish berishi kerak. $F - F_q = ma$. Bu yerda $F_q = k \cdot P$ va $P = mg$.

$$m = \frac{P}{g}$$

$$F = ma + F_q = \frac{P}{g}a + kP = P\left(\frac{a}{g} + k\right)$$

$$a = \frac{v - v_0}{t} = \frac{v}{t} \quad v_0 = 0$$

$$F = P\left(\frac{v}{gt} + k\right)$$

$$\text{Javob: D) } F = P\left(\frac{v}{gt} + k\right).$$

28-§. Impulsning saqlanish qonuni. Reaktiv harakat

28.1. v tezlik bilan harakatlanayotgan $2m$ massali plastilin sharcha $3m$ massali tinch turgan sharchaga uriladi. To'qnashuvdan so'ng ular qanday yig'indi impulsiga ega bo'ladi?

- A) 0 B) $2mv/5$ C) $2mv$ D) $3mv$

Berilgan:

$$v_1 = v$$

$$m_1 = 2m$$

$$m_2 = 3m$$

$$p = ?$$

Yechilishi: sharchalar plastilin bo'lganligi uchun, ular to'qnashuvda bir-biriga yopishib qoladi. U holda:

$$P = (m_1 + m_2)u$$

Impulsning saqlanish qonuniga asosan, to'qnashuvgacha bo'lgan impulslar yig'indisi to'qnashuvdan keyingi impulslar yig'indisiga teng bo'lishi kerak.

$$m_1v_1 + m_2v_2 = (m_1 + m_2)u. \quad 2mv + 3m \cdot 0 = P \quad P = 2mv$$

Javob: C) $2mv$.

28.2. Massalari 6 kg va 18 kg bo'lgan sharlar o'zaro noelastik to'qnashgandan so'ng to'xtab qolishlari uchun, ularning to'qnashuvgacha bo'lgan tezliklari nisbati v_1/v_2 qanday bo'lishi lozim?

- A) 1 B) 3 C) $1/3$ D) 2

Berilgan:

$$m_1 = 6 \text{ kg}$$

$$m_2 = 18 \text{ kg}$$

$$v = 0$$

$$\frac{v_1}{v_2} = ?$$

Yechilishi: impulsning saqlanish qonuniga asosan:

$$m_1\bar{v}_1 + m_2\bar{v}_2 = (m_1 + m_2)\bar{v}$$

$$m_1v_1 - m_2v_2 = 0$$

$$m_1v_1 = m_2v_2 \quad \frac{v_1}{v_2} = \frac{m_2}{m_1} = \frac{18}{6} = 3$$

Javob: B) 3.

28.3. Relslarga parallel ravishda 500 m/s tezlik bilan uchayotgan 100 kg massali jism massasi 10 t bo'lgan tinch turgan qumli platformaga urildi va qumga kirib qoldi. Platforma qanday (m/s) tezlik bilan harakatlanadi?

- A) 4,55 B) 5,05 C) 5 D) 4,95

Berilgan:

$$\begin{aligned} v_1 &= 500 \text{ m/s} \\ m_1 &= 100 \text{ kg} \\ m_2 &= 10 \text{ t} \\ v_2 &= 0 \\ \hline v &= ? \end{aligned}$$

Yechilishi: Impulsning saqlanish qonuniga asosan:

$$m_1 \bar{v}_1 + m_2 \bar{v}_2 = (m_1 + m_2) \bar{v}$$

$$m_1 \bar{v}_1 + 0 = (m_1 + m_2) \bar{v}$$

$$m_1 \bar{v}_1 = (m_1 + m_2) \bar{v}$$

$$v = \frac{m_1 v_1}{m_1 + m_2} = \frac{100 \cdot 500}{10000 + 100} = 4,95 \text{ m/s}$$

Javob: D) 4,95.

28.4. Tezligi 0,3 m/s, massasi 30 t vagon tezligi 0,2 m/s, massasi 20 t vagonni quvib yetdi va unga ulanib qoldi. Vagonlarning birgalikdagi tezligi qanday (sm/s)?

- A) 28 B) 26 C) 25 D) 24

Berilgan:

$$\begin{aligned} v_1 &= 0,3 \text{ m/s} \\ m_1 &= 30 \text{ t} \\ v_2 &= 0,2 \text{ m/s} \\ m_2 &= 20 \text{ t} \\ \hline v &= ? \end{aligned}$$

Yechilishi: Impulsning saqlanish qonuniga asosan:

$$m_1 \bar{v}_1 + m_2 \bar{v}_2 = (m_1 + m_2) \bar{v}$$

$$m_1 v_1 + m_2 v_2 = (m_1 + m_2) v$$

$$v = \frac{m_1 v_1 + m_2 v_2}{m_1 + m_2}$$

$$v = \frac{30 \cdot 10^3 \cdot 0,3 + 20 \cdot 10^3 \cdot 0,2}{30 \cdot 10^3 + 20 \cdot 10^3} = 0,26 \frac{\text{m}}{\text{s}} = 26 \text{ sm/s},$$

Javob: B) 26.

28.5. v tezlik bilan harakatlanayotgan M massali aravachaga m massali bola chiqib olsa, aravacha tezligi qanday bo'ladi?

- A) $\frac{m}{M} v$ B) $\frac{M+m}{M} v$ C) $\frac{M}{m} v$ D) $\frac{M}{M+m} v$

Berilgan:

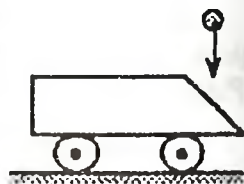
$$\begin{aligned} v, M, m \\ \hline u = ? \end{aligned}$$

Yechilishi: Dastlab M massali arava v tezlik bilan ketayotgan edi. Unga m massali bola chiqqandan keyin tezligi u bo'lib qoldi. Impulsning saqlanish qonuniga asosan:

$$Mv = (M + m)u \quad u = \frac{Mv}{M+m}$$

Javob: D) $\frac{M}{M+m} v$.

28.6. 10 g massali sharcha 2 m balandlikdan tinch turgan aravachaning gorizont bilan 45° burchak hosil qiluvchi orqa sirtiga tushib urildi va undan elastik qaytdi. Bunda aravachaning olgan tezligini aniqlang (m/s). Aravachaning massasi 90 g. Ishqalanish kuchini hisobga olmang.



- A) 0 B) 0,1 C) 0,7 D) 7

Berilgan:

$$m_1 = 10 \text{ g}$$

$$h = 2 \text{ m}$$

$$\alpha = 45^\circ$$

$$m_2 = 90 \text{ g}$$

$$u = ?$$

Yechilishi: Urilish absolut elastik bo'lganligi uchun sharcha qanday burchak ostida urilsa, xuddi shunday burchak ostida qaytadi va urilish tezligi qaytish tezligiga teng bo'ladi.

Jism h balandlikdan tushganda $v = \sqrt{2gh}$ tezlikka erishadi.

$$m_1 v = m_2 u \quad u = \frac{m_1 v}{m_2} = \frac{m_1}{m_2} \sqrt{2gh}$$

$$u = \frac{10 \cdot 10^{-3}}{90 \cdot 10^{-3}} \sqrt{2 \cdot 10 \cdot 2} = 0,7 \text{ m/s}$$

Javob: C) 0,7.

28.7. Agar massasi 70 kg bo'lgan odam tinch turgan qayiqdan 4 m/s tezlik bilan sakraganda, qayiq 0,2 m/s tezlik olgan bo'lsa, qayiqlarning massasi qanday (kg)?

- A) 2800 B) 1400 C) 1200 D) 700

Berilgan:

$$m = 70 \text{ g}$$

$$v = 4 \text{ m/s}$$

$$u = 0,2 \text{ m/s}$$

$$M = ?$$

Yechilishi: Dastlab qayiq tinch holatda edi. Odam qayiqdan sakraganda, qayiq uning harakatiga qarama-qarshi yo'nalishda tezlik oladi. Impulsning saqlanish qonuniga asosan:

$$0 = mv - Mu \quad mv = Mu \quad M = \frac{mv}{u} = \frac{70 \cdot 4}{0,2} = 1400 \text{ kg}$$

Javob: B) 1400.

28.8. Qayiqda suzib borayotgan ovchi miltiqdan ketma-ket 5 ta o'q otganda, qayiq to'xtab qoldi. Odam bilan qayiqlarning massasi 200 kg, bitta o'qning massasi 20 g, uchib chiqish tezligi 800 m/s bo'lsa, qayiqlarning tezligi qanday bo'lgan (m/s)?

- A) 0,1 B) 0,2 C) 0,8 D) 0,4

Berilgan:

$$N = 5$$

$$M = 200 \text{ kg}$$

$$m = 20 \text{ g}$$

$$v = 800 \text{ m/s}$$

$$u = ?$$

Yechilishi: Miltiqdan o'q uzganda miltiq orqaga impuls oladi va bu impuls qayiq harakatiga to'sqinlik qiladi. Qayiq harakatidan to'xtashi uchun uzilgan N ta o'qning impulsi qayiqlarning impulsi teng bo'lishi kerak.

$$Mu = Nmv \quad u = \frac{Nmv}{M} = \frac{5 \cdot 20 \cdot 10^{-3} \cdot 800}{200} = 0,4 \text{ m/s}$$

Javob: D) 0,4.

28.9. v_1 tezlik bilan harakatlanayotgan m_1 massali aravachaga qarshi tomondan yerga nisbatan v_2 tezlik bilan harakatlanayotgan m_2 massali jism kelib tushdi. Agar $m_2 v_2 > m_1 v_1$ bo'lsa, aravacha to'xtab qolishi uchun jism unga qanday α burchak ostida tushishi kerak?

A) aravachaning to'xtashi burchakka bog'liq emas B) $\alpha = \arctg \frac{m_1 v_1}{m_2 v_2}$

C) $\alpha = \arccos \frac{m_1 v_1}{m_2 v_2}$

D) $\alpha = \frac{m_1 v_1}{m_2 v_2}$

Berilgan:

$v_1; m_1;$

$v_2; m_2$

$m_2 v_2 > m_1 v_1$

$\alpha = ?$

Yechilishi:

arava to'xtab qolishi uchun jism shunday burchak ostida kelib tushishi kerakki, uning impulsining gorizontal tashkil etuvchisi aravachaning impulsiga teng va qarama-qarshi yo'nalgan bo'lishi kerak.

$$m_2 v_2 \cos \alpha = m_1 v_1 \quad \cos \alpha = \frac{m_1 v_1}{m_2 v_2} \quad \alpha = \arccos \frac{m_1 v_1}{m_2 v_2}$$

Javob: C) $\alpha = \arccos \frac{m_1 v_1}{m_2 v_2}$.

28.10. Ko'lda turgan, uzunligi 3 m, massasi 150 kg qayiqning quyrug'idan 75 kg massali odam qayiq chetiga o'tsa, qayiq necha metr ga siljiydi? Suvning qarshiligini hisobga olmang.

A) siljimaydi

B) 1

C) 1,5

D) 2

Berilgan:

$L = 3 \text{ m}$

$M = 150 \text{ kg}$

$m = 75 \text{ kg}$

$S = ?$

Yechilishi: Agar odamning qayiqqa nisbatan tezligini v bilan, qayiqning suvga nisbatan tezligini u bilan belgilasak, odamning suvga nisbatan tezligi $v - u$ ga teng bo'ladi. Impulsning saqlanish qonuniga asosan:

$$m(v - u) - Mu = 0$$

$$mv - mu - Mu = 0$$

$$mv = u(M + m)$$

Odam v tezlik bilan t vaqtda L masofani o'tsa, shu vaqt ichida qayiq u tezlik bilan S masofaga siljiydi.

$$\begin{cases} L = vt \\ S = ut \end{cases} \quad \frac{L}{S} = \frac{v}{u} \quad \frac{v}{u} = \frac{M + m}{m} \quad \frac{M + m}{m} = \frac{L}{S}$$

$$S = \frac{m}{M + m} L = \frac{75}{150 + 75} 3 = 1 \text{ m}$$

Javob: B) 1.

28.11. Massasi $m_1 = 100$ g bo'lgan sharcha $v_1 = 8$ m/s tezlik bilan $m_2 = 1$ kg massali tinch turgan sharchaga kelib urildi. Buning natijasida m_1 massali sharcha o'zining dastlabki harakat yo'nalishiga nisbatan perpendikular yo'nalishda $u_2 = 6$ m/s tezlik bilan harakat qila boshladi. Ikkinchi sharcha necha m/s tezlik olgan?

A) 0,3

B) 0,7

C) 1

D) 1,5

Berilgan:

$$m_1 = 100 \text{ g}$$

$$v_1 = 8 \text{ m/s}$$

$$m_2 = 1 \text{ kg}$$

$$v_2 = 0$$

$$u_1 = 6 \text{ m/s}$$

$$u_2 = ?$$

Yechilishi: Impulsning saqlanish qonuniga asosan:

$$m_1 \vec{v}_1 + m_2 \vec{v}_2 = m_1 \vec{u}_1 + m_2 \vec{u}_2$$

Impulslarni x va y o'qlariga proyeksiyalaymiz.

$$m_1 v_1 = m_2 u_2 \cos \alpha$$

$$0 = m_1 u_1 - m_2 u_2 \sin \alpha$$

$$(m_1 v_1)^2 = (m_2 u_2)^2 \cos^2 \alpha$$

$$(m_1 u_1)^2 = (m_2 u_2)^2 \sin^2 \alpha$$

$$(m_1 v_1)^2 + (m_1 u_1)^2 = (m_2 u_2)^2 (\cos^2 \alpha + \sin^2 \alpha); \quad \cos^2 \alpha + \sin^2 \alpha = 1$$

$$\sqrt{m_1^2 (v_1^2 + u_1^2)} = m_2 u_2 \quad u_2 = \frac{m_1}{m_2} \sqrt{v_1^2 + u_1^2} = \frac{0,1}{1} \sqrt{64 + 36} = 1 \text{ m/s}$$

Javob: C) 1.

II bo'lim. MOLEKULAR FIZIKA

V BOB. MOLEKULAR KINETIK NAZARIYA

29-§. Molekulalarning massasi

29.1. Molekular-kinetik nazariyaning asosiy qoidalari qaysi javobda nisbatan to'liq bayon qilingan?

A) har qanday jism molekulalardan tuzilgan, ular betartib harakatda bo'ladi, ular orasida o'zaro ta'sir kuchlari mavjud

B) modda mayda zarralardan tashkil topgan va ular orasida o'zaro ta'sir kuchlari mavjud

C) modda mayda bo'laklardan tuziladi va ular fazoni uzluksiz to'ldiradi

D) modda elementar zarralardan tuziladi va ular bir-biriga tinimsiz aylanib turadi

Javob: A) Har qanday jism molekulalardan tuzilgan, ular betartib harakatda bo'ladi, ular orasida o'zaro ta'sir kuchlari mavjud.

29.2. 1 mol BXS da qaysi kattalikning birligi hisoblanadi?

A) massa

B) modda miqdori

C) hajm

D) molyar massa

Javob: B) Modda miqdori.

29.3. Ta'rifni to'ldiring. Avogadro doimiysi ...

A) 12 g ugleroddagi atomlar soniga teng

B) bir mol miqdorda olingan modda massasiga teng

C) bir mol moddadagi atomlar soniga teng

D) 0,12 kg ugleroddagi atomlar soniga teng bo'lgan atomlari bo'lgan modda miqdori

Javob: A) 12 gr ugleroddagi atomlar soniga teng.

29.4. Molyar massa deb nimaga aytiladi?

A) $T = 273 \text{ K}$ da 1 m^3 hajmdagi modda massasiga

B) molekulaning grammlarda ifodalangan massasiga

C) berilgan modda atomi massasining uglerod atomi massasining $\frac{1}{12}$ qismiga nisbatiga

D) $N_A = 6,02 \cdot 10^{23}$ ta zarrachadan tashkil topgan modda massasiga

Javob: D) $6 \cdot 10^{23}$ ta zarrachalardan tashkil topgan modda massasiga.

29.5. Moddanning molyar massasi BXS da qanday o'lchamga ega?

- A) $kg \cdot m^3 \cdot mol$ B) $kg \cdot mol$ C) $kg \cdot m^{-3}$ D) $kg \cdot mol^{-1}$

Javob: D) $kg \cdot mol^{-1}$.

29.6. Gazning bitta molekulasi massasi $m_0 = 4,8 \cdot 10^{-26}$ kg ga teng. Shu gazning molyar massasi qanday (g/mol). $N_A = 6,02 \cdot 10^{23} mol^{-1}$.

- A) 8 B) 32 C) 12 D) 29

Berilgan:

$$m_0 = 4,8 \cdot 10^{-26} kg$$

$$N_A = 6,02 \cdot 10^{23} mol^{-1}$$

$$M = ?$$

Yechilishi: $v = \frac{m}{M}$, $v = \frac{N}{N_A}$, massani o'rniga olib

kelib qo'yamiz, $m = N \cdot m_0$ keyin esa modda miqdorilarni tenglashtirib:

$$v = \frac{m}{M} = \frac{N \cdot m_0}{M} \quad \frac{N \cdot m_0}{M} = \frac{N}{N_A}$$

$$M = m_0 \cdot N_A = 4,8 \cdot 10^{-26} \cdot 6,02 \cdot 10^{23} = 29 \cdot 10^{-3} kg/mol$$

Javob: D) 29.

29.7. Moddanning molyar massasi 36 g/mol bo'lsa, bitta molekulasi massasi necha kilogramm bo'ladi? $N_A = 6,02 \cdot 10^{23} mol^{-1}$.

- A) $36 \cdot 10^{-3}$ B) $6 \cdot 10^{-26}$ C) $36 \cdot 10^{-23}$ D) $3,6 \cdot 10^{-23}$

Berilgan:

$$M = 36 \frac{g}{mol} =$$

$$= 36 \cdot 10^{-3} \frac{kg}{mol}$$

$$N_A = 6,02 \cdot 10^{23} mol^{-1}$$

$$m_0 = ?$$

Yechilishi: Moddanning molyar massasi uning molekulasi bilan quyidagicha bog'langan:

$$M = m_0 \cdot N_A \quad m_0 = \frac{M}{N_A}$$

$$m_0 = \frac{M}{N_A} = \frac{36 \cdot 10^{-3}}{6,02 \cdot 10^{23}} = 6 \cdot 10^{-26} kg$$

Javob: B) $6 \cdot 10^{-26}$.

29.8. Kislorodning molyar massasi 0,032 kg/mol. Kislorod molekulasi massasi qanday (kg)?

- A) $5,3 \cdot 10^{-23}$ B) $5,3 \cdot 10^{-26}$
C) $5,3 \cdot 10^{-27}$ D) $8,6 \cdot 10^{-27}$

Berilgan:

$$M = 32 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$
$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$m_0 = ?$$

Yechilishi: M moddaning molyar massasi uning molekulasi massasi bilan quyidagicha bog'langan:

$$M = m_0 \cdot N_A, \quad m_0 = \frac{M}{N_A}$$
$$m_0 = \frac{M}{N_A} = \frac{32 \cdot 10^{-3}}{6,02 \cdot 10^{23}} = 5,3 \cdot 10^{-26} \text{ kg}$$

Javob: B) $5,3 \cdot 10^{-26}$.

29.9. Bitta kislorod (O_2) molekulasi massasi qanday (kg)?

- A) $5,3 \cdot 10^{-23}$ B) $5,3 \cdot 10^{-26}$ C) $1,9 \cdot 10^{-23}$ D) $1,9 \cdot 10^{-26}$

Berilgan:

$$M = 32 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$
$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$m_0 = ?$$

Yechilishi: Moddaning molyar massasi uning molekulasi massasi bilan quyidagicha bog'langan:

$$M = m_0 \cdot N_A \quad m_0 = \frac{M}{N_A}$$
$$m_0 = \frac{M}{N_A} = \frac{32 \cdot 10^{-3}}{6,02 \cdot 10^{23}} = 5,3 \cdot 10^{-26} \text{ kg}$$

Javob: $5,3 \cdot 10^{-26}$.

29.10. Bitta uglerod atomining massasi necha kg? $M = 12 \text{ g/mol}$; $N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$.

- A) $5 \cdot 10^{-27}$ B) $7,2 \cdot 10^{-27}$ C) $5 \cdot 10^{-26}$ D) $2 \cdot 10^{-26}$

Berilgan:

$$M = 12 \frac{\text{g}}{\text{mol}} =$$
$$= 12 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$
$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$m_0 = ?$$

Yechilishi: Moddaning molyar massasi uning molekulasi massasi bilan quyidagicha bog'langan:

$$M = m_0 \cdot N_A \quad m_0 = \frac{M}{N_A}$$
$$m_0 = \frac{M}{N_A} = \frac{12 \cdot 10^{-3}}{6,02 \cdot 10^{23}} \approx 2 \cdot 10^{-26} \text{ kg}$$

Javob: D) $2 \cdot 10^{-26}$.

29.11. Molekulalar soni $3 \cdot 10^{23}$ bo'lgan azotning massasi qanday (g)? $M = 28 \text{ g/mol}$, $N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$.

- A) 14 B) 28 C) 56 D) 84

Berilgan:

$$N = 3 \cdot 10^{23}$$

$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$M = 28 \cdot 10^{-3} \text{ kg/mol}$$

$$m = ?$$

Yechilishi: m massali moddadaagi molekular

soni $N = \frac{m}{M} N_A$ ifoda yordamida aniqlanadi. Bu ifodadan modda massasini topamiz:

$$m = \frac{N \cdot M}{N_A} = \frac{3 \cdot 10^{23} \cdot 28 \cdot 10^{-3}}{6,02 \cdot 10^{23}} \approx 14 \cdot 10^{-3} \text{ kg} \approx 14 \text{ g}$$

Javob: A) 14.

29.12. $3,0 \cdot 10^{26}$ ta temir atomining massasi nechaga teng (kg)? Temirning molyar massasi 56 g/mol, $N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$.

A) 56

B) 280

C) 28

D) 168

Berilgan:

$$N = 3 \cdot 10^{26} \text{ ta}$$

$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$M = 56 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$m_0 = ?$$

Yechilishi: $\nu = \frac{m}{M}$, $\nu = \frac{N}{N_A}$, modda miqdor-

larini tenglashtirib:

$$\frac{m}{M} = \frac{N}{N_A}, \quad m = \frac{N \cdot M}{N_A} \text{ massani topamiz.}$$

$$m = \frac{N \cdot M}{N_A} = \frac{3 \cdot 10^{26} \cdot 56 \cdot 10^{-3}}{6,02 \cdot 10^{23}} = 28 \text{ kg}$$

Javob: C) $m = 28 \text{ kg}$.

29.13. Gazning massasi m ga, molekulari soni N ga teng bo'lsa, uning molyar massasi qanday? N_A – Avogadro doimiysi.

A) NmN_A

B) $\frac{Nm}{N_A}$

C) $\frac{N_A m}{N}$

D) $\frac{N_A}{Nm}$

Berilgan:

$$m$$

$$N$$

$$N_A$$

$$M = ?$$

Yechilishi: $\nu = \frac{m}{M}$, $\nu = \frac{N}{N_A}$, modda miqdorilarni teng-

lashtirib:

$$\frac{m}{M} = \frac{N}{N_A}, \quad M = \frac{m \cdot N_A}{N} \text{ molyar massani topamiz.}$$

Javob: C) $M = \frac{N_A m}{N}$.

29.14. Suv molekulari H_2O ning massasi qanday (kg)? Vodorod va kislorod massalarini mos ravishda 1 va 16 u ga teng deb oling. $N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$.

A) $18 \cdot 10^{-30}$

B) $6 \cdot 10^{-26}$

C) $1,67 \cdot 10^{-27}$

D) $3 \cdot 10^{-26}$

Berilgan:

$$N = 1$$

$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$M = 18 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$m = ?$$

Yechilishi: $\nu = \frac{m}{M}$, $\nu = \frac{N}{N_A}$, modda miqdorlarini tenglashtirib:

$$\frac{m}{M} = \frac{N}{N_A}, m = \frac{N \cdot M}{N_A} \text{ massani topamiz.}$$

$$m = \frac{N \cdot M}{N_A} = \frac{1 \cdot 18 \cdot 10^{-3}}{6,02 \cdot 10^{23}} = 3 \cdot 10^{-26} \text{ kg}$$

Javob: D) $m = 3 \cdot 10^{-26} \text{ kg}$.

29.15. Berk idishdagi gaz molekulari soni 68 marta kamaytirildi. Gazning massasi qanday o'zgargan?

A) 68 marta kamaygan

B) 34 marta ortgan

C) 34 marta kamaygan

D) 68 marta ortgan

Berilgan:

$$N_1 = 68 N_2$$

$$\frac{m_2}{m_1} = ?$$

Yechilishi: berk idish bo'lsa, u holda hajm o'zgarmaydi, massa esa molekular soniga bog'liq bo'ladi, ya'ni, gaz massasi 68 marta kamayadi.

Javob: A) 68 marta kamaygan.

29.16. 16 g kislorod moddasining miqdorini (mol) aniqlang. $M = 32 \cdot 10^{-3} \text{ kg/mol}$.

A) 0,5

B) 1

C) 2

D) 16

Berilgan:

$$m = 16 \cdot 10^{-3} \text{ kg}$$

$$M = 32 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$\nu = ?$$

Yechilishi: $\nu = \frac{m}{M}$

$$\nu = \frac{m}{M} = \frac{16 \cdot 10^{-3}}{32 \cdot 10^{-3}} = 0,5 \text{ mol}$$

Javob: A) 0,5.

29.17. 9 g suvda necha mol modda bor?

A) 0,45

B) 0,5

C) 0,9

D) 4,5

Berilgan:

$$m = 9 \cdot 10^{-3} \text{ kg}$$

$$M = 18 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$\nu = ?$$

Yechilishi: $\nu = \frac{m}{M}$

$$\nu = \frac{m}{M} = \frac{9 \cdot 10^{-3}}{18 \cdot 10^{-3}} = 0,5 \text{ mol}$$

Javob: B) 0,5.

29.18. 5 mol geliyning massasi qanday?

- A) 0,1 kg B) 0,2 kg C) 10 g D) 20 g

Berilgan:

$$\nu = 5 \text{ mol}$$

$$M = 4 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$m = ?$$

Yechilishi: $\nu = \frac{m}{M}, m = \nu \cdot M$

$$m = \nu \cdot M = 5 \cdot 4 \cdot 10^{-3} = 20 \cdot 10^{-3} \text{ kg} = 20 \text{ g}$$

Javob: D) 20 g.

29.19. 5 mol kislorodning massasini toping. Kislorodning molyar massasi $32 \cdot 10^{-3} \text{ kg/mol}$.

- A) 320 g B) 32 g C) 1,6 kg D) 160 g

Berilgan:

$$\nu = 5 \text{ mol}$$

$$M = 32 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$m = ?$$

Yechilishi: $\nu = \frac{m}{M}, m = \nu \cdot M$

$$m = \nu \cdot M = 5 \cdot 32 \cdot 10^{-3} = 160 \cdot 10^{-3} \text{ kg} = 160 \text{ g}$$

Javob: D) 160 g.

29.20. CO_2 gazining 10 molining massasi nechaga teng (g)?

- A) 500 B) 440 C) 400 D) 340

Berilgan:

$$\nu = 10 \text{ mol}$$

$$M = 44 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$m = ?$$

Yechilishi: $\nu = \frac{m}{M}, m = \nu \cdot M$

$$m = \nu \cdot M = 10 \cdot 44 \cdot 10^{-3} = 440 \cdot 10^{-3} \text{ kg} = 440 \text{ g}$$

Javob: B) 440.

29.21. 2 mol suv necha sm^3 hajmni egallaydi?

- A) 2 B) 36 C) 64 D) 18

Berilgan:

$$\nu = 2 \text{ mol}$$

$$M = 18 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$\rho = 1000 \text{ kg/m}^3$$

$$V = ?$$

Yechilishi: $\nu = \frac{m}{M}, m = \rho V, \nu = \frac{\rho \cdot V}{M}$

$$V = \frac{M \cdot \nu}{\rho} = \frac{18 \cdot 10^{-3} \cdot 2}{1000} = 36 \cdot 10^{-6} \text{ m}^3 = 36 \text{ sm}^3$$

Javob: B) 36.

29.22. 2 g vodoroddagi molekular sonini aniqlang. $N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$;
 $M = 2 \cdot 10^{-3} \text{ kg/mol}$.

- A) $1,2 \cdot 10^{24}$ B) $6 \cdot 10^{23}$ C) $3 \cdot 10^{23}$ D) $1,2 \cdot 10^{23}$

Berilgan:

$$m = 2 \text{ g} = 2 \cdot 10^{-3} \text{ kg}$$

$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$M = 2 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$N = ?$$

Yechilishi:

$$\nu = \frac{m}{M}, \quad \nu = \frac{N}{N_A} \text{ modda miqdorlarini teng-}$$

lashtirib:

$$\frac{m}{M} = \frac{N}{N_A}, \quad N = \frac{m \cdot N_A}{M} \text{ topamiz.}$$

$$N = \frac{m \cdot N_A}{M} = \frac{2 \cdot 10^{-3} \cdot 6,02 \cdot 10^{23}}{2 \cdot 10^{-3}} = 6 \cdot 10^{23} \text{ ta}$$

Javob: B) $6 \cdot 10^{23}$.

29.23. 64 g kisloroddagi molekular soni nechta?

- A) $5 \cdot 10^{23}$ B) $3 \cdot 10^{23}$ C) $12 \cdot 10^{23}$ D) $4 \cdot 10^{23}$

Berilgan:

$$m = 64 \text{ g} = 64 \cdot 10^{-3} \text{ kg}$$

$$M = 32 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$N = ?$$

Yechilishi:

$$\nu = \frac{m}{M}, \quad \nu = \frac{N}{N_A} \text{ modda miqdorlarini teng-}$$

lashtirib:

$$\frac{m}{M} = \frac{N}{N_A}, \quad N = \frac{m \cdot N_A}{M} \text{ topamiz.}$$

$$N = \frac{m \cdot N_A}{M} = \frac{64 \cdot 10^{-3} \cdot 6,02 \cdot 10^{23}}{32 \cdot 10^{-3}} = 12 \cdot 10^{23} \text{ ta}$$

Javob: C) $12 \cdot 10^{23}$.

29.24. 320 g kislorodda nechta molekula bor? $N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$.

- A) $6 \cdot 10^{24}$ B) $12 \cdot 10^{23}$ C) $12 \cdot 10^{24}$ D) $6 \cdot 10^{20}$

Berilgan:

$$m = 320 \text{ g} = 320 \cdot 10^{-3} \text{ kg}$$

$$M = 32 \cdot 10^{-3} \text{ kg/mol}$$

$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$N = ?$$

Yechilishi:

$$\nu = \frac{m}{M}, \quad \nu = \frac{N}{N_A} \text{ modda miqdorlarini teng-}$$

lashtirib:

$$\frac{m}{M} = \frac{N}{N_A}, \quad N = \frac{m \cdot N_A}{M} \text{ topamiz.}$$

$$N = \frac{m \cdot N_A}{M} = \frac{320 \cdot 10^{-3} \cdot 6,02 \cdot 10^{23}}{32 \cdot 10^{-3}} = 6 \cdot 10^{24} \text{ ta}$$

Javob: A) $6 \cdot 10^{24}$.

29.25. 0,009 kg suvdagi molekular sonini toping.

A) $6 \cdot 10^{23}$

B) $2 \cdot 10^{23}$

C) 10^{23}

D) $3 \cdot 10^{23}$

Berilgan:

$$m = 0,009 \text{ kg} = 9 \cdot 10^{-3} \text{ kg}$$

$$M = 18 \cdot 10^{-3} \text{ kg/mol}$$

$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$N = ?$$

Yechilishi:

$$\nu = \frac{m}{M}, \quad \nu = \frac{N}{N_A} \text{ modda miqdorlarini teng-}$$

lashtirib:

$$\frac{m}{M} = \frac{N}{N_A}, \quad N = \frac{m \cdot N_A}{M} \text{ topamiz.}$$

$$N = \frac{m \cdot N_A}{M} = \frac{9 \cdot 10^{-3} \cdot 6,02 \cdot 10^{23}}{18 \cdot 10^{-3}} = 3 \cdot 10^{23} \text{ ta}$$

Javob: D) $3 \cdot 10^{23}$.

29.26. Massasi 140 g bo'lgan xlor molekularining sonini aniqlang. $M = 70 \cdot 10^{-3} \text{ kg/mol}$, $N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$.

A) $6,02 \cdot 10^{23}$

B) $12,04 \cdot 10^{24}$

C) $1,2 \cdot 10^{23}$

D) $12,04 \cdot 10^{23}$

Berilgan:

$$m = 140 \text{ g} = 140 \cdot 10^{-3} \text{ kg}$$

$$M = 70 \cdot 10^{-3} \text{ kg/mol}$$

$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$N = ?$$

Yechilishi: $\nu = \frac{m}{M}, \quad \nu = \frac{N}{N_A} \text{ modda}$
miqdorlarini tenglashtirib:

$$\frac{m}{M} = \frac{N}{N_A}, \quad N = \frac{m \cdot N_A}{M} \text{ topamiz.}$$

$$N = \frac{m \cdot N_A}{M} = \frac{140 \cdot 10^{-3} \cdot 6,02 \cdot 10^{23}}{70 \cdot 10^{-3}} = 12,04 \cdot 10^{23} \text{ ta}$$

Javob: D) $12,04 \cdot 10^{23}$.

29.27. Massasi $3 \cdot 10^{-5} \text{ g}$ bo'lgan suv tomchisida nechta molekula bor? Avogadro soni $N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$.

A) 10^{21}

B) $5 \cdot 10^{18}$

C) 10^{18}

D) $2 \cdot 10^{21}$

Berilgan:

$$m = 3 \cdot 10^{-5} \text{ g} = 3 \cdot 10^{-8} \text{ kg}$$

$$M = 18 \cdot 10^{-3} \text{ kg/mol}$$

$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$N = ?$$

Yechilishi: $\nu = \frac{m}{M}, \quad \nu = \frac{N}{N_A} \text{ modda}$
miqdorlarini tenglashtirib:

$$\frac{m}{M} = \frac{N}{N_A}, \quad N = \frac{m \cdot N_A}{M} \text{ topamiz.}$$

$$N = \frac{m \cdot N_A}{M} = \frac{3 \cdot 10^{-8} \cdot 6,02 \cdot 10^{23}}{18 \cdot 10^{-3}} = 1 \cdot 10^{18} \text{ ta}$$

Javob: C) 10^{18} .

29.28. 0,3 g li suv tomchisida qancha suv molekulasini bor? $N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$.

- A) $3 \cdot 10^{23}$ B) $1 \cdot 10^{22}$ C) $1,8 \cdot 10^{23}$ D) $2 \cdot 10^{23}$

Berilgan:

$$m = 0,3 \text{ g} = 3 \cdot 10^{-4} \text{ kg}$$

$$M = 18 \cdot 10^{-3} \text{ kg/mol}$$

$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$N = ?$$

Yechilishi: $\nu = \frac{m}{M}$, $\nu = \frac{N}{N_A}$ modda miqdorlarini tenglashtirib:

$$\frac{m}{M} = \frac{N}{N_A}, N = \frac{m \cdot N_A}{M}, \text{ topamiz.}$$

$$N = \frac{m \cdot N_A}{M} = \frac{3 \cdot 10^{-4} \cdot 6,02 \cdot 10^{23}}{18 \cdot 10^{-3}} = 1 \cdot 10^{22} \text{ ta}$$

Javob: B) $1 \cdot 10^{22}$.

29.29. 0,036 kg suvda nechta molekula bor? Avogadro soni $N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$.

- A) $3 \cdot 10^{23}$ B) $12 \cdot 10^{23}$ C) $6 \cdot 10^{20}$ D) $6 \cdot 10^{23}$

Berilgan:

$$m = 0,036 \text{ kg} = 36 \cdot 10^{-3} \text{ kg}$$

$$M = 18 \cdot 10^{-3} \text{ kg/mol}$$

$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$N = ?$$

Yechilishi: $\nu = \frac{m}{M}$, $\nu = \frac{N}{N_A}$ modda miqdorlarini tenglashtirib:

$$\frac{m}{M} = \frac{N}{N_A}, N = \frac{m \cdot N_A}{M} \text{ topamiz.}$$

$$N = \frac{m \cdot N_A}{M} = \frac{36 \cdot 10^{-3} \cdot 6,02 \cdot 10^{23}}{18 \cdot 10^{-3}} = 12 \cdot 10^{23} \text{ ta}$$

Javob: B) $12 \cdot 10^{23}$.

29.30. 9 g suvdagi molekular sonini toping. $M = 18 \text{ g/mol}$, $N_A = 6 \cdot 10^{23} \text{ mol}$.

- A) $3 \cdot 10^{23}$ B) $6 \cdot 10^{23}$ C) $3,24 \cdot 10^{24}$ D) $12 \cdot 10^{23}$

Berilgan:

$$m = 9 \text{ g} = 9 \cdot 10^{-3} \text{ kg}$$

$$M = 18 \cdot 10^{-3} \text{ kg/mol}$$

$$N = ?$$

Yechilishi: $\nu = \frac{m}{M}$, $\nu = \frac{N}{N_A}$ modda miqdorlarini

tenglashtirib: $\frac{m}{M} = \frac{N}{N_A}$, $N = \frac{m \cdot N_A}{M}$ topamiz.

$$N = \frac{m \cdot N_A}{M} = \frac{9 \cdot 10^{-3} \cdot 6 \cdot 10^{23}}{18 \cdot 10^{-3}} = 3 \cdot 10^{23} \text{ ta}$$

Javob: A) $3 \cdot 10^{23}$.

29.31. Massasi 3 g bo'lgan suv tomchisida nechta elektron bor? $N_A = 6 \cdot 10^{23} \text{ mol}$.

- A) 10^{26} B) 10^{25} C) 10^{24} D) 10^{23}

Berilgan:

$$m = 3 \text{ g} = 3 \cdot 10^{-3} \text{ kg}$$

$$M = 18 \cdot 10^{-3} \text{ kg/mol}$$

$$N_e = ?$$

Yechilishi: $\nu = \frac{m}{M}$, $\nu = \frac{N}{N_A}$ modda miqdorla-

rini tenglashtirib: $\frac{m}{M} = \frac{N}{N_A}$, $N = \frac{m \cdot N_A}{M}$ topamiz.

$$N = \frac{m \cdot N_A}{M} = \frac{3 \cdot 10^{-3} \cdot 6 \cdot 10^{23}}{18 \cdot 10^{-3}} = 10^{23} \text{ ta}$$

Endi 1 ta molekulasidagi elektronlar sonini topamiz, keyin esa suvni N ta molekulasiga ko'paytirib elektronlar sonini topamiz.

Suv molekulasida 2 ta vodorod va 1 ta kislorod bor. Vodorodda 1 ta bo'lib, 2 ta vodorodda 2 ta elektron va 1 ta kislorodda 8 ta elektron bo'ladi. Demak, suv molekulasida 10 ta elektron bo'ladi. Suvning N ta molekulasida $N \cdot 10$ ta elektron bo'ladi. $N_e = N \cdot 10 = 10^{23} \cdot 10 = 10^{24}$ ta

Javob: C) 10^{24} .

29.32. Massasi 1,187 kg bo'lgan qalay bo'lagida qancha atom bor? Qalayning molyar massasi $M = 118,7 \text{ g/mol}$, $N_A = 6 \cdot 10^{23} \text{ mol}$.

A) $6 \cdot 10^{26}$

B) $6 \cdot 10^{23}$

C) $6 \cdot 10^{24}$

D) $6 \cdot 10^{27}$

Berilgan:

$$m = 1,187 \text{ kg}$$

$$N_A = 6 \cdot 10^{23} \text{ mol}$$

$$M = 118,7 \cdot 10^{-3} \text{ kg/mol}$$

$$N = ?$$

Yechilishi: $\nu = \frac{m}{M}$, $\nu = \frac{N}{N_A}$ modda miq-

dorlarni tenglashtirib: $\frac{m}{M} = \frac{N}{N_A}$, $N = \frac{m \cdot N_A}{M}$ topamiz

$$N = \frac{m \cdot N_A}{M} = \frac{1,187 \cdot 6 \cdot 10^{23}}{118,7 \cdot 10^{-3}} = 6 \cdot 10^{26} \text{ ta}$$

Javob: A) $6 \cdot 10^{26}$.

29.33. 36 sm^3 hajmdagi suvda nechta molekula bor? $M = 18 \text{ g/mol}$; $N_A = 6 \cdot 10^{23} \text{ mol}$.

A) $3,6 \cdot 10^{24}$

B) $2,4 \cdot 10^{24}$

C) $1,2 \cdot 10^{24}$

D) $6 \cdot 10^{24}$

Berilgan:

$$V = 36 \text{ sm}^3 = 36 \cdot 10^{-6} \text{ m}^3$$

$$\rho = 1000 \text{ kg/m}^3$$

$$N_A = 6 \cdot 10^{23} \text{ mol}$$

$$M = 18 \cdot 10^{-3} \text{ kg/mol}$$

$$N = ?$$

Yechilishi: $\nu = \frac{m}{M}$, $\nu = \frac{N}{N_A}$ modda miq-dorlarini tenglashtirib:

$\frac{m}{M} = \frac{N}{N_A}$, $m = \rho \cdot V$, $N = \frac{m \cdot N_A}{M}$ topamiz.

$$N = \frac{\rho \cdot V \cdot N_A}{M} = \frac{10^3 \cdot 36 \cdot 10^{-6} \cdot 6 \cdot 10^{23}}{18 \cdot 10^{-3}} = 1,2 \cdot 10^{24} \text{ ta}$$

Javob: C) $1,2 \cdot 10^{24}$.

29.34. Sig'imi 200 sm^3 bo'lgan stakandagi suvda nechta molekula bor? $M = 18 \text{ g/mol}$; $N_A = 6 \cdot 10^{23} \text{ mol}^{-1}$.

A) $6,5 \cdot 10^{28}$

B) $1,8 \cdot 10^{24}$

C) $6 \cdot 10^{25}$

D) $6,7 \cdot 10^{24}$

Berilgan:

$$V = 200 \text{ sm}^3 = 200 \cdot 10^{-6} \text{ m}^3$$

$$\rho = 1000 \text{ kg/m}^3$$

$$N_A = 6 \cdot 10^{23} \text{ mol}^{-1}$$

$$M = 18 \cdot 10^{-3} \text{ kg/mol}$$

$$N = ?$$

Yechilishi: $\nu = \frac{m}{M}$, $\nu = \frac{N}{N_A}$ modda miqdorlarini tenglashtirib:

$$\frac{m}{M} = \frac{N}{N_A}, \quad m = \rho \cdot V, \quad N = \frac{m \cdot N_A}{M} = \frac{\rho \cdot V \cdot N_A}{M}$$

topamiz.

$$N = \frac{\rho \cdot V \cdot N_A}{M} = \frac{10^3 \cdot 200 \cdot 10^{-6} \cdot 6 \cdot 10^{23}}{18 \cdot 10^{-3}} = 6,7 \cdot 10^{24} \text{ ta}$$

Javob: D) $6,7 \cdot 10^{24}$.

29.35. 3 l suvdagi molekular sonini aniqlang. $N_A = 6 \cdot 10^{23} \text{ mol}^{-1}$.

A) $1 \cdot 10^{25}$

B) $3,3 \cdot 10^{25}$

C) $3,3 \cdot 10^{26}$

D) $1 \cdot 10^{26}$

Berilgan:

$$V = 3 \text{ l} = 3 \cdot 10^{-3} \text{ m}^3$$

$$\rho = 1000 \text{ kg/m}^3$$

$$N_A = 6 \cdot 10^{23} \text{ mol}^{-1}$$

$$N = ?$$

Yechilishi: $\nu = \frac{m}{M}$, $\nu = \frac{N}{N_A}$ modda miqdorlarini tenglashtirib:

$$\frac{m}{M} = \frac{N}{N_A}, \quad m = \rho \cdot V, \quad N = \frac{m \cdot N_A}{M} = \frac{\rho \cdot V \cdot N_A}{M}$$

topamiz.

$$N = \frac{\rho \cdot V \cdot N_A}{M} = \frac{10^3 \cdot 3 \cdot 10^{-3} \cdot 6 \cdot 10^{23}}{18 \cdot 10^{-3}} = 1 \cdot 10^{26} \text{ ta}$$

Javob: D) $1 \cdot 10^{26}$.

29.36. 36 g suvdagi molekular soni 2 g vodoroddagi molekular sonidan necha marta katta?

A) 2

B) 6

C) 9

D) 18

Berilgan:

$$m_s = 36 \text{ g}$$

$$m_v = 2 \text{ g}$$

$$M_s = 18 \frac{\text{g}}{\text{mol}}$$

$$M_v = 2 \frac{\text{g}}{\text{mol}}$$

$$\frac{N_s}{N_v} = ?$$

Yechilishi:

$\nu = \frac{m}{M}$, $\nu = \frac{N}{N_A}$ modda miqdorlarini tenglashtirib,

$N = \frac{m \cdot N_A}{M}$ topamiz. Endi esa suv va vodorod uchun yozamiz:

$$N_s = \frac{m_s \cdot N_A}{M_s}, \quad N_v = \frac{m_v \cdot N_A}{M_v}, \text{ nisbatlarni olamiz,}$$

$$\frac{N_s}{N_v} = \frac{\frac{m_s \cdot N_A}{M_s}}{\frac{m_v \cdot N_A}{M_v}} = \frac{m_s M_v}{m_v M_s} = \frac{36 \cdot 2}{2 \cdot 18} = 2$$

Javob: A) 2.

29.37. Massalari teng bo'lgan vodorod va kisloroddagi molekular soni o'zaro necha marta farq qiladi? $M_k = 32 \frac{g}{mol}$; $M_v = 2 \frac{g}{mol}$

- A) 64 B) 32 C) 18 D) 16

Berilgan:

$$m_k = m_v$$

$$M_v = 2 \frac{g}{mol}$$

$$M_k = 32 \frac{g}{mol}$$

$$\frac{N_v}{N_k} = ?$$

Yechilishi:

$v = \frac{m}{M}$, $v = \frac{N}{N_A}$, modda miqdorlarini tenglashtirib,

$N = \frac{m \cdot N_A}{M}$ ni topamiz. Endi kislorod va vodorod uchun

yozamiz: $N_v = \frac{m_v \cdot N_A}{M_v}$ va $N_k = \frac{m_k \cdot N_A}{M_k}$ nisbatlarni olamiz,

$$\frac{N_v}{N_k} = \frac{\frac{m_v \cdot N_A}{M_v}}{\frac{m_k \cdot N_A}{M_k}} = \frac{m_v M_k}{m_k M_v} = \frac{m_v \cdot 32}{m_v \cdot 2} = 16$$

Javob: D) 16.

29.38. 135 g aluminiydagi atomlar soni 197 g oltindagi atomlar sonidan necha marta katta? $M_{Al} = 27 \frac{g}{mol}$; $M_0 = 197 \frac{g}{mol}$

- A) 5 B) 2 C) 2,5 D) 4

Berilgan:

$$m_{Al} = 135 \text{ g}$$

$$m_v = 197 \text{ g}$$

$$M_{Al} = 27 \frac{g}{mol}$$

$$M_0 = 197 \frac{g}{mol}$$

$$\frac{N_{Al}}{N_0} = ?$$

Yechilishi:

$v = \frac{m}{M}$, $v = \frac{N}{N_A}$ modda miqdorlarini tenglashtirib,

$N = \frac{m \cdot N_A}{M}$ topamiz. Endi esa suv va vodorod uchun

yozamiz: $N_{Al} = \frac{m_{Al} \cdot N_A}{M_{Al}}$, $N_0 = \frac{m_0 \cdot N_A}{M_0}$ nisbatlarni olamiz,

$$\frac{N_{Al}}{N_0} = \frac{\frac{m_{Al} \cdot N_A}{M_{Al}}}{\frac{m_0 \cdot N_A}{M_0}} = \frac{m_{Al} M_0}{m_0 M_{Al}} = \frac{135 \cdot 197}{197 \cdot 27} = 5$$

Javob: A) 5.

29.39. Hajmlari teng bo'lgan suv va muzdagi molekular sonini taqqoslang.

- A) $\frac{N_m}{N_s} = 2$ B) $\frac{N_s}{N_m} = 0,1$ C) $\frac{N_s}{N_m} = 1,1$ D) $\frac{N_s}{N_m} = 1$

Berilgan:

$$V_s = V_m$$

$$M_m = M_s = 18 \frac{\text{g}}{\text{mol}}$$

$$\rho_s = 1000 \frac{\text{kg}}{\text{m}^3}$$

$$\rho_m = 900 \frac{\text{kg}}{\text{m}^3}$$

$$\frac{N_{Al}}{N_0} = ?$$

Yechilishi:

$N = \frac{m \cdot N_A}{M}$ formuladan foydalanamiz va massa o'rniga quyidagi:

$m = \rho \cdot V$ formulani qo'yamiz. Suv va muz uchun molekular sonini topamiz:

$$N_s = \frac{\rho_s \cdot V_s \cdot N_A}{M_s}, \quad N_m = \frac{\rho_m \cdot V_m \cdot N_A}{M_m} \text{ endi esa nisbatlarini olamiz:}$$

$$\frac{N_s}{N_m} = \frac{\frac{\rho_s \cdot V_s \cdot N_A}{M_s}}{\frac{\rho_m \cdot V_m \cdot N_A}{M_m}} = \frac{\rho_s \cdot V_s \cdot M_m}{\rho_m \cdot V_m \cdot M_s} = \frac{1000 \cdot V_s \cdot M_m}{900 \cdot V_s \cdot M_m} = 1,1$$

Javob: C) $\frac{N_s}{N_m} = 1,1$.

29.40. Diametri 1 mm li suv tomchisida nechta molekula bor? $N_A = 6 \cdot 10^{23}$ mol.

A) $1,75 \cdot 10^{18}$

B) $2 \cdot 10^{17}$

C) $1,75 \cdot 10^{29}$

D) $1,75 \cdot 10^{19}$

Berilgan:

$$d = 1 \text{ mm} = 1 \cdot 10^{-3} \text{ m}$$

$$\rho = 1000 \text{ kg/m}^3$$

$$N_A = 6 \cdot 10^{23} \text{ mol}$$

$$M = 18 \cdot 10^{-3} \text{ kg/mol}$$

$$N = ?$$

Yechilishi: $\nu = \frac{m}{M}$, $\nu = \frac{N}{N_A}$ modda miqdorlarini tenglashtirib:

$$\frac{m}{M} = \frac{N}{N_A}, \quad m = \rho \cdot V, \quad V = \frac{1}{6} \pi d^3$$

$$N = \frac{m \cdot N_A}{M} = \frac{\rho \cdot V \cdot N_A}{M} = \frac{\rho \cdot \pi d^3 \cdot N_A}{6M}$$

$$N = \frac{\rho \cdot \pi d^3 \cdot N_A}{6M} = \frac{10^3 \cdot 3,14 \cdot 10^{-9} \cdot 6,02 \cdot 10^{23}}{6 \cdot 18 \cdot 10^{-3}} = 1,75 \cdot 10^{19} \text{ ta}$$

Javob: D) $1,75 \cdot 10^{19}$.

29.41. 18 mg suv 6 s da bug'lansa, 1 s da suv sirtidan o'rtacha nechta molekula uchib ketadi?

Avogadro soni $N_A = 6 \cdot 10^{23}$ mol

A) $1 \cdot 10^{23}$

B) $1 \cdot 10^{20}$

C) $4 \cdot 10^{19}$

D) $2 \cdot 10^{18}$

Berilgan:

$$m = 18 \text{ mg} = 18 \cdot 10^{-6} \text{ kg}$$

$$N_A = 6 \cdot 10^{23} \text{ mol}$$

$$M = 18 \cdot 10^{-3} \text{ kg/mol}$$

$$N_1 = ?$$

Yechilishi:

$$\nu = \frac{m}{M}, \quad \nu = \frac{N}{N_A} \text{ miqdorlarini tenglash-}$$

tirib:

$$\frac{m}{M} = \frac{N}{N_A}, \quad N = \frac{m \cdot N_A}{M} \text{ topamiz.}$$

$$N = \frac{m \cdot N_A}{M} = \frac{18 \cdot 10^{-6} \cdot 6 \cdot 10^{23}}{18 \cdot 10^{-3}} = 6 \cdot 10^{20} \text{ ta endi bu sonni 6 ga bo'lamiz.}$$

$$N_1 = \frac{N}{6} = \frac{6 \cdot 10^{20}}{6} = 10^{20} \text{ ta}$$

Javob: B) $1 \cdot 10^{20}$.

29.42. Piyolaga quyilgan 180 g suv bir haftada to'la bug'lanib ketdi. Piyoladan bir sekunda o'rta hisobda nechta molekula suv bug'langanligini aniqlang. $N_A = 6 \cdot 10^{23}$ mol.

A) 10^{22}

B) 10^{19}

C) 10^{15}

D) 10^9

Berilgan:

$$m = 180 \text{ g} = 18 \cdot 10^{-2} \text{ kg}$$

$$t = 604800 \text{ s}$$

$$\Delta t = 1 \text{ s}$$

$$M = 18 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$N_A = 6 \cdot 10^{23} \text{ mol}$$

$$N_1 = ?$$

Yechilishi:

$$N = \frac{m \cdot N_A}{M} \text{ formuladan topamiz.}$$

$$N = \frac{18 \cdot 10^{-2} \cdot 6 \cdot 10^{23}}{18 \cdot 10^{-3}} = 6 \cdot 10^{24} \text{ endi esa 1 s da bug'la-}$$

nadigan molekular sonini aniqlash uchun, t ga bo'lamiz:

$$N_1 = \frac{N}{t} = \frac{6 \cdot 10^{24}}{604800} = 10^{19}$$

Javob: B) 10^{19} .

29.43. Idishdagi gaz massasining 84 foizini azot, 16 foizini kislorod tashkil qilsa, bitta kislorod molekulasi ga nechta azot molekulasi to'g'ri keladi? $M_A = 28$ g/mol; $M_k = 32$ g/mol.

A) 4

B) 3

C) 2

D) 6

Berilgan:

$$m_A = 0,84m$$

$$m_k = 0,16m$$

$$M_A = 28 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$M_k = 32 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$\frac{N_k}{N_A} = ?$$

Yechilishi:

$$\nu = \frac{m}{M}, \nu = \frac{N}{N_A} \text{ modda miqdorlarini tenglashtirib,}$$

$$N = \frac{m \cdot N_A}{M} \text{ topamiz. Endi azot va kislorod uchun}$$

$$\text{yozamiz: } N_A = \frac{m_A \cdot N_A}{M_A}, N_k = \frac{m_k \cdot N_A}{M_k} \text{ nisbatlarni}$$

olamiz.

$$\frac{N_k}{N_A} = \frac{\frac{m_k \cdot N_A}{M_k}}{\frac{m_A \cdot N_A}{M_A}} = \frac{m_k M_A}{m_A M_k} = \frac{0,16m \cdot 28 \cdot 10^{-3}}{0,84m \cdot 32 \cdot 10^{-3}} = \frac{1}{6}$$

Javob: D) 6.

29.44. Sirt yuzi 20 sm^2 bo'lgan qurilmaning sirtiga $1 \mu\text{m}$ qalinlikda oltin qatlami qoplandi. Avogadro doimiysi $N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$, oltinning atom massasi 197 m.a.b , zichligi esa $19,3 \text{ g/sm}^3$ ekanligidan foydalanib, qoplamda nechta oltin atomi borligini aniqlang.

A) $1,18 \cdot 10^{20}$

B) $1,5 \cdot 10^{20}$

C) $2,0 \cdot 10^{20}$

D) $1,13 \cdot 10^{20}$

Berilgan:

$$d = 1 \mu\text{m} = 10^{-6} \text{ m}$$

$$S = 20 \text{ sm}^2 = 2 \cdot 10^{-3} \text{ m}^2$$

$$M = 197 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$\rho = 19,3 \cdot 10^3 \frac{\text{kg}}{\text{m}^3}$$

$$N = ?$$

Yechilishi:

$$N = \frac{m \cdot N_A}{M} \text{ formuladagi massa o'rniga}$$

$$m = \rho \cdot V \text{ formulani qo'yamiz } N = \frac{\rho \cdot V \cdot N_A}{M}$$

hajm o'rniga $V = S \cdot d$ ni qo'yamiz,

$$N = \frac{\rho \cdot S \cdot d \cdot N_A}{M}$$

$$N = \frac{19,3 \cdot 10^3 \cdot 2 \cdot 10^{-3} \cdot 10^{-6} \cdot 6,02 \cdot 10^{23}}{197 \cdot 10^{-3}} = 1,18 \cdot 10^{20}$$

Javob: A) $1,18 \cdot 10^{20}$.

29.45. Qalinligi $1 \mu\text{m}$ bo'lgan kumush qatlamining 36 sm^2 yuzasida nechta kumush atomi borligini toping. $M = 108 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$, $\rho = 10,5 \cdot 10^3 \frac{\text{kg}}{\text{m}^3}$, $N_A = 6 \cdot 10^{23} \text{ mol}^{-1}$.

A) $2,1 \cdot 10^{23}$

B) $4,2 \cdot 10^{22}$

C) $4,2 \cdot 10^{21}$

D) $2,1 \cdot 10^{20}$

Berilgan:

$$d = 1 \mu m = 10^{-6} m$$

$$S = 36 sm^2 = 36 \cdot 10^{-4} m^2$$

$$M = 108 \cdot 10^{-3} \frac{kg}{mol}$$

$$N_A = 6 \cdot 10^{23} mol$$

$$\rho = 10,5 \cdot 10^3 \frac{kg}{m^3}$$

$$N = ?$$

Yechilishi:

$$N = \frac{m \cdot N_A}{M} \text{ formuladan topamiz va massa}$$

$$\text{o'rniga } m = \rho \cdot V \text{ formulani qo'yamiz } N = \frac{\rho \cdot V \cdot N_A}{M}$$

$$\text{hajm o'rniga } V = S \cdot d \text{ qo'yamiz,}$$

$$N = \frac{\rho \cdot S \cdot d \cdot N_A}{M}$$

$$N = \frac{10,5 \cdot 10^3 \cdot 36 \cdot 10^{-4} \cdot 10^{-6} \cdot 6 \cdot 10^{23}}{108 \cdot 10^{-3}} = 2,1 \cdot 10^{20} \text{ ta}$$

Javob: D) $2,1 \cdot 10^{20}$.

29.46. Metall jism yuqori haroratgacha qizitildi. Bunda jismning hajmi, zichligi va modda miqdori qanday o'zgaradi?

A) ortadi, ortadi, ortadi

B) ortadi, kamayadi, ortadi

C) ortadi, ortadi, o'zgarmaydi

D) ortadi, kamayadi, o'zgarmaydi

Javob: D) ortadi, kamayadi, o'zgarmaydi.

29.47. Broun harakati deyilganda, nima tushuniladi?

A) suyuqlik molekulalarining issiqlik harakati

B) suyuqlikka solingan qattiq jism zarralarining suyuqlik molekulalari ta'siridagi harakati

C) suyuqlik molekulalarining unga solingan mayda zarralar ta'siridagi harakati

D) suyuqlikka solingan qattiq jism zarralarining o'zaro ta'sirlashuvlari natijasida yuzaga keladigan harakati

Javob: B) suyuqlikka solingan qattiq jism zarralarining suyuqlik molekulalari ta'siridagi harakati.

30- §. Ideal gaz. MKNning asosiy tenglamasi

30.1. Quyidagi tasdiqlarning qaysi biri ideal gaz uchun noto'g'ri?

A) molekulalar orasidagi o'zaro ta'sir kuchlarini hisobga olmaslik mumkin

B) molekulalarning o'zaro ta'sir potensial energiyasini hisobga olmaslik mumkin

C) molekulalar hajmini hisobga olmaslik mumkin

D) molekulalar massasini hisobga olmaslik mumkin

Javob: D) molekulalar massasini hisobga olmaslik mumkin.

30.2. Gazni ideal deb hisoblash uchun nimani hisobga olmaslik kerak?

A) molekulalarning to'qnashuvini

- B) molekulalarning to'qnashgandagi o'zaro ta'sirini
 C) molekulalarning harakatini.
 D) molekulalarning masofadan ta'sirlashishini

Javob: D) molekulalarning masofadan ta'sirlashishini

30.3. Ideal gazning bosimi molekulalarni tavsiflaydigan quyidagi kattaliklarning qaysi biriga bog'liq?

- A) molekulalar orasidagi tortishish kuchiga
 B) kinetik energiyaga
 C) potensial energiyaga
 D) molekulalar orasidagi itarishish kuchiga

Javob: B) kinetik energiyaga.

30.4. $\overline{v_x^2} = \frac{1}{2} \overline{v^2}$ ifoda quyida keltirilgan mulohazalarning qaysi biriga asoslanib yozilgan?

- A) molekulalar o'zaro elastik to'qnashadi
 B) molekulalar soni kam
 C) molekulalar shar shaklida
 D) molekulalar tartibsiz harakat qiladi

Javob: D) molekulalar tartibsiz harakat qiladi.

30.5. Tezligi 1200 m/s bo'lgan kislorod molekulasining idish devoriga 60° burchak ostida mutloq elastik urilishi natijasida idish devori olgan kuch impulsini toping (N · s). $N_A = 6 \cdot 10^{23} \text{ mol}^{-1}$.

- A) $3,2 \cdot 10^{-23}$ B) $3,2 \cdot 10^{-25}$ C) 0 D) $6,4 \cdot 10^{-23}$

Berilgan:

$$v = 1200 \text{ m/s}$$

$$\alpha = 60^\circ$$

$$N_A = 6 \cdot 10^{23} \text{ mol}^{-1}$$

$$I = ?$$

Yechilishi: jism impulsining o'zgarishi kuch impulsiga teng.

$$I = \Delta p = 2m_0 v \cos \alpha = 2 \frac{\mu}{N_A} v \cos \alpha$$

Bu yerda $\mu = 32 \cdot 10^{-3} \text{ kg/mol}$ kislorodning molyar massasi.

$$I = 2 \frac{32 \cdot 10^{-3}}{6 \cdot 10^{23}} 1200 \cdot \frac{1}{2} = 6,4 \cdot 10^{-23} \text{ N} \cdot \text{s}$$

Javob: D) $6,4 \cdot 10^{-23}$.

30.6. Azot molekulasining idish devoriga 60° burchak ostida mutlaq elastik urilishi natijasida impulsning o'zgarishi $1,4 \cdot 10^{-23} \text{ kg} \cdot \text{m/s}$ ga teng bo'ldi. Azot molekulasi tezligini toping (m/s). $N_A = 6 \cdot 10^{23} \text{ mol}^{-1}$.

A) 300

B) 600

C) 1000

D) 1200

Berilgan:

$$\Delta p = 1,4 \cdot 10^{-23} \text{ kg} \cdot \frac{\text{m}}{\text{s}}$$

$$\alpha = 60^\circ$$

$$N_A = 6 \cdot 10^{23} \text{ mol}^{-1}$$

$$v = ?$$

Yechilishi: Jism impulsining o'zgarishi

$$\Delta p = 2m_0 v \cos \alpha = 2 \frac{\mu}{N_A} v \cos \alpha$$

ga teng.

Bu yerda $\mu = 28 \cdot 10^{-3} \text{ kg/mol}$ azotning molyar massasi.

$$v = \frac{\Delta p \cdot N_A}{2 \cdot \mu \cdot \cos \alpha} = \frac{1,4 \cdot 10^{-23} \cdot 6 \cdot 10^{23}}{2 \cdot 28 \cdot 10^{-3} \cdot \frac{1}{2}} = 300 \text{ m/s}.$$

Javob: A) 300.

30.7. Molekular-kinetik nazariyaning asosiy tenglamasini toping.

A) $p = \frac{2}{3} n \bar{E}$

B) $pV = \text{const}$

C) $pV = \frac{m}{M} RT$

D) $\frac{V}{T} = \text{const}$

Molekular-kinetik nazariyaning asosiy tenglamasini

$$p = \frac{1}{3} \cdot m_0 \cdot n \cdot \overline{v_{kv}^2}$$

Bu yerda $m_0 \cdot \overline{v_{kv}^2} = 2 \cdot \bar{E}$ ekanligini hisobga olsak, quyidagi qiymatga ega bo'lamiz:

$$p = \frac{2}{3} \cdot n \cdot \bar{E}$$

Javob: A) $p = \frac{2}{3} n \bar{E}$.

30.8. Quyidagi qaysi munosabat molekular kinetik nazariyaning asosiy tenglamasi hisoblanadi:

1) $p = nkT$

2) $pV = mRT/\mu$

3) $p = (1/3)nm_0\overline{v^2}$

4) $E_k = 3kT/2$

A) 1

B) 2

C) 3

D) 4

Molekular-kinetik nazariyaning asosiy tenglamasini

$$p = \frac{1}{3} \cdot m_0 \cdot n \cdot \overline{v_{kv}^2}$$

Javob: C) 3.

30.9. Quyidagilardan gazlar molekular-kinetik nazariyasining asosiy tenglamasini ko'rsating:

- 1) $p = \frac{1}{3} n E_k$ 2) $p = \frac{3}{2} n E_k$ 3) $p = \frac{1}{3} p v$ 4) $p = \frac{1}{3} n m_0 \overline{v^2}$
 A) faqat 1 B) 1, 4 C) 2, 3 D) faqat 4

Molekular-kinetik nazariyaning asosiy tenglamasini

$$p = \frac{1}{3} m_0 \cdot n \cdot \overline{v_{kv}^2}$$

Javob: D) faqat 4.

30.10. Quyidagi formulalarning qaysilari noto'g'ri?

- 1) $p = \frac{1}{3} n m_0 \overline{v^2}$ 2) $p = \frac{m}{M} \frac{RT}{V}$ 3) $p = \frac{2}{3} n E$
 4) $p = \frac{R}{V} \nu T$ 5) $p = \frac{1}{3} \rho \overline{v^2}$ 6) $p = nkT$ 7) $p = \frac{m}{3N} n \overline{v^2}$
 A) noto'g'risi yo'q B) 3, 5, 6 C) 1, 5, 6 D) 1, 6, 7

Javob: A) noto'g'risi yo'q.

30.11. Birlik hajmdagi massani hisoblash formulasini ko'rsating:

- 1) $\rho = m/V$ 2) $\rho = n m_0$ 3) $\rho = n M / N_A$ 4) $\rho = N N_A / V$
 A) 1, 2 B) 2, 3, 4 C) 1, 2, 3 D) 1, 3

Javob: C) 1, 2, 3.

30.12. m_1 massali gazi bo'lgan V_1 hajmli idish m_2 massali gazi bo'lgan V_2 hajmli idish bilan tutashtirildi. Shu idishlar sistemasidagi gaz zichligini toping.

- A) m_1/V_1 B) m_2/V_2 C) $m_1/V_1 + m_2/V_2$ D) $(m_1 + m_2)/(V_1 + V_2)$

Idishlar tutashtirilgandan keyin umumiy massa $m = m_1 + m_2$ ga, umumiy hajm esa $V = V_1 + V_2$ ga teng bo'ladi. Aralashmaning zichligi

$$\rho = \frac{m}{V} = \frac{m_1 + m_2}{V_1 + V_2}$$

ga teng bo'ladi.

Javob: D) $(m_1 + m_2)/(V_1 + V_2)$.

30.13. Idishdagi kislorod molekularlarining konsentratsiyasi $n = 6 \cdot 10^{25} \text{ m}^{-3}$ bo'lsa, gaz zichligi qanday (kg/m^3)? $N_A = 6 \cdot 10^{23} \text{ mol}^{-1}$.

- A) 0,6 B) 1,2 C) 1,6 D) 3,2

Berilgan:

$$n = 6 \cdot 10^{25} \text{ m}^{-3}$$

$$\mu = 32 \cdot 10^{-3} \text{ kg/mol}$$

$$N_A = 6 \cdot 10^{23} \text{ mol}^{-1}$$

$$\rho = ?$$

Javob: D) 3,2.

Yechilishi: bizga ma'lumki, zichlik massaning hajmga nisbati bilan aniqlanadi.

$$\rho = \frac{m}{V} \quad m = m_0 \cdot N \quad m_0 = \frac{\mu}{N_A} \quad N = n \cdot V$$

$$\rho = \frac{\mu \cdot n}{N_A} = \frac{32 \cdot 10^{-3} \cdot 6 \cdot 10^{25}}{6 \cdot 10^{23}} = 3,2 \text{ kg/m}^3$$

30.14. Modda zichligi ρ , molekulasining massasi m_0 bo'lsa, hajm birligidagi molekulalar soni qanday?

A) $m_0 N_A / \rho$

B) ρ / m_0

C) ρm_0

D) $\rho N_A / m_0$

Berilgan:

$\rho;$

m_0

$n = ?$

Yechilishi: Birlik hajmdagi molekulalar soni

$$n = \frac{N}{V}$$

ga teng. Bu tenglamani $N = \frac{m}{m_0}$ ekanligini hisobga olib quyidagicha yozamiz:

Javob: B) ρ / m_0 .

31- §. Absolut temperatura. Molekulalarning o'rtacha kinetik energiyasi

31.1. Bir necha jism issiqlik muvozanati holatida bo'lishi uchun ularning qaysi fizik parametri bir xil bo'lishi kerak?

A) bosim

B) kinetik energiya

C) hajm

D) temperatura

Javob: D) temperatura.

31.2. Molekular fizika va termodinamikadagi SI sistemasiga kirgan asosiy birliklarni ko'rsating.

A) $^{\circ}\text{C}; \text{m}^3$

B) mol; J

C) mol; K

D) K; Pa

Javob: C) Mol; K.

31.3. Mutlaq haroratning 150 K qiymatiga Selsiy shkalasida qanday qiymat mos keladi?

A) -231°C

B) -223°C

C) 273°C

D) -123°C

Berilgan:

$T = 150 \text{ K}$

$t = ?$

Yechilishi:

$$T = t + 273, t = T - 273 \quad t = T - 273 = 150 - 273 = -123^{\circ}\text{C}$$

Javob: D) $t = -123^{\circ}\text{C}$.

31.4. Haroratning Kelvin shkalasi bo'yicha olingan 100 K qiymatiga Selsiy shkalasidagi qanday qiymat mos keladi?

A) -273°C

B) -173°C

C) 173°C

D) 273°C

Berilgan:

$T = 100 \text{ K}$

$t = ?$

Yechilishi: $T = t + 273, t = T - 273$

$$t = T - 273 = 100 - 273 = -173^{\circ}\text{C}$$

Javob: B) $t = -173^{\circ}\text{C}$.

31.5. Gazning boshlang'ich temperaturasi 500 K. U 6 % ortdi. Gazning oxirgi temperaturasi qanday (K)?

- A) 530 B) 500 C) 470 D) 560

Berilgan:

$$T_0 = 500 \text{ K}$$

$$\eta = 6 \%$$

$$t = ?$$

Yechilishi: $T = T_0(1 + \frac{\eta}{100})$

$$T = T_0(1 + \frac{\eta}{100}) = 500(1 + \frac{6}{100}) = 530 \text{ K}$$

Javob: A) $T = 530 \text{ K}$.

31.6. Temperaturaning fizik ma'nosi nima?

- A) gaz bajaradigan ishning o'lchovi
B) molekulalarning vaqt birligidagi to'qnashishlar soni o'lchovi
C) modda agregat holatining tavsifnomasi
D) molekulalar o'rtacha kinetik energiyasi o'lchovi

Javob: D) Molekulalar o'rtacha kinetik energiyasi o'lchovi.

31.7. Suv molekulasining o'rtacha kinetik energiyasi 100°C suvda kattami yoki shunday temperaturali bug'dami?

- A) bug'da katta B) ikkalasida teng
C) javob bug'ning to'yingan yoki to'yinmaganligiga bog'liq
D) suvda katta

100°C da suv parchalanadi. Shuning uchun tezlik bir xil bo'ladi.

Javob: A) ikkalasida teng.

31.8. Agar haroratlari bir xil bo'lsa, moddaning qaysi holatida molekulalar eng katta o'rtacha kinetik energiyaga ega bo'ladi?

- A) hammasida bir xil B) suyuq C) qattiq D) gaz va suyuq

$E_k = \frac{3}{2} kT$ formuladan ko'rinadiki, faqat temperaturaga bog'liq, temperaturalar teng bo'lsa, demak, hammasida bir xil.

Javob: A) hammasida bir xil.

31.9. Agar E — ideal gaz molekulalarining kinetik energiyasi, k — Bolsman doimiysi bo'lsa, $x = \frac{2E}{3k}$ formula orqali qaysi kattalik hisoblanadi?

- A) ichki energiya B) gaz bosimi
C) gazning absolut temperaturasi D) molekulalarning o'rtacha tezligi

Yechilishi: Molekulalarning o'rtacha kinetik energiyasi $E_k = \frac{3}{2} kT$, ifoda yordamida aniqlanadi. Bu yerda $\frac{2E}{3R} = T$

Javob: C) gazning absolut temperaturasi.

31.10. Ideal gazning qaysi parametri $x = \frac{P}{kT}$ ifodadan aniqlanishi mumkin, bu yerda: P — gazning bosimi, k — Bolsman doimiysi, T — absolut temperatura?

- A) hajm B) bosim
C) temperatura D) molekulalar konsentratsiyasi

$$P = nkT, \quad n = \frac{P}{kT}$$

Javob: D) molekulalar konsentratsiyasi.

31.11. Gaz molekulalarining konsentratsiyasi 2 marta kamayib, harorati 2 marta ortsa, gaz bosimi qanday o'zgaradi?

- A) o'zgarmaydi B) 2 marta ortadi
C) 2 marta kamayadi D) 4 marta ortadi

Berilgan:

$$\begin{array}{l} n_1 = 2n_2 \\ T_2 = 2T_1 \end{array}$$

$$\frac{P_2}{P_1} = ?$$

Yechilishi: $P = nkT, \quad P_1 = n_1 k T_1, \quad P_2 = n_2 k T_2$

$$\frac{P_2}{P_1} = \frac{n_2 k T_2}{n_1 k T_1}, \quad \frac{P_2}{P_1} = \frac{n_2 k T_2}{n_1 k T_1} = \frac{n_2 k \cdot 2T_1}{2n_2 k T_1} = 1, \quad P_1 = P_2$$

Javob: A) o'zgarmaydi.

31.12. Ideal gaz haroratining 2 marta ko'tarilishi hajm birligidagi molekulalar sonining 2 marta kamayishiga olib kelgan bo'lsa, uning bosimi qanday o'zgargan?

- A) 4 marta oshgan B) 2 marta kamaygan
C) 2 marta oshgan D) o'zgarmagan

Berilgan:

$$\begin{array}{l} n_1 = 2n_2 \\ T_2 = 2T_1 \end{array}$$

$$\frac{P_2}{P_1} = ?$$

Yechilishi: $P_1 = n_1 k T_1, \quad P_2 = n_2 k T_2, \quad \frac{P_2}{P_1} = \frac{n_2 k T_2}{n_1 k T_1},$

$$\frac{P_2}{P_1} = \frac{n_2 k T_2}{n_1 k T_1} = \frac{n_2 k \cdot 2T_1}{2n_2 k T_1} = 1 \quad P_1 = P_2$$

Javob: D) o'zgarmagan.

31.13. Ideal gaz absolut temperaturasi 3 marta ko'tarilishi bosimning 1,5 marta ortishiga olib kelgan bo'lsa, hajm birligidagi molekulalar soni qanday o'zgaragan?

- A) 2 marta kamaygan
C) 1,5 marta kamaygan

- B) 2 marta oshgan
D) o'zgarmagan

Berilgan:

$$P_2 = 1,5 P_1$$

$$T_2 = 3 T_1$$

$$\frac{n_2}{n_1} = ?$$

Yechilishi: $n_1 = \frac{P_1}{kT_1}, n_2 = \frac{P_2}{kT_2}, \frac{n_2}{n_1} = \frac{P_2 k T_1}{P_1 k T_2}$

$$\frac{n_2}{n_1} = \frac{P_2 k T_1}{P_1 k T_2} = \frac{1,5 P_1 k T_1}{P_1 k 3 T_1} = 0,5, n_1 = 2 n_2$$

Javob: A) 2 marta kamaygan.

31.14. Agar ochiq idishdagi ideal gazning absolut temperaturasi 30% orttirilsa, gaz molekularining konsentratsiyasi qanday o'zgaradi?

- A) 30% ortadi

- B) 23 % kamayadi

- C) 60 % kamayadi

- D) o'zgarmaydi

Berilgan:

$$P_2 = P_1$$

$$T_2 = 1,3 T_1$$

$$\frac{n_2}{n_1} = ?$$

Yechilishi: $n_1 = \frac{P_1}{kT_1}, n_2 = \frac{P_2}{kT_2}, \frac{n_2}{n_1} = \frac{P_2 k T_1}{P_1 k T_2}$

$$\frac{n_2}{n_1} = \frac{P_2 k T_1}{P_1 k T_2} = \frac{P_1 k T_1}{P_1 k 1,3 T_1} = 0,77, n_1 = 0,77 n_2$$

Javob: B) 23 % kamayadi.

31.15. Izotermik jarayonda gaz bosimi 3 marta kamaydi. Bunda gaz molekulari konsentratsiyasi qanday o'zgaradi?

- A) 3 marta ortadi

- B) 3 marta kamayadi

- C) o'zgarmaydi

- D) 9 marta ortadi

Berilgan:

$$P_1 = 3 P_2$$

$$T = \text{const}$$

$$T_2 = T_1$$

$$\frac{n_2}{n_1} = ?$$

Yechilishi: $n_1 = \frac{P_1}{kT_1}, n_2 = \frac{P_2}{kT_2}, \frac{n_2}{n_1} = \frac{P_2 k T_1}{P_1 k T_2}$

$$\frac{n_2}{n_1} = \frac{P_2 k T_1}{P_1 k T_2} = \frac{P_1 k T_1}{3 P_2 k T_1} = \frac{1}{3}, n_1 = 3 n_2$$

Javob: B) 3 marta kamayadi.

31.16. Izobarik jarayonda ideal gazning absolut temperaturasi 2 marta oshsa, hajm birligidagi molekular soni qanday o'zgaradi?

- A) o'zgarmaydi

- B) 2 marta kamayadi

- C) 2 marta oshadi

- D) 4 marta kamayadi

Berilgan:

$$P = \text{const}$$

$$P_1 = P_2$$

$$T_2 = 2T_1$$

$$\frac{n_2}{n_1} = ?$$

Yechilishi:

$$n_1 = \frac{P_1}{kT_1}, \quad n_2 = \frac{P_2}{kT_2}, \quad \frac{n_2}{n_1} = \frac{P_2 k T_1}{P_1 k T_2},$$

$$\frac{n_2}{n_1} = \frac{P_2 k T_1}{P_1 k T_2} = \frac{P_2 k T_1}{P_2 k 2T_1} = \frac{1}{2},$$

$$n_1 = 2n_2$$

Javob: B) 2 marta kamayadi.

31.17. Izobarik jarayonda ideal gaz molekularining o'rtacha kinetik energiyasi 2 marta oshsa, hajm birligidagi molekular soni qanday o'zgaradi?

A) o'zgarmaydi

B) 2 marta oshadi

C) 2 marta kamayadi

D) 2 marta kamayadi

Berilgan:

$$P = \text{const}$$

$$P_1 = P_2$$

$$E_{k2} = 2 E_{k1}$$

$$\frac{n_2}{n_1} = ?$$

Yechilishi:

$$P = \frac{2}{3} n E_k, \quad n_1 = \frac{3P_1}{2E_{k1}}, \quad n_2 = \frac{3P_2}{2E_{k2}}$$

$$\frac{n_2}{n_1} = \frac{3P_2 2E_{k1}}{3P_1 2E_{k2}} = \frac{P_2 E_{k1}}{P_1 E_{k2}}, \quad \frac{n_2}{n_1} = \frac{P_2 E_{k1}}{P_1 E_{k2}} = \frac{P_1 E_{k1}}{P_1 2E_{k2}} = \frac{1}{2}$$

$$n_1 = 2n_2$$

Javob: D) 2 marta kamayadi.

31.18. Normal sharoitdagi hajmi 1 l bo'lgan havo molekularining sonini aniqlang. $N_A = 6 \cdot 10^{23} \text{ mol}^{-1}$

A) $2,7 \cdot 10^{22}$ B) $6 \cdot 10^{23}$ C) $2 \cdot 10^{20}$ D) $2,7 \cdot 10^{15}$ **Berilgan:**

$$P = 10^5 \text{ Pa}$$

$$T = 273 \text{ K}$$

$$V = 1 \text{ l} = 10^{-3} \text{ m}^3$$

$$k = 1,38 \cdot 10^{-23} \text{ J/K}$$

$$N = ?$$

Yechilishi:

$$P = nkT, \quad n = \frac{N}{V}, \quad N = \frac{PV}{kT}$$

$$N = \frac{PV}{kT} = \frac{10^5 \cdot 10^{-3}}{1,38 \cdot 10^{-23} \cdot 273} = 2,7 \cdot 10^{22} \text{ ta}$$

Javob: A) $2,7 \cdot 10^{22}$.

31.19. 400 K temperatura va 138 kPa bosimda gaz molekularining konsentratsiyasi qanday bo'ladi? (m^{-3}) $k = 1,38 \cdot 10^{-23} \text{ J/K}$

A) $5 \cdot 10^{25}$ B) $2,76 \cdot 10^6$

C) 345

D) $2,5 \cdot 10^{25}$

Berilgan:

$$P = 138 \text{ kPa} = 1,38 \cdot 10^5 \text{ Pa}$$

$$T = 400 \text{ K}$$

$$k = 1,38 \cdot 10^{-23} \text{ J/K}$$

$$n = ?$$

Yechilishi:

$$P = nkT, \quad n = \frac{P}{kT}$$

$$n = \frac{P}{kT} = \frac{1,38 \cdot 10^5}{1,38 \cdot 10^{-23} \cdot 400} = 2,5 \cdot 10^{25} \text{ m}^{-3}$$

Javob: D) $2,5 \cdot 10^{25}$.

31.20. Temperaturasi 127°C va bosimi $1,38 \text{ MPa}$ bo'lgan gaz molekularining konsentratsiyasini hisoblang (m^{-3}). Bolsman doimiysi $k = 1,38 \cdot 10^{-23} \text{ J/K}$.

A) 10^{25}

B) $2 \cdot 10^{25}$

C) $2,5 \cdot 10^{26}$

D) 10^{26}

Berilgan:

$$P = 1,38 \text{ MPa} =$$

$$= 1,38 \cdot 10^6 \text{ Pa}$$

$$T = 400 \text{ K}$$

$$k = 1,38 \cdot 10^{-23} \text{ J/K}$$

$$N = ?$$

Yechilishi:

$$n = \frac{P}{kT}$$

$$n = \frac{P}{kT} = \frac{1,38 \cdot 10^6}{1,38 \cdot 10^{-23} \cdot 400} = 2,5 \cdot 10^{26} \text{ m}^{-3}$$

Javob: C) $2,5 \cdot 10^{26}$.

31.21. 27°C haroratda simob bug'larining bosimi $0,75 \text{ Pa}$ ga teng bo'lsa, 1 sm^3 hajmdagi simob atomlarining soni qanday? $N = 6 \cdot 10^{23} \text{ mol}^{-1}$.

A) $1,38 \cdot 10^{23}$

B) $3 \cdot 10^{27}$

C) $6,023 \cdot 10^{23}$

D) $1,8 \cdot 10^{14}$

Berilgan:

$$P = 0,75 \text{ Pa}$$

$$T = 300 \text{ K}$$

$$V = 1 \text{ sm}^3 = 10^{-6} \text{ m}^3$$

$$k = 1,38 \cdot 10^{-23} \text{ J/K}$$

$$N = ?$$

Yechilishi:

$$P = nkT, \quad n = \frac{N}{V}$$

$$n = \frac{PV}{kT}$$

$$n = \frac{P}{kT} = \frac{0,75 \cdot 10^{-6}}{1,38 \cdot 10^{-23} \cdot 300} = 1,8 \cdot 10^{14} \text{ ta}$$

Javob: D) $N = 1,8 \cdot 10^{14} \text{ ta}$

31.22. Harorati 300 K bo'lgan gaz molekularining ilgarilanma harakat kinetik energiyasi necha joul bo'ladi? Bolsman doimiysi $k = 1,38 \cdot 10^{-23} \text{ J/K}$.

A) 10^{-21} ;

B) $0,621 \cdot 10^{-21}$;

C) $6,21 \cdot 10^{-21}$;

D) $62,1 \cdot 10^{-21}$.

Berilgan:

$$T = 300 \text{ K}$$

$$k = 1,38 \cdot 10^{-23} \text{ J/K}$$

$$E_k = ?$$

$$\text{Yechilishi: } E_k = \frac{3}{2} kT$$

$$E_k = \frac{3}{2} kT = \frac{3}{2} 1,38 \cdot 10^{-23} \cdot 300 = 6,21 \cdot 10^{-21} \text{ J}$$

Javob: C) $E_k = 6,21 \cdot 10^{-21} \text{ J}$.

31.23. Molekulalari ilgarilanma harakatining o'rtacha kinetik energiyasi $8,28 \cdot 10^{-21}$ J bo'lgan gazning temperaturasi qanday ($^{\circ}\text{C}$). $k = 1,38 \cdot 10^{-23}$ J/K.

- A) 127 B) 137 C) 117 D) 130

Berilgan:

$$E_k = 8,28 \cdot 10^{-21} \text{ J}$$

$$k = 1,38 \cdot 10^{-23} \text{ J/K}$$

Yechilishi:

$$E_k = \frac{3}{2} kT, \quad T = \frac{2E_k}{3k}, \quad t = T - 273$$

$$T = \frac{2E_k}{3k} = \frac{2 \cdot 8,28 \cdot 10^{-21}}{3 \cdot 1,38 \cdot 10^{-23}} = 400 \text{ K}$$

$$t = T - 273 = 400 - 273 = 127^{\circ}\text{C}$$

Javob: A) 127.

31.24. Hajm birligidagi molekulalar soni $3 \cdot 10^{27} \text{ m}^{-3}$ va bosimi $8 \cdot 10^5$ Pa bo'lgan bir atomli gaz molekulalarining o'rtacha kinetik energiyasini toping (J).

- A) $4 \cdot 10^{-27}$ B) $4 \cdot 10^{-22}$ C) $2,66 \cdot 10^{-22}$ D) $8 \cdot 10^{-27}$

Berilgan:

$$n = 3 \cdot 10^{27} \text{ m}^{-3}$$

$$P = 8 \cdot 10^5 \text{ Pa}$$

$$E_k = ?$$

Yechilishi: $P = \frac{2}{3} nE_k, \quad E_k = \frac{3P}{2n}$

$$E_k = \frac{3P}{2n} = \frac{3 \cdot 8 \cdot 10^5}{2 \cdot 3 \cdot 10^{27}} = 4 \cdot 10^{-22} \text{ J}$$

Javob: B) $E_k = 4 \cdot 10^{-22} \text{ J}$.

31.25. Bir atomli gaz molekulalarining ilgarilanma harakat o'rtacha kinetik energiyasi $1 \cdot 10^{-12}$ J va bosimi 2 MPa bo'lsa, shu gaz molekulalarining konsentratsiyasi qanday bo'ladi (m^{-3})?

- A) 10^{18} B) $3 \cdot 10^{18}$ C) $6 \cdot 10^{18}$ D) $3 \cdot 10^{19}$

Berilgan:

$$E_k = 1 \cdot 10^{-12} \text{ J}$$

$$P = 2 \text{ MPa} = 2 \cdot 10^6 \text{ Pa}$$

$$n = ?$$

Yechilishi: $P = \frac{2}{3} nE_k, \quad n = \frac{3P}{2E_k}$

$$n = \frac{3P}{2E_k} = \frac{3 \cdot 2 \cdot 10^6}{2 \cdot 10^{-12}} = 3 \cdot 10^{18} \text{ m}^{-3}$$

Javob: B) $n = 3 \cdot 10^{18} \text{ m}^{-3}$.

31.26. Bosimi $4 \cdot 10^5$ Pa bo'lgan 1 m^3 bir atomli ideal gaz molekulalarining kinetik energiyasini toping (J).

- A) $24 \cdot 10^5$ B) $4 \cdot 10^5$ C) $8 \cdot 10^5$ D) $12 \cdot 10^5$

Berilgan:

$$V = 1 \text{ m}^3$$

$$P = 4 \cdot 10^5 \text{ Pa}$$

$$E_k = ?$$

Yechilishi: $P = \frac{2}{3} nE_k, \quad n = \frac{N}{V}, \quad NE_k = \frac{3P}{2V}$

$$NE_k = \frac{3P}{2V} = \frac{3 \cdot 4 \cdot 10^5}{2 \cdot 1} = 6 \cdot 10^5 \text{ J}$$

Javob: D) $E_k = 6 \cdot 10^5 \text{ J}$.

31.27. O'lchami $2,5 \cdot 4 \cdot 3 \text{ m}^3$ bo'lgan idishdagi gazning bosimi 831 mm Hg, temperaturasi 27°C bo'lsa, undagi molekular soni nechta? $N_A = 6 \cdot 10^{23} \frac{1}{\text{mol}}$

- A) $1,8^{-1}$ B) $6 \cdot 10^{26}$ C) $2,5 \cdot 10^{27}$ D) $8 \cdot 10^{26}$

Berilgan:

$$P = 831 \text{ mm.sim.ust} = 1,1 \cdot 10^5 \text{ Pa}$$

$$T = 300 \text{ K}$$

$$V = 2,5 \cdot 4 \cdot 3 \text{ m}^3 = 30 \text{ m}^3$$

$$k = 1,38 \cdot 10^{-23} \text{ J/K}$$

$$N = ?$$

Yechilishi: $P = nkT, \quad n = \frac{N}{V}$

$$N = \frac{PV}{kT}$$

$$N = \frac{PV}{kT} = \frac{1,1 \cdot 10^5 \cdot 30}{1,38 \cdot 10^{-23} \cdot 300} = 8 \cdot 10^{26} \text{ ta}$$

Javob: D) $N = 8 \cdot 10^{26} \text{ ta}$.

32-§. Gaz molekularining o'rtacha tezligi

32.1. Ideal gazning mutlaq harorati 4 marta ortganida molekularning o'rtacha kvadratik tezligi necha marta ortadi?

- A) o'zgarmaydi B) 2 C) 4 D) 8

Berilgan:

$$T_2 = 4T_1$$

$$\frac{v_2}{v_1} = ?$$

Yechilishi: $v = \sqrt{\frac{3RT}{M}}$

$$\frac{v_2}{v_1} = \sqrt{\frac{T_2}{T_1}} = 2$$

Javob: B) 2 marta ortadi.

32.2. Ideal gazning mutlaq temperaturasi 3 marta ortganida, molekularining o'rtacha kvadratik tezligi necha marta ortadi?

- A) 9 B) 3 C) 27 D) $\sqrt{3}$

Berilgan:

$$T_2 = 3T_1$$

$$\frac{v_2}{v_1} = ?$$

Yechilishi: $v = \sqrt{\frac{3RT}{M}}$

$$\frac{v_2}{v_1} = \sqrt{\frac{T_2}{T_1}} = \sqrt{3}$$

Javob: D) $\sqrt{3}$.

32.3. Atmosferadagi qaysi gaz molekulari tezroq harakat qiladi?

- A) N_2 B) O_2 C) H_2 D) CO_2

Yechilishi: $\sqrt{\frac{3RT}{M}}$ formulada qaysi gazning molyar massa kichik bo'lsa, shu gaz molekulasi tezligi katta bo'ladi.

Javob: C) H_2 .

32.4. Atmosfera havosidagi qaysi gazning molekulari eng tez harakatlanadi: kislorodniki, vodorodniki, karbonat angidridniki?

- A) kislorodniki B) karbonat angidridniki C) vodorodniki
D) molekular o'rtacha tezligi uchchala gazda bir xil.

Yechilishi: $\sqrt{\frac{3RT}{M}}$ formulaga muvofiq qaysi gazning molyar massasi kichik bo'lsa, shu gazning tezligi katta bo'ladi. Demak, vodorod.

Javob: C) Vodorodniki.

32.5. Bir xil sharoitda vodorod molekulasi o'rtacha kvadratik tezligi kattami yoki kislorodniki? Necha marta katta?

- A) kislorodniki, 2 marta B) kislorodniki, 4 marta
C) vodorodniki, 2 marta D) vodorodniki, 4 marta

Berilgan:

$$T = \text{const}$$

$$M_v = 2 \text{ g/mol}$$

$$M_k = 32 \text{ g/mol}$$

$$\frac{v_v}{v_k} = ?$$

$$v_k$$

Yechilishi: $v = \sqrt{\frac{3RT}{M}}$

$$\frac{v_v}{v_k} = \sqrt{\frac{M_k}{M_v}} = 4$$

Javob: D) vodorodniki, 4 marta.

32.6. Havoda muallaq bo'lgan chang zarrachasi o'rtacha kvadratik tezligi havo molekulalarining o'rtacha kvadratik tezligidan necha marta kichik. Chang zarrasining massasi $4,8 \cdot 10^{-10} \text{ kg}$, havoning molyar massasi 29 g/mol , $N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$.

A) 10^5

B) 10^8

C) $3 \cdot 10^6$

D) $3 \cdot 10^{10}$

Berilgan:

$$T = \text{const}$$

$$M_h = 29 \text{ g/mol} =$$

$$= 29 \cdot 10^{-3} \text{ kg/mol}$$

$$m_0 = 4,8 \cdot 10^{-10} \text{ kg}$$

$$N_A = 6,02 \cdot 10^{23} \text{ mol}^{-1}$$

$$\frac{v_v}{v_k} = ?$$

$$v_k$$

Yechilishi:

$$v_h = \sqrt{\frac{3RT}{M}}, \quad v_{ch} = \sqrt{\frac{3kT}{m_0}}$$

$$\frac{v_h}{v_{ch}} = \sqrt{\frac{m_0 R}{M_h k}} = \sqrt{\frac{m_0 N_A}{M_h}} = \sqrt{\frac{4,8 \cdot 10^{-10} \cdot 6,02 \cdot 10^{23}}{29 \cdot 10^{-3}}} = 10^8$$

Javob: B) 10^8 .

32.7. Vodorod gazi molekulasi -193°C dagi o'rtacha kvadratik tezligi qanday (m/s)?

- A) 500 B) 800 C) 1600 D) 1000

Berilgan:

$$T = 80 \text{ K}$$

$$M_v = 2 \text{ g/mol} =$$

$$= 2 \cdot 10^{-3} \text{ kg/mol}$$

$$R = 8,31 \text{ J/(mol} \cdot \text{K)}$$

Yechilishi:

$$v = \sqrt{\frac{3RT}{M}}$$

$$v = \sqrt{\frac{3 \cdot 8,31 \cdot 80}{2 \cdot 10^{-2}}} = 1000 \frac{\text{m}}{\text{s}}$$

Javob: D) $1000 \frac{\text{m}}{\text{s}}$.

32.8. Havo molekulasi 27°C dagi o'rtacha kvadratik tezligini aniqlang (m/s). Havoning molyar massasi $29 \cdot 10^{-3} \text{ kg/mol}$.

- A) 100 B) 500 C) 800 D) 1000

Berilgan:

$$T = 300 \text{ K}$$

$$M_h = 29 \text{ g/mol}$$

$$R = 8,31 \text{ J/(mol} \cdot \text{K)}$$

Yechilishi:

$$v = \sqrt{\frac{3RT}{M}}$$

$$v = \sqrt{\frac{3 \cdot 8,31 \cdot 300}{29 \cdot 10^{-3}}} = 500 \frac{\text{m}}{\text{s}}$$

Javob: B) $500 \frac{\text{m}}{\text{s}}$.

32.9. Gaz molekulalarining o'rtacha kvadratik tezligi 4 marta ortishi uchun gazning absolut temperaturasi qanday o'zgartirish kerak?

- A) 16 marta orttirish B) 4 marta kamaytirish
C) 4 marta orttirish D) 2 marta kamaytirish

Berilgan:

$$v_2 = 4v_1$$

$$\frac{T_2}{T_1} = ?$$

Yechilishi:

$$v = \sqrt{\frac{3RT}{M}}$$

$$\frac{T_2}{T_1} = \frac{v_2^2}{v_1^2} = 16, \quad T_2 = 16T_1$$

Javob: A) 16 marta orttirish kerak.

32.10. Qanday temperaturadagi geliy molekulalarining o'rtacha kvadratik tezligi 200 K temperaturadagi vodorod molekulalarining o'rtacha kvadratik tezligiga teng bo'ladi (K)?

- A) 800 B) 600 C) 50 D) 400

Berilgan:

$$\begin{aligned}v_g &= v_v \\M_g &= 4 \text{ g/mol} \\M_v &= 2 \text{ g/mol} \\T_v &= 200 \text{ K} \\T_g &= ?\end{aligned}$$

Yechilishi:

$$v = \sqrt{\frac{3RT}{M}}, \quad v_g = v_v, \quad \sqrt{\frac{3RT_g}{M_g}} = \sqrt{\frac{3RT_v}{M_v}}$$
$$T_g = \frac{M_g}{M_v} T_v = \frac{4}{2} \cdot 200 = 400 \text{ K}$$

Javob: D) 400 K.

32.11. Qanday temperaturadagi kislorod molekularining o'rtacha kvadratik tezligi 100 K temperaturadagi vodorod molekularining o'rtacha kvadratik tezligiga teng bo'ladi (K)?

A) 160

B) 320

C) 800

D) 3200

Berilgan:

$$\begin{aligned}v_k &= v_v \\M_k &= 32 \text{ g/mol} \\M_v &= 2 \text{ g/mol} \\T_v &= 100 \text{ K} \\T_k &= ?\end{aligned}$$

Yechilishi:

$$v = \sqrt{\frac{3RT}{M}}, \quad v_g = v_v, \quad \sqrt{\frac{3RT_k}{M_k}} = \sqrt{\frac{3RT_v}{M_v}}$$
$$T_k = \frac{M_k}{M_v} T_v = \frac{32}{2} \cdot 100 = 3200 \text{ K}$$

Javob: D) 3200 K.

32.12. Qanday temperaturadagi (K) vodorod gazi molekularining o'rtacha kvadratik tezligi 580 K temperaturadagi geliy gazi molekularining o'rtacha kvadratik tezligiga teng bo'ladi?

A) 580

B) 290

C) 273

D) 200

Berilgan:

$$\begin{aligned}v_k &= v_v \\M_g &= 4 \text{ g/mol} \\M_v &= 2 \text{ g/mol} \\T_g &= 580 \text{ K} \\T_v &= ?\end{aligned}$$

Yechilishi:

$$v = \sqrt{\frac{3RT}{M}}, \quad v_g = v_v, \quad \sqrt{\frac{3RT_g}{M_g}} = \sqrt{\frac{3RT_v}{M_v}}$$
$$T_v = \frac{M_v}{M_g} T_g = \frac{2}{4} \cdot 580 = 290 \text{ K}$$

Javob: B) 290 K.

32.13. Necha kelvin temperaturada kislorod molekularining o'rtacha kvadratik tezligi 600 m/s bo'ladi?

A) 220

B) 275

C) 462

D) 530

Berilgan:

$$v = 600 \text{ m/s}$$

$$M = 32 \text{ g/mol} =$$

$$= 32 \cdot 10^{-3} \text{ kg/mol}$$

$$R = 8,31 \text{ J/(mol} \cdot \text{K)}$$

$$T = ?$$

Yechilishi: $v = \sqrt{\frac{3RT}{M}}, \quad T = \frac{Mv^2}{3R}$

$$T = \frac{32 \cdot 10^{-3} \cdot 360000}{3 \cdot 8,31} = 462 \text{ K}$$

Javob: C) 462 K.

32.14. Ideal gazning bosimi 2 marta ortsa, molekularining konsentratsiyasi esa 2 marta kamaysa, gaz molekularining o'rtacha kvadratik tezligi qanday o'zgaradi?

A) o'zgarmaydi

B) 4 marta ortadi

C) 4 marta kamayadi

D) 2 marta ortadi

Berilgan:

$$P_2 = 2P_1$$

$$n_1 = 2n_2$$

$$\frac{v_2}{v_1} = ?$$

Yechilishi: $P = \frac{1}{3} nm_0 v^2, \quad v = \sqrt{\frac{3P}{nm_0}}$

$$\frac{v_2}{v_1} = \sqrt{\frac{P_2 n_1}{P_1 n_2}} = 2$$

Javob: D) 2 marta ortadi.

32.15. Agar ideal gazning zichligi 9 marta ortsa, bosimi esa 9 marta kamaysa, gaz molekularining o'rtacha kvadratik tezligi qanday o'zgaradi?

A) 9 marta kamayadi

B) 9 marta ortadi

C) 81 marta kamayadi

D) 3 marta ortadi

Berilgan:

$$P_2 = \frac{P_1}{9}$$

$$\rho_2 = 9\rho_1$$

$$\frac{v_2}{v_1} = ?$$

Yechilishi:

$$P = \frac{1}{3} \rho v^2, \quad v = \sqrt{\frac{3P}{\rho}}$$

$$\frac{v_2}{v_1} = \sqrt{\frac{P_2 \rho_1}{P_1 \rho_2}} = \frac{1}{9}$$

Javob: A) 9 marta kamayadi.

32.16. Idishdagi gaz molekularining konsentratsiyasi 2 marta kamaysa va o'rtacha kvadratik tezligi 4 marta oshsa, gaz bosimi qanday o'zgaradi?

A) 2 marta kamayadi

B) 2 marta oshadi

C) 8 marta kamayadi

D) 8 marta oshadi

Berilgan:

$$v_2 = 4v_1$$

$$n_2 = \frac{n_1}{2}$$

$$\frac{P_2}{P_1} = ?$$

Yechilishi: $P = \frac{1}{3} nm_0 v^2$,

$$\frac{P_2}{P_1} = \frac{n_2 v_2^2}{n_1 v_1^2} = 8$$

Javob: D) 8 marta ortadi.

32.17. Agar gaz molekularining konsentratsiyasi 4 marta ortib, o'rtacha kvadratik tezligi 4 marta kamaysa, gaz bosimi qanday o'zgaradi?

A) 4 marta kamayadi

B) 4 marta ortadi

C) o'zgarmaydi

D) 2 marta ortadi

Berilgan:

$$v_2 = \frac{v_1}{4}$$

$$n_2 = 4n_1$$

$$\frac{P_2}{P_1} = ?$$

Yechilishi: $P = \frac{1}{3} nm_0 v^2$

$$\frac{P_2}{P_1} = \frac{n_2 v_2^2}{n_1 v_1^2} = \frac{1}{4}$$

Javob: A) 4 marta kamayadi.

32.18. Molekulalari bir xil konsentratsiyada va bir xil o'rtacha kvadratik tezlikda bo'lgan kislorod va vodorod gazlarining bosimlarini solishtiring?

A) 1:1

B) 2:3

C) 16:1

D) 8:3

Berilgan:

$$v_2 = v_1$$

$$n_1 = n_1$$

$$M_1 = 32 \text{ g/mol}$$

$$M_2 = 2 \text{ g/mol}$$

$$\frac{P_2}{P_1} = ?$$

Yechilishi:

$$P = \frac{1}{3} nm_0 v^2, \quad M = m_0 \cdot N_A, \quad m_0 = \frac{M}{N_A}, \quad P = \frac{1}{3} \frac{nMv^2}{N_A}$$

$$\frac{P_1}{P_2} = \frac{M_1 n_1 v_1^2}{M_2 n_2 v_2^2} = 16$$

Javob: C) 16:1.

32.19. Ideal gaz molekularining o'rtacha kvadratik tezligi 10^3 m/s , zichligi $0,9 \text{ kg/m}^3$ bo'lsa, gaz bosimi qanday (kPa)?

A) 9

B) 30

C) 90

D) 300

Berilgan:

$$v = 10^3 \text{ m/s}$$

$$\rho = 0,9 \frac{\text{kg}}{\text{m}^3}$$

$$P = ?$$

Yechilishi: $P = \frac{1}{3} \rho v^2,$

$$P = \frac{1}{3} \cdot 0,9 \cdot 10^6 = 30000 \text{ Pa} = 300 \text{ kPa}$$

Javob: D) 300 kPa.

32.20. Ideal gazning zichligi 3 kg/m^3 va bosimi 10 kPa bo'lsa, gaz molekulalarining o'rtacha kvadratik tezligi qanday (m/s)?

A) 30

B) 100

C) 300

D) 500

Berilgan:

$$P = 10 \text{ kPa} = 10^4 \text{ Pa}$$

$$\rho = 0,9 \frac{\text{kg}}{\text{m}^3}$$

$$v = ?$$

Yechilishi: $P = \frac{1}{3} \rho v^2$

$$v = \sqrt{\frac{3P}{\rho}} = \sqrt{\frac{3 \cdot 10^4}{0,9}} = 100 \text{ m/s}$$

Javob: B) 100 m/s.

32.21. Zichligi $\rho = 0,09 \text{ kg/m}^3$ bo'lgan gaz bosimi $0,3 \cdot 10^5 \text{ Pa}$ bo'lsa, gaz molekulalarining o'rtacha kvadratik tezligi qanday (m/s) bo'ladi?

A) 200

B) $3 \cdot 10^3$

C) 1000

D) 171

Berilgan:

$$P = 0,3 \cdot 10^5 \text{ Pa}$$

$$\rho = 0,09 \frac{\text{kg}}{\text{m}^3}$$

$$v = ?$$

Yechilishi: $P = \frac{1}{3} \rho v^2$

$$v = \sqrt{\frac{3P}{\rho}} = \sqrt{\frac{3 \cdot 0,3 \cdot 10^5}{0,09}} = 1000 \text{ m/s}$$

Javob: C) 1000 m/s.

32.22. Zichligi $1,17 \text{ kg/m}^3$, bosimi esa $31,59 \text{ MPa}$ bo'lgan gaz molekulalarining o'rtacha kvadratik tezligini toping.

A) 450 m/s

B) 900 m/s

C) 4,5 km/s

D) 9 km/s

Berilgan:

$$P = 31,59 \text{ MPa} = 3,159 \cdot 10^7 \text{ Pa}$$

$$\rho = 1,17 \frac{\text{kg}}{\text{m}^3}$$

$$v = ?$$

Yechilishi: $P = \frac{1}{3} \rho v^2$

$$v = \sqrt{\frac{3P}{\rho}} = \sqrt{\frac{3 \cdot 3,159 \cdot 10^7}{1,17}} = 9000 \frac{\text{m}}{\text{s}} = 9 \text{ km/s}$$

Javob: D) 9 km/s.

33- §. Ideal gaz holatining tenglamasi

33.1. Quyidagi formulalarning qaysi biri Klapayron tenglamasi deyiladi:

- 1) $PV = \text{const}$ 2) $PV^\gamma = \text{const}$ 3) $V/T = \text{const}$
 4) $PV/T = \text{const}$ 5) $P/V = \text{const}$
 A) 1 B) 2 C) 3 D) 4

$$PV/T = \text{const}$$

Javob: D) 4.

33.2. Berilgan tenglamalar ichidan Mendeleyev- Klapayron tenglamasini toping.

- A) $PV = \text{const}$ B) $\frac{PV}{T} = \frac{m}{M} R$ C) $PV/T = \text{const}$ D) $V/T = \text{const}$

$$\frac{PV}{T} = \frac{m}{M} R$$

Javob: B) $\frac{PV}{T} = \frac{m}{M} R$.

33.3. Universal gaz doimiysining birligini ko'rsating.

- A) $\frac{J}{\text{kg} \cdot K}$ B) $\frac{J \cdot \text{mol}}{K}$ C) $\frac{J}{K}$ D) $\frac{J}{\text{mol} \cdot K}$

$$\frac{J}{\text{mol} \cdot K}$$

Javob: D) $\frac{J}{\text{mol} \cdot K}$.

33.4. Hajmi va absolut harorati 2 martadan oshirilsa, ideal gazning bosimi qanday o'zgaradi?

- A) 2 marta kamayadi B) 2 marta ortadi
 C) 4 marta kamayadi D) o'zgarmaydi

Berilgan:

$$\begin{aligned} V_2 &= 2V_1 \\ T_2 &= 2T_1 \end{aligned}$$

$$\frac{P_2}{P_1} = ?$$

Yechilishi: $\frac{PV}{T} = \text{const}$, $\frac{P_1 V_1}{T_1} = \text{const}$, $\frac{P_2 V_2}{T_2} = \text{const}$

ikkinchi tenglikni birinchi tenglikka bo'lib yuboramiz: $\frac{P_2}{P_1} = \frac{T_2 V_1}{T_1 V_2}$

$$\frac{P_2}{P_1} = \frac{T_2 V_1}{T_1 V_2} = \frac{2T_1 V_1}{T_1 2V_1} = 1; \quad P_2 = P_1$$

Javob: D) o'zgarmaydi.

33.5. Agar ideal gazning hajmi va harorati 4 marta oshirilsa, uning bosimi qanday o'zgaradi?

- A) o'zgarmaydi B) 4 marta ortadi
 C) 4 marta kamayadi D) 16 marta ortadi

Berilgan: $V_2 = 4V_1$ $T_2 = 4T_1$ $\frac{P_2}{P_1} = ?$	Yechilishi: $\frac{PV}{T} = \text{const}$, $\frac{P_1V_1}{T_1} = \text{const}$, $\frac{P_2V_2}{T_2} = \text{const}$ ikkinchi tenglikni birinchi tenglikka bo'lib yuboramiz: $\frac{P_2}{P_1} = \frac{T_2V_1}{T_1V_2}$ $\frac{P_2}{P_1} = \frac{T_2V_1}{T_1V_2} = \frac{4T_1V_1}{T_14V_1} = 1; \quad P_2 = P_1$
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Javob: A) o'zgarmaydi.

33.6. Ideal gazning harorati 4 marta ortganda, uning hajmi 2 marta ortsa, bosimi qanday o'zgaradi?

- A) 4 marta ortadi B) 4 marta kamayadi
 C) o'zgarmaydi D) 2 marta ortadi

Berilgan: $V_2 = 2V_1$ $T_2 = 4T_1$ $\frac{P_2}{P_1} = ?$	Yechilishi: $\frac{P_1V_1}{T_1} = \text{const}$, $\frac{P_2V_2}{T_2} = \text{const}$ ikkinchi tenglikni birinchi tenglikka bo'lib yuboramiz: $\frac{P_2}{P_1} = \frac{T_2V_1}{T_1V_2}$ $\frac{P_2}{P_1} = \frac{T_2V_1}{T_1V_2} = \frac{4T_1V_1}{T_12V_1} = 2; \quad P_2 = 2P_1$
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Javob: D) 2 marta ortadi.

33.7. Agar ballondagi ideal gazning massasi 4 marta oshirilib, harorati 4 marta kamaytirilsa, uning bosimi qanday o'zgaradi?

- A) o'zgarmaydi B) 4 marta ortadi
 C) 4 marta kamayadi D) 16 marta ortadi

Berilgan: $m_2 = 4m_1$ $T_1 = 4T_2$ $V_2 = V_1$ $\frac{P_2}{P_1} = ?$	Yechilishi: $\frac{P_1V_1}{T_1} = \frac{m_1}{M}R$, $\frac{P_2V_2}{T_2} = \frac{m_2}{M}R$, ikkinchi tenglikni birinchi tenglikka bo'lib yuboramiz: $\frac{P_2}{P_1} = \frac{m_2T_2V_1}{m_1T_1V_2}$ $\frac{P_2}{P_1} = \frac{4m_1T_2V_1}{m_14T_2V_1} = 1; \quad P_2 = P_1$
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Javob: A) o'zgarmaydi.

33.8. Bir xil hajmli 3 ta idishda har biri 1 moldan bo'lgan N_2 , O_2 va CO_2 gazlari bor. Gazlarning temperaturallari bir xil bo'lsa, idishdagi bosimlar qanday munosabatda bo'ladi?

- A) $p_{O_2} > p_{CO_2} > p_{N_2}$ B) $p_{CO_2} > p_{O_2} > p_{N_2}$
 C) $p_{N_2} > p_{O_2} > p_{CO_2}$ D) $p_{N_2} = p_{O_2} = p_{CO_2}$

Berilgan:

$$V = \text{const}$$

$$\nu = 1 \text{ mol}$$

$$T = \text{const}$$

$$P = ?$$

Yechilishi: $\frac{PV}{T} = \nu R$, $P = \frac{\nu RT}{V}$ 3 ta gazning hamma parametrlari teng bo'lsa, u holda Mendeleyev-Klapeyron tenglamasiga ko'ra bosimlari ham teng bo'ladi.

$$p_{N_2} = p_{O_2} = p_{CO_2}$$

Javob: D) $p_{N_2} = p_{O_2} = p_{CO_2}$

33.9. Teng massali argon va neon gazlari bir xil idishda saqlanmoqda. Qaysi bir gazning bosimi katta? $M_a = 40 \text{ g/mol}$; $M_n = 20 \text{ g/mol}$.

A) neonning

B) argonning

C) bir xil

D) javob idish hajmiga bog'liq

Berilgan:

$$V = \text{const}$$

$$T = \text{const}$$

$$m = \text{const}$$

$$M_a = 40 \text{ g/mol}$$

$$M_n = 20 \text{ g/mol}$$

$$P = ?$$

Yechilishi: $P = \frac{mRT}{MV}$, $P_a = \frac{mRT}{M_a \nu}$, $P_n = \frac{mRT}{M_n \nu}$

$$\frac{P_a}{P_n} = \frac{M_n}{M_a} = \frac{1}{2}$$

Neon gazniki katta.

Javob: A) neonning.

33.10. Beshta bir xil idish quyidagi gazlar bilan to'ldirilgan: 1) azot; 2) havo; 3) kislorod; 4) geliy; 5) vodorod. Gazlarning massalari va temperaturalari bir xil. Qaysi gazning bosimi eng katta?

A) 5

B) 4

C) 3

D) 2

Berilgan:

$$V = \text{const}$$

$$T = \text{const}$$

$$m = \text{const}$$

$$M_a = 28 \text{ g/mol}$$

$$M_h = 29 \text{ g/mol}$$

$$M_g = 4 \text{ g/mol}$$

$$M_v = 2 \text{ g/mol}$$

$$M_k = 32 \text{ g/mol}$$

$$P = ?$$

Yechilishi: $P = \frac{mRT}{MV}$ suratlari bir xil bo'lsa, maxraji eng kichigi 5 ta gaz ichida eng katta bosimga ega bo'ladi. Molyar massasi eng kichigi bu vodorod gazidir.

Javob: A) 5.

33.11. 27°C li 10 mol gazning bosimi necha paskal? Gazning hajmi 5 l. Gazning universal doimiysi $R = 8,31 \text{ J/(mol K)}$.

A) $2 \cdot 10^6$

B) $5 \cdot 10^5$

C) $2 \cdot 10^5$

D) $5 \cdot 10^6$

Berilgan:

$$\begin{aligned} \nu &= 10 \text{ mol} \\ T &= 300 \text{ K} \\ V &= 5 \text{ l} = 5 \cdot 10^{-3} \text{ m}^3 \\ R &= 8,31 \text{ J/(mol} \cdot \text{K)} \\ P &= ? \end{aligned}$$

Yechilishi:

$$P = \frac{\nu RT}{V},$$

$$P = \frac{\nu RT}{V} = \frac{10 \cdot 8,31 \cdot 300}{5 \cdot 10^{-3}} = 5 \cdot 10^5 \text{ Pa}$$

Javob: B) $5 \cdot 10^5 \text{ Pa}$.

33.12. 1 m³ hajmda 7°C li 1 kg azot qanday bosimga ega bo'ladi (kPa)?

- A) 83 B) 16,6 C) 166 D) 830

Berilgan:

$$\begin{aligned} m &= 1 \text{ kg} \\ T &= 280 \text{ K} \\ V &= 1 \text{ m}^3 \\ R &= 8,31 \text{ J/(mol} \cdot \text{K)} \\ M &= 28 \cdot 10^{-3} \text{ kg/mol} \\ P &= ? \end{aligned}$$

Yechilishi:

$$\frac{PV}{T} = \frac{m}{M} R, P = \frac{mRT}{MV}$$

$$P = \frac{mRT}{MV} = \frac{1 \cdot 8,31 \cdot 280}{28 \cdot 10^{-3} \cdot 1} = 8,31 \cdot 10^4 \text{ Pa} = 83,1 \text{ kPa}$$

Javob: A) $P = 83,1 \text{ kPa}$.

33.13. Hajmi 8,31 l bo'lgan 1 mol gazning 27°C temperaturadagi bosimi qanday (Pa)?

- A) $2 \cdot 10^5$ B) $3 \cdot 10^4$ C) $4 \cdot 10^5$ D) $3 \cdot 10^5$

Berilgan:

$$\begin{aligned} \nu &= 1 \text{ mol} \\ T &= 300 \text{ K} \\ V &= 8,31 \text{ l} = 8,31 \cdot 10^{-3} \text{ m}^3 \\ R &= 8,31 \text{ J/(mol} \cdot \text{K)} \\ P &= ? \end{aligned}$$

Yechilishi:

$$\frac{PV}{T} = \nu R, P = \frac{\nu RT}{V}$$

$$P = \frac{\nu RT}{V} = \frac{1 \cdot 8,31 \cdot 300}{8,31 \cdot 10^{-3}} = 3 \cdot 10^5 \text{ Pa}$$

Javob: D) $P = 3 \cdot 10^5 \text{ Pa}$.

33.14. Ballondagi gaz chiqishi natijasida gazning massasi 1,5 marta, temperaturasi 1,4 marta kamaysa, bosim necha marta pasayadi?

- A) 2,9 B) 2,1 C) 1,5 D) 1,4

Berilgan:

$$\begin{aligned} m_1 &= 1,5 m_2 \\ T_1 &= 1,4 T_2 \\ V &= \text{const} \\ \frac{P_2}{P_1} &= ? \end{aligned}$$

Yechilishi:

$$\frac{PV}{T} = \frac{m}{M} R, P_1 = \frac{m_1 RT_1}{MV}, P_2 = \frac{m_2 RT_2}{MV}$$

$$P_2 = \frac{m_2 RT_2}{MV} \text{ o'rniga qo'yamiz.}$$

$$P_2 = \frac{P_1 m_2 T_2}{T_1 m_1} \text{ ni hosil qilamiz.}$$

$$P_2 = \frac{P_1 m_2 T_2}{T_1 m_1} = \frac{P_1 m_2 T_2}{1,4 T_2 1,5 m_2} = \frac{P_1}{2,1}$$

Javob: B) 2,1.

33.15. Yopiq idishda temperaturasi 87°C , bosimi 4,5 MPa bo'lgan gaz bor. Gazning $1/5$ qismi chiqarib yuborilganda, temperatura 27°C gacha pasaygan bo'lsa, qaror topgan bosim qanday (MPa)?

A) 2,2 B) 1,2 C) 3 D) 1

Berilgan:

$$m_2 = 0,8 m_1$$

$$T_1 = 360 \text{ K}$$

$$T_2 = 300 \text{ K}$$

$$V = \text{const}$$

$$P_1 = 4,5 \text{ MPa}$$

$$P_2 = ?$$

Yechilishi:

$$\frac{PV}{T} = \frac{m}{M} R, P_1 = \frac{m_1 R T_1}{M V}, P_2 = \frac{m_2 R T_2}{M V}$$

$$P_2 = \frac{m_2 R T_2}{M V} \text{ o'rniga qo'yamiz } P_2 = \frac{P_1 m_2 T_2}{T_1 m_1} \text{ ni hosil qilamiz.}$$

$$P_2 = \frac{P_1 m_2 T_2}{T_1 m_1} = \frac{4,5 \cdot 0,8 m_2 \cdot 300}{360 \cdot m_1} = 3 \text{ MPa}$$

Javob: C) 3.

33.16. Ballonda 4 MPa bosim ostida siqilgan 27°C temperaturali gaz turibdi. Agar gazning yarmi chiqarilganda, temperaturasi 15°C ga pasaysa, uning bosimi qanday (MPa) bo'ladi?

A) 1,5 B) 1,8 C) 1,9 D) 2

Berilgan:

$$m_2 = 0,5 m_1$$

$$T_1 = 300 \text{ K}$$

$$T_2 = 288 \text{ K}$$

$$V = \text{const}$$

$$P_1 = 4 \text{ MPa}$$

$$P_2 = ?$$

Yechilishi:

$$\frac{PV}{T} = \frac{m}{M} R, P_1 = \frac{m_1 R T_1}{M V}, P_2 = \frac{m_2 R T_2}{M V}$$

$$P_2 = \frac{m_2 R T_2}{M V} \frac{R}{M V} \text{ o'rniga qo'yamiz } P_2 = \frac{P_1 m_2 T_2}{T_1 m_1} \text{ ni hosil qilamiz.}$$

$$P_2 = \frac{P_1 m_2 T_2}{T_1 m_1} = \frac{4 \cdot 0,5 m_1 \cdot 288}{300 \cdot m_1} = 1,9 \text{ MPa}$$

Javob: C) 1,9.

33.17. Bir atomli gazning hajmi 2 marta kamaytirilsa va molekularining o'rtacha kinetik energiyasi 4 marta oshirilsa, uning bosimi qanday o'zgaradi?

- A) 4 marta ortadi B) 4 marta kamayadi
C) 8 marta ortadi D) 8 marta kamayadi

Berilgan:

$$\begin{aligned} V_1 &= 2V_2 \\ E_2 &= 4E_1 \end{aligned}$$

$$\frac{P_2}{P_1} = ?$$

Yechilishi:

$$\frac{PV}{T} = \text{const}, \quad E = \frac{3}{2}kT, \quad \frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{P_2}{P_1} = \frac{E_2 \cdot V_1}{E_1 \cdot V_2} = 8$$

Javob: C) 8 marta ortadi.

33.18. Bir atomli gazning hajmi ikki marta orttirilib, molekulalar o'rtacha kinetik energiyasi ham 2 marta orttirilsa, gazning bosimi qanday o'zgaradi?

- A) 4 marta ortadi B) 4 marta kamayadi
C) 2 marta ortadi D) o'zgarmaydi

Berilgan:

$$\begin{aligned} V_2 &= 2V_1 \\ E_2 &= 2E_1 \end{aligned}$$

$$\frac{P_2}{P_1} = ?$$

Yechilishi:

$$\frac{PV}{T} = \text{const}, \quad E = \frac{3}{2}kT, \quad \frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{P_2}{P_1} = \frac{E_2 \cdot V_1}{E_1 \cdot V_2} = 1$$

Javob: D) o'zgarmaydi.

33.19. Agar gazning hajmi 2 marta ortsa va gaz molekulalarining o'rtacha kvadratik tezligi shuncha marta kamaysa, uning bosimi qanday o'zgaradi?

- A) 8 marta kamayadi B) 4 marta ortadi
C) 4 marta kamayadi D) 8 marta ortadi

Berilgan:

$$\begin{aligned} V_2 &= 2V_1 \\ v_1 &= 2v_2 \end{aligned}$$

$$\frac{P_2}{P_1} = ?$$

Yechilishi:

$$\frac{PV}{T} = \text{const}, \quad v = \sqrt{\frac{3RT}{M}}$$

$$\frac{P_2}{P_1} = \frac{v_2^2 \cdot V_1}{v_1^2 \cdot V_2} = \frac{1}{8}$$

Javob: A) 8 marta kamayadi.

33.20. 1-holatdan 2-holatga o'tganda, ideal gazning bosimi qanday o'zgaradi (rasmga q.)?

- A) ortadi B) o'zgarmaydi
C) kamayadi D) javob gaz massasiga bog'liq



Yechilishi: 1-holatda temperaturaning kam o'zgarishiga hajmning ko'proq o'zgarishi to'g'ri kelyapti. Bosim hajmga teskari proporsional bo'lgani uchun bosim kichik bo'lsa, ikkinchi holatda teskari. Demak, bosim ortadi.

Javob: A) ortadi.

33.21. Grafikda ideal gaz hajmining absolut haroratga bog'lanishi tasvirlangan.

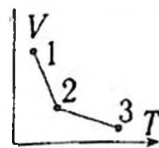
1-, 2- va 3-nuqtalardagi bosim haqida nima deyish mumkin?

A) $p_1 < p_2 > p_3$

B) $p_1 > p_2 > p_3$

C) $p_1 < p_2 < p_3$

D) $p_1 = p_2 = p_3$



Yechilishi: temperatura kichik paytda hajm katta bo'lyapti, demak, bosim kichik. Temperatura ortishi bilan hajm kamayib boradi, bosim orta boshlaydi $p_1 < p_2 < p_3$.

Javob: C) $p_1 < p_2 < p_3$.

33.22. Qandaydir jarayonda ideal gazning holat tenglamasi $V^2/T = \text{const}$ ko'rinishga ega. Gazning hajmi 2 marta ortganda, uning bosimi qanday o'zgaradi?

A) 2 marta ortadi

B) 2 marta kamayadi

C) o'zgarmaydi

D) 4 marta ortadi

Berilgan:

$$V^2/T = \text{const}$$

$$V_2 = 2V_1$$

$$\frac{P_2}{P_1} = ?$$

Yechilishi: $\frac{V_1^2}{T_1} = \frac{V_2^2}{T_2}$, $\frac{T_2}{T_1} = \frac{V_2^2}{V_1^2}$ endi holat tenglamasini

yozamiz $\frac{PV}{T} = \text{const}$

$$\frac{P_2}{P_1} = \frac{T_2 V_1}{T_1 V_2} = \frac{V_2}{V_1} = 2$$

Javob: A) 2 marta ortadi.

33.23. Yopiq idishdan gazning yarmi chiqarib yuborildi. Idishdagi gaz bosimi avvalgicha qolishi uchun absolut temperaturani qanday o'zgartirish kerak?

A) 4 marta orttirish

B) 3 marta orttirish

C) 2 marta orttirish

D) 2 marta pasaytirish

Berilgan:

$$m_2 = 0,5 m_1$$

$$V = \text{const}$$

$$P_1 = P_2$$

$$\frac{T_2}{T_1} = ?$$

Yechilishi:

$$\frac{PV}{T} = \frac{m}{M} R, T_1 = \frac{PMV}{m_1 R}, T_2 = \frac{PMV}{m_2 R}$$

$$\frac{T_2}{T_1} = \frac{m_1}{m_2} = 2$$

Javob: C) 2 marta orttirish.

33.24. Ideal gazning bosimi 16,6 kPa, zichligi $\rho = 2 \text{ kg/m}^3$, molyar massasi 2 g/mol. Gazning temperaturasi necha kelvin? $R = 8,3 \text{ J/(mol} \cdot \text{K)}$.

- A) 573 B) 473 C) 275 D) 2

Berilgan:

$$\begin{aligned} \rho &= 2 \text{ kg/m}^3 \\ P &= 16,6 \text{ kPa} = 16,6 \cdot 10^3 \text{ Pa} \\ R &= 8,3 \text{ J/(mol} \cdot \text{K)} \\ M &= 2 \cdot 10^{-3} \text{ kg/mol} \\ T &= ? \end{aligned}$$

Yechilishi:

$$\begin{aligned} \frac{PV}{T} &= \frac{m}{M} R, T = \frac{PMV}{mR}, m = \rho V \\ T &= \frac{PM}{\rho R} \\ T &= \frac{PM}{\rho R} = \frac{16,6 \cdot 10^3 \cdot 2 \cdot 10^{-3}}{2 \cdot 8,3} = 2 \text{ K} \end{aligned}$$

Javob: D) $T = 2 \text{ K}$.

33.25. Ballondagi argon gazi ishlatilishi davomida gazning massasi 20%, bosimi esa 2 marta kamaygan bo'lsa, uning harorati dastlabki haroratga nisbatan necha marta kamaygan?

- A) 1,25 B) 1,6 C) 2 D) 2,5

Berilgan:

$$\begin{aligned} m_2 &= 0,8 m_1 \\ P_1 &= 2 P_2 \\ \frac{T_2}{T_1} &= ? \end{aligned}$$

Yechilishi: Mendeleev-Klaapeyron tenglamasidan temperaturani topamiz :

$\frac{PV}{T} = \frac{m}{M} R, T = \frac{PMV}{mR}$ keyin esa har bir holat uchun tenglamasini yozamiz.

$$T_1 = \frac{P_1 M V_1}{m_1 R}, T_2 = \frac{P_2 M V_2}{m_2 R}, \text{ballonni hajmi o'zgarmagani}$$

uchun hajmlar teng bo'ladi.

$$V = \text{const}, \frac{T_2}{T_1} = \frac{\frac{P_2 M V}{m_2 R}}{\frac{P_1 M V}{m_1 R}} = \frac{P_2 m_1}{P_1 m_2} = \frac{P_2 m_1}{2 P_2 \cdot 0,8 m_1} = \frac{1}{1,6}, T_1 = 1,6 T_2$$

Javob: B) 1,6 marta kamayadi.

33.26. Hajmi $0,8 \text{ m}^3$ bo'lgan gazning 300 K dagi bosimi $2,8 \cdot 10^5 \text{ Pa}$. Shu gaz $3,2 \cdot 10^5 \text{ Pa}$ bosimda $1,4 \text{ m}^3$ hajmni egallasa, uning temperaturasi necha kelvinga teng bo'ladi?

- A) 150 B) 165 C) 300 D) 600

Berilgan:

$$\begin{aligned} V_1 &= 0,8 \text{ m}^3 \\ V_2 &= 1,4 \text{ m}^3 \end{aligned}$$

Yechilishi: Mendeleev- Klaapeyron tenglamasidan temperaturani topamiz :

$$\frac{PV}{T} = \frac{m}{M} R, T = \frac{PMV}{mR} \text{ keyin esa har bir holat uchun}$$

$$\begin{aligned} P_1 &= 2,8 \cdot 10^5 \text{ Pa} \\ P_2 &= 3,2 \cdot 10^5 \text{ Pa} \\ T_1 &= 300 \text{ K} \\ \hline T_2 &= ? \end{aligned}$$

tenglamasini yozamiz $T_1 = \frac{P_1 M V_1}{m_1 R}$, $T_2 = \frac{P_2 M V_2}{m_2 R}$, massa o'zgarmagani uchun massalar teng bo'ladi $m = \text{const}$

$$\frac{T_2}{T_1} = \frac{\frac{P_2 M V_2}{m R}}{\frac{P_1 M V_1}{m R}} = \frac{P_2 V_2}{P_1 V_1} = \frac{3,2 \cdot 10^5 \cdot 1,4}{2,8 \cdot 10^5 \cdot 0,8} = 2, \quad T_2 = 2T_1, \quad T_2 = 600 \text{ K}$$

Javob: D) 600 K.

33.27. Normal sharoitda 500 mol kislorod gazi qanday hajmni egallaydi (m^3)?

A) 6,4 B) 11,2 C) 16 D) 22,4

Berilgan:

$$\begin{aligned} \nu &= 500 \text{ mol} \\ P &= 1 \cdot 10^5 \text{ Pa} \\ T &= 273 \text{ K} \\ R &= 8,31 \frac{\text{J}}{\text{kg mol}} \\ \hline V &= ? \end{aligned}$$

Yechilishi: Mendeleyev-Klapeyron tenglamasidan hajmni topamiz :

$$\frac{PV}{T} = \nu R, \quad V = \frac{\nu RT}{P} \text{ keyin esa hisoblaymiz:}$$

$$V = \frac{500 \cdot 8,31 \cdot 273}{1 \cdot 10^5} = 11,2 \text{ m}^3$$

Javob: B) 11,2 m^3 .

33.28. 1 kmol gaz 100kPa bosim ostida va 100°C temperaturada qanday hajmni egallaydi (m^3)?

A) 31 B) 62 C) 16,62 D) 8,31

Berilgan:

$$\begin{aligned} \nu &= 1000 \text{ mol} \\ P &= 1 \cdot 10^5 \text{ Pa} \\ T &= 373 \text{ K} \\ R &= 8,31 \frac{\text{J}}{\text{kg mol}} \\ \hline V &= ? \end{aligned}$$

Yechilishi: Mendeleyev-Klapeyron tenglamasidan hajmni topamiz :

$$\frac{PV}{T} = \nu R, \quad V = \frac{\nu RT}{P} \text{ keyin esa hisoblaymiz:}$$

$$V = \frac{1000 \cdot 8,31 \cdot 373}{1 \cdot 10^5} = 31 \text{ m}^3$$

Javob: A) 31 m^3 .

33.29. 2 mol ideal gaz 500 K da 100 kPa bosimga ega bo'lsa, uning hajmi qanday (l)?

A) 8,31 B) 16,62
C) 83,1 D) 166,2

Berilgan:

$$\nu = 2 \text{ mol}$$

$$P = 1 \cdot 10^5 \text{ Pa}$$

$$T = 500 \text{ K}$$

$$R = 8,31 \frac{\text{J}}{\text{kg mol}}$$

$$V = ?$$

Yechilishi: Mendeleyev-Klapeyron tenglamasidan hajmni topamiz :

$$\frac{PV}{T} = \nu R, V = \frac{\nu RT}{P} \text{ keyin esa hisoblaymiz:}$$

$$V = \frac{2 \cdot 8,31 \cdot 500}{1 \cdot 10^5} = 0,0831 \text{ m}^3 = 83,1 \text{ l}$$

Javob: C) 83,1 l.

33.30. Ideal gazning mutlaq harorati 3 marta ko'tarilganda, bosimi 50% ga oshgan bo'lsa, uning hajmi qanday o'zgargan?

A) 3 marta kamaygan

B) 2 marta oshgan

C) 2 marta kamaygan

D) 3 marta oshgan

Berilgan:

$$T_2 = 3 T_1$$

$$P_2 = 1,5 P_1$$

$$\frac{V_2}{V_1} = ?$$

Yechilishi: Mendeleyev- Klapeyron tenglamasidan hajmni

topamiz: $\frac{PV}{T} = \nu R$ $V_1 = \frac{\nu RT_1}{P_1}$, $V_2 = \frac{\nu RT_2}{P_2}$ o'zgarmagani

uchun modda miqdori teng bo'ladi $\nu = \text{const}$

$$\frac{V_2}{V_1} = \frac{\frac{\nu RT_2}{P_2}}{\frac{\nu RT_1}{P_1}} = \frac{P_1 T_2}{P_2 T_1} = 2$$

Javob: B) 2 marta oshgan.

33.31. Ideal gaz absolut haroratining 2 marta ko'tarilishi bosimning 2 marta oshishiga olib kelgan bo'lsa, hajm necha marta o'zgargan?

A) 4 marta oshgan

B) 4 marta kamaygan

C) 2 marta oshgan

D) o'zgarmagan

Berilgan:

$$T_2 = 2 T_1$$

$$P_2 = 2 P_1$$

$$\frac{V_2}{V_1} = ?$$

Yechilishi: Mendeleyev- Klapeyron tenglamasidan hajmni

topamiz: $\frac{PV}{T} = \nu R$ $V_1 = \frac{\nu RT_1}{P_1}$, $V_2 = \frac{\nu RT_2}{P_2}$ o'zgarmagani

uchun, modda miqdori teng bo'ladi $\nu = \text{const}$

$$\frac{V_2}{V_1} = \frac{\frac{\nu RT_2}{P_2}}{\frac{\nu RT_1}{P_1}} = \frac{P_1 T_2}{P_2 T_1} = 1$$

Javob: D) o'zgarmagan.

33.32. Aerostatning hajmi normal sharoitda 4200 m^3 edi. Aerostatning 4320 m balandlikdagi hajmi necha m^3 ? Havoning bu balandlikdagi temperaturasi 260 K . $p_n = 760 \text{ mm.sim.ust.}$

- A) 7600 B) 6000 C) 4000 D) 6500

Berilgan:

$$\begin{aligned} V_1 &= 4200 \text{ m}^3 \\ P_1 &= 760 \text{ mm.sim.ust} \\ h &= 4320 \text{ m} \\ T_1 &= 273 \text{ K} \\ T_2 &= 260 \text{ K} \\ V_2 &= ? \end{aligned}$$

Yechilishi: Mendeleyev- Klapayron tenglamasidan temperaturani topamiz:

$$\frac{PV}{T} = \nu R \quad T = \frac{PV}{\nu R} \text{ keyin esa har bir holat uchun}$$

tenglamasini yozamiz $V_1 = \frac{\nu RT_1}{P_1}$, $V_2 = \frac{\nu RT_2}{P_2}$ o'zgar-
magani uchun, modda miqdori teng bo'ladi $\nu = \text{const}$

atmosfera bosimi har 12 m da 1 mm.sim.ust ga kamayadi, keyingi bosim 360 mm.sim.ust ga kamayadi.

$$\frac{V_2}{V_1} = \frac{\frac{\nu RT_2}{P_2}}{\frac{\nu RT_1}{P_1}} = \frac{P_1 T_2}{P_2 T_1} = \frac{760 \cdot 260}{400 \cdot 273} = 1,8,$$

$$V_2 = 1,8 V_1, \quad V_2 = 7600 \text{ m}^3$$

Javob: A) 7600 m^3 .

33.33. Me'yoriy (normal) bosimda turgan velosiped kamerasi nasos yordamida 50 marta damlanib, undagi bosim 2 atm. ga etkazildi. Nasos silindrining hajmi kamera hajmidan necha marta kichik?

- A) 50 B) 25 C) 75 D) 100

Berilgan:

$$\begin{aligned} n &= 50 \text{ marta} \\ P_1 &= 1 \text{ atm} \\ T_1 &= T_2 \\ P_2 &= 2 \text{ atm} \\ \frac{V_s}{V_n} &= ? \end{aligned}$$

Yechilishi: Mendeleyev- Klapayron tenglamasidan temperaturani topamiz:

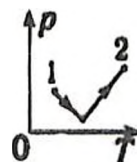
$$\frac{PV}{T} = \text{const} \text{ keyin esa har bir holat uchun tenglamasini}$$

yozamiz $P_1 V_1 = P_2 V_2$, 1- holatda hajm o'rniga silindr va n marta damlanadigan nasos hajmini qo'shib yozamiz.
 $P_1(V_s + nV_n) = P_2 V_s$

$$\frac{V_s}{V_n} = \frac{n P_1}{P_2 - P_1} = 50$$

Javob: A) 50.

33.34. Ideal gazning hajmi 1-holatdan 2-holatga o'tganda qanday o'zgaradi?



A) o'zgarmaydi

B) kamayadi

C) ortadi

D) javob gaz massasiga bog'liq

Yechilishi: izoxora chiziqlarning OT o'qqa yaqinida hajm katta bo'ladi.

Javob: B) ortadi.

33.35. Hajmi 40 l bo'lgan idishda temperaturasi 300 K va bosimi 200 kPa bo'lgan gaz bor. Modda miqdorini toping (mol). $R = 8,31 \text{ J}/(\text{mol} \cdot \text{K})$.

A) 3200

B) 3,2

C) 1,6

D) 1600

Berilgan:

$$V = 40 \text{ l} = 0,04 \text{ m}^3$$

$$P = 2 \cdot 10^5 \text{ Pa}$$

$$T = 300 \text{ K}$$

$$R = 8,31 \frac{\text{J}}{\text{kg mol}}$$

$$\nu = ?$$

Yechilishi: Mendeleyev- Klapayron tenglamasidan modda miqdorini topamiz:

$$\frac{PV}{T} = \nu R, \quad \nu = \frac{PV}{RT} \text{ keyin esa hisoblaymiz:}$$

$$\nu = \frac{1 \cdot 10^5 \cdot 0,04}{8,31 \cdot 300} = 1,6 \text{ mol}$$

Javob: C) 1,6 mol.

33.36. Hajmi 0,05 m³, temperaturasi 500 K bo'lgan gazning bosimi 166 kPa. Modda miqdorini aniqlang (mol).

A) 20

B) 4

C) 3

D) 2

Berilgan:

$$V = 0,05 \text{ m}^3$$

$$P = 166 \text{ kPa} = 166 \cdot 10^3 \text{ Pa}$$

$$T = 500 \text{ K}$$

$$R = 8,31 \frac{\text{J}}{\text{kg mol}}$$

$$\nu = ?$$

Yechilishi: Mendeleyev-Klapayron tenglamasidan modda miqdorini topamiz:

$$\frac{PV}{T} = \nu R, \quad \nu = \frac{PV}{RT} \text{ keyin esa hisoblaymiz:}$$

$$\nu = \frac{166 \cdot 10^3 \cdot 0,05}{8,31 \cdot 500} = 2 \text{ mol}$$

Javob: D) 2 mol.

33.37. Temperaturasi 27°C bo'lgan 5x10x3 m³ o'lchamli xonada necha mol havo bor? Atmosfera bosimi 100 kPa ga teng.

A) 6 · 10⁵

B) 3 · 10⁶

C) 6 · 10⁴

D) 6 · 10³

Berilgan:

$$V = 5 \cdot 10 \cdot 3 \text{ m}^3 = 150 \text{ m}^3$$

$$P = 100 \text{ kPa} = 1 \cdot 10^5 \text{ Pa}$$

$$T = 300 \text{ K}$$

Yechilishi: Mendeleyev-Klapayron tenglamasidan modda miqdorini topamiz:

$$\frac{PV}{T} = \nu R, \quad \nu = \frac{PV}{RT} \text{ keyin esa hisoblaymiz:}$$

$$\frac{R = 8,31 \frac{J}{kg \cdot mol}}{v = ?}$$

$$v = \frac{1 \cdot 10^5 \cdot 150}{8,31 \cdot 300} = 6 \cdot 10^3 \text{ mol}$$

Javob: D) $6 \cdot 10^3$.

33.38. 20 g gaz 600 K da va 8,31 MPa bosimda 6 l hajmni egallaydi. Bu qanday gaz?

A) kislorod

B) argon

C) azot

D) vodorod

Berilgan:

$$V = 6 \text{ l} = 6 \cdot 10^{-3} \text{ m}^3$$

$$P = 8,31 \text{ MPa} = 8,31 \cdot 10^6 \text{ Pa}$$

$$T = 600 \text{ K}$$

$$m = 20 \text{ g} = 0,02 \text{ kg}$$

$$R = 8,31 \frac{J}{kg \cdot mol}$$

$$M = ?$$

Yechilishi: Mendeleyev-Klapeyron tenglamasidan modda miqdorini topamiz:

$\frac{PV}{T} = \frac{m}{M} R$, $M = \frac{mRT}{PV}$ keyin esa hisoblaymiz:

$$M = \frac{0,02 \cdot 8,31 \cdot 600}{8,31 \cdot 10^6 \cdot 6 \cdot 10^{-3}} = 2 \cdot 10^{-3} \frac{kg}{mol}$$

Javob: D) vodorod.

33.39. Me'yordagi sharoitda ($p=101 \text{ kPa}$, $T=273 \text{ K}$) 0,74 g massali gaz 8,31 l hajmni egallaydi. Bu qanday gaz?

A) azot

B) vodorod

C) kislorod

D) is gazi

Berilgan:

$$V = 8,31 \text{ l} = 8,31 \cdot 10^{-3} \text{ m}^3$$

$$P = 101 \text{ kPa} = 1,01 \cdot 10^5 \text{ Pa}$$

$$T = 273 \text{ K}$$

$$m = 0,74 \text{ g} = 7,4 \cdot 10^{-4} \text{ kg}$$

$$R = 8,31 \frac{J}{kg \cdot mol}$$

$$M = ?$$

Yechilishi: Mendeleyev-Klapeyron tenglamasidan modda miqdorini topamiz:

$\frac{PV}{T} = \frac{m}{M} R$, $M = \frac{mRT}{PV}$ keyin esa hisoblaymiz:

$$M = \frac{7,4 \cdot 10^{-4} \cdot 8,31 \cdot 273}{1,01 \cdot 10^5 \cdot 8,31 \cdot 10^{-3}} = 2 \cdot 10^{-3} \frac{kg}{mol}$$

Javob: B) vodorod.

33.40. Ballonda 0,5 g massaga ega bo'lgan noma'lum gaz 23°C da 60 kPa bosimni vujudga keltirdi, xuddi shu ballonning o'zida 50 g massali kislorod gazi 47°C temperaturada 480 kPa bosimga ega bo'ladi. Noma'lum gazning molyar massasi qanday (g/mol)?

A) 4

B) 2

C) 18

D) 28

Berilgan:

$$P_1 = 60 \text{ kPa}$$

$$P_2 = 480 \text{ kPa}$$

$$T_1 = 250 \text{ K}$$

$$T_2 = 320 \text{ K}$$

$$m_1 = 0,5 \text{ g}$$

$$m_2 = 50 \text{ g}$$

$$M_2 = 32 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$R = 8,31 \frac{\text{J}}{\text{kg mol}}$$

$$M_1 = ?$$

Yechilishi: Mendeleyev-Klapeyron tenglamasidan foydalanamiz:

$$\frac{PV}{T} = \frac{m}{M} R, \quad M = \frac{mRT}{PV} \text{ keyin esa har bir holat}$$

$$\text{uchun molyar massani topamiz} \quad M_1 = \frac{m_1 RT_1}{P_1 V},$$

$$M_2 = \frac{m_2 RT_2}{P_2 V} \text{ bu yerda ballonning hajmi o'zgarmaydi}$$

$$\frac{M_2}{M_1} = \frac{\frac{m_2 RT_2}{P_2 V}}{\frac{m_1 RT_1}{P_1 V}} = \frac{P_2 m_2 T_2}{P_1 m_1 T_1} = \frac{480 \cdot 50 \cdot 320}{60 \cdot 0,5 \cdot 250} = 16$$

$$M_1 = \frac{M_2}{16} = 2 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

Javob: B) 2.

33.41. Metall ballon ventiling nosozligi tufayli gaz chiqaradi. Agar ballon ichidagi m massali gazning bosimi ikki marta kamaygan bo'lsa, undan qancha gaz chiqib ketgan? $T = \text{const}$.

A) $m/5$

B) $m/4$

C) $m/3$

D) $m/2$

Berilgan:

$$P_1 = 2P_2$$

$$T_1 = T_2$$

$$R = 8,31 \frac{\text{J}}{\text{kg mol}}$$

$$m_1 = m$$

$$m_2 = ?$$

Yechilishi: Mendeleyev-Klapeyron tenglamasidan foydalanamiz:

$$\frac{PV}{T} = \frac{m}{M} R, \quad m = \frac{PVM}{RT} \text{ keyin esa har bir holat uchun massani topamiz:}$$

$$m_1 = \frac{P_1 VM}{TR}, \quad m_2 = \frac{P_2 VM}{TR} \text{ bu yerda ballondagi gaz, temperatura va hajm o'zgarmaydi.}$$

$$\frac{m_2}{m_1} = \frac{\frac{P_2 VM}{TR}}{\frac{P_1 VM}{TR}} = \frac{P_2}{P_1} = \frac{P_2}{2P_2} = 0,5, \quad m_2 = 0,5 m$$

Javob: D) $\frac{m}{2}$.

33.42. Ballondagi gazning bir qismi ishlatilganda bosimi 75% kamaygan bo'lsa, uning massasi necha marta kamaygan? $T = \text{const}$ deb hisoblang.

A) 1,4

B) 4

C) 1,33

D) 2

Berilgan:

$$P_2 = 0,25 P_1$$

$$T_1 = T_2$$

$$R = 8,31 \frac{J}{kg \cdot mol}$$

$$\frac{m_2}{m_1} = ?$$

Yechilishi: Mendeleyev-Klapeyron tenglamasidan foydalanamiz:

$\frac{PV}{T} = \frac{m}{M} R$, $m = \frac{PVM}{RT}$ keyin esa har bir holat uchun massani topamiz:

$m_1 = \frac{P_1 VM}{RT}$, $m_2 = \frac{P_2 VM}{RT}$ bu yerda ballondagi gaz, temperatura va hajm o'zgarmaydi.

$$\frac{m_2}{m_1} = \frac{\frac{P_2 VM}{RT}}{\frac{P_1 VM}{RT}} = \frac{P_2}{P_1} = \frac{0,25 P_1}{P_1} = 0,25, \quad m_1 = 4m_2$$

Javob: B) 4.

33.43. 17°C li 8,3 l havo normal bosimda necha kg massaga ega? $p_n = 10^5$ Pa, $M = 29$ g/mol, $R = 8,3$ J/(mol · K).

A) 0,1

B) 0,5

C) 0,01

D) 0,05

Berilgan:

$$V = 8,3 \text{ l} = 8,3 \cdot 10^{-3} \text{ m}^3$$

$$P = 1 \cdot 10^5 \text{ Pa}$$

$$T = 290 \text{ K}$$

$$M = 29 \frac{g}{mol} = 29 \cdot 10^{-3} \frac{kg}{mol}$$

$$R = 8,3 \frac{J}{kg \cdot mol}$$

$$m = ?$$

Yechilishi: Mendeleyev-Klapeyron tenglamasidan massani topamiz:

$\frac{PV}{T} = \frac{m}{M} R$, $m = \frac{PVM}{RT}$ keyin esa hisoblaymiz:

$$m = \frac{1 \cdot 10^5 \cdot 8,3 \cdot 10^{-3} \cdot 29 \cdot 10^{-3}}{290 \cdot 8,3} = 1 \cdot 10^{-2} \text{ kg} = 0,01 \text{ kg}$$

Javob: C) 0,01 kg.

33.44. Balandligi 5 m va sathi 200 m² bo'lgan auditoriyadagi havoning massasi topilsin (kg). Binoning harorati 17°C, havo bosimi 750 mm Hg, havoning molyar massasi 29 kg/kmol.

A) 1200

B) 1400

C) 1600

D) 200

Berilgan:

$$h = 5 \text{ m}$$

$$S = 200 \text{ m}^2$$

$$t_1 = 17^\circ \text{C}$$

$$p = 750 \text{ mmHg}$$

$$M = 29 \text{ kg/mol}$$

$$m = ?$$

Yechilishi: Mendeleyev-Klapeyron tenglamasidan massani topamiz:

$\frac{PV}{T} = \frac{m}{M} R$, $m = \frac{PVM}{RT}$ hajm o'rniga $V = S \cdot h$ qo'yamiz, $m = \frac{PS \cdot h \cdot M}{RT}$

$$m = \frac{1 \cdot 10^5 \cdot 5 \cdot 200 \cdot 29 \cdot 10^{-3}}{290 \cdot 8,31} = 1200 \text{ kg}$$

Javob: A) 1200 kg.

33.45. Havo ochiq idishda 27°C dan 127°C gacha isitildi. Idishdagi havoning boshlang'ich m_1 va oxirgi m_2 massalari o'zaro qanday bog'langan?

A) $m_2 = 4m_1/3$

B) $m_2 = 3m_1/4$

C) $m_2 = 0,1m_1$

D) $m_2 = 0,4m_1$

Berilgan:

$P = \text{const}$

$T_1 = 300 \text{ K}$

$T_2 = 100 \text{ K}$

$\frac{m_2}{m_1} = ?$

Yechilishi: Mendeleyev-Klapeyron tenglamasidan massani topamiz:

$\frac{PV}{T} = \frac{m}{M} R, \quad m = \frac{PVM}{RT}$ birinchi va ikkinchi holatlar

uchun yozamiz, idishning hajmi o'zgarmaydi $m_1 = \frac{PVM}{RT_1}$,

$m_2 = \frac{PVM}{RT_2}$ nisbatini olamiz.

$$\frac{m_2}{m_1} = \frac{\frac{PVM}{RT_2}}{\frac{PVM}{RT_1}} = \frac{T_1}{T_2} = \frac{300}{100} = 3$$

Javob: B) $m_2 = 3m_1/4$.

33.46. Ballondagi gazning qancha qismi chiqib, harorati 2 marta kamayganda uning bosimi 3 marta kamayadi?

A) $1/3$

B) $1/2$

C) $0,4$

D) $2/3$

Berilgan:

$V = \text{const}$

$P_2 = \frac{P_1}{3}$

$T_1 = 2T_2$

$\frac{m_2}{m_1} = ?$

Yechilishi: Mendeleyev-Klapeyron tenglamasidan massani topamiz:

$\frac{PV}{T} = \frac{m}{M} R, \quad m = \frac{PVM}{RT}$ birinchi va ikkinchi holatlar

uchun yozamiz, idishning hajmi o'zgarmaydi $m_1 = \frac{P_1VM}{RT_1}$,

$m_2 = \frac{P_2VM}{RT_2}$ nisbatini olamiz $\frac{m_2}{m_1} = \frac{\frac{P_2VM}{RT_2}}{\frac{P_1VM}{RT_1}} = \frac{P_2T_1}{P_1T_2} = \frac{2}{3}$ demak,

$2/3$ qismi qolgan bo'lsa, $1/3$ qismi chiqib ketgan.

Javob: A) $1/3$.

33.47. Ballondagi gazning chiqib ketishi natijasida bosim 2 marta, temperatura 1,5 marta kamaygan bo'lsa, gazning necha foizi chiqib ketgan bo'ladi?

A) 80

B) 75

C) 50

D) 25

Berilgan:

$$V = \text{const}$$

$$P_2 = \frac{P_1}{2}$$

$$T_1 = 1,5 T_2$$

$$\frac{m_2}{m_1} = ?$$

Yechilishi: Mendeleyev-Klapeyron tenglamasidan massani topamiz:

$$\frac{PV}{T} = \frac{m}{M} R, \quad m = \frac{PVM}{RT} \quad \text{birinchi va ikkinchi holatlar}$$

uchun yozamiz, idishning hajmi o'zgarmaydi $m_1 = \frac{P_1 VM}{RT_1}$,

$$m_2 = \frac{P_2 VM}{RT_2} \quad \text{nisbatini olamiz} \quad \frac{m_2}{m_1} = \frac{\frac{P_2 VM}{RT_2}}{\frac{P_1 VM}{RT_1}} = \frac{P_2 T_1}{P_1 T_2} = 0,75$$

demak, 0,75 qismi qolgan bo'lsa, 0,25 qismi chiqib ketgan.

Javob: D) 25 %.

33.48. Ideal gazning bosimi, absolut temperaturasi T , molyar massasi M ni bilgan holda, uning zichligini aniqlang.

A) $\frac{MRT}{p}$

B) $\frac{RT}{pM}$

C) $\frac{pM}{RT}$

D) $\frac{p}{RTM}$

Yechilishi: $\frac{PV}{T} = \frac{m}{M} R, \quad T = \frac{PM}{\rho R}, \quad m = \rho V$

$$\rho = \frac{PM}{TR}$$

Javob: C) $\rho = \frac{PM}{TR}$.

33.49. Bir xil sharoitda kislorod gazining zichligi azot gazining zichligidan qanday farq qiladi?

A) 8/7 marta kichik

B) 8,31 marta kichik

C) 8/7 marta katta

D) 8,31 marta katta

Berilgan:

$$M_k = 32 \frac{\text{g}}{\text{mol}}$$

$$M_a = 28 \frac{\text{g}}{\text{mol}}$$

$$P = \text{const}$$

$$T = \text{const}$$

$$\rho = ?$$

Yechilishi: $\rho = \frac{PM}{TR}, \quad \rho_1 = \frac{P_1 M}{T_1 R}$ endi zichliklarning nisbatini topamiz:

$\frac{\rho_k}{\rho_a} = \frac{M_k}{M_a}$ boshqa parametrlar bir xil bo'lgani uchun qisqarib ketadi.

$$\frac{\rho_k}{\rho_a} = \frac{M_k}{M_a} = \frac{32}{28} = \frac{8}{7}$$

Javob: C) 8/7 marta katta.

33.50. Ideal gazning mutlaq harorati 3 marta oshganda bosimi 1,5 marta oshgan bo'lsa, uning zichligi qanday o'zgargan?

- A) 1,5 marta oshgan B) 2 marta oshgan
C) 1,5 marta kamaygan D) 2 marta kamaygan

Berilgan:

$$T_2 = 3T_1$$

$$P_2 = 1,5P_1$$

$$\frac{\rho_2}{\rho_1} = ?$$

Yechilishi: $\rho = \frac{PM}{TR}, \rho_1 = \frac{P_1 M}{T_1 R}$

$\rho_2 = \frac{P_2 M}{T_2 R}$ endi zichliklarning nisbatini topamiz:

$$\frac{\rho_2}{\rho_1} = \frac{P_2 T_1}{P_1 T_2} = \frac{1}{2}$$

Javob: D) 2 marta kamaygan.

33.51. 83,1 kPa bosim va 127°C haroratdagi vodorod zichligini aniqlang (kg/m³).

- A) 0,05 B) 0,08 C) 0,83 D) 0,02

Berilgan:

$$P = 83,1 \text{ kPa} = 8,31 \cdot 10^4 \text{ Pa}$$

$$T = 400 \text{ K}$$

$$M = 2 \frac{\text{g}}{\text{mol}} = 2 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$R = 8,31 \frac{\text{J}}{\text{kg mol}}$$

$$\rho = ?$$

Yechilishi: $\rho = \frac{PM}{TR}$

$$\rho = \frac{PM}{TR} = \frac{8,31 \cdot 10^4 \cdot 2 \cdot 10^{-3}}{400 \cdot 8,31} = 0,05 \frac{\text{kg}}{\text{m}^3}$$

Javob: A) $0,05 \frac{\text{kg}}{\text{m}^3}$.

33.52. Harorati 17°C va bosimi 204 kPa bo'lgan vodorod gazining zichligi topilsin (kg/m³).

- A) $17 \cdot 10^{-3}$ B) 0,17 C) 1,7 D) 17

Berilgan:

$$P = 204 \text{ kPa} = 2,04 \cdot 10^5 \text{ Pa}$$

$$T = 290 \text{ K}$$

$$M = 2 \frac{\text{g}}{\text{mol}} = 2 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$R = 8,31 \frac{\text{J}}{\text{kg mol}}$$

$$\rho = ?$$

Yechilishi: $\rho = \frac{PM}{TR}$

$$\rho = \frac{PM}{TR} = \frac{2,04 \cdot 10^5 \cdot 2 \cdot 10^{-3}}{290 \cdot 8,31} = 0,17 \frac{\text{kg}}{\text{m}^3}$$

Javob: B) $0,17 \frac{\text{kg}}{\text{m}^3}$.

33.53. Temperaturası 367°C va bosimi $8,31 \cdot 10^5 \text{ Pa}$ bo'lgan kislorod gazining zichligi qanday (kg/m^3)?

- A) 5 B) 6,44 C) 8,31 D) 2

Berilgan:

$$P = 8,31 \cdot 10^5 \text{ Pa}$$

$$T = 640 \text{ K}$$

$$M = 32 \frac{\text{g}}{\text{mol}} = 32 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$R = 8,31 \frac{\text{J}}{\text{kg mol}}$$

$$\rho = ?$$

Yechilishi: $\rho = \frac{PM}{TR}$

$$\rho = \frac{PM}{TR} = \frac{8,31 \cdot 10^5 \cdot 32 \cdot 10^{-3}}{640 \cdot 8,31} = 5 \frac{\text{kg}}{\text{m}^3}$$

Javob: A) $5 \frac{\text{kg}}{\text{m}^3}$.

33.54. -73°C temperatura va $83,1 \text{ kPa}$ bosimda azot qanday zichlikka ega bo'ladi (kg/m^3)? $M = 28 \text{ g/mol}$.

- A) 4 B) 1,4 C) 0,7 D) 0,14

Berilgan:

$$P = 83,1 \text{ kPa} = 0,831 \cdot 10^5 \text{ Pa}$$

$$T = 200 \text{ K}$$

$$M = 28 \frac{\text{g}}{\text{mol}} = 28 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$R = 8,31 \frac{\text{J}}{\text{kg mol}}$$

$$\rho = ?$$

Yechilishi: $\rho = \frac{PM}{TR}$

$$\rho = \frac{PM}{TR} = \frac{0,831 \cdot 10^5 \cdot 28 \cdot 10^{-3}}{200 \cdot 8,31} = 1,4 \frac{\text{kg}}{\text{m}^3}$$

Javob: B) $1,4 \frac{\text{kg}}{\text{m}^3}$.

33.55. Biror balandlikda havoning bosimi $83,1 \text{ kPa}$ va temperaturasi -43°C ga teng bo'lsa, shu balandlikdagi havoning zichligi qanday (kg/m^3)? $M_h = 29 \text{ g/mol}$.

- A) 0,23 B) 0,36 C) 0,46 D) 1,26

Berilgan:

$$P = 83,1 \text{ kPa} = 0,831 \cdot 10^5 \text{ Pa}$$

$$T = 230 \text{ K}$$

$$M = 29 \frac{\text{g}}{\text{mol}} = 29 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

$$R = 8,31 \frac{\text{J}}{\text{kg mol}}$$

$$\rho = ?$$

Yechilishi: $\rho = \frac{PM}{TR}$

$$\rho = \frac{PM}{TR} = \frac{0,831 \cdot 10^5 \cdot 29 \cdot 10^{-3}}{230 \cdot 8,31} = 1,26 \frac{\text{kg}}{\text{m}^3}$$

Javob: D) $1,26 \frac{\text{kg}}{\text{m}^3}$.

33.56. Me'yordagi (normal) sharoitda havoning zichligi $1,29 \text{ kg/m}^3$. Havoning molyar massasini aniqlang (g/mol).

A) 29000

B) 0,29

C) 2,9

D) 29

Yechilishi: $M = \frac{\rho TP}{P}$

$$M = \frac{\rho TR}{P} = \frac{273 \cdot 8,31 \cdot 1,29}{1 \cdot 10^5} = 0,029 \frac{\text{kg}}{\text{mol}}$$

Javob: D) $29 \frac{\text{g}}{\text{mol}}$.

34-§. Gaz qonunlari

34.1. Izoxorik jarayonda ...

A) V va T o'zgaradi, p o'zgarmaydi. B) p va V o'zgaradi, T o'zgarmaydi. C) p va T o'zgaradi, V o'zgarmaydi. D) p , V va T o'zgaradi va tashqi muhit bilan issiqlik almashinish bo'lmaydi.

Izoxorik jarayonda bosim va harorat o'zgarib, hajm o'zgarmaydi.

Javob: C) p va T o'zgaradi, V o'zgarmaydi.

34.2. Silindrdagi gazning siqilish jarayoni qanday jarayon deb ataladi?

Gazning hajmi va haroratining o'zgarishi grafikda ko'rsatilgan.

A) izoxorik

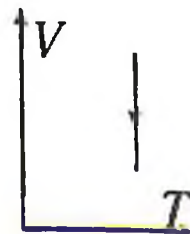
B) adiabatik

C) izobarik

D) izotermik



bu jarayonda harorat o'zgarmayapti.



Javob: D) izotermik.

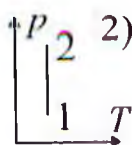
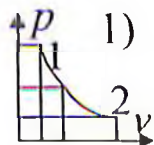
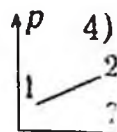
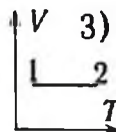
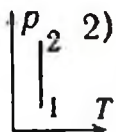
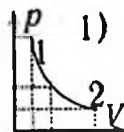
34.3. Quyida keltirilgan grafiklarning qaysilari izotermik jarayonni tasvirlaydi?

A) 1

B) 1; 3

C) 2; 3

D) 1; 2



Javob: D) 1; 2.

34.4. Boyle-Mariott ideal gaz uchun qanday bog'lanishni o'rgangan?

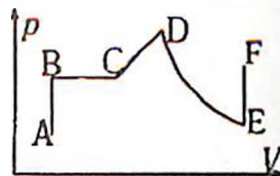
- A) $p \sim V$ B) $p \sim T$ C) $pT = \text{const}$ D) $p \sim 1/V$

Boyle-Mariott qonuni $p_1 V_1 = p_2 V_2$ ko'rinishda ifodalanadi.

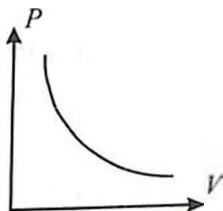
Javob: D) $p \sim 1/V$.

34.5. Ideal gaz A holatdan F holatga rasmda tasvirlangan oraliq holatlardan o'tadi. Bu oraliq holatlarning qaysi qismi izotermik jarayonga to'g'ri keladi?

- A) AB B) BC C) DE D) CD



Izotermik jarayon grafigi quyidagicha bo'ladi.



Bu berilgan grafikdagi DE oraliq bilan mos keladi.

Javob: C) DE.

34.6. Normal atmosfera bosimi sharoitida gaz 10 l hajmni egallaydi. Agar bosim 5 marta ortsa, gaz necha litr hajmni egallaydi?

- A) 10 B) 5 C) 4 D) 2

Berilgan:

$$T = \text{const}$$

$$V_1 = 10 \text{ l}$$

$$P_1 = 5 P_2$$

$$V_2 = ?$$

Yechilishi: Ideal gaz holat tenglamasini yozamiz:

$$P_1 V_1 = P_2 V_2, \quad V_2 \text{ hajmni topamiz } V_2 = \frac{P_1 V_1}{P_2} \quad V_2 = \frac{P_1 \cdot 10}{5 P_1} = 2 \text{ l}$$

Javob: D) 2 l.

34.7. Gaz 10^5 Pa bosimda 1 m³ hajmni egallaydi. Temperatura o'zgarmaganda, shu gaz 5 MPa bosimda qanday hajmni egallaydi (m³)?

- A) 0,02 B) 0,05 C) 0,2 D) 0,5

Berilgan:

$$T = \text{const}$$

$$V_1 = 1 \text{ m}^3$$

$$P_1 = 10^5 \text{ Pa}$$

$$P_2 = 5 \text{ MPa} = 5 \cdot 10^6 \text{ Pa}$$

$$V_2 = ?$$

Yechilishi: Ideal gaz holat tenglamasini yozamiz:

$$P_1 V_1 = P_2 V_2, \quad V_2 \text{ hajmni topamiz } V_2 = \frac{P_1 V_1}{P_2}$$

$$V_2 = \frac{10^5 \cdot 1}{5 \cdot 10^6} = 0,02 \text{ m}^3$$

Javob: A) 0,02 m³.

34.8. O'zgaras temperaturada gazning bosimi 400 mm simob ustunidan 1 atm. gacha o'zgarsa, uning hajmi necha marta o'zgaradi?

- A) 1,2 B) 1,4 C) 1,6 D) 1,9

Berilgan:

$$T = \text{const}$$

$$P_1 = 400 \text{ mm.sim.ust} = 53320 \text{ Pa}$$

$$P_2 = 1 \text{ atm} = 1 \cdot 10^5 \text{ Pa}$$

$$\frac{V_1}{V_2} = ?$$

Yechilishi: Ideal gaz holat tenglamasini yozamiz:

$$P_1 V_1 = P_2 V_2, \quad \frac{V_1}{V_2} = \frac{P_2}{P_1}$$

$$\frac{V_1}{V_2} = \frac{10^5}{53320} = 1,9$$

Javob: D) 1,9.

34.9. Agar porshen silindr balandligining 1/3 qismiga tushirilsa, undagi gazning bosimi necha marta ortadi? Temperatura o'zgaras.

- A) o'zgaraydi B) 3 C) 2 D) 1,5

Berilgan:

$$T = \text{const}$$

$$h_1 = h$$

$$h_2 = \frac{2}{3} h$$

$$\frac{P_2}{P_1} = ?$$

Yechilishi: Ideal gaz holat tenglamasini yozamiz:

$$P_1 V_1 = P_2 V_2, \quad V = S \cdot h, \quad \frac{P_2}{P_1} = \frac{V_1}{V_2} = \frac{S \cdot h_1}{S \cdot h_2}$$

$$\frac{P_2}{P_1} = \frac{S \cdot h}{S \cdot \frac{2}{3} h} = 1,5$$

Javob: D) 1,5.

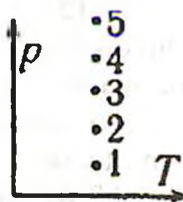
34.10. O'zgaras massali ideal gazning turli holatlari ko'rsatilgan. Shu holatlarning qaysi birida gaz hajmi eng katta?

- A) 1 B) 2 C) 3 D) 4

$$PV = \text{const}$$

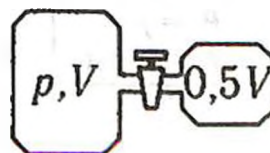
Agar bosim kichik bo'lsa, hajm eng katta bo'ladi. Demak, 1- nuqta.

Javob: A) 1.



34.11. 1-idishdagi gazning bosimi R, hajmi esa V ga teng. Agar kran ochilib (rasm) 1-idishga hajmi 0,5 V bo'lgan bo'sh idish ulansa, 1 -idishdagi gaz bosimi necha marta kamayadi? $T = \text{const}$.

- A) 3,5 B) 3 C) 2,5 D) 1,5



Berilgan:

$$T = \text{const}$$

$$P_1 = P$$

$$P_2 = P$$

$$V_1 = V$$

$$V_2 = 0,5V$$

$$\frac{P_2}{P_1} = ?$$

Yechilishi: Ideal gaz holat tenglamasini yozamiz:

$$P_1 V_1 = P_1' V_1', \quad V_1' = V_1 + V_2,$$

$$\frac{P_1'}{P_1} = \frac{V_1}{V_1'} = \frac{V}{V+0,5V} = \frac{2}{3} = \frac{1}{1,5} \quad P_1' = \frac{P_1}{1,5}$$

Javob: D) 1,5.

34.12. Chizmada ideal gazning izotermik kengayish jarayoni tasvirlangan. Bu jarayon uchun bosimning hajmga bog'lanish tenglamasini toping.

A) $p = \frac{2 \cdot 10^5}{V}$

B) $p = \frac{1,6 \cdot 10^5}{V}$

C) $p = 1,6 \cdot 10^5 V$

D) $p = 2 \cdot 10^5 V$

Berilgan:

$$T = \text{const}$$

$$V_1 = 0,1 \text{ m}^3$$

$$P_1 = 4 \cdot 10^5 \text{ Pa}$$

$$P_2 = 2 \cdot 10^5 \text{ Pa}$$

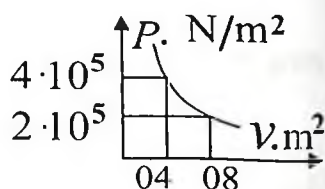
$$V_2 = 0,8 \text{ m}^3$$

$$P(V) = ?$$

Yechilishi: Ideal gaz holat tenglamasini yozamiz:

$$P_1 V_1 = P V, \quad P = \frac{P_1 V_1}{V}$$

$$P = \frac{4 \cdot 10^5 \cdot 0,4}{V} = \frac{1,6 \cdot 10^5}{V}$$



Javob: B) $p = \frac{1,6 \cdot 10^5}{V}$.

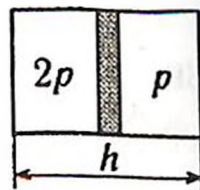
34.13. Uzunligi h bo'lgan yopiq silindrik idishni ishqalanishsiz siljiydigan porshen teng ikkiga ajratib turibdi. Porshen shu vaziyatda mahkamlab qo'yilgan holda, silindrning har ikkala yarmi ideal gaz bilan to'ldirildi. Bunda bir tomondagi bosim ikkinchi tomondagidan 2 marta katta bo'ldi. Agar porshen bo'shatilsa, u qanday masofaga siljiydi? Jarayonni izotermik deb hisoblang.

A) $h/6$

B) $h/4$

C) $2h/5$

D) $h/3$



Berilgan:

$$P_1 = 2P$$

$$P_2 = P$$

$$T = \text{const}$$

$$l = ?$$

Yechilishi: Ideal gaz holat tenglamasini yozamiz:

$$\left\{ \begin{aligned} P_1 \frac{V}{2} &= P_1' \left(\frac{V}{2} + S \cdot l \right) \\ P_2 \frac{V}{2} &= P_2' \left(\frac{V}{2} - S \cdot l \right) \end{aligned} \right.$$

$$P_1' = P_2'$$

$$\frac{P_1}{P_2} = \frac{\frac{V}{2} + S \cdot l}{\frac{V}{2} + S \cdot l}$$

$$2 = \frac{V+2Sl^2}{V-2Sl} \quad V = 6 \cdot S \cdot l$$

$$S \cdot h = 6 \cdot S \cdot l$$

$$l = \frac{h}{6}.$$

Javob: A) $h/6$.

34.14. Rasmdagi grafikning qaysi nuqtasi siklning minimal temperaturasiiga mos keladi?

- A) 5 B) 4 C) 3 D) 2

5- nuqtasi sababi, bosim va hajm 5- nuqtada kichik, surat kichik bo'lsa, maxraj ham kichik bo'ladi $\frac{PV}{T} = const$

Javob: A) 5.

34.15. PV diagrammadagi A va B nuqtalar massasi o'zgarmas bir gazning ikki holatiga mos keladi. Gazning bu holatlardagi temperaturalari va zichliklari orasidagi munosabatlarni toping.

A) $T_A < T_B, \rho_A > \rho_B$

B) $T_A < T_B, \rho_A < \rho_B$

C) $T_A > T_B, \rho_A < \rho_B$

D) $T_A > T_B, \rho_A > \rho_B$

Javob: A) $T_A < T_B, \rho_A > \rho_B$.

34.16. Quyidagi rasmda uchta izoterma tasvirlangan. Ularning qaysi biri eng yuqori temperaturaga mos keladi?

A) 1

B) 2

C) 3

D) hammasi bir xil

$$T_3 > T_2 > T_1$$

Javob: C) 3.

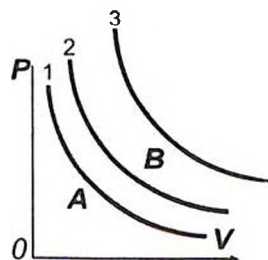
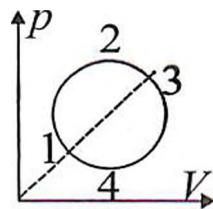
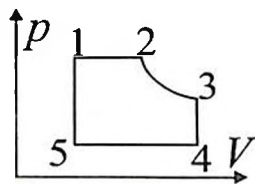
34.17. Izotermik jarayonda gaz bosimi 4 marta kamaydi. Bunda gaz molekularining konsentratsiyasi qanday o'zgaradi?

A) o'zgarmaydi

B) 4 marta kamayadi

C) 16 marta ortadi

D) 16 marta kamayadi



Berilgan:

$T = \text{const}$

$P_1 = 4P_2$

$\frac{n_2}{n_1} = ?$

Yechilishi:

$P = nkT$, formuladan foydalanamiz

$$\frac{n_2}{n_1} = \frac{P_2}{P_1} = \frac{P_2}{4P_2} = \frac{1}{4}$$

Javob: B) 4 marta kamayadi.

34.18. Gaz 6 l hajm dan 4 l hajmgacha izotermik siqildi. Bunda gazning bosimi 0,75 normal atmosferaga ortdi. Gazning dastlabki bosimini toping (Pa). $p_n = 10^5 \text{ Pa}$.

A) $1,9 \cdot 10^5$

B) $1,8 \cdot 10^5$

C) $1,6 \cdot 10^6$

D) $1,5 \cdot 10^5$

Berilgan:

$T = \text{const}$

$\Delta P = 0,75 \text{ atm}$

$V_1 = 6 \text{ l}$

$V_2 = 4 \text{ l}$

$P_1 = ?$

Yechilishi: Izotermik jarayon uchun ideal gaz holat tenglamasini yozamiz:

$P_1 V_1 = P_2 V_2$

$P_1 V_1 = (P_1 + \Delta P) V_2$

$$P_1 = \frac{\Delta P V_2}{V_1 - V_2} = \frac{0,75 \cdot 4}{6 - 4} = 1,5 \text{ atm} = 1,5 \cdot 10^5 \text{ Pa}$$

Javob: D) $1,5 \cdot 10^5$.

34.19. $V_1 = 20 \text{ l}$ hajmli ideal gaz $V_2 = 15 \text{ l}$ ga kelguncha izotermik ravishda siqildi. Bu holda bosim 6 kPa ortdi. Boshlang'ich bosim qanday (kPa) bo'lgan?

A) 15

B) 16

C) 17

D) 18

Berilgan:

$T = \text{const}$

$\Delta P = 6 \text{ kPa}$

$V_1 = 20 \text{ l}$

$V_2 = 15 \text{ l}$

$P_1 = ?$

Yechilishi: Ideal gaz holat tenglamasini yozamiz:

$P_1 V_1 = P_2 V_2$

$P_1 V_1 = (P_1 + \Delta P) V_2$

$$P_1 = \frac{\Delta P V_2}{V_1 - V_2} = \frac{6 \cdot 20}{20 - 15} = 18 \text{ Pa}$$

Javob: D) 18 kPa.

34.20. 3 m chuqurlikdagi suvda suzib yurgan havo pufakchasining hajmi 5 mm^3 ga teng.

Agar tashqi bosim normal atmosfera bosimiga teng bo'lsa, suv betiga qalqib chiqqan havo pufakchasining hajmi qanday (mm^3) bo'ladi?

A) 5,3

B) 6

C) 6,4

D) 7,1

Berilgan:

$$h = 3 \text{ m}$$

$$V_1 = 5 \text{ mm}^3 = 5 \cdot 10^{-9} \text{ m}^3$$

$$P = 1 \cdot 10^5 \text{ Pa}$$

$$\rho = 10^3 \frac{\text{kg}}{\text{m}^3}$$

$$V_2 = ?$$

Yechilishi: Ideal gaz holat tenglamasini yoza-miz:

$$P_1 V_1 = P_2 V_2$$

$$(P_0 + \rho gh) V_1 = P_0 V_2$$

$$V_2 = \frac{(P_0 + \rho gh) V_1}{P_0} \approx \frac{(1 \cdot 10^5 + 10^3 \cdot 10 \cdot 3) \cdot 5 \cdot 10^{-9}}{1 \cdot 10^5} \approx 6,5 \cdot 10^{-9} \text{ m}^3 \approx 6,5 \text{ mm}^3$$

Javob: C) 6,4.

34.21. 20 m chuqurlikdagi ko'lining pufakchasi suv sirtiga ko'tarilganda, necha marta ortadi?

A) 2

B) 3

C) 7

D) 10

Berilgan:

$$h = 20 \text{ m}$$

$$P = 1 \cdot 10^5 \text{ Pa}$$

$$\rho = 10^3 \frac{\text{kg}}{\text{m}^3}$$

$$\frac{V_2}{V_1} = ?$$

Yechilishi: Ideal gaz holat tenglamasini yozamiz:

$$P_1 V_1 = P_2 V_2$$

$$(P_0 + \rho gh) V_1 = P_0 V_2$$

$$\frac{V_2}{V_1} = \frac{P_0 + \rho gh}{P_0} = \frac{1 \cdot 10^5 + 10^3 \cdot 10 \cdot 20}{1 \cdot 10^5} = 3$$

Javob: B) 3.

34.22. Ko'lining tubidagi havo pufagi suv yuziga chiqqanda hajmi 3 marta ortgan bo'lsa, ko'lining chuqurligi necha metr?

A) 25

B) 20

C) 15

D) 10

Berilgan:

$$\frac{V_2}{V_1} = 3$$

$$P = 1 \cdot 10^5 \text{ Pa}$$

$$\rho = 10^3 \frac{\text{kg}}{\text{m}^3}$$

$$h = ?$$

Yechilishi: Ideal gaz holat tenglamasini yozamiz:

$$P_1 V_1 = P_2 V_2, \quad V_2 = 3 V_1$$

$$(P_0 + \rho gh) V_1 = P_0 V_2$$

$$h = \frac{P_0 V_2 - P_0 V_1}{\rho g V_1} = \frac{2 P_0}{\rho g} = \frac{2 \cdot 10^5}{10^3 \cdot 10} = 20 \text{ m}$$

Javob: B) 20 m.

34.23. Ideal gaz V_1 hajmdan V_2 gacha izotermik siqilganda, bosim Δp ga ortdi. Boshlang'ich p bosimni toping.

A) $p = \frac{V_1 - V_2}{V_2} \Delta p$ B) $p = \frac{V_1}{V_1 - V_2} \Delta p$

C) $p = \frac{V_1}{V_2} \Delta p$ D) $p = \frac{V_1 + V_2}{V_1 - V_2} \Delta p$

Berilgan:

$T = \text{const}$

ΔP

V_1

V_2

$p = ?$

Yechilishi: Izotermik jarayon uchun ideal gaz holat tenglamasini yozamiz:

$P_1 V_1 = P_2 V_2$

$P V_1 = (P + \Delta P) V_2$

$P = \frac{\Delta P V_2}{V_1 - V_2}$

Javob: D) $p = \frac{V_1 + V_2}{V_1 - V_2} \Delta p$.

34.24. Jo'mrak bilan tutashtirilgan ikkita idish bor. Jo'mrak yopiq. Birinchi idishdagi gazning bosimi p_1 va hajmi V_1 bo'lib, ikkinchi idishdagi gazning bosimi p_2 ga, hajmi esa V_2 ga teng. Jo'mrak ochib yuborilgandan so'ng, idishlarda qanday bosim yuzaga keladi? Temperatura o'zgarmas deb oling.

A) $\frac{(p_1 + p_2)(V_2 - V_1)}{V_1 + V_2}$ B) $\frac{(p_1 + p_2)(V_2 - V_1)}{V_1 + V_2}$

C) $\frac{p_1 V_1}{p_2 V_2} (p_1 + p_2)$ D) $\frac{p_1 V_1 + p_2 V_2}{V_1 + V_2}$

Berilgan:

$T = \text{const}$

P_1

P_2

V_1

V_2

$p = ?$

Yechilishi: Mendeleyev-Klaapeyron tenglamasini yozamiz:

$\frac{P_1 V_1}{T} = \nu_1 R$, $\frac{P_2 V_2}{T} = \nu_2 R$, jo'mrak ochib yuborilsa, modda

miqdori va idishlarning hajmi qo'shiladi. $\nu = \nu_1 + \nu_2$, $V = V_1 + V_2$,

$\nu = \frac{P_1 V_1 + P_2 V_2}{TR}$

$\frac{P(V_1 + V_2)}{T} = (\nu_1 + \nu_2)R$, $\frac{P(V_1 + V_2)}{T} = \frac{P_1 V_1 + P_2 V_2}{T} R$

$P = \frac{P_1 V_1 + P_2 V_2}{V_1 + V_2}$

Javob: D) $\frac{p_1 V_1 + p_2 V_2}{V_1 + V_2}$.

34.25. 1—2 va 2—3 izojarayonlar tenglamalarini ko'rsating.

A) $\frac{V_1}{T_1} = \frac{V_2}{T_2}, \frac{p_2}{T_2} = \frac{p_3}{T_3}$

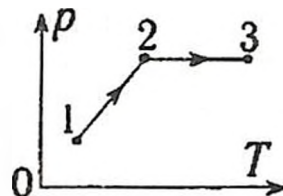
B) $\frac{p_1}{T_1} = \frac{p_2}{T_2}, \frac{V_2}{T_2} = \frac{V_3}{T_3}$

C) $\frac{p_1}{T_2} = \frac{p_2}{T_2}, p_1 V_1 = p_2 V_2$

D) $p_1 V_1 = p_2 V_2, \frac{V_2}{T_2} = \frac{V_3}{T_3}$

1—2 o'tish izoxorik jarayon, 2—3 o'tish izobarik jarayon.

Javob: B) $\frac{p_1}{T_1} = \frac{p_2}{T_2}, \frac{V_2}{T_2} = \frac{V_3}{T_3}$.



34.26. Quyidagi jumlaning mazmuniga mos ravishda gapni davom ettiring:
Izobarik jarayonda ...

A) P va V o'zgaradi, T o'zgarmaydi

B) p va T o'zgaradi, V o'zgarmaydi

C) V va T o'zgaradi, p o'zgarmaydi

D) p, V va T o'zgaradi va tashqi muhit bilan issiqlik almashinish bo'lmaydi.

Javob: C) V va T o'zgaradi, p o'zgarmaydi.

34.27. Gaz 1-holatdan 2-holatga o'tkazildi.

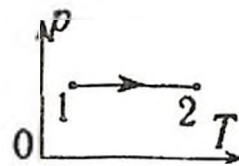
Bu qanday jarayon? Gazning zichligi qanday o'zgaradi?

A) izoxorik; kamayadi

B) izobarik; o'zgarmaydi

C) izobarik; ortadi

D) izobarik; kamayadi



1—2 o'tish izobarik jarayon bo'lyapti va bu jarayonda gazning hajmi ortyapti.
Natijada gaz siyraklashib, zichligi kamayyapti.

Javob. D) izobarik; kamayadi.

34.28. Silindrdagi gazning kengayish jarayoni qanday jarayon deb ataladi?

Hajm va bosimning o'zgarishi rasmda ko'rsatilgan.

A) izoxorik B) izobarik C) izotermik D) adiabatik

$P = \text{const}$ izobarik jarayon.

Javob: B) izobarik.



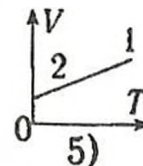
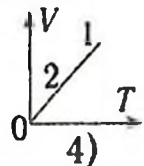
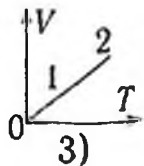
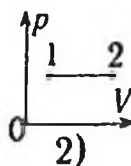
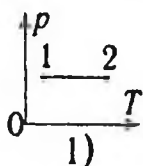
34.29. Quyidagi grafiklarning qaysilari izobaradan iborat?

A) 1, 2, 3, 4

B) 2, 4

C) 1, 2, 4, 5

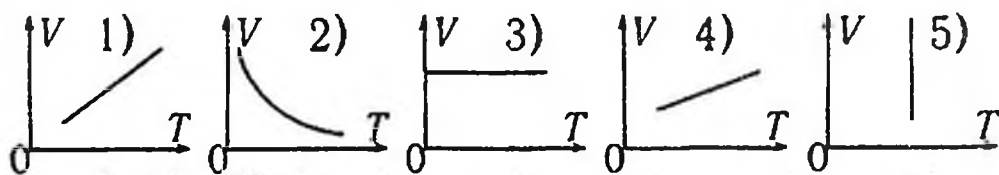
D) 1, 5



Javob: A) 1, 2, 3, 4.

34.30. Ideal gaz o'zgarmas bosim sharoitida isitilmoqda. Shu gaz hajmining o'zgarishi temperaturaga qanday bog'liq?

- A) 5 B) 4 C) 3 D) 1



Javob: D) 1.

34.31. Ideal gaz $P = \text{const}$ sharoitda $t_1 = 27^\circ\text{C}$ dan $t_2 = 227^\circ\text{C}$ gacha qizdirildi. V_1/V_2 nisbat qanday?

- A) 27/227 B) 227/27 C) 3/5 D) 5/3

Berilgan:

$$\begin{aligned} P &= \text{const} \\ T_1 &= 300 \text{ K} \\ T_2 &= 500 \text{ K} \end{aligned}$$

$$\frac{V_1}{V_2} = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, \quad \frac{V_1}{V_2} = \frac{T_1}{T_2}$$

$$\frac{V_1}{V_2} = \frac{300}{500} = \frac{3}{5}$$

Javob: C) 3/5.

34.32. 27°C da gazning hajmi 6 l bo'lgan. 77°C da shu gazning hajmi necha litr bo'ladi? ($P = \text{const}$)

- A) 8 B) 7 C) 10 D) 11

Berilgan:

$$\begin{aligned} P &= \text{const} \\ T_1 &= 300 \text{ K} \\ T_2 &= 350 \text{ K} \\ V_1 &= 6 \text{ l} \end{aligned}$$

$$\frac{V_1}{V_2} = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, \quad V_2 = \frac{V_1 T_2}{T_1}$$

$$V_2 = \frac{V_1 T_2}{T_1} = \frac{6 \cdot 350}{300} = 7 \text{ l}$$

Javob: B) 7.

34.33. Qanday temperaturali ($^\circ\text{C}$) gaz 1°C isitilganda hajmi 2 marta ortadi? ($p = \text{const.}$)

- A) 0 B) 1
C) $-272,15$ D) 272

Berilgan:

$$p = \text{const}$$

$$\Delta T = 1 \text{ K}$$

$$V_2 = 2V_1$$

$$T_1 = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, \quad T_1 = \frac{V_1 T_2}{V_2}, \quad T_2 = T_1 + \Delta T$$

$$T_1 = \frac{V_1 \Delta T}{V_2 - V_1} = 1 \text{ K}$$

$$t_1 = (T_1 - 273,15)^\circ \text{C} = -272,15^\circ \text{C}$$

Javob: C) $-272,15^\circ \text{C}$.

34.34. O'zgarmas bosimda gazni 0°C dan necha $^\circ \text{C}$ gacha isitganda uning hajmi 2 marta oshadi?

A) 100

B) 173

C) 200

D) 273

Berilgan:

$$P = \text{const}$$

$$T_1 = 273 \text{ K}$$

$$V_2 = 2V_1$$

$$T_2 = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, \quad T_2 = \frac{V_2 T_1}{V_1}$$

$$T_2 = \frac{V_2 T_1}{V_1} = \frac{2V_1 \cdot 273}{V_1} = 546 \text{ K}$$

$$t_2 = T_2 - 273 = 546 - 273 = 273^\circ \text{C}$$

Javob: D) 273°C .

34.35. Porshenli idishdagi gaz temperaturasi 10°C . Gazning hajmi 2 marta ortishi uchun uni izobarik ravishda necha gradusga isitish kerak?

A) 10

B) 20

C) 283

D) 373

Berilgan:

$$P = \text{const}$$

$$T_1 = 283 \text{ K}$$

$$V_2 = 2V_1$$

$$\Delta T = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, \quad \frac{V_1}{T_1} = \frac{V_2}{T_1 + \Delta T}$$

$$\Delta T = \frac{T_1(V_2 - V_1)}{V_1} = 283 \text{ K}$$

$$\Delta t = \Delta T - 273 = 283 - 273 = 10^\circ \text{C}$$

Javob: A) 10°C .

34.36. Gaz o'zgarmas bosimda 27°C dan 57°C gacha isitilganda, uning hajmi necha foizga ortadi?

A) 10

B) 15

C) 21

D) 30

Berilgan:

$$P = \text{const}$$

$$T_1 = 300 \text{ K}$$

$$T_2 = 330 \text{ K}$$

$$\frac{V_1}{V_2} = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, \frac{V_2}{V_1} = \frac{T_2}{T_1}$$

$$\frac{V_2}{V_1} = \frac{330}{300} = 1,1$$

Javob: A) 10% ga ortadi.

34.37. 27°C da ideal gazning hajmi 10 l edi. $P = \text{const}$ sharoitda 54°C ga isitilganda uning hajmi necha litr bo'ladi?

A) 5,9

B) 11,8

C) 20

D) 23,6

Berilgan:

$$P = \text{const}$$

$$T_1 = 300 \text{ K}$$

$$\Delta T = 54 \text{ K}$$

$$V_1 = 10 \text{ l}$$

$$V_2 = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, V_2 = \frac{V_1 T_2}{T_1}, T_2 = T_1 + \Delta T$$

$$V_2 = \frac{V_1(T_1 + \Delta T)}{T_1} = \frac{10 \cdot 354}{300} = 11,8 \text{ l}$$

Javob: B) 11,8.

34.38. Izobarik jarayonda ideal gaz hajmi ikki marta kamaygan bo'lsa, molekulalarning o'rtacha kinetik energiyasi qanday o'zgargan?

A) o'zgarmagan

B) 2 marta ortgan

C) 2 marta kamaygan

D) 4 marta ortgan

Berilgan:

$$P = \text{const}$$

$$V_1 = 2 V_2$$

$$\frac{E_{k2}}{E_{k1}} = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, \frac{T_2}{T_1} = \frac{V_1}{V_2}$$

$$E_k = \frac{3}{2} kT, \frac{E_{k2}}{E_{k1}} = \frac{\frac{3}{2} kT_2}{\frac{3}{2} kT_1} = \frac{V_1}{V_2} = \frac{1}{2}$$

Javob: C) 2 marta kamaygan.

34.39. Izobarik jarayon natijasida idishdagi gaz molekulalarining konsentratsiyasi 5 marta ortsa, molekulaning o'rtacha kinetik energiyasi qanday o'zgaradi?

A) 10 marta ortadi

B) 10 marta kamayadi

C) o'zgarmaydi

D) 5 marta kamayadi

Berilgan:

$$P = \text{const}$$

$$n_2 = 2n_1$$

$$\frac{E_{k2}}{E_{k1}} = ?$$

Yechilishi:

$$E_k = \frac{3P}{2n}, \frac{E_{k2}}{E_{k1}} = \frac{\frac{3P}{2n_2}}{\frac{3P}{2n_1}} = \frac{n_1}{n_2} = \frac{1}{2}$$

Javob: D) 5 marta kamayadi.

34.40. Hajmi $0,1 \text{ m}^3$ bo'lgan silindrik idish yuzi $0,01 \text{ m}^2$ bo'lgan porshen bilan yopilgan. Gazning absolut temperaturasi izobarik ravishda 4 marta pasaytirilganda porshen idish tubidan necha metr balandlikda bo'ladi?

A) 1,52

B) 2

C) 2,5

D) 3

Berilgan:

$$S = 0,01 \text{ m}^2$$

$$V_1 = 0,1 \text{ m}^3$$

$$P = \text{const}$$

$$T_1 = 4T_2$$

$$h_2 = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, V = S \cdot h$$

$$\frac{V_1}{T_1} = \frac{S \cdot h_2}{T_2}$$

$$h_2 = \frac{T_2 \cdot V_1}{S \cdot T_1} = \frac{T_2 \cdot 0,1}{0,01 \cdot 4T_2} = 2,5 \text{ m}$$

Javob: C) 2,5.

34.41. $0,1 \text{ m}^3$ hajmli idish yuzi $0,03 \text{ m}^2$ bo'lgan porshen bilan berkitilgan. Idishdagi absolut temperatura izobarik ravishda 4 marta kamaygan bo'lsa, porshen qanchaga pasaygan (m)?

A) 4

B) 1,5

C) 2

D) 2,5

Berilgan:

$$S = 0,03 \text{ m}^2$$

$$V_1 = 0,1 \text{ m}^3$$

$$P = \text{const}$$

$$T_1 = 4T_2$$

$$\Delta h = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, V = S \cdot h, h_1 = \frac{V_1}{S}$$

$$\frac{V_1}{T_1} = \frac{S \cdot h_2}{T_2}$$

$$h_2 = \frac{T_2 \cdot V_1}{S \cdot T_1}, \Delta h = h_1 - h_2 = \frac{V_1}{S} - \frac{T_2 \cdot V_1}{S \cdot T_1} = \frac{V_1}{S} \left(1 - \frac{T_2}{T_1}\right) =$$

$$\frac{0,1}{0,03} \cdot \frac{3}{4} = 2,5 \text{ m}$$

Javob: D) 2,5.

34.42. Agar qish kunlari issiqlik uzatish tarmog'ida yoqilgan gaz trubadan ko'tarilish jarayonida temperaturasi 819°C dan 0°C gacha pasaysa, uning hajmi qanday o'zgaradi?

- A) 4 marta kamayadi B) 3 marta ortadi
C) 3 marta kamayadi D) 4 marta ortadi

Berilgan:

$$\begin{aligned} P &= \text{const} \\ T_1 &= 1092 \text{ K} \\ T_2 &= 273 \text{ K} \end{aligned}$$

$$\frac{V_2}{V_1} = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, \frac{V_2}{V_1} = \frac{T_2}{T_1}$$

$$\frac{V_2}{V_1} = \frac{273}{1092} = \frac{1}{4}$$

Javob: A) 4 marta kamayadi.

34.43. Gazning temperaturasi 17°C va hajmi 25. Bosim o'zgarmaganda, hajm 12,5 ga teng bo'lishi uchun gazni necha kelvingacha sovitish kerak?

- A) 170 B) 150 C) 160 D) 145

Berilgan:

$$\begin{aligned} P &= \text{const} \\ T_1 &= 290 \text{ K} \\ V_1 &= 25 \text{ l} \\ V_2 &= 12,5 \text{ l} \end{aligned}$$

$$T_2 = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, T_2 = \frac{V_2 T_1}{V_1}$$

$$T_2 = \frac{V_2 T_1}{V_1} = \frac{12,5 \cdot 290}{25} = 145 \text{ K}$$

Javob: D) 145.

34.44. Gaz 27°C temperaturada 30 l hajmni egallagan. Bosimni o'zgartirmasdan, hajmni 5 l ga orttirish uchun gazning temperaturasini necha kelvinga ko'tarish kerak?

- A) 30 B) 50 C) 32 D) 300

Berilgan:

$$\begin{aligned} P &= \text{const} \\ T_1 &= 300 \text{ K} \\ V_1 &= 30 \text{ l} \\ V_2 &= 35 \text{ l} \end{aligned}$$

$$\Delta T = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, V_2 = \frac{V_1 T_2}{T_1}, T_2 = T_1 + \Delta T$$

$$\Delta T = \left(\frac{V_2}{V_1} - 1 \right) T_1 = 50 \text{ K}$$

Javob: B) 50.

34.45. Hajmi 250 sm^3 bo'lgan og'zi ochiq shisha kolba 127°C gacha qizdirildi va ochiq og'zi bilan suvga tushirildi. Natijada kolba 7°C temperaturagacha sovidi. Bunda kolbaning ichiga necha gramm suv kirgan?

- A) 125 B) 75 C) 50 D) 25

Berilgan:

$$P = \text{const}$$

$$V_1 = 250 \text{ sm}^3$$

$$T_1 = 400 \text{ K}$$

$$T_2 = 280 \text{ K}$$

$$\Delta m = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, \quad V_2 = \frac{V_1 T_2}{T_1}, \quad \Delta V = V_1 - V_2, \quad \Delta m = \rho \Delta V$$

$$\Delta m = \rho V_1 \left(1 - \frac{T_2}{T_1}\right) = 75 \text{ g}$$

Javob: B) 75.

34.46. Rasmdagi qaysi chiziqlar izobara chizig'i va qaysi birining bosimi katta?

A) 1 va 5, $p_1 > p_5$

B) 3 va 6, $p_3 > p_6$

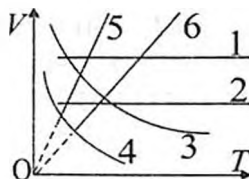
C) 2 va 4, $p_2 > p_4$

D) 5 va 6, $p_6 > p_5$

5 va 6

$$V_5 > V_6, \quad P_5 < P_6$$

Javob: D) 5 va 6 $P_6 > P_5$.



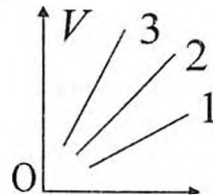
34.47. Kislorod, geliy va karbonat angidrid gazlari izobar isitilganda hajmlarining temperaturaga bog'lanish grafiklari $V-T$ diagrammada tasvirlangan. Gazlarning massalari va bosimlari bir xil. Qaysi grafik qaysi gazga mos keladi?

A) 1-He, 2-O₂, 3-CO₂

B) 1-O₂, 2-He, 3-O₂

C) 1-He, 2-CO₂, 3-O₂

D) 1-CO₂, 2-O₂, 3-He



Berilgan:

$$P = \text{const}$$

$$m = \text{const}$$

$$M = ?$$

Yechilishi:

$$\frac{PV}{T} = \frac{m}{M} R, \quad M = \frac{mRT}{PV}, \quad T = \text{const}, \quad V_1 < V_2 < V_3$$

$$\text{demak, } M_1 > M_2 > M_3$$

Javob: D) 1-CO₂, 2-O₂, 3-He.

34.48. Agar gaz 10 K ga izobarik isitilganda, hajmi 1,1 marta ortsa, u qanday temperaturada bo'lgan (K)?

A) 10

B) 100

C) 110

D) 150

Berilgan:

$$P = \text{const}$$

$$\Delta T = 10 \text{ K}$$

$$V_2 = 1,1 V_1$$

$$T_1 = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, V_2 = \frac{V_1 T_2}{T_1}, T_2 = T_1 + \Delta T$$

$$T_1 = \frac{\Delta T V_1}{V_2 - V_1} = 100 \text{ K}$$

Javob: B) 100K.

34.49. Gaz 30 K isitilganda uning hajmi 10% ortsa, shu gazning boshlang'ich harorati necha kelvin? (Gaz bosimi o'zgarmagan).

A) 273

B) 400

C) 600

D) 300

Berilgan:

$$P = \text{const}$$

$$\Delta T = 30 \text{ K}$$

$$V_2 = 1,1 V_1$$

$$T_1 = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, V_2 = \frac{V_1 T_2}{T_1}, T_2 = T_1 + \Delta T$$

$$T_1 = \frac{\Delta T V_1}{V_2 - V_1} = 300 \text{ K}$$

Javob: D) 300 K.

34.50. Gaz o'zgarmas bosimda 10 K ga isitilganda, o'zining boshlang'ich hajmiga nisbatan 3 % kengaydi. Gazning boshlang'ich harorati necha kelvin?

A) 300

B) 290

C) 320

D) 333

Berilgan:

$$P = \text{const}$$

$$\Delta T = 10 \text{ K}$$

$$V_2 = 1,03 V_1$$

$$T_1 = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, V_2 = \frac{V_1 T_2}{T_1}, T_2 = T_1 + \Delta T$$

$$T_1 = \frac{\Delta T V_1}{V_2 - V_1} = 333 \text{ K}$$

Javob: D) 333 K.

34.51. Agar ideal gaz 270 K ga izobarik ravishda sovitilganda, hajmi 4 marta kamaygan bo'lsa, uning dastlabki temperaturasi qanday ($^{\circ}\text{C}$) bo'lgan?

A) 60

B) 81

C) 87

D) 807

Berilgan:

$$P = \text{const}$$

$$\Delta T = 270 \text{ K}$$

$$V_1 = 4 V_2$$

$$T_1 = ?$$

Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, V_2 = \frac{V_1 T_2}{T_1}, T_2 = T_1 + \Delta T$$

$$T_1 = \frac{\Delta T V_1}{V_1 - V_2} = 360 \text{ K}, t_1 = T_1 - 273 = 360 - 273 = 87^{\circ}\text{C}$$

Javob: C) 87.

34.52. Ideal gaz temperaturasi izobarik ravishda 4°C ga oshirilganda, gaz hajmi dastlabki qiymatining $1/450$ qismi qadar oshdi. Gazning dastlabki temperaturasi toping ($^{\circ}\text{C}$).

- A) 1600 B) 1800 C) 1527 D) 1537

Berilgan:

$$P = \text{const}$$

$$\Delta T = 4 \text{ K}$$

$$V_2 = \frac{451}{450} V_1$$

$$T_1 = ?$$

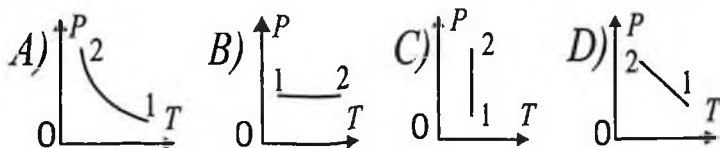
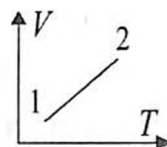
Yechilishi:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}, \quad V_2 = \frac{V_1 T_2}{T_1}, \quad T_2 = T_1 + \Delta T$$

$$T_1 = \frac{\Delta T V_1}{V_2 - V_1} = 1800 \text{ K}$$

Javob: B) 1800.

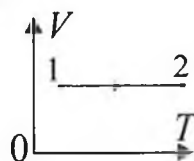
34.53. Rasmda ideal gaz holatining o'zgarish jarayoni grafigi $V-T$ koordinata o'qlarida tasvirlangan. $p-T$ koordinatalarda bu jarayonga qaysi grafik mos keladi?



$p = \text{const}$ doimiy bosimda kechuvchi jarayon izobarik jarayon deyiladi.

Javob: B)

34.54. Grafikda qanday jarayon ifodalangan? Gaz 1-holatdan 2-holatga o'tganda, uning zichligi qanday o'zgaradi?



- A) izoxorik; zichlik ortadi
B) izoxorik; zichlik o'zgarmaydi
C) izotermik; zichlik o'zgarmaydi
D) izoxorik; zichlik kamayadi

Izoxorik, zichlik o'zgarmaydi, chunki hajm va massa o'zgarmaydi.

Javob: B) izoxorik; zichlik o'zgarmaydi.

34.55. Qaysi tenglama izoxorik jarayonni ifodalaydi?

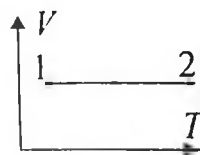
- A) $p = nkT$ B) $\frac{p}{T} = \text{const}$ C) $pV = \text{const}$ D) $pV = RT$

Javob: B) $\frac{p}{T} = \text{const}$.

34.56. Ideal gazning 1-holatdan 2-holatga o'tishiga mos keladigan tenglamani ko'rsating.

- A) $p_1 V_1 = p_2 V_2$ B) $\frac{p_1}{T_1} = \frac{p_2}{T_2}$
 C) $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ D) $\frac{p_1}{T_1} = \frac{V_2}{T_2}$

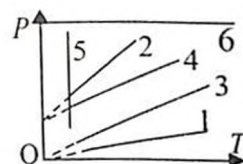
Javob: B) $\frac{p_1}{T_1} = \frac{p_2}{T_2}$.



34.57. Rasmdagi qaysi chiziqlar izoxora chizig'i va qaysi birining hajmi katta?

- A) 1, 3; $V_1 > V_3$ B) 4, 6; $V_6 > V_4$
 C) 2, 3; $V_2 > V_3$ D) 1, 5; $V_1 > V_5$

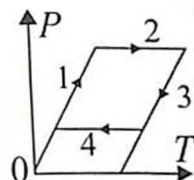
Javob: A) 1, 3; $V_1 > V_3$.



34.58. Rasmdagi diagrammada nechta izoxora bor va u qaysi qismlarga mos keladi?

- A) ikkita; 1 va 3 B) bitta; 1
 C) ikkita; 2 va 4 D) bitta

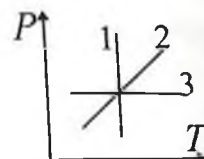
Javob: B) Bitta, 1.



34.59. Chizmadagi jarayonlar qaysi javobda to'g'ri aks etgan?

- A) 1—izobara, 2—izoterma, 3—izoxara
 B) 1—izoxara, 2—izoterma, 3—izobara
 C) 1—izoterma, 2—izoxara, 3—izobara
 D) 1—izoterma, 2—izobara, 3—izoxara

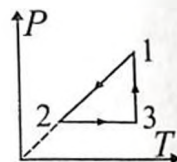
Javob: C) 1-izoterma, 2- izoxara, 3- izobara.



34.60. Diagrammasi rasmda ko'rsatilgan siklning 1-2, 2-3 va 3-1 qismlari qanday jarayonlarga mos keladi?

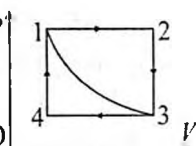
- A) izobarik, izoxorik, izotermik
 B) izotermik, izobarik, izoxorik
 C) izoxorik, izobarik, izotermik
 D) izoxorik, izotermik, izobarik

Javob: C) Izoxara, izobara, izoterma.



34.61. Chizmada besh jarayonning grafiklari keltirilgan. Ularning turlarini aniqlang.

- A) 1-2 va 3-4 izoxaralar, 2-3 va 4-1 izobaralar, 1-3 izoterma.
 B) 1-2 va 3-4 izobaralar, 2-3 va 4-1 izoxaralar, 1-3 izoterma.
 C) 1-2 va 3-4 izotermalar, 2-3 va 4-1 izobaralar, 1-3 izoxara.
 D) 1-2 va 3-4 izobaralar, 2-3 va 4-1 izotermalar, 1-3 o

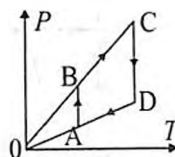


izoxora.

Javob: B) 1—2 va 3—4 izobaralar, 2—3, 4—1 izoxaralar, 1—3 izoterma.

34.62. Ushbu siklning qaysi nuqtasida hajm eng kichik qiyamatga ega?

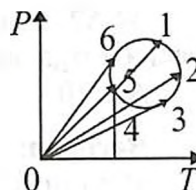
- A) D nuqtada
 B) C nuqtada
 C) B—C oraliqda
 D) A nuqtada



Javob: C) B — C oraliqda.

34.63. Chizmada keltirilgan nuqtalarning qaysi biriga mos keluvchi holatda gaz hajmi eng kichik bo'ladi?

- A) 2, 4
 B) 3
 C) 1, 5
 D) 6



Javob: D) 6-nuqtada.

34.64. Ballondagi geliy gazining harorati 127°C dan 527°C gacha ko'tarilsa, gaz zichligi qanday o'zgaradi? Ballon hajmining o'zgarishi hisobga olinmasin.

- A) 4 marta ortadi
 B) 4 marta kamayadi
 C) o'zgarmaydi
 D) 2 marta kamayadi

Berilgan:

$$T_1 = 400 \text{ K}$$

$$T_2 = 800 \text{ K}$$

$$\frac{\rho_2}{\rho_1} = ?$$

Yechilishi:

$m = \text{const}$, $V = \text{const}$ zichlik o'zgarmaydi, chunki hajm va massa o'zgarmaydi.

Javob: C) o'zgarmaydi.

34.65. Ballondagi kislorodning harorati 327°C dan 27°C gacha pasaysa, molekular konsentratsiyasi qanday o'zgaradi. Ballon hajmini o'zgarmas deb nisoblang.

- A) 4 marta ortadi
 B) 4 marta kamayadi
 C) o'zgarmaydi
 D) 2 marta kamayadi

Berilgan:

$$T_1 = 600 \text{ K}$$

$$T_2 = 300 \text{ K}$$

$$\frac{n_2}{n_1} = ?$$

Yechilishi:

O'zgarmaydi, chunki hajm va molekular soni o'zgarmaydi.

Javob: C) o'zgarmaydi.

34.66. Gaz o'zgarmas hajmda 27°C dan 77°C gacha isitilganda, uning bosimi necha marta o'zgaradi?

A) 1,5

B) 6/7

C) 27/57

D) 7/6

Berilgan:

$$V = \text{const}$$

$$T_1 = 300 \text{ K}$$

$$T_2 = 350 \text{ K}$$

$$\frac{P_2}{P_1} = ?$$

Yechilishi:

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}, \frac{P_2}{P_1} = \frac{T_2}{T_1}$$

$$\frac{P_2}{P_1} = \frac{T_2}{T_1} = \frac{7}{6}$$

Javob: D) 7/6.

34.67. Gaz o'zgarmas hajmda 27°C dan 147°C gacha isitilganda, uning bosimi necha foizga ortadi?

A) 20

B) 30

C) 35

D) 40

Berilgan:

$$V = \text{const}$$

$$T_1 = 300 \text{ K}$$

$$T_2 = 420 \text{ K}$$

$$a = ?$$

Yechilishi:

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}, \frac{P_2}{P_1} = \frac{T_2}{T_1}$$

$$\frac{P_2}{P_1} = \frac{T_2}{T_1} = 1,7, a = 40\%$$

Javob: D) 40 %.

34.68. Yopiq idishdagi temperaturasi 27°C bo'lgan ideal gazni 81°C gacha isitilganda, uning bosimi necha marta ortadi?

A) 1,18

B) 2

C) 3

D) 2,21

Berilgan:

$$V = \text{const}$$

$$T_1 = 300 \text{ K}$$

$$T_2 = 354 \text{ K}$$

$$\frac{P_2}{P_1} = ?$$

Yechilishi:

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}, \frac{P_2}{P_1} = \frac{T_2}{T_1}$$

$$\frac{P_2}{P_1} = \frac{T_2}{T_1} = 1,18$$

Javob: A) 1,18.

34.69. Agar ballondagi gaz 57°C temperaturada $1 \cdot 10^5$ bosimga ega bo'lsa, qanday temperaturada uning bosimi $3 \cdot 10^5$ Pa bo'ladi (°C)?

A) 990

B) 717

C) 648

D) 444

Berilgan:

$$\begin{array}{l}
 V = \text{const} \\
 T_1 = 330 \text{ K} \\
 P_1 = 1 \cdot 10^5 \text{ Pa} \\
 P_2 = 3 \cdot 10^5 \text{ Pa} \\
 \hline
 t_2 = ?
 \end{array}$$

Yechilishi:

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}, \frac{P_2}{P_1} = \frac{T_2}{T_1}$$

$$T_2 = \frac{P_2 T_1}{P_1} = 990 \text{ K}, t_2 = T_2 - 273 = 717^\circ\text{C}$$

Javob: B) 717°C .

34.70. Cho'g'lanma chiroq yonganda, temperaturasi 17°C dan 307°C gacha ko'tarilsa, uning ichidagi gaz bosimi necha marta ortadi?

- A) 2 B) 3 C) 4 D) 9

Berilgan:

$$\begin{array}{l}
 V = \text{const} \\
 T_1 = 290 \text{ K} \\
 T_2 = 580 \text{ K} \\
 \hline
 \frac{P_2}{P_1} = ?
 \end{array}$$

Yechilishi:

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}, \frac{P_2}{P_1} = \frac{T_2}{T_1}$$

$$\frac{P_2}{P_1} = \frac{T_2}{T_1} = 2$$

Javob: A) 2.

34.71. Berk idishdagi 27°C li gazning bosimi 2 marta oshishi uchun temperaturani necha gradus ko'tarish kerak?

- A) 27 B) 54 C) 300 D) 327

Berilgan:

$$\begin{array}{l}
 V = \text{const} \\
 T_1 = 300 \text{ K} \\
 P_2 = 2P_1 \\
 \hline
 \Delta t = ?
 \end{array}$$

Yechilishi:

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}, \frac{P_2}{P_1} = \frac{T_2}{T_1}$$

$$T_2 = \frac{P_2 T_1}{P_1} = 600 \text{ K}, \Delta t = T_2 - T_1 = 300^\circ\text{C}$$

Javob: C) 300°C .

34.72. Idishdagi gaz harorati 150°C ga izoxorik ravishda oshirilganda uning bosimi 1,5 marta ortsa, gazning dastlabki harorati qanday bo'lgan ($^\circ\text{C}$)?

- A) 1,5 B) 7 C) 27 D) 15

Berilgan:

$$\begin{array}{l}
 V = \text{const} \\
 \Delta T = 150 \text{ K} \\
 P_2 = 2P_1 \\
 \hline
 T_1 = ?
 \end{array}$$

Yechilishi:

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}, \frac{P_2}{P_1} = \frac{T_2}{T_1}, T_2 = T_1 + \Delta T$$

$$T_1 = \frac{\Delta T P_1}{P_2 - P_1} = 300 \text{ K}, t_1 = T_1 - 273 = 27^\circ\text{C}$$

Javob: C) 27°C .

VI BOB. SUYUQLIK VA QATTIQ JISM XOSSALARI

35-§. To'yingan bug'. Qaynash. Kritik temperatura

35.1. Nima sababli efir bilan ho'llanganida qo'limiz suv bilan ho'llanganidan ko'ra qattiqroq soviydi?

A) qaynash nuqtasi inson badani temperaturasiga yaqin bo'lgani uchun efir suvga nisbatan tez bug'lanadi

B) suvning qaynash temperaturasi efinikidan ancha katta

C) suvning qaynash temperaturasi efinikidan ancha kichik

D) efining solishtirma bug'lanish issiqligi suvnikidan ancha kichik

Javob: A) Qaynash nuqtasi inson badani temperaturasiga yaqin bo'lgani uchun efir suvga nisbatan tez bug'lanadi.

35.2. Germetik berk idishda faqat to'yingan suv bug'i bor (suv yo'q). Idish isitilganda bug' molekulalarining konsentratsiyasi qanday o'zgaradi?

A) o'zgarmaydi

B) kamayadi

C) ortadi

D) ortishi ham, kamayishi ham mumkin

Javob: A) O'zgarmaydi.

35.3. To'yingan bug' bosimining hajmga bog'lanishi qanday?

A) hajmga to'g'ri proporsional

B) hajmga bog'liq emas

C) hajmga teskari proporsional

D) hajmning kvadratiga proporsional

To'yingan bug'ning bosimi hajmga bog'liq emas.

Javob: B) hajmga bog'liq emas.

35.4. O'zgarmas temperaturada to'yingan bug'ning hajmi 4 marta kamaytirilsa, bosim qanday o'zgaradi?

A) 2 marta oshadi

B) 2 marta kamayadi

C) o'zgarmaydi

D) 4 marta kamayadi

To'yingan bug'ning bosimi hajmga bog'liq emas, demak, o'zgarmaydi.

Javob: C) o'zgarmaydi.

35.5. Bir xil idishdagi, bir xil hajmli, bir xil temperaturadagi suyuqlik, muhit temperaturalari teng bo'lganda, qayerda tezroq bug'lanadi?

- A) hamma joyda bir xil bug'lanadi B) tog'da
C) tekislikda D) shaxtada

Javob: A) Hamma joyda bir xil bug'lanadi.

35.6. To'yingan bug' bosimi uning qaysi parametrlariga bog'liq?

- A) temperaturasi va hajmiga B) temperaturasi va hajmiga bog'liq emas
C) hajmiga D) temperaturasiga

To'yingan bug'ning bosimi temperaturaga bog'liq.

Javob: D) temperaturasiga.

35.7. 1-yopiq idishda suv va suv bug'i bor, 2- idishda esa faqat to'yingan suv bug'i bor. Temperatura ortganda bu idishlardagi bosim qanday o'zgaradi?

- A) 2-sida ko'proq ortadi B) 1-sida ko'proq ortadi
C) ikkalasida bir xil ortadi D) 1-sida o'zgarmaydi, 2-sida ortadi

Agar temperatura oshirilsa, 1-idishdagi suv bug'lanadi va bug'ning konsentratsiyasi ortadi, bu esa suv bug'i bosimining oshishiga olib keladi.

Javob: B) 1-idishda ko'proq ortadi.

35.8. Germetik yopilgan idishda suv va suv bug'i bor. Idish isitilganda suv bug'i molekulalarining konsentratsiyasi qanday o'zgaradi?

- A) o'zgarmaydi B) kamayadi
C) ortadi D) 4 °C dan yuqori temperaturada kamayadi, 4°C dan past temperaturada ortadi

Agar temperatura oshirilsa, idishdagi suv bug'lanadi va bug'ning konsentratsiyasi ortadi.

Javob: C) ortadi.

35.9. Rasmda tasvirlangan bug' bosimining temperaturaga bog'lanish grafigidagi qaysi soha to'yingan bug' holatini ifodalaydi?

- A) 1 B) 2 C) 3 D) 4

2-sohada to'yingan bug' bosimi bilan temperaturasi orasidagi bog'lanishga to'g'ri keladi.

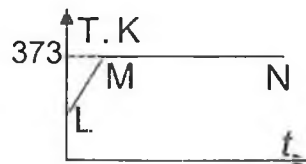
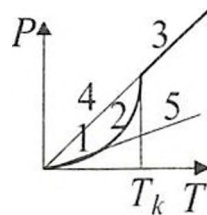
Javob: B) 2.

35.10. Rasmda suv temperaturasining vaqtga bog'lanish grafigi keltirilgan. Bu grafikning MN qismi qanday jarayonga mos keladi?

- A) kondensatsiya B) bug'lanish
C) isish D) sovish

Qaynashda suvning temperaturasi o'zgarmaydi.

Javob: B) bug'lanish.



35.11. Ochiq idishdagi suv 95°C da qaynadi. Buning sababi nima?

- A) havo bosimi normal atmosfera bosimidan katta
- B) suv sekin isitilgan
- C) suv tez isitilgan
- D) havo bosimi normal atmosfera bosimidan kichik

Normal atmosfera bosimida suv 100°C da qaynaydi. Havo bosimi normal atmosfera bosimidan kichik bo'lganda, suv qaynash temperaturasidan past temperaturada qaynaydi.

Javob: D) Havo bosimi normal atmosfera bosimidan kichik.

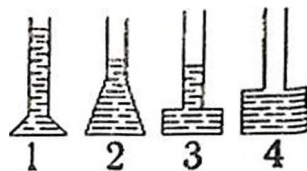
35.12. Berk idishdagi suv 105°C da qaynadi. Buning sababi nima?

- A) idishdagi bosim normal atmosfera bosimidan yuqori
- B) suv tez isitilgan
- C) idishdagi bosim normal atmosfera bosimidan past
- D) suv juda sekin isitilgan

Normal atmosfera bosimida suv 100°C da qaynaydi. Havo bosimi normal atmosfera bosimidan katta bo'lganda, suv qaynash temperaturasidan yuqori temperaturada qaynaydi.

Javob: A) Havo bosimi normal atmosfera bosimidan katta.

35.13. Rasmdagi asos yuzlari teng bo'lgan idishlarga bir xil miqdorda suyuqlik solingan. Bu idishlarni bir xil quvvatli elektr isitkichlar ustiga qo'yilsa, qaysi biridagi suv birinchi qaynaydi?



- A) barchasi barobar qaynaydi
- B) 1
- C) 2
- D) 4

Javob: D) 4.

35.14. Bug'lanishga teskari jarayon qaysi javobda berilgan?

- A) rekombinatsiya
- B) dissosiatsiya
- C) korroziya
- D) kondensatsiya

Bug'lanishga teskari jarayon kondensatsiya.

Javob: D) kondensatsiya.

35.15. Quyida bayon etilgan fikrlarning qaysi biri noto'g'ri?

- A) kondensatsiya – bug'lanishga teskari jarayon.
- B) suyuqlik molekulalarining gaz holatiga o'tish jarayoni bug'lanish deb ataladi.

C) havoning namligi va harorati bir xil bo'lganida, ho'l mato shabadali joyda shamol esmaydigan joydagiga qaraganda tezroq quriydi.

D) qaynayotgan suv ichida paydo bo'luvchi to'yingan bug' bosimi tashqi bosimga teng bo'ladi.

Qaynash suyuqlikning to'la hajm bo'yicha bug'lanish jarayonidir.

Javob: D)

35.16. Sublimatsiya nima?

- A) moddaning suyuq holatdan gaz holatiga o'tishi
- B) moddaning qattiq holatdan gaz holatiga o'tishi
- C) moddaning gaz holatidan suyuq holatga o'tishi
- D) moddaning qattiq holatdan suyuq holatga o'tishi

Sublimatsiya — moddaning qattiq holatdan gaz holatiga o'tishi.

Javob: B).

35.17. Berilgan jummalarning qaysi biri noto'g'ri?

- A) to'yingan bug' Mendeleyev-Klapeyron qonuniga bo'ysunadi
- B) kritik temperaturada suyuqlik bilan to'yingan bug' fizik xossalariining farqi yo'qoladi

C) temperatura qancha yuqori bo'lsa, to'yingan bug'ning elastikligi shuncha katta bo'ladi

D) o'zining suyuqligi bilan dinamik muvozanatda bo'lgan bug' to'yingan bug' deyiladi

To'yingan bug'ning elastikligi o'zgarmas temperaturada bug' egallab turgan hajmga bog'liq emas.

Javob: A).

35.18. Qanday holda gazlarni suyuqlikka aylantirish mumkin?

- A) bu gazning miqdoriga bog'liq
- B) har qanday temperaturada
- C) faqat kritik temperaturada
- D) kritik temperaturadan past temperaturalarda

Gazni siqish yo'li bilan kritik temperaturadan past temperaturalarda suyuqlikka aylantirish mumkin.

Javob: D).

35.19. Moddaga tegishli bo'lgan kritik temperaturadan yuqori temperaturalarda u qanday agregat holatda bo'ladi?

- A) gaz va suyuq
- B) suyuq
- C) gaz
- D) to'yingan bug'

Kritik temperaturadan yuqori temperaturada modda gaz holatida bo'ladi.

Javob: C) gaz.

36-§. Havoning namligi

36.1. Agar 1 m^3 havoda 15 g suv bug'i bo'lsa, uzunligi 70 m , eni 7 m va balandligi 4 m bo'lgan maktab koridorida necha kg suv bug'i bor?

- A) 25 B) $28,6$ C) $39,2$ D) $29,4$

Berilgan:

$$V = 1 \text{ m}^3$$

$$m = 15 \text{ g}$$

$$l = 70 \text{ m}$$

$$b = 4 \text{ m}$$

$$a = 7 \text{ m}$$

$$m_h = ?$$

Yechilishi: Xonaning hajmini quyidagi formuladan topamiz:

bunda xona parallelepiped shaklda deb hisoblab, formulasini yozamiz: $V = a \cdot b \cdot l = 70 \cdot 7 \cdot 4 = 1960 \text{ m}^3$ agar 1 m^3 hajmda 15 g massali suv bug'i bo'lsa, u holda, berilgan hajmda suv bug'i massasini aniqlaymiz: $1 \text{ m}^3 - 15 \text{ g}$.

$V = m_h$ proporsiyadan m_h ni topamiz: $m_h = \frac{15 \text{ g} \cdot V}{1 \text{ m}^3}$, endi hisoblaymiz:

$$m_h = \frac{15 \text{ g} \cdot 1960 \text{ m}^3}{1 \text{ m}^3} = 29400 \text{ g} = 29,4 \text{ kg}$$

Javob: D) $29,4 \text{ kg}$.

36.2. Ta'rifni davom ettiring: «Havodagi suv bug'ining parsial bosimi, bu ...»

- A) havoning barometr ko'rsatadigan bosimi
B) suv bugi to'yinganda hosil qiladigan bosim
C) suv bug'ining kritik temperaturadagi bosimi
D) boshqa gazlar bo'lmaganda suv bug'i hosil qiladigan bosim

Havodagi suv bug'ining parsial bosimi boshqa gazlar bo'lmaganda suv bug'i hosil qiladigan bosim.

Javob: D).

36.3. Gapni davom ettiring. Absolut namlik deb:

- 1) berilgan temperaturadagi to'yingan bug' bosimiga aytiladi;
- 2) berilgan temperaturada havodagi suv bug'ining parsial bosimiga aytiladi;
- 3) havodagi to'yingan bug' massasiga aytiladi;
- 4) 1 m^3 havodagi suv bug'larining miqdoriga aytiladi;
- 5) havoda bo'lgan suv bug'ining zichligi bilan o'lchanadigan kattalikka aytiladi.

- A) $1, 5$ B) $2, 4, 5$ C) $2, 3$ D) $4, 5$

Javob: D) $4, 5$.

36.4. Birliklarning xalqaro sistemasida havoning mutlaq (absolut) namligi qanday birlikda o'lchanadi?

- A) kg/m^3 B) o'lchamsiz C) K D) %

$$[\rho] = 1 \frac{\text{kg}}{\text{m}^3} \text{ — absolut namlik.}$$

Javob: A) kg/m^3 .

36.5. Ichida namlikni yutuvchi modda bo'lgan naycha orqali 10 l havo o'tkazilganda, havoning absolut namligi 30 g/m³ ekanligi aniqlangan. Bunda naychanning massasi qanchaga ortgan?

- A) 3 mg B) 30 mg C) 3 g D) 0,3 g

Berilgan:

$$V = 10 \text{ l} = 0,01 \text{ m}^3$$

$$\rho = 30 \frac{\text{g}}{\text{m}^3}$$

$$\Delta m = ?$$

Yechilishi:

$\Delta m = \rho \cdot V$ formuladan topamiz:

$$\Delta m = 30 \cdot 0,01 = 0,3 \text{ g}$$

Javob: D) 0,3 g.

36.6. Ichida namlikni yutuvchi modda bo'lgan naycha orqali 20 l havo o'tkazilgan. Bunda naychanning massasi 400 mg ortdi. Havoning absolut namligi qanday (g/m³)?

- A) 40 B) 30 C) 20 D) 50

Berilgan:

$$V = 20 \text{ l} = 0,02 \text{ m}^3$$

$$\Delta m = 400 \text{ mg} = 0,4 \text{ g}$$

$$\rho = ?$$

Yechilishi:

$\Delta m = \rho \cdot V$ formuladan topamiz

$$\rho = \frac{\Delta m}{V} = \frac{0,4}{0,02} = 20 \frac{\text{g}}{\text{m}^3}$$

Javob: C) $20 \frac{\text{g}}{\text{m}^3}$.

36.7. Harorat ortishi bilan havoning absolut va nisbiy namliklari qanday o'zgaradi?

- A) ikkala namlik ham o'zgarmaydi
B) absolut namlik ortadi, nisbiy namlik kamayadi
C) abs. namlik o'zgarmaydi, nisbiy namlik kamayadi
D) ikkala namlik ham kamayadi

Harorat ortishi bilan absolut namlik o'zgarmaydi, nisbiy namlik kamayadi.

Javob: C).

36.8. Suv bug'ining 19°C dagi parsial bosimi 1,1 kPa bo'lsa, havoning nisbiy namligi qanday (%)? 19°C da to'yingan bug' bosimi 2,2 kPa.

- A) 30 B) 40 C) 50 D) 60

Berilgan:

$$P = 1,1 \text{ kPa}$$

$$P_0 = 2,2 \text{ kPa}$$

$$\varphi = ?$$

Yechilishi: $\varphi = \frac{P}{P_0} \cdot 100\%$ formuladan topamiz:

$$\varphi = \frac{1,1}{2,2} \cdot 100\% = 50\%$$

Javob: C) 50.

36.9. 20°C da 5 m³ havoda 50 g suv bug'i bo'lsa, havoning nisbiy namligi necha foiz bo'ladi? 20°C temperaturada to'yingan suv bug'ining zichligi 17,3 g/m³.

- A) 50 B) 58 C) 62 D) 65

Berilgan:

$$V = 5 \text{ m}^3$$

$$m = 50 \text{ g}$$

$$\rho_0 = 17,3 \frac{\text{g}}{\text{m}^3}$$

$$\varphi = ?$$

Yechilishi: $\varphi = \frac{\rho}{\rho_0} \cdot 100\%$ $m = \rho \cdot V$ formuladan ρ ni

topamiz, $\rho = \frac{m}{V}$ $\varphi = \frac{\frac{m}{V}}{\rho_0} \cdot 100\% = \frac{m}{V\rho_0} \cdot 100\%$, endi hisoblaymiz:

$$\varphi = \frac{50}{5 \cdot 17,3} \cdot 100\% = 58\%$$

Javob: B) 58 %.

36.10. Havoning nisbiy namligi 50%, temperaturasi 16°C bo'lsa, absolut namlik qanday bo'ladi (kg/m³)? 16°C temperaturada to'yingan bug' zichligi $\rho = 13,6 \cdot 10^{-3} \text{ kg/m}^3$.

- A) $4,8 \cdot 10^{-3}$ B) $6,8 \cdot 10^{-4}$ C) $6,8 \cdot 10^{-3}$ D) $1,8 \cdot 10^{-2}$

Berilgan:

$$\varphi = 50 \%$$

$$\rho_0 = 13,6 \cdot 10^{-3} \frac{\text{kg}}{\text{m}^3}$$

$$\rho = ?$$

Yechilishi: $\varphi = \frac{\rho}{\rho_0} \cdot 100\%$ formuladan ρ ni topamiz,

$$\rho = \frac{\varphi \rho_0}{100\%} \text{ hisoblaymiz:}$$

$$\rho = \frac{50\% \cdot 13,6 \cdot 10^{-3}}{100\%} = 6,8 \cdot 10^{-3} \frac{\text{kg}}{\text{m}^3}$$

Javob: C) $6,8 \cdot 10^{-3} \frac{\text{kg}}{\text{m}^3}$.

36.11. Shudring nuqtasi nima?

- A) suv bug'i to'yinishga erishadigan nisbiy namlik
B) suv bug'i to'yinishga erishadigan bosim
C) berilgan bosimdagi suvning qaynash temperaturasi
D) suv bug'i to'yinadigan temperatura

Shudring nuqtasi — suv bug'i to'yinishga erishadigan temperatura.

Javob: D).

36.12. Quyida keltirilgan fikrlarning qaysi biri noto'g'ri:

- 1) shudring nuqtasida havoning nisbiy namligi 100% oshadi;
- 2) suv bug'i to'yinadigan holdagi temperatura shudring nuqtasi deb ataladi;
- 3) havo shudring nuqtasigacha sovisa, bug' kondensatsiyalana boshlaydi: tuman hosil bo'ladi, shudring tushadi;

4) shudring nuqtasida suv bug'larining elastikligi to'yingan bug' elastikligiga teng.

- A) 4 B) 1 C) 2 D) 3

Shudring nuqtasida havoning nisbiy namligi 100% bo'ladi.

Javob: B) 1.

36.13. Hajmi 10 sm^3 li idishda parsial bosimi 100 kPa bo'lgan suv bug'i bor. Agar to'yingan suv bug'ining 100°C haroratdagi bosimi 105 Pa bo'lsa, idishdagi havo uchun shudring nuqtasi qanday bo'ladi (K)?

- A) 10 B) 100 C) 273 D) 373

Berilgan:

$$t = 100^\circ\text{C}$$

$$T = ?$$

Yechilishi: $T = t + 273$

$$T = 100 + 273 = 373 \text{ K}$$

Javob: D) 373.

36.14. Shudring nuqtasi quyida sanab o'tilgan asboblarning qaysi biri yordamida aniqlanadi?

- A) areometr B) manometr
C) barometr D) gigrometr

Shudring nuqtasi gigrometr yordamida aniqlanadi.

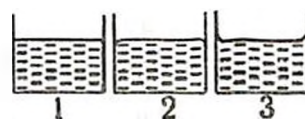
Javob: D) gigrometr.

37-§. Kapillarlik hodisalari. Sirt taranglik

37.1. Idishga suyuqlik quyildi. Agar suyuqlik molekullari orasidagi tortishish kuchi suyuqlik molekullari bilan qattiq jism (idish) molekullari orasidagi tortishish kuchidan katta bo'lsa, suyuqlik sirtining shakli qanday bo'ladi?

- A) faqat 2 B) faqat 1 C) faqat 3
D) 1; 3

Javob: A) faqat 2.



37.2. Sovun pufagining radiusini 1 sm dan 6 sm gacha puflab shishirish uchun necha mJ ish bajarish kerak? Sovun eritmasining sirt taranglik koeffitsiyenti 45 mN/m ga teng.

- A) 4,5 B) 4,0 C) 3,6 D) 1,89

Berilgan:

$$R_1 = 1 \text{ sm} = 0,01 \text{ m}$$

$$R_2 = 6 \text{ sm} = 0,06 \text{ m}$$

$$\sigma = 45 \frac{\text{mN}}{\text{m}} = 45 \cdot 10^{-3} \frac{\text{N}}{\text{m}}$$

$$A = ?$$

Yechilishi: Birinchi holatda sirt energiyasi

$E_1 = 2\sigma S_1$, ikkinchi holatda sirt energiyasi $E_2 = 2\sigma S_2$, bajarilgan ish energiyaning o'zgarishiga teng, yuza esa $S = 4\pi R^2$ ga teng.

$$A = E_2 - E_1 = 2\sigma S_1 - 2\sigma S_2 = 2\sigma(S_1 - S_2) = 8\sigma\pi$$

$(R_2^2 - R_1^2)$ endi hisoblaymiz:

$$A = 8 \cdot 45 \cdot 10^{-3} \cdot 3,14(0,06^2 - 0,01^2) = 4 \cdot 10^{-3} \text{ J} = 4 \text{ mJ}$$

Javob: B) 4 mJ.

37.3. Sovun pufagining yuzasini 1 sm² dan 3 sm² gacha oshirish uchun necha joul ish bajarish kerak? Sovun eritmasining sirt taranglik koeffitsiyenti $5 \cdot 10^{-2} \text{ N/m}$.

A) $1 \cdot 10^{-6}$

B) $5 \cdot 10^{-6}$

C) $2 \cdot 10^{-5}$

D) $5 \cdot 10^{-5}$

Berilgan:

$$S_1 = 1 \text{ sm}^2 = 1 \cdot 10^{-4} \text{ m}^2$$

$$S_2 = 3 \text{ sm}^2 = 3 \cdot 10^{-4} \text{ m}^2$$

$$\sigma = 5 \cdot 10^{-2} \frac{\text{N}}{\text{m}}$$

$$A = ?$$

Yechilishi: $A = 2\sigma(S_1 - S_2)$ formuladan hisoblaymiz:

$$A = 2 \cdot 5 \cdot 10^{-2} \cdot (3 \cdot 10^{-4} - 1 \cdot 10^{-4}) = 2 \cdot 5 \cdot 10^{-2} \cdot 2 \cdot 10^{-4}$$

Javob: C) $2 \cdot 10^{-5}$.

37.4. Shar shaklidagi sakkizta bir xil haroratli simob tomchilari birlashib yagona tomchi hosil qildi. Bunda harorat qanday va nima sababli o'zgaradi?

A) o'zgarmaydi, chunki suyuqlik sirti energiyasi o'zgarmaydi

B) pasayadi, chunki sirt energiyasi kamayadi

C) pasayadi, chunki sirt energiyasi ortadi

D) ko'tariladi, chunki sirt energiyasi kamayadi

Ko'tariladi, chunki sirt energiyasi kamayadi.

Javob: D.

37.5. Radiusi 5 sm li sim halqa sovun eritmasiga gorizontal botirildi. Halqaning massasi 7,5 g, sovun eritmasining sirt taranglik koeffitsiyenti 40 mN/m bo'lsa, necha nyuton kuch yordamida halqani eritmadan ajratib olish mumkin?

A) 0,025

B) 0,075

C) 0,1

D) 0,05

Berilgan:

$$R = 5 \text{ sm} = 5 \cdot 10^{-2} \text{ m}$$

$$m = 7,5 \text{ g} = 7,5 \cdot 10^{-3} \text{ kg}$$

Yechilishi:

Halqani tortib olish uchun $F = F_{st} + mg$ teng kuch kerak, $F = 2\sigma l + mg = 2\sigma \cdot 2\pi R + mg = 4\pi\sigma R + mg$

$$\sigma = 40 \frac{mN}{m} = 4 \cdot 10^{-2} \frac{N}{m}$$

$$F = ?$$

$$F = 4 \cdot 3,14 \cdot 4 \cdot 10^{-2} \cdot 5 \cdot 10^{-2} + 7,5 \cdot 10^{-3} \cdot 10 = 0,1 \text{ N}$$

Javob: C) 0,1 N.

37.6. Diametri 1 mm bo'lgan vertikal shisha naychadan suv tomchisi uzildi. Tomchining og'irligi qanday (mN)? Suvning sirt taranglik koeffitsiyenti 73 mN/m.

A) 0,11

B) 0,23

C) 0,32

D) 0,41

Berilgan:

$$d = 1 \text{ mm} = 1 \cdot 10^{-3} \text{ m}$$

$$\sigma = 73 \frac{mN}{m} = 73 \cdot 10^{-3} \frac{N}{m}$$

$$P = ?$$

Yechilishi:

Agar tomchining og'irligi sirt taranglik kuchiga teng bo'lsa, tomchi uziladi. $P = F_{st}$

$$P = \sigma l = \sigma \cdot \pi d$$

$$P = 3,14 \cdot 73 \cdot 10^{-3} \cdot 1 \cdot 10^{-3} = 0,23 mN$$

Javob: B) 0,23 mN.

37.7. Teshigining diametri 1 mm bo'lgan tomizg'ichdan tomadigan suv tomchisining massasini aniqlang (mg). Suvning sirt taranglik koeffitsiyenti 73 mN/m, $\pi = 3$, $g = 10 \text{ m/s}^2$ deb hisoblang.

A) 3,19

B) 10

C) 20

D) 21,9

Berilgan:

$$d = 1 \text{ mm} = 1 \cdot 10^{-3} \text{ m}$$

$$\sigma = 73 \frac{mN}{m} = 73 \cdot 10^{-3} \frac{N}{m}$$

Yechilishi:

Tomchi og'irligi sirt taranglik kuchiga teng bo'lganda uziladi. $P = F_{st}$, $mg = \sigma l = \sigma \cdot \pi d$,

$$m = \frac{\sigma \cdot \pi \cdot d}{g}$$

$$m = \frac{3 \cdot 73 \cdot 10^{-3} \cdot 1 \cdot 10^{-3}}{10} = 21,9 \cdot 10^{-6} \text{ kg} = 21,9 \text{ mg}$$

Javob: D) 21,9.

37.8. Agar suv diametri 1,8 mm bo'lgan naychadan tomchilayotgan bo'lsa, 1 sm³ suvda necha tomchi bo'ladi? Suvning sirt taranglik koeffitsiyenti 0,072 N.

A) 49

B) 36

C) 30

D) 25

Berilgan:

$$d = 1,8 \text{ mm} = 1,8 \cdot 10^{-3} \text{ m}$$

$$\sigma = 72 \frac{mN}{m} = 72 \cdot 10^{-3} \frac{N}{m}$$

$$V = 1 \text{ sm}^3 = 1 \cdot 10^{-6} \text{ m}^3$$

Yechilishi:

Tomchi og'irligi sirt taranglik kuchiga teng bo'lganda uzilsa: $P = F_{st}$, $mg = \sigma l = \sigma \cdot \pi d$,

$m = \frac{\sigma \cdot \pi \cdot d}{g}$ bo'ladi. Bundan V hajmli suvning massasini topamiz: $\Delta m = \rho \cdot V$,

$$\rho = 1000 \frac{\text{kg}}{\text{m}^3}$$

$$N = ?$$

$$N = \frac{\Delta m}{m} = \frac{\rho \cdot V}{\frac{\sigma \cdot \pi d}{g}} = \frac{\rho \cdot V \cdot g}{\sigma \cdot \pi d}$$

$$N = \frac{1000 \cdot 1 \cdot 10^{-6} \cdot 10}{3,14 \cdot 72 \cdot 10^{-3} \cdot 1,8 \cdot 10^{-3}} = 25 \text{ ta}$$

Javob: D) 25 ta.

37.9. Teshigining diametri 2 mm bo'lgan tomizg'ichda 219 sm³ suv bor. Suvning sirt taranglik koeffitsiyenti 73 mN/m. Tomizg'ichdan hammasi bo'lib nechta tomchi tomadi? $\pi = 3$, $g = 10 \text{ m/s}^2$ deb hisoblang.

- A) 2180 B) 4000 C) 5000 D) 6000

Berilgan:

$$d = 2 \text{ mm} = 2 \cdot 10^{-3} \text{ m}$$

$$\sigma = 73 \frac{\text{mN}}{\text{m}} = 73 \cdot 10^{-3} \frac{\text{N}}{\text{m}}$$

$$V = 219 \text{ sm}^3 = 2,19 \cdot 10^{-4} \text{ m}^3$$

$$\rho = 1000 \frac{\text{kg}}{\text{m}^3}$$

$$N = ?$$

Yechilishi:

Tomchi og'irligi sirt taranglik kuchiga teng bo'lganda uziladi. $P = F_{\text{st}}$, $mg = \sigma l = \sigma \cdot \pi d$, $m = \frac{\sigma \cdot \pi d}{g}$, keyin V hajmli suvning massasini topamiz $\Delta m = \rho \cdot V$

$$N = \frac{\Delta m}{m} = \frac{\rho \cdot V}{\frac{\sigma \cdot \pi d}{g}} = \frac{\rho \cdot V \cdot g}{\sigma \cdot \pi d}$$

$$N = \frac{1000 \cdot 2,19 \cdot 10^{-4} \cdot 10}{3,73 \cdot 10^{-3} \cdot 2 \cdot 10^{-3}} = 5000 \text{ ta}$$

Javob: C) 5000 ta.

37.10. Diametri 0,73 mm li kapillar nayda suv necha sm balandlikka ko'tariladi? Suvning sirt taranglik koeffitsiyenti $\sigma = 73 \text{ mN/m}$.

- A) 1 B) 2 C) 4 D) 8

Berilgan:

$$d = 0,73 \text{ mm} = 7,3 \cdot 10^{-4} \text{ m}$$

$$\sigma = 73 \frac{\text{mN}}{\text{m}} = 73 \cdot 10^{-3} \frac{\text{N}}{\text{m}}$$

$$\rho = 1000 \frac{\text{kg}}{\text{m}^3}$$

$$h = ?$$

Yechilishi:

Og'irlik kuchi sirt taranglik kuchiga teng bo'ladi. $P = F_{\text{st}}$, $mg = \sigma l$, $\rho \cdot V \cdot g = \sigma \cdot \pi d$, $\rho \cdot g \cdot S \cdot h = \sigma \cdot 2\pi R$, $\rho \cdot \pi R^2 \cdot h \cdot g = \sigma \cdot 2\pi R$,

$$h = \frac{4\sigma}{\rho g d}$$

$$h = \frac{4 \cdot 73 \cdot 10^{-3}}{1000 \cdot 10 \cdot 7,3 \cdot 10^{-4}} = 0,04 \text{ m} = 4 \text{ sm}$$

Javob: C) 4 sm.

37.11. Yer sirtida joylashgan kapillar naychada suv 24 mm ga ko'tariladi. Oyda erkin tushish tezlanishi Yerdagidan 6 marta kichik. Oyda shu naychadagi suv qanday (mm) balandlikka ko'tariladi?

A) 134

B) 35

C) 144

D) 102

Berilgan:

$$h_{yer} = 24 \text{ mm}$$

$$g_{oy} = \frac{g_{yer}}{6}$$

$$h_{oy} = ?$$

Yechilishi:

$h = \frac{2\sigma}{\rho g R}$ formuladan Yer va Oyda suv qanday balandlikka ko'tarilishini yozamiz, $h_{yer} = \frac{2\sigma}{\rho g_{yer} R}$, nisbatlarini topamiz:

$$\frac{h_{oy}}{h_{yer}} = \frac{\frac{2\sigma}{\rho g_{oy} R}}{\frac{2\sigma}{\rho g_{yer} R}} = \frac{g_{yer}}{g_{oy}}, \quad h_{oy} = \frac{h_{yer} \cdot g_{yer}}{g_{oy}}$$

$h_{oy} = \frac{h_{yer} \cdot g_{yer}}{\frac{g_{yer}}{6}} = 6h_{yer}$. Demak, Oyda kapillar naydagi suv yerdagidan ko'ra 6 marta ko'proq balandlikka ko'tarilar ekan: $h_{oy} = 6 \cdot 24 = 144 \text{ mm}$.

Javob: C) 144 mm.

37.12. Ichki diametri 1 va 2 mm li ikkita kapillardagi suv sathlarining farqini aniqlang (mm). Suvning sirt taranglik koeffitsiyenti 72 mN/m.

A) 0

B) 14,4

C) 28,8

D) 43,2

Berilgan:

$$d_1 = 1 \text{ mm} = 1 \cdot 10^{-3} \text{ m}$$

$$d_2 = 2 \text{ mm} = 2 \cdot 10^{-3} \text{ m}$$

$$\sigma = 72 \frac{\text{mN}}{\text{m}} = 72 \cdot 10^{-3}$$

$$\rho = 1000 \frac{\text{kg}}{\text{m}^3}$$

$$\Delta h = ?$$

Yechilishi:

$h = \frac{4\sigma}{\rho g d}$ formuladan 1- va 2- nay uchun

yozamiz, $h_1 = \frac{4\sigma}{\rho g d_1}$

$$h_2 = \frac{4\sigma}{\rho g d_2}$$

$$\begin{aligned} \Delta h &= h_1 - h_2 = \frac{4\sigma}{\rho g d_1} - \frac{4\sigma}{\rho g d_2} = \frac{4\sigma}{\rho g} \left(\frac{1}{d_1} - \frac{1}{d_2} \right) = \\ &= \frac{4\sigma}{\rho g} \cdot \frac{d_2 - d_1}{d_1 \cdot d_2} \end{aligned}$$

$$\Delta h = \frac{4 \cdot 72 \cdot 10^{-3}}{1000 \cdot 10} \cdot \frac{2 \cdot 10^{-3} - 1 \cdot 10^{-3}}{1 \cdot 10^{-3} \cdot 2 \cdot 10^{-3}} = 14,4 \cdot 10^{-3} \text{ m} = 14,4 \text{ mm}$$

Javob: B) 14,4 mm.

37.13. Diametri 0,3 mm bo'lgan kapillarda kerosin 20 mm ko'tarildi. Kerosinning sirt taranglik koeffitsiyentini aniqlang (mN/m). $\rho = 0,8 \text{ g/sm}^3$.

- A) 8 B) 10 C) 12 D) 13

Berilgan:

$$d = 0,3 \text{ mm} = 0,3 \cdot 10^{-3} \text{ m}$$

$$\rho = 0,8 \frac{\text{g}}{\text{sm}^3} = 800 \frac{\text{kg}}{\text{m}^3}$$

$$h = 20 \text{ mm} = 2 \cdot 10^{-2} \text{ m}$$

$$\sigma = ?$$

Yechilishi:

$h = \frac{4\sigma}{\rho g d}$ formuladan sirt taranglik koeffitsiyentini topamiz:

$$\sigma = \frac{\rho g d h}{4} \text{ hisoblaymiz:}$$

$$\sigma = \frac{800 \cdot 10 \cdot 0,3 \cdot 10^{-3} \cdot 2 \cdot 10^{-2}}{4} = 12 \cdot 10^{-3} \frac{\text{N}}{\text{m}} = 12 \frac{\text{mN}}{\text{m}}$$

Javob: C) $12 \frac{\text{mN}}{\text{m}}$.

37.14. Agar zichligi $0,8 \text{ g/sm}^3$ bo'lgan suyuqlikning 2 mm diametrli kapillar nayda ko'tarilish balandligi 7,5 mm bo'lsa, shu suyuqlikning sirt taranglik koeffitsiyentini toping (mN/m).

- A) 73 B) 24 C) 40 D) 30

Berilgan:

$$d = 2 \text{ mm} = 2 \cdot 10^{-3} \text{ m}$$

$$\rho = 0,8 \frac{\text{g}}{\text{sm}^3} = 800 \frac{\text{kg}}{\text{m}^3}$$

$$h = 7,5 \text{ mm} = 7,5 \cdot 10^{-3} \text{ m}$$

$$\sigma = ?$$

Yechilishi:

$h = \frac{4\sigma}{\rho g d}$ formuladan sirt taranglik koeffitsiyentini topamiz $\sigma = \frac{\rho g d h}{4}$. Bundan

$$\sigma = \frac{800 \cdot 10 \cdot 2 \cdot 10^{-3} \cdot 7,5 \cdot 10^{-3}}{4} = 30 \cdot 10^{-3} \frac{\text{N}}{\text{m}} = 30 \frac{\text{mN}}{\text{m}} \text{ kelib chiqadi.}$$

Javob: D) $30 \frac{\text{mN}}{\text{m}}$.

38-§. Qattiq jismlarning mexanik xossalari

38.1. Har qanday monokristall quyidagi xossalardan qaysi biriga albatta ega bo'ladi?

- A) anizotroplik B) izotroplik C) shaffoflik D) qattiqlikka

Monokristall anizotroplik xossasiga ega.

Javob: A) anizotroplik.

38.2. Har qanday amorf modda quyidagi xossalardan qaysi biriga albatta ega bo'ladi?

- A) qattiqlik B) izotroplik C) shaffoflik D) anizotroplik

Amorf modda izotroplik xossasiga ega.

Javob: B) izotroplik.

38.3. Metall sterjenning absolut va nisbiy uzayishi mos holda 2 mm va 0,1% bo'lsa, deformatsiyalanmagan sterjenning uzunligi qanday (m)?

- A) 0,2 B) 1 C) 2 D) 2,5

Berilgan:

$$\Delta l = 2 \text{ mm} = 2 \cdot 10^{-3} \text{ mm}$$

$$\varepsilon = 0,1\%$$

$$l = ?$$

Yechilishi:

$$\varepsilon = \frac{\Delta l}{l} 100\% \text{ formuladan foydalanamiz,}$$

$$l = \frac{\Delta l}{\varepsilon} 100\% = \frac{2 \cdot 10^{-3}}{0,1\%} 100\% = 2 \text{ m}$$

Javob: C) 2 m.

38.4. Ko'ndalang kesimi 2 sm² bo'lgan po'lat tayoqchaga og'irligi $3 \cdot 10^4$ N bo'lgan yuk osilgan. Tayoqchani mexanik kuchlanishi topilsin.

- A) $0,75 \cdot 10^4$ N/sm² B) $1,5 \cdot 10^4$ Pa
C) $1,5 \cdot 10^4$ N/sm² D) $3 \cdot 10^4$ N/m²

Berilgan:

$$F = 3 \cdot 10^4 \text{ N}$$

$$S = 2 \text{ sm}^2$$

$$\sigma = ?$$

Yechilishi:

$$\sigma = \frac{F}{S} \text{ formuladan topamiz:}$$

$$\sigma = \frac{F}{S} = \frac{3 \cdot 10^4}{2} = 1,5 \cdot 10^4 \frac{\text{N}}{\text{sm}^2}$$

Javob: C) $1,5 \cdot 10^4 \frac{\text{N}}{\text{sm}^2}$.

38.5. Diametri 2 sm bo'lgan simga 10 kg yuk osilgan bo'lsa, mexanik kuchlanish necha kPa bo'ladi?

- A) 500 B) 320 C) 160 D) 80

Berilgan:

$$m = 10 \text{ kg}$$

$$d = 2 \text{ sm} = 2 \cdot 10^{-2} \text{ m}$$

$$\sigma = ?$$

Yechilishi:

$\sigma = \frac{F}{S}$, bu yerda kuch o'rnida ogirlik kuchi bo'ladi, ko'ndalang kesimni doira yuzi deb olamiz:

$$F = mg, \quad S = \frac{\pi d^2}{4}, \quad \sigma = \frac{mg}{\frac{\pi d^2}{4}} = \frac{4mg}{\pi d^2}$$

$$\sigma = \frac{4 \cdot 10 \cdot 10}{3,14 \cdot (2 \cdot 10^{-2})^2} = 3,2 \cdot 10^5 \text{ Pa} = 320 \text{ kPa}$$

Javob: B) 320 kPa

38.6. Diametri 2 mm bo'lgan po'lat simga 9 kg massali yuk osilgan. Simda hosil bo'lgan mexanik kuchlanishni toping (MPa). $\pi = 3$, $g = 10 \text{ m/s}^2$.

- A) 15 B) 27 C) 0,3 D) 270

Berilgan:

$$d = 2 \text{ mm} = 2 \cdot 10^{-3} \text{ m}$$

$$m = 9 \text{ kg}$$

$$\pi = 3$$

$$\sigma = ?$$

Yechilishi:

$\sigma = \frac{F}{S}$, bu yerda kuch o'rnida ogirlik kuchi bo'ladi, ko'ndalang kesimni doira yuzi deb olamiz:

$$F = mg, \quad S = \frac{\pi d^2}{4}, \quad \sigma = \frac{mg}{\frac{\pi d^2}{4}} = \frac{4mg}{\pi d^2}$$

$$\sigma = \frac{4 \cdot 10 \cdot 9}{3 \cdot (2 \cdot 10^{-2})^2} = 30 \cdot 10^4 \text{ Pa} = 0,3 \text{ MPa}$$

Javob: C) 0,3.

38.7. Diametri 2 sm bo'lgan trosga og'irligi 6000 N bo'lgan yuk osilgan. Mexanik kuchlanish qanday (Pa)? ($\pi = 3$)

- A) $2 \cdot 10^6$; B) $0,5 \cdot 10^7$; C) $2 \cdot 10^8$; D) $2 \cdot 10^7$.

Berilgan:

$$d = 2 \text{ sm} = 2 \cdot 10^{-2} \text{ m}$$

$$F = 6000 \text{ N} = 6 \cdot 10^3 \text{ N}$$

$$\pi = 3$$

$$\sigma = ?$$

Yechilishi:

$$S = \frac{\pi d^2}{4}, \quad \sigma = \frac{mg}{\frac{\pi d^2}{4}} = \frac{4mg}{\pi d^2}$$

$$\sigma = \frac{4 \cdot 6 \cdot 10^3 \cdot 10}{3 \cdot (2 \cdot 10^{-2})^2} = 2 \cdot 10^7 \text{ Pa}$$

Javob: D) $2 \cdot 10^7 \text{ Pa}$.

38.8. 30 kN nagruzka berilganda, $6 \cdot 10^7 \text{ N/m}^2$ mexanik kuchlanish hosil bo'lishi uchun po'lat sterjenning ko'ndalang kesim yuzi qancha bo'lishi kerak?

- A) $0,5 \text{ mm}^2$ B) $5 \cdot 10^{-2} \text{ m}^2$ C) 5 sm^2 D) $0,5 \text{ sm}^2$

Berilgan:

$$F = 30 \text{ kN} = 3 \cdot 10^4 \text{ N}$$

$$\sigma = 6 \cdot 10^7 \frac{\text{N}}{\text{m}^2}$$

$$S = ?$$

Yechilishi:

$$\sigma = \frac{F}{S}, \text{ formuladan topamiz } S = \frac{F}{\sigma}$$

$$S = \frac{3 \cdot 10^4}{6 \cdot 10^7} = 5 \cdot 10^{-4} \text{ m}^2 = 5 \text{ sm}^2$$

Javob: C) 5 sm^2 .

38.9. Yuk osilganda sim 9 mm choʻzildi. Xuddi shunday, lekin 2 marta uzun sim shu yuk osilganda necha mm choʻziladi?

- A) 9 B) 18 C) 27 D) 36

Berilgan:

$$\Delta l_1 = 9 \text{ mm}$$

$$l_2 = 2 l_1$$

$$m_1 = m_2$$

$$\Delta l_2 = ?$$

Yechilishi:

$$F = k\Delta l, \quad F = E \frac{S}{l} \Delta l, \quad \Delta l = \frac{Fl}{ES}, \quad F_1 = F_2 = mg,$$

$$\Delta l_1 = \frac{Fl_1}{ES}, \quad \Delta l_2 = \frac{Fl_2}{ES}, \quad \frac{\Delta l_2}{\Delta l_1} = \frac{\frac{Fl_2}{ES}}{\frac{Fl_1}{ES}} = \frac{l_2}{l_1}, \quad \Delta l_2 = \frac{\Delta l_1 l_2}{l_1}$$

$$\Delta l_2 = \frac{9 \cdot 2 l_1}{l_1} = 18 \text{ mm}$$

Javob: B) 18 mm.

38.10. Kuchni oʻzgartirmasdan deformatsiyalanuvchi simni oʻsha moddadan yasalgan oʻshanday uzunlikdagi, lekin diametri 2 marta katta boʻlgan sim bilan almashtirilsa, uning mutlaq uzayishi qanday oʻzgaradi?

- A) oʻzgarmaydi B) 2 marta ortadi C) 2 marta kamayadi D) 4 marta kamayadi

Berilgan:

$$F_1 = F_2$$

$$l_2 = l_1$$

$$d_2 = 2d_1$$

$$\frac{\Delta l_2}{\Delta l_1} = ?$$

Yechilishi:

$$F = k\Delta l, \quad F = E \frac{S}{l} \Delta l, \quad \Delta l = \frac{Fl}{ES}, \quad S = \frac{\pi d^2}{4}$$

$$\Delta l = \frac{Fl}{E \frac{\pi d^2}{4}} = \frac{4Fl}{E\pi d^2}, \quad F_1 = F_2$$

demak, mutlaq uzayish kesim diametri kvadratiga teskari proporsional. Agar diametr 2 marta katta boʻlsa, uzayish 4 marta kichik boʻlarkan.

Javob: D) 4 marta kamayadi.

38.11. Birining uzunligi ikkinchisidan 2 marta katta boʻlgan, bir xil materialdan tayyorlangan ikkita sim teng mexanik kuchlanish taʼsirida choʻzilsa, nisbiy uzayish ularning qaysi birida katta va necha marta katta boʻladi?

- A) ikkalasida bir xil B) ikkinchisida 2 marta
C) birinchisida 4 marta D) ikkinchisida 4 marta

Berilgan:

$$\sigma_1 = \sigma_2$$

$$l_2 = 2l_1$$

$$E_1 = E_2$$

$$\frac{\varepsilon_2}{\varepsilon_1} = ?$$

Yechilishi:

$$\sigma = E\varepsilon \text{ formuladan foydalanamiz } \varepsilon = \frac{\sigma}{E}, \quad \varepsilon_1 = \frac{\sigma_1}{E_1}, \quad \varepsilon_2 = \frac{\sigma_2}{E_2}$$

$$\frac{\varepsilon_2}{\varepsilon_1} = \frac{\frac{\sigma_1}{E_1}}{\frac{\sigma_2}{E_2}} = \frac{\sigma_1 E_2}{\sigma_2 E_1}, \quad \frac{\varepsilon_2}{\varepsilon_1} = \frac{\sigma_1 E_1}{\sigma_1 E_1} = 1$$

Javob: A) ikkalasida ham bir xil.

38.12. Yuk osilgan prujinani ikki buklab, yana shu yuk osilsa, uning absolut uzayishi qanday o'zgaradi?

- A) 4 marta ortadi C) o'zgarmaydi
B) 4 marta kamayadi D) 2 marta ortadi

Berilgan:

$$l_2 = \frac{l}{2}$$

$$m_1 = m_2$$

$$\frac{\Delta l_2}{\Delta l_1} = ?$$

Yechilishi:

$F = k\Delta l$, $k = E \frac{S}{l}$, ikki buklaganda prujinalar uzunliklari bir xil bo'ladi va parallel ulangan bo'ladi, keyingi holatdagi birlilik

$$k_{umum} = k_1 + k_2 = 2k_1 = 2E \frac{S}{l_2} = 2E \frac{S}{\frac{l}{2}} = 4k, \quad F_1 = F_2 = mg,$$

$$\Delta l = \frac{F}{k} \quad \frac{\Delta l_2}{\Delta l_1} = \frac{\frac{F}{k_{umum}}}{\frac{F}{k}} = \frac{k}{k_{umum}} = \frac{k}{4k} = \frac{1}{4},$$

Javob: B) 4 marta kamayadi.

38.13. Uzunligi 4 m, kesimi 1 mm² bo'lgan po'lat simni 2 mm ga cho'zish uchun qanday kuch qo'yish kerak? Po'latning elastiklik moduli 200 GPa.

- A) 10 N B) 1 N C) 100 kN D) 100 N

Berilgan:

$$l = 4\text{m}$$

$$S = 1 \text{ mm}^2 = 1 \cdot 10^{-6} \text{ m}^2$$

$$E = 200 \text{ GPa} = 2 \cdot 10^{11} \text{ Pa}$$

$$\Delta l = 2 \text{ mm} = 2 \cdot 10^{-3} \text{ m}$$

$$F = ?$$

Yechilishi:

$$F = k\Delta l = E \frac{S}{l} \Delta l$$

$$F = \frac{2 \cdot 10^{11} \cdot 1 \cdot 10^{-6} \cdot 2 \cdot 10^{-3}}{4} = 100 \text{ N}$$

Javob: D) 100 N.

38.14. Mustahkamlik chegarasi 0,36 MPa va zichligi 1,8 g/sm³ bo'lgan g'isht devorning balandligi eng ko'pi bilan necha metr bo'lishi mumkin?

- A) 20 B) 25 C) 64 D) 30

Berilgan:

$$\sigma = 0,36 \text{ MPa} = 3,6 \cdot 10^5 \text{ Pa}$$

$$\rho = 1,8 \frac{\text{g}}{\text{sm}^3} = 1800 \frac{\text{kg}}{\text{m}^3}$$

$$h = ?$$

Yechilishi:

$$F = \sigma S, \quad F = mg, \quad m = \rho V = \rho Sh$$

$$\rho Shg = \sigma S, \quad h = \frac{\sigma}{\rho g}$$

$$h = \frac{3,6 \cdot 10^5}{1800 \cdot 10} = 20 \text{ m}$$

Javob: A) 20 m.

38.15. Mustahkamlik chegarasi σ va zichligi ρ bo'lgan sim bir uchidan osiltirib qo'yilgan. Sim uzilmasligi uchun uning uzunligi ko'pi bilan qanday bo'lishi kerak?

- A) $\sigma\rho g$ B) $\frac{\sigma}{\rho g}$ C) $\frac{\rho g}{\sigma}$ D) $\frac{\sigma\rho}{g}$

Berilgan:

ρ

σ

$l = ?$

Yechilishi:

$$F = \sigma S, F = mg, m = \rho V = \rho Sl, \rho Slg = \sigma S, l = \frac{\sigma}{\rho g}$$

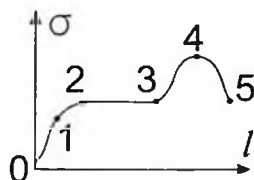
Javob: B) $\frac{\sigma}{\rho g}$.

38.16. Rasmda moddaning cho'zilish diagrammasi berilgan. Diagrammaning qaysi qismida Guk qonuni bajariladi?

- A) 4-5 B) 1-2
C) 2-3 D) 0-1

0-1 soha, chunki qo'yilgan kuch uzayishga to'g'ri proporsional bo'lyapti.

Javob: D) 0-1

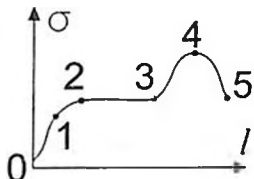


38.17. Rasmda moddaning cho'zilish diagrammasi berilgan. Diagrammaning qaysi nuqtasi olingan materialning mustahkamlik chegarasiga mos keladi?

- A) 1 B) 2 C) 3 D) 4

4- nuqta bo'ladi.

Javob: D) 4.



38.18. Metall diskning sektor ko'rinishidagi qismi qirqib olingan. Agar disk sovitilsa, α burchak qanday o'zgaradi?

- A) ortadi
B) o'zgarmaydi
C) javob disk materialiga bog'liq
D) kamayadi



Agar disk sovitilsa, unda yuza bo'yicha torayish bo'ladi va markaziy burchak o'zgarmay qoladi.

Javob: B) o'zgarmaydi.

VII bob. TERMODINAMIKA ASOSLARI

39-§. Ichki energiya

39.1. Jismning (moddaning) ichki energiyasi deganda nimani tushunamiz:

- 1) 1 kg massali moddaning temperaturasi 1 gradusga oshirish uchun sarflangan issiqlik miqdorini;
- 2) issiqlik almashishda jism olgan yoki uzatgan issiqlik miqdorini;
- 3) moddaning temperaturasi 1 gradusga oshirish uchun sarflangan issiqlik miqdorini;
- 4) jismni tashkil etuvchi barcha molekulalarning kinetik va o'zaro ta'sir potensial energiyalarining yig'indisini.

A) 4 B) 3 C) 2 D) 1

Javob: A) 4.

39.2. Gazning izotermik kengayishida uning ichki energiyasi qanday o'zgaradi?

- A) ortadi B) o'zgarmaydi C) kamayadi
D) ichki energiya ixtiyoriy bo'lishi mumkin

Javob: B) o'zgarmaydi.

39.3. Metall silindrdagi gaz porshen bilan izotermik siqilganda, uning hajmi 5 marta kamaydi. Bunda gazning ichki energiyasi qanday o'zgaradi?

- A) 5 marta ortadi B) o'zgarmaydi
C) 5 marta kamayadi D) 2,5 marta ortadi

Berilgan:

$$V_1 = 5 V_2$$

$$\Delta T = 0$$

$$\Delta U = ?$$

Yechilishi:

Ichki energiya o'zgarishi.

$$\Delta U = \frac{i}{2} \cdot \frac{m}{M} R \Delta T = 0$$

Javob: B) o'zgarmaydi.

39.4. Ideal gaz bosimi va absolut temperaturasi 2 marta oshsa, uning ichki energiyasi qanday o'zgaradi?

- A) o'zgarmaydi B) 2 marta kamayadi
C) 2 marta oshadi D) 4 marta kamayadi

Berilgan:

$$T_2 = 2T_1$$

$$\frac{U_1}{U_2} = ?$$

Yechilishi:

Ichki energiya

$$\Delta U = \frac{i}{2} \frac{m}{M} RT, \quad \frac{U_1}{U_2} = \frac{\frac{i}{2} \frac{m}{M} RT_1}{\frac{i}{2} \frac{m}{M} RT_2} = \frac{T_1}{2T_1} = \frac{1}{2}, \quad U_2 = 2U_1$$

Javob: C) 2 marta oshadi.**39.5.** Izobarik qizdirilgan bir atomli gazning ichki energiyasi qanday o'zgaradi?

- A) o'zgarmaydi B) kamayadi
C) ortadi D) istalgancha o'zgarishi mumkin

Javob: C) ortadi.**39.6.** Izobarik kengayganida ideal gazning ichki energiyasi qanday o'zgaradi?

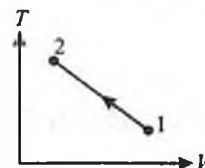
- A) o'zgarmaydi B) kamayadi
C) ortadi D) javob bosimga bog'liq

Javob: C) ortadi.**39.7.** Izobarik siqilganda ideal gazning ichki energiyasi qanday o'zgaradi?

- A) o'zgarmaydi B) kamayadi
C) ortadi D) ideal gazning ichki energiyasi hamma vaqt nolga teng

Javob: B) kamayadi.**39.8.** Gaz 1-holatdan 2-holatga o'tganda, uning ichki energiyasi qanday o'zgaradi?

- A) ortadi B) o'zgarmaydi
C) kamayadi D) avval kamayadi, so'ngra ortadi

Javob: A) ortadi.**39.9.** Agar ideal gaz bosimi va hajmi 2 marta oshsa, uning ichki energiyasi qanday o'zgaradi?

- A) 4 marta oshadi B) 8 marta oshadi
C) 2 marta kamayadi D) o'zgarmaydi

Berilgan:

$$V_2 = 2V_1$$

$$P_2 = 2P_1$$

$$\frac{U_1}{U_2} = ?$$

Yechilishi:

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT = \frac{i}{2} PV, \text{ quyidagi nisbatni olamiz}$$

$$\frac{U_1}{U_2} = \frac{\frac{i}{2} P_1 V_1}{\frac{i}{2} P_2 V_2} = \frac{P_1 V_1}{2P_1 2V_1} = \frac{1}{4}, \quad U_2 = 4U_1$$

Javob: A) 4 marta ortadi.

39.10. Ideal gazning bosimi 2 marta ortsa va hajmi 2 marta kamaysa, uning ichki energiyasi qanday o'zgaradi?

- A) o'zgarmaydi B) 4 marta kamayadi
D) 2 marta kamayadi C) 4 marta ortadi

Berilgan:

$$\begin{array}{l} V_1 = 2V_2 \\ P_2 = 2P_1 \end{array}$$

$$\frac{U_1}{U_2} = ?$$

Yechilishi:

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT = \frac{i}{2} PV, \text{ nisbat olamiz}$$

$$\frac{U_1}{U_2} = \frac{\frac{i}{2} P_1 V_1}{\frac{i}{2} P_2 V_2} = \frac{P_1 2V_2}{2P_1 V_2} = 1, \quad U_2 = U_1$$

Javob: A) o'zgarmaydi.

39.11. Ideal gazning bosimi 2 marta kamayib, hajmi 3 marta ortsa, uning ichki energiyasi qanday o'zgaradi?

- A) 6 marta kamayadi B) 6 marta ortadi
C) 1,5 marta kamayadi D) 1,5 marta ortadi

Berilgan:

$$\begin{array}{l} V_2 = 3V_1 \\ P_1 = 2P_2 \end{array}$$

$$\frac{U_1}{U_2} = ?$$

Yechilishi:

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT = \frac{i}{2} PV, \text{ nisbat olamiz}$$

$$\frac{U_1}{U_2} = \frac{\frac{i}{2} P_1 V_1}{\frac{i}{2} P_2 V_2} = \frac{2P_2 V_1}{P_2 3V_1} = \frac{2}{3}, \quad U_2 = \frac{3}{2} U_1 = 1,5U_1$$

Javob: D) 1,5 marta ortadi.

39.12. Bir atomli ideal gazning bosimi 50% kamayib, hajmi 2 marta oshsa, uning ichki energiyasi qanday o'zgaradi?

- A) o'zgarmaydi B) 4 marta kamayadi
C) 4 marta ortadi D) 2 marta kamayadi

Berilgan:

$$\begin{array}{l} V_2 = 2V_1 \\ \Delta P_1 = 0,5P_1 \end{array}$$

$$\frac{U_1}{U_2} = ?$$

Yechilishi:

$$P_2 = P_1 - \Delta P = P_1 - 0,5P_1 = 0,5P_1, \quad P_1 = 2P_2$$

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT = \frac{i}{2} PV, \text{ nisbat olamiz}$$

$$\frac{U_1}{U_2} = \frac{\frac{i}{2} P_1 V_1}{\frac{i}{2} P_2 V_2} = \frac{2P_2 V_1}{P_2 2V_1} = 1, \quad U_2 = U_1$$

Javob: A) o'zgarmaydi.

39.13. Bosimlari $P_1 = 2P_2$, hajmlari $V_2 = 2V_1$ bo'lgan bir atomli ideal gazlarning ichki energiyalarini taqqoslang.

A) $U_1 = 4U_2$

B) $U_1 = 2U_2$

C) $U_1 = U_2$

D) $U_2 = 2U_1$

Berilgan:

$$V_2 = 2V_1$$

$$P_1 = 2P_2$$

$$\frac{U_1}{U_2} = ?$$

Yechilishi:

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT = \frac{i}{2} PV, \text{ nisbat olamiz}$$

$$\frac{U_1}{U_2} = \frac{\frac{i}{2} P_1 V_1}{\frac{i}{2} P_2 V_2} = \frac{2P_2 V_1}{P_2 2V_1} = 1, \quad U_2 = U_1$$

Javob: C) $U_2 = U_1$.

39.14. Bir atomli gazning hajmi 3 marta kamayganda, bosimi 50% ga oshgan bo'lsa, uning ichki energiyasi qanday o'zgargan?

A) 3 marta oshgan

B) 2 marta oshgan

C) 3 marta kamaygan

D) 2 marta kamaygan

Berilgan:

$$V_1 = 3V_2$$

$$\Delta P_1 = 0,5P_1$$

$$\frac{U_1}{U_2} = ?$$

Yechilishi:

$$P_2 = P_1 + \Delta P = P_1 + 0,5P_1 = 1,5P_1,$$

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT = \frac{i}{2} PV, \text{ nisbat olamiz}$$

$$\frac{U_1}{U_2} = \frac{\frac{i}{2} P_1 V_1}{\frac{i}{2} P_2 V_2} = \frac{P_1 3V_2}{1,5P_1 V_2} = 2, \quad U_1 = 2U_2$$

Javob: D) 2 marta kamaygan.

39.15. Agar bir atomli ideal gazning bosimi 3 marta ortib, hajmi 2 marta kamaysa, uning ichki energiyasi qanday o'zgaradi? ($m = \text{const}$)

A) 6 marta oshadi

B) 3 marta oshadi

C) 3 marta kamayadi

D) 1,5 marta oshadi

Berilgan:

$$V_1 = 2V_2$$

$$P_2 = 3P_1$$

$$\frac{U_1}{U_2} = ?$$

Yechilishi:

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT = \frac{i}{2} PV, \text{ nisbat olamiz}$$

$$\frac{U_1}{U_2} = \frac{\frac{i}{2} P_1 V_1}{\frac{i}{2} P_2 V_2} = \frac{P_1 2V_2}{3P_1 V_2} = \frac{2}{3}, \quad U_2 = \frac{3}{2} U_1 = 1,5U_1$$

Javob: D) 1,5 marta ortadi.

39.16. 1 mol bir atomli ideal gaz molekularining o'rtacha kinetik energiyalari yig'indisi qaysi javobda to'g'ri ko'rsatilgan?

- A) $E_k = 3kT$ B) $E_k = 3RT/2$
 C) $E_k = 3kT/2$ D) $E_k = 3RT$

Berilgan:

$$\nu = 1 \text{ mol}$$

$$E_k = ?$$

Javob: B) $E_k = \frac{3}{2} RT$.

39.17. Temperaturasi -73°C bo'lgan bir mol bir atomli ideal gazning ichki energiyasini toping (J)

- A) 1246 B) 1662 C) 2077 D) 2493

Berilgan:

$$\nu = 1 \text{ mol}$$

$$t = -73^\circ\text{C}$$

$$U = ?$$

Yechilishi:

Ichki energiya

$$U = \frac{i}{2} \nu RT = \frac{3}{2} \cdot 8,31 \cdot 200 = 2493 \text{ J}$$

$$T = 273 + t = 200 \text{ K}$$

Javob: D) $U = 2493 \text{ J}$.

39.18. 2 mol geliy 20°C dan -80°C gacha sovitilganda, uning ichki energiyasi necha kJ kamayadi?

- A) 8,31 B) 25 C) 2,5 D) 16,62

Berilgan:

$$\nu = 2 \text{ mol}$$

$$t_1 = 20^\circ\text{C}$$

$$t_2 = -80^\circ\text{C}$$

$$U = ?$$

Yechilishi:

$$\Delta T = \Delta t = t_2 - t_1 = -100 \text{ K}$$

Ichki energiya o'zgarishi.

$$\Delta U = \frac{i}{2} \nu R \Delta T = \frac{3}{2} \cdot 2 \cdot 8,31 \cdot (-100) = -2,5 \text{ J}$$

Javob: C) 2,5 J kamaygan.

39.19. $4 \cdot 10^{23}$ ta molekulaga ega bo'lgan bir atomli ideal gazning temperaturasi 100 K ga ortganda, ichki energiyasi necha joulga o'zgaradi? $N_A = 6 \cdot 10^{23} \text{ mol}^{-1}$.

- A) 8,31 B) 38,1 C) 415 D) 831

Berilgan:

$$N = 4 \cdot 10^{23}$$

$$\Delta T = 100 \text{ K}$$

$$\Delta U = ?$$

Yechilishi:

Ichki energiya o'zgarishi.

$$\Delta U = \frac{i}{2} \nu R \Delta T = \frac{i}{2} \frac{N}{N_A} R \Delta T = \frac{3}{2} \cdot \frac{4 \cdot 10^{23}}{6 \cdot 10^{23}} \cdot 8,31 \cdot 100 = 831 \text{ J}$$

Javob: D) 831.

39.20. Temperaturasi -73°C va ichki energiyasi 2493 J bo'lgan geliy gazining massasini aniqlang (g).

A) 3

B) 4

C) 6

D) 17

Berilgan:

$$t = -73^{\circ}\text{C}$$

$$U = 2493 \text{ J}$$

$$m = ?$$

Yechilishi:

$$T = 273 + t = 200 \text{ K}$$

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT, \quad m = \frac{2UM}{iRT} = \frac{2 \cdot 2493 \cdot 4 \cdot 10^{-3}}{3 \cdot 8,31 \cdot 200} = 4 \text{ g}$$

Javob: B) 4.

39.21. Ballondagi gazning temperaturasi 100 K ga ortganda, uning bosimi 2 marta oshgan bo'lsa, ichki energiyasi necha marta ortgan?

A) 1,5

B) 2

C) 4

D) 25

Berilgan:

$$\Delta T = 100 \text{ K}$$

$$P_2 = 2P_1$$

$$\frac{U_1}{U_2} = ?$$

$$M = 4 \cdot 10^{-3} \frac{\text{kg}}{\text{mol}}$$

Yechilishi:

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT = \frac{i}{2} PV, \text{ nisbat olamiz}$$

$$\frac{U_1}{U_2} = \frac{\frac{i}{2} P_1 V_1}{\frac{i}{2} P_2 V_2} = \frac{P_1 V_1}{2 P_2 V_2} = \frac{1}{2}, \quad U_2 = 2U_1$$

Javob: B) 2.

39.22. Ballondagi gazning yarmi chiqib ketganda bosim 3 marta kamaygan bo'lsa, gazning ichki energiyasi qanday o'zgargan?

A) 1,5 marta kamaygan

B) 3 marta oshgan

C) 3 marta kamaygan

D) 1,5 marta oshgan

Berilgan:

$$m_1 = 2m_2$$

$$P_1 = 3P_2$$

$$\frac{U_1}{U_2} = ?$$

Yechilishi:

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT = \frac{i}{2} PV, \text{ nisbat olamiz}$$

$$\frac{U_1}{U_2} = \frac{\frac{i}{2} P_1 V_1}{\frac{i}{2} P_2 V_2} = \frac{3P_2 V}{P_2 V} = 3, \quad U_1 = 3U_2$$

Javob: C) 3 marta kamaygan.

39.23. Ballondagi gazning yarmi chiqib ketishi natijasida uning temperaturasi 57°C dan 2°C gacha pasaygan bo'lsa, ichki energiya necha marta kamayadi?

A) 5,6

B) 1,2

C) 1,4

D) 2,4

Berilgan:

$$m_1 = 2m_2$$

$$t_1 = 57^\circ\text{C}$$

$$t_2 = 2^\circ\text{C}$$

$$\frac{U_1}{U_2} = ?$$

Yechilishi:

$$T_1 = 273 + t_1 = 330 \text{ K}$$

$$T_2 = 273 + t_2 = 275 \text{ K}$$

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT, \text{ nisbat olamiz}$$

$$\frac{U_1}{U_2} = \frac{\frac{i}{2} \frac{m}{M} RT}{\frac{i}{2} \frac{m}{M} RT} = \frac{m_1 T_1}{m_2 T_2} = \frac{2m_2 330}{m_2 275} = 2,4, \quad U_1 = 2,4 U_2$$

Javob: D) 2,4.

39.24. Bosimlari va hajmlari bir xil bo'lgan kislorod va vodorod gazlarining U_1 va U_2 ichki energiyalarini solishtiring.

A) $U_1 = 32 U_2$

B) $U_1 = 16 U_2$

C) $U_1 = U_2$

D) $U_2 = 16 U_1$

Berilgan:

$$V_1 = V_2$$

$$P_1 = P_2$$

$$\frac{U_1}{U_2} = ?$$

Yechilishi:

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT = \frac{i}{2} PV, \text{ nisbat olamiz } \frac{U_1}{U_2} = \frac{\frac{i}{2} P_1 V_1}{\frac{i}{2} P_2 V_2} = 1$$

$$U_1 = U_2$$

Javob: C) $U_1 = U_2$

39.25. Argon va geliy gazlari bir xil massaga ega bo'lib, bir xil sharoitda turibdi. Ularning ichki energiyalarini taqqoslang. ($M_{Ar} = 40 \text{ g/mol}$, $M_{He} = 4 \text{ g/mol}$.)

A) geliyniki 10marta katta

B) argonniki 10 marta katta

C) barobar

D) argonniki 4 marta kichik

Berilgan:

$$m_1 = m_2$$

$$T_1 = T_2$$

$$M_{Ar} = 40 \text{ g/mol}$$

$$M_{He} = 4 \text{ g/mol}$$

$$\frac{U_1}{U_2} = ?$$

Yechilishi:

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT, \text{ nisbat olamiz}$$

$$\frac{U_{Ar}}{U_{He}} = \frac{\frac{i}{2} \frac{m}{M_{Ar}} RT}{\frac{i}{2} \frac{m}{M_{He}} RT} = \frac{M_{He}}{M_{Ar}} = \frac{4}{40} = \frac{1}{10}, \quad U_{He} = 10 U_{Ar}$$

Javob: A) geliyniki 10 marta katta.

39.26. Temperaturalari bir xil bo'lgan teng massali geliy va argonning ichki energiyalari nisbati qanday bo'ladi? Geliyning molyar massasi 4 g/mol, argonniki 40 g/mol.

A) 1

B) 2

C) 10

D) 1/4

Berilgan:

$$m_1 = m_2$$

$$T_1 = T_2$$

$$M_{Ar} = 40 \text{ g/mol}$$

$$M_{He} = 4 \text{ g/mol}$$

$$\frac{U_1}{U_2} = ?$$

Yechilishi:

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT, \text{ nisbat olamiz}$$

$$\frac{U_{He}}{U_{Ar}} = \frac{\frac{i}{2} \frac{m}{M_{He}} RT}{\frac{i}{2} \frac{m}{M_{Ar}} RT} = \frac{M_{Ar}}{M_{He}} = \frac{40}{4} = 10$$

Javob: C) 10.

39.27. Bir xil miqdorda olingan H_2 , O_2 , N_2 gazlarining temperaturasi bir xil o'rttirilsa, qaysi gazning ichki energiyasi ko'proq o'zgaradi?

A) H_2

B) O_2

C) N_2

D) barchasiniki bir xil o'zgaradi

Berilgan:

$$\nu_1 = \nu_2 = \nu_3$$

$$\Delta T_1 = \Delta T_2 = \Delta T_3$$

$$U = ?$$

Yechilishi:

Ichki energiya o'zgarishi.

$$\Delta U = \frac{i}{2} \nu R \Delta T \text{ ifodadan xulosa chiqarish mumkin,}$$

barchasiniki bir xil o'zgaradi.

Javob: D) barchasiniki bir xil o'zgaradi.

39.28. Agar bir atomli ideal gazning hajmi 2 m^3 va ichki energiyasi 1500 J bo'lsa, uning bosimi qanday (Pa)?

A) 2000

B) 1500

C) 1000

D) 500

Berilgan:

$$V = 2 \text{ m}^3$$

$$U = 1500 \text{ J}$$

$$P = ?$$

Yechilishi:

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT = \frac{i}{2} PV, \quad P = \frac{2U}{iV} = \frac{2 \cdot 1500}{3 \cdot 2} = 500 \text{ Pa}$$

Javob: D) $P = 500 \text{ Pa}$

39.29. Bir atomli gaz molekulalarining konsentratsiyasi n bo'lsa, T haroratda V hajmni egallagan gazning ichki energiyasi qanday bo'ladi?

A) $\frac{3mV}{2M} RT$

B) $\frac{3nVR}{2} T$

C) $\frac{3m}{2V} RT$

D) $\frac{3}{2} nV kT$

Berilgan: n T V $U = ?$ **Yechilishi:**

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT = \frac{i}{2} PV, \quad P = nkT, \text{ o'rniga qo'ysak,}$$

$$U = \frac{3}{2} nV kT$$

Javob: D) $\frac{3}{2} nV kT$.

39.30. Agar molekularining konsentratsiyasi n bo'lgan bir atomli gaz T haroratda V hajmga ega bo'lsa, uning ichki energiyasi qanday bo'ladi?

A) $\frac{3}{2} \cdot nV kT$

B) $\frac{3}{2} \cdot nV RT$

C) $\frac{2}{3} \cdot nV kT$

D) $\frac{1}{2} \cdot nV RT$

Berilgan: n T V $U = ?$ **Yechilishi:**

Ichki energiya

$$U = \frac{i}{2} \frac{m}{M} RT = \frac{i}{2} PV, \quad P = nkT, \text{ o'rniga qo'ysak,}$$

$$U = \frac{3}{2} nV kT$$

Javob: A) $\frac{3}{2} \cdot nV kT$.

39.31. Molekularining o'rtacha kvadratik tezligi 500 m/s bo'lgan 20 g massali bir atomli gazning ichki energiyasi necha joul bo'ladi?

A) 20

B) 50

C) 250

D) 2500

Berilgan:

$v = 500 \text{ m/s}$

$m = 20 \text{ g}$

 $U = ?$ **Yechilishi:** Ichki energiya har bir molekulaning kinetik energiyalari yig'indisiga teng.

$$U = E_k = \frac{mv^2}{2} = \frac{0,02 \cdot 500^2}{2} = 2500 \text{ J}$$

Javob: D) $U = 2500 \text{ J}$.

40-§. Termodinamikada ish

40.1. Silindrdagi gazning o'rtacha bosimi 1 MN/m². Porshenning yuzi 200 sm², yurish uzunligi 0,5 m. Porshenning bir marta yurishida gaz qanday ish bajaradi (kJ)?

A) 20

B) 12

C) 10

D) 4

Berilgan:

$$P = 1 \text{ MPa}$$

$$S = 200 \text{ sm}^2$$

$$\Delta h = 0,5 \text{ m}$$

$$A = ?$$

Yechilishi:

Gaz kengayib bajargan ishi

$$A = P\Delta V = PS\Delta h = 10^6 \cdot 200 \cdot 10^{-4} \cdot 0,5 = 10^4 \text{ J} = 10 \text{ kJ}$$

Javob: C) $A = 10 \text{ kJ}$.

40.2. O'rtacha bosimi 760 mm simob ustuniga teng bo'lgan gaz yuzi 1000 sm^2 bo'lgan porshenni 80 sm ga surdi. Gaz bajargan ishni aniqlang (kJ).

A) 0,8

B) 6,08

C) 7,6

D) 8

Berilgan:

$$P = 760 \text{ mm. sim. ust.}$$

$$S = 1000 \text{ sm}^2 = 0,1 \text{ m}^2$$

$$\Delta h = 0,8 \text{ m}$$

$$A = ?$$

Yechilishi:

$$P = 760 \text{ mm. sim. ust.} = 100 \text{ kPa ga teng.}$$

Gaz kengayib bajargan ishi

$$A = P\Delta V = PS\Delta h = 10^5 \cdot 0,1 \cdot 0,8 = 8 \cdot 10^3 \text{ J} = 8 \text{ kJ}$$

Javob: D) $A = 8 \text{ kJ}$.

40.3. Yuzi 100 sm^2 bo'lgan, erkin siljiy oladigan porshen ostidagi bosimi 150 kPa bo'lgan gazga issiqlik uzatilishi natijasida porshen 2 sm ga ko'tarildi. Gaz necha joul ish bajargan?

A) 30

B) 150

C) 10

D) 15

Berilgan:

$$P = 150 \text{ kPa}$$

$$S = 100 \text{ sm}^2$$

$$\Delta h = 2 \text{ sm}$$

$$A = ?$$

Yechilishi:

Gaz kengayib bajargan ishi

$$A = P\Delta V = PS\Delta h = 150 \cdot 10^3 \cdot 100 \cdot 10^{-4} \cdot 0,02 = 30 \text{ J}$$

Javob: A) $A = 30 \text{ J}$.

40.4. 0,2 MPa bosim ostidagi gaz 1,5 l hajmdan 2,5 l hajmgacha izobarik kengayganda qanday (kJ) ish bajaradi?

A) 0,2

B) 0,35

C) 0,6

D) 0,8

Berilgan:

$$P = 0,2 \text{ MPa} = 0,2 \cdot 10^6 \text{ Pa}$$

$$V_1 = 1,5 \text{ l} = 1,5 \cdot 10^{-3} \text{ m}^3$$

$$V_2 = 2,5 \text{ l} = 2,5 \cdot 10^{-3} \text{ m}^3$$

$$A = ?$$

Yechilishi:

Gaz kengayib bajargan ishi

$$\begin{aligned} A &= P\Delta V = P(V_2 - V_1) = \\ &= 0,2 \cdot 10^6 (2,5 \cdot 10^{-3} - 1,5 \cdot 10^{-3}) = \\ &= 0,2 \cdot 10^3 \text{ J} = 0,2 \text{ kJ.} \end{aligned}$$

Javob: A) $A = 0,2 \text{ kJ}$.

40.5. 10^5 Pa bosim ostida turgan ideal gazning hajmi izobar ravishda 300 sm^3 dan 500 sm^3 gacha oshdi. Bunda gaz necha joul ish bajargan?

- A) 200 B) 100 C) 50 D) 20

Berilgan:

$$P = 10^5 \text{ Pa}$$

$$V_1 = 300 \text{ sm}^3 = 3 \cdot 10^{-4} \text{ m}^3$$

$$V_2 = 500 \text{ sm}^3 = 5 \cdot 10^{-4} \text{ m}^3$$

$$A = ?$$

Yechilishi:

Gaz kengayib bajargan ishi

$$A = P\Delta V = P(V_2 - V_1) =$$

$$= 10^5 (5 \cdot 10^{-4} - 3 \cdot 10^{-4}) = 20 \text{ J}$$

Javob: D) $A = 20 \text{ J}$.

40.6. Bosimi 1 MPa bo'lgan gaz izobar ravishda 1 l dan 10 l hajmgacha kengaytirildi. Bu jarayonda bajarilgan ishni aniqlang, (J).

- A) 10^4 B) 10^3 C) $4,5 \cdot 10^3$ D) $9 \cdot 10^3$

Berilgan:

$$P = 1 \text{ MPa} = 10^6 \text{ Pa}$$

$$V_1 = 1 \text{ l} = 10^{-3} \text{ m}^3$$

$$V_2 = 10 \text{ l} = 10 \cdot 10^{-3} \text{ m}^3$$

$$A = ?$$

Yechilishi:

Gaz kengayib bajargan ishi

$$A = P\Delta V = P(V_2 - V_1) =$$

$$= 10^6 (10 \cdot 10^{-3} - 10^{-3}) = 9 \cdot 10^3 \text{ J}$$

Javob: D) $9 \cdot 10^3 \text{ J}$.

40.7. 1 mol ideal gaz izobarik ravishda 2 K ga isitilganda bajarilgan ishni toping (J).

- A) 16,62 B) 8,31 C) 2 D) 1

Berilgan:

$$\nu = 1 \text{ mol}$$

$$\Delta T = 2 \text{ K}$$

$$A = ?$$

Yechilishi:

Gaz kengayib bajargan ishi

$$A = P\Delta V = \nu R\Delta T = 1 \cdot 8,31 \cdot 2 = 16,62 \text{ J}$$

Javob: A) $A = 16,62 \text{ J}$.

40.8. 2 mol ideal gaz o'zgarmas bosimda 100°C ga qizdirildi. Bunda gaz necha joul ish bajargan? $R = 8,3 \text{ J}/(\text{mol}\cdot\text{K})$.

- A) 16,6 B) 830 C) 83 D) 1660

Berilgan:

$$\nu = 2 \text{ mol}$$

$$\Delta T = 100 \text{ K}$$

$$A = ?$$

Yechilishi:

Gaz kengayib bajargan ishi

$$A = P\Delta V = \nu R\Delta T = 2 \cdot 8,3 \cdot 100 = 1660 \text{ J}$$

Javob: D) $A = 1660 \text{ J}$.

40.9. 320 g kislorodni 10 K ga izobarik qizdirganda qanday ish bajaradi (J)?
 A) 16,62 B) 83,1 C) 640 D) 831

Berilgan:

$$\begin{array}{l} m = 320 \text{ g} \\ \Delta T = 10 \text{ K} \\ M_{\text{O}_2} = 32 \text{ g/mol} \\ \hline A = ? \end{array}$$

Yechilishi:

Gaz kengayib bajargan ishi

$$A = P\Delta V = \frac{m}{M} R\Delta T = \frac{320 \cdot 10^{-3}}{32 \cdot 10^{-3}} \cdot 8,31 \cdot 10 = 831 \text{ J}$$

Javob: D) $A = 831 \text{ J}$.

40.10. 20 g massaga ega bo'lgan karbonat angidrid gazi o'zgarmas bosimda 44°C ga qizdirilsa, necha joule ish bajaradi? Uning molyar massasi 44 g/mol.
 A) 166,2 B) 88,2 C) 83,1 D) 44

Berilgan:

$$\begin{array}{l} m = 20 \text{ g} \\ \Delta T = 44 \text{ K} \\ M_{\text{CO}_2} = 44 \text{ g/mol} \\ \hline A = ? \end{array}$$

Yechilishi:

Gaz kengayib bajargan ishi

$$A = P\Delta V = \frac{m}{M} R\Delta T = \frac{20 \cdot 10^{-3}}{44 \cdot 10^{-3}} \cdot 8,31 \cdot 44 = 166,2 \text{ J}$$

Javob: A) $A = 166,2 \text{ J}$.

40.11. Bir xil massali vodorod va geliy gazlari doimiy bosimda 10 K ga isitildi. Bunda gazlarning qaysi biri ko'proq ish bajaradi?

- A) bir xil ish bajariladi B) geliy
 C) vodorod D) ma'lumotlar yetarli emas

Berilgan:

$$\begin{array}{l} m_{\text{H}_2} = m_{\text{He}} \\ \Delta T = 10 \text{ K} \\ M_{\text{He}} = 4 \text{ g/mol} \\ M_{\text{H}_2} = 2 \text{ g/mol} \\ \hline \frac{A_{\text{H}_2}}{A_{\text{He}}} = ? \end{array}$$

Yechilishi:

Gaz kengayib bajargan ishi

$$A = P\Delta V = \frac{m}{M} R\Delta T$$

$$\frac{A_{\text{H}_2}}{A_{\text{He}}} = \frac{\frac{m_{\text{H}_2}}{M_{\text{H}_2}} R\Delta T}{\frac{m_{\text{He}}}{M_{\text{He}}} R\Delta T} = \frac{M_{\text{He}}}{M_{\text{H}_2}} = \frac{4}{2} = 2 \quad A_{\text{H}_2} = 2A_{\text{He}}$$

Javob: C) vodorod.

40.12. Teng massali argon va neon gazlari 10 K ga izobarik isitildi. Qaysi gaz ko'proq ish bajaradi? $M_a = 40 \text{ g/mol}$; $M_n = 20 \text{ g/mol}$.

- A) ish bajarilmaydi B) bir xil
 C) argon D) neon

Berilgan:

$$\begin{aligned} m_a &= m_n \\ \Delta T &= 10 \text{ K} \\ M_a &= 40 \text{ g/mol} \\ M_n &= 20 \text{ g/mol} \end{aligned}$$

$$\frac{A_n}{A_a} = ?$$

Javob: D) neon.

Yechilishi:

Gaz kengayib bajargan ishi

$$A = P\Delta V = \frac{m}{M} R\Delta T$$

$$\frac{A_n}{A_a} = \frac{\frac{m_n}{M_n} R\Delta T}{\frac{m_a}{M_a} R\Delta T} = \frac{M_a}{M_n} = \frac{40}{20} = 2$$

$$A_n = 2A_a$$

40.13. Bir xil massali kislorod va vodorod o'zgaras bosimda bir xil temperaturaga isitiladi. Bunda qaysi gaz ko'proq ish bajaradi?

A) vodorod B) kislorod C) ishlar bir xil D) ish bajarilmaydi

Berilgan:

$$\begin{aligned} M_{H_2} &= M_{O_2} \\ \Delta T_{O_2} &= \Delta T_{H_2} \\ M_{O_2} &= 32 \text{ g/mol} \\ M_{H_2} &= 2 \text{ g/mol} \end{aligned}$$

$$\frac{A_{H_2}}{A_{O_2}} = ?$$

Javob: A) vodorod.

Yechilishi:

Gaz kengayib bajargan ishi

$$A = P\Delta V = \frac{m}{M} R\Delta T$$

$$\frac{A_{H_2}}{A_{O_2}} = \frac{\frac{m_{H_2}}{M_{H_2}} R\Delta T}{\frac{m_{O_2}}{M_{O_2}} R\Delta T} = \frac{M_{O_2}}{M_{H_2}} = \frac{32}{2} = 16$$

$$A_{H_2} = 16 A_{O_2}$$

40.14. Massasi va bosimi bir xil bo'lgan vodorod va geliy gazlari 60 K ga izobarik qizdirildi. Vodorodni qizdirishda bajarilgan ish A_1 va geliyni qizdirishda bajarilgan ish A_2 qanday munosabatda bo'ladi?

A) $A_2 = 2A_1$ B) $A_1 = 2A_2$ C) $A_1 = A_2$ D) $A_2 = 4A_1$

Berilgan:

$$\begin{aligned} m_{H_2} &= m_{He} \\ \Delta T &= 60 \text{ K} \\ M_{He} &= 4 \text{ g/mol} \\ M_{H_2} &= 2 \text{ g/mol} \end{aligned}$$

$$\frac{A_{H_2}}{A_{He}} = ?$$

Javob: B) $A_{H_2} = 2 A_{He}$

Yechilishi:

Gaz kengayib bajargan ishi

$$A = P\Delta V = \frac{m}{M} R\Delta T$$

$$\frac{A_{H_2}}{A_{He}} = \frac{\frac{m_{H_2}}{M_{H_2}} R\Delta T}{\frac{m_{He}}{M_{He}} R\Delta T} = \frac{M_{He}}{M_{H_2}} = \frac{4}{2} = 2$$

$$A_{H_2} = 2 A_{He}$$

$$\begin{aligned} A_{H_2} &= A_1 \\ A_{He} &= A_2 \end{aligned}$$

40.15. 0,2 MPa bosim ostida turgan gaz izobarik ravishda kengayib, 50 J ish bajardi. Bunda gazning hajmi necha litr ortgan?

- A) 0,25 B) 0,35 C) 0,5 D) 1

Berilgan:

$$P = 0,2 \text{ MPa} = 2 \cdot 10^5 \text{ Pa}$$

$$A = 50 \text{ J}$$

$$\Delta V = ?$$

Yechilishi:

Gaz kengayib bajargan ishi

$$A = P \Delta V$$

$$\Delta V = \frac{A}{P} = \frac{50}{2 \cdot 10^5} = 25 \cdot 10^{-5} \text{ m}^3 = 0,25 \text{ l}$$

Javob: A) $\Delta V = 0,25 \text{ l}$.

40.16. Tashqi kuchlar 10^6 Pa o'zgarmas bosimli gaz ustida 100 kJ ish bajardilar. Bu jarayonda gazning hajmi qanday o'zgardi?

- A) 10 marta ortdi B) 10 marta kamaydi
C) o'zgarmadi D) $0,1 \text{ m}^3$ kamaydi

Berilgan:

$$P = 10^6 \text{ Pa}$$

$$A = 100 \text{ kJ}$$

$$\Delta V = ?$$

Yechilishi:

$$A = P \Delta V$$

$$\Delta V = \frac{A}{P} = \frac{100 \cdot 10^3}{10^6} = 0,1 \text{ m}^3 \text{ tashqi kuchlar gaz ustida ish bajarganda gaz hajmi kamayadi.}$$

Javob: D) $\Delta V = 0,1 \text{ m}^3$ kamaygan.

40.17. Kislorod 10 K ga izobarik isitilganda, 831 J ish bajarildi. Kislorodning massasini aniqlang (kg).

- A) 0,16 B) 0,32 C) 0,64 D) 3,2

Berilgan:

$$\Delta T = 10 \text{ K}$$

$$A = 831 \text{ J}$$

$$M_{\text{O}_2} = 32 \text{ g/mol}$$

$$m = ?$$

Yechilishi:

Gaz kengayib bajargan ishi

$$A = P \Delta V = \frac{m}{M} R \Delta T \text{ dan}$$

$$m = \frac{M_{\text{O}_2} \cdot A}{R \Delta T} = \frac{32 \cdot 10^{-3} \cdot 831}{8,31 \cdot 10} = 0,32 \text{ kg}$$

Javob: B) $m = 0,32 \text{ kg}$.

40.18. Universal gaz doimiysining fizik ma'nosini qanday tushunasiz?

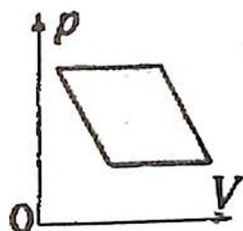
A) 1 mol ideal gaz temperaturasi 1 K ga o'zgartirish uchun kerak bo'lgan issiqlik miqdori. B) 1 mol ideal gaz temperaturasi o'zgarmas bosimda 1 K ga o'zgartirganda bajariladigan ish. C) 1 mol gazdagi molekular soni. D) normal sharoitda gaz bosimi bilan hajmining ko'paytmasi.

Javob: B) 1 mol ideal gaz temperaturasi o'zgarmas bosimda 1 K ga o'zgartirganda bajariladigan ish.

40.19. Rasmdagi shtrixlangan yuzaning fizik ma'nosi nimadan iborat?

- A) temperatura o'zgarishiga teng
- B) fizik ma'noga ega emas
- C) bajarilgan ishga teng
- D) bosib o'tilgan yo'lga teng

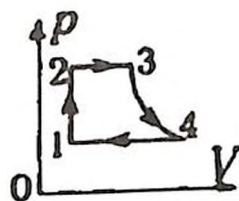
Javob: C) bajarilgan ishga teng.



40.20. Rasmda ko'rsatilgan siklning qaysi qismida gaz bajargan ish nolga teng?

- A) 3-4
- B) 2-3
- C) 1-2 va 1-4
- D) 1-2

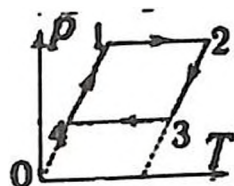
Javob: D) 1-2. Chunki $V_1 = V_2$, $\Delta V = 0$.



40.21. Rasmdagi ideal gaz siklining qaysi qismida ish bajarilmaydi?

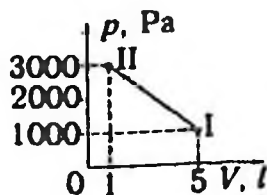
- A) 4-1
- B) 2-3
- C) 4-1 va 2-3
- D) 1-2

Javob: A) 4-1. $V = \text{const}$ bo'lgani uchun.



40.22. Gazning birinchi holatdan ikkinchi holatga o'tganda bajarilgan ishini toping (J).

- A) 12
- B) 8
- C) -4
- D) -8



Berilgan:

$$P_1 = 1000 \text{ Pa}$$

$$P_2 = 3000 \text{ Pa}$$

$$V_1 = 5 \text{ l}$$

$$= 5 \cdot 10^{-3} \text{ m}^3$$

$$V_2 = 1 \text{ l} = 10^{-3} \text{ m}^3$$

$$A = ?$$

Yechilishi:

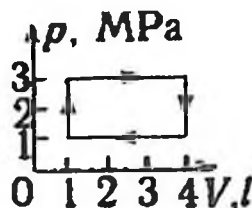
Bajarilgan ish grafikdagi yuzaga son jihatidan teng. Gaz bajarilgan ish manfiy. Chunki gaz hajmi kamaygan.

$$A = \frac{(P_1 + P_2)}{2} (V_2 - V_1) = \frac{(3000 + 1000)}{2} (10^{-3} - 5 \cdot 10^{-3}) = -8 \text{ J}$$

Javob: D) -8.

40.23. Diagrammada ko'rsatilgan sikl bo'yicha ishlovchi issiqlik mashinasi bir sikl davomida qanday (kJ) ish bajaradi?

- A) 3
- B) 6
- C) 8
- D) 9



Berilgan:

$$P_1 = 1 \text{ MPa} = 10^6 \text{ Pa}$$

$$P_2 = 3 \text{ MPa} = 3 \cdot 10^6 \text{ Pa}$$

$$V_1 = 1 \text{ l} = 10^{-3} \text{ m}^3$$

$$V_2 = 4 \text{ l} = 4 \cdot 10^{-3} \text{ m}^3$$

$$A = ?$$

Javob: C) $A = 8 \text{ kJ}$.

40.24. Diagrammada ko'rsatilgan sikl bo'yicha ishlovchi issiqlik mashinasi bir sikl davomida qanday (kJ) ish bajaradi?

- A) 3 B) 4 C) 6 D) 7

Berilgan:

$$P_1 = 1 \text{ MPa} = 10^6 \text{ Pa}$$

$$P_2 = 3 \text{ MPa} = 3 \cdot 10^6 \text{ Pa}$$

$$\Delta V_1 = 1 \text{ l} = 10^{-3} \text{ m}^3$$

$$\Delta V_2 = 3 \text{ l} = 3 \cdot 10^{-3} \text{ m}^3$$

$$A = ?$$

Javob: B) $A = 4 \text{ kJ}$.

40.25. Rasmda tasvirlangan jarayonda necha joul ish bajarilgan? (Rasmdagi shakl yarim aylana.)

- A) 0 B) $6,28 \cdot 10^6$
C) $6,28 \cdot 10^3$ D) aniqlab bo'lmaydi

Javob: D) aniqlab bo'lmaydi.

40.26. Quyida sanab o'tilgan jarayonlarning qaysi birida gaz hajmi V_1 dan V_2 gacha ortganda eng ko'p ish bajariladi?

- A) izobar jarayon
B) izotermik jarayon
C) adiabat jarayon
D) bosim hajmga mutanosib bo'lgan $p = \text{const} - V$ jarayon

Javob: D) bosim hajmga munosib bo'lgan $P = \text{const} \cdot V$ jarayon.

40.27. Hajmning ortishi bir xil bo'lganda, quyidagi hollarning qaysi birida ideal gaz ko'proq ish bajaradi?

- A) izotermik jarayonda B) adiabatik jarayonda
C) izobarik jarayonda D) izotermik va adiabatik jarayonlarda bir xil

Javob: C) izobarik jarayonda

Yechilishi:

Bajarilgan ish grafikdagi yuzaga son jihatidan teng yuzani topamiz

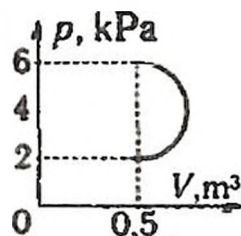
$$A = (P_2 - P_1)(V_2 - V_1) = (3 \cdot 10^6 - 10^6) \cdot (4 \cdot 10^{-3} - 10^{-3})$$

**Yechilishi:**

Bajarilgan ish grafikdagi trapetsiyaning yuzasiga son jihatidan teng yuzani topamiz:

$$A = (P_2 - P_1) \frac{(\Delta V_2 + \Delta V_1)}{2} =$$

$$= (3 \cdot 10^6 - 10^6) \cdot \left(\frac{3 \cdot 10^{-3} + 10^{-3}}{2} \right) = 4 \cdot 10^3 \text{ J}.$$



40.28. Gazli suv hosil qilish uchun suv ichidan siqilgan karbonat angidrid gazi o'tkaziladi. Bunda suvning harorati qanday va nima sababli o'zgaradi?

- A) gaz hajmi kengayganligi uchun suvning harorati ortadi
- B) suvning harorati pasayadi, chunki gaz kengayganda ichki energiyasi hisobiga ish bajaradi
- C) suvning harorati pasayadi, chunki kengayish jarayoni izobarikdir
- D) suvning harorati pasayadi, chunki kengayish jarayoni adiabatdir

Javob: B) suvning harorati pasayadi, chunki gaz kengayganda ichki energiya hisobiga ish bajaradi.

41-§. Issiqlik miqdori

41.1. Jismning ichki energiyasi ... o'zgarishi mumkin.

- A) jismga issiqlik berilganda va uning ustida ish bajarilganda
- B) faqat jism ish bajarganda
- C) jismning kinetik va potentsial energiyalari o'zgarganda
- D) faqat jismga biror miqdor issiqlik berilganda

Javob: A) jismga issiqlik berilganda va uning ustida ish bajarilganda.

41.2. Moddaning solishtirma issiqlik sig'imi quyidagi parametrlarning qaysi biriga bog'liq?

- A) hech biriga bog'liq emas
- B) modda massasi
- C) boshlang'ich temperatura
- D) oxirgi temperatura

Javob: A) hech biriga bog'liq emas.

41.3. Temperaturasi 15°C bo'lgan 50 l suv 45°C li 25 l suv bilan aralashtirildi. Aralashmaning temperaturasi qanday ($^{\circ}\text{C}$) bo'ladi?

- A) 20
- B) 60
- C) 30
- D) 25

Berilgan:

$$t_1 = 15^{\circ}\text{C}$$

$$V_1 = 50 \text{ l}$$

$$t_2 = 45^{\circ}\text{C}$$

$$V_2 = 25 \text{ l}$$

$$t = ?$$

Yechilishi: Issiqlik almashinish jarayoni temperatura muvozanati qaror topguncha davom etadi. Bunda t_2 temperaturali suv t temperaturagacha soviganda ajralgan issiqlik miqdori $Q = c\rho V_2(t_2 - t)$ teng bo'ladi, t_1 temperaturali suv t temperaturagacha isiganda olgan issiqlik miqdori $Q = c \cdot \rho \cdot V_1(t - t_1)$ ga teng bo'ladi. Buni hisobga olib quyidagini yozamiz:

$$c\rho V_2(t_2 - t) = c\rho V_1(t - t_1)$$

$$t_{um} = \frac{t_1 V_1 + t_2 V_2}{V_1 + V_2} = \frac{15 \cdot 50 + 45 \cdot 25}{50 + 25} = 25^{\circ}\text{C}$$

Javob: D) 25°C .

41.4. Stakanda 20°C li 100 g suv bor. Agar stakanga yana 50°C li 50 g suv qo'shilsa, undagi suvning harorati qanday bo'ladi (°C)? Stakanning issiqlik sig'ini hisobga olmang.

A) 40 B) 38

C) 35 D) 30

Berilgan:

$$\begin{aligned} t_1 &= 20^\circ\text{C} \\ m_1 &= 100 \text{ g} = 0,1 \text{ kg} \\ t_2 &= 50^\circ\text{C} \\ m_2 &= 50 \text{ g} = 0,05 \text{ kg} \end{aligned}$$

$$t_{um} = ?$$

Yechilishi:

Aralashmaning temperaturasi topish formulasi.

$$t_{um} = \frac{t_1 m_1 + t_2 m_2}{m_1 + m_2} = \frac{20 \cdot 0,1 + 50 \cdot 0,05}{0,1 + 0,05} = 30^\circ\text{C}$$

Javob: D) $t_{um} = 30^\circ$.

41.5. Temperaturasi 10°C bo'lgan 1 kg suvga 200 g qaynoq suv qo'shib aralashtirildi. Aralashma temperaturasi toping (°C).

A) 20 B) 25

C) 35 D) 40

Berilgan:

$$\begin{aligned} t_1 &= 10^\circ\text{C} \\ m_1 &= 1 \text{ kg} \\ t_2 &= 100^\circ\text{C} \\ m_2 &= 0,2 \text{ kg} \end{aligned}$$

$$t_{um} = ?$$

Yechilishi:

Aralashmaning temperaturasi topish formulasi.

$$t_{um} = \frac{t_1 m_1 + t_2 m_2}{m_1 + m_2} = \frac{10 \cdot 1 + 100 \cdot 0,2}{1 + 0,2} = 25^\circ\text{C}$$

Javob: B) $t_{um} = 25^\circ\text{C}$.

41.6. Rasmda ko'rsatilgan ma'lumotlarga ko'ra, suvning oxirgi haroratini aniqlang.

A) 10 B) 20

C) 7 D) 16

Berilgan:

$$\begin{aligned} t_1 &= 20^\circ\text{C} \\ m_1 &= 0,06 \text{ kg} \\ t_2 &= 10^\circ\text{C} \\ m_2 &= 0,04 \text{ kg} \end{aligned}$$

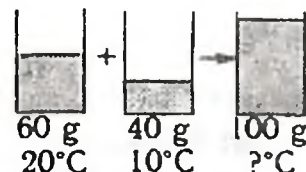
$$t_{um} = ?$$

Yechilishi:

Aralashmaning temperaturasi topish formulasidan foydalanamiz.

$$t_{um} = \frac{t_1 m_1 + t_2 m_2}{m_1 + m_2} = \frac{10 \cdot 0,06 + 10 \cdot 0,04}{0,06 + 0,04} = 16^\circ\text{C}$$

Javob: D) $t_{um} = 16^\circ\text{C}$.



41.7. Harorati 100°C, massasi 2 kg bo'lgan suvni 60°C gacha sovitish uchun 10°C temperaturali necha kg suv qo'shish kerak?

A) 2

B) 1,2

C) 1,6

D) 1,4

Berilgan:

$$t_1 = 100^\circ\text{C}$$

$$m_1 = 2 \text{ kg}$$

$$t_2 = 10^\circ\text{C}$$

$$t_{um} = 60^\circ\text{C}$$

$$m_2 = ?$$

Yechilishi:

Aralashmaning temperaturasi topish formulasidan.

$$t_{um} = \frac{t_1 m_1 + t_2 m_2}{m_1 + m_2}, m_2 \text{ ning massani topamiz,}$$

$$t_{um} m_1 + t_{um} m_2 = t_1 m_1 + t_2 m_2$$

$$t_{um} m_2 - t_2 m_2 = t_1 m_1 - t_{um} m_1$$

$$m_2 = \frac{(t_1 - t_{um}) m_1}{t_{um} - t_2} = \frac{(100 - 60) \cdot 2}{60 - 10} = 1,6 \text{ kg}$$

Javob: C) $m_2 = 1,6 \text{ kg}$.

41.8. Agar vodoprovod suvining harorati 20°C bo'lsa, 40°C li 100 l suv tayyorlash uchun necha litr qaynoq suv kerak bo'ladi?

A) 40

B) 35

C) 30

D) 25

Berilgan:

$$t_1 = 20^\circ\text{C}$$

$$t_2 = 100^\circ\text{C}$$

$$V_{um} = 100 \text{ l}$$

$$t_{um} = 40^\circ\text{C}$$

$$V_2 = ?$$

Yechilishi:

Aralashmaning temperaturasi topish formulasi.

$$t_{um} = \frac{t_1 V_1 + t_2 V_2}{V_1 + V_2} = \frac{t_1 V_1 + t_2 V_2}{V_{um}} = \frac{t_1 (V_{um} - V_2) + t_2 V_2}{V_{um}} =$$

$$= \frac{t_1 V_{um} - t_1 V_2 + t_2 V_2}{V_{um}}$$

V_2 hajmini topamiz

$$t_{um} V_{um} - t_1 V_{um} = t_2 V_2 - t_1 V_2$$

$$V_2 = \frac{(t_{um} - t_1) V_{um}}{t_2 - t_1} = \frac{(40 - 20) \cdot 100}{100 - 20} = 25 \text{ l}$$

Javob: D) $V_2 = 25 \text{ l}$.

41.9. Vannaning yarmi harorati 25°C sovuq suv bilan to'ldirilgan. Vannaga yana harorati 70°C li suv quyildi va shundan so'ng vanna hajmining 75%i iliq suvga to'ldi. Iliq suvning harorati qanday ($^\circ\text{C}$)?

A) 40

B) 36

C) 32

D) 28

Berilgan:

$$t_1 = 25^\circ\text{C}$$

$$t_2 = 70^\circ\text{C}$$

$$V_1 = 0,5 \text{ V}$$

$$V_2 = 0,25 \text{ V}$$

$$t_{um} = ?$$

Yechilishi:

Aralashmaning temperaturasi topish formulasi.

$$t_{um} = \frac{t_1 V_1 + t_2 V_2}{V_1 + V_2} = \frac{25 \cdot 0,5 + 70 \cdot 0,25}{0,5 + 0,25} = 40^\circ\text{C}$$

Javob: A) $t_{um} = 40^\circ\text{C}$.

41.10. Idishga 10°C li 6 l, 20°C li 9 l va 40°C li 15 l suv quyildi. Natijaviy temperatura qanday (°C)?

A) 15

B) 20

C) 28

D) 32

Berilgan:

$$t_1 = 10^\circ\text{C}$$

$$t_2 = 20^\circ\text{C}$$

$$t_3 = 40^\circ\text{C}$$

$$V_1 = 6\text{ l}$$

$$V_2 = 9\text{ l}$$

$$V_3 = 15\text{ l}$$

$$t_{um} = ?$$

Yechilishi:

Aralashmaning temperaturasi topish formulasi.

$$t_{um} = \frac{t_1 V_1 + t_2 V_2 + t_3 V_3}{V_1 + V_2 + V_3} = \frac{10 \cdot 6 + 20 \cdot 9 + 40 \cdot 15}{6 + 9 + 15} = 28^\circ\text{C}$$

Javob: C) $t_{um} = 28^\circ\text{C}$.

41.11. Solishtirma issiqlik sig'imi 3800 va massasi 0,4 kg bo'lgan jism 4°C dan 24°C gacha isitilganda, qancha issiqlik miqdori oladi?

A) 3040 J

B) 30,4 J

C) 18240 J

D) 30,4 kJ

Berilgan:

$$c = 3800\text{ J/(kg} \cdot \text{K)}$$

$$m = 0,4\text{ kg}$$

$$t_1 = 4^\circ\text{C}$$

$$t_2 = 24^\circ\text{C}$$

$$Q = ?$$

Yechilishi:

Berilgan issiqlik miqdori

$$Q = mc(t_2 - t_1) = 0,4 \cdot 3800(24 - 4) = 30400\text{ J}$$

$$J = 30,4\text{ kJ.}$$

Javob: D) $Q = 30,4\text{ kJ}$.

41.12. Yozda dengiz suvining o'rtacha harorati 27°C, qishda esa 7°C. Yozdan qishga o'tishda dengiz necha joul issiqlik chiqaradi? Dengiz yuzi 250000 km², chuqurligi esa 1000 m. Suvning solishtirma issiqlik sig'imi 4,2 kJ/(kg · K).

A) $4,2 \cdot 10^{21}$

B) $2,1 \cdot 10^{21}$

C) $4,2 \cdot 10^{20}$

D) $2,1 \cdot 10^{22}$

Berilgan:

$$t_1 = 27^\circ\text{C}$$

$$t_2 = 7^\circ\text{C}$$

$$S = 25 \cdot 10^{10}\text{ m}^2$$

$$h = 1000\text{ m}$$

$$c = 4200\text{ J/(kg} \cdot \text{K)}$$

$$Q = ?$$

Yechilishi:

Berilgan issiqlik miqdori

$$Q = mc(t_2 - t_1) = \rho S \cdot hc(t_2 - t_1) = -2,1 \cdot 10^{22}\text{ J}$$

Minus ishora issiqlik atrof-muhitga tarqayotganini va jism soviyotganini bildiradi.

Javob: D) $2,1 \cdot 10^{22}$.

41.13. Massasi 4 kg bo'lgan qizdirilgan g'isht suvda 2°C ga sovitilganda, 7040 J issiqlik miqdori ajraldi. G'ishtning solishtirma issiqlik sig'imini toping ($\text{J}/(\text{kg} \cdot \text{K})$).

A) 56320

B) 3520

C) 1760

D) 880

Berilgan:

$$m = 4 \text{ kg}$$

$$\Delta t = 2^{\circ}\text{C}$$

$$Q = 7040 \text{ J}$$

$$c = ?$$

Yechilishi:

Berilgan issiqlik miqdori

$$Q = mc\Delta t \text{ dan } c = \frac{Q}{m\Delta t} = \frac{7040}{4 \cdot 2} = 880 \text{ J}/(\text{kg} \cdot \text{K}) \text{ kelib}$$

chiqadi.

Javob: D) $c = 880 \text{ J}/(\text{kg} \cdot \text{K})$.

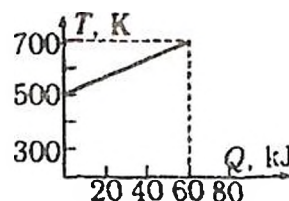
41.14. Massasi 3 kg bo'lgan jism haroratining unga berilayotgan issiqlikka qarab o'zgarishi rasmda keltirilgan. Jism moddasining solishtirma issiqlik sig'imi qanday ($\text{J}/(\text{kg} \cdot \text{K})$)?

A) 500

B) 400

C) 300

D) 100



Berilgan:

$$\Delta Q = 60 \text{ kJ}$$

$$\Delta T = 200 \text{ K}$$

$$m = 3 \text{ kg}$$

$$c = ?$$

Yechilishi:

Berilgan issiqlik miqdori

$$Q = mc\Delta T, \quad c = \frac{Q}{m\Delta T} = \frac{60 \cdot 10^3}{3 \cdot 200} = 100 \text{ J}/(\text{kg} \cdot \text{K})$$

Javob: D) $c = 100 \text{ J}/(\text{kg} \cdot \text{K})$.

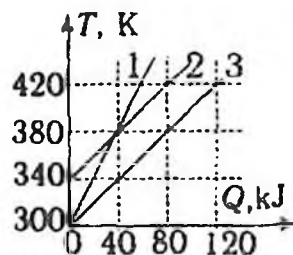
41.15. Rasmda massalari $m_1 > m_2 > m_3$ bo'lgan uchta jism temperaturalarining ularga berilayotgan issiqlik miqdoriga bog'liq ravishda o'zgarish grafiklari tasvirlangan. Bu jismlarning issiqlik sig'imlarini taqqoslang.

A) $C_1 < C_2 < C_3$

B) $C_1 > C_2 = C_3$

C) $C_1 > C_2 > C_3$

D) $C_1 < C_2 = C_3$



Berilgan:

$$m_1 > m_2 > m_3$$

$$\Delta T_1 = 80 \text{ K}$$

$$\Delta T_2 = 80 \text{ K}$$

$$\Delta T_3 = 80 \text{ K}$$

$$Q_1 = 40 \text{ kJ}$$

$$Q_2 = 80 \text{ kJ}$$

$$Q_3 = 80 \text{ kJ}$$

$$C = ?$$

Yechilishi:

Issiqlik sig'imini topish formulasi.

$$C_1 = \frac{Q_1}{\Delta T_1} = \frac{40 \cdot 10^3}{80} = 500 \text{ J/K}$$

$$C_2 = \frac{Q_2}{\Delta T_2} = \frac{80 \cdot 10^3}{80} = 1000 \text{ J/K}$$

$$C_3 = \frac{Q_3}{\Delta T_3} = \frac{80 \cdot 10^3}{80} = 1000 \text{ J/K}$$

Javob: D) $C_1 < C_2 = C_3$.

41.16. FIK 50% bo'lgan o'choqda 42 kg toshko'mir yoqilganda, 2,9 m³ suvning temperaturasi necha kelvinga o'zgaradi? $q = 29 \cdot 10^6$ J/kg, $c = 4200$ J/(kg · K).

A) 21

B) 29

C) 35

D) 50

Berilgan:

$$\eta = 50 \%$$

$$m = 42 \text{ kg}$$

$$V = 2,9 \text{ m}^3$$

$$q = 29 \cdot 10^6 \text{ J/kg}$$

$$c = 4200 \text{ J/(kg} \cdot \text{K)}$$

$$\Delta T = ?$$

Yechilishi:

$$\text{Yonish issiqligi } Q_{\text{yon}} = qm$$

$$\text{Suvga berilgan issiqlik miqdori } Q = \frac{\eta Q_{\text{yon}}}{100\%}$$

Temperatura o'zgarishi

$$\begin{aligned} \Delta T &= \frac{Q}{m_s} = \frac{\frac{\eta Q_{\text{yon}}}{100\%}}{\rho V c} = \frac{\eta Q_{\text{yon}}}{\rho V c 100\%} = \frac{\eta q m}{\rho V c 100\%} = \\ &= \frac{29 \cdot 10^6 \cdot 42 \cdot 50\%}{1000 \cdot 2,9 \cdot 4200 \cdot 100\%} = 50 \text{ K} \end{aligned}$$

Javob: D) $\Delta T = 50$ K.

41.17. Quvvati 200 W bo'lgan qaynatgich bir stakan suv (150 g) ni 5 minutda 80°C ga isitadi. Bu jarayonda necha kJ issiqlik miqdori havoga ketadi? $c = 4200$ J/(kg · K).

A) 4,8

B) 9,6

C) 12,8

D) 38,4

Berilgan:

$$P = 200 \text{ W}$$

$$m = 0,15 \text{ kg}$$

$$t = 300 \text{ s}$$

$$\Delta t = 80 \text{ }^\circ\text{C}$$

$$c = 4200 \frac{\text{J}}{\text{kg} \cdot \text{K}}$$

$$Q_x = ?$$

Yechilishi:

$$\text{Qaynatgichdan ajralayotgan issiqlik miqdori } Q_1 = Pt$$

$$\text{Suvga berilgan issiqlik miqdori } Q_2 = mc\Delta t$$

Havoga ketgan issiqlik miqdori

$$\begin{aligned} Q_x &= Q_1 - Q_2 = Pt - mc\Delta t = 200 \cdot 300 - 0,15 \cdot 4200 \cdot 80 = \\ &= 9600 \text{ J} = 9,6 \text{ kJ} \end{aligned}$$

Javob: B) 9,6 kJ.

41.18. Quvvati 600 W bo'lgan qaynatgichda 10°C temperaturadagi 1 l suv 12,5 minutda qaynaydi. Qaynatgichning FIK ni toping (%). Suvning solishtirma issiqlik sig'imi $c = 4200$ J/(kg · K) ga teng.

A) 92

B) 84

C) 81

D) 75

Berilgan:

$$P = 600 \text{ W}$$

$$t_1 = 10 \text{ }^\circ\text{C}$$

$$t_2 = 100 \text{ }^\circ\text{C}$$

$$V = 1 \text{ l} = 10^{-3} \text{ m}^3$$

Yechilishi:

Qaynatgichdan ajralayotgan issiqlik miqdori

$$Q_1 = Pt$$

Suvga berilgan issiqlik miqdori

$$Q_2 = mc\Delta t = \rho V c (t_2 - t_1)$$

$$t = 12,5 \text{ min} = 750 \text{ s}$$

$$c = 4200 \frac{\text{J}}{\text{kg} \cdot \text{K}}$$

$$\eta = ?$$

Javob: B) $\eta = 84\%$.

FIK ini topish formulasi

$$\eta = \frac{Q_2}{Q_1} \cdot 100\% = \frac{\rho V c (t_2 - t_1)}{P t} \cdot 100\% = \frac{1000 \cdot 10^{-3} \cdot 4200 \cdot (100 - 10)}{600 \cdot 750} \cdot 100\% = 84\%$$

41.19. Quvvati 600 W va FIK 84% bo'lgan qaynatgich yordamida 10°C dagi 1 l suv necha minutda qaynaydi? Suvning solishtirma issiqlik sig'imi $c = 4200 \text{ J}/(\text{kg} \cdot \text{K})$.

A) 6

B) 8

C) 9,5

D) 12,5

Berilgan:

$$P = 600 \text{ W}$$

$$t_1 = 10^\circ \text{C}$$

$$t_2 = 100^\circ \text{C}$$

$$V = 1 \text{ l} = 10^{-3} \text{ m}^3$$

$$c = 4200 \frac{\text{J}}{\text{kg} \cdot \text{K}}$$

$$\eta = 80\%$$

$$t = ?$$

Yechilishi:

Qaynatgichdan ajralayotgan issiqlik miqdori

$$Q_1 = P t$$

Suvga berilgan issiqlik miqdori

$$Q_2 = mc\Delta t = \rho V c (t_2 - t_1)$$

FIK ini topish formulasi

$$\eta = \frac{Q_2}{Q_1} \cdot 100\% = \frac{\rho V c (t_2 - t_1)}{P t} \cdot 100\%$$

$$t = \frac{\rho V c (t_2 - t_1)}{P \eta} \cdot 100\% = \frac{10^3 \cdot 10^{-3} \cdot 4200 (100 - 10)}{600 \cdot 84\%} \cdot 100\% = 750 \text{ s} = 12,5 \text{ min.}$$

Javob: D) $t = 12,5 \text{ min}$.

41.20. Agar FIK 80 % bo'lgan elektr choynak 20°C temperaturadagi 2 l suvni 10 minutda qaynatsa, uning quvvati necha kilovattga teng? Suvning solishtirma issiqlik sig'imi $c = 4200 \text{ J}/(\text{kg} \cdot \text{K})$.

A) 0,84

B) 0,7

C) 1,4

D) 2,8

Berilgan:

$$t_1 = 20^\circ \text{C}$$

$$t_2 = 100^\circ \text{C}$$

$$V = 2 \text{ l} = 2 \cdot 10^{-3} \text{ m}^3$$

$$c = 4200 \frac{\text{J}}{\text{kg} \cdot \text{K}}$$

$$h = 80\%$$

$$t = 10 \text{ min} = 600 \text{ s}$$

$$P = ?$$

Yechilishi:

Qaynatgichdan ajralayotgan issiqlik miqdori $Q_1 = P t$

Suvga berilgan issiqlik miqdori

$$Q_2 = mc\Delta t = \rho V c (t_2 - t_1)$$

FIK ini topish formulasi

$$\eta = \frac{Q_2}{Q_1} \cdot 100\% = \frac{\rho V c (t_2 - t_1)}{P t} \cdot 100\%$$

$$P = \frac{\rho V c (t_2 - t_1)}{\eta t} \cdot 100\% = \frac{10^3 \cdot 2 \cdot 10^{-3} \cdot 4200 (100 - 10)}{600 \cdot 80\%} \cdot 100\% = 1,4 \cdot 10^3 \text{ W} = 1,4 \text{ kW}$$

Javob: C) $P = 1,4 \text{ kW}$.

41.21. Foydali ish koeffitsiyenti 20% bo'lgan pechkada 0,5 t aluminiyni 282 K dan 932 K gacha qizdirish uchun qancha toshko'mir yoqish kerak (kg)? Aluminiyning solishtirma issiqlik sig'imi 880 J/(kg · K), ko'mirning solishtirma yonish issiqligi $2 \cdot 10^7$ J/kg.

- A) 50 B) 60 C) 71 D) 80

Berilgan:

$$h = 20 \%$$

$$m_{Al} = 500 \text{ kg}$$

$$T_1 = 282 \text{ K}$$

$$T_2 = 932 \text{ K}$$

$$c = 880 \frac{\text{J}}{\text{kg} \cdot \text{K}}$$

$$q = 2 \cdot 10^7 \frac{\text{J}}{\text{kg}}$$

$$m_t = ?$$

Yechilishi:

Alyuminiyga berilgan issiqlik miqdori

$$Q_2 = m_{Al} c \Delta T = m_{Al} c (T_2 - T_1)$$

Toshko'mir yonganda ajralgan issiqlik miqdori

$$Q_1 = q m_t$$

FIK ini topish formulasi

$$\eta = \frac{Q_2}{Q_1} \cdot 100\% = \frac{m_{Al} c (T_2 - T_1)}{q m_t} \cdot 100\%$$

$$m_t = \frac{m_{Al} c (T_2 - T_1)}{q \eta} \cdot 100\% = \frac{500 \cdot 880 \cdot (932 - 282)}{2 \cdot 10^7 \cdot 20\%} \cdot 100\% = 71 \text{ kg}$$

Javob: C) $m_t = 71$ kg.

41.22. 420 m balandlikdan tushgan suv bajargan ishining 60 foizi uning temperaturasi qanchaga ko'taradi (K)? $c = 4200$ J/(kg · K).

- A) 0,42 B) 0,6 C) 2,1 D) 4,2

Berilgan:

$$h = 420 \text{ m}$$

$$\eta = 60 \%$$

$$c = 4200 \text{ J/(kg} \cdot \text{K)}$$

$$\Delta T = ?$$

Yechilishi:

Jismning potensial energiyasining 60% i ichki energiyaga aylanadi.

$$\eta = \frac{Q}{E_p} 100\% = \frac{mc \Delta T}{mgh} 100\% = \frac{c \Delta T}{gh} 100\%$$

$$\Delta T = \frac{\eta gh}{c \cdot 100\%} = \frac{10 \cdot 420 \cdot 60\%}{4200 \cdot 100\%} = 0,6 \text{ K}$$

Javob: B) $\Delta T = 0,6 \text{ K}$.

41.23. Agar sharsharaning yuqori qismidagi suvning harorati pastdagi suvning haroratidan 0,1 K past bo'lsa, sharsharaning balandligi necha metr? Suv uchun $c = 4200$ J/(kg · K).

- A) 10 B) 28 C) 42 D) 98

Berilgan:

$$\Delta T = 0,1 \text{ K}$$

$$c = 4200 \text{ J/(kg} \cdot \text{K)}$$

$$h = ?$$

Yechilishi:

Suvning potensial energiyasi ichki energiyaga aylanadi.

$$mgh = mc \Delta T, \quad gh = c \Delta T$$

$$h = \frac{c \Delta T}{g} = \frac{4200 \cdot 0,1}{10} = 42 \text{ m}$$

Javob: C) 42 m.

Berilgan:

$$\begin{aligned}v &= 100 \text{ m/s} \\c &= 125 \text{ J/(kg} \cdot \text{K)} \\Q &= 0,5 E_k \\ \hline \Delta T &= ?\end{aligned}$$

Yechilishi:

$$\begin{aligned}Q &= 0,5 E_k, Q = mc\Delta T, E_k = \frac{mv^2}{2} \\ \Delta T &= \frac{0,5v^2}{2c} = \frac{0,5 \cdot 100^2}{2 \cdot 125} = 20 \text{ K}\end{aligned}$$

Javob: C) 20 K.

41.30. Taxtani teshib o'tgan qo'rg'oshin o'q tezligi 500 m/s dan 300 m/s gacha kamaydi. Ajralib chiqqan issiqlikning 50%i o'qqa o'tgan bo'lsa, o'qning harorati necha °C ga o'zgargan? $c = 130 \text{ J/(kg} \cdot \text{K)}$.

- A) 108 B) 127 C) 273 D) 308

Berilgan:

$$\begin{aligned}v_1 &= 500 \text{ m/s} \\v_2 &= 300 \text{ m/s} \\c &= 130 \text{ J/(kg} \cdot \text{K)} \\Q &= 0,5 E_k \\ \hline \Delta T &= ?\end{aligned}$$

Yechilishi:

$$\begin{aligned}Q &= 0,5 E_k, Q = mc\Delta T, E_k = \frac{mv_2^2}{2} - \frac{mv_1^2}{2} \\ \Delta T &= \frac{0,5(v_2^2 - v_1^2)}{2c} = \frac{0,5 \cdot (500^2 - 300^2)}{2 \cdot 130} = 308 \text{ K}\end{aligned}$$

Javob: D) 308 K.

41.31. 72 km/h tezlik bilan borayotgan benzin tashuvchi mashina keskin to'xtadi. Bunda sisternadagi benzin temperaturasi necha kelvinga oshdi? Benzin uchun $c = 2 \cdot 10^3 \text{ J/(kg} \cdot \text{K)}$.

- A) 12 B) 7,2 C) 3,6 D) 0,1

Berilgan:

$$\begin{aligned}v &= 20 \text{ m/s} \\c &= \text{J/(kg} \cdot \text{K)} \\ \hline \Delta T &= ?\end{aligned}$$

Yechilishi:

Jismning kinetik energiyasi ichki energiyaga aylanadi.

$$\frac{mv^2}{2} = mc\Delta T$$

$$\Delta T = \frac{v^2}{2c} = \frac{20^2}{2 \cdot 2000} = 0,1 \text{ K}$$

Javob: D) 0,1 K.

41.32. Kinetik energiyasi E_k bo'lgan o'q qum solingan qopga kirib to'xtadi. Agar o'q kinetik energiyasining yarmi uning ichki energiyasiga aylansa, u necha gradusga qiziydi? O'qning issiqlik sig'imi C ga teng.

- A) $\frac{E_k}{4C}$ B) $\frac{E_k}{2C}$ C) $\frac{E_k}{C}$ D) $\frac{2E_k}{C}$

Berilgan:

$$\frac{E_k}{C}$$

$$\Delta T = ?$$

Yechilishi:

Jismning kinetik energiyasi ichki energiyaga aylanadi

$$0,5 \cdot E_k = Q = C \Delta T$$

$$\Delta T = \frac{0,5 \cdot E_k}{2C}$$

$$\text{Javob: B) } \Delta T = \frac{E_k}{2C}.$$

41.33. Qaynash temperaturasi 300 g ruxni bug'ga aylantirishda qancha issiqlik miqdori (kJ) sarflanadi? Ruxning solishtirma bug'lanish issiqligi $1,8 \cdot 10^6$ J/kg.

A) 57000

B) 5700

C) 540

D) 60

Berilgan:

$$m = 0,3 \text{ kg}$$

$$r = 1,8 \cdot 10^6 \text{ J/kg}$$

$$Q = ?$$

Yechilishi:

Bug'lanish issiqligi formulasi

$$Q = mr = 0,3 \cdot 1,8 \cdot 10^6 = 540 \text{ kJ}$$

$$\text{Javob: C) } 540.$$

41.34. 20°C temperaturada suvning solishtirma bug'lanish issiqligi 2260 kJ/kg. Shu temperaturadagi 1 kg bug'ni suvga aylantirilsa, qancha issiqlik ajralib chiqadi?

A) $2,26 \cdot 10^6$ J

B) 1130 kJ

C) 226 J

D) $4,32 \cdot 10^6$ J

Berilgan:

$$t_1 = 20^\circ \text{C}$$

$$r = 2260 \text{ kJ/kg}$$

$$m = 1 \text{ kg}$$

$$Q = ?$$

Yechilishi:

Bug'lanish issiqligi formulasi

$$Q = mr = 1 \cdot 2260 \cdot 10^3 = 2260 \text{ kJ} = 2,26 \cdot 10^6 \text{ J}$$

$$\text{Javob: A) } 2,26 \cdot 10^6.$$

41.35. Yuzi 1000 m² bo'lgan hovuz suvi 2 mm qalinlikdagi muz bilan qoplandi. Bunda atrofqa qancha issiqlik miqdori ajralgan (MJ)? Muzning zichligi 900 kg/m³, solishtirma erish issiqligi 330 kJ/kg.

A) 0,594

B) 2,97

C) 29,7

D) 594

Berilgan:

$$S = 1000 \text{ m}^2$$

$$h = 2 \text{ mm} = 2 \cdot 10^{-3} \text{ m}$$

$$\lambda = 330 \text{ kJ/kg}$$

$$\rho = 900 \text{ kg/m}^3$$

$$Q = ?$$

Yechilishi:

Erish issiqlik miqdori

$$Q = m\lambda = \rho V\lambda = \lambda S \cdot h\lambda =$$

$$= 900 \cdot 1000 \cdot 2 \cdot 10^{-3} \cdot 330 \cdot 10^3 = 594 \cdot 10^6 \text{ J} =$$

$$= 594 \text{ MJ}$$

$$\text{Javob: D) } 594.$$

41.36. Har qaysisining massasi 10 g bo'lgan ikki bo'lak muzni bir-biriga ishqalash yo'li bilan eritib yuborish uchun necha joul ish bajarish kerak? Muzning solishtirma erish issiqligi 330 kJ/kg.

- A) $7,2 \cdot 10^3$ B) $3,3 \cdot 10^3$ C) $1,2 \cdot 10^3$ D) $6,6 \cdot 10^3$

Berilgan:

$$m_1 = m_2 = 10 \text{ g}$$

$$\lambda = 330 \text{ kJ/kg}$$

$$Q = ?$$

Yechilishi:

$$Q = (m_1 + m_2)\lambda = (10^{-2} + 10^{-2}) \cdot 330 \cdot 10^3 = 6,6 \cdot 10^3 \text{ J}$$

Javob: D) $Q = 6,6 \cdot 10^3$.

41.37. 0°C dagi teng massali ikkita muz parchasi bir-biriga qanday bir xil tezlik bilan urilganda, to'liq erib ketadi? Muzning solishtirma erish issiqligi λ ga teng.

- A) $2\sqrt{\lambda}$ B) $3\sqrt{\lambda}$ C) $\sqrt{3\lambda}$ D) $\sqrt{2\lambda}$

Berilgan:

$$t = 0^\circ\text{C}$$

$$\lambda$$

$$v = ?$$

Yechilishi:

Muzning kinetik energiyasi uni eritishga sarflanadi.

$$E_k = \frac{mv^2}{2}, Q = m\lambda, \frac{2mv^2}{2} = 2m\lambda, v^2 = 2\lambda, v = \sqrt{2\lambda}$$

Javob: D) $\sqrt{2\lambda}$.

41.38. Erish temperaturasidagi 3 kg suyuq metallning qotishi uchun 60 s vaqt ketdi. Bu holda issiqlik miqdorining yo'qolish tezligi 1000 J/s bo'lsa, uning solishtirma erish issiqligi qanday (kJ/kg)?

- A) 10 B) 20 C) 60 D) 100

Berilgan:

$$m = 3 \text{ kg}$$

$$t = 60 \text{ s}$$

$$\frac{\Delta Q}{\Delta t} = 1000 \text{ J/s}$$

$$\lambda = ?$$

Yechilishi:

Qotish jarayonida ajralib chiqqan issiqlik miqdori

$$Q = m\lambda = \frac{\Delta Q}{\Delta t} \cdot t, \lambda = \frac{\Delta Q}{\Delta t} \cdot \frac{t}{m} = 1000 \cdot \frac{60}{3} = 2 \cdot 10^4 \text{ J/kg} = 20 \text{ kJ/kg}$$

Javob: B) 20.

42-§. Termodinamikaning birinchi qonuni va uning turli jarayonlarga tatbiqi

42.1. Agar gaz ustida tashqi kuchlar bajargan ish 600 J ga, unga berilgan issiqlik miqdori 200 J ga teng bo'lsa, gaz ichki energiyasining o'zgarishi qanday (J)?

- A) 0 B) 200 C) 400 D) 800

Berilgan:

$$A' = 600 \text{ J}$$

$$Q = 200 \text{ J}$$

$$\Delta U = ?$$

Yechilishi:

Termodinamikaning birinchi qonuni

$$Q + A' = \Delta U$$

$$\Delta U = Q + A' = 200 + 600 = 800 \text{ J}$$

Javob: D) 800.

42.2. Gazga 200 J issiqlik berildi va tashqi kuchlar gaz ustida 300 J ish bajardi. Gaz ichki energiyasining o'zgarishi necha joul bo'ladi?

- A) 0 B) 100 C) 200 D) 500

Berilgan:

$$A' = 300 \text{ J}$$

$$Q = 200 \text{ J}$$

$$\Delta U = ?$$

Yechilishi:

Termodinamikaning birinchi qonuni

$$Q + A' = \Delta U$$

$$\Delta U = Q + A' = 200 + 300 = 500 \text{ J}$$

Javob: D) 500.

42.3. Gazga 40 kJ issiqlik miqdori berilganda, u 60 kJ ish bajardi. Gaz ichki energiyasining o'zgarishini toping (kJ).

- A) +60 B) -60 C) +100 D) -20

Berilgan:

$$A = 60 \text{ kJ}$$

$$Q = 40 \text{ kJ}$$

$$\Delta U = ?$$

Yechilishi:

Termodinamikaning birinchi qonuni

$$Q + \Delta U = A$$

$$\Delta U = Q - A = 40 - 60 = -20 \text{ kJ}$$

Javob: D) -20.

42.4. Gaz ustida 7,2 kJ ish bajarildi. Bu jarayonda atrof-muhitga 6 kJ issiqlik miqdori uzatildi. Gazning ichki energiyasi qanchaga o'zgardi (kJ)?

- A) 13,2 B) 7,2 C) 6 D) 1,2

Berilgan:

$$A' = 7,2 \text{ kJ}$$

$$Q = -6 \text{ kJ}$$

$$\Delta U = ?$$

Yechilishi:

Gaz olgan issiqlik miqdori musbat, bergan issiqlik miqdori manfiy bo'ladi. Termodinamikaning birinchi qonuni

$$Q + A' = \Delta U$$

$$\Delta U = Q + A' = -6 + 7,2 = 1,2 \text{ J}$$

Javob: D) 1,2.

42.5. Agar gaz 1000 J issiqlik olib, ichki energiyasini 250 J ga orttirs, gazning bajargan ishi qanday (J)?

- A) 0 B) 250 C) 750 D) 1000

Berilgan:

$Q = 1000 \text{ J}$

$\Delta U = 250 \text{ J}$

$A = ?$

Yechilishi:

Termodinamikaning birinchi qonuni

$Q + \Delta U = A$

$A = Q - \Delta U = 1000 - 250 = 750 \text{ J}$

Javob: C) 750.

42.11. Gazga 150 J issiqlik miqdori berilganda ichki energiyasi 600 J ortgan bo'lsa, tashqi kuchlar gaz ustida necha joul ish bajargan?

A) 0

B) 150

C) 600

D) 450

Berilgan:

$Q = 150 \text{ J}$

$\Delta U = 600 \text{ J}$

$A' = ?$

Yechilishi:

Termodinamikaning birinchi qonuni

$Q + A' = \Delta U$

$A' = \Delta U - Q = 600 - 150 = 450 \text{ J}$

Javob: D) 450.

42.7. Tashqi kuchlar gaz ustida 300 J ish bajardilar. Bunda gazning ichki energiyasi 400 J ortdi. Gazga necha joul issiqlik miqdori berilgan?

A) 0

B) 700

C) 400

D) 100

Berilgan:

$A' = 300 \text{ J}$

$\Delta U = 400 \text{ J}$

$Q = ?$

Yechilishi:

Termodinamikaning birinchi qonuni

$Q + A' = \Delta U$

$Q = \Delta U - A' = 400 - 300 = 100 \text{ J}$

Javob: D) 100.

42.8. Birinchi gal silindrdagi gazga tashqaridan 200 J energiya beriladi va u 50 J ish bajardi. Ikkinchi gal porshen gazni adiabatik ravishda siqib 50 J ish bajardi. Shu ikki holda gaz ichki energiyasining o'zgarishlari nisbati $\Delta U_1 / \Delta U_2$ qanday bo'ladi?

A) 1

B) 2

C) 3

D) 4

Berilgan:

$Q_1 = 200 \text{ J}$

$A_1 = 50 \text{ J}$

$Q_2 = 0$

$A_2 = 50 \text{ J}$

$\frac{\Delta U_1}{\Delta U_2} = ?$

Yechilishi:

Termodinamikaning birinchi qonuni

$Q_1 = \Delta U_1 + A_1; \quad Q_2 + A'_2 = \Delta U_2$

Ichki energiyaning o'zgarishini topamiz

$\Delta U_1 = Q_1 - A_1; \quad \Delta U_2 = Q_2 + A'_2$

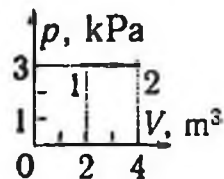
Nisbat olamiz

$\frac{\Delta U_1}{\Delta U_2} = \frac{Q_1 - A_1}{Q_2 + A'_2} = \frac{200 - 50}{0 + 50} = \frac{150}{50} = 3$

Javob: C) 3.

42.9. Gaz 1-holatdan 2-holatga o'tishi uchun unga 15 kJ issiqlik miqdori berilsa, uning ichki energiyasi qanday o'zgaradi?

- A) 9 kJ ga kamayadi B) o'zgarmaydi
C) 6 kJ ga ortadi D) 9 kJ ga ortadi



Berilgan:

$$Q = 15 \text{ kJ}$$

$$P_1 = P_2 = 3 \text{ kPa}$$

$$V_1 = 2 \text{ m}^3$$

$$V_2 = 4 \text{ m}^3$$

$$\Delta U = ?$$

Yechilishi:

Grafikdan ko'rinib turibdiki, bu jarayon izobarik jarayon $P = \text{const}$ izobarik jarayon uchun termodinamikaning birinchi qonuni

$$Q = \Delta U + A,$$

$$A = P\Delta V = P(V_2 - V_1) = 3 \cdot 10^3(4 - 2) = 6 \cdot 10^3 \text{ J} = 6 \text{ kJ}$$

$$\Delta U = Q - A = 15 - 6 = 9 \text{ kJ}$$

$$\Delta U > 0 \text{ ichki energiya ortgan.}$$

Javob: D) 9 kJ ortgan.

42.10. Termodinamikaning 1-qonuni izoxorik jarayon uchun qanday ko'rinishda yoziladi?

- A) $Q = \Delta U$ B) $Q = \Delta U + A$
C) $A = -\Delta U$ D) $A = Q$

Yechilishi:

Izoxorik jarayonda $V = \text{const}$ demak, $A = P\Delta V = 0$.

Termodinamikaning birinchi qonuni

$$Q = \Delta U + A$$

$$Q = \Delta U$$

Javob: A) $Q = \Delta U$.

42.11. Ideal gaz izoxorik isitilganda, uning ichki energiyasi qanday o'zgaradi?

- A) $\Delta U = 0$ B) $\Delta U > 0$
C) $\Delta U < 0$ D) $\Delta U = A$

Yechilishi:

Izoxorik jarayonda bajarilgan ish nolga teng. Demak, ichki energiyaning o'zgarishi berilgan issiqlik miqdoriga teng $Q = \Delta U$, gazga berilgan issiqlik miqdori musbat bo'ladi $Q > 0$ demak, $\Delta U > 0$.

Javob: B) $\Delta U > 0$.

42.12. Massasi 4 kg bo'lgan geliyni izoxorik ravishda 200 K ga qizdirish uchun necha megajoul issiqlik miqdori kerak?

- A) 4 B) 2,5 C) 1,25 D) 4,25

Berilgan:

$$m = 4 \text{ kg}$$

$$\Delta V = 0$$

$$\Delta T = 200 \text{ K}$$

$$M = 4 \cdot 10^{-3} \text{ kg/mol}$$

$$Q = ?$$

Yechilishi:

Termodinamikaning birinchi qonuni

$$Q = \Delta U + A$$

Ichki energiya o'zgarishi

$$\Delta U = \frac{3}{2} \cdot \frac{m}{M} R \Delta T = \frac{3}{2} \cdot \frac{4}{4 \cdot 10^{-3}} \cdot 8,31 \cdot 200 =$$
$$= 2493000 \text{ J} = 2,493 \text{ MJ} \approx 2,5 \text{ MJ}.$$

$$A = P \Delta V = 0$$

$$Q = \Delta U + A = 2,5 \text{ MJ}$$

Javob: B) 2,5.

42.13. Ballondagi 1 mol bir atomli gaz temperaturasini 20 K ga ko'tarish uchun unga necha joul issiqlik miqdori berish kerak?

A) 16,6

B) 24,9

C) 83,1

D) 249

Berilgan:

$$\nu = 1 \text{ mol}$$

$$\Delta T = 20 \text{ K}$$

$$Q = ?$$

Yechilishi:

Termodinamikaning birinchi qonuni

$$Q = \Delta U + A$$

Ichki energiya o'zgarishi

$$\Delta U = \frac{3}{2} \nu R \Delta T = \frac{3}{2} \cdot 1 \cdot 8,31 \cdot 20 = 249,3 \text{ J} = 249 \text{ J}$$

$$A = P \Delta V = 0$$

$$Q = \Delta U + A = 249 \text{ J}$$

Javob: D) 249.

42.14. Ballondagi massasi 1 g bo'lgan geliy gaziga 25 J issiqlik miqdori berilganda, uning temperaturasi qanchaga ortadi (K)?

A) 25

B) 16

C) 8

D) 12,5

Berilgan:

$$m = 1 \text{ g} = 10^{-3} \text{ kg}$$

$$M = 4 \cdot 10^{-3} \text{ kg/mol}$$

$$Q = 25 \text{ J}$$

$$\Delta T = ?$$

Yechilishi:

Termodinamikaning birinchi qonuni

$$Q = \Delta U + A$$

$$A = P \Delta V = 0$$

$$Q = \Delta U$$

Ichki energiya o'zgarishi

$$\Delta U = \frac{3}{2} \cdot \frac{m}{M} R \Delta T = Q$$

$$\Delta T = \frac{2MQ}{3mR} = \frac{2 \cdot 4 \cdot 10^{-3} \cdot 25}{3 \cdot 10^{-3} \cdot 8,31} = 8 \text{ K}$$

Javob: C) 8.

42.15. Ballondagi bir atomli gazga 498,6 J issiqlik miqdori berilganda, uning temperaturasi 40 K ga oshdi. Ballondagi gaz miqdorini aniqlang (mol).

A) 1

B) 2

C) 0,5

D) 1,5

Berilgan:

$$Q = 498,6 \text{ J}$$

$$\Delta T = 40 \text{ K}$$

$$i = 3$$

$$\nu = ?$$

Yechilishi:

Termodinamikaning birinchi qonuni

$$Q = \Delta U + A$$

$$\text{Ichki energiya o'zgarishi } \Delta U = \frac{i}{2} \cdot \nu R \Delta T$$

$$\text{Bajarilgan ish } A = P \Delta V = 0$$

$$Q = \Delta U = \frac{i}{2} \cdot \nu R \Delta T = \frac{i}{2} \nu R \Delta T = \frac{i}{2} \nu R \Delta T$$

$$\nu = \frac{2Q}{iR\Delta T} = \frac{2 \cdot 498,6}{3 \cdot 8,31 \cdot 40} = 1 \text{ mol}$$

Javob: A) 1.

42.16. Ballondagi geliy gaziga 25 J issiqlik miqdori berilganda, uning temperaturasi 2 K ga oshdi. Gaz massasini toping (g).

A) 10

B) 4

C) 2

D) 1

Berilgan:

$$Q = 25 \text{ J}$$

$$\Delta T = 2 \text{ K}$$

$$i = 3$$

$$M = 4 \cdot 10^{-3} \text{ kg/mol}$$

$$m = ?$$

Yechilishi:

Termodinamikaning birinchi qonuni

$$Q = \Delta U + A$$

$$A = P \Delta V = 0$$

Ichki energiya o'zgarishi

$$\Delta U = \frac{i}{2} \cdot \frac{m}{M} R \Delta T$$

$$Q = \Delta U = \frac{i}{2} \cdot \frac{m}{M} R \Delta T$$

Massani topamiz

$$m = \frac{2MQ}{iR\Delta T} = \frac{2 \cdot 4 \cdot 10^{-3} \cdot 25}{3 \cdot 8,31 \cdot 2} = 4 \cdot 10^{-3} \text{ kg} = 4 \text{ g}$$

Javob: B) 4.

42.17. Doimiy V_0 hajmli ballonda T_0 temperatura va p_0 bosim ostida turgan bir atomli ideal gazga Q issiqlik miqdori berilganda, gazning temperaturasi qanday bo'ladi?

A) $\frac{QT_0}{p_0V_0}$

B) $T_0 \frac{p_0V_0}{2Q}$

C) $T_0 \left(1 + \frac{Q}{p_0V_0} \right)$

D) $T_0 \left(1 + \frac{2}{3p_0V_0} \right)$

Berilgan:

$$V = V_0 = \text{const}$$

$$T_1 = T_0$$

$$P_1 = P_0$$

$$i = 3$$

$$Q$$

$$T_2 = ?$$

Yechilishi:

Termodinamikaning birinchi qonuni

$$Q = \Delta U + A$$

$$A = P\Delta V = 0$$

Ichki energiya o'zgarishi

$$\Delta U = \frac{i}{2} \cdot \frac{m}{M} R \Delta T = \frac{3}{2} \cdot \frac{m}{M} R (T_2 - T_1)$$

$$\text{Ideal gaz holat tenglamasi } \frac{P_1 V_1}{T_1} = \frac{m}{M} R$$

$$Q = \Delta U = \frac{3}{2} \cdot \frac{m}{M} R (T_2 - T_1)$$

$$T_2 - T_1 = \frac{Q}{\frac{3}{2} \cdot \frac{m}{M} R} = \frac{Q}{\frac{3}{2} \cdot \frac{P_1 V_1}{T_1}} = \frac{2T_1 Q}{3P_1 V_1}$$

$$T_2 = T_1 + \frac{2T_1 Q}{3P_1 V_1} = T_1 \left(1 + \frac{2Q}{3P_1 V_1} \right) = T_0 \left(1 + \frac{2Q}{3P_0 V_0} \right)$$

$$\text{Javob: D) } T_0 \left(1 + \frac{2}{3P_0 V_0} \right).$$

42.18. Quyida keltirilgan munosabatlarning qaysi biri faqat izotermik jarayon uchun o'rinli?

A) $Q = \Delta U$

B) $Q = \Delta U + A$

C) $\Delta U = A$

D) $Q = A$

Yechilishi:

$$\text{Izotermik jarayonda } \Delta T = 0, \Delta U = \frac{i}{2} \cdot \frac{m}{M} R \Delta T = 0$$

Termodinamikaning birinchi qonuni

$$Q = \Delta U + A$$

$$Q = A$$

$$\text{Javob: D) } Q = A.$$

42.19. Qanday jarayonda gazning ichki energiyasi o'zgarmaydi?

A) adiabatik

B) izotermik

C) izobarik

D) izoxorik

Yechilishi:

Gazning ichki energiyasining o'zgarishi temperaturaga bog'liq. Temperatura o'zgarmasa, ya'ni, izotermik jarayonda $\Delta T = 0$ gaz ichki energiyasi o'zgarmaydi.

$$\Delta U = \frac{i}{2} \cdot \frac{m}{M} R \Delta T = 0$$

$$\text{Javob: B) izotermik.}$$

42.24. Gaz bir xil haroratga izoxorik va izobarik qizdirildi. Qaysi holda kam issiqlik sarf bo'ladi?

- A) izobarik
B) izoxorik
C) ikkala holda bir xil
D) javob gaz turiga bog'liq

Javob: B) izoxorik.

42.25. Keltirilgan tenglamalar ichidan izobarik jarayon tenglamasini, shu jarayon uchun termodinamika I qonuni tenglamasini va shu jarayonda bajariladigan ish ifodasini toping:

- 1) $\frac{V}{T} = \text{const}$; 2) $p/T = \text{const}$; 3) $pV = \text{const}$;
4) $pV = mRT/M$; 5) $Q = A + \Delta U$; 6) $Q = \Delta U$;
7) $Q = A$; 8) $Q = 0$; 9) $A = p\Delta V$;
10) $A = 0$; 11) $A = Q$; 12) $A = -\Delta U$.
A) 3, 7, 10 B) 2, 6, 10 C) 1, 5, 9 D) 4, 8, 12

Javob: C) 1, 5, 9.

42.26. Quyida keltirilgan tenglamalarning qaysi biri izobarik jarayon uchun o'rinli?

- A) $Q = \Delta U + p\Delta V$ B) $Q = p\Delta V$
C) $pV = \text{const}$ D) $\Delta U = -p\Delta V$

Javob: A) $Q = \Delta U + p\Delta V$.

42.27. Bir atomli ideal gazga 12,5 kJ issiqlik berilganda, 0,05 m³ ga izobarik kengaydi. Agar gaz bosimi 10⁵ Pa bo'lsa, gazning ichki energiyasi qanchaga ortadi (kJ)?

- A) 5,5 B) 7 C) 7,5 D) 9

Berilishi:

$$Q = 12,5 \text{ kJ}$$
$$\Delta V = 0,05 \text{ m}^3$$
 $p = 10^5 \text{ Pa}$
$$\Delta U = ?$$

Yechilishi:

Termodinamikaning 1-qonuni.

$$0 = \Delta U + A = \Delta U + p\Delta V,$$
$$\Delta U = Q - p\Delta V = 12,5 \cdot 10^3 - 10^5 \cdot 0,05 = 7,5 \text{ kJ}$$

Javob: C) 7,5.

42.28. Bir atomli ideal gazni izobarik isitishda unga berilgan Q issiqlik miqdorining qanday qismi gazning ichki energiyasini oshirishga sarflanadi?

- A) 0,2 B) 0,3 C) 0,6 D) 0,5

Berilgan:

$$Q$$

$$i = 3$$

$$\Delta U = ?$$

Yechilishi:

Termodinamikaning 1-qonuni.

$$Q = \Delta U + A = \Delta U + p\Delta V = \Delta U + \frac{m}{M} R\Delta T =$$

$$= \Delta U + \frac{2}{i} \Delta U = \frac{i+2}{i} \Delta U$$

$$\Delta U = \frac{i}{i+2} Q = \frac{3}{3+2} Q = 0,6Q$$

Javob: C) 0,6.

42.29. Bir atomli gazga 150 J issiqlik berilganda, u o'zgarmas bosimda qanday ish bajara oladi (J)?

A) 60

B) 75

C) 100

D) 120

Berilgan:

$$Q = 150 \text{ J}$$

$$P = \text{const}$$

$$A = ?$$

Yechilishi:

Termodinamikaning 1-qonuni.

$$Q = \Delta U + A = \frac{i}{2} \frac{m}{M} R\Delta T + P\Delta V = \frac{i}{2} P\Delta V + P\Delta V = \frac{i+2}{2} P\Delta V = \frac{i+2}{2} A,$$

$$A = \frac{2Q}{i+2} = \frac{2 \cdot 150}{3+2} = 60 \text{ J}$$

Javob: A) 60.

42.30. Erkin siljiy oladigan porshenli tik turgan silindrik idishdagi bir atomli gazga 300 J issiqlik miqdori berilsa, gaz necha joule ish bajaradi?

A) 300

B) 240

C) 200

D) 120

Berilgan:

$$Q = 300 \text{ J}$$

$$P = \text{const}$$

$$A = ?$$

Yechilishi:

Termodinamikaning 1-qonuni.

$$Q = \Delta U + A = \frac{i}{2} \frac{m}{M} R\Delta T + P\Delta V = \frac{i}{2} P\Delta V + P\Delta V = \frac{i+2}{2} P\Delta V = \frac{i+2}{2} A,$$

$$A = \frac{2Q}{i+2} = \frac{2 \cdot 300}{3+2} = 120 \text{ J}$$

Javob: D) 120.

42.31. Bir atomli gazga 60 kJ issiqlik miqdori berilganda, u izobar ravishda kengaydi. Gaz ichki energiyasining o'zgarishini aniqlang (kJ).

A) 24

B) 30

C) 36

D) 60

Berilgan:

$$Q = 60 \text{ kJ}$$

$$i = 3$$

$$P = \text{const}$$

$$\Delta U = ?$$

Yechilishi:

Termodinamikaning 1-qonuni.

$$Q = \Delta U + A = \Delta U + p\Delta V = \Delta U + \frac{m}{M} R\Delta T =$$

$$= \Delta U + \frac{2}{i} \Delta U = \frac{i+2}{i} \Delta U$$

$$\Delta U = \frac{i}{i+2} Q = \frac{3 \cdot 60 \cdot 10^3}{3+2} = 36 \text{ kJ}$$

Javob: C) 36.

42.32. Erkin siljiy oladigan porshenli tik turgan silindrik idishdagi bir atomli gazga 500 J issiqlik miqdori berilsa, gazning ichki energiyasi necha joulga ortadi?

A) 300

B) 450

C) 500

D) 250

Berilgan:

$$Q = 500 \text{ kJ}$$

$$i = 3$$

$$P = \text{const}$$

$$\Delta U = ?$$

Yechilishi:

Termodinamikaning 1-qonuni.

$$Q = \Delta U + A = \Delta U + p\Delta V = \Delta U + \frac{m}{M} R\Delta T =$$

$$= \Delta U + \frac{2}{i} \Delta U = \frac{i+2}{i} \Delta U$$

$$\Delta U = \frac{i}{i+2} Q = \frac{3 \cdot 500}{3+2} = 300 \text{ J}$$

Javob: A) 300.

42.33. Erkin siljiydigan porshenli tik turgan silindrik idishda bir atomli gaz bor. Gazga Q issiqlik miqdori berilishi natijasida porshen surilib, 60 J ish bajarildi. Qissiqlik miqdorini aniqlang (J).

A) 60

B) 90

C) 100

D) 150

Berilgan:

$$A = 60 \text{ J}$$

$$P = \text{const}$$

$$Q = ?$$

Yechilishi:

Termodinamikaning 1-qonuni.

$$Q = \Delta U + A = \frac{i}{2} \frac{m}{M} R\Delta T + P\Delta V = \frac{i}{2} P\Delta V + P\Delta V =$$

$$\frac{i+2}{2} P\Delta V = \frac{i+2}{2} A = \frac{3+2}{2} \cdot 60 = 150 \text{ J.}$$

Javob: D) 150.

42.34. Tik turgan silindrik idishdagi erkin siljiydigan porshen ostida bir atomli gaz bor. Gazga Q issiqlik miqdori berilishi natijasida uning ichki energiyasi 60 J ga oshdi. Qissiqlik miqdorini toping (J).

A) 200

B) 180

C) 120

D) 100

Berilgan:

$$\Delta U = 60 \text{ J}$$

$$P = \text{const}$$

$$Q = ?$$

Yechilishi:

Termodinamikaning 1-qonuni.

$$Q = \Delta U + A = \Delta U + p\Delta V = \Delta U + \frac{m}{M} R\Delta T =$$

$$= \Delta U + \frac{2}{i} \Delta U = \frac{i+2}{i} \Delta U = \frac{3+2}{3} \cdot 60 = 100 \text{ J}$$

Javob: D) 100.

42.35. Yuzi 100 sm^2 bo'lgan va erkin siljiy oladigan porshen ostidagi bosimi 150 kPa bo'lgan bir atomli gazga necha joul issiqlik miqdori berilsa, porshen 2 sm ko'tariladi?

A) 200

B) 75

C) 175

D) 50

Berilgan:

$$S = 100 \text{ sm}^2 = 0,01 \text{ m}^2$$

$$P = 150 \text{ kPa}$$

$$\Delta h = 2 \text{ sm} = 0,02 \text{ m}$$

$$Q = ?$$

Yechilishi:

Termodinamikaning 1-qonuni.

$$Q = \Delta U + A = \frac{i}{2} \frac{m}{M} R\Delta T + P\Delta V =$$

$$\frac{i}{2} P\Delta V + P\Delta V = \frac{i+2}{2} P\Delta V = \frac{i+2}{2} \cdot PS \cdot \Delta h =$$

$$= \frac{3+2}{2} \cdot 150 \cdot 10^3 \cdot 0,01 \cdot 0,02 = 75 \text{ J}$$

Javob: B) 75.

42.36. T temperaturadagi 1 mol bir atomli gazning absolut temperaturasini doimiy bosimda 2 marta oshirish uchun qancha issiqlik miqdori kerak bo'ladi?

A) RT B) $1,5RT$ C) $2,5RT$ D) $2RT$ **Berilgan:**

$$\nu = 1 \text{ mol}$$

$$\Delta T = T$$

$$Q = ?$$

Yechilishi:

Termodinamikaning 1-qonuni

$$Q = \Delta U + A = \frac{i}{2} \nu R\Delta T + p\Delta V = \frac{i}{2} \nu R\Delta T + \nu R\Delta T =$$

$$\frac{i+2}{2} \nu R\Delta T = 2,5RT$$

Javob: C) 2,5.

42.37. Vertikal joylashgan silindrik idishdagi erkin siljiy oladigan porshen ostida 1 mol bir atomli gaz bor. Unga qancha issiqlik miqdori berilsa, temperaturasi 40 K ga o'zgaradi (J)?

A) 8,31

B) 40

C) 831

D) 83,1

Berilgan:

$$\nu = 1 \text{ mol}$$

$$\Delta T = 40 \text{ K}$$

$$Q = ?$$

Yechilishi:

Termodinamikaning 1-qonuni

$$Q = \Delta U + A = \frac{i}{2} \nu R\Delta T + p\Delta V = \frac{i}{2} \nu R\Delta T + \nu R\Delta T =$$

$$\frac{i+2}{2} \nu R\Delta T = \frac{3+2}{2} \cdot 1 \cdot 8,31 \cdot 40 = 831 \text{ J}$$

Javob: C) 831.

42.38. Bir atomli gazga 250 J issiqlik berilganda, u izobarik kengayib, qandaydir ish bajardi. Gaz ichki energiyasining o'zgarishini aniqlang (J).

- A) 75 B) 100 C) 125 D) 150

Berilgan:

$$Q = 250 \text{ J}$$

$$\Delta U = ?$$

Yechilishi:

Termodinamikaning 1-qonuni.

$$Q = \Delta U + A = \Delta U + p\Delta V = \Delta U + \frac{m}{M} R\Delta T = \Delta U +$$

$$+ \frac{2}{i} \Delta U = \frac{i+2}{i} \Delta U$$

$$\Delta U = \frac{i}{i+2} Q = \frac{3 \cdot 250}{3+2} = 150 \text{ J}$$

Javob: D) 150.

42.39. Tik turgan silindrik idishdagi erkin siljiydigan porshen ostida bir atomli gaz bor. Gaz bosimi $1,5 \cdot 10^5 \text{ Pa}$ ga teng. Unga necha joul issiqlik miqdori berilsa, hajmi 2 l ga oshadi?

- A) 1662 B) 750 C) 500 D) 166,2

Berilgan:

$$P = 1,5 \cdot 10^5 \text{ Pa}$$

$$\Delta V = 2 \text{ l} = 2 \cdot 10^{-3} \text{ m}^3$$

$$Q = ?$$

Yechilishi:

Termodinamikaning 1-qonuni.

$$Q = \Delta U + A = \frac{i}{2} \frac{m}{M} R\Delta T + P\Delta V = \frac{i}{2} P\Delta V +$$

$$+ P\Delta V = \frac{i+2}{2} P\Delta V = \frac{3+2}{2} \cdot 1,5 \cdot 10^5 \cdot 2 \cdot 10^{-3} =$$

$$= 750 \text{ J}$$

Javob: B) 750.

42.40. Bir atomli gazga qancha issiqlik miqdori berilganda, u izobar ravishda kengayib, 8 kJ ish bajaradi (kJ)?

- A) 80 B) 20 C) 16 D) 12

Berilgan:

$$A = 8000 \text{ J}$$

$$Q = ?$$

Yechilishi:

Termodinamikaning 1-qonuni.

$$Q = \Delta U + A = \frac{i}{2} \frac{m}{M} R\Delta T + P\Delta V = \frac{i}{2} P\Delta V +$$

$$+ P\Delta V = \frac{i+2}{2} P\Delta V = \frac{3+2}{2} \cdot 8000 = 20000 \text{ J} = 20 \text{ kJ}$$

Javob: B) 20.

42.41. Vertikal joylashgan silindrik idishdagi erkin siljiy oladigan porshen ostida 1 mol bir atomli gaz bor. Gazga 831 J issiqlik miqdori berilsa, uning temperaturasi qanchaga oshadi (K)?

- A) 831 B) 200 C) 133 D) 40

Berilgan:

$\nu = 1 \text{ mol}$

$Q = 831 \text{ J}$

$\Delta T = ?$

Yechilishi:

Termodinamikaning 1-qonuni

$$Q = \Delta U + A = \frac{i}{2} R \Delta T + p \Delta V = \frac{i}{2} \nu P \Delta V + \nu R \Delta T =$$

$$= \frac{i+2}{2} \nu P \Delta V$$

$$\Delta T = \frac{2Q}{(i+2)\nu R} = \frac{2 \cdot 831}{(3+2)1 \cdot 8,31} = 40 \text{ K}$$

Javob: D) 40.

42.42. Vertikal joylashgan silindrik idishdagi erkin siljiydigan porshen ostida bir atomli gaz bor. Gaz bosimi $1 \cdot 10^5 \text{ Pa}$ ga teng. Unga 500 J issiqlik berilsa, hajmi necha litrga oshadi?

A) 50

B) 25

C) 10

D) 2

Berilgan:

$P = 10^5 \text{ Pa}$

$Q = 500 \text{ J}$

$\Delta V = ?$

Yechilishi:

Termodinamikaning 1-qonuni.

$$Q = \Delta U + A = \frac{i}{2} \frac{m}{M} R \Delta T + P \Delta V = \frac{i}{2} P \Delta V + P \Delta V =$$

$$= \frac{i+2}{2} P \Delta V$$

$$\Delta V = \frac{2Q}{(i+2)P} = \frac{2 \cdot 500}{(3+2)10^5} = 2 \text{ l}$$

Javob: D) 2.

42.43. Bir atomli ideal gazga issiqlik berilganda, gaz izobar ravishda $0,05 \text{ m}^3$ kengaydi. Agar gazning bosimi 10^5 Pa bo'lsa, gazning ichki energiyasi necha kJ ortgan?

A) 5,5

B) 7

C) 7,5

D) 9

Berilgan:

$\Delta V = 0,05 \text{ m}^3$

$P = 10^5 \text{ Pa}$

$\Delta U = ?$

Yechilishi:

Ichki energiyaning o'zgarishi

$$\Delta U = \frac{i}{2} \frac{m}{M} R \Delta T = \frac{i}{2} P \Delta V = \frac{3}{2} \cdot 10^5 \cdot 0,05 = 7,5 \text{ kJ}$$

Javob: C) 7,5.

42.44. 1 mol bir atomli ideal gaz hajmini doimiy bosim sharoitida 2 marta oshirish uchun qanday issiqlik miqdori kerak bo'ladi? Gazning boshlang'ich temperaturasi T . R — universal gaz doimiysi.

A) $3RT$ B) $2,5RT$ C) $2RT$ D) $1,5RT$

Berilgan:

$\nu = 1 \text{ mol}$

$\Delta V = V$

$T_1 = T$

R

$Q = ?$

Yechilishi:

Termodinamikaning 1-qonuni.

$$Q = \Delta U + A = \frac{i}{2} \nu R \Delta T + P \Delta V = \frac{i}{2} P \Delta V + P \Delta V =$$

$$\frac{i+2}{2} P \Delta V = \frac{i+2}{2} P V = \frac{i+2}{2} \nu R T = 2,5 R T$$

Javob: B) 2,5 RT.

42.45. 2 mol bir atomli ideal gazning boshlang'ich T_0 temperaturasini o'zgar-mas bosimda 2 marta orttirish uchun unga qanday issiqlik miqdori berish kerak? (R universal gaz doimiysi).

A) $2RT_0$

B) $4RT_0$

C) $5RT_0$

D) $6RT_0$

Berilgan:

$\nu = 2 \text{ mol}$

$\Delta T = T_0$

$Q = ?$

Yechilishi:

Termodinamikaning 1-qonuni

$$Q = \Delta U + A = \frac{i}{2} \nu R \Delta T + p \Delta V = \frac{i}{2} \nu P \Delta V + \nu R \Delta T =$$

$$\frac{i+2}{2} \nu R \Delta T = \frac{3+2}{2} 2RT_0 = 5RT_0$$

Javob: C) 5 RT₀.

42.46. Massasi m , molyar massasi μ bo'lgan ideal gazni doimiy bosimda ΔT ga isitish uchun Q_p miqdor issiqlik sarflandi. Shu gazni ΔT ga o'zgar-mas hajm sharoitida isitish uchun qanday Q_v miqdor issiqlik kerak bo'ladi?

A) $mR\Delta T/m$

B) Q_p

C) $Q_p + \frac{m}{\mu} R \Delta T$

D) $Q_p - \frac{m}{\mu} R \Delta T$

Berilgan:

m

M

ΔT

Q_p

$Q_v = ?$

Yechilishi:

O'zgar-mas bosim uchun

$$Q_p = \Delta U + A = \frac{i}{2} \frac{m}{M} R \Delta T + P \Delta V = \frac{i}{2} \frac{m}{M} R \Delta T + \frac{m}{M} R \Delta T$$

Izoxorik jarayon uchun $A = P \Delta V = 0$

$$Q_v = \Delta U = \frac{i}{2} \frac{m}{M} R \Delta T = Q_p - \frac{m}{M} R \Delta T$$

Javob: D) $Q_p - \frac{m}{\mu} R \Delta T$.

42.47. Adiabatik jarayon deb qanday jarayonga aytiladi?

A) doimiy issiqlik sig'imida ...

B) doimiy hajmda...

C) doimiy bosim ostida ...

D) issiqlik almashmasdan... ...kechuvchi jarayon adiabatik jarayon deb ataladi

Javob: D) issiqlik almashmasdan.

42.48. Gapni to'g'ri tugallang. Adiabatik jarayonda...

- A) V va P o'zgaradi, T o'zgarmaydi
- B) V va T o'zgaradi, P o'zgarmaydi
- C) P va T o'zgaradi, V o'zgarmaydi
- D) V , T va P o'zgaradi, tashqi muhit bilan issiqlik almashinish bo'lmaydi

Javob: D) V , T va P o'zgaradi, tashqi muhit bilan issiqlik almashinish bo'lmaydi.

42.49. Termodinamikaning 1-qonuni adiabatik jarayon uchun qanday yoziladi?

- A) $Q = \Delta U + A$
- B) $Q = \Delta U$
- C) $A = Q$
- D) $\Delta U + A = 0$

Javob: D) $\Delta U + A = 0$.

42.50. Adiabatik kengayishda gazning ichki energiyasi qanday o'zgaradi?

- A) $\Delta U = 0$
- B) $\Delta U > 0$
- C) o'zgarmaydi
- D) $\Delta U < 0$

Javob: D) $\Delta U < 0$.

42.51. Gazni siqishdagi ish uning ichki energiyasining o'zgarishiga teng bo'ldi.

Bu qanday jarayon?

- A) adiabatik
- B) izobarik
- C) izoxorik
- D) izotermik

Javob: A) adiabatik.

42.52. Gaz ichki energiyasining o'zgarishi ideal gazni siqishda tashqi kuchlar bajargan ishga teng bo'lishi uchun siqish jarayoni qanday bo'lishi kerak?

- A) izobarik
- B) adiabatik
- C) izoxorik
- D) izotermik

Javob: B) adiabatik.

42.53. Ideal gaz adiabatik kengayganda, harorati qanday o'zgaradi?

- A) o'zgarmaydi
- B) ko'tariladi
- C) ko'tarilishi ham, pasayishi ham mumkin
- D) pasayadi

Javob: D) pasayadi.

42.54. Ideal gaz adiabatik kengayganda, uning harorati qanday o'zgaradi?

- A) $\Delta T < 0$
- B) $\Delta T = 0$
- C) $\Delta T > 0$
- D) $\Delta T \geq 0$

Javob: A) $\Delta T < 0$.

42.55. Gaz adiabat ravishda siqilmoqda. Bunda gazning T temperaturasi va P bosimi qanday o'zgaradi?

- A) T ortadi, P kamayadi
- B) T kamayadi, p ortadi
- C) T va P ortadi
- D) T va P kamayadi

Javob: C) T va P ortadi.

42.56. Gazni adiabatik siqishda 50 MJ ish bajarildi. Bunda gazning ichki energiyasi ...

- A) 50 MJ ga ortishi ham, kamayishi ham mumkin
- B) 50 MJ ga kamayadi
- C) 50 MJ ga ortadi
- D) nolga teng bo'ladi

Berilgan:

$$A' = 50 \text{ MJ}$$

$$Q = 0$$

$$\Delta U = ?$$

Yechilishi:

Termodinamikaning 1-qonuni

$$Q = \Delta U - A' = 0, \Delta U = A' = 50 \text{ MJ}$$

Javob: C) 50 MJ ga ortadi.

42.57. Adiabatik jarayonda gazning ichki energiyasi 5 kJ kamaydi. Gaz necha kJ ish bajardi?

- A) 5
- B) 2,5
- C) 10
- D) 0,5

Berilgan:

$$\Delta U = -5 \text{ kJ}$$

$$A = ?$$

Yechilishi:

Termodinamikaning 1-qonuni

$$Q = \Delta U + A = 0, A = -\Delta U = 5 \text{ kJ}$$

Javob: A) 5.

42.58. Ideal gaz adiabatik kengayib, 5 kJ ish bajardi. Bunda gazning ichki energiyasi necha kJ kamaygan?

- A) 2,5
- B) 10
- C) 5
- D) 0,5

Berilgan:

$$A = 5 \text{ kJ}$$

$$\Delta U = ?$$

Yechilishi:

Termodinamikaning 1-qonuni

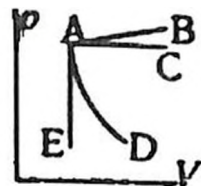
$$Q = \Delta U + A = 0, \Delta U = -A = 5 \text{ kJ}$$

Javob: C) 5.

42.59. Rasmda ideal gaz uchun tasvirlangan grafiklarning qaysi biri adiabatik jarayonga tegishli?

- A) AB
- B) AC
- C) AE
- D) AD

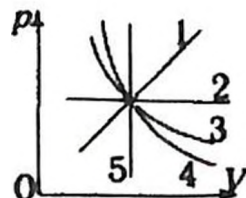
Javob: D) AD.



42.60. Rasmda keltirilgan grafiklar ichida izoxora, izobara, izoterma va adiabata chiziqlari bor. Adiabata chizig'ini ko'rsating.

- A) 5
- B) 4
- C) 3
- D) 2

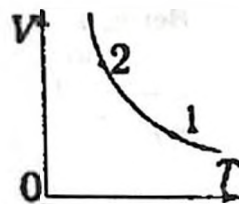
Javob: B) 4.



42.61. Rasmda ideal gazning 1-holatdan 2-holatga o'tish adiabatasi tasvirlangan. Bunda gaz temperaturasi qanday o'zgaradi?

- A) bunday jarayon bo'lmaydi B) ortadi
C) o'zgarmaydi D) pasayadi

Javob: D) pasayadi.



42.62. Ideal gazni adiabat tarzda siqib, ish bajarildi. Bunda gaz molekularining kinetik va potensial energiyalari qanday o'zgaradi?

- A) kinetik energiya ortadi, potensial energiya kamayadi
B) kinetik energiya kamayadi, potensial energiya o'zgarmaydi
C) energiyalar ortadi
D) kinetik energiya ortadi, potensial energiya o'zgarmaydi

Javob: D) kinetik energiya ortadi, potensial energiya o'zgarmaydi.

42.63. Gaz hajmi izotermik va adiabatik siqish orqali bir xil kamaytirildi. Qaysi holda bosim kamroq o'zgargan?

- A) izotermik B) bir xil C) gaz turiga bog'liq D) adiabatik

Javob: A) izotermik.

42.64. Gaz: 1) izobarik; 2) izotermik; 3) adiabatik ravishda bir xil hajmga kengayadi. Qaysi holda gazning bajargan ishi eng kichik bo'ladi?

- A) 2 va 3 B) 1 C) 2 D) 3

Javob: D) 3.

42.65. 4 mol miqdordagi bir atomli ideal gazni adiabatik siqishda 249 J ish bajarilgan bo'lsa, gazning temperaturasi necha gradusga o'zgargan? $R = 8,3 \text{ J}/(\text{mol} \cdot \text{K})$.

- A) 1; B) 2; C) 5; D) 4.

Berilgan:

$$\nu = 4 \text{ mol}$$

$$A = 249 \text{ J}$$

$$\Delta T = ?$$

Yechilishi:

Termodinamikaning 1-qonuni

$$Q = \Delta U - A' = \frac{i}{2} \nu R \Delta T - A' = 0, \frac{i}{2} \nu R \Delta T = A'$$

$$\Delta T = \frac{2A'}{i\nu R} = \frac{2 \cdot 249}{3 \cdot 4 \cdot 8,3} = 5 \text{ K}$$

Javob: C) 5.

42.66. 5 mol miqdordagi bir atomli ideal gazni adiabatik siqishda 249 J ish bajarilgan bo'lsa, gazning temperaturasi necha gradusga o'zgargan?

- A) 20 B) 10 C) 5 D) 4

Berilgan:

$$\nu = 5 \text{ mol}$$

$$A = 249 \text{ J}$$

$$\Delta T = ?$$

Yechilishi:

Termodinamikaning 1-qonuni

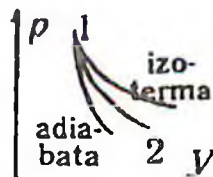
$$Q = \Delta U - A' = \frac{i}{2} \nu R \Delta T - A' = 0, \frac{i}{2} \nu R \Delta T = A'$$

$$\Delta T = \frac{2A'}{i\nu R} = \frac{2 \cdot 249}{3 \cdot 5 \cdot 8,3} = 4 \text{ K}$$

Javob: D) $\Delta t = 4^\circ \text{C}$.

42.67. Gazning kengayishi izoterma va adiabatlar orasida yotuvchi 1–2 chiziq bo'ylab sodir bo'ldi. Bunda gazning harorati qanday o'zgargan? Gazga issiqlik berilganmi?

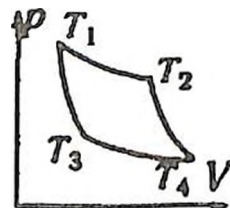
- A) o'zgarmagan, berilmagan B) ortgan, berilmagan
C) pasaygan, berilmagan D) pasaygan, berilgan



Javob: D) pasaygan, berilgan.

42.68. Karno sikli ikki izoterma va ikki adiabatdan iborat. Temperaturalar uchun yozilgan quyidagi munosabatlarning qaysi biri o'rinli?

- A) $T_1 = T_2 > T_3 = T_4$ B) $T_1 > T_2 = T_3 > T_4$
C) $T_1 = T_2 = T_3 = T_4$ D) $T_1 < T_2 < T_3 < T_4$



Javob: A) $T_1 = T_2 > T_3 = T_4$.

42.69. Issiqlik jihatdan izolyatsiyalangan sistemadagi gaz siqilsa, uning temperaturasi qanday o'zgaradi.

- A) ortishi ham, pasayishi ham mumkin B) pasayadi
C) ortadi D) o'zgarmaydi

Javob: C) ortadi.

42.70. Adiabat sistema tashkil qiluvchi jismlar uchun quyidagi ifodalarning qaysi biri hamisha o'rinli bo'ladi? (c-solishtirma issiqlik sig'imi.)

A) $c_1 m_1 (t_{2,1} - t_{1,1}) + c_2 m_2 (t_{2,2} - t_{1,1}) + \dots + c_n m_n (t_{2,n} - t_{1,n}) = \text{const}$

B) $Q = c_1 m_1 (t_1 - t) + c_2 m_2 (t_2 - t) + \dots + c_n m_n (t_n - t)$

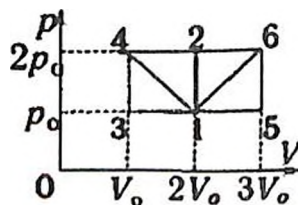
C) $pV^{C_p/C_p} = \text{const}$ D) $\Delta U = -A$

Javob: D) $\Delta U = -A$.

42.71. Ideal gaz 1-holatdan 2-holatga qaysi jarayon orqali o'tganda eng ko'p issiqlik oladi?

- A) 1-3-4-2 B) 1-5-6-2
C) 1-2 D) 1-4-2

Javob: A) 1-3-4-2.



42.72. Qaysi qonun tabiatdagi jarayonlarning yo'nalishini ko'rsatadi?

- A) massaning saqlanish qonuni
- B) termodinamikaning I qonuni
- C) termodinamikaning II qonuni
- D) zaryad miqdorining saqlanish qonuni

Javob: C) termodinamikaning II qonuni

43-§. Issiqlik dvigatellarining foydali ish ko'effitsiyenti (FIK)

43.1. Issiqlik mashinalarida qanday energiya hisobiga ish bajariladi?

- A) potentsial
- B) elektromagnit
- C) kinetik
- D) ichki

Issiqlik energiyasini mexanik energiyaga aylantirib beradigan qurilma issiqlik mashinalari deyiladi.

Javob. D) ichki.

43.2. Quyida bayon etilgan fikrlarning qaysi biri noto'g'ri?

- A) issiqlik mashinalarida barcha ichki energiya mexanik ishga aylanadi
- B) issiqlik mashinasidagi ishchi jism ideal gaz bo'lsa, mashinaning FIK isitkich va sovutkich haroratlari farqiga bog'liq bo'ladi
- C) bug' turbinalarida qizdirilgan bug'ning ichki energiyasidan foydalaniladi
- D) nurlanish — issiqlik uzatish usullaridan biridir

Javob: A) issiqlik mashinalarida barcha ichki energiya mexanik ishga aylanadi.

43.3. Real issiqlik mashinasi FIK ifodasini ko'rsating.

- A) $\frac{Q_1 - Q_2}{Q_2} 100\%$
- B) $\frac{Q_1 - Q_2}{Q_1} 100\%$
- C) $\frac{Q_2 - Q_1}{Q_1} 100\%$
- D) $\frac{T_1 - T_2}{T_2} 100\%$

Javob: B) $\frac{Q_1 - Q_2}{Q_1} 100\%$.

43.4. Issiqlik mashinasi sikl davomida isitkichdan 100 J issiqlik oldi va sovutkichga 60 J issiqlik berdi. Mashinaning FIK ni toping.

- A) 67%
- B) 60%
- C) 40%
- D) 25%

Berilgan:

$$Q_1 = 100 \text{ J}$$

$$Q_2 = 60 \text{ J}$$

$$\eta = ?$$

Yechilishi:

Issiqlik mashinasining foydali ish ko'effitsiyentini topish formulasidan foydalanamiz.

$$\eta = \frac{Q_1 - Q_2}{Q_1} \cdot 100\% = \frac{100 - 60}{100} \cdot 100\% = 40\%$$

Javob: C) 40%.

43.5. FIK η bo'lgan issiqlik mashinasi isitkichdan Q issiqlik miqdori olganda qanday ish bajaradi?

- A) ηQ B) $(1 + \eta)Q$ C) $(1 - \eta)Q$ D) Q/η

Berilgan:

$$\begin{array}{l} \eta \\ Q_1 = Q \\ A = ? \end{array}$$

Yechilishi:

Issiqlik mashinasining foydali ish koeffitsiyentini topish formulasidan foydalanamiz.

$$\eta = \frac{Q_1 - Q_2}{Q_1} = \frac{A}{Q_1}$$

$$A = \eta Q_1 = \eta Q$$

Javob: A) $A = \eta Q$.

43.6. Foydali ish koeffitsienti 40% bo'lgan issiqlik mashinasi bir siklda 100 kJ ish bajargan bo'lsa, u isitkichdan necha kilojoul issiqlik miqdori olgan?

- A) 100 B) 250 C) 400 D) 25

Berilgan:

$$\begin{array}{l} \eta = 40\% \\ A = 100 \text{ kJ} = 10^5 \text{ J} \\ Q_1 = ? \end{array}$$

Yechilishi:

Issiqlik mashinasining foydali ish koeffitsiyentini topish formulasidan foydalanamiz.

$$\eta = \frac{Q_1 - Q_2}{Q_1} \cdot 100\% = \frac{A}{Q_1} \cdot 100\%$$

$$Q_1 = \frac{A}{\eta} \cdot 100\% = \frac{10^5}{40} \cdot 100\% = 2,5 \cdot 10^5 \text{ J} = 250 \text{ kJ}$$

Javob: B) $Q_1 = 250 \text{ kJ}$.

43.7. Issiqlik dvigateli isitkichdan olgan issiqlik miqdorining uchdan bir qismini sovitkichga beradi. Dvigatelning FIK ni toping (%).

- A) 67 B) 54 C) 58 D) 60

Berilgan:

$$\begin{array}{l} Q_2 = \frac{1}{3} Q_1 \\ \eta = ? \end{array}$$

Yechilishi:

Issiqlik mashinasining foydali ish koeffitsiyentini topish formulasidan foydalanamiz.

$$\eta = \frac{Q_1 - Q_2}{Q_1} \cdot 100\%$$

$$Q_1 = 3 Q_2$$

$$\eta = \frac{Q_1 - Q_2}{Q_1} \cdot 100\% = \frac{3Q_2 - Q_2}{3Q_2} \cdot 100\% = \frac{2}{3} \cdot 100\% = 67\%$$

Javob: A) $\eta = 67\%$

43.8. Issiqlik dvigateli isitkichdan har sekunda 7200 kJ issiqlik oladi va sovitkichga 6400 kJ issiqlik beradi. Dvigatelning FIK qanday?

A) 62%

B) 41%

C) 24%

D) 11%

Berilgan:

$$Q_1 = 7200 \text{ kJ} = 7,2 \cdot 10^6 \text{ J}$$

$$Q_2 = 6400 \text{ kJ} = 6,4 \cdot 10^6 \text{ J}$$

$$\eta = ?$$

Yechilishi:

Issiqlik mashinasining foydali ish koeffitsiyen-tini topish formulasidan foydalanamiz.

$$\eta = \frac{Q_1 - Q_2}{Q_1} \cdot 100\% = \frac{7,2 \cdot 10^6 - 6,4 \cdot 10^6}{7,2 \cdot 10^6} \cdot 100\% =$$

$$= \frac{0,8 \cdot 10^6}{7,2 \cdot 10^6} \cdot 100\% = 11\%$$

Javob: D) $\eta = 11\%$.

43.9. Issiqlik dvigateli isitkichdan 0,8 MJ issiqlik miqdori olib, sovitkichga 0,3 MJ issiqlik miqdorini beradi. Bu issiqlik dvigatelining FIK ni (%) toping.

A) 30

B) 48

C) 50

D) 62,5

Berilgan:

$$Q_1 = 0,8 \text{ MJ} = 8 \cdot 10^5 \text{ J}$$

$$Q_2 = 0,3 \text{ MJ} = 3 \cdot 10^5 \text{ J}$$

$$\eta = ?$$

Yechilishi:

Issiqlik mashinasining foydali ish koeffitsiyen-tini topish formulasidan foydalanamiz.

$$\eta = \frac{Q_1 - Q_2}{Q_1} \cdot 100\% = \frac{8 \cdot 10^5 - 3 \cdot 10^5}{8 \cdot 10^5} \cdot 100\% =$$

$$= \frac{5 \cdot 10^5}{8 \cdot 10^5} \cdot 100\% = 62,5\%$$

Javob: D) $\eta = 62,5\%$.

43.10. Issiqlik dvigateli isitkichdan 0,4 MJ issiqlik miqdori olib, sovitkichga 0,26 MJ issiqlik miqdorini uzatadi. Dvigatelning FIK ni hisoblang (%)

A) 30

B) 35

C) 40

D) 45

Berilgan:

$$Q_1 = 0,4 \text{ MJ} = 4 \cdot 10^5 \text{ J}$$

$$Q_2 = 0,26 \text{ MJ} = 2,6 \cdot 10^5 \text{ J}$$

$$\eta = ?$$

Yechilishi:

Issiqlik mashinasining foydali ish koeffitsiyen-tini topish formulasidan foydalanamiz.

$$\eta = \frac{Q_1 - Q_2}{Q_1} \cdot 100\% = \frac{4 \cdot 10^5 - 2,6 \cdot 10^5}{4 \cdot 10^5} \cdot 100\% =$$

$$= \frac{1,4 \cdot 10^5}{4 \cdot 10^5} \cdot 100\% = 35\%$$

Javob: B) $\eta = 35\%$.

43.11. Bitta siklda issiqlik mashinasi 28 kJ ish bajarib, sovitkichga 42 kJ issiqlik miqdorini beradi. Mashinaning FIKni aniqlang (%).

A) 30

B) 42

C) 40

D) 50

Berilgan:

$$A = 28 \text{ kJ} = 28 \cdot 10^3 \text{ J}$$

$$Q_2 = 42 \text{ kJ} = 42 \cdot 10^3 \text{ J}$$

$$\eta = ?$$

Yechilishi:

Issiqlik mashinasining foydali ish koeffitsiyentini topish formulasidan foydalanamiz.

$$\eta = \frac{Q_1 - Q_2}{Q_1} \cdot 100\% = \frac{A}{Q_1} \cdot 100\%$$

$$A = Q_1 - Q_2 \quad Q_1 = A + Q_2$$

Yuqoridagi ifodaning o'rniga qo'yamiz.

$$\eta = \frac{A}{Q_1} \cdot 100\% = \frac{A}{A + Q_2} \cdot 100\% = \frac{28 \cdot 10^3}{28 \cdot 10^3 + 42 \cdot 10^3} \cdot 100\%$$

$$\eta = \frac{28 \cdot 10^3}{70 \cdot 10^3} \cdot 100\% = 40\%$$

Javob: C) $\eta = 40\%$.

43.12. FIK 25% bo'lgan issiqlik mashinasi sovutkichga 600 J issiqlik beradi. U qanday foydali ish bajaradi (J)?

A) 200

B) 300

C) 400

D) 500

Berilgan:

$$\eta = 25\%$$

$$Q_2 = 600 \text{ J}$$

$$A = ?$$

Yechilishi:

Issiqlik mashinasining foydali ish koeffitsiyentini topish formulasidan foydalanamiz.

$$\eta = \frac{A}{Q_1} \cdot 100\% = \frac{A}{A + Q_2} \cdot 100\%$$

$$\eta(A + Q_2) = A \cdot 100\%$$

$$\eta A + \eta Q_2 = A \cdot 100\%$$

$$A \cdot 100\% - \eta A = \eta Q_2$$

$$A(100\% - \eta) = \eta Q_2$$

$$A = \frac{\eta Q_2}{100\% - \eta}$$

$$A = \frac{\eta Q_2}{100\% - \eta} = \frac{25\% \cdot 600}{100\% - 25\%} = 200 \text{ J}$$

Javob: A) $A = 200 \text{ J}$.

43.13. FIK 40% bo'lgan issiqlik mashinasi bitta siklda necha kJ ish bajaradi?

A) 21

B) 28

C) 168

D) 56

Berilgan:

$$\eta = 40\%$$

$$Q_2 = 42 \text{ kJ} = 42 \cdot 10^3 \text{ J}$$

$$A = ?$$

Yechilishi:

Issiqlik mashinasining foydali ish koeffitsiyentini topish formulasidan foydalanamiz.

$$\eta = \frac{A}{Q_1} \cdot 100\% = \frac{A}{A+Q_2} \cdot 100\%$$

$$\eta(A + Q_2) = A \cdot 100\%$$

$$\eta A + \eta Q_2 = A \cdot 100\%$$

$$A \cdot 100\% - \eta A = \eta Q_2$$

$$A(100\% - \eta) = \eta Q_2$$

$$A = \frac{\eta Q_2}{100\% - \eta} = \frac{40\% \cdot 42 \cdot 10^3}{100\% - 40\%} = \frac{40\% \cdot 42 \cdot 10^3}{60\%} = 28 \cdot 10^3 \text{ J} = 28 \text{ kJ}$$

Javob: B) $A = 28 \text{ kJ}$.

43.14. Issiqlik mashinasining FIK 25%. Uning isitkichdan olgan issiqlik miqdori 800 J bo'lsa, foydali ishi necha joul bo'ladi?

A) 100

B) 200

C) 300

D) 400

Berilgan:

$$\eta = 25\%$$

$$Q_1 = 800 \text{ J}$$

$$A = ?$$

Yechilishi:

Issiqlik mashinasining foydali ish koeffitsiyentini topish formulasidan foydalanamiz.

$$\eta = \frac{A}{Q_1} \cdot 100\%$$

$$A = \frac{\eta Q_1}{100\%}$$

$$A = \frac{\eta Q_1}{100\%} = \frac{25\% \cdot 800}{100\%} = 200 \text{ J}$$

Javob: B) $A = 200 \text{ J}$.

43.15. Foydali ish koeffitsiyenti 30% bo'lgan ideal issiqlik mashinasi qizdirgichdan 10 kJ issiqlik oladi. Sovitkichga berilayotgan issiqlik miqdori qanday (kJ)?

A) 6

B) 7

C) 3

D) 2,4

Berilgan:

$$\eta = 30\%$$

$$Q_1 = 10 \text{ kJ} = 10^4 \text{ J}$$

$$Q_2 = ?$$

Yechilishi:

Issiqlik mashinasining foydali ish koeffitsiyentini topish formulasidan foydalanamiz.

$$\eta = \frac{Q_1 - Q_2}{Q_1} \cdot 100\%$$

$$\eta Q_1 = (Q_1 - Q_2)100\% = Q_1 100\% - Q_2 100\%$$

$$Q_2 100\% = Q_1 100\% - \eta Q_1 = Q_1 (100\% - \eta)$$

$$Q_2 = \frac{Q_1(100\% - \eta)}{100\%}$$

$$Q_2 = \frac{10^4(100\% - 30\%)}{100\%} = \frac{10^4 \cdot 70\%}{100\%} = 7 \cdot 10^3 J = 7 kJ.$$

Javob: B) $Q_2 = 7$ kJ.

43.16. FIK 40% bo'lgan issiqlik mashinasi bitta siklda 42 kJ ish bajaradi. Mashina bitta siklda sovitkichga qanday (kJ) issiqlik miqdori beradi?

A) 63 B) 42 C) 51 D) 28

Berilgan:

$$\eta = 40\%$$

$$A = 42 \text{ kJ} = 42 \cdot 10^3 J$$

$$Q_2 = ?$$

Yechilishi:

Issiqlik mashinasining foydali ish koeffitsiyentini topish formulasidan foydalanamiz.

$$\eta = \frac{A}{Q_1} \cdot 100\% = \frac{A}{A + Q_2} \cdot 100\%$$

$$\eta(A + Q_2) = A \cdot 100\%$$

$$\eta A + \eta Q_2 = A \cdot 100\%$$

$$A \cdot 100\% - \eta A = \eta Q_2$$

$$A(100\% - \eta) = \eta Q_2$$

$$Q_2 = \frac{A(100\% - \eta)}{\eta}$$

$$Q_2 = \frac{A(100\% - \eta)}{\eta} = \frac{42 \cdot 10^3 (100\% - 40\%)}{40\%} = \frac{42 \cdot 10^3 \cdot 60\%}{40\%}$$

$$Q_2 = 63 \cdot 10^3 J = 63 kJ$$

Javob: A) $Q_2 = 63$ kJ.

43.17. Isitkichning harorati 150°C , sovitkichniki 20°C . Ideal issiqlik mashinasining FIK necha foiz?

A) 20 B) 23 C) 25 D) 30,7

Berilgan:

$$t_1 = 150^\circ\text{C}$$

$$T_1 = 423 \text{ K}$$

$$t_2 = 20^\circ\text{C}$$

$$T_2 = 293 \text{ K}$$

$$\eta = ?$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\% = \frac{423 - 293}{423} \cdot 100\% =$$

$$= \frac{130}{423} \cdot 100\% = 30,7\%$$

Javob: D) $\eta = 30,7\%$.

43.18. Ideal issiqlik mashina isitkichining harorati 117°C , sovitkichiniki 27°C . Mashinaning FIK ni toping (%).

A) 23 B) 33 C) 70 D) 30

Berilgan:

$$t_1 = 117 \text{ }^{\circ}\text{C}$$

$$T_1 = 390 \text{ K}$$

$$t_2 = 27 \text{ }^{\circ}\text{C}$$

$$T_2 = 300 \text{ K}$$

$$\eta = ?$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\% = \frac{390 - 300}{390} \cdot 100\% = \frac{90}{390} \cdot 100\% = 23\%$$

Javob: A) $\eta = 23\%$.

43.19. Ideal issiqlik mashinasida isitkichning mutlaq harorati sovitkichning mutlaq haroratidan 2 marta katta bo'lsa, bunday mashinaning foydali ish koeffitsiyenti necha foiz?

A) 30

B) 40

C) 50

D) 60

Berilgan:

$$T_1 = 2 T_2$$

$$\eta = ?$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\% = \frac{2T_1 - T_1}{2T_1} \cdot 100\% = \frac{T_1}{2T_1} \cdot 100\% = 50\%$$

Javob: C) $\eta = 50\%$.

43.20. Karno siklida ishlayotgan issiqlik mashinasiga temperaturasi 480°C bo'lgan bug' kirib, undan 30°C temperaturada chiqsa, mashinaning FIK qanday (%)?

A) 30

B) 40

C) 50

D) 60

Berilgan:

$$t_1 = 480 \text{ }^{\circ}\text{C}$$

$$T_1 = 753 \text{ K}$$

$$t_2 = 30 \text{ }^{\circ}\text{C}$$

$$T_2 = 303 \text{ K}$$

$$\eta = ?$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\% = \frac{753 - 303}{753} \cdot 100\% = \frac{450}{753} \cdot 100\% = 60\%$$

Javob: D) $\eta = 60\%$.

43.21. FIK ning maksimal qiymati 50% bo'lishi uchun isitkichining harorati 527°C bo'lgan issiqlik mashinasi sovitkichining harorati qanday ($^{\circ}\text{C}$) bo'lishi kerak?

A) 400

B) 351

C) 263,5

D) 127

Berilgan:

$$\eta = 50\%$$

$$t_1 = 527 \text{ }^{\circ}\text{C}$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\frac{T_1 = 800 \text{ K}}{t_2 = ?}$$

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\%$$

$$\eta T_1 = (T_1 - T_2) \cdot 100\% = T_1 \cdot 100\% - T_2 \cdot 100\%$$

$$T_2 \cdot 100\% = T_1 \cdot 100\% - \eta T_1 = T_1(100\% - \eta)$$

$$T_2 = \frac{T_1(100\% - \eta)}{100\%}$$

$$T_2 = \frac{T_1(100\% - \eta)}{100\%} = \frac{800 \cdot (100\% - 50\%)}{100\%} = \frac{800 \cdot 50\%}{100\%} = 400 \text{ K}$$

$$t_2 = T_2 - 273 = 400 - 273 = 127^\circ\text{C}$$

Javob: D) $t_2 = 127^\circ\text{C}$

43.22. Isitkichining harorati 500 K bo'lgan issiqlik mashinasining FIK 50%. Sovitkichning harorati qanday (K)?

A) 190

B) 200

C) 230

D) 250

Berilgan:

$$\eta = 50\%$$

$$T_1 = 500 \text{ K}$$

$$T_2 = ?$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\%$$

$$\eta T_1 = (T_1 - T_2) \cdot 100\% = T_1 \cdot 100\% - T_2 \cdot 100\%$$

$$T_2 \cdot 100\% = T_1 \cdot 100\% - \eta T_1 = T_1(100\% - \eta)$$

$$T_2 = \frac{T_1(100\% - \eta)}{100\%}$$

$$T_2 = \frac{T_1(100\% - \eta)}{100\%} = \frac{500 \cdot (100\% - 50\%)}{100\%} = \frac{500 \cdot 50\%}{100\%} = 250 \text{ K}$$

Javob: D) $T_2 = 250 \text{ K}$.

43.23. Ideal issiqlik mashinasining FIK 60% bo'lishi uchun uning isitkichining harorati necha kelvin bo'lishi kerak? Sovitkichning harorati 300 K.

A) 700

B) 750

C) 800

D) 1200

Berilgan:

$$\eta = 60\%$$

$$T_2 = 300 \text{ K}$$

$$T_1 = ?$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\%$$

$$\eta T_1 = (T_1 - T_2) \cdot 100\% = T_1 \cdot 100\% - T_2 \cdot 100\%$$

$$T_2 \cdot 100\% = T_1 \cdot 100\% - \eta T_1 = T_1(100\% - \eta)$$

$$T_2 = \frac{T_1 \cdot 100\%}{100\% - \eta} = \frac{300 \cdot (100\% - 50\%)}{100\% - 60\%} = \frac{300 \cdot 100\%}{40\%} = 750 K$$

Javob: B) $T_1 = 750 K$.

43.24. Agar sovutkichining harorati $27^\circ C$ bo'lsa, issiqlik mashinasining FIK 60% bo'lishi uchun uning isitkichining harorati kamida qanday ($^\circ C$) bo'lishi kerak?

A) 477

B) 40,5

C) 1023

D) 750

Berilgan:

$$\eta = 60\%$$

$$t_2 = 27^\circ C$$

$$T_2 = 300 K$$

$$t_1 = ?$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\%$$

$$\eta T_1 = (T_1 - T_2) \cdot 100\% = T_1 \cdot 100\% - T_2 \cdot 100\%$$

$$T_2 \cdot 100\% = T_1 \cdot 100\% - \eta T_1 = T_1(100\% - \eta)$$

$$T_1 = \frac{T_2 \cdot 100\%}{100\% - \eta} = \frac{300 \cdot 100\%}{100\% - 60\%} = \frac{300 \cdot 100\%}{40\%} = 750 K$$

$$t_1 = T_1 - 273 = 477^\circ C$$

Javob: A) $t_1 = 477^\circ C$.

43.25. Isitkichining temperaturasi $127^\circ C$, sovutkichining temperaturasi $7^\circ C$ bo'lgan ideal issiqlik mashinasi bir siklda isitkichdan 1200 J issiqlik olsa, necha joul foydali ish bajaradi?

A) 400

B) 500

C) 600

D) 360

Berilgan:

$$t_1 = 127^\circ C$$

$$T_1 = 400 K$$

$$t_2 = 7^\circ C$$

$$T_2 = 280 K$$

$$Q_1 = 1200 J$$

$$A = ?$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\% = \frac{400 - 280}{400} \cdot 100\% = \frac{120}{400} \cdot 100\% = 30\%$$

Issiqlik mashinasining foydali ish koeffitsiyentini topish formulasidan foydalanamiz.

$$\eta = \frac{A}{Q_1} \cdot 100\%$$

$$A = \frac{\eta Q_1}{100\%} = \frac{30\% \cdot 1200}{100\%} = 360 \text{ J}$$

Javob: D) $A = 360 \text{ J}$.

43.26. Issiqlik mashina isitkichining temperaturasi 500 K, sovitkichiniki 250 K bo'lsa va u bir siklda isitkichdan 3000 J issiqlik olsa, bir siklda bajarilgan ish necha joul bo'ladi?

A) 1200

B) 1500

C) 300

D) 3000

Berilgan:

$$T_1 = 500 \text{ K}$$

$$T_2 = 250 \text{ K}$$

$$Q_1 = 3000 \text{ J}$$

$$A = ?$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\% = \frac{500 - 250}{500} \cdot 100\% = \frac{250}{500} \cdot 100\% = 50\%$$

Issiqlik mashinasining foydali ish koeffitsiyentini topish formulasidan foydalanamiz.

$$\eta = \frac{A}{Q_1} \cdot 100\%$$

$$A = \frac{\eta Q_1}{100\%} = \frac{50\% \cdot 3000}{100\%} = 1500 \text{ J}$$

Javob: B) $A = 1500 \text{ J}$.

43.27. Ideal issiqlik dvigatelida sovitkichning temperaturasi 62°C, issiqlik dvigatelining FIK 33% bo'lsa, isitkich bilan sovitkichning temperaturalari farqi necha kelvin?

A) 62

B) 500

C) 438

D) 165

Berilgan:

$$t_2 = 62^\circ \text{C}$$

$$T_2 = 335 \text{ K}$$

$$\eta = 33\%$$

$$\Delta T = ?$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\% = \frac{\Delta T}{T_2 + \Delta T} \cdot 100\%$$

$$\eta(T_2 + \Delta T) = \Delta T \cdot 100\%$$

$$\Delta T \cdot 100\% = \eta T_2 + \eta \Delta T$$

$$\Delta T \cdot 100\% - \eta \Delta T = \eta T_2$$

$$\Delta T(100\% - \eta) = \eta T_2$$

$$\Delta T = \frac{\eta T_2}{100\% - \eta}$$

$$\Delta T = \frac{\eta T_2}{100\% - \eta} = \frac{33\% \cdot 335}{100\% - 33\%} = 165 \text{ K}$$

Javob: D) $\Delta T = 165 \text{ K}$.

43.28. Ideal issiqlik mashinasining FIK 80% bo'lishi uchun isitkichning temperaturasi sovitkichning temperaturasidan necha marta katta bo'lishi kerak?

A) 4

B) 5

C) 8

D) 3

Berilgan:

$$\eta = 80\%$$

$$\frac{T_1}{T_2} = ?$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\% \text{ ifodadan } T_2 \text{ ni topamiz.}$$

$$\eta T_1 = (T_1 - T_2) \cdot 100\% = T_1 \cdot 100\% - T_2 \cdot 100\%$$

$$T_2 \cdot 100\% = T_1 \cdot 100\% - \eta T_1 = T_1(100\% - \eta)$$

$$T_2 = \frac{T_1(100\% - \eta)}{100\%}$$

$$\frac{T_1}{T_2} = \frac{T_1}{\frac{T_1(100\% - \eta)}{100\%}} = \frac{100\%}{100\% - \eta} = \frac{100\%}{100\% - 80\%} = 5$$

Javob: B) 5 marta katta.

$$T_1 = 5 T_2$$

43.29. Ideal issiqlik mashinasining foydali ish koeffitsiyenti 30%, isitkich va sovitkich haroratlari farqi 210 K bo'lishi uchun isitkich harorati qanday bo'lishi kerak?

A) 700°C

B) 6300°C

C) 630 K

D) 700 K

Berilgan:

$$\eta = 30\%$$

$$\Delta T = 210 \text{ K}$$

$$T_1 = ?$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\% = \frac{\Delta T}{T_1} \cdot 100\%$$

$$T_1 = \frac{\Delta T}{\eta} \cdot 100\% = \frac{210}{30\%} \cdot 100\% = 700 \text{ K}$$

Javob: D) $T_1 = 700 \text{ K}$.

43.30. Ideal issiqlik dvigatelida isitkich bilan sovitkichning temperaturalar farqi 175°C. Issiqlik dvigatelining FIK 35% bo'lsa, sovitkichning temperaturasi qanday (°C)?

A) 27

B) 75

C) 125

D) 52

Berilgan:

$\eta = 35\%$

$\Delta T = 175^\circ\text{C}$

$t_2 = ?$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\% = \frac{\Delta T}{T_2 + \Delta T} \cdot 100\%$$

$$\eta(T_2 + \Delta T) = \Delta T \cdot 100\%$$

$$\Delta T \cdot 100\% - \eta T_2 + \eta \Delta T$$

$$\Delta T \cdot 100\% - \eta \Delta T = \eta T_2$$

$$\Delta T(100\% - \eta) = \eta T_2$$

$$T_2 = \frac{\Delta T(100\% - \eta)}{\eta} = \frac{175 \cdot (100\% - 35\%)}{35\%} = 5 \cdot 65 = 325\text{ K}$$

$$t_2 = T_2 - 273 = 325 - 273 = 52^\circ\text{C}$$

Javob: D) $t_2 = 52^\circ\text{C}$.

43.31. Ideal issiqlik mashinasidagi gaz isitkichdan olgan issiqligining 70% ini sovitkichga beradi. Agar isitkichning harorati 227°C bo'lsa, sovitkichning harorati qanday?

A) 68°C B) 159°C C) 77°C

D) 150 K

Berilgan:

$Q_2 = 0,70 Q_1$

$t_1 = 227^\circ\text{C}$

$T_2 = 500\text{ K}$

$t_2 = ?$

Yechilishi:

Sovutkichga 70% issiqlik miqdorini olsa, u 30% issiqlikni foydali ishga sarflagan $\eta = 30\%$

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\%$$

$$\eta T_1 = (T_1 - T_2) \cdot 100\% = T_1 \cdot 100\% - T_2 \cdot 100\%$$

$$T_2 \cdot 100\% = T_1 \cdot 100\% - \eta T_1 = T_1(100\% - \eta)$$

$$T_2 = \frac{T_1(100\% - \eta)}{100\%} = \frac{500 \cdot (100\% - 30\%)}{100\%} = 5 \cdot 70 = 350\text{ K}$$

$$t_2 = T_2 - 273 = 350 - 273 = 77^\circ\text{C}$$

Javob: C) $t_2 = 77^\circ\text{C}$

43.32. Ideal issiqlik mashinasi bir siklda 500 K haroratli isitkichdan 3000 J issiqlik miqdori olsa, 300 K haroratli sovitkichga necha joul issiqlik miqdori beradi?

A) 1200

B) 1000

C) 500

D) 1800

Berilgan:

$Q_1 = 3000 \text{ J}$

$T_1 = 500 \text{ K}$

$T_2 = 300 \text{ K}$

$Q_2 = ?$

Yechilishi:

Ideal va real issiqlik mashinalarining FIK ni tenglashtiramiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\%; \quad \eta = \frac{Q_1 - Q_2}{Q_1} \cdot 100\%$$

$$\frac{T_1 - T_2}{T_1} = \frac{Q_1 - Q_2}{Q_1}; \quad \frac{Q_1(T_1 - T_2)}{T_1} = Q_1 - Q_2$$

$$Q_2 = Q_1 - \frac{Q_1(T_1 - T_2)}{T_1} = 3000 - \frac{3000 \cdot (500 - 300)}{500} = 3000 - 6 \cdot 200 = \\ = 3000 - 1200 = 1800 \text{ J}$$

Javob: D) $Q_2 = 1800 \text{ J}$.

43.33. Ideal issiqlik mashinasi isitkichining absolut temperaturasi sovitkich-nikidan 3 marta yuqori. Isitkich gazga 30 kJ issiqlik berganda, u qancha ish bajaradi (kJ)?

A) 30

B) 25

C) 20

D) 15

Berilgan:

$T_1 = 3 T_2$

$Q_2 = 30 \text{ kJ}$

$A = ?$

Yechilishi:

Ideal va real issiqlik mashinalarining FIK ni tenglashtiramiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\%; \quad \eta = \frac{Q_1 - Q_2}{Q_1} \cdot 100\%$$

$$\frac{T_1 - T_2}{T_1} = \frac{Q_1 - Q_2}{Q_1} = \frac{A}{Q_1}$$

$$A = \frac{Q_1(T_1 - T_2)}{T_1} = \frac{Q_1(3T_2 - T_2)}{3T_2} = \frac{2Q_1}{3} = \frac{2 \cdot 30000}{3} = 20000 \text{ J} = 20 \text{ kJ}$$

Javob: C) $A = 20 \text{ kJ}$.

43.34. Ideal issiqlik dvigatelida isitkichning mutlaq harorati sovitkich haroratidan 3 marta yuqori. Isitkich gazga 42 kJ issiqlik bergan. Bu gaz qanday (kJ) ish bajargan?

A) 14

B) 42

C) 24

D) 28

Berilgan:

$T_1 = 3 T_2$

$Q_1 = 42 \text{ kJ}$

$A = ?$

Yechilishi:

Ideal va real issiqlik mashinalarining FIK ni tenglashtiramiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\%; \quad \eta = \frac{Q_1 - Q_2}{Q_1} \cdot 100\%$$

$$\frac{T_1 - T_2}{T_1} = \frac{Q_1 - Q_2}{Q_1} = \frac{A}{Q_1}$$

$$A = \frac{Q_1(T_1 - T_2)}{T_1} = \frac{Q_1(3T_2 - T_2)}{3T_2} = \frac{2Q_1}{3} = \frac{2 \cdot 42000}{3} = 28000 \text{ J} = 28 \text{ kJ}$$

Javob: D) $A = 28 \text{ kJ}$.

43.35. Ideal mashina isitkichining harorati 327°C bo'lib, sovutkichining harorati 127°C ga teng. Shu ideal mashinaning FIKni 2 marta oshirish uchun isitkichning haroratini necha gradus oshirish kerak?

A) 527

B) 654

C) 327

D) 600

Berilgan:

$$t_1 = 327^\circ\text{C}$$

$$t_2 = 127^\circ\text{C}$$

$$T_1 = 600 \text{ K}$$

$$T_2 = 400 \text{ K}$$

$$\eta_2 = 2\eta_1$$

$$\Delta t = ?$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta = \frac{T_1 - T_2}{T_1} \cdot 100\%; \quad \eta = \frac{600 - 400}{600} \cdot 100\% = \frac{200}{600} \cdot 100\% = \frac{100}{3} \%$$

$$\eta_2 = \frac{T_3 - T_2}{T_3} \cdot 100\% = 2\eta_1 = \frac{2 \cdot 100}{3} \% = \frac{200}{3} \%$$

$$\eta_2 = \frac{T_3 - T_2}{T_3} \cdot 100\% = \frac{200}{3} \%$$

$$3(T_3 - T_2) = 2T_3$$

$$3T_3 - 3T_2 = 2T_3$$

$$T_3 = 3T_2 = 3 \cdot 400 = 1200 \text{ K}$$

$$\Delta T = T_3 - T_1 = 1200 - 600 = 600 \text{ K}$$

$$\Delta t = \Delta T = 600^\circ\text{C}$$

Javob: D) $\Delta t = 600^\circ\text{C}$.

43.36. Ideal issiqlik mashinasi isitkichining temperaturasi 127°C , sovutkichiniki 27°C . Agar isitkichning absolut temperaturasi 2 marta orttirilsa, bu mashinaning FIK necha foizga ortadi?

A) 25

B) 30

C) 35

D) 37,5

Berilgan:

$$t_1 = 127^\circ\text{C}$$

$$t_2 = 27^\circ\text{C}$$

$$T_1 = 400 \text{ K}$$

$$T_2 = 300 \text{ K}$$

$$T_3 = 2T_1$$

$$\Delta \eta = ?$$

Yechilishi:

Ideal issiqlik mashinasining FIKni topish ifodasidan foydalanamiz:

$$\eta_1 = \frac{T_1 - T_2}{T_1} \cdot 100\% = \frac{400 - 300}{400} \cdot 100\% = \frac{100}{400} \cdot 100\% = 25\%;$$

$$\eta_2 = \frac{T_3 - T_2}{T_3} \cdot 100\% = \frac{2T_1 - T_2}{2T_1} \cdot 100\% = \frac{2 \cdot 400 - 300}{2 \cdot 400} \cdot 100\% = 62,5\%$$

$$\Delta \eta = \eta_2 - \eta_1 = 62,5\% - 25\% = 37,5\%$$

Javob: D) $\Delta \eta = 37,5\%$.

43.37. Isitkich harorati 427°C bo'lib, sovitkich harorati 127°C . Issiqlik mashinasi bir siklda 600 J issiqlik olib, sovitkichga 400 J issiqlik beradi. Real mashinaning FIK ideal mashina FIK ning qancha qismini tashkil qiladi?

A) $1/2$

B) $6/7$

C) $7/8$

D) $7/9$

Berilgan:

$$t_1 = 427^{\circ}\text{C}$$

$$t_2 = 127^{\circ}\text{C}$$

$$Q_1 = 600 \text{ J}$$

$$Q_2 = 400 \text{ J}$$

$$\frac{\eta_r}{\eta_i} = ?$$

Yechilishi:

Ideal va real issiqlik mashinasining FIKni topish ifodasidan foydalanamiz.

$$T_1 = t_1 + 273 = 427 + 273 = 700 \text{ K}$$

$$T_2 = t_2 + 273 = 127 + 273 = 400 \text{ K}$$

$$\eta_i = \frac{T_1 - T_2}{T_1} \cdot 100\%$$

$$\eta_r = \frac{Q_1 - Q_2}{Q_1} \cdot 100\%$$

$$\frac{\eta_r}{\eta_i} = \frac{\frac{Q_1 - Q_2}{Q_1} \cdot 100\%}{\frac{T_1 - T_2}{T_1} \cdot 100\%} = \frac{\frac{600 - 400}{600}}{\frac{700 - 400}{700}} = \frac{\frac{200}{600}}{\frac{300}{700}} = \frac{2 \cdot 7}{3 \cdot 6} = \frac{14}{18} = \frac{7}{9}$$

Javob: D) $\frac{\eta_r}{\eta_i} = \frac{7}{9}$.

43.38. FIK η bo'lgan issiqlik dvigatelida gaz bajargan ishni 13 marta oshirish uchun isitkichdan olinadigan issiqlik miqdorini qanday o'zgartirish kerak?

A) $\sqrt{13}$ marta orttirish

B) 13 marta orttirish

C) $\sqrt{13}$ marta kamaytirish

D) 13 marta kamaytirish

Berilgan:

$$A_2 = 13 A_1$$

$$\eta_1 = \eta_2 = \eta$$

$$\frac{Q_3}{Q_2} = ?$$

Yechilishi:

Real issiqlik mashinasining FIKni topish ifodasidan foydalanamiz.

$$\eta_1 = \frac{Q_1 - Q_2}{Q_1} = \frac{A_1}{Q_1}; \quad Q_1 = \frac{A_1}{\eta_1}; \quad \eta_2 = \frac{Q_3 - Q_2}{Q_3} = \frac{A_2}{Q_3}; \quad Q_3 = \frac{A_2}{\eta_2}$$

$$\text{Nisbat olamiz } \frac{Q_3}{Q_1} = \frac{\frac{A_2}{\eta_2}}{\frac{A_1}{\eta_1}} = \frac{A_2 \eta_1}{A_1 \eta_2} = \frac{13 A_1 \eta}{A_1 \eta} = 13$$

$$Q_3 = 13 Q_1$$

Javob: B) 13 marta ortadi.

43.39. Karno siklida ishlaydigan mashinada isitkich va sovitkich absolut temperaturalarining nisbati 5 ga teng. Agar bir siklda sovitkichga 36 kJ issiqlik berilgan bo'lsa, isitkichdan olingan issiqlik miqdori qanday (kJ)?

A) 900

B) 180

C) 72

D) 7,2

Berilgan:

$$T_1 = 5T_2$$

$$Q_2 = 36 \text{ kJ} = 36000 \text{ J}$$

$$Q_1 = ?$$

Yechilishi:

Ideal va real issiqlik mashinasining FIKni topish ifodasidan foydalanamiz va tenglashtiramiz;

$$\eta = \frac{Q_1 - Q_2}{Q_1}, \quad \eta = \frac{T_1 - T_2}{T_1}$$

$$\frac{Q_1 - Q_2}{Q_1} = \frac{T_1 - T_2}{T_1} = \frac{5T_2 - T_2}{5T_2} = \frac{4T_2}{5T_2} = \frac{4}{5}$$

$$5(Q_1 - Q_2) = 4Q_1$$

$$5Q_1 - 5Q_2 = 4Q_1$$

$$5Q_1 - 4Q_1 = 5Q_2$$

$$Q_1 = 5Q_2 = 5 \cdot 36000 = 180000 \text{ J} = 180 \text{ kJ}$$

Javob: B) $Q_1 = 180 \text{ kJ}$.

43.40. Ideal issiqlik mashinasi bir sikl davomida $5,36 \cdot 10^4 \text{ J}$ ish bajardi. Isitkich temperaturasi 100°C , sovutkichniki esa 0°C bo'lsa, mashina bir siklda isitkichdan qanday (kJ) issiqlik miqdori oladi?

A) 150

B) 170

C) 200

D) 210

Berilgan:

$$A = 5,36 \cdot 10^4 \text{ J}$$

$$t_1 = 100^\circ\text{C}$$

$$t_2 = 0^\circ\text{C}$$

$$Q_1 = ?$$

Yechilishi:

Ideal va real issiqlik mashinasining FIKni topish ifodasidan foydalanamiz va tenglashtiramiz;

$$\eta = \frac{Q_1 - Q_2}{Q_1} = \frac{A}{Q_1}, \quad \eta = \frac{T_1 - T_2}{T_1}$$

$$T_1 = t_1 + 273 = 100 + 273 = 337 \text{ K}$$

$$T_2 = t_2 + 273 = 0 + 273 = 273 \text{ K}$$

$$\frac{A}{Q_1} = \frac{T_1 - T_2}{T_1} \text{ dan } Q_1 \text{ ni topamiz.}$$

$$Q_1 = \frac{AT_1}{T_1 - T_2} = \frac{5,36 \cdot 10^4 \cdot 337}{337 - 273} = \frac{2000 \cdot 10^4}{100} = 20 \cdot 10^4 \text{ J} = 200 \text{ kJ}$$

Javob: C) $Q_1 = 200 \text{ kJ}$.

43.41. Isitkichining temperaturasi T_1 , sovutkichining temperaturasi T_2 bo'lgan issiqlik mashinasi bor. T_1 ni ΔT ga orttirib, T_2 ni o'zgartirmagan va T_2 ni ΔT ga kamaytirib, T_1 ni o'zgartirmagan hollardagi FIK larining nisbatini toping.

A) $\frac{T_1 - \Delta T}{T_2}$

B) $\frac{T_1 - \Delta T}{T_2 + \Delta T}$

C) $\frac{T_1}{T_1 + \Delta T}$

D) $\frac{T_1 - T_2}{T_1}$

Berilgan:

$$\begin{aligned} T_1 \\ T_2 \\ a) \\ T_3 = T_1 + \Delta T \\ T_2 = \text{const} \\ b) \\ T_4 = T_2 - \Delta T \\ T_1 = \text{const} \\ \hline \frac{\eta_1}{\eta_2} = ? \end{aligned}$$

Yechilishi:

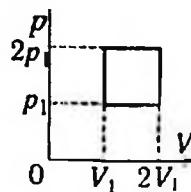
Har ikki hol uchun ideal issiqlik mashinasi uchun FIKni topish formulasini yozamiz:

$$\begin{aligned} a) \quad \eta_1 &= \frac{T_3 - T_2}{T_3} = \frac{T_1 + \Delta T - T_2}{T_1 + \Delta T}; \\ b) \quad \eta_1 &= \frac{T_1 - T_4}{T_1} = \frac{T_1 - (T_2 - \Delta T)}{T_1} = \frac{T_1 - T_2 + \Delta T}{T_1} \\ \frac{\eta_1}{\eta_2} &= \frac{\frac{T_1 + \Delta T - T_2}{T_1 + \Delta T}}{\frac{T_1 - T_2 + \Delta T}{T_1}} = \frac{T_1}{T_1 + \Delta T} \end{aligned}$$

Javob: C) $\frac{\eta_1}{\eta_2} = \frac{T_1}{T_1 + \Delta T}$.

43.42. Ishchi moddasi bir atomli ideal gaz bo'lgan issiqlik mashinasi rasmda tasvirlangan sikl bo'yicha ishlaydi. Uning FIK qanday (%)?

- A) 25 B) 15,4 C) 33,3 D) 50



Berilgan:

$$\begin{aligned} P_1 &= P \\ P_2 &= 2P \\ V_1 &= V \\ V_2 &= 2V \\ i &= 3 \\ \hline \eta &= ? \end{aligned}$$

Yechilishi:

Sistema bajargan foydali ish to'rtburchakning yuzasiga teng, ya'ni

$$A = (P_2 - P_1)(V_2 - V_1) = (2P - P)(2V - V) = PV$$

Sistema ikki jarayonda issiqlik oladi. Bu issiqlik sistemasining birinchi izoxorik jarayonda bosimining ortishiga va izobarik jarayonda hajmining ortishiga to'g'ri keladi. Sistema izoxorik jarayonda bosim kamayishida va izobarik jarayonda hajm kamayishida issiqlik beradi. Sistema olgan issiqlik miqdorini topamiz:

$$Q_{um} = Q_1 + Q_2$$

Termodinamikaning I qonuniga asosan $Q_1 = \Delta U_1 + A_1$. Izoxorik jarayon uchun

$$\Delta U_1 = \frac{i}{2} \frac{m}{M} R \Delta T_1 = \frac{i}{2} \Delta PV = \frac{i}{2} PV, \quad A_1 = P \Delta V = 0$$

$$Q_1 = \Delta U_1 + A_1 = \frac{i}{2} PV$$

Izobarik jarayon uchun: $Q_2 = \Delta U_2 + A_2$

$$\Delta U_2 = \frac{i}{2} \frac{m}{M} R \Delta T_2 = \frac{i}{2} P_2 \Delta V_2 = \frac{i}{2} 2PV = iPV; \quad A_1 = P_2 \Delta V_2 = 2PV$$

$$\begin{aligned}
 Q_2 &= \Delta U_2 + A_2 = iPV + 2PV \\
 \eta &= \frac{A}{Q_{um}} \cdot 100\% = \frac{A}{Q_1 + Q_2} \cdot 100\% = \frac{PV}{Q_1 + Q_2} \cdot 100\% = \frac{PV}{\frac{1}{2}PV + iPV + 2PV} \cdot 100\% = \\
 &= \frac{PV}{\left(\frac{i}{2} + i + 2\right)PV} \cdot 100\% \\
 100\% &= \frac{1}{\frac{i+2i+2}{2}} \cdot 100\% = \frac{2}{i+2i+4} \cdot 100\% = \frac{2}{3+2 \cdot 3+4} \cdot 100\% = \frac{2}{13} \cdot 100\% = 15,4\% \\
 \text{Javob: B) } \eta &= 15,4\%.
 \end{aligned}$$

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