PHYSICS

FOR IIT JEE ASPIRANTS OF CLASS 12 FOR PHYSICS

MASTER PRACTICE PROBLEM

Straight Objective Type

1. The dimensions of $\frac{a}{b}$ in the equation $P = \frac{a - t^2}{bx}$ where P is pressure, x is distance and t is time are

A. $\left[M^2LT^{-3}\right]$

B. $\left[MT^{-2}\right]$

C. $\left[LT^{-3}\right]$

D. $\left[ML^3T^{-1}\right]$

Answer: B

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2. If the mass time and work are taken as fundamental physical quantities then dimensional formula of length

A. $\left[m^{\frac{1}{2}}T^1W^{-\frac{1}{2}}\right]$

B. $\left[M^{-\frac{1}{2}}T^1W^{\frac{1}{2}}\right]$

C. $\left[M^{-1}T^2W\right]$

D. none of these

Answer: B

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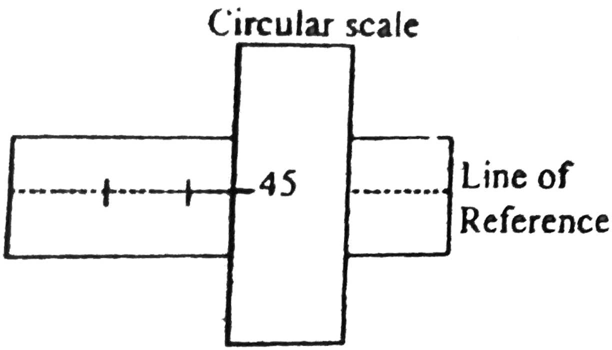
3. Consider a screw gauge without any zero error. What will be the final reading corresponding to the final state as shown? It is given that the circular head translates P msd in N rotations One msd is equal to 1 mm.



The circular scale has 100 divisions

A. $\left(\frac{P}{N}\right)\left(2+\frac{45}{100}\right)$mm

B. $\left(\frac{N}{P}\right)\left(2+\frac{45}{N}\right)$mm

C. $P\left(\frac{2}{N}+\frac{45}{100}\right)$mm

D. $\left[2+\frac{45}{100}\times\frac{P}{N}\right]$mm

Answer: D

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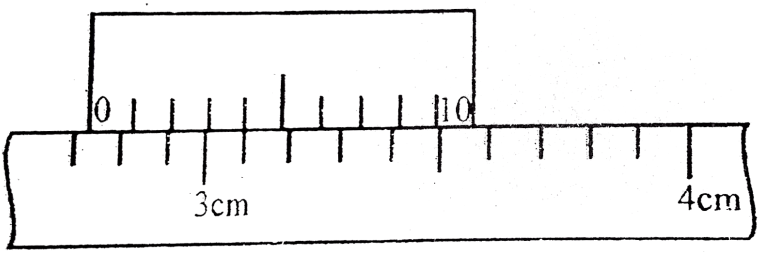
4. The diagram shows part of the vernier scale on a pair of calipers Which reading is correct



A. 2.74cm

B. 3.10cm

C. 3.26cm

D. 3.64cm

Answer: A

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5. In a vernier callipers having 10 Vsd the vernier constant is 0.1 mm When the jaws are closed zero of varnier lies to the left of zero of main and 7th Vsd coincides with scale division when a cylinder is placed between the jaws the main scale reading was 7.7 cm and vernier scale read 8 division What is the diameter of the cylinder ?

A. 78.1mm

B. 77.5mm

C. 77.8mm

D. 78.5mm

Answer: A

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6. In a meter bridge experiment the resistance of resistance box is 16Ω which is inserted in right gap The null point is obtained at 36cm from the left end the least count of meter scale is lmm What is the value of unknown resistence ?(Error = L.C or L.C /2)

A. $9 \pm \frac{5}{128}\Omega$

B. $9 \pm \frac{5}{256}\Omega$

C. $9 \pm \frac{5}{512}\Omega$

D. $\frac{128}{9} \pm \frac{1}{2560}\Omega$

Answer: B

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7. In an optical bench experiment to measure the focal length of a concave mirror random error in focal length will be

A. minimum when $u = f$ and maximum when $u = \infty$

B. minimum when $u = \infty$ and minimum when $u = f$

C. minimum when $u = 0$ and maximum when $u = 2f$

D. minimum when $u = 2f$ and maximum when $u = 0$

Answer: D

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8. The acceleration of a particle is given by

$$\vec{a} = \left[2\hat{i} + 6t\hat{j} + \frac{2\pi^2}{9}\cos\frac{\pi t}{3}\hat{k}\right] ms^{-2}$$

At $t = 0, \vec{r} = 0$ and $\vec{v} = \left(2\hat{i} + \hat{j}\right)ms^{-1}$ The position vector at $t = 2$ s is

A. $\left(8\hat{i} + 10\hat{j} + \hat{k}\right)m$

B. $\left(8\hat{i} + 10\hat{j} + 3\hat{k}\right)$ m

C. $\left(3\hat{i} + 8\hat{j} + 10\hat{k}\right)m$

D. $\left(10\hat{i} + 3\hat{j} + 8\hat{k}\right)m$

Answer: B

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9. A projectile is to be projected towards enemy territory at the same horizontal level. The initial velocity of the projectile is known to be $100 \pm 1m/s$ Initial angle of the projectile is known to be projected $45^{\circ} \pm 1^{\circ}$ What is the possible range of the projectile?

A. $990m \le R \le 1010m$

B. $980m \le R \le 1020m$

C. $970m \le R \le 1030m$

D. $930m \le R \le 970m$

Answer: B

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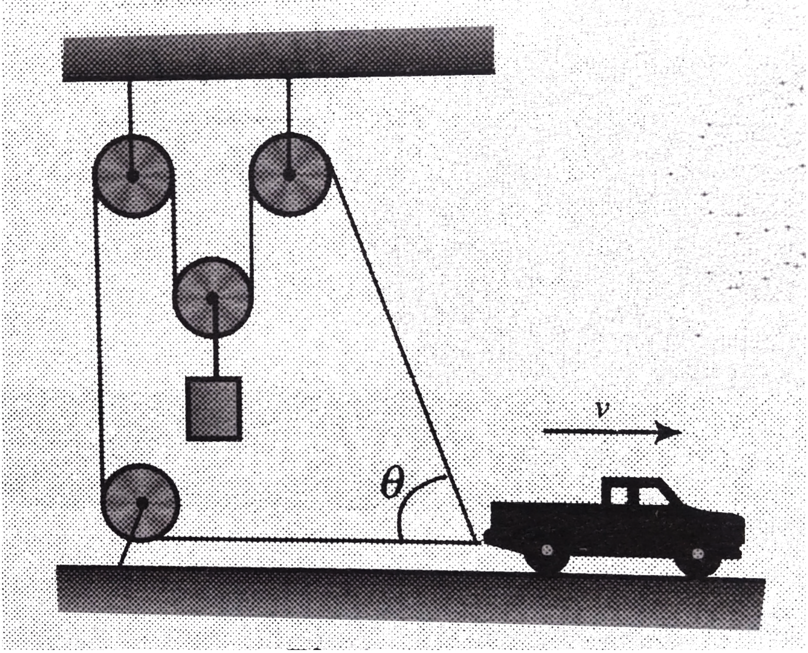
10. In fig. shown, the speed of the truck is v to the right. Find the speed with which the block is moving up at $\theta = 60^\circ$.



A. v

B. $2v/3$

C. $3v/4$

D. none

Answer: C

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11. A bird flies for 4 seconds with a velocity of $|t - 2| m/\sec.$ In a straight line, where $t =$ time in seconds. It covers a distance of

A. 2m

B. 4m

C. 6m

D. 8m

Answer: B

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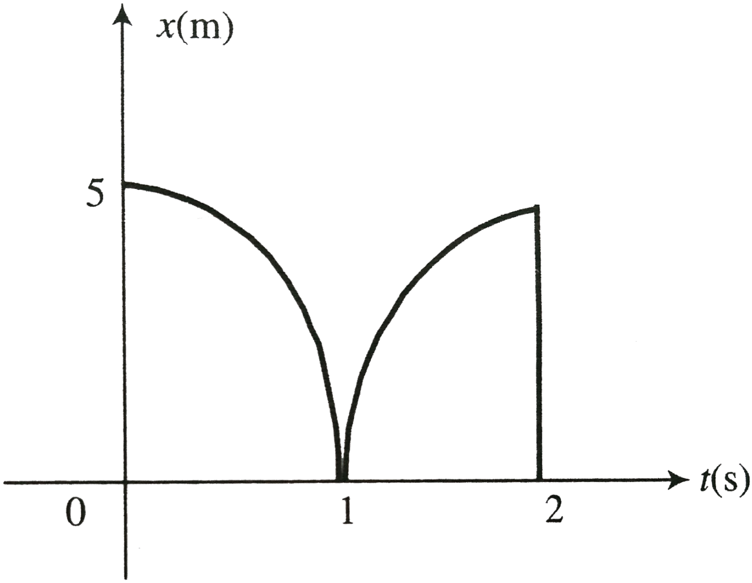
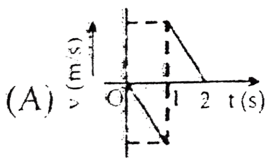
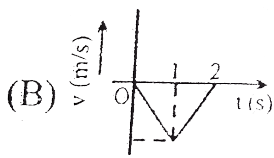
12. The displacement-time graph of a moving particle with constant acceleration is shown in. The velocity-time is given by

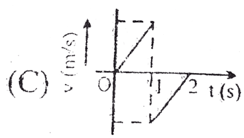




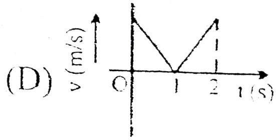
A.



B.



C.

D. 

Answer: A

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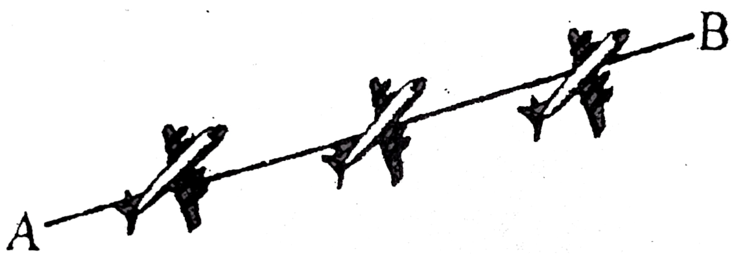
13. An aeroplane moves along horizontal line AB as shown in figure Choose correct option about wind velocity.



A. wind may not be moving at all

B. wind may be moving in east direction

C. wind may be moving in north direction

D. wind may be moving in west direction

Answer: B

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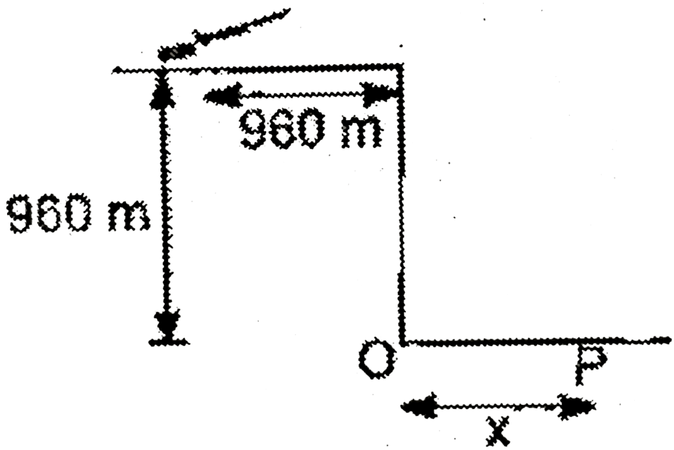
14. A gun is mounted on a plateau 960 m away from its edge as shown. Height of plateau is 960 m The gun can fire shells with a velocity of 100 m/s at any angle. Of the following choices, what is the minimum distance (OP)x from the edge of plateau where the shell of gun can reach?



A. 480m

B. 720m

C. 360m

D. none

Answer: A

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15. Two towns A and B are connected by a regular bus service with a bus leaving in either direction every T min. A man cycling with a speed of $20kmh^{-1}$ in the direction A to B notices that a bus goes past him every $18 \min$ in the direction of his motion, and every $6 \min$ in the opposite direction. What is the period T of the bus service and with what speed (assumed constant)do the buses ply on the road?

A. $4.5 \min utes$

B. 24 minutes

C. 9minutes

D. 12 minutes

Answer: C

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16. Three particles starts from origin at the same time with a velocity $2ms^{-1}$ along positive x-axis, the second with a velocity $6ms^{-1}$ along negative y-axis, Find the velocity of the third particle along $x = y$ line so that the three particles may always lie in a straight line.

A. $-3\sqrt{3}$

B. $3\sqrt{2}$

C. $-3\sqrt{2}$

D. $2\sqrt{2}$

Answer: B

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17. Two boats were going down stream with different velocities When one overtook the other a plastic ball was dropped from one of the boats Some time later both boats turned back simultaneously & went at the same speed as before (relative to the water) towards the spot where the ball had been dropped which boat will reach the ball first?

A. the boat which has greater velocity (relative to water)

B. the boat which has lesser velocity (relative to water)

C. both will reach the ball simultaneously

D. cannot be decided unless we know the actual values of the velocities and the time after which they turned around.

Answer: C

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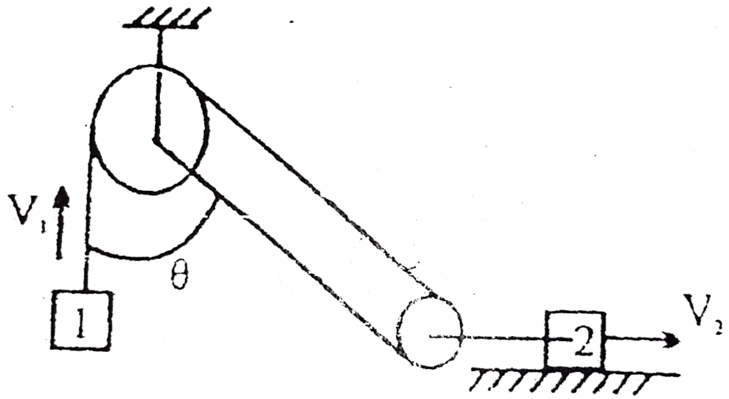
18. In the arrangement shown in figure the ratio of velocity $V_1 \& V_2$ of block (1)&(2) is



A. $\frac{V_1}{V_2} = 2\cot\theta$

B. $\frac{V_1}{V_2} = \frac{\sin\theta}{2}$

C. $\frac{V_1}{V_2} = 2\sin\theta$

D. none

Answer: C

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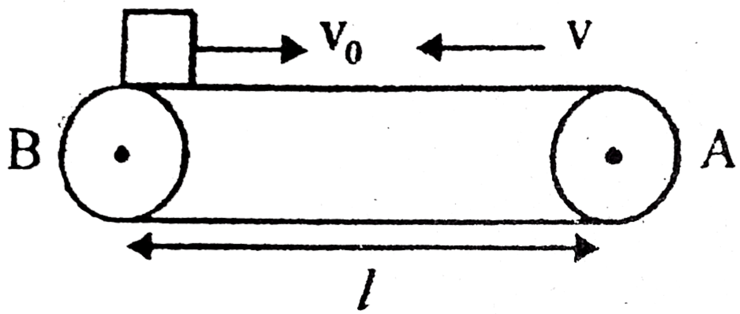
19. A conveyed belt of length lis moving with velocity v.a block of mass is pushed against the motion of conveyed belt with velocity v_0 form end B Co- efficient of friction between block and belt is u the value of v_0 so that the amount of heat liberated as a result of retardation of the block by conveyed belt is maximum is



A. $\sqrt{\mu g l}$

B. $\sqrt{2\mu g l}$

C. $2\sqrt{\mu g l}$

D. $\sqrt{3\mu g l}$

Answer: B

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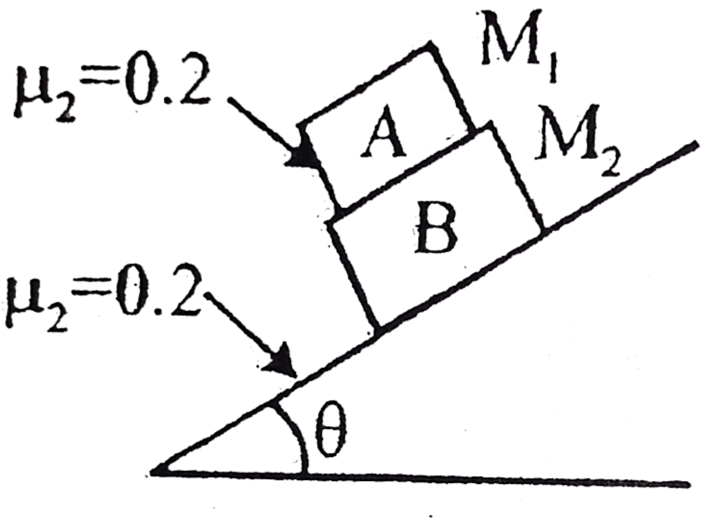
20. Two blockM_1 and M_2 rest upon each other on an inclined plane Coefficient of friction between surfaces are shown if the angle 0 is slowly increased and $M_1 \leq M_2$ then



A. block A slips first

B. block B slips first

C. both slip simultaneously

D. both remain at rest

Answer: B

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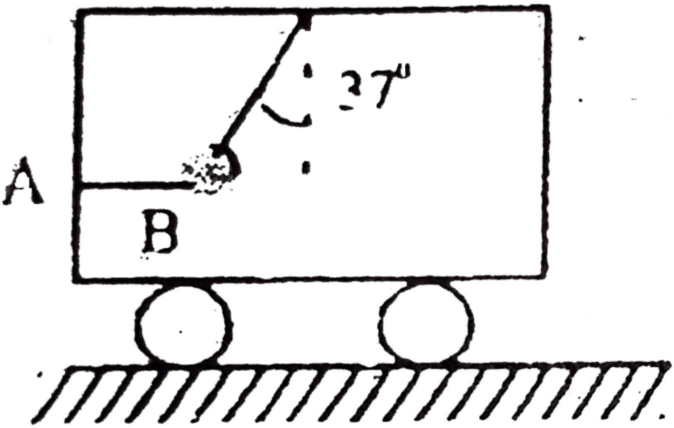
21. A bob B of mass 1kg is suspended form the ceiling of a toy train as shown in the figure the train oscillates simple harmonically in horizontal direction with angular frequency $\omega = 5 rad/s$ amd amplitude $a = 0.1 m$what is the ratio of maximum and minimum tensions in the string AB during the motion

$\left(g = 10ms^{-2} \& \tan 37^{\circ} = 3/4\right)$



A. 2

B. 3

C. 4

D. 1

Answer: A

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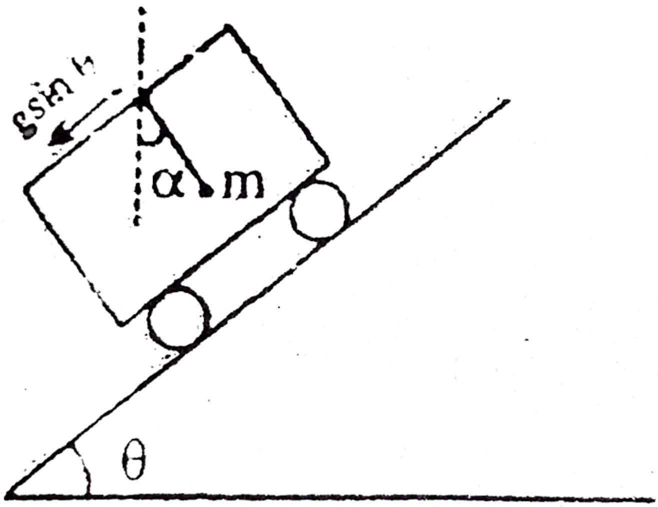
22. A trolley is accelerating down an incline of angle theta with acceleration g sintheta which of the following is correct (a is the angle made by the string with vertical)



A. $\alpha = \theta$

B. $\alpha = \theta$ °

C. Tension in the string T=mg

D. Tension in the string $T = mg\sec\theta$

Answer: A

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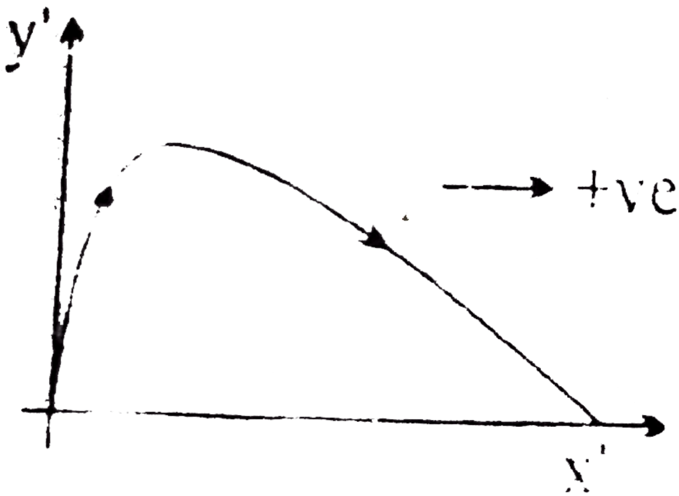
23. A railroad car is moving in the +x direction on a straight and level track A person in the railroad car throws a ball the ball follows trajectory shown relative to the railroad car from an inspection of the trajectory what can be concluded about the motion of railroad car ? Treaty axis along vertical



A. it is moving at a constant speed

B. it is speeding up

C. it is slowing down

D. none of the above can be concluded

Answer: C

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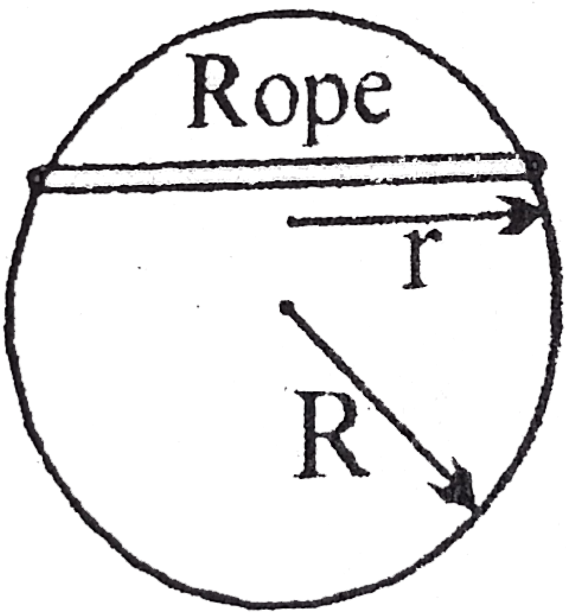
24. A circular rope of weight W and radius $r = \frac{R}{2}$ is resting on a smooth sphere of radius R The tension in rope is



A. $W/\left(\pi\sqrt{6}\right)$

B. $W/\left(\pi\sqrt{12}\right)$

C. $W/\left(\pi\sqrt{10}\right)$

D. none of these

Answer: B

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25. The rear side of a truck is open and a box of mass 20kg is placed on the truck 4 meters away from the open end coofficent of friction between truck and block is 0.15 the truck starts from rest with an acceleration of $2m/\sec^2$on a straight road The box will fall off the truck when truck is at a distance from the starting point equal to$\left(g = 10m/s^2\right)$

A. 4metres

B. 8 metres

C. 16 metres

D. 32metres

Answer: C

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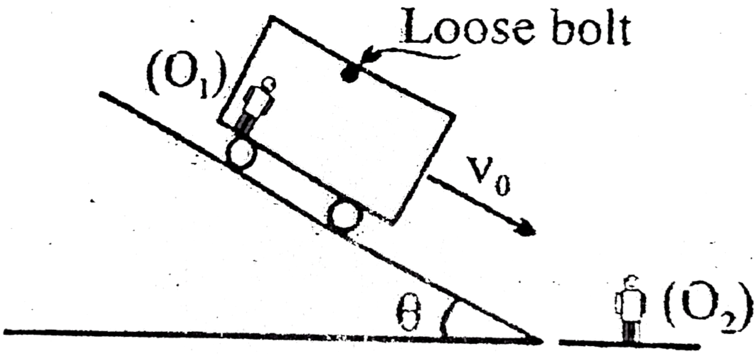
26. A cart is sliding on a smooth incline An observer $\left(O_1\right)$ is fixed to cart and another abserver fixed on ground $\left(O_2\right)$ observes a loose bolt that is released from ceiling at the instant of release cart has velocity v_0 as seen by O_2 Mark the correct option



A. Trajectory of bolt for O_1 is parabola

B. Trajectory of bolt for O_2 is straight line inclined at an angle

0with verticle

C. Trajectory of bolt for O_2 is a straight line perpendicular to

ceiling of cart.

D. Trajectory of bolt for O_1 is straight line

Answer: D

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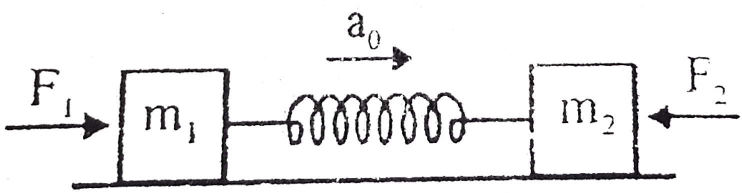
27. Two blocks m_1 and m_2 are connected with a compressed spring and placed on a smooth horizontal surface as shown in figure Force constant of spring is k under the influence of forces f_1 and f_2 at an instant blocks move with common acceleration a_0 at that instant force f_2 is suddenly withdraw Mark correct option



A. Instantaneous acceleration of $m_1 is a_0$ - $\frac{F_1}{m_1}$

B. instantaneous acceleration of $m_2 is a_0 + \frac{F_2}{m_2}$

C. Instantaneous acceleration of $m_1 is a_1 = 0$

D. instantaneous acceleration of $m_2 is a_0 = 0$

Answer: B

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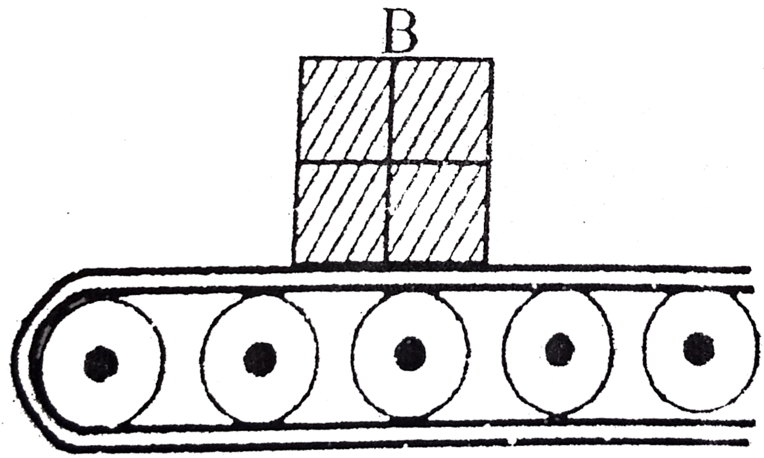
28. The conveyed belt is moving at $4m/s$ the coefficient of static friction between the conveyed belt and the 10kg package Bis ` mu_(s)=0.2 determine the shortest time in which the belt can be stopped so the the package does not slide on the belt



A. 1s

B. 2s

C. 4s

D. 8s

Answer: B

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29. The potential energy of a body is given by $U = \frac{9}{x^2} - \frac{2}{x}$ The position at which its speed can be maximum is.

A. $x = +3m$

B. $x = -3m$

C. $x = 9m$

D. $x = -9m$

Answer: C

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30. The potential energy of a 1kg particle free to move along the x-axis is given by $V(x) = \left(\frac{x^4}{4} - \frac{x^2}{2}\right)J$ The total mechanical energy of the particle is 2J then the maximum speed ($\in m/s$) is

A. $\frac{3}{\sqrt{2}}$

B. $3\sqrt{2}$

C. $\frac{9}{2}$

D. 2

Answer: A

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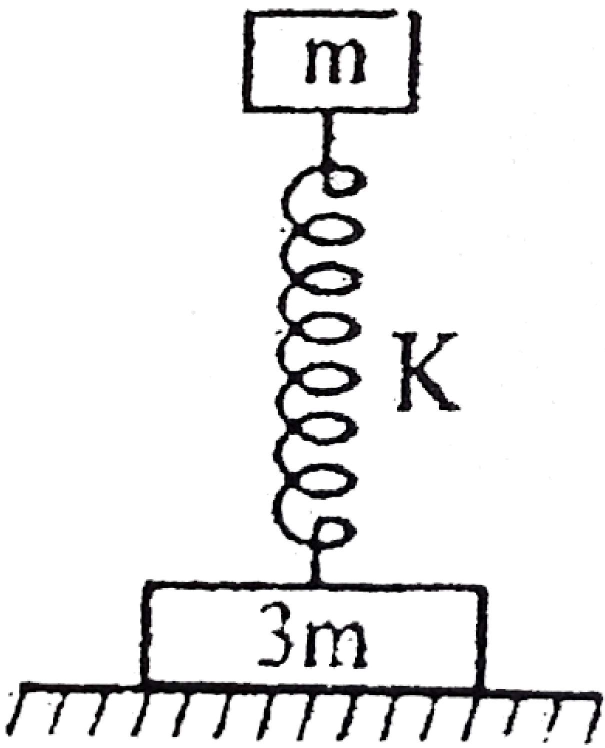
31. In the figure shown the spring constant is K the mass of the upper disc is m and that of the lower disc is 3m the upper block is depressed down from its equilibrium position by a distance $\delta = 5mg/k$ and released at t=0 find the velocity of m when normal reaction on 3m is mg



A. zero

B. $g[m/k]^{1/2}$

C. $2g[m/k]^{1/2}$

D. $4g[m/k]^{1/2}$

Answer: D

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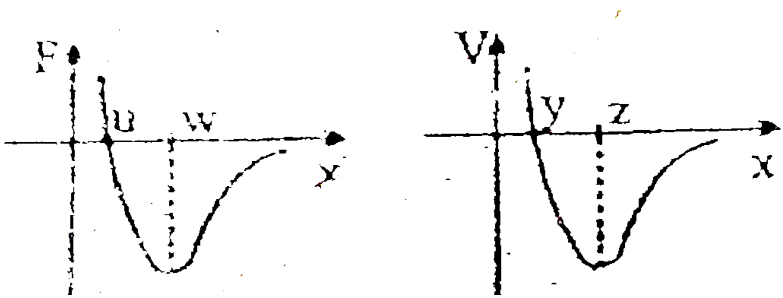
32. Two atoms interact with each other according to the following force F and potential energy V diagrams. What is their equilibrium separation?



A. the seperation u which is equal to y

B. the seperation u which is equal to z

C. the separation w which is equal to y

D. the separation w which is equal to z

Answer: B

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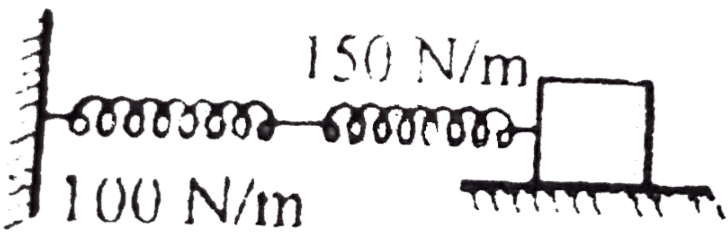
33. Two springs of force constant $100 N/m$ and $150 N/m$ are in series as shown the block is pulled by a distance of 2.5 cm to the right from equilibrium position what is the ratio of work done by the spring at left to the work done by the spring at right:



A. $\frac{3}{2}$

B. $\frac{2}{3}$

C. 0.2

D. none of these

Answer: A

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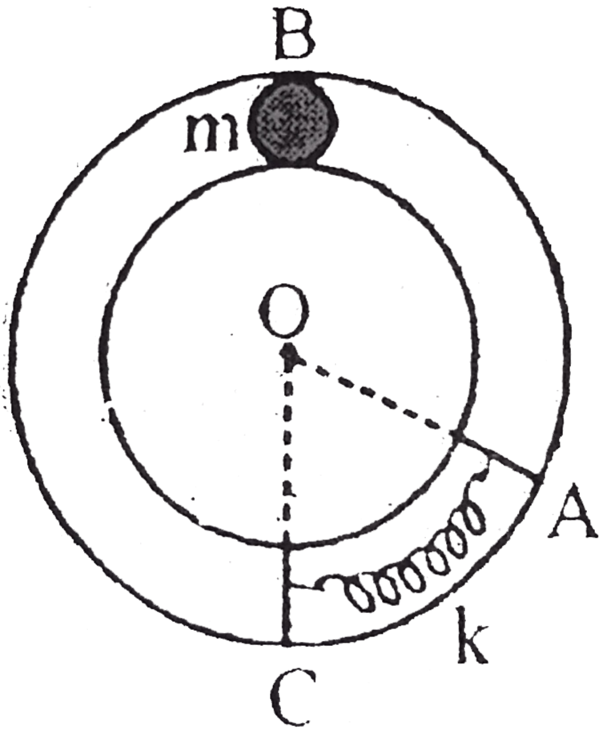
34. In the figure shown there is a smooth tube of radius 'R' fixed in the vertical plane A ball 'B' of mass 'm'is released from the top of the tube B slides down due to gravity and compresses the spring the end 'C' of the spring is fixed and the end A is free Initially the line OA makes an angle of 60° with OC and finally it makes an angle of 30° after compression find the spring constant of the spring



Fix smooth tube

A. $\dfrac{12mg\left(2+\sqrt{3}\right)}{\pi^2 R}$

B. $\dfrac{36mg\left(2+\sqrt{3}\right)}{\pi^2 R}$

C. $\dfrac{18mg}{\pi^2 R}$

D. none of these

Answer: B

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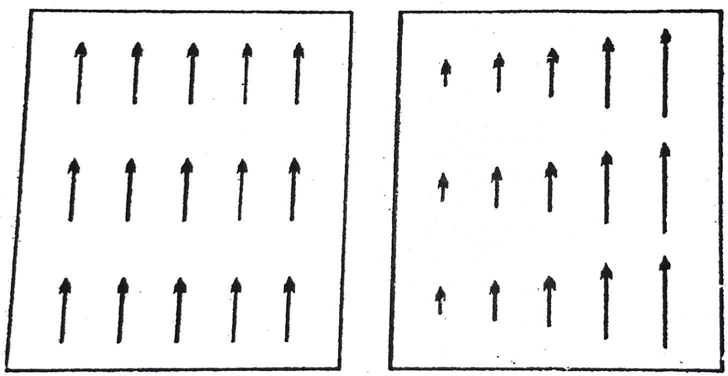
35. Figure shows force vectors at different points in space for two forces



(a) (b)

In figure (a) the force functions is $\vec{f}_1 = f_0\hat{j}$where f_0 is a constant the force in figure (b) is given by $\vec{f}_2 = f_0\left(\frac{x}{a}\right)\hat{j}$ where origin is taken at left corner of the box a is width of the each square box ,mark the correct options.

A. Both forces $\vec{f}_1$ and $\vec{f}_2$ are conservative forces

B. Both forces $\vec{f}_1$ and $\vec{f}_2$ are nonconservative forces

C. $\vec{f}_1$ is conservative $\vec{f}_2$ is non conservative

D. $\vec{f}_1$is nonconservative vec(f)$_2$ is conservative

Answer: C

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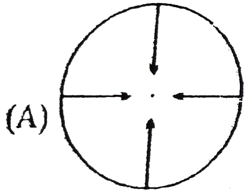
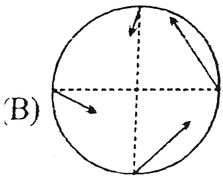
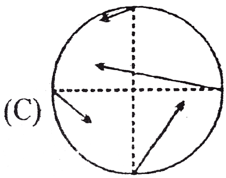
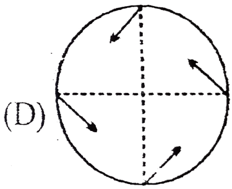
36. A car speeds up with constant magnitude of tangential acceleration in a circular path moving in anticlockwise direction which of the following figure represents acceleration of the car

A. 

B. 

C. 

D. 

Answer: C

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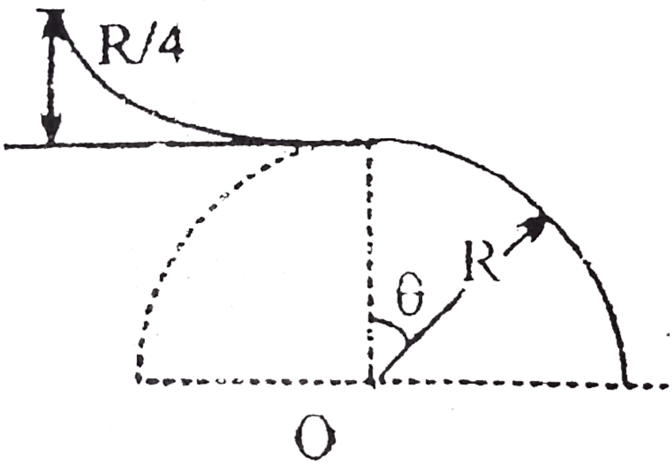
37. A skier plans to ski a smooth fixed hemisphere of radius R He starts from rest from a curved smooth surface of height (R/4) the angle θ at which he leaves the hemisphere is



A. $\cos^{-1}(2/3)$

B. $\cos^{-1}\left(5/\sqrt{3}\right.$

C. $\cos^{-1}(5/6)$

D. $\cos^{-1}\left(5/2\sqrt{3}\right.$

Answer: C

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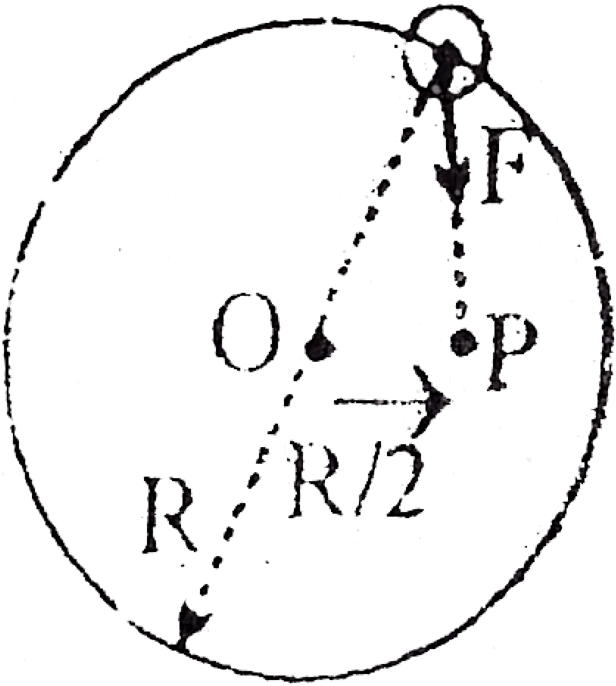
38. A small bead of mass m can moves on a smooth circular wire (radiusR) under the action of a force $F = \frac{km}{r^2}$ directed (r=position of bead from P&K=constant) towards a point P with in the circle at a distance $\frac{R}{2}$ from the centre what should be the minimum velocity of bead at the point of the wire nearest the centre of force (P) so that bead will complete the circle



A. $\sqrt{\frac{3k}{R}}$

B. $\sqrt{\frac{8k}{3R}}$

C. $\sqrt{\frac{6k}{R}}$

D. none of these

Answer: B

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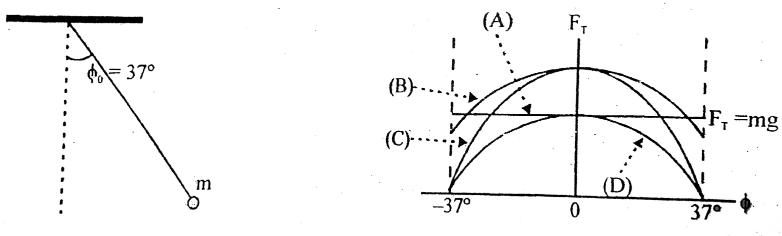
39. A small ball of mass m is attached to a piece of light and released from rest at an angle $\phi_0 = 37^\circ$ from the verticle as shown which of the graphs best represents the tension in the string as a function of the angle ϕ (also relative to the vertical)?



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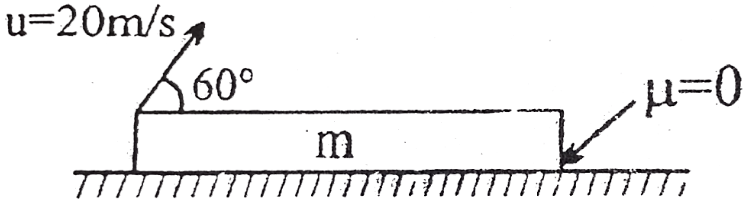
40. A particle of mass m is projected at an angle of 60° with a velocity of $20 m/s$ relative to the ground from a plank of same mass m which is placed on smooth surface Initially Plank was at rest The minimum length of the plank for which the ball will fall on the plank itself is $\left(g = 10m/s^2\right)$



A. $40\sqrt{3}m$

B. $20\sqrt{3}m$

C. $10\sqrt{3}m$

D. $60\sqrt{3}m$

Answer: A

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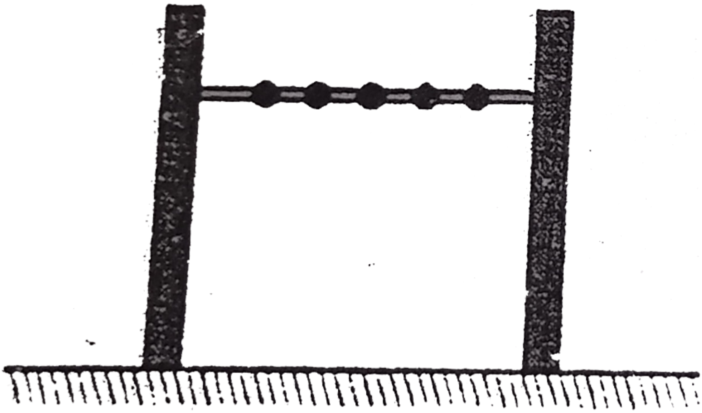
41. Five identical balls each of mass m and radius r are string like beads at random and at rest along a smooth rigid horizontal thin rod of length L mounted between immovable supports Assume $10r \leq L$ and that the collision between balls or between balls and supports are elastic if one ball is struck horizontally so as to acquire a speed v the average force felt by the support is



A. $\dfrac{5mv^2}{L - 5r}$

B. $\dfrac{mv^2}{L - 10r}$

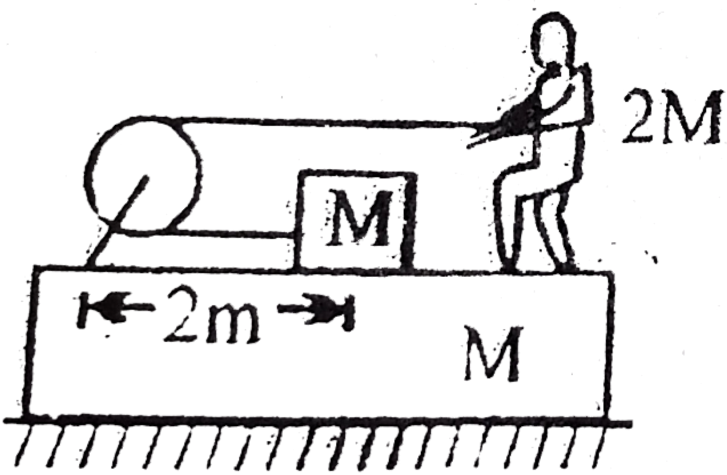
C. $\dfrac{5mv^2}{L - 10r}$

D. $\dfrac{mv^2}{L - 5r}$

Answer: B

Watch Video Solution

42. A block of mass M is tied to one end of a massless rope the other end of the rope is in the hands of a man of mass 2M as shown in the figure the block and the man are resting on a rough plank of mass M as shown in the figure the whole system is resting on a smooth horizontal surface the man pulls the rope pulley is massless and friction what is the displacement of the plank when the block meets the pulley (Man does not leave his position on plank during the pull)



A. $0.5m$

B. $1m$

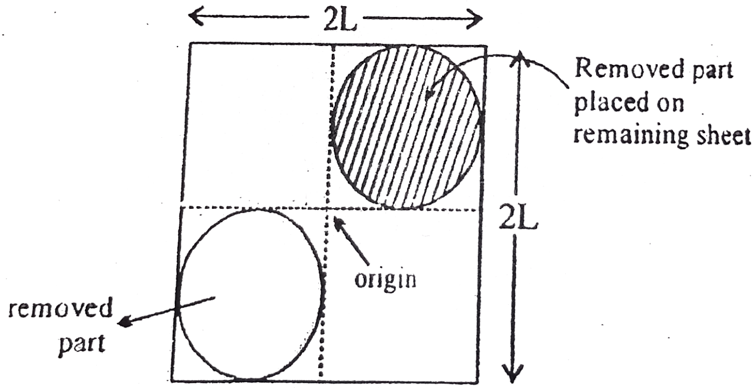
C. zero

D. $2/3m$

Answer: A

Watch Video Solution

43. Figure shows a square lamina with a disc of radius $\frac{L}{2}$ removed from it which is now placed symmetrically over upper right quarter what is location of centre of mass of system relative to origin shown in figure



A. $\frac{\pi L}{12}\left(\hat{i}+\hat{j}\right)$

B. $\frac{\pi L}{8}\left(\hat{i}+\hat{j}\right)$

C. $\frac{\pi L}{4}\left(\hat{i}+\hat{j}\right)$

D. $\frac{\pi L}{16}\left(\hat{i}+\hat{j}\right)$

Answer: D

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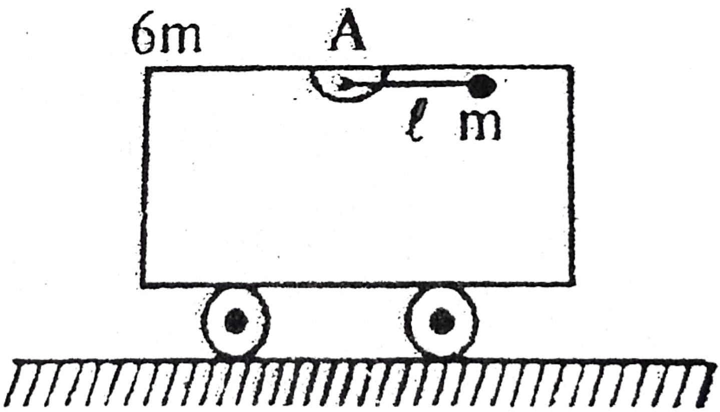
44. In the figure shown, the cart of mass 6m is initially at rest. A particle of mass m is attached to the end of the light rod which can rotate freely about A. If the rod is released from rest in a horizontal position shown, determine the velocity v_{rel} of the particle with respect to the cart when the rod is vertical. (Assume frictionless surface)



A. $\sqrt{\frac{7}{3}gl}$

B. $\sqrt{\frac{7}{6}gl}$

C. $\sqrt{\frac{14}{3}gl}$

D. $\sqrt{\frac{8}{3}gl}$

Answer: A

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45. Suppose a golf ball is hurled at a heavy bowling ball initially at rest and bounces elastically from the bowling ball after the collision

A. the golf ball has the greater momentum and the greater kinetic energy

B. the bowling ball has the greater momentum and the greater kinetic energy

C. the golf ball has the greater momentum but has the smaller kinetic energy

D. the bowling ball has the greater momentium but has the smaller kinetic energy

Answer: D

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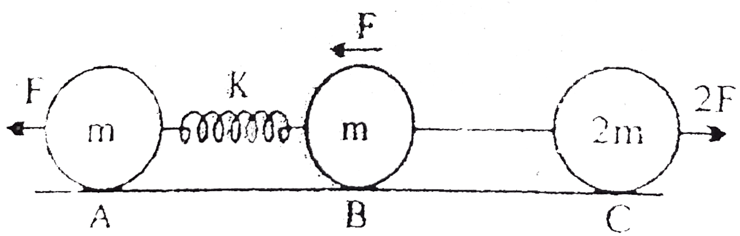
46. The masses are connected with a spring & a string as shown they are initially at rest with springs at its natural length & string too at its original length fing the maximum extension in the spring after the forces start acting as shown



A. F/K

B. $2F/K$

C. $F/2K$

D. $4F/K$

Answer: B

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47. A 5000 kg rocket is set for verticle firing the relative speed of burnt gas is $800ms^{-1}$ To give an initial upwards acceleration of $20ms^{-2}$ the amount of gas ejected per second to supply the needed thrust will be

A. $127.5kgs^{-1}$

B. $187.5kgs^{-1}$

C. $185.5kgs^{-1}$

D. $137.5kgs^{-1}$

Answer: B

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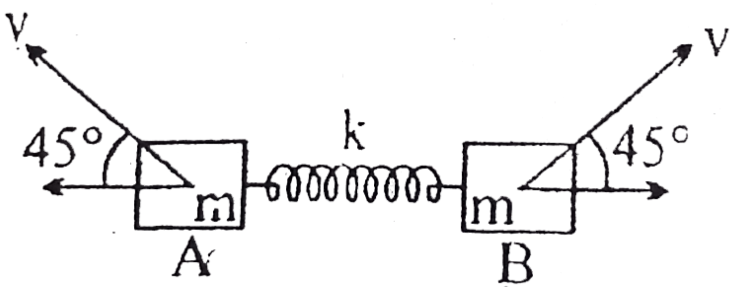
48. Blocks A&B of mass m each are connected with spring of constant k both blocks lie on frictionless ground and are imparted horizontal velocity v as shown when spring is unstretched find the maximum stretch of spring.



A. $v\sqrt{\frac{m}{k}}$

B. $v\sqrt{\frac{m}{2}k}$

C. $v\frac{\sqrt{2m}}{k}$

D. none

Answer: A

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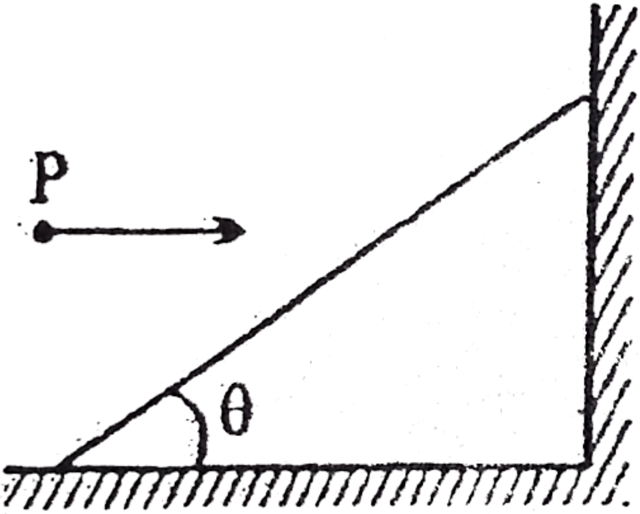
49. In the figure shown a particle P strikes the inclined smooth plane horizontally and rebounds vertically if the angle θ is 60°

then the coefficient of restitution is:



A. $1/3$

B. $1/\sqrt{2}$

C. $1/2$

D. 1

Answer: A

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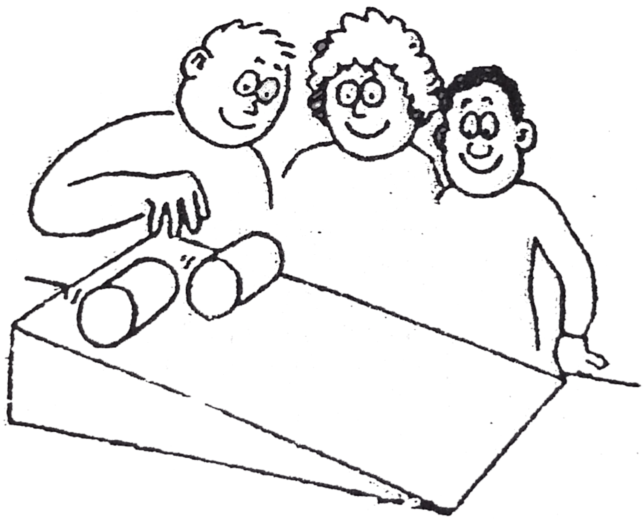
50. Which will roll down a hill faster a can of regular fruit juice or a can of frozen fruit juice?



A. Regular fruit juice

B. Frozen fruit juice

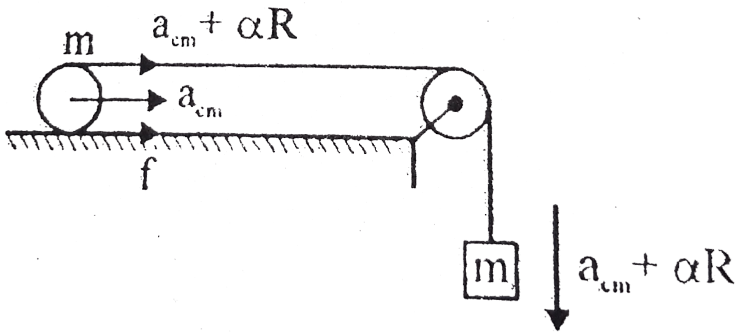
C. Depends on the temperature

D. Depends on the angle of inclination.

Answer: A

View Text Solution

51. In the given figure a ring of mass m is kept on a horizontal surface while a body of equal mas 'm' attached through a string Which is wounded on the ring when the system is released the ring rolls without slipping consider the following statements and choose the correct option.



(1)acceleration of the centre of mass of ring is $\frac{2g}{3}$

(2) acceleration of the hanging particle is $\frac{4g}{3}$

(3) frictional force (on the ring) acts along forward direction

(4) Frictional force (on the ring) acts along backward direction

A. Statement (1) and (2)only

B. Statement (2) and (3) only

C. Statement (1) and (4) only

D. none of these

Answer: D

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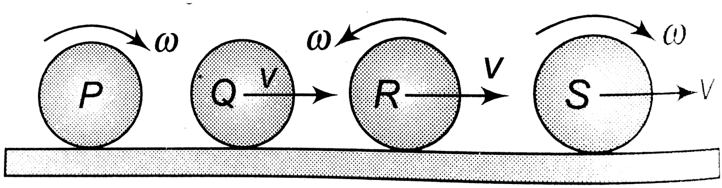
52. Four solid spheres are made to move on a rough horizontal surface. Sphere P is given a spin and released. Sphere Q is given a forward linear velocity. Spheres R and S are given linear and rotational motions as shown in the figure. Directions of the friction force on spheres P, Q, R, S are respectively.



A. Right,Left,Right,Left

B. Right,Left,Left,Right

C. Left,Right,Left either Left or Right

D. Right,Left ,Left either Left or Right

Answer: D

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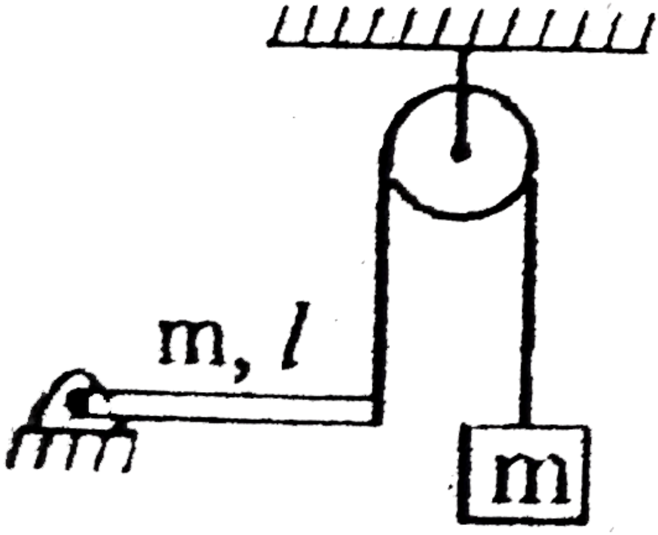
53. A mechanism consists of a part which is translated with a velocity u and a rod AB of length L and mass M hinged at A The rod rotates about axis A with angular velocity ω the kinetic energy of rod when it is vertical as shown is



A. $\frac{1}{2}Mu^2 + \frac{1}{6}ML^2\omega^2$

B. $\frac{1}{2}Mu^2 + \frac{1}{6}ML\omega u$

C. $\frac{1}{2}Mu^2 + \frac{1}{6}ML^2\omega^2 + \frac{1}{2}ML\omega u$

D. none of these

Answer: C

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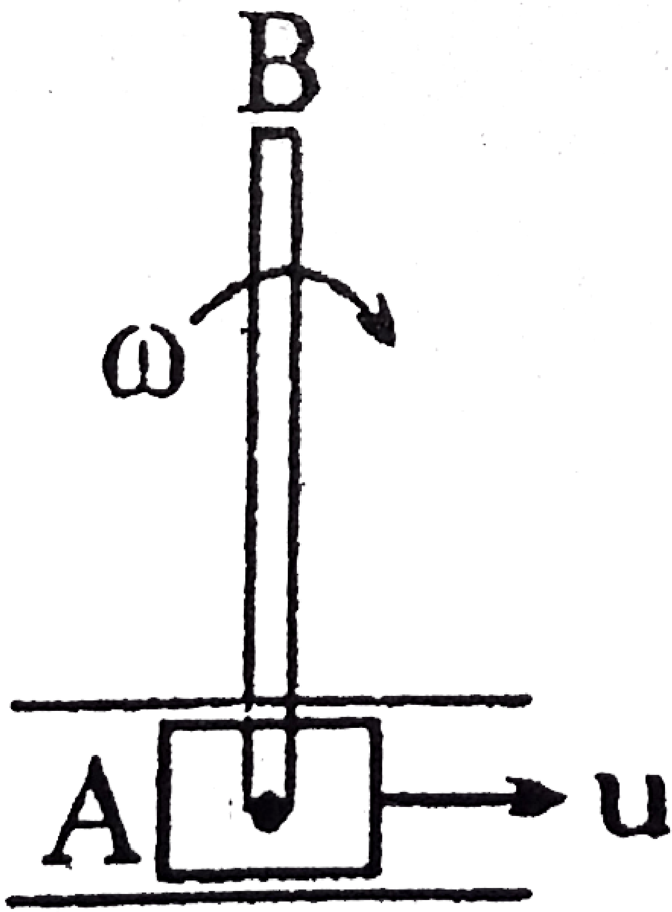
54. Uniform rod AB is hinged at end A in horizontal position as shown in the figure the other end is connected to a block through a massless string m as shown the pulley is smooth and massless masses of block and rod is same and is equal to m then acceleration of block just after release from this position is



A. $6g/13$

B. $g/4$

C. $3g/8$

D. none

Answer: C

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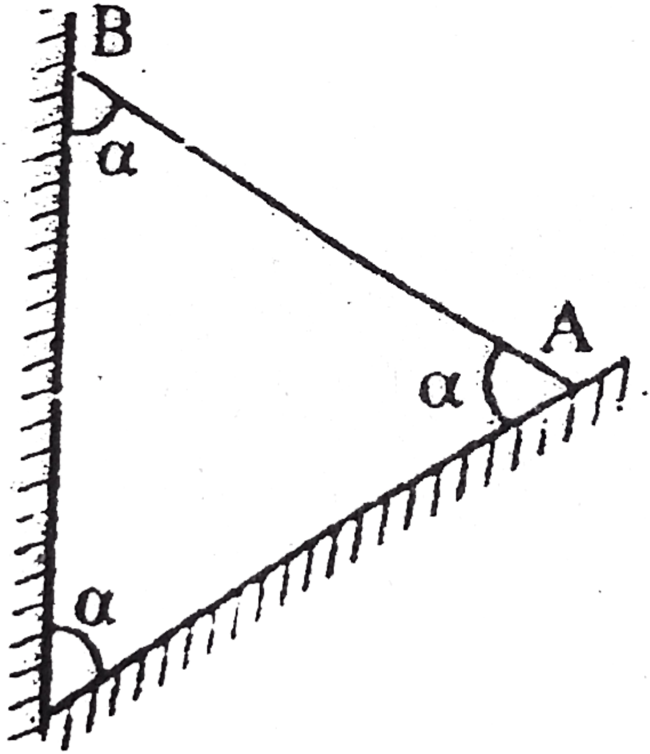
55. In the figure shown the end A of the rod of length L is being pushed down parallel to the inclined surface with a velocity =v let the velocity of end B=u and the angular velocity of the rod = ω

then



A. $u = v\cos\alpha$ (upward)

B. $u = v$ (downwards)

C. $\omega = v\sin\alpha/L$

D. $\omega = 2v\sin\alpha/L$

Answer: D

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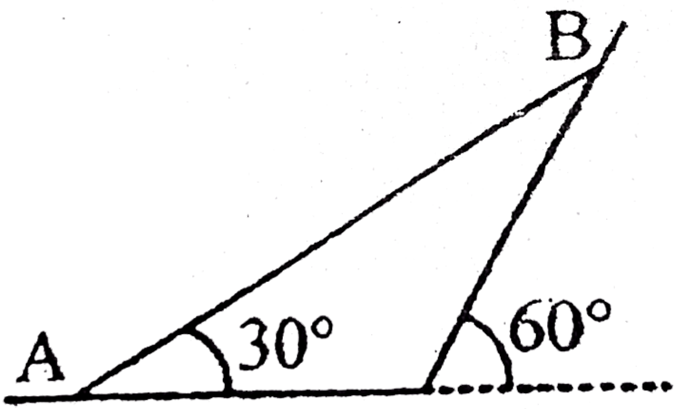
56. In the figure shown the instantaneous speed of end A of the rod is v to the left the angular velocity of the rod of lengthL must be



A. $v/2L$

B. v/L

C. $v\sqrt{3}/2L$

D. none

Answer: B

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57. A uniform horizontal rod of length l falls vertically from height h on two identical blocks placed symmertrically below the rod as shown in figure the coefficients of restitution are e_1 and e_2 the maximum height through which the centre of mass of the rod will rise after after bouncing off the blocks is

A. $\dfrac{h}{\left(e_1+e_2\right)}$

B. $\dfrac{\left(e_1+e_2\right)^2 h}{4}$

C. $\frac{(e_1 + e_2)^2 h}{2}$

D. $\frac{4h}{(e_1^2 + e_2^2)}$

Answer: B

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58. A ring of radius R is rolling purely on the outer surface of a pipe of radius 4R At some instant the center of the ring has constant speed =v then the acceleration of the point on the ring which is in contact with the surface of the pipe is

A. $4v^2 / 5R$

B. $3v^2 / 5R$

C. $v^2 / 4R$

D. zero

Answer: A

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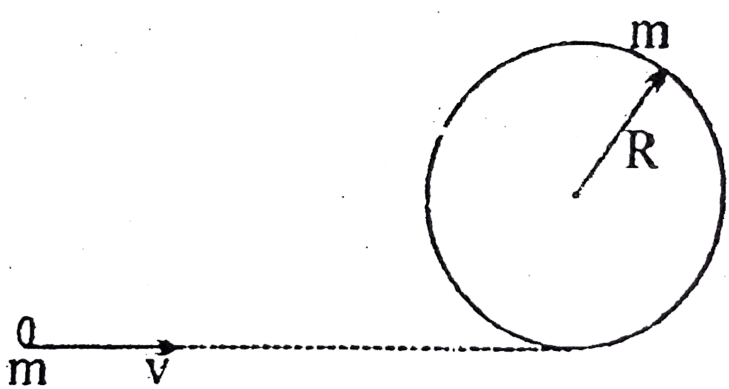
59. A circular hoop of mass m and radius R rests flat on a horizontal frictionless surface A bullet also of mass m and moving with a velocity v strikes the hoop and gets embedded in it the thickness of the hoop is much smaller then R the angular velocity with which the system rotates after the bullet strikes the hoop is



A. $V/(4R)$

B. $V/(3R)$

C. $2V/(3R)$

D. $3V/(4R)$

Answer: B

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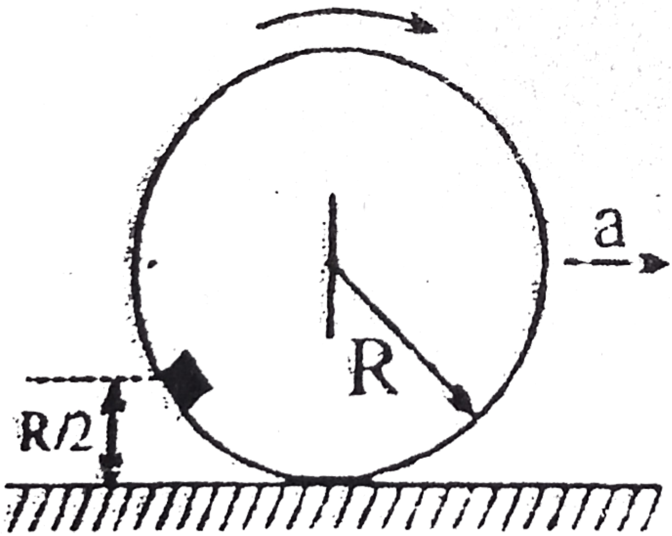
60. Inside a uniformly accelerating thin-walled spherical shell of radius R which is rolling on horizontal surface there is a small body slipping around Angle of friction between body and inner surface of sphere is 23° which of the following can be the acceleration a of the center of sphere to ensure that the small body stays at $R/2$ distance from the surface?



A. $\frac{g}{\sqrt{3}}$

B. $\frac{3g}{4}$

C. $g\tan 23^{\circ}$

D. $\frac{g\sqrt{3}}{2}$

Answer: B

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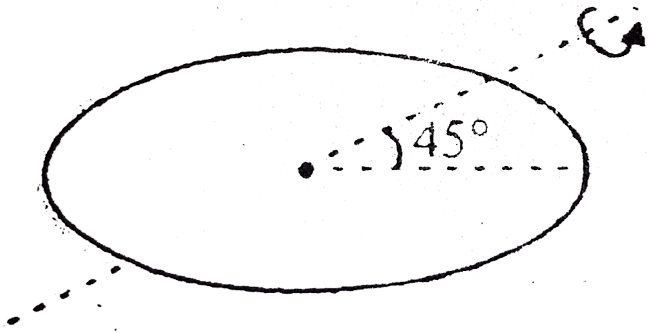
61. Find the moment of inertia of ring of mass m and radius R about an axis passing through its centre and making an angle of 45° with its plane:



A. $\frac{MR^2}{4}$

B. $\frac{MR^2}{2}$

C. $\frac{3}{4}MR^2$

D. MR^2

Answer: C

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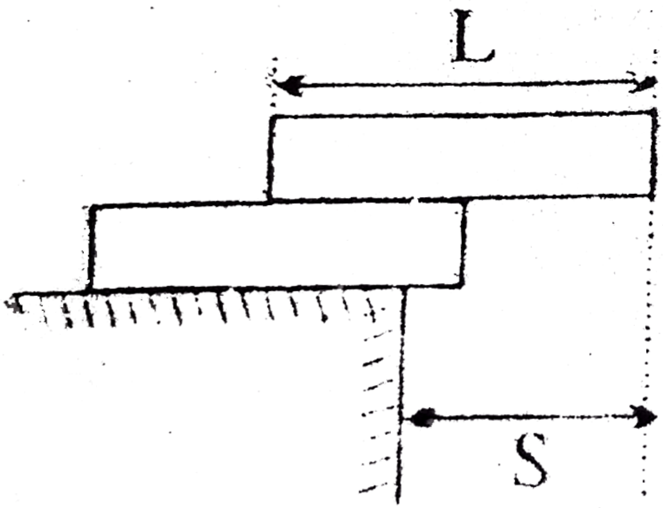
62. Two identical bricks of length L are piled one on top of the other on a table as shown in the figure the maximum distance S the top brick can overhand the table with the system still balanced is:



A. $\frac{1}{2}L$

B. $\frac{2}{3}L$

C. $\frac{3}{4}L$

D. $\frac{7}{8}L$

Answer: C

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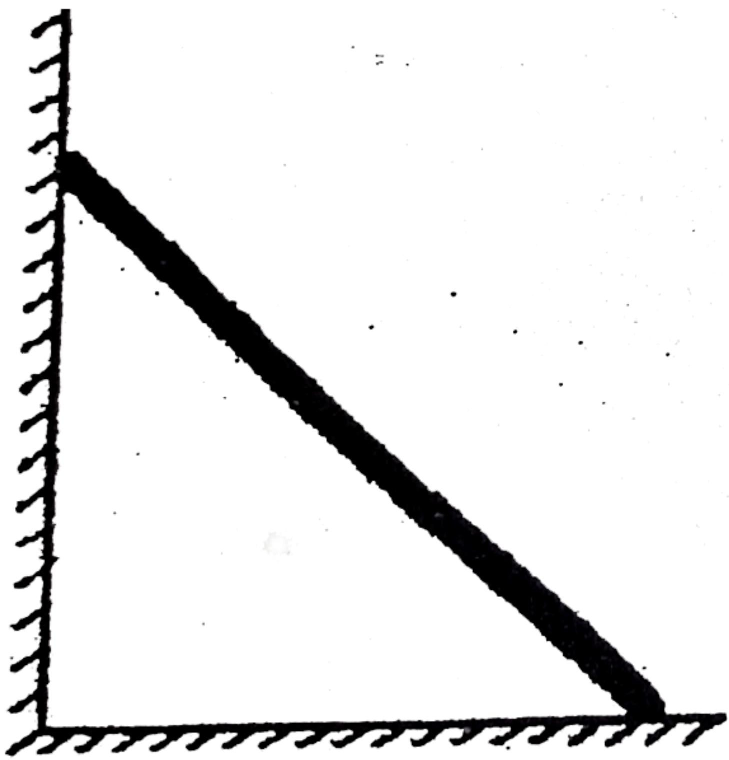
63. A ladder leans against a wall if the ladder Is not to slip which one of the following must be true?



A. the coefficient of friction between the ladder and the wall must not be zero

B. the coefficient of friction between the ladder and the floor must not be zero

C. Both A and B

D. Either A or B

Answer: B

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64. The young's modulus of material of a thin ring shaped elastic body is Y the mass of ring is m area of cross section is A its's initial radius is R ring is a little elongated then left alone At what time will ring circumference be same as it was initially neglect loss of energy

A. $\sqrt{\frac{\pi m R}{8YA}}$

B. $\frac{3}{2}\sqrt{\frac{\pi m R}{YA}}$

C. $2\sqrt{\frac{\pi m R}{YA}}$

D. $\sqrt{\frac{\pi m R}{2YA}}$

Answer: A

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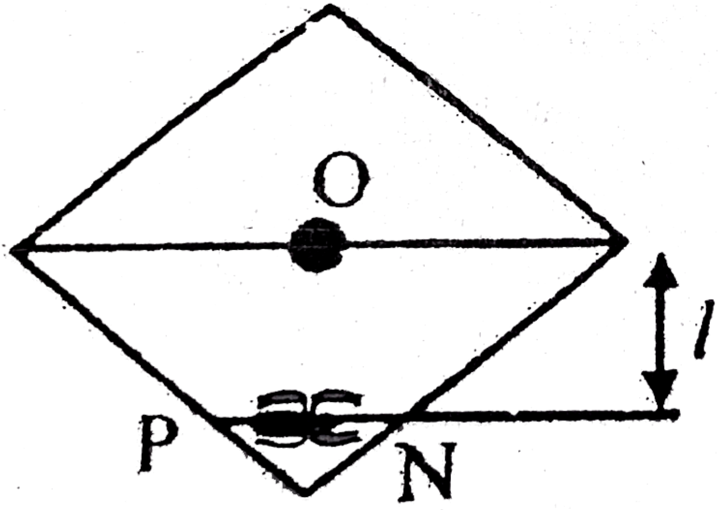
65. A square metal frame in the vertical plane is hinged at O at its center a bug moves along the rod PN which is at a distance l from the hinge such that the whole frame is always stationary even though the frame is free to ratate in the verticle plane about the hinge then the motion of the bug will be simple harmonic with time period



A. $2\pi\sqrt{\frac{l}{g}}$

B. $2\pi\sqrt{\frac{2l}{g}}$

C. $2\pi\sqrt{\frac{4l}{g}}$

D. $2\pi\sqrt{\frac{l}{2g}}$

Answer: A

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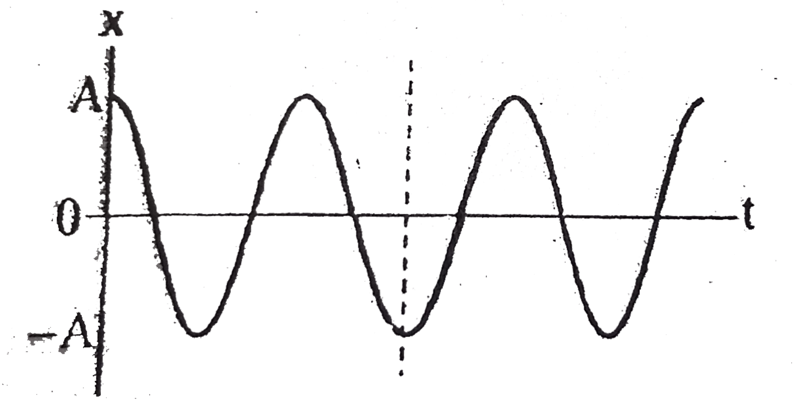
66. This is the position graph of a mass on a spring what can you say about the velocity and the force at the instant indicated by the dashed line ? Positive direction is to right



A. Velocity is zero , force is to the right

B. Velocity is positive , force is to the right

C. Velocity is negative , force is to the right

D. Velocity is zero , force is to the left

Answer: A

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67. A particle performs harmonic ascillations along a straight line with a period T and amplitude a The mean velocity of the particle averaged over the time interval during which it travels a distance $\frac{a}{2}$ starting from the extreme position is:

A. $\frac{a}{T}$

B. $2\frac{a}{T}$

C. $3\frac{a}{T}$

D. $\frac{a}{2}T$

Answer: C

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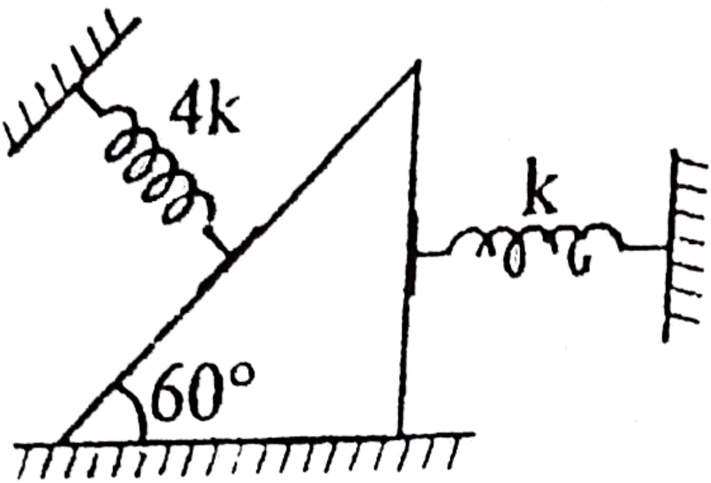
68. A smooth wedge of mass m and angle of inclination $60°$ rests unattached between two springs of spring constant K and 4k on a smooth horizontal plane both springs in the unextended position the time period of small oscillation of the wedge (assuming that the springs are constrained to get compressed along their length) equals



A. $\pi\left(1+\frac{1}{2}\right)\sqrt{\frac{m}{k}}$

B. $\pi\left(1+\frac{1}{\sqrt{3}}\right)\sqrt{\frac{m}{k}}$

C. $\pi\left(1+\frac{2}{\sqrt{3}}\right)\sqrt{\frac{m}{k}}$

D. none of the above

Answer: B

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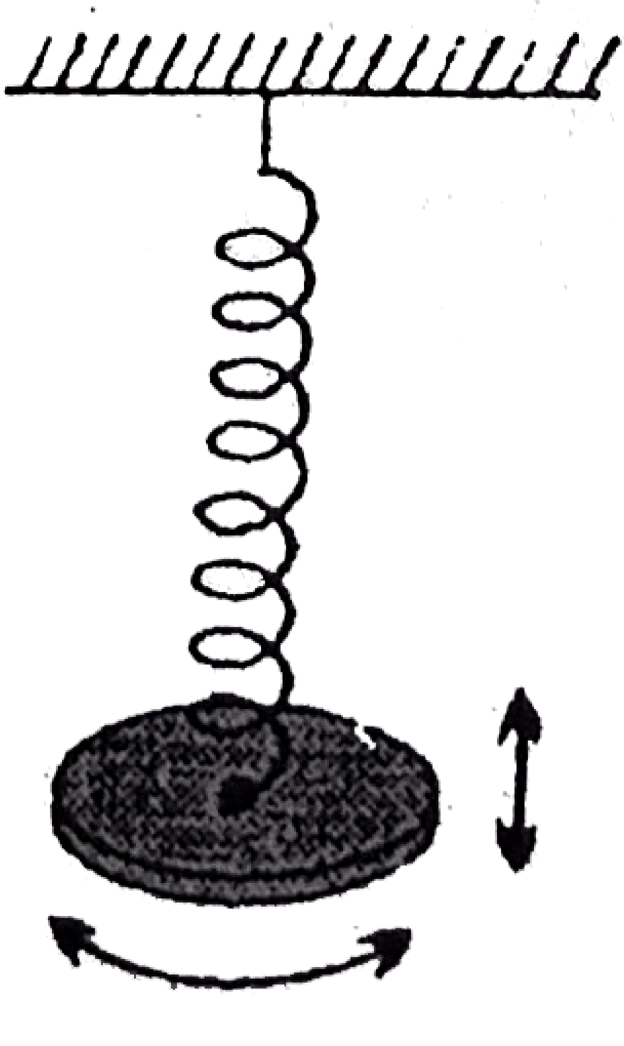
69. A solid disk of radius R is suspended from a spring of linear constant k and torsional constant c as shown in figure in terms of k and c what value of R will give the same period for the vertical and torsional oscillational oscillations of this system?



A. $\sqrt{\frac{2c}{k}}$

B. $\sqrt{\frac{c}{2k}}$

C. $2\sqrt{\frac{c}{k}}$

D. $\frac{1}{2}\sqrt{\frac{c}{k}}$

Answer: A

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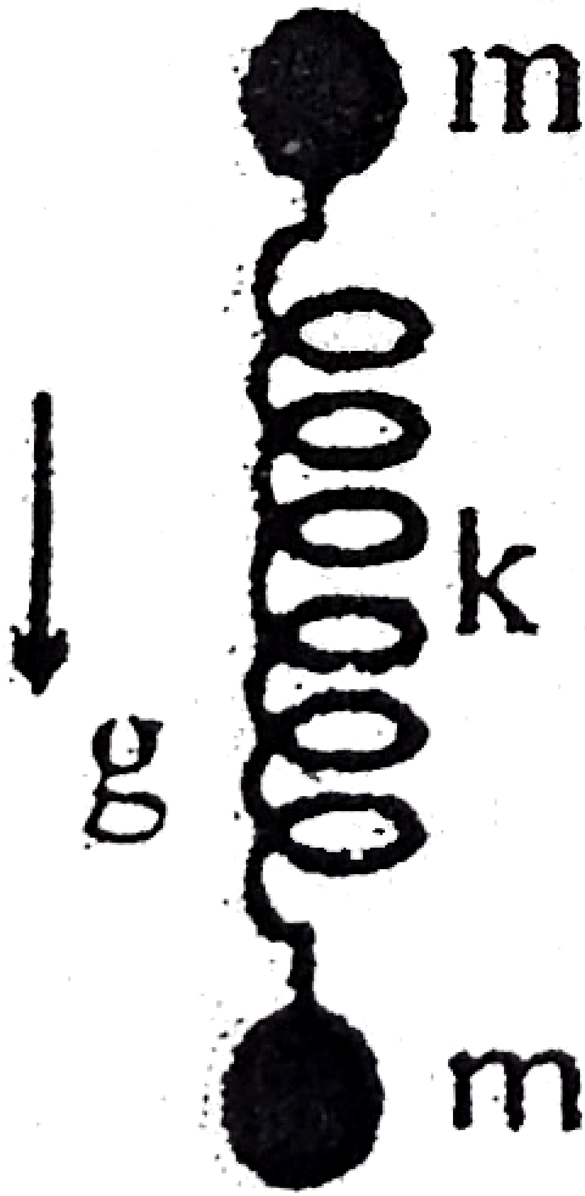
70. A mass m is hung on an ideal massless spring another equal mass is connected to the other end of the spring the whole system is at rest at t=0 m is released and the system falls freely under gravity assume that natural length of the spring is L_0 its initial stretched length is L and the acceleration due to gravity is g what is distance between masses as function of time



A. $L_0 + \left(L - L_0\right)\cos\sqrt{\frac{2k}{m}}t$

B. $L_0\cos\sqrt{\frac{2k}{m}}t$

C. $L_0\sin\sqrt{\frac{2k}{m}}t$

D. $L_0 + \left(L - L_0\right)\sin\sqrt{\frac{2k}{m}}t$

Answer: A

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71. A uniform solid cylinder of mass 5kg and radius 0.1m is resting on a horizontal platform (parallel to the x-y plane) and is free to rotate about its axis along the y-axis the platform is given a motion in the x direction given by x=0.2 cos (10t) m if there is no slipping then maximum torque acting on the cylinder during its motion is

A. $0.2N - m$

B. $2.0N - m$

C. $5.0N - m$

D. $10.0N - m$

Answer: C

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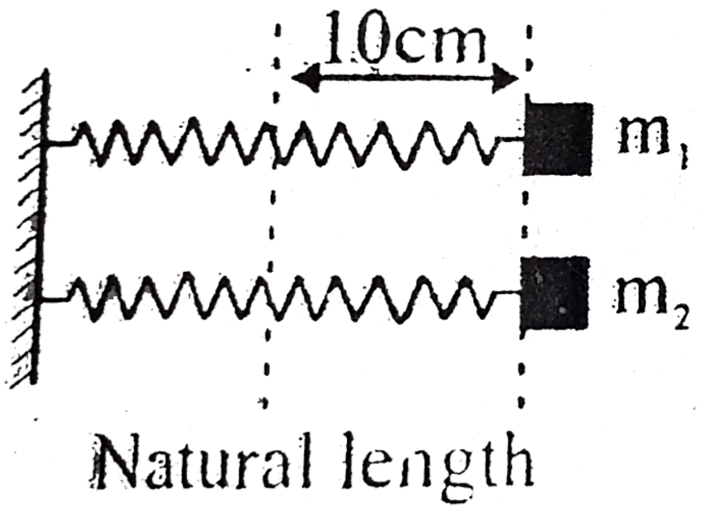
72. The drawing shows a top view of a frictionsless horizontal surface where there are two indentical springs with particles of mass m_1 and m_2 attached to them each spring constant of $1200N/m$ the particles are pulled to the right and then released from the positions shown in the drawing how much time passes before the particles are again side by side for the first time if

$m_1 = 3.0 \text{kg}$ and $m_2 = 27 \text{kg}$?



A. $\frac{\pi}{40}$ sec

B. $\frac{\pi}{20}$ sec

C. $\frac{3\pi}{40}$ sec

D. $\frac{\pi}{10}$ sec

Answer: C

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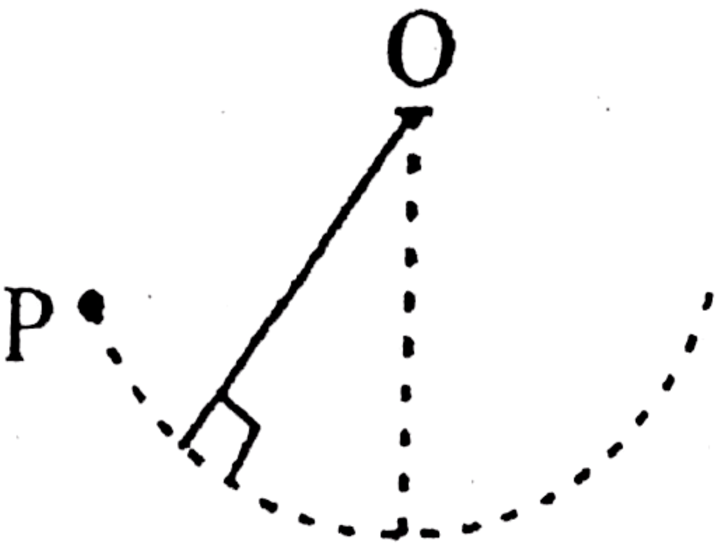
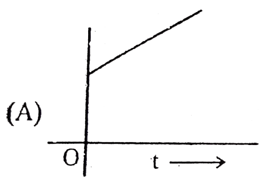
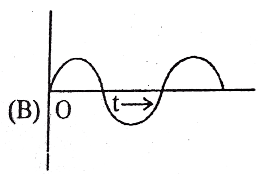
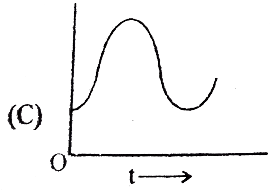
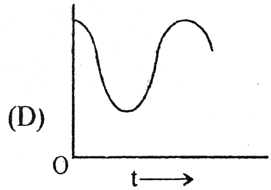
73. A short boy sits on a seat suspended by a light string from a fixed point O and starts swinging in a vertical plane from the extreme position P with a small amplitude the graph which shows the variation of the tension in the string with time 't' is:



A. 

B. 

C. 

D. 

Answer: C

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74. A particle at the end of a spring executes simple harmonic motion with a period t_1 while the corresponding period for another spring is t_2 if the oscillation with the two springs in series is T then

A. $T^2 = t_1^2 + t_2^2$

B. $T = t_1 + t_2$

C. $T^{-1} = t_1^{-1} + t_2^{-1}$

D. $T^{-2} = t_1^{-2} + t_2^{-2}$

Answer: A

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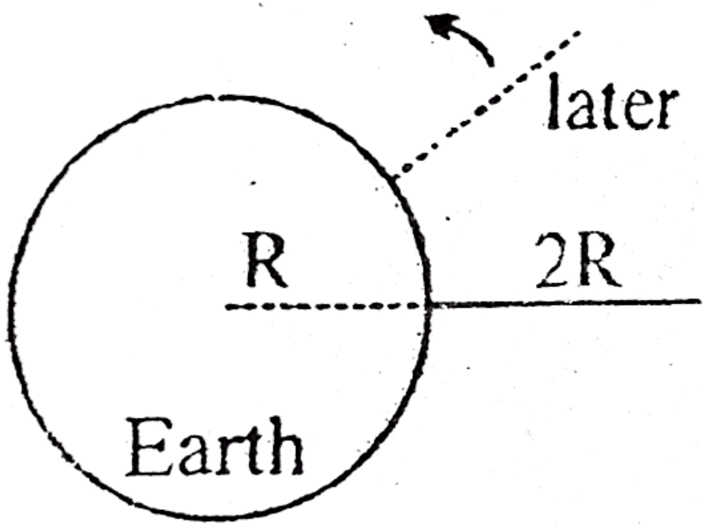
75. Consider a very long stick of length 2R which extends from just above the surface of the earth to a radius 3R if initial conditions have been set up so that this stick moves in a circular orbit while always pointing radially what is the period of this orbit a represents acceleration due to gravity on surface of earth



A. $6\pi\sqrt{\frac{R}{2g}}$

B. $2\pi\sqrt{6}\sqrt{\frac{R}{g}}$

C. $\pi\sqrt{6}\sqrt{\frac{R}{g}}$

D. none of these

Answer: B

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76. A satelite revolving in a circular equatorial orbit from west to east appears over a certain point on the equator every 8 hours therefore it's period is

A. $16hr$

B. $8hr$

C. $6hr$

D. 32

Answer: C

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77. A space vehicle approaching a planet has a speed v when it is very far from the planet At that moment tangent of its trajectory would miss the centre of the planet by distance R if the planet has mass M and radius r what is the smallest value of R in order that the resulting orbit of the space vehicle will just miss the surface of the planet?

A. $R = \frac{r}{v}\left[v^2 + \frac{2GM}{r}\right]^{1/2}$

B. $R = vr\left[1 + \frac{2GM}{r}\right]$

C. $R = \frac{v}{r}\left[v^2 + \frac{2GM}{r}\right]$

D. $R = \frac{2GMv}{r}$

Answer: A

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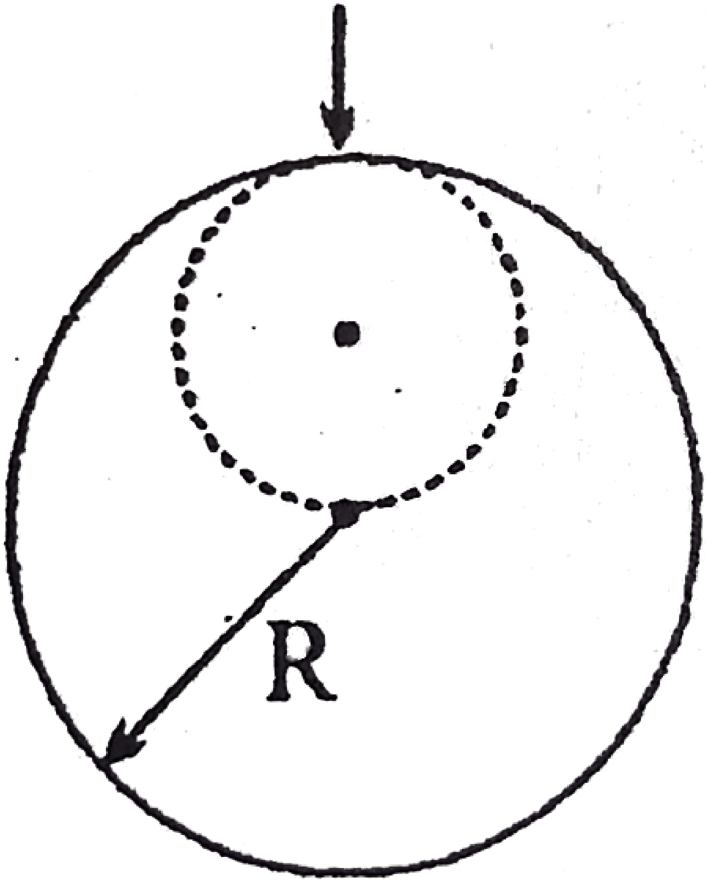
78. A spherical hole of radius $R/2$ is excavated from the asteroid of mass M as shown in the figure the gravitational acceleration at a point on the surface of the asteroid just above the excavation is



A. $\frac{GM}{R^2}$

B. $\frac{GM}{2R^2}$

C. $\frac{GM}{8k^2}$

D. $\frac{7GM}{8R^2}$

Answer: B

Watch Video Solution

79. A space vehicle approaching a planet has a speed v when it is very far from the planet At that moment tangent of its trajectory would miss the centre of the planet by distance R if the planet has mass M and radius r what is the smallest value of R in order that the resulting orbit of the space vehicle will just miss the surface of the planet?

A. $R = \frac{r}{v}\left[v^2 + \frac{2GM}{r}\right]^{1/2}$

B. $R = vr\left[1 + \frac{2GM}{r}\right]$

C. $R = \frac{v}{r}\left[v^2 + \frac{2GM}{r}\right]$

D. $R = \frac{2GMv}{r}$

Answer: A

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80. Two satellites S_1 and S_2 revolve around a planet in coplanar circular orbits in the same sense their periods of revolution are 1 hour and 8hours respectively the radius of the orbit of S_1 is 10^4 km when S_1 is closest to S_2 the angular speed of S_2 as observed by an astronaut in S_1 is :

A. $\pi rad/hr$

B. $\pi/3 rad/hr$

C. $2\pi rad/hr$

D. $\pi/2 rad/hr$

Answer: B

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81. maximum height reached by a bullet fired vertically upward with a speed equal to 50% if the escape velocity from earth's surface is (R is radius of earth):

A. $R/3$

B. $R/2$

C. $16R/9$

D. $R/8$

Answer: A

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82. A satellite is revolving round the earth with orbital speed v_0 if it is imagined to stop suddenly the speed with which it will strike the surface of the earth would be $\left(v_e\right.$ - escape speed of a body from earth s surface)

A. $\dfrac{v_e^2}{v_0}$

B. v_0

C. $\left(v_e^2 - v_0^2\right)^{1/2}$

D. $\left(v_e^2 - 2v_0^2\right)^{1/2}$

Answer: D

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83. In the asteroid belt a pebble is in close orbit around a shperical rock having density nearly same as that of earth (close meaning that the pebble goes around the rock very near to the rock's surface) orbital period of the pebble around the rock is of the order of

A. 1 day

B. 1 month

C. 1 hr

D. 1 yr

Answer: C

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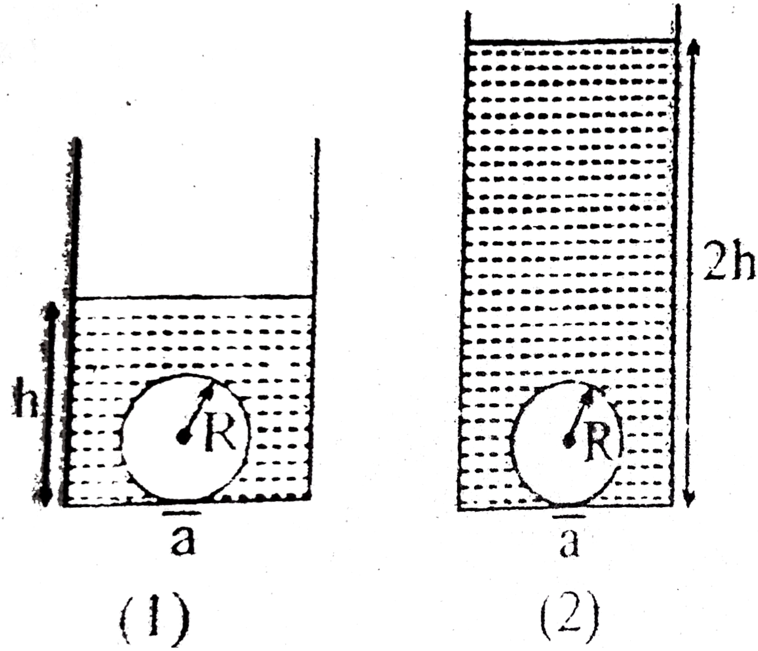
84. Two indentical cylinders have a hole of radius a $(a \le \ \le R)$ at its bottom a ball of radius R is kept on the hole and water is filled in the cylinder sucj that there is no water leakage from bottom in case1 water is filled upto height h and in second case it is filled upto height 2h if F_1 is net force by liquid on sphere in case1 and F_2 is net force by liquid on sphere in case-2 then



A. $F_1 = F_2 = 0$

B. $F_1 \geq F_2$

C. $F_2 \geq F_1$

D. $F_1 = F_2 \neq 0$

Answer: B

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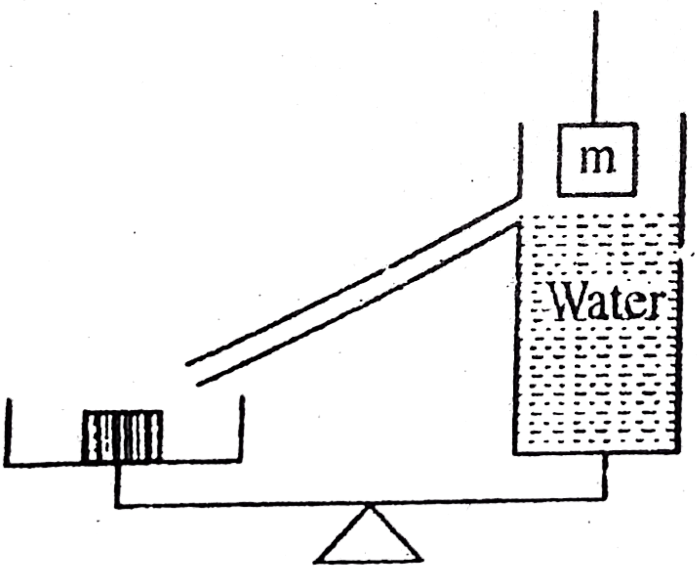
85. A pan balance has a container of water with an overflow spout on the right hand pan as shown it is full of water right up to the overflow spout A container on the left hand pan is positioned to catch any water that overflow the entire apparatus is adjusted so that it's balanced A brass weight on the end of a string is then lowered into the water but not allowed to rest on the bottom of the container what happens next?



A. water overflows and the right side of the balance tips down

B. water overflows and the left side of the balance tips down

C. water overflows but the balance remains balanced

D. water overflows but which side of the balance tips down depends on whether the brass weight is partly or completely submerged

Answer: B

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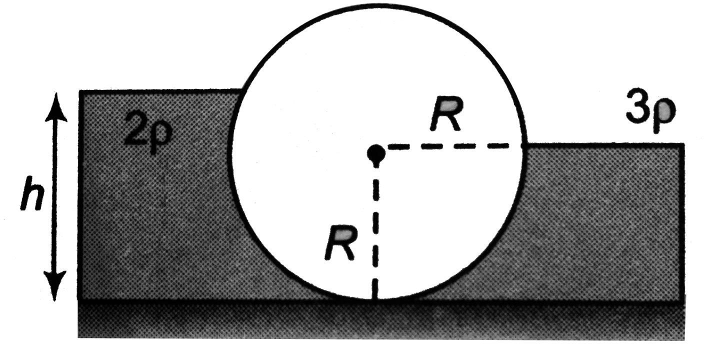
86. In the figure shown, the heavy cylinder (radius R) reasting on a smooth surface separates two liquids of densities 2ρ and 3ρ.

The height h for the equilibrium of cylinder must be



A. $\frac{3R}{2}$

B. $R\sqrt{\frac{3}{2}}$

C. $R\sqrt{2}$

D. $R\sqrt{\frac{3}{4}}$

Answer: B

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87. A cubical block of wood of specific gravity 0.5 and chunk of concrete of specific gravity 2.5 are fastened together the ratio of mass of wood to the mass of concrete which makes the combination to float with entire volume of the combination submerged in water is

A. $1/5$

B. $1/3$

C. $3/5$

D. $2/5$

Answer: C

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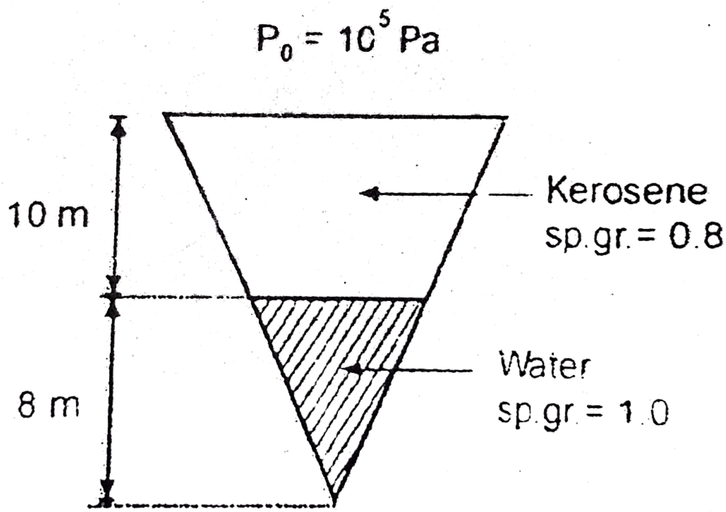
88. The figure shows a conical container of half-apex angle $37°$ filled with certain quantities of kerosene and water the force exerted by the water on the kerosene is approximately



A. $3 \times 17^7 N$

B. $4 \times 10^7 N$

C. $2 \times 10^7 N$

D. $5 \times 10^7 N$

Answer: C

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89. A barometer tube of length 0.99m reads 0.76m The volume of air measured at atmospheric pressure to be introduced into space to cause of length of mercury column to drop to 0.57m is (the cross section of the barometer tube is $0.1cm^2$)?

A. 10.5

B. 1.05

C. 105

D. none of these

Answer: A

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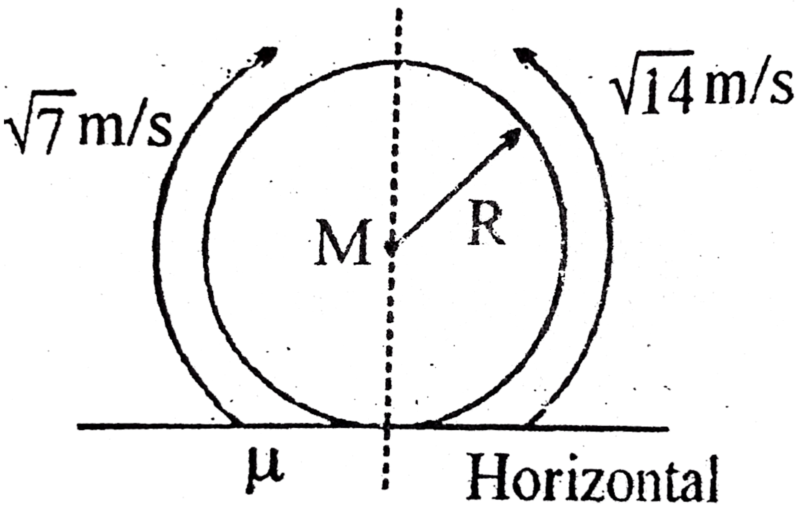
90. A solid spere of mass M and radius R is kept on rough surface the velocities of air (density p) around the sphere are as shown in figure Assuming R to be small and M = $\frac{4\pi\rho R^2}{g} kg$ what is the minimum value of coefficient of friction so that the sphere starts pure rolling? (Assume force due to pressure difference is acting on centre of mass of the sphere)



A. 0.25

B. 0.50

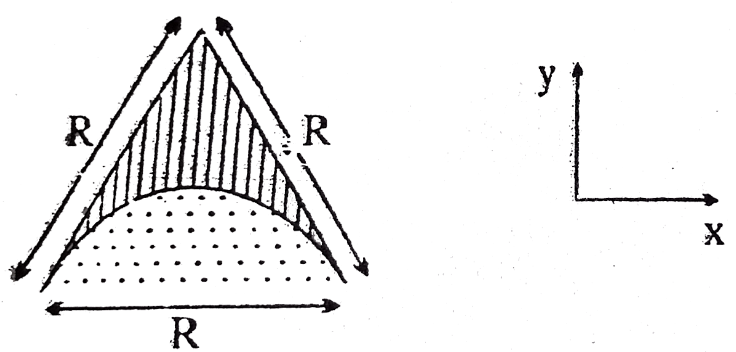
C. 0.75

D. 1.0

Answer: A

Watch Video Solution

91. A light rigid sheet of triangular shape has a curved portion cut from it as shown in figure it floats on the surface of water some soap solution is dropped over dotted region surface tension of water and soap film are T_1 & T_2 respectively $T_1 = 1.5T_2$ Mark correct option



A. The frame experiences a net force $F = \left(T_1 - T_2\right)R$ in $y \leq 0$ direction

B. The frame experiences force $F = \left(T_1 - T_2\right)R$ in $y \leq 0$ direction

C. The frame experiences force $\left(T_1 - T_2\right)(2 - \pi)R$ in $y \geq 0$ direction

D. Resultant force on wire frame is zero

Answer: B

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92. A plastic circular disc of radius R is placed on a thin oil film spread over a flat horizontal surface the torque required to spin the disc about its central vertical axis with a constant angular velocity is proportional to

A. R^2

B. R^2

C. R^4

D. R^6

Answer: C

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93. A sphere of brass released in a long liquid column attains a terminal speed v_0. If the terminal speed attained by a sphere of marble of the same radius and released in the same liquid is nv_0, then the value of n will be (Given: The specific gravities of brass, marble and liquid are 8.5, 2.5 and 0.8, respectively)

A. $\frac{5}{17}$

B. $\frac{17}{77}$

C. $\frac{11}{31}$

D. $\frac{17}{5}$

Answer: B

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94. A sphere of radius 10cm and density $500kg/m^3$ is under water of density $1000kg/m^3$ The acceleration of the sphere is $9.80m/s^2$ upward viscosity of water is 1.0 centipoise if $g = 9.81m/s^2$ the velocity of the sphere is

A. $9m/s$

B. $10m/s$

C. $11m/s$

D. $12m/s$

Answer: C

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95. A solid floats with $2/3$ of its volume immersed in a liquid and with $3/4$ of its volume immersed in another liquid what fraction of its volume will be immersed of it floats in a homogenous mixture formed of equal volumes of the liquids?

A. $6/7$

B. $8/11$

C. $11/16$

D. $12/17$

Answer: D

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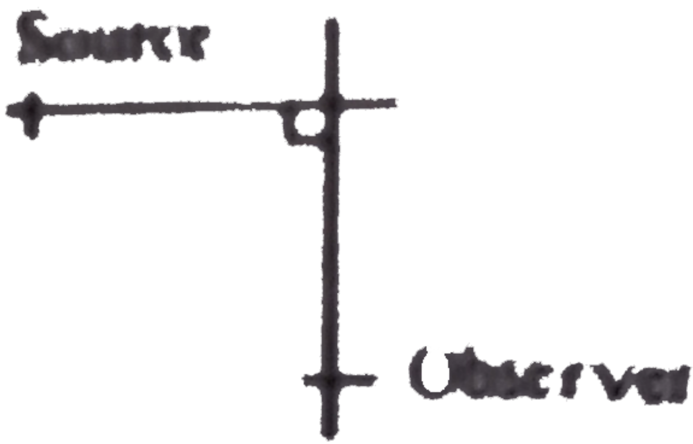
96. A source and an observer are situated on two perpendicular tracks as shown in the figure the observer is at rest and source is moving with a speed $50 m/s$ the source emits sound waves of frequency 90Hz which travel in the medium with velocity $200 m/s$ the frequency of sound heard by observer when the source crosses the origin is



A. $84Hz$

B. $88Hz$

C. $92Hz$

D. $96Hz$

Answer: D

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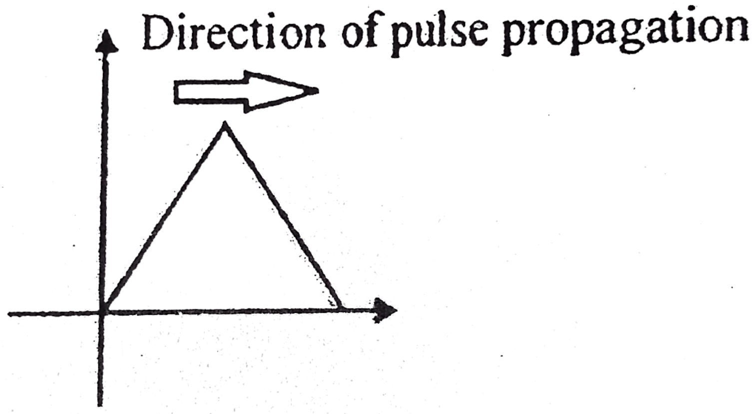
97. The wave function of a triangular wave pulse is defined by the relation below at time t=0 sec

$$y = \begin{matrix} mx & \text{for } 0 \le x \le \frac{a}{2} \\ -m(x-a) & f\text{ or } \frac{a}{2} \le x \le a \\ 0 & everywhereelse \end{matrix}$$

The wave pulse is moving in the +x direction in a string having tension T and mass per unit length mu the total energy present with the wave pule is



A. $\dfrac{m^2Ta}{2}$

B. m^2Ta

C. $\dfrac{m^2Ta}{\mu}$

D. $\dfrac{m^2Ta}{2\mu}$

Answer: B

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98. A closed organ pipe of length L is vibrating in its first overtone there is a point Q inside the pipe at a distance $7L/9$ form the open end the ratio of pressure amplitude at Q to the maximum pressure amplitude in the pipe is

A. $1:2$

B. $2:1$

C. $1:1$

D. $2:3$

Answer: A

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99. A string of length 3L is fixed at both ends it resonates with a tunning fork in third harmonic with amplitude at antinode equal to A_0 at time t=0 a string element at position of antinode is at half its positive amplitude and moving towards mean position displacement of a string element at $L/2$ is given by

A. $\frac{A_0}{2}\sin\left(\omega t+\frac{11\pi}{6}\right)$

B. $\frac{\sqrt{3A_0}}{2}\sin\left(\omega t+\frac{5\pi}{6}\right)$

C. $A_0\sin\left(\omega t+\frac{5\pi}{6}\right)$

D. $\frac{A_0}{2}\sin\left(\omega t+\frac{5\pi}{6}\right)$

Answer: C

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100. The shape of a wave propagating in the positive x or negative x-direction is given $y=\frac{1}{\sqrt{1+x^2}}$ at t=0 and

$y = \frac{1}{\sqrt{2 - 2x + x^2}}$ at t=1s where x and y are in meters the shape the wave disturbance does not change during propagation find the velocity of the wave

A. $1m/s$ in positive x direction

B. $1m/s$ in negative x direction

C. $\frac{1}{2}m/s$ in positive x direction

D. $\frac{1}{2}m/s$ in negative x direction

Answer: A

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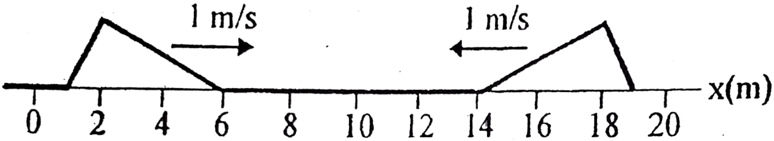
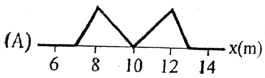
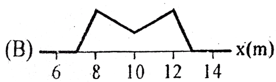
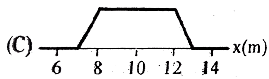
101. Two pulses on a string approach each other at speeds of $1m/s$ what is the shape of the string at t=6s?

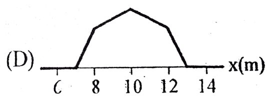


Approaching waves at t = 0 s

A. 

B. 

C. 

D. 

Answer: C

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102. A composite string is made up by joining two strings of different masses per unit length rightarrow μ and 4μ the composite string is under the same tension A transverse wave pulse Y=(6mm) sin (5t+40x) where is in seconds and x in metres is sent along the lighter string towards the joint the joint is at x=0 the equation of the wave pulse reflected from the joint is

A. $(2mm)\sin\left(5t_{40}x\right)$

B. $(4mm)\sin(40x - 5t)$

C. $-(2mm)\sin(5t - 40x)$

D. $(2mm)\sin(5r - 10x)$

Answer: C

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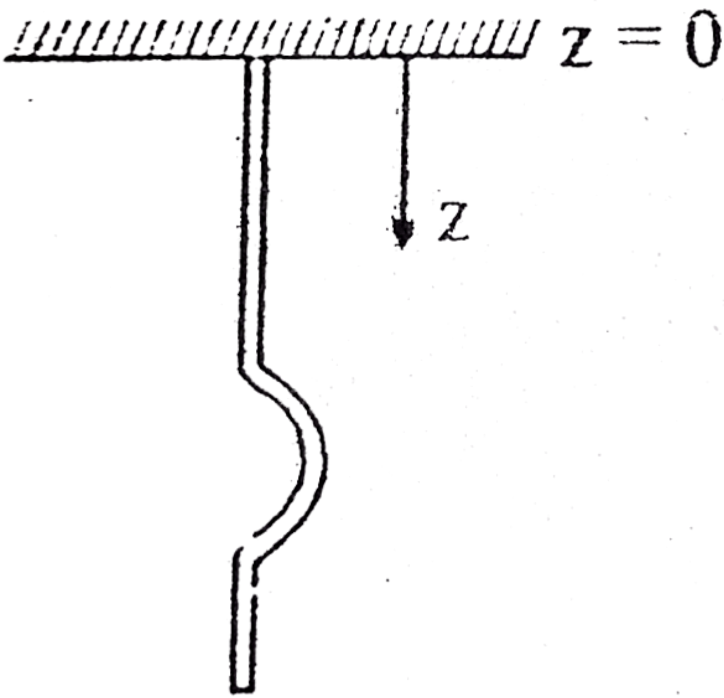
103. A rope hangs from a rigid support A pulse is set by jiggling the bottom end we want to design a rope in which velocity v of pulse is independent of z the distance of the pulse from fixed end of the rope if the rope is very long the desired function for mass per unit length $\mu(z)$ in terms of μ_0 (mass per unit length of the top (z=0) g v and z is:



A. $\mu(z) = \mu_0 e^{-\left[g/v^2\right]z}$

B. $\mu(z) = \mu_0 e^{+\left[g/v^2\right]z}$

C. $\mu(z) = \mu_0 \log_e\left(\frac{g}{v^2}\right)z$

D. $\mu(z) = \mu_0 e + \left(\frac{v^2}{g}\right)z$

Answer: A

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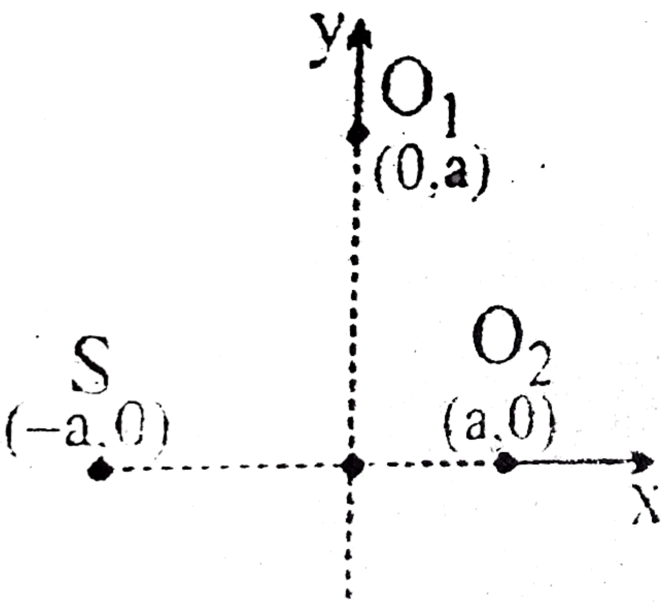
104. A sound sourse S and observers O_1, O_2 are placed as shown S is always at rest and O_1, O_2 start moving with velocity v_0 at t=0 at any later instant let f_1 ans f_2 represent apparent frequencies of sound received by O_1 and O_2 respectively the ratio f_1/f_2 is



A. zero

B. between 0 and 1

C. 1

D. ≥ 1

Answer: D

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105. A source of sound attached to the bob of a simple pendulum execute SHM the difference between the apparent frequency of sound as received by an observer during its approach and recession at the mean position of the SHM motion is 2% of the natural frequency of the source the velocity of the source at the mean position is (velocity of sound in the air is $340m/s$) [Assume velocity of sound source $\leq$ $\leq$ velocity of sound in air]

A. $1.4 m/s$

B. $3.4 m/s$

C. $1.7 m/s$

D. $2.1 m/s$

Answer: B

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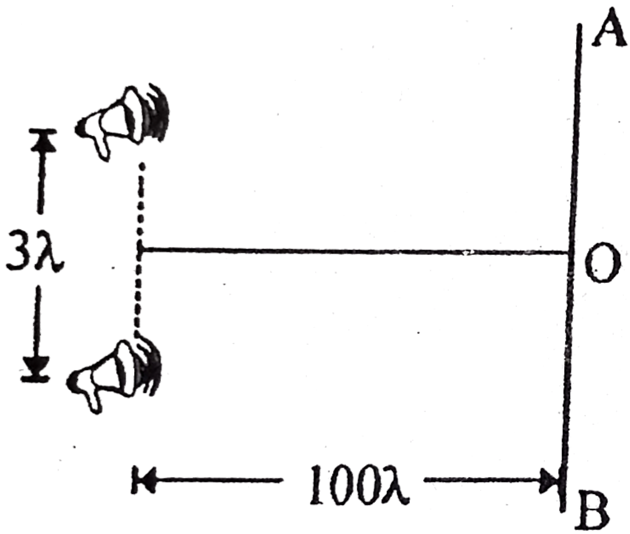
106. 2 loudspeakers are emitting sound waves of wavelength lambda with an initial phase difference of $\frac{\pi}{2}$ at what minimum distance from O on line AB will one hear a maximum



A. 25λ

B. $\frac{100\lambda}{\sqrt{15}}$

C. $\frac{25\lambda}{3}$

D. 50λ

Answer: C

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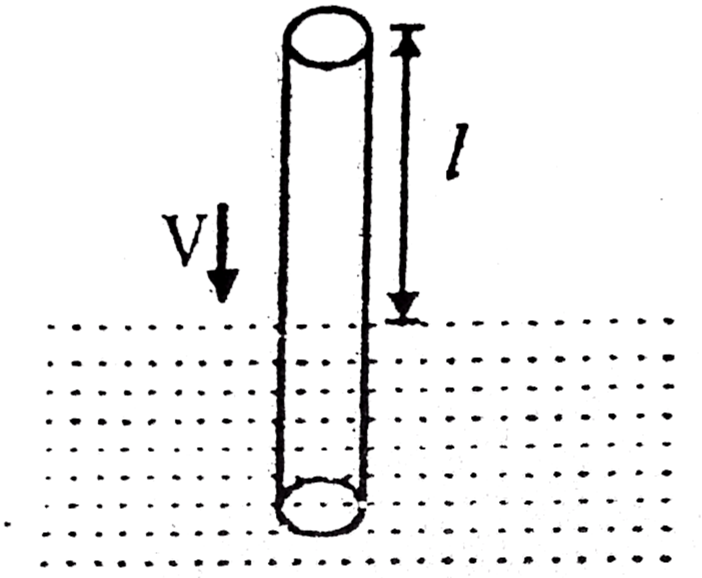
107. An open pipe of sufficient length is dipping in water with a speed V vertically if at any instant l is length of tube above water then the rate at which fundamental frequency of pipe changes is (C is the speed of sound in air)



A. $\frac{CV}{2}l^2$

B. $\frac{CV}{4}l^2$

C. $\frac{CV}{2v^2t^2}$

D. $\frac{CV}{4v^2t^2}$

Answer: B

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108. The frequency of a car horm is f what frequency is observed is both the car and the observer are at rest, but a wind is blowing from the car toward the observer?

A. f

B. greater than f

C. lessthanf

D. either greater or less thanf

Answer: A

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109. If a source of sound approaches a stationery observer with velocity v then he observes an increase in frequency equal to Δn_1 if source recedes away from the stationary observer with same velocity v then he observer a decrease in frequency equal to Δn_2 then:

A. $\Delta n_1 = \Delta n_2$

B. $\Delta n_1 \geq \Delta n_2$

C. $\Delta n_1 \leq \Delta n_2$

D. $\Delta n_1 \geq \Delta n_2$ or $\Delta n_2 \geq \Delta n_1$ depending upon velocity v

Answer: B

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110. A liquid of volumetric thermal expansion coefficient = γ and bulk modulus B is filled in a spherical tank of negligible heat expansion coefficient its radius R and wall thickness is t $(t \leq \ \leq R)$ when the temperature of the liquid is raised by theta the tensile stress developed in the walls of th tank is:

A. $B\gamma\theta R/2t$

B. $B\gamma\theta R/t$

C. $2B\gamma\theta R/t$

D. $B\gamma\theta R/4t$

Answer: A

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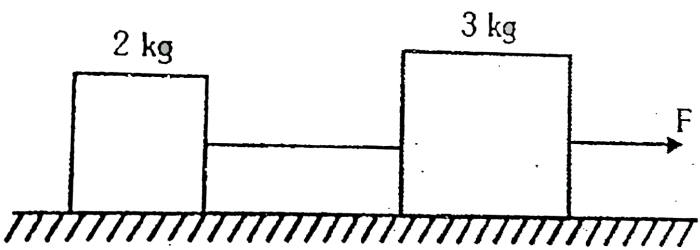
111. Two bodies of masses 2kg and 3kg are connected by a metal wire of cross section 0.04 mm^2. Breaking stress of metal wire is 2.5 Gpa. The maximum force F that can be applied to 3kg block so that wire does not break is :



A. 100N

B. 150N

C. 200N

D. 250N

Answer: D

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112. A steel rod is 4000cm in diameter at $30^{\circ}C$ A brass ring has an interior diameter of $3.992 cm at 30^{\circ}$ in order that the ring just slides onto the steel rod the common temperature of the two should be nearly

$$\left(\alpha_{steel} = 11 \times \frac{10^{-6}}{\wedge(\circ)C} \text{ and } \alpha_{brass} = 19 \times \frac{10^{-6}}{\wedge(\circ)C}\right.$$

A. $200^{\circ}C$

B. $250^{\circ}C$

C. $280^{\circ}C$

D. $400^{\circ}C$

Answer: C

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113. A sealed glass bulb containing mercury (incompletely filled) just floats in water at $4^\circ C$ if the water and bulb are (1)cooled to $2^\circ C$ and (2) warmed to $8^\circ C$ the bulb

A. (1)sinks (2) sinks

B. (1)sinks(2)floats

C. (1)floats (2)floats

D. (1)floats(2)sinks

Answer: A

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114. Two spheres of different materials one with double the radius and one-fourth wall thickness of the other are filled with ice. If the time taken for complete melting of ice in the larger sphere is 25 minutes and for smaller one is 16 minutes, the ratio of thermal conductivities of the materials of larger sphere to that of smaller sphere is:

A. $4:5$

B. $25:1$

C. $1:25$

D. $8:25$

Answer: D

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115. Two identical heaters are coated with paint in 1st case $e_1 = 1.0$ and in 2nd case $e_2 = 0.5$ Both are kept in identical chambers which are in similar surroundings if the heaters are switched on In steady state 1st heater has temperature T_1 on surface and θ_1 of its chamber 2nd heater has temperature T_2 on surface and θ_2 of its chamber.

A. $\theta_1 = \theta_2 T_1 \leq T_2$

B. $\theta_1 \geq \theta_2, T_1 = T_2$

C. $\theta_1 = \theta_2, T_1 \geq T_2$

D. $\theta_1 \leq \theta_2, T_1 = T_2$

Answer: A

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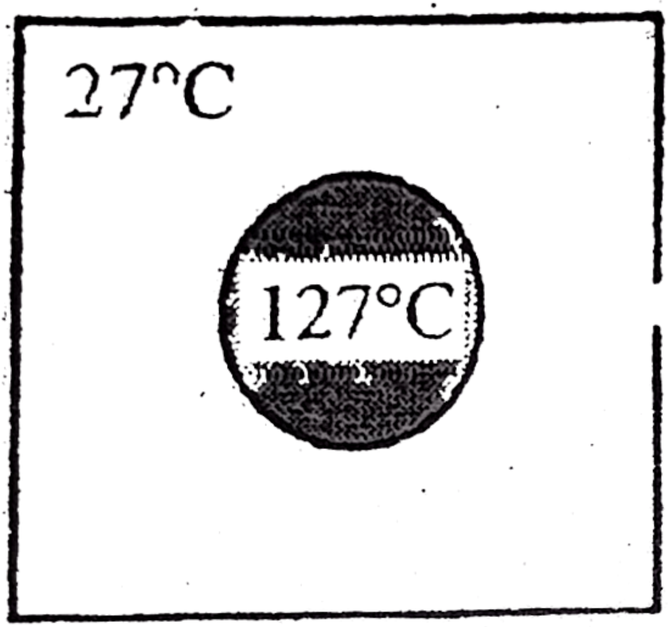
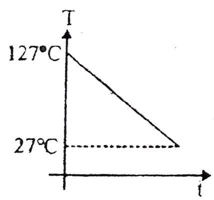
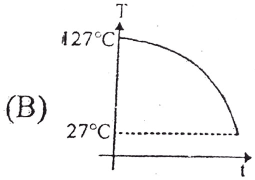
116. A silver ball painted black is kept inside a box which is maintained at a temprature of $27^\circ C$ the ball is maintained initially at a constant temperature of $127^\circ C$ by making the radiation to fall on it through a small hole in the box latter on due to some chemical reaction between silver and paint the paint uniformly evaporates from the surface of ball exposing the silver if same amount of radiation continues to fall on ball then temperature of ball as a function of time is hown as :(Assume emissivity of silver is zero and paint to be black body also assume radiation to be the only mode of heat transfer)

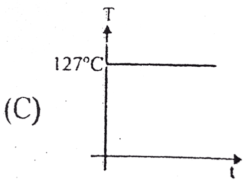


A. (A)

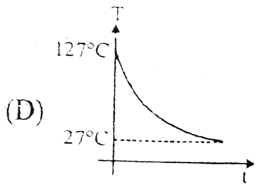




B.



C.



D.

Answer: C

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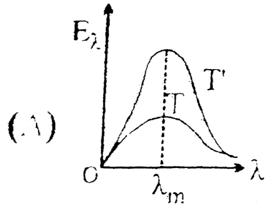
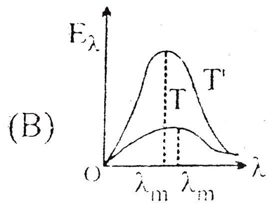
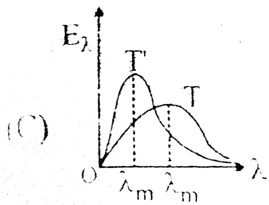
117. Identify the graph which correctly represents the spectral intensity versus wavelength graph at two temperatures T and T $(T \leq T)$

A. 

B. 

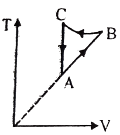
C. 

D. none of these

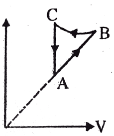
Answer: B

View Text Solution

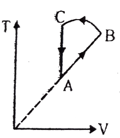
118. Two moles of an idea gas is initially in state A having pressure $1.01 \times 10^5 N/m^2$ and temperature 300k keeping pressure constant the gas is taken to state B temperature at B is 500K the gas is then taken to state C in such a way that its temperature increases and volume decreases also from B To c the magnitude of $\frac{dT}{dV}$ increases the volume of gas at C is equal to volume of gas at A now the gas is taken to initial state A keeping volume constant A total of 1200 J of heat is with drawn from the sample in the cyclic process the T-V graph for the cyclic process and work done in path B to C are respectively $(take R = 8.3 J/k/mol)$

A. (A) 

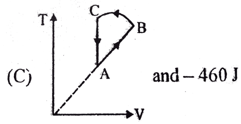
and -4520 J

B. (B) 

and -460 J

C. (C) 

and -4520 J

D. 

Answer: A

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119. A liquid whose coefficient of volume expansion is γ_r Completely fills a sealed metal tank at negligible pressure the coefficient of linear expansion of the metal is alpha and the pressure of the liquid will be

A. $\gamma_r \frac{t}{k}$

B. $\frac{t}{k}\left(\gamma_r - 3\alpha\right)$

C. $tk\left(\gamma_r\right) - 3\alpha)$

D. $\frac{t}{k}\left(\gamma_r - \alpha\right)$

Answer: B

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120. There are two identical vessels containing same quantity of an ideal gas at same pressure vessel A is placed in a train moving with constant speed and the vessel B is placed on the platform in the frame of an observer standing on the platform select the correct statement

A. Temperature of gas in both vessel is same where as kinetic energy of gas in the vessel is different

B. kinetic energy of gas in both vessels is same but temperature are different

C. both kinetic energy and temperature are same.

D. both kinetic energy and temperature are different

Answer: A

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121. Two identical glass spheres filled with air are connected by a thin horizontal glass tube the glass tube contains a pellet of mercury at its mid-point Air in one sphere is at $0^{\circ} C$ and the other is at $20^{\circ} C$ if temperature of both the vessels are increased by $10^{\circ} C$ then neglecting the expansions of the bulbs and the tube

A. the mercury pellet gets displaced towards the sphere at lower temperature

B. the mercury pellet gets displaced towards the sphere at higher temperature

C. the mercury pellet does not get displaced at all

D. the temperature rise causes the pellet to expand without any displacement

Answer: B

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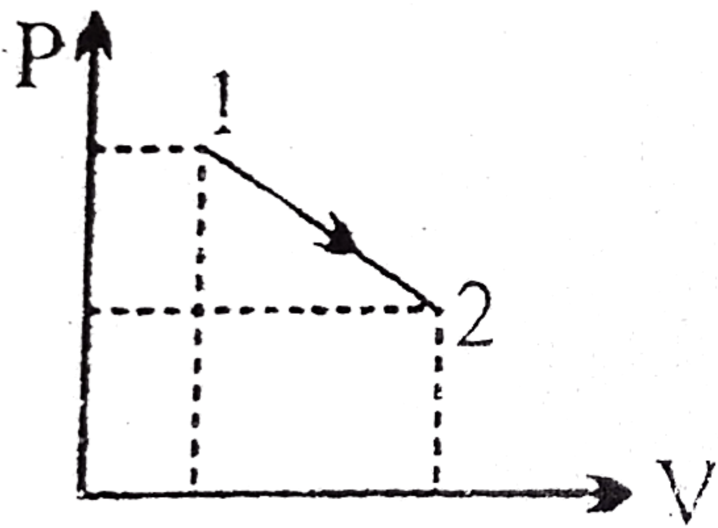
122. A process $1 \rightarrow 2$ using monoatomic gas is shown on the P-V diagram on the right $P_1 = 2P_2 = 10^6 N/m^2, V_2 = 4V_1 = 0.4m^3$ The heat ansorbed by the gas



A. 350kJ

B. 375kJ

C. 425kJ

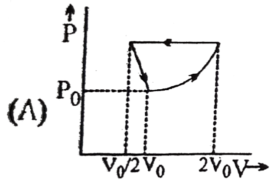
D. none

Answer: B

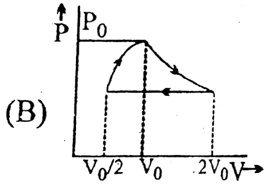
View Text Solution

123. One mole of an ideal gas at pressure P_0 and temperature T_0 is expanded isothermally to twice ist volume and then compressed at constant pressure to $\left(V_0/2\right)$ and the gas is brought bac to original state by a process in which $P \alpha V$ (pressure is direclty proportional to volume). The correct temperature of the process is

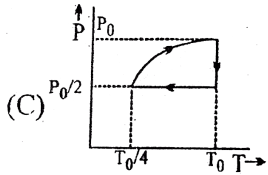
A.



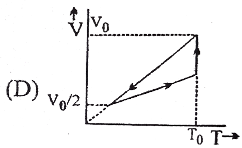
B.



C.



D.



Answer: C

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124. One mole of diatomic gas is being heated in a closed tank 300K up to 1000K During the process part of the molecules dissociate At 1000K the energy of the diatomic molecules are only half of that of the whole gas By what factor has the gas pressure increased $\left(P_{f \in al} / P_{\in itial}\right)$? (The oscillation of the molecules are not to be taken in account)

A. $\frac{160}{33}$

B. $\frac{16}{11}$

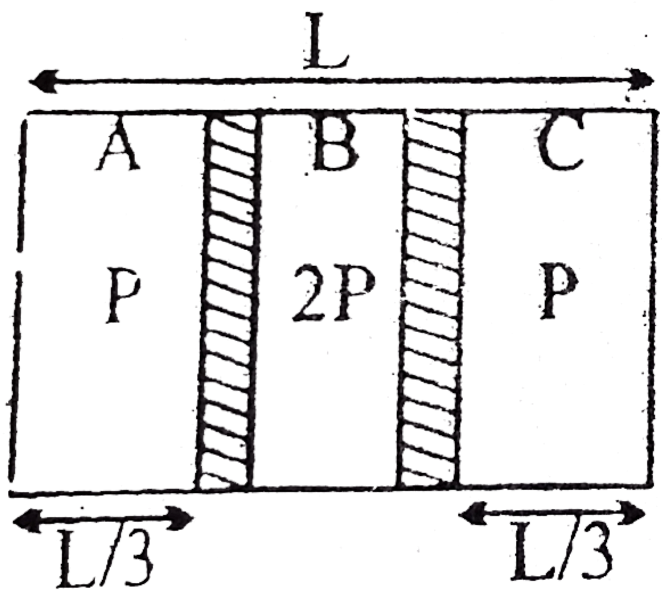
C. $\frac{3}{2}$

D. none

Answer: A

Watch Video Solution

125. Two pistons having low thermal conductivity divide an adiabatic container in three equal parts as shown An ideal gas is present in the three parts AB&C having initial pressures as shown and same temperatures Now the pistons are releasef Then the final equilibrium length of part A after long time will be



A. $L/8$

B. $L/4$

C. $L/6$

D. $L/5$

Answer: B

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126. The pressure and density of a gas $(\gamma = 1.5)$ changes for $(P, \rho) \rightarrow (P', \rho')$ during adiabatic changes if $\rho' / \rho = 32, then P' / P$ will be

A. 128

B. 1//128

C. 32

D. 1//32

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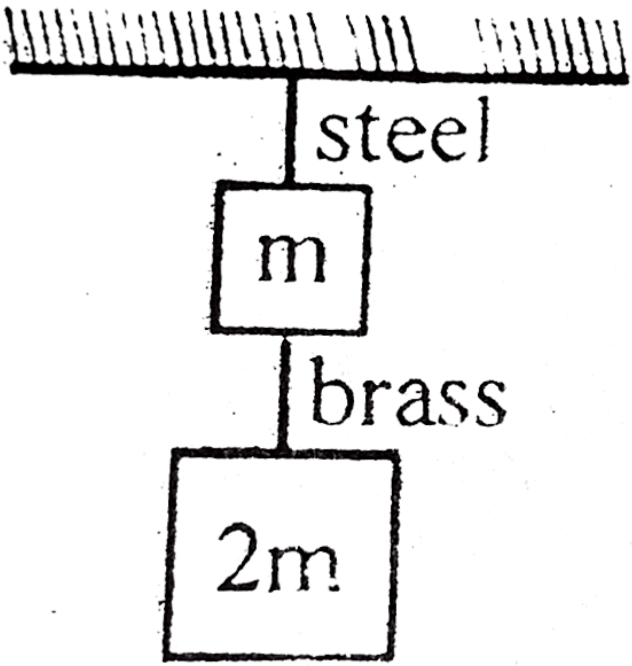
127. If the ratio of lengths, radii and Young's moduli of steel and brass wires in the figure are a,b and c repectively then the corresponding ratio of increase in their lengths is



A. $2a^2c/b$

B. $3a/2b^2c$

C. $2ac/b^2$

D. $3c/2ab^2$

Answer: B

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128. A point mass m is suspended by means of a light metallic wire The mass is given enough horizontal velocity so that it moves in a vertical circle Now temperature is increased but the wire continues to move in a circle of increased radius if T_H and T_1 are the value of tension in the wire at its highest and lowest point respectively then due to increase in temperature the value of $\left(T_1 - T_H\right)$ will:

A. decrease

B. increase

C. remain same

D. cannot be determined

Answer: C

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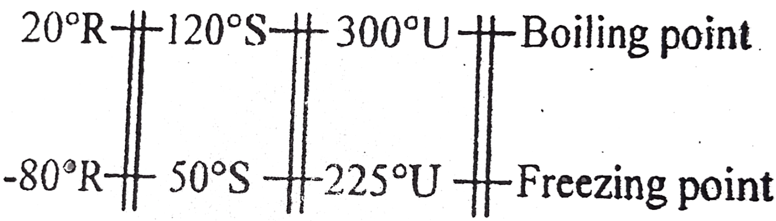
129. Figure shows three temperature scales with the freezing and boilling point of water indicated. A change of $25R^{\circ}$, $25S^{0}$ and $25U^{0}$ is denoted by x_1, x_2, x_3 respectively which of the following is correct:



A. $x_1 \geq x_2 \geq x_3$

B. $x_2 \leq x_1 \leq x_3$

C. $x_3 \geq x_2 \geq x_1$

D. $x_2 \geq x_3 \geq x_1$

Answer: D

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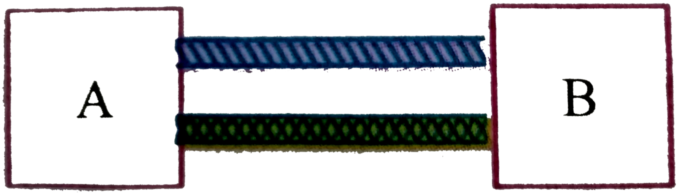
130. The container A is constantly maintained at $100\,^{\circ}C$ and insulated container B in the contains ice at $0\,^{\circ}C$ Different rods are used to connect them For a rod made of copper, it takes 30 mintes for the ice to melt and for a rod of steel of same cross-section taken in different experiment it takes 60 minutes for ice to melt. When these rods are simultaneously connected in parallel, the ice melts is



A. 15minutes

B. 20minutes

C. 45minutes

D. 90minutes

Answer: B

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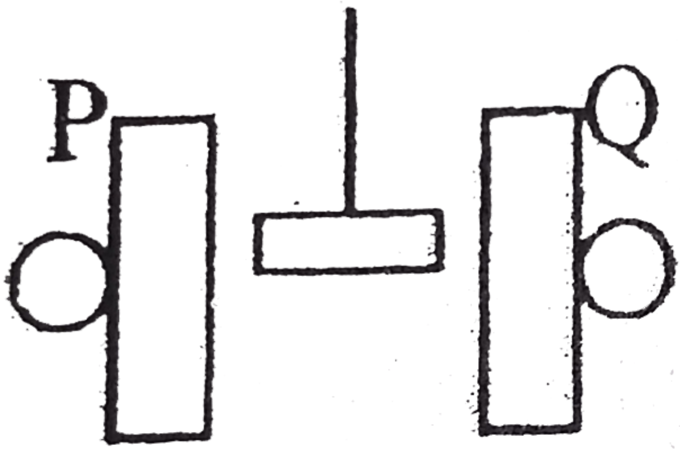
131. Two identical balls of wax are attached on the outer surfaces of two tin sheets. The inner surface of 'P' is coated with lamp black and that of Q is polished. If a source of heat is palced between P and Q then which ball with melt first?



A. Q ball

B. P ball

C. both simultaneously

D. nothing can be predicted

Answer: B

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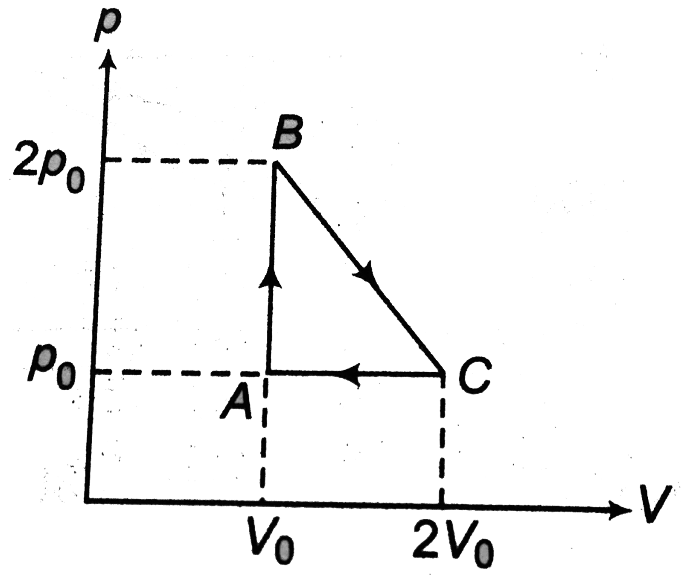
132. In the process shown in figure, the internal energy of and ideal gas decreases by $\frac{3p_0V_0}{2}$ in going from point C to A. Heat transfer along the process CA is



A. $\left(+ P_0V_0/2\right)$

B. $\left(- 5P_0V_0/2\right)$

C. $\left(- 3P_0V_0/2\right)$

D. 0

Answer: B

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133. On an imaginary planet the acceleration due to gravity is same as that on Earth but there is also a downward electric field that is uniform close to the planet's surface. A ball of mass m carrying a charge q is thrown upward at a speed v and hits the ground after an interval t, What is the magnitude of potential difference between the starting point and top point of the trajectory?

A. $\frac{mv}{2q}\left(v - \frac{gt}{2}\right)$

B. $\frac{mv}{q}\left(v - \frac{gt}{2}\right)$

C. $\frac{mv}{2q}(v - gt)$

D. $\frac{2mv}{q}(v - gt)$

Answer: A

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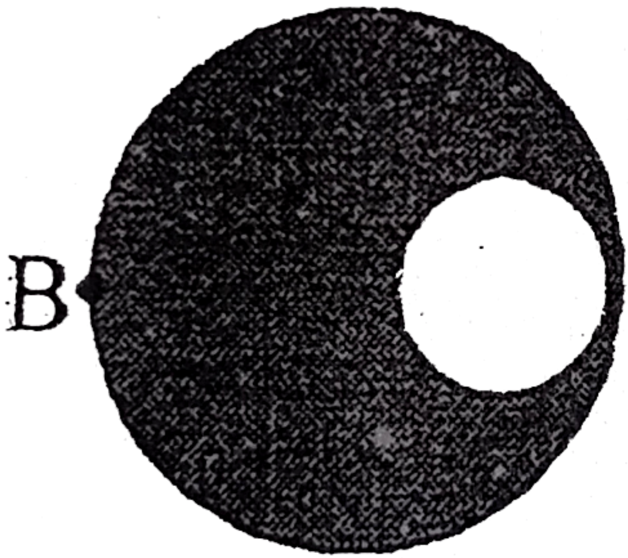
134. A positively charged sphere of radius r_0 carries a volume charge density ρ_E (Figure). A spherical cavity of radius $r_0/2$ is then scooped out and left empty, as shown. What is the direction and magnitude of the electric field at point B?



A. $\frac{17\rho r_0}{54 \in_0}$ *left*

B. $\frac{\rho_0}{6 \in_0}$ *left*

C. $\frac{17\rho r_0}{54 \in_0}$ *right*

D. $\frac{\rho r_0}{6 \in_0}$ *right*

Answer: A

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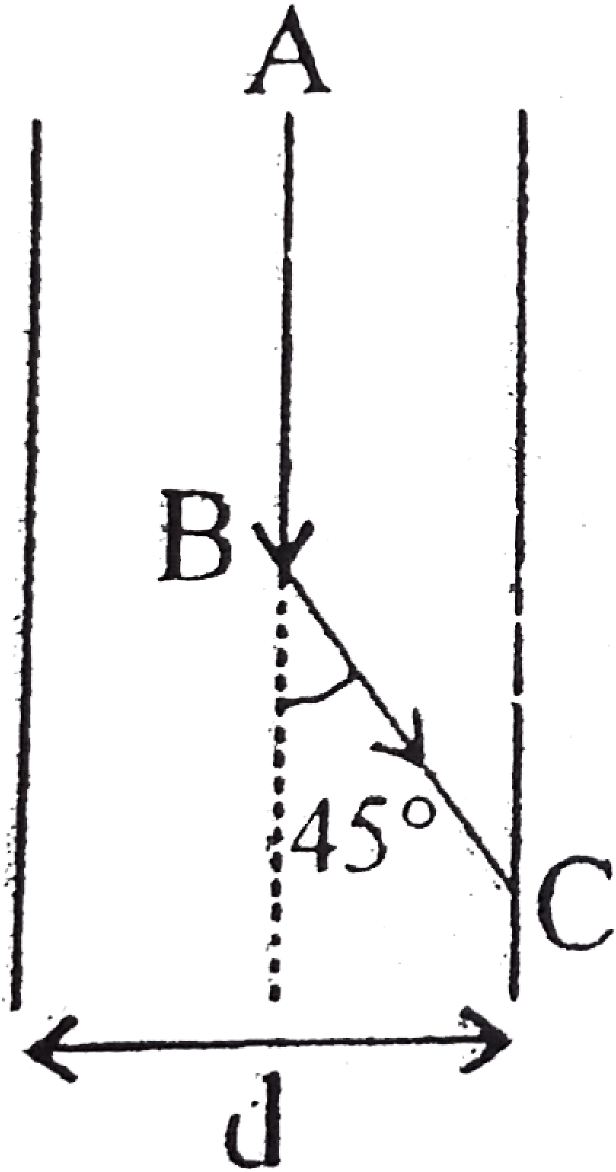
135. A sphere carrying a charge of Q having weight w falls under gravity between a pair of vertical plates at a distance of d from each other. When a potential difference V is applied between the plates the acceleration of sphere changes as shown in the figure, to along line BC. The value of Q is



A. $\frac{w}{v}$

B. $\frac{w}{2}V$

C. $w\frac{d}{V}$

D. $\frac{\sqrt{2wd}}{V}$

Answer: C

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136. Two conducting spheres of radii R each are given equal charges +Q and are kept such that their centre are at distance r $(\geq R)$. The force of attraction (F) between them is:

A. $\frac{KQ^2}{r^2}$

B. $\frac{KQ^2}{(r+2R)^2}$

C. $\frac{KQ^2}{r^2} \geq F \geq \frac{KQ^2}{(r-2R)^2} \geq F \geq \frac{KQ}{r^2}$

D. $\frac{KQ^2}{(r-2R)^2} gtFgt \frac{KQ}{r^2}$

Answer: C

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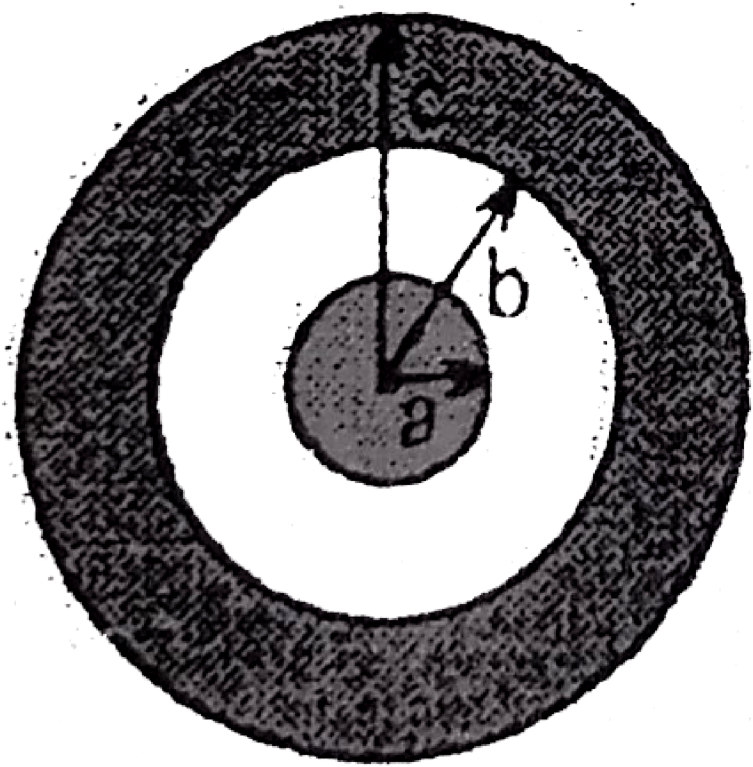
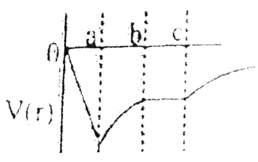
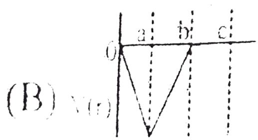
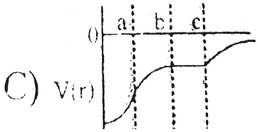
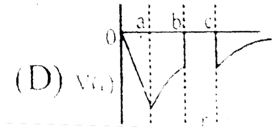
137. A nonconducting sphere with radius a is concentric with and surrounded by a conducting spherical shell with inner radius b and outer radius c. The inner sphere has a negative charge uniformly distributed throughout its volume, while the spherical shell has no net charge. The potential V (r) as a function of distance from the center is given by



A. 

B. 

C. 

D. 

Answer: C

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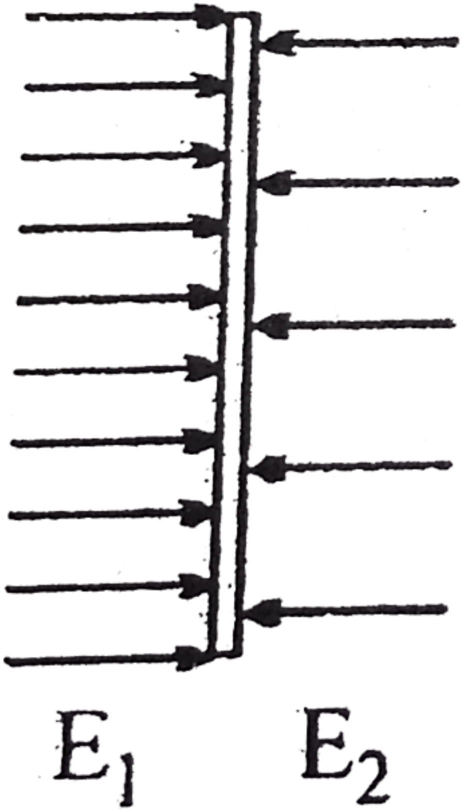
138. A charged large metal sheet is placed into uniform electric field, perpendicularly to the electric field lines. After placing the sheet into the field, the electric field on the left side of the sheet is $E_1 = 5 \times 10^5 V/m$ and on the right it is $E_2 = 3 \times 10^5 V/m$. The sheet experiences a net electric force of 0.08N. Find the area of one face of the sheet. Assume external field to remain constant after introducing the large sheet. Use $\left(\frac{1}{4\pi\varepsilon_0}\right) = 9 \times 10^9 Nm^2/C^2$



A. $3.6\pi \times 10^{-2} m^2$

B. $0.9\pi \times 10^{-2} m^2$

C. $1.8\pi \times 10^{-2} m^2$

D. none

Answer: A

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139. The magnitude of electric field intensity at point $B(2, 0, 0)$ due to dipole of dipole moment, $\vec{p} = \hat{i} + \sqrt{3}\hat{j}$ kept at origin is (assume that the point B is at large distance from the dipole and $k = \dfrac{1}{4\pi\varepsilon_0}\Big)$

A. $\dfrac{\sqrt{13k}}{8}$

B. $\dfrac{\sqrt{13k}}{4}$

C. $\dfrac{\sqrt{7k}}{8}$

D. $\dfrac{\sqrt{7k}}{4}$

Answer: C

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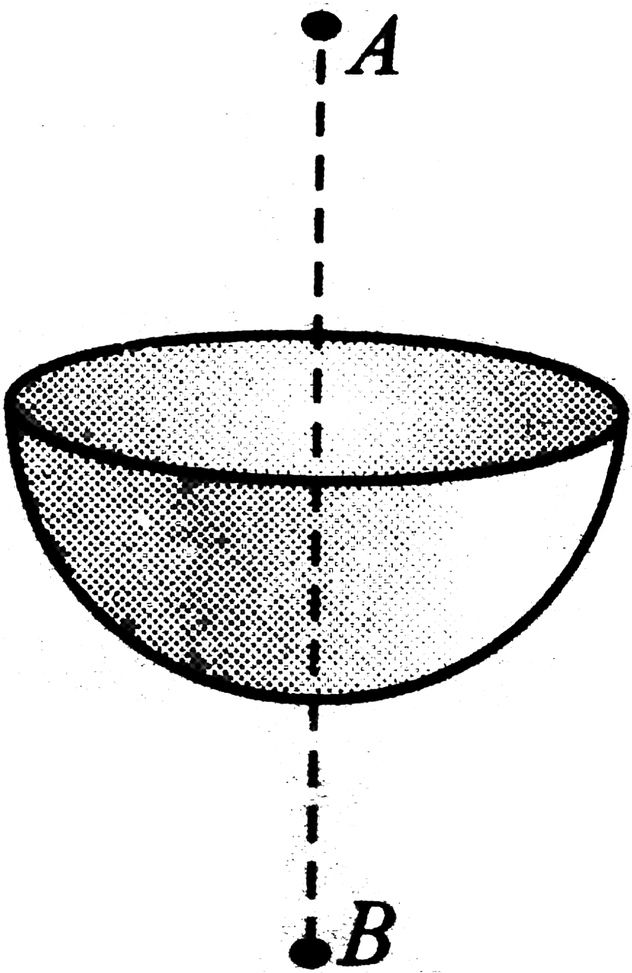
140. Figure shows a uniformly charged hemisphere of radius R. It has a volume charge density ρ. If the electric field at a point 2R, above the its center is E, then what is the electric field at the point 2R below its center?



A. $\rho/6\varepsilon_0 + E$

B. $\rho R/12\varepsilon_0$ - E

C. -$\rho R/6\varepsilon_0 + E$

D. $\rho R/24\varepsilon_0 + E$

Answer: B

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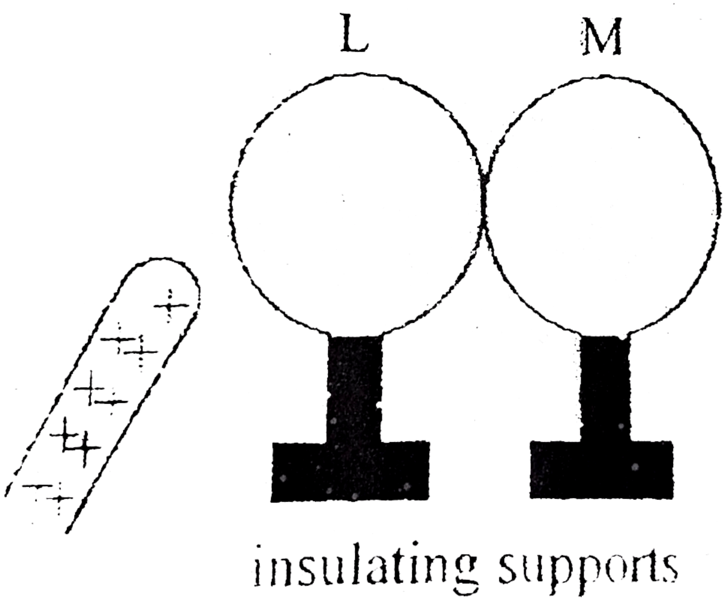
141. Two uncharged metal spheres, L and M, are in contact A positively charged rod is brought close to L, but not touching it, as shown. The two spheres are slightly separated and the rod is then withdrawn. As a result:



A. L is positive and M is negative

B. both spheres are positive

C. both spheres are negative

D. L is negative and M is positive

Answer: D

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142. Which of the following statement is true?

A. The rate of change of potential with distance along any direction is constant in a uniform electric field.

B. The electric field is zero where the potential is zero.

C. The potential arising from a single point charge may vary from positive to negative in different regions.

D. The force on a charged particle located on an equipotential surface is zero.

Answer: A

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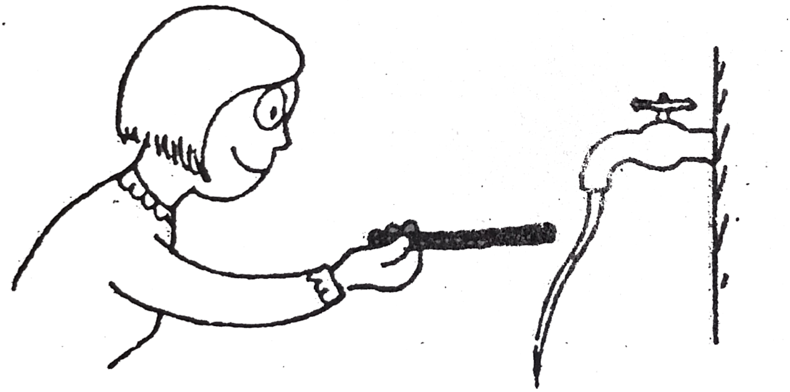
143. In normal cases thin stream of water bends toward a negatively charged rod. When a positively charged rod is placed near the stream, it will bend in the



A. Opposite direction.

B. Same direction.

C. It won't bend at all.

D. Can't be predicted.

Answer: B

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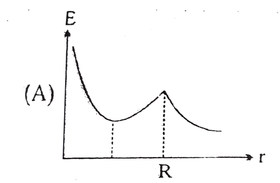
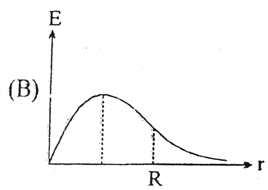
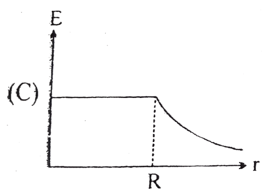
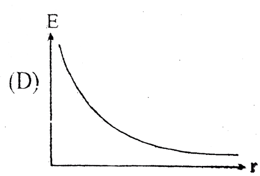
144. A spherical insulator of radius R is charged uniformly with a charge Q throughout its volume and contains a point charge $\frac{Q}{16}$ located at its centre. Which of the following graphs best represent quanlitatively, the variation of electric field intensity E with distance r from the centre.

A. 

B. 

C. 

D. 

Answer: A

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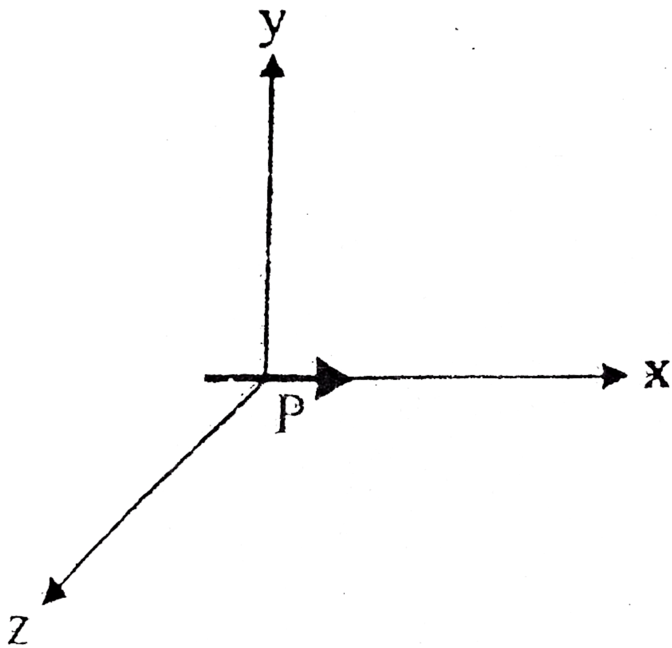
145. A short electric dipole is oriented along x-direction at origin. At which of following point the electric field have no x component.



A. $(1, 1, 0)$

B. $\left(\sqrt{2}, 1, 0\right)$

C. $\left(1, \sqrt{2}, 0\right)$

D. $(1, 0, 0)$

Answer: C

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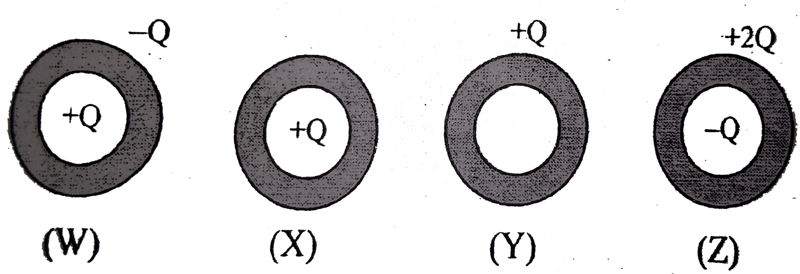
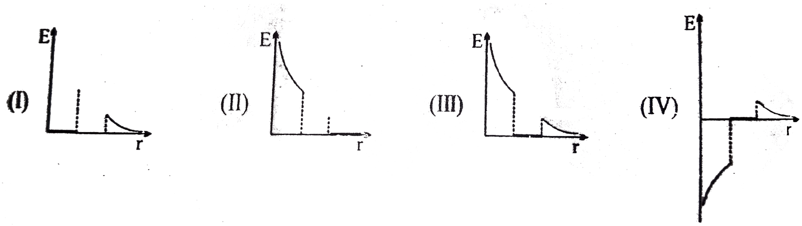


146. Figure shows charged hollow metal spheres (exceptX) each with internal radius a and external radius b Match each charged distribution with the corresponding E- field graph.



A. W-II,X-I,Y-III,Z-IV

B. W-III,X-I,Y-II,Z-IV

C. W-I,X-II,Y-III,Z-IV

D. W-II,X-III,Y-I,Z-IV

Answer: D

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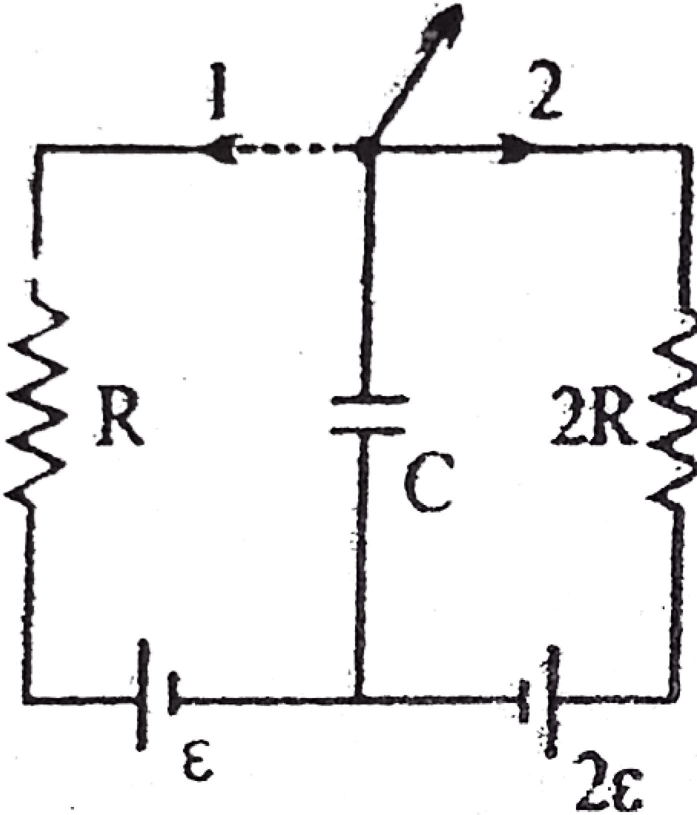
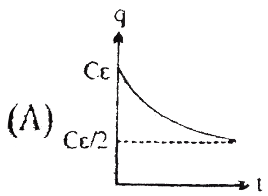
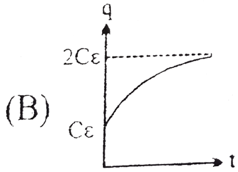
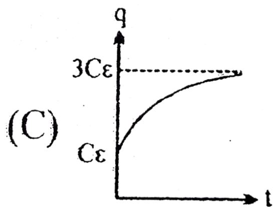
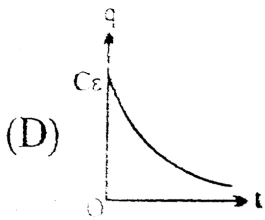
147. In the circuit shown, the switch is shifted from position 1rightarrow 2 at t=0. The switch was initially in position I since a long time. The graph between charge on capacitor C and time 't' is



A. 

B. 

C. 

D. 

Answer: B

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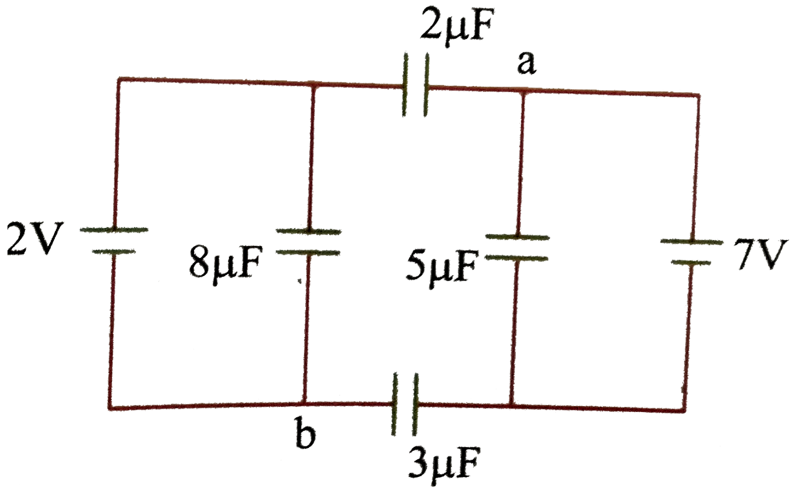
148. Four capacitors and two batteries are connected as shown in the diagram. The $p.d$ between the points a and b is



A. zero

B. 13

C. 17

D. 27

Answer: C

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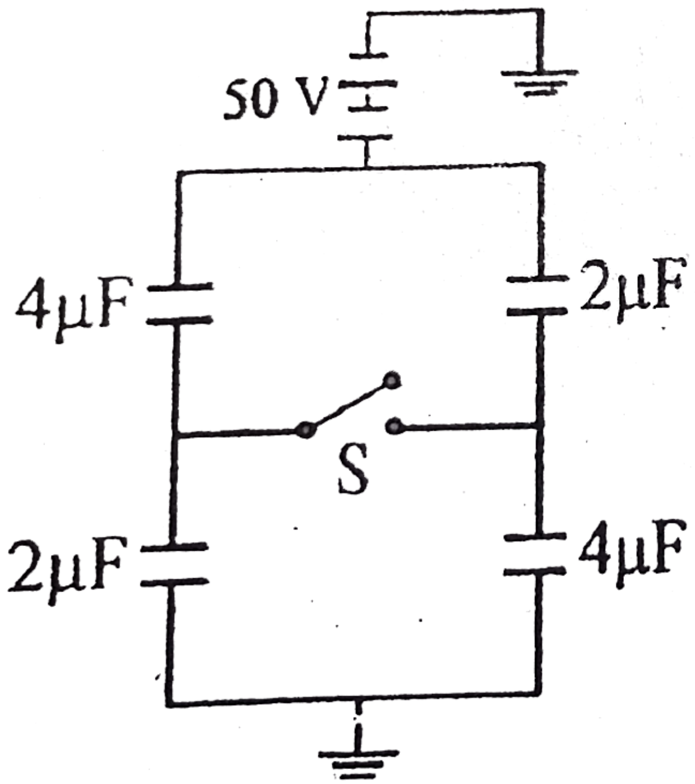
149. The circuit was in the shown state from a long time. Now the switch S is closed. The charged that flows through the switch is



A. $\frac{400}{3}\mu C$

B. $100\mu C$

C. $50\mu C$

D. $\frac{100}{3}\mu C$

Answer: C

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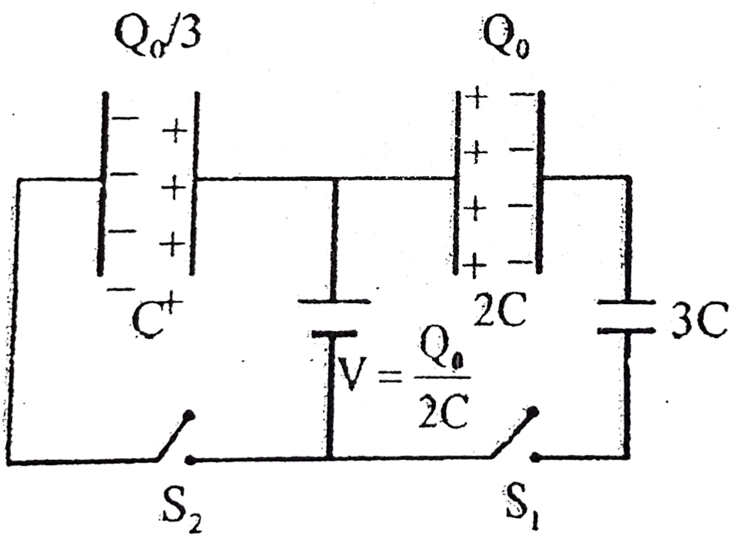
150. In the given circuit, the initial charges on the capacitors are shown in the figure. The charge flown through the switches S_1 and S_2 respectively after closing the switches are



A. $zero \frac{Q_0}{6}$

B. $\frac{Q_0}{5}, \frac{Q_0}{2}$

C. $zero, \frac{Q_0}{2}$

D. $\frac{3}{5}Q_0, \frac{Q_0}{6}$

Answer: A

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151. A $3\mu F$ and a $5\mu F$ capacitor are connected in series across a $30V$ battery. A $7\mu F$ capacitor is then connected in parallel across the $3\mu F$ capacitor. Choose the INCORRECT option :

A. Voltage across $3\mu F$ capacitor before connecting $7\mu F$ capacitor is 18.75V

B. Charge flown through battery after connecting $7\mu F$ capacitor is 43.75 μC

C. $5\mu F$ capacitor and $7\mu F$ capasitor can be said to be in series.

D. After connecting $7\mu F$ capacitor, it has charge of $70\mu C$

Answer: C

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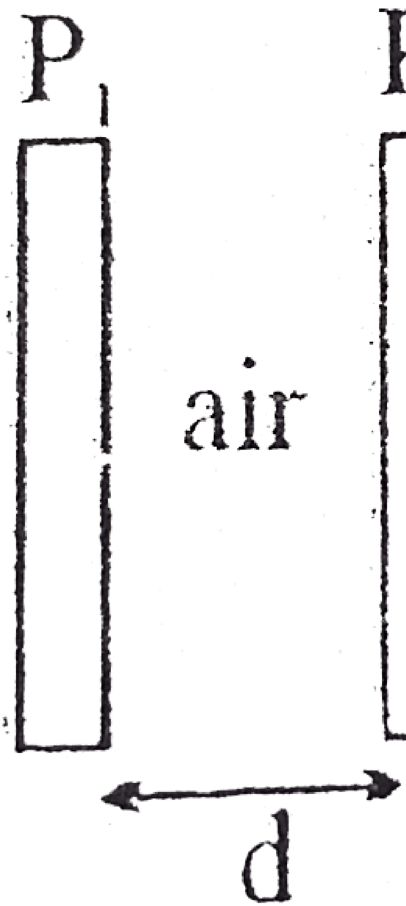
152. Two conducting large plates $P_1 \& P_2$ are placed parallel to each other at very small seperation 'd'. The plate area of either face of plate is A. A charge +2Q is given to plate P_1 & -Q to the plate P_2 (neglect ends effects). If plate $P_1 \& P_2$ are now connected by conducting wire, then total amount of heat produced is



A. $\dfrac{4Q^2d}{3\in_0A}$

B. $\dfrac{9Q^2d}{8\in_0A}$

C. $\dfrac{3Q^2d}{8\in_0A}$

D. None of these

Answer: B

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153. A hollow conducting sphere of inner radius R and outer radius 2R has resistivity $'\rho'$ a function of the distance 'r' from the centre of the sphere: $\rho = kr^2/R$. The inner and outer surfaces are painted with a perfectly conducting 'paint' and a potential difference ΔV is applied between the two surfaces. Then, as 'r' increases from R to 2R, the electric field inside the sphere

A. increases

B. decreases

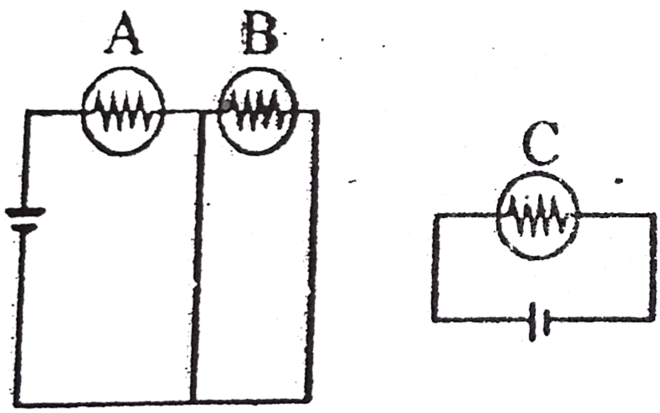
C. remains constant

D. passes through a maximum

Answer: C

View Text Solution

154. In the two circuits shown, all the light bulbs and batteries are identical. If A,B and C repectively denotes the brightness of light bulbs A,B & C then



A. $C \geq A = B$

B. $C \leq A = B$

C. $C = A \geq B$

D. $C = A \leq B$

Answer: C

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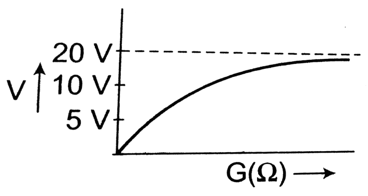
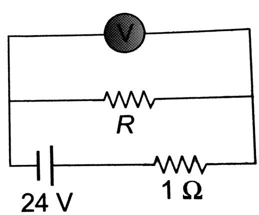
155. A cell of internal resistance is connected across a resistor. A voltemeter having varible resistance G is used to meausre p.d. across resistor. The plot of voltmeter reading V against G is shown. What is value of external resitor R





A. 5Ω

B. 4Ω

C. 3Ω

D. 1Ω

Answer: A

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156. Two scales on a voltmeter measure voltage up to $20.0V$ and $30.0V$. The resistance connected in series with the galvanometer is 1680Ω for the $20.0V$ scale and 2930Ω for the $30.0V$ scale. The resistance of the galvanometer and the full scale current are respectively

A. 320Ω and $8mA$

B. 70Ω and $10mA$

C. 820Ω and $10mA$

D. $0.05mA$

Answer: D

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157. A galvanometer shows a reading of 0.65 mA. When a galvanometer is shunted with a 4Ω resistance, the deflection is reduced to 0.13 mA if the galvanometer is further shunted with a 2Ω wire, the new reading will be (the main current remains the same)

A. $0.60mA$

B. $0.08mA$

C. $0.12mA$

D. $0.05 mA$

Answer: D

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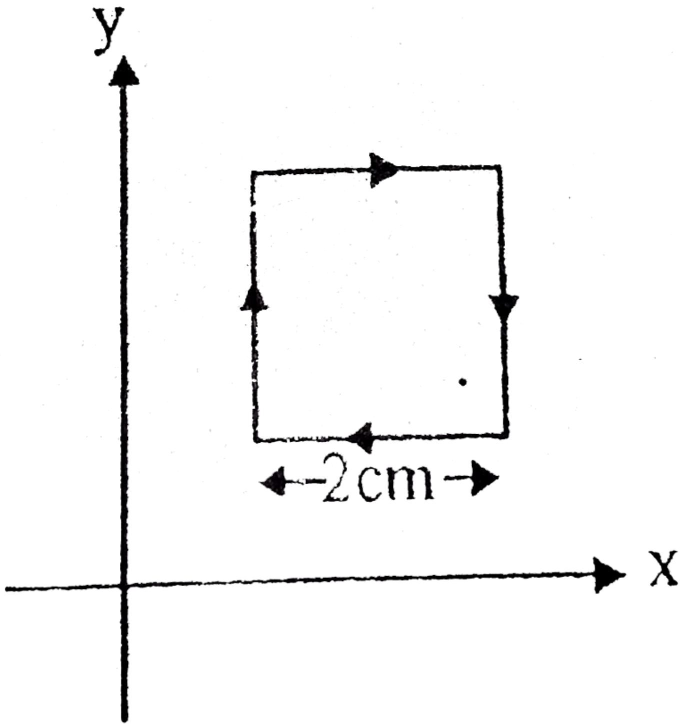
158. A square loop of side 2cm carrying current I_0 is placed in x-y plane in a magnetic field $B = \left(4\hat{i} + 3\hat{j}\right)$ T Find the unit vector along the axis about which it will start rotating.



A. $\dfrac{4\hat{j} + 3\hat{i}}{5}$

B. $\dfrac{-4\hat{j} - 3\hat{i}}{5}$

C. $\dfrac{-4\hat{j} + 3\hat{i}}{5}$

D. $\dfrac{4\hat{j} - 3\hat{i}}{5}$

Answer: C

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159. The resistance of a circular coil is 50 turns & 10cm diameter is 5Ω What must be the potential difference across the ends of the coil so as to multify the horizontal component of the earth's magnetic field $\left[\left(B_H = \pi \times 10^{-5} T\right]\right.$ at the centre of the coil? How should the coil be placed to achieve this result?

A. 0.5 V with plane of coil normal to the magnetic meridian

B. 0.5 V with plane of coil in the magnetic meridian

C. 0.25 V with plane of coil normal to the magnetic meridian

D. 0.25 V with plane of the coil in the magnetic meridian

Answer: C

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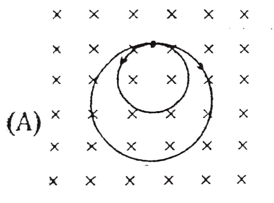
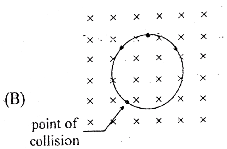
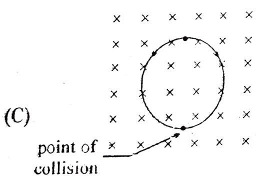
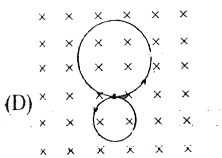
160. A neutral particle at rest in a magnetic field decays into two charged particles of different mass. The energy released goes into their kinetic energy. Then what can be the path of the particles. Neglect any interaction between the two charges.

A. 

B. 

C. 

D. 

Answer: B

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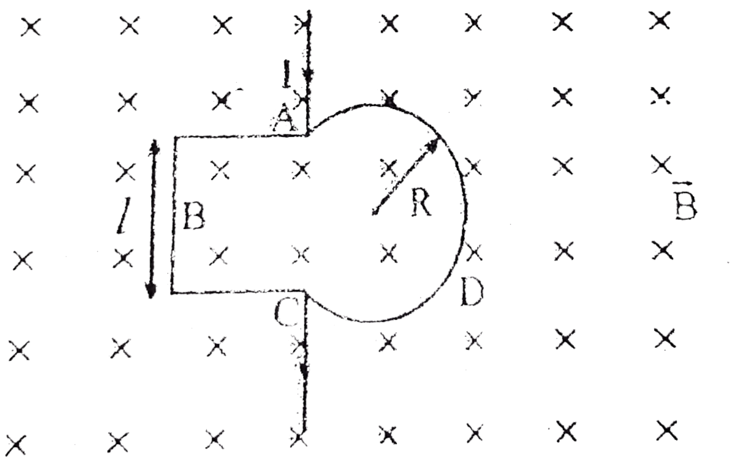
161. The figure shows a conducting loop ABCDA placed in a uniform magnetic field perpendicular to its plane. The part ABC is the $(3/4)^{th}$ portion of the square of side lengthl. The part ADC is a circular are. Of radius R. The points A and C are connected to a battery which supply a current I to the circuit. The magnetic force on the loop due to the field B is



A. zero

B. Bil

C. 2BIR

D. $\dfrac{BI/R}{l+R}$

Answer: B

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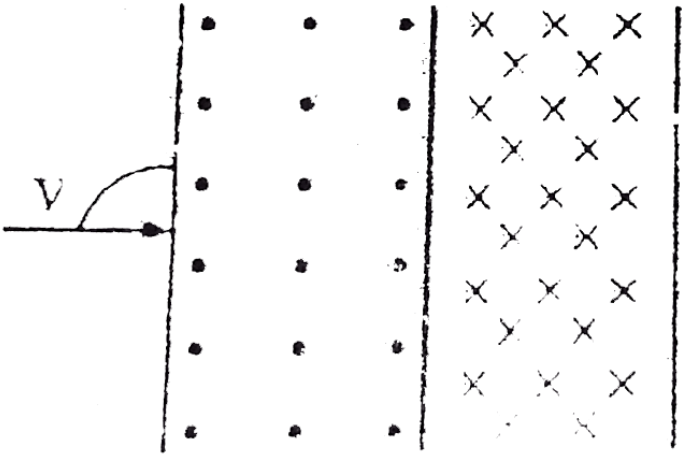
162. The magnetic field shown in the figure consists of two uniform regions. The width of the first part is 5cm and the magnetic induction here is 0.001 T. The width of the other part is also 5cm, with the direction of the induction being opposite in direction and 0.002 T in magnitude. What should be the minimum speed of the electron arriving from the direction indicated in the figure so that it can pass through the magnetic field? Mass of electron $= 9 \times 10^{-31}$kg



A. $\frac{8}{9} \times 10^7 m/s$

B. $\frac{4}{9} \times 10^7 m/s$

C. $\frac{16}{9} \times 10^7 m/s$

D. none

Answer: A

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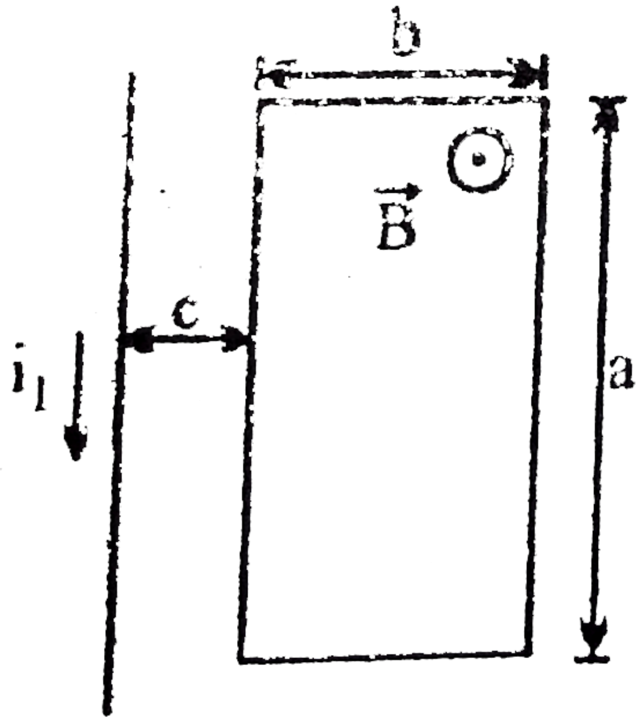
163. The mutual inductance between the rectangular loop and the long straight wire as shown in figure is M.



A. M=Zero

B. $M = \frac{\mu_0 a}{2\pi} In\left(1 + \frac{c}{b}\right)$

C. $M = \frac{\mu_0 b}{2\pi} In\left(\frac{a + c}{b}\right)$

D. $M = \frac{\mu_0 a}{2\pi} In\left(1 + \frac{b}{c}\right)$

Answer: D

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164. Which of the following quantities has the units $Kgm^2 s^{-3} A^{-2}$?

A. Resistance

B. Inductance

C. Capacitance

D. Magnetic flux

Answer: A

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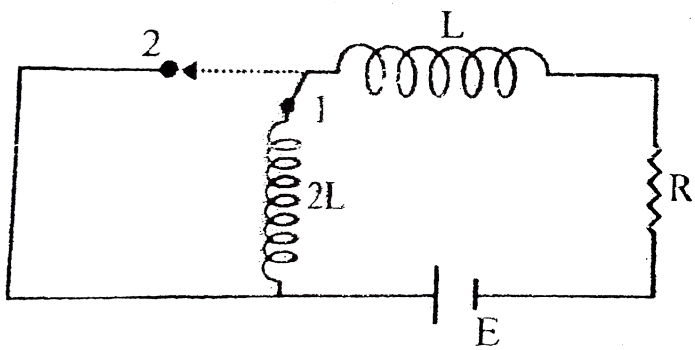
165. In the circuit shown switch is connected to I for a very long time. At a particular instant $t = 0$ switch is shifted to 2, the current in the circuit after a time gap of $\frac{L}{R}$ is



A. $\frac{\varepsilon}{2Re}$

B. $\frac{3\varepsilon}{R}$

C. $\frac{3\varepsilon}{Re}$

D. $\frac{\varepsilon}{R}$

Answer: D

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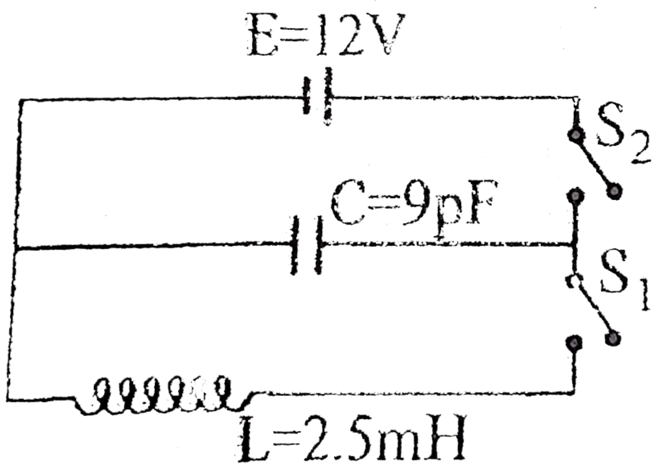
166. In the circuit shown, the capacitor is initially charged with a 12V battery, when switch S_1 is open and switch S_2 is closed. S_1 is then closed and, at the same time, S_2 is opened. The maximum value of current in the circuit is



A. 0.38 mA

B. 0.84 mA

C. 0.72 mA

D. 0.1 mA

Answer: C

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167. After switch S_2 is closed and S_1 is opened, the maximum value of current through the inductor is:

A. $\left(\sqrt{\frac{C}{L}}\right)E$

B. $\left(\sqrt{\frac{C}{2L}}\right)E$

C. $\left(\sqrt{\frac{3C}{2L}}\right)E$

D. $\left(\sqrt{\frac{5C}{4L}}\right)E$

Answer: C

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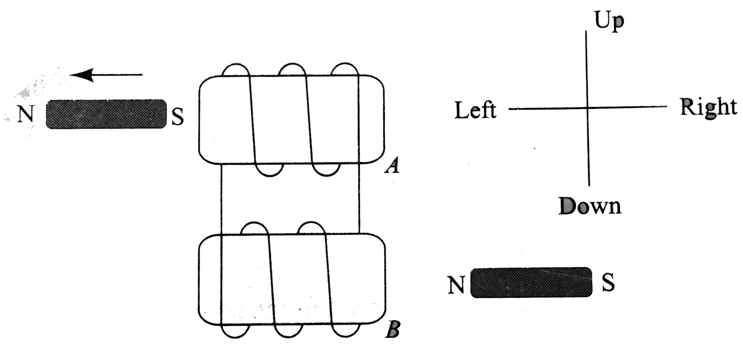
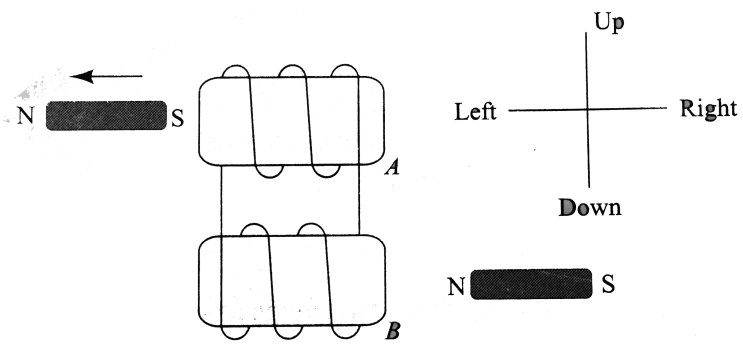
168. A bar magnet was pulled away from a hollow coil A as shows in Fig As the south pole came out of the coil, the bar magnet next to hollow coil B experiened a magnetic force





A. to the right.

B. to the left.

C. upwards.

D. equal to zero.

Answer: A

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169. A coil of inductance $L = 0.2$ H and of resistance $R = 62.8\Omega$ is connected to the mains alternating voltage of frequency 50Hz. What can be the capacitance of the capacitor connected in series with the coil if the useful power has to remain unchanged?

A. $10\mu C$

B. $50\mu C$

C. $25\mu C$

D. $100\mu C$

Answer: C

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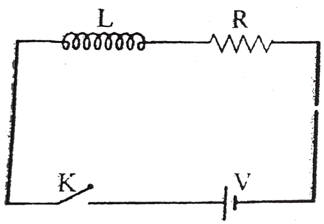
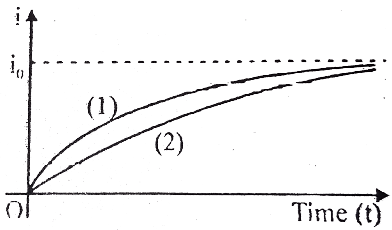
170. Refer to the circuit diagram and the corresponding graphs. The current rises when key K is pressed. With R=R_1 and $L = L_1$ the rise of current is shown by curve(1), while curve(2) shows the rise of current when $R = R_2$ and $L = L_2$. The maximum current is same for both curves, then:





A. $R_1 = R_2, L_1 > L_2$

B. $R_1 > R_2, L_1 = L_2$

C. $R_1 > R_2, L_1 < L_2$

D. $R_1 = R_2, L_1 < L_2$

Answer: D

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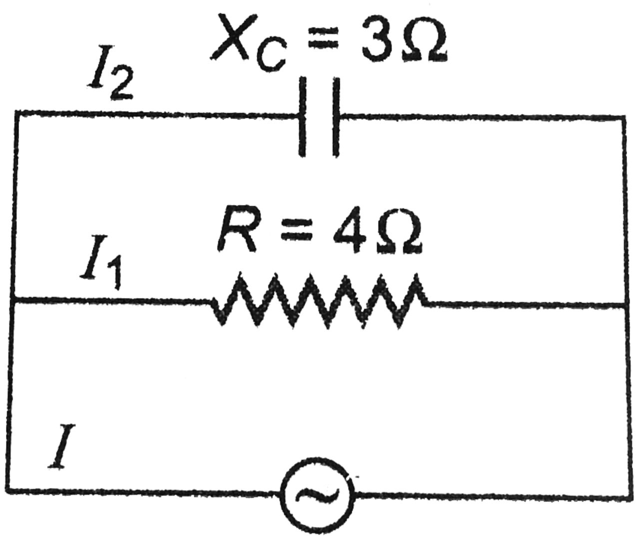
171. A capacitor and resistor are connected with an AC source as shown in figureure. Reactance of capacitor is $X_C = 3\Omega$ and resistance of resistor is 4Ω. Phase difference between current I and $I_1 is \left[\tan^{-1}\left(\frac{3}{4}\right) = 37°\right]$



A. 90°

B. zero

C. 53°

D. 37°

Answer: C

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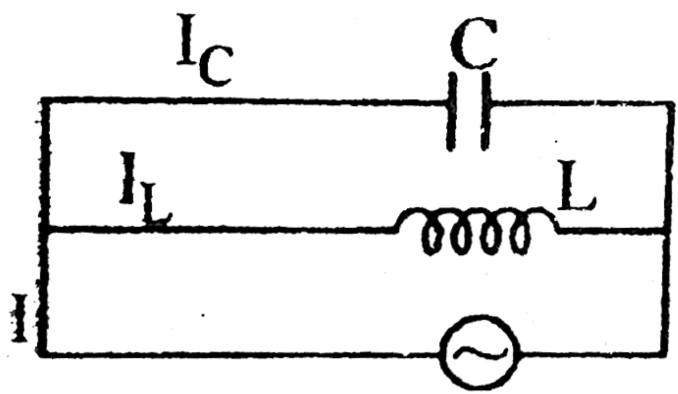
172. In the figure if $I_L = 0.8A, I_C = 0.6A$, then I=?



A. 0.4 A

B. 0.2 A

C. 1.0 A

D. 1.4 A

Answer: B

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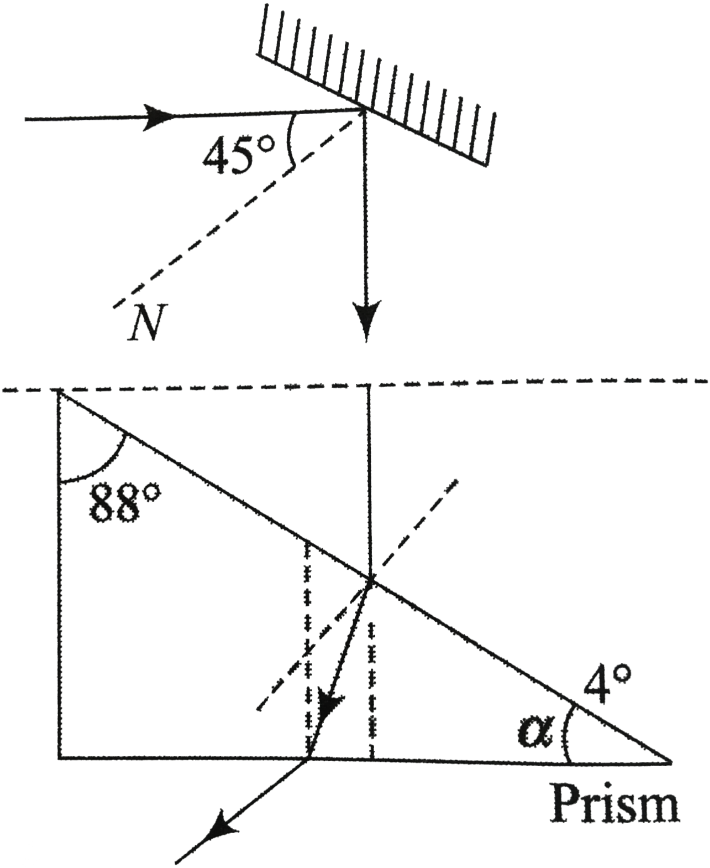
173. A ray of light strikes a plane mirror at an angle of incidence 45° as shown in Figure . After reflection,l the ray passes through a prism of refractive indes 1.5 whos apex angle is 4°. Through what angle must the mirror be rotated it total deviation of the ray be $90°$?



A. $1°$ clockwise

B. $1°$ anticlockwise

C. $2°$ clockwise

D. $2°$ anticlockwise

Answer: B

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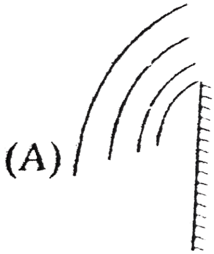
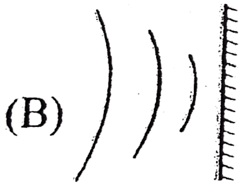
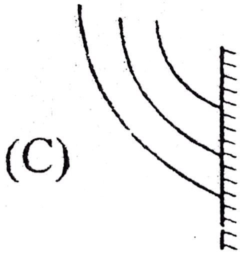
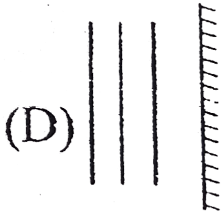
174. Spherical wave fronts shown in figure,strike a plane mirror .reflected

A. 

B. 

C. 

D. 

Answer: C

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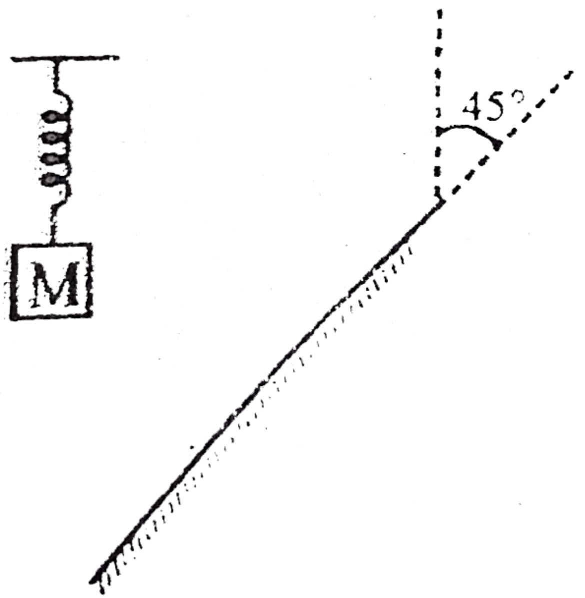
175. An insect of negligible mass is sitting on a block of mass M, tied with a spring of force constant K. The block performs simple harmonic motion with amplitude A infront of a plane mirror placed as shown. The maximum speed of insect relative to its image will be



A. $A\sqrt{\frac{K}{M}}$

B. $\frac{A}{\sqrt{2}}\sqrt{\frac{K}{M}}$

C. $A\sqrt{2}\sqrt{\frac{K}{M}}$

D. $A\sqrt{\frac{M}{K}}$

Answer: C

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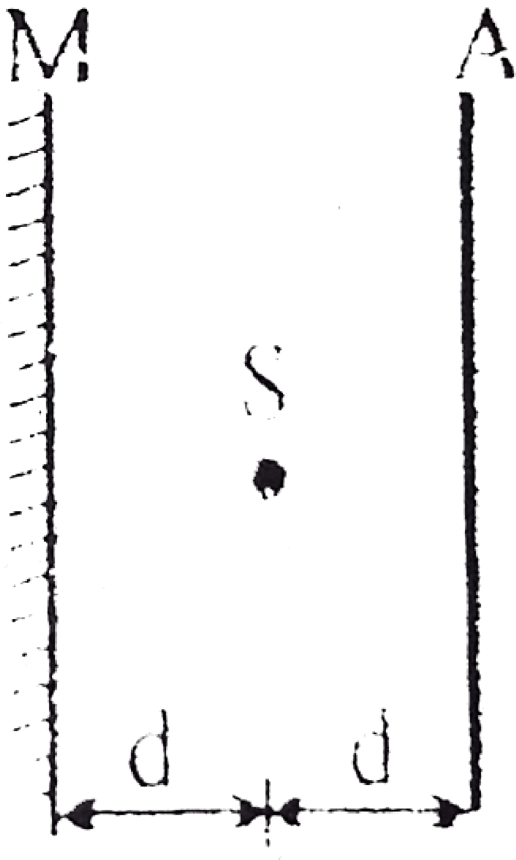
176. A point source of light 'S' at a distance d from the screen A produces light intensity I_0 at the centre of the screen. If a completely reflecting mirror M is placed at a distance d behind the source as shown in the figure, find the intensity at the centre of the screen



A. $\frac{9}{10}I_0$

B. $\frac{10}{9}I_0$

C. $\frac{8}{9}I_0$

D. $\frac{9}{8}I_0$

Answer: B

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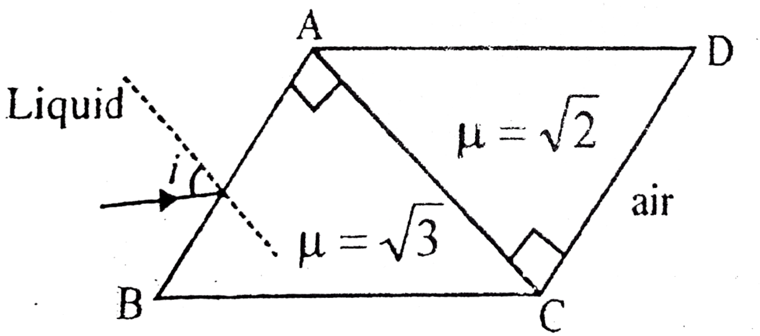
177. A ray light from a liquid $(\mu = \sqrt{3})$ is incident on a system of two right angled prism of refractive indices $\sqrt{3}$ and $\sqrt{2}$ as shown. The ray suffers zero deviation when emerges into air from CD. The angle of incidence I is



A. 45°

B. 35°

C. 20°

D. 10°

Answer: A

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178. The x-z plane separates two media A and B of refractive indices $\mu_1 = 1.5$ and $\mu_2 = 2$. A ray of light travels from A to B. Its directions in the two media are given by unit vectors $u_1 = a\hat{i} + b\hat{j}$ and $u_2 = c\hat{i} + a\hat{j}$. Then

A. $\frac{a}{c} = \frac{4}{3}$

B. $\frac{a}{c} = \frac{3}{4}$

C. $\frac{b}{d} = \frac{4}{3}$

D. $\frac{b}{d} = \frac{3}{4}$

Answer: A

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179. A vessel is quarter filled with a liquid of refractive index μ. The remaining parts of the vessel is filled with an immiscible liquid of refractive index $3\mu/2$. The apparent depth of the vessel is 50% of the actual depth. The value of mu is

A. 1

B. $3/2$

C. $2/3$

D. $4/3$

Answer: B

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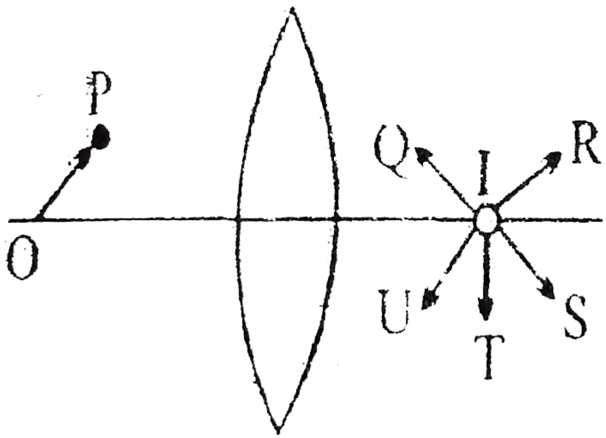
180. A point object O moves from the principal axis of a converging lens in a direction OP. I is the image of O, will move initially in the direction



A. 1Q

B. 1R

C. IS

D. IU

Answer: C

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181. Two point sources P and Q are 24cm apart. Where should a convex lens of focal length 9cm be placed in between them so that the images of both sources are formed at the same place?

A. 3cm fromP

B. 15cmfrom Q

C. 9cm from Q

D. 18 cm from P

Answer: D

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182. An object was placed upright 25cm in front of a converging lens with a focal length of 20cm. A concave mirror with a focal length of 15cm was placed 120cm behind the lens. Which of these describes the final image?

A. real, enlarged

B. virtual, upright

C. virtual, inverted

D. inverted, diminished

Answer: A

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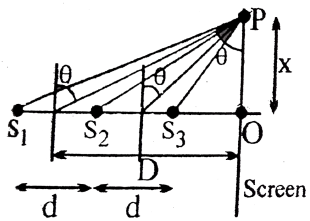
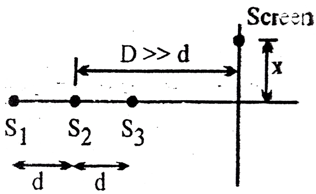
183. Three coherent point sources S_1, S_2 and S_3 are placed on a line perpendicular to the screen as shown in the figure. The wavelength of the light emitted by the sources is lambda. The distance between adjacent sources is $d = 3\lambda$ The distance of S_2 from the screen is D($>$ $>$ λ). Find the minimum (non zero) distance x of a point P on the screen at which complete darkness is obtained.





A. $\frac{2\sqrt{2}D}{7}$

B. $\sqrt{(17)}\frac{D}{8}$

C. $4\sqrt{5}D$

D. $\frac{4\sqrt{2}D}{7}$

Answer: B

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184. A thin perfectly transparent glass sheet of thickness t and refractive index mu is pasted on one of the two identical slits. If the intensity of light at the centre of the screen is I_0 in the absence of glass sheet, the intensity at O as a function of thickness of the glass plate is

A. $I_0\cos\left(\frac{\mu t}{\lambda}\right)$

B. $I_0\cos^2\left(\frac{\mu t}{\lambda}\right)$

C. $I_0\cos^2\left(\frac{\pi(\mu - I)t}{\lambda}\right)$

D. $I_0\cos\left(\frac{\pi(\mu - I)t}{\lambda}\right)$

Answer: C

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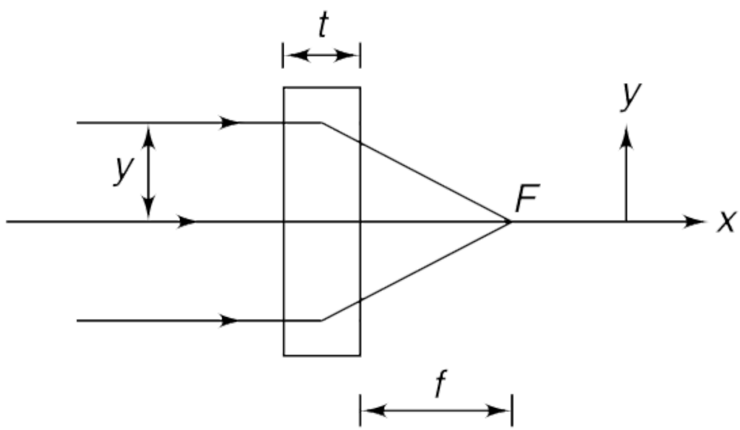
185. A parallel beam of light travelling in x direction is incident on a glass slab of thickness t. The refractive index of the slab changes with y as $\mu = \mu_0\left(1 - \frac{y^2}{y_0^2}\right)$ where μ_0 is the refractive index along x axis and y_0 is a constant. The light beam gets focused at a point F on the x axis. By using the concept of optical path length calculate the focal length f. Assume $f >> t$ and consider y to be small.



A. $Z_0^2/\left(2\mu_0 t\right)$

B. $Z_0^2/\left(\mu_0 t\right)$

C. $\mu_0 Z_0^2/(2t)$

D. None

Answer: A

Watch Video Solution

186. In a regular YDSE, when thin film of refractive index mu is placed in front of the upper slit then it is observed that the intensity at the central point becomes half of the original intensity. It is also observed that the initial 3^(rd) maxima is now below the central point and the initial 4^{th} minima is above the central point. Now, a film of refractive index μ_1 and thickness same as the above film. is put in the front of the lower slit also. It is observed that whole fringe pattern shifts by one fringe width. What is the value of μ_1 ?

A. $(4\mu + 9)/12$

B. $(4\mu + 9)/13$

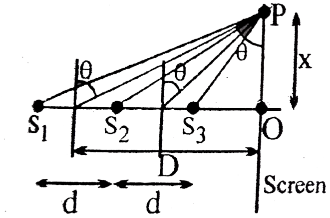
C. $(4\mu + 9)/11$

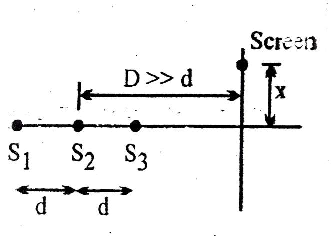
D. None

Answer: B

Watch Video Solution

187. Three coherent point sources S_1, S_2 and S_3 are placed on a line perpendicular to the screen as shown in the figure. The wavelength of the light emitted by the sources is lambda. The distance between adjacent sources is $d = 3\lambda$ The distance of S_2 from the screen is D($>$ $>$ λ). Find the minimum (non zero) distance x of a point P on the screen at which complete darkness is obtained.





A. $\frac{2\sqrt{2}D}{7}$

B. $\frac{\sqrt{(17)D}}{8}$

C. $4\sqrt{5}D$

D. $\frac{4\sqrt{2}D}{7}$

Answer: B

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188. In Young's double slit experiment the y-coordinates of central maxima and 10th maxima are $2cm$ and $5cm$ respectively.

When the YDSE apparatus is immersed in a liquid of refractive index 1.5 the corresponding y-coordintates will be

A. $2cm, 7, 5cm$

B. $3cm, 6cm$

C. $\frac{4}{3}cm, \frac{10}{3}cm$

D. $2cm, 4cm$

Answer: D

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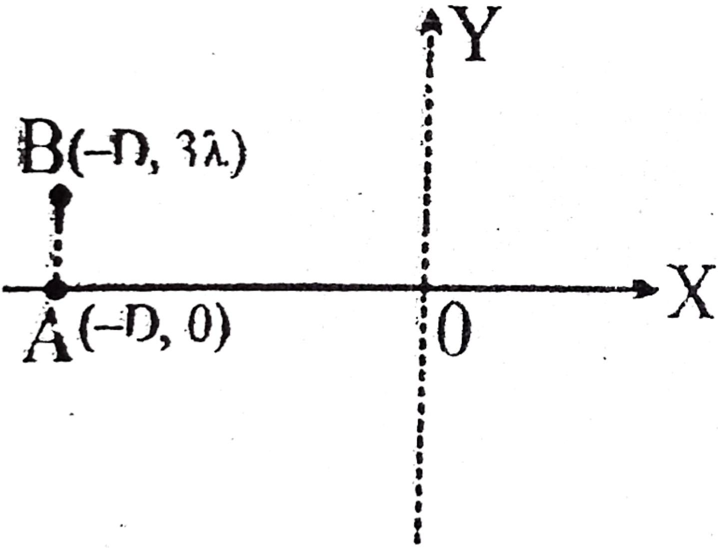
189. Two coherent sources A & B emitting light of wavelength lambda are placed at position (-D,0) and $(-D, 3\lambda)$ respectively Here D $> > \lambda$ The number of minima on y-axis and maxima on x-axis respectively are



A. 6,5

B. 5,6

C. 4,3

D. 3,4

Answer: A

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190. If light of wavelength of maximum intensity emitted from surface at temperature T_1 Is used to cause photoelectric emission from a metallic surface, the maximum kinetic energy of the amitted electron is 6 ev, which is 3 time the work function of the metallic surface. If light of wavelength of maximum intensity emitted from a surface at temperature $T_2\left(T_2 = 2T_1\right)$ is used, the maximum kinetic energy of the photoelectrons emitted is

A. 2 eV

B. 4 eV

C. 14 eV

D. 18 eV

Answer: C

Watch Video Solution

191. The half lives of a radioactive sample are 30 years and 60 years from α- emission and β- emission respectively If the sample decays both by alpha-emission and β-emission simultaneously, the time after which, only one-fourth of the sample remain is

A. 10 years

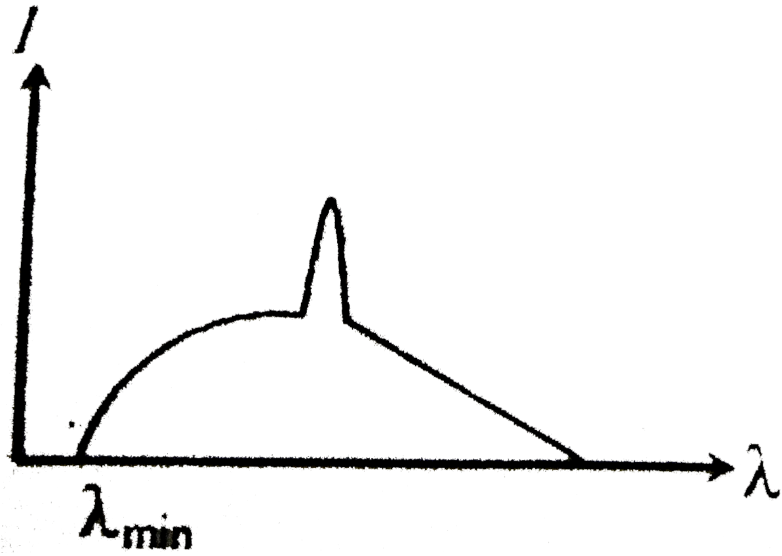
B. 20 years

C. 40 years

D. 45 years

Answer: C

Watch Video Solution

192. 

An X-ray tube has three main controls.

(i). The target material (its atomic number Z)

(ii). The filament current $\left(I_f\right)$ and

(iii). The accelerating voltage (V)

Figure shown a typical intensity distribution against wavelength

which of the following si incorrect?

A. The limit $\lambda_{\min}$ is proportional to V^{-1}

B. The sharp peak shifts to the right as Z in increased

C. The penetrating power of X ray increases if V increased

D. The intensity everywhere increases if filament current I_f is increased

Answer: B

Watch Video Solution

193. During negative B decay, an anti- neutrino is also emmited along with the ejected electron. Then

A. only linear momentum will be conserved

B. total linear momentum and total angular momentum but not total energy will be conserved

C. total linear momentum and total energy but not total energy but not total angular momentum will be conserved

D. total linear momentum, total angular momentum and total energy will be conserved

Answer: D

Watch Video Solution

194. Which of the following statement is correct in connection with hydrogen spectrum

A. The longest wavelength in the Balmer series is longer than the longest wavelength in Lyman series

B. The shortest wavelength in the Balmer series is shorter then the shortest wavelength in the Lyman series

C. The longest wavelength in both Balmer and Lyman series are equal

D. The longest wavelength in Balmer series is shorter than the longest wavelength in the Lyman series.

Answer: A

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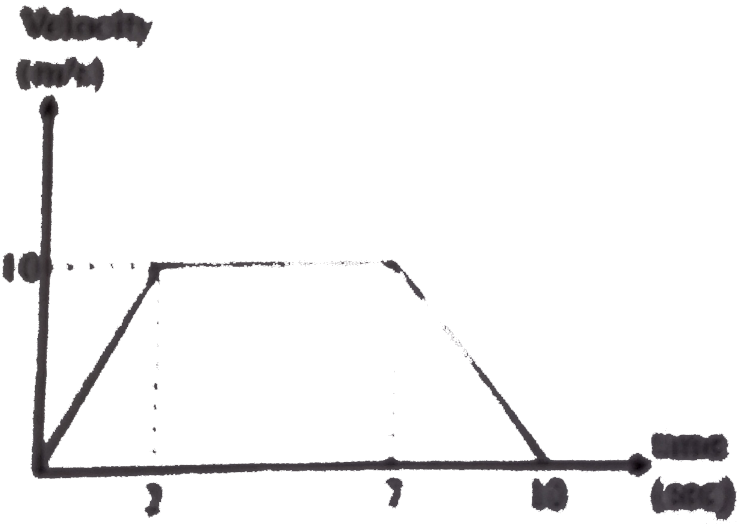
Comphrehension

1. The velocity- time graph of car moving on a straight track is given below. The car weight 1000kg.



The distance travelled by the car during the whole motion is:

A. 50m

B. 75m

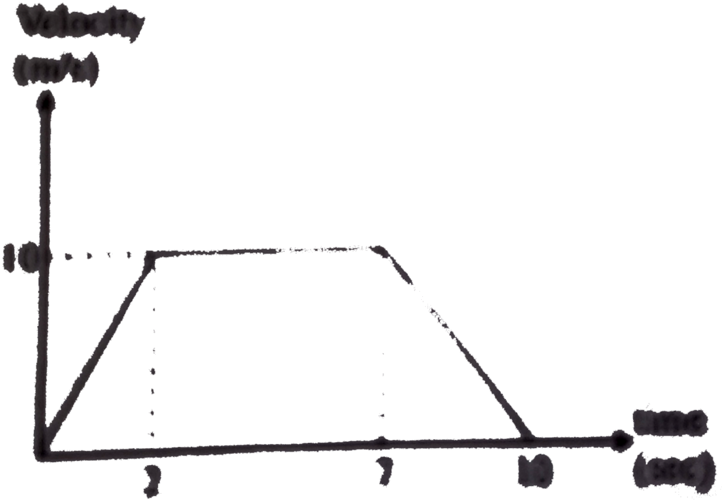
C. 100m

D. 150m

Answer: B

Watch Video Solution

2. The velocity- time graph of car moving on a straight track is given below. The car weight 1000kg.



The braking force rewquired to boring the car to a stop with in one second from the maximum speed is:

A. $\frac{10000}{3} N$

B. $5000 N$

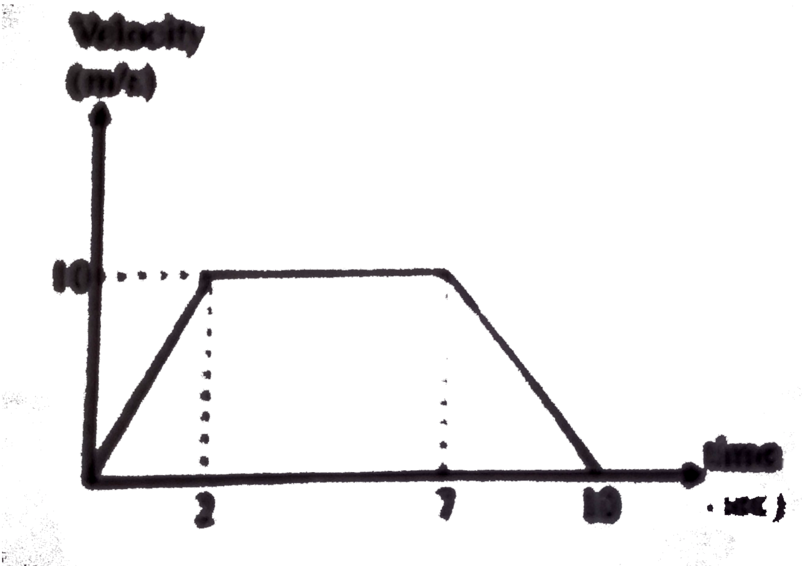
C. $10000 N$

D. $\frac{5000}{3} N$

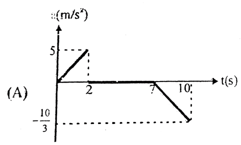
Answer: C

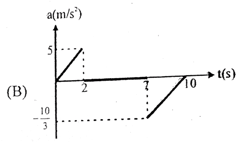
Watch Video Solution

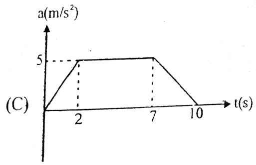
3. The velocity- time graph of car moving on a straight track is given below. The car weight 1000kg.

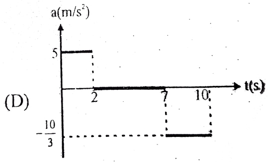


correct acceleration-time graph representing the motion of car is:

A. 

B. 

C. 

D. 

Answer: D

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4. To find the speed of a river's current, boatman decides to carry out the following experiment. He drops a wooden bucket into the water and himself sets off downstream, rowing along the flow of river. After 40 min, he reaches a point A, 1km from his starting-point and turns back. After travelling some distance upstream, he picks up the bucket, turns round again and, rowing downstram once more, reaches A for the second time 24 min later (after picking the bucket). Assuming that the speeds of both current and boat (w.r.t. river) are constant, and also that no time is wasted on turning round. How long does the boatman spend on rowing upstream to meet the bucket?

A. 24min

B. 40 min

C. 84 min

D. 16 min

Answer: B

Watch Video Solution

5. To find the speed of a river's current, boatman decides to carry out the following experiment. He drops a wooden bucket into the water and himself sets off downstream, rowing along the flow of river. After 40 min, he reaches a point A, 1km from his starting-point and turns back. After travelling some distance upstream, he picks up the bucket, turns round again and, rowing downstram once more, reaches A for the second time 24 min later (after picking the bucket). Assuming that the speeds of both current and boat (w.r.t. river) are constant, and also that no time is wasted on turning round. What is the speed of the current?

A. $1 km/hr$

B. $\frac{4}{3} km/hr$

C. $\frac{3}{4} km/hr$

D. $\frac{3}{10} km/hr$

Answer: D

Watch Video Solution

6. To find the speed of a river's current, boatman decides to carry out the following experiment. He drops a wooden bucket into the water and himself sets off downstream, rowing along the flow of river. After 40 min, he reaches a point A, 1km from his starting-point and turns back. After travelling some distance upstream, he picks up the bucket, turns round again and, rowing downstram once more, reaches A for the second time 24 min later (after picking the bucket). Assuming that the speeds of both current and boat (w.r.t. river) are constant, and also that no time is wasted on turning round. What is the boat's speed relative to the water?

A. $1.2km/hr$

B. $1 km / hr$

C. $0.75 km / hr$

D. None of these

Answer: A

Watch Video Solution

7. Friction is a force that aids us daily, in fact so much so that we don't even pause to appreciate its important. We would not be able to wear pants or jeans without friction. We would have to live like aborigines in the jungle. The shirt is supported at our shoulders. But if we stand up the weight of our jeans is to be supported by a verticle force. The surface of our shoulders. But if we stand up the weight of our jeans is to be supported by a vertical cylinder. The force of friction acting between this curved surface and jeans balances the weight of the jeans. To understand this mathematically, let us consider a verticle man whose waist is a rigid cylinder having a circumference of 90 cm. He wears a jeans of mass 500 gm using an elastic massless belt which can be assumed to be on elastic string of forc e constant $500N/m$ and circumference 85cm when not extended. The coefficient of friction between waist and jeans is 0.5. What is the net normal force exerted by the jeans on the man?

A. 25 N

B. 10 N

C. 12.5 N

D. 0

Answer: D

Watch Video Solution

8. Friction is a force that aids us daily, in fact so much so that we don't even pause to appreciate its important. We would not be able to wear pants or jeans without friction. We would have to live like aborigines in the jungle. The shirt is supported at our shoulders. But if we stand up the weight of our jeans is to be supported by a verticle force. The surface of our shoulders. But if we stand up the weight of our jeans is to be supported by a vertical cylinder. The force of friction acting between this curved surface and jeans balances the weight of the jeans. To understand this mathematically, let us consider a verticle man whose waist is a rigid cylinder having a circumference of 90 cm. He wears a jeans of mass 500 gm using an elastic massless belt which can be assumed to be on elastic string of forc e constant $500N/m$ and circumference 85cm when not extended. The coefficient of friction between waist and jeans is 0.5. What is the friction force acting between the man's waist and jeans?

A. 5 N

B. $12.5N$

C. $7.5N$

D. 25 N

Answer: A

Watch Video Solution

9. Friction is a force that aids us daily, in fact so much so that we don't even pause to appreciate its important. We would not be able to wear pants or jeans without friction. We would have to live like aborigines in the jungle. The shirt is supported at our shoulders. But if we stand up the weight of our jeans is to be supported by a verticle force. The surface of our shoulders. But if we stand up the weight of our jeans is to be supported by a vertical cylinder. The force of friction acting between this curved surface and jeans balances the weight of the jeans. To understand this mathematically, let us consider a verticle man whose waist is a rigid cylinder having a circumference of 90 cm. He wears a jeans of mass 500 gm using an elastic massless belt which can be assumed to be on elastic string of forc e constant $500N/m$ and circumference 85cm when not extended. The coefficient of friction between waist and jeans is 0.5. When the man stands in an elevator going up with a high acceleration, his jeans start sliding down. What can be the minimum acceleration of the elevator?

A. $147m/s^2$

B. $288m/s^2$

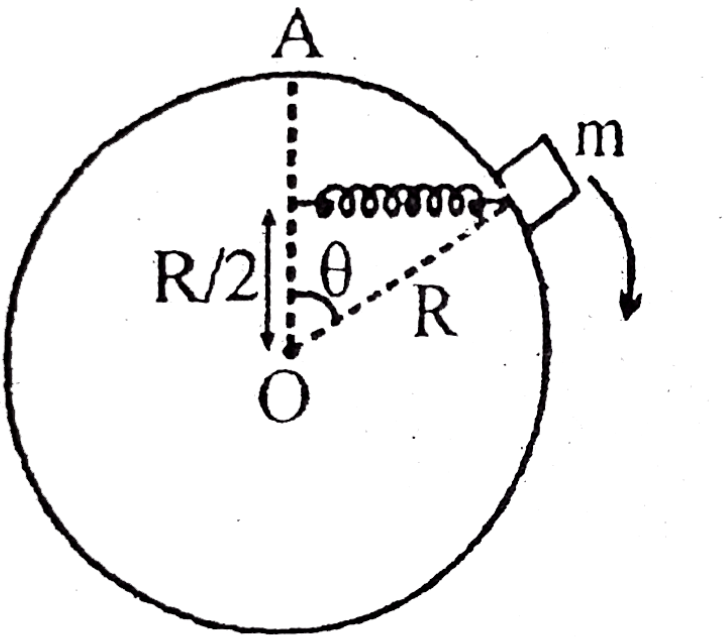
C. $87m/s^2$

D. $24m/s^2$

Answer: A

Watch Video Solution

10. A small block of mass m, can move without friction on the outside of a fixed vertical circular track of radiusR. The block is attached to a spring of natural length $R/2$ and spring constant K. The other end of spring is connected to a point at height $R/2$ directly above the centre of track.



If the block is released from rest when the spring is in horizontal state (see figure) then at that moment,

A. tangential acceleration is g $\frac{\sqrt{3}}{2} - \frac{kR}{4m}\left(\sqrt{3} - 1\right)$

B. radial acceleration is $\frac{g}{2} + \frac{kR\sqrt{3}}{4m}\left(\sqrt{3} - 1\right)$

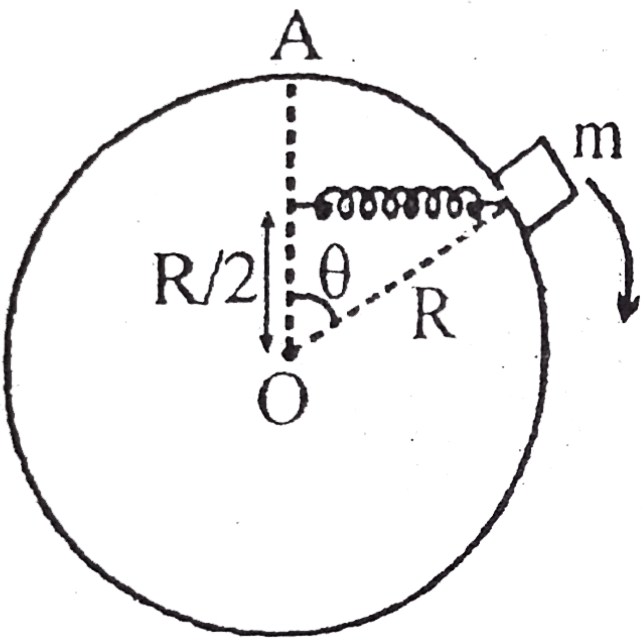
C. tangential acceleration is $\frac{g}{2} - \frac{kR\sqrt{3}}{4m}\left(\sqrt{3} - 1\right)$

D. radial acceleration is $g\frac{\sqrt{3}}{2} - \frac{kR}{4m}\left(\sqrt{3} - 1\right)$

Answer: A

Watch Video Solution

11. A small block of mass m, can move without friction on the outside of a fixed vertical circular track of radiusR. The block is attached to a spring of natural length $R/2$ and spring constant K. The other end of spring is connected to a point at height $R/2$ directly above the centre of track.



Consider block to be at rest at top most point A of track. If the block is slowly pushed from rest at the highest A. When the spring reaches in horizontal state, then.

A. Spring potential energy is $\left(\frac{3kR^2}{4}\right)\left(2 - \sqrt{3}\right)$

B. Spring potential energy is $\left(\frac{kR^2}{8}\right)\left(\sqrt{3} - 1\right)^2$

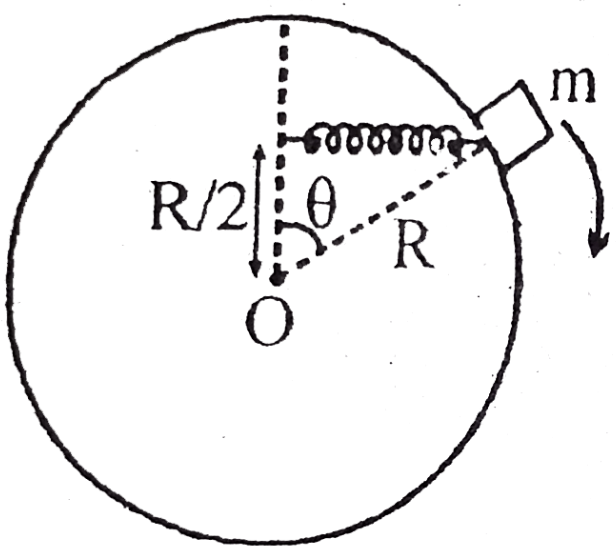
C. Gravitational potential energy (taking $U = 0 at \theta = 0$) is $\left(\frac{mgR}{2}\right)$

D. Gravitational potential energy (taking $U = 0 at \theta = 0$) is $\left(\frac{3mgR}{8}\right)$

Answer: B

Watch Video Solution

12. A small block of mass m, can move without friction on the outside of a fixed vertical circular track of radiusR. The block is attached to a spring of natural length $R/2$ and spring constant K. The other end of spring is connected to a point at height $R/2$ directly above the centre of track.



If the complete stup is in a gravity free space, then the minimum speed (v_(0)) required at the highest point A to just reach the lowest point is

A. $2R\sqrt{\frac{k}{m}}$

B. $\frac{3R}{2}\sqrt{\frac{k}{m}}$

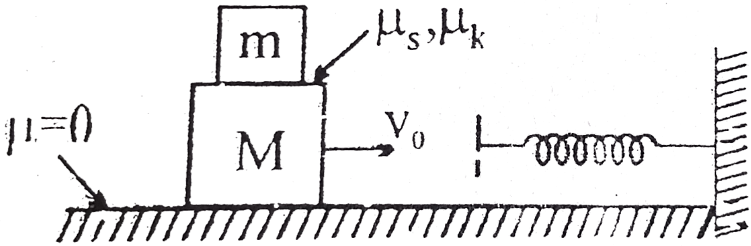
C. $R\sqrt{\frac{k}{m}}$

D. Motion not possible in gravity free space.

Answer: C

Watch Video Solution

13. A block of mass M slides on a frictionless surface with an initial speed of v_0 On top of block is a small box of mass m. the coefficients of friction between box and block are μ_6 and μ_k. The sliding block encounters and ideal spring with force constant K. Answer following questions.



Assuming no relative motion between box and block what is the maximum possible acceleration of block and box at the instant of maximum compression?

A. $\mu_s g$

B. $\frac{\mu_s M g}{m}$

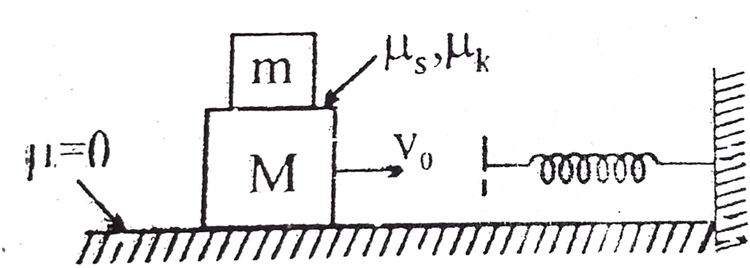
C. $\frac{\mu_s (M+m) g}{m}$

D. $\frac{\mu_s m g}{M}$

Answer: A

Watch Video Solution

14. A block of mass M slides on a frictionless surface with an initial speed of v_0 On top of block is a small box of mass m. the coefficients of friction between box and block are μ_6 and μ_k. The sliding block encounters and ideal spring with force constant K. Answer following questions. What is maximum value of k for which it remains true that box does not slide?



A. $\left(\frac{\mu_s g}{v_0}\right)^2 \frac{M}{(M+m)}$

B. $\left(\frac{\mu_s g}{v_0}\right)^2 (M+m)$

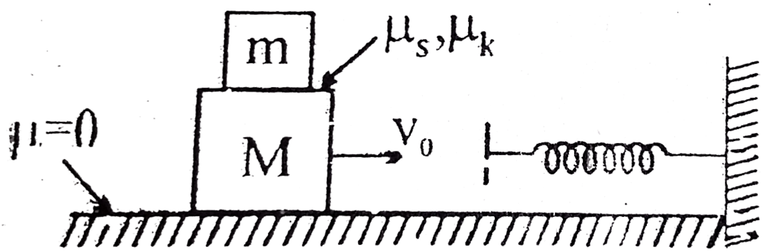
C. $\left(\frac{\mu_s g}{2v_0}\right)^2 \frac{(M+m)^2}{M}$

D. None of these

Answer: B

Watch Video Solution

15. A block of mass M slides on a frictionless surface with an initial speed of v_0 On top of block is a small box of mass m. the coefficients of friction between box and block are μ_6 and μ_k. The sliding block encounters and ideal spring with force constant K. Answer following questions. Suppose the value of k is just slightly greater then the value found in previous question, so that the box begins to slide just as the spring reaches maximum compression. The acceleration of box and block are repectively.



A. $a_{\text{Box}} = \mu_k g, a_{Block} = \dfrac{m\left(\mu_s - \mu_k\right) + \mu_s M}{M} g$

B. $a_{\text{Box}} = \left(\mu_s - \mu_k\right) g, a_{Block} = \left(\mu_s - \mu_k\right) \dfrac{mg}{M}$

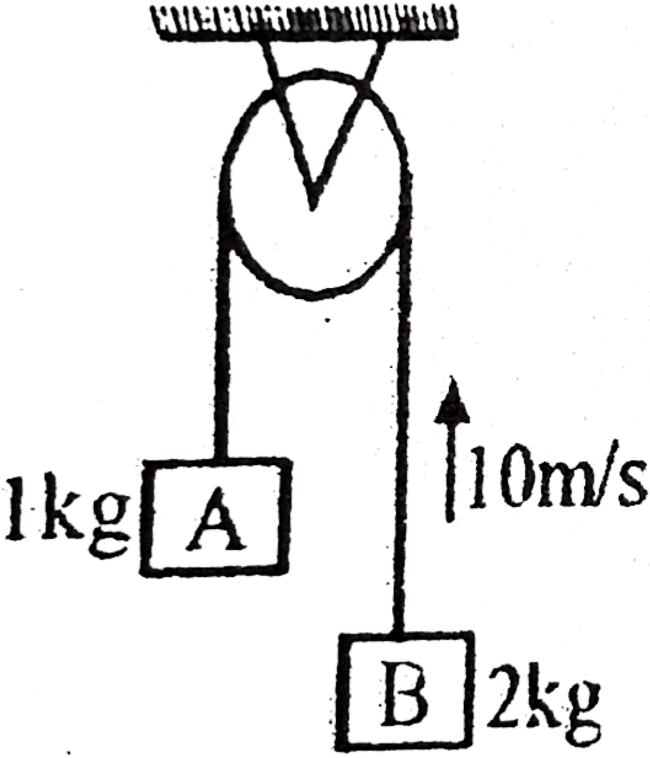
C. $a_{\text{Box}} = \mu_k g, a_{Block} = \left(\mu_s - \mu_k\right) \dfrac{mg}{M}$

D. None of these

Answer: A

Watch Video Solution

16. Two block of A and B of mass 1kg and 2kg are hung from light pulley. Initially the block B is held stationary. At $t = 0$ block B is given velocity 10m//s in upward direction. String and pulley are light and there is no friction anywhere.



Time till which acceleration (magnitude and direction both) of the two block ramains same

A. $\frac{1}{2}$ sec

B. 1 sec

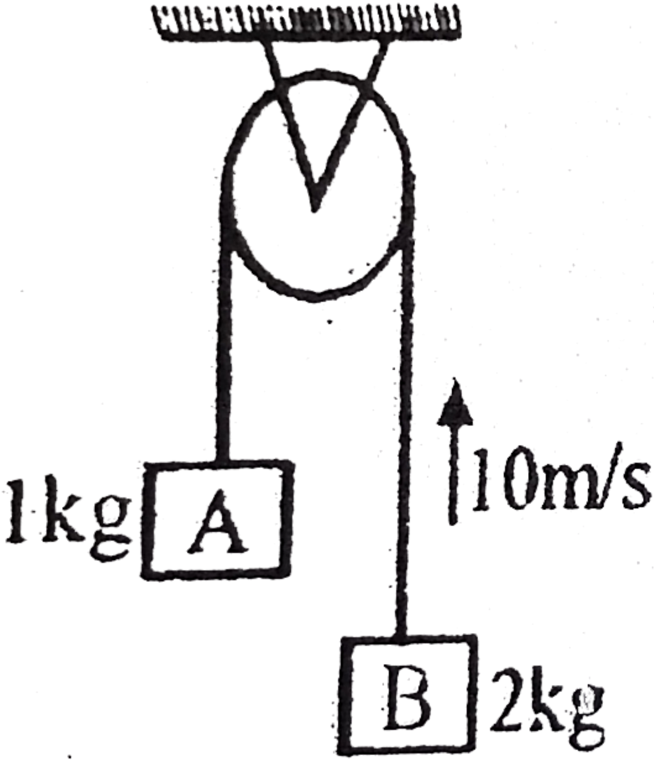
C. 2 sec

D. Acceleration of the blocks always remains same.

Answer: B

Watch Video Solution

17. Two block of A and B of mass 1kg and 2kg are hung from light pulley. Initially the block B is held stationary. At $t = 0$ block B is given velocity 10m//s in upward direction. String and pulley are light and there is no friction anywhere.



Velocity of block 'B' as block 'A' has acended by distance 5m from its original position

A. $10\sqrt{7}m/s$

B. $\frac{10}{3}\sqrt{2}m/s$

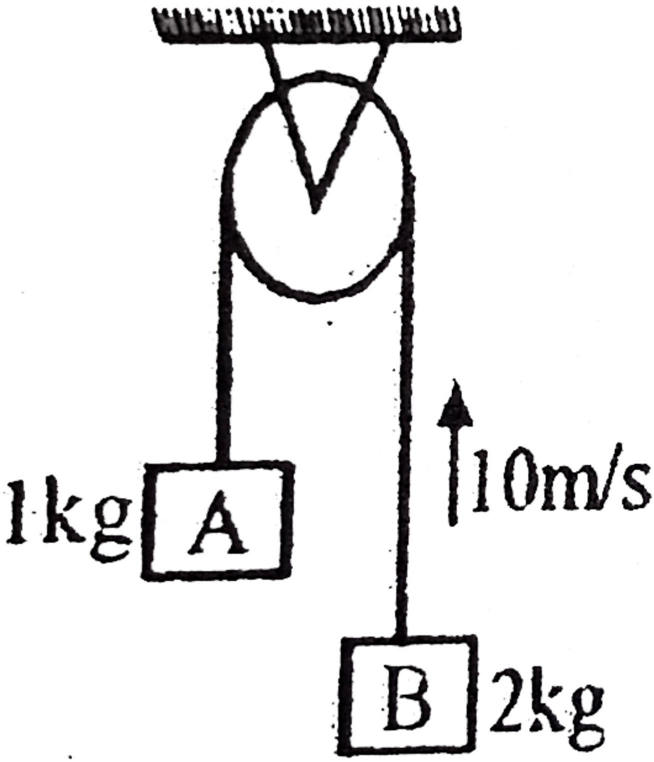
C. $10\sqrt{\frac{5}{3}}m/s$

D. $10\frac{\sqrt{7}}{3}m/s$

Answer: D

Watch Video Solution

18. Two block of A and B of mass 1kg and 2kg are hung from light pulley. Initially the block B is held stationary. At $t = 0$ block B is given velocity 10m//s in upward direction. String and pulley are light and there is no friction anywhere.



Total mechanical energy lost when the string becomes taut is

A. $\frac{100}{3}$ J

B. 100 J

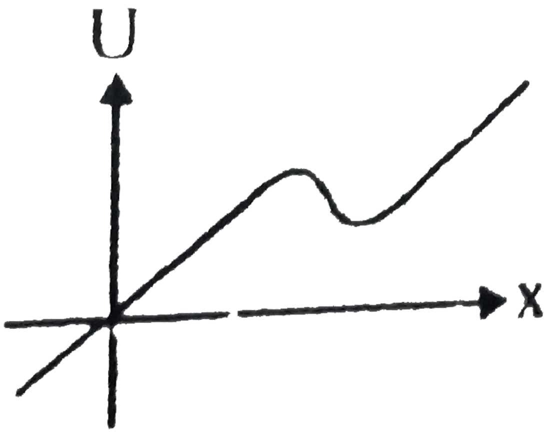
C. 300 J

D. $\frac{200}{3}$ J

Answer: A

Watch Video Solution

19. A particle of mass 1.5 kg moves along x-axis in a conservative force field. Its potential energy is given by $V(x) = 2x^3 - 9x^2 + 12x$, where all quantities are written in SI units. The plot of this potential energy is given below.



It is seen that the particle can be in stable equilibrium at a point on x-axis, x_(0). When it is displaced slightly from this equilibrium position, It executes SHM with time period T. What is the range of total mechanical energy of the particle for which its motion can be oscillatory about a point

A. $E < 5J$

B. $E < 8J$

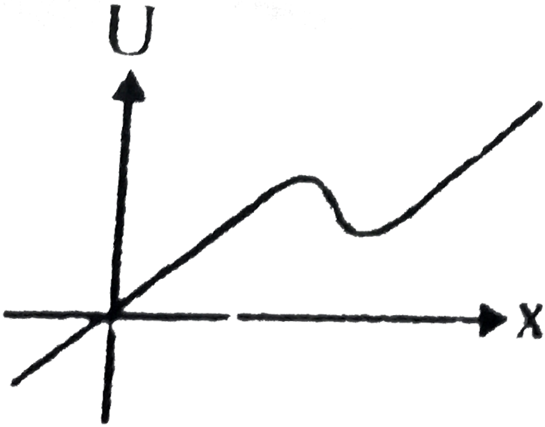
C. $E < 12J$

D. $E < 9J$

Answer: A

Watch Video Solution

20. A particle of mass 1.5 kg moves along x-axis in a conservative force field. Its potential energy is given by $V(x) = 2x^3 - 9x^2 + 12x$, where all quantities are written in SI units. The plot of this potential energy is given below.



It is seen that the particle can be in stable equilibrium at a point on x-axis, x_(0). When it is displaced slightly from this equilibrium position, It executes SHM with time period T. What is the value of x_0 ?

A. 2m

B. 3m

C. 1m

D. 1.5 m

Answer: A

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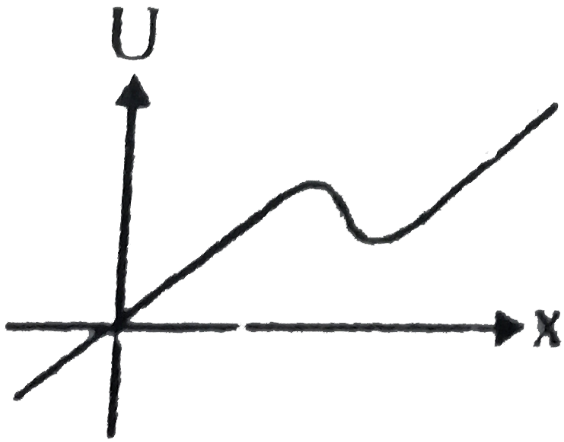
21. A particle of mass 1.5 kg moves along x-axis in a conservative force field. Its potential energy is given by $V(x) = 2x^3 - 9x^2 + 12x$, where all quantities are written in SI units. The plot of this potential energy is given below.



It is seen that the particle can be in stable equilibrium at a point on x-axis, x_(0). When it is displaced slightly from this equilibrium position, It executes SHM with time period T. What is the time period of SHM mentioned in the paragraph?

A. $\pi \sec$

B. $2\pi \sec$

C. $\frac{\pi}{2} \sec$

D. $\frac{\pi}{4} \sec$

Answer: A

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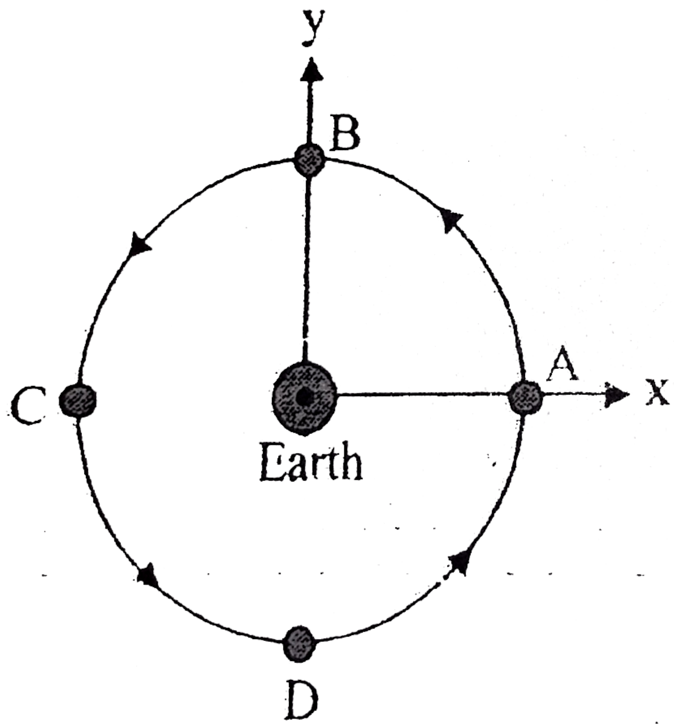
22. Ram and Shyam are two students of ACME couse. One day after the test, they start discussing about the motion of the moon around the earth. The moon is known to take 27 days in competing a circular orbit.



In the figure, the moon moves counterclockwise (ABCD) around the earth. Ram asks Shyam : "What is the direction of the moon's instantaneous velocity at point D"?

A. $+x$

B. $+y$

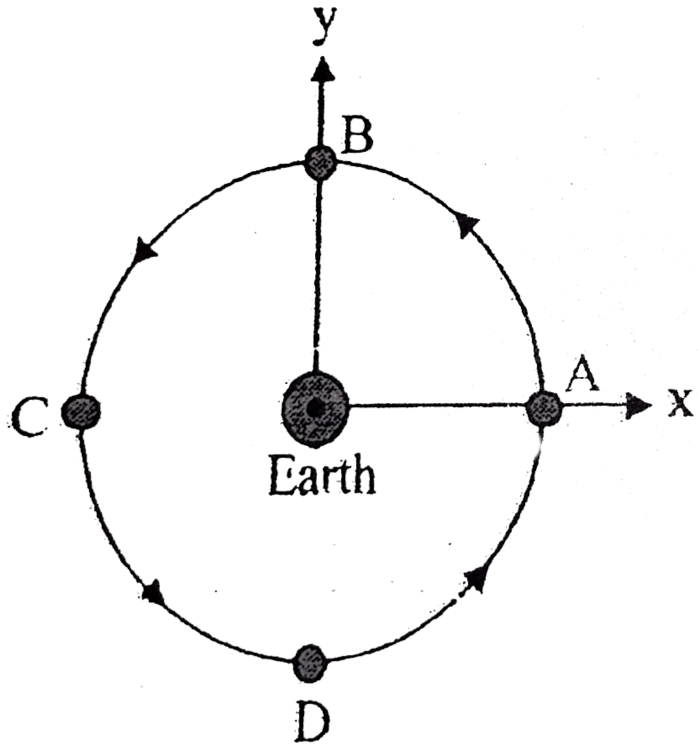
C. $-x$

D. $-y$

Answer: A

Watch Video Solution

23. Ram and Shyam are two students of ACME couse. One day after the test, they start discussing about the motion of the moon around the earth. The moon is known to take 27 days in competing a circular orbit.



In the figure, the moon moves counterclockwise (ABCD) around the earth. Shyam asks Ram : "What is the direction of the moon's average velocity for one quarter of an orbit, starting at C and ending at D "?

A. 45° above $+x$ (toward+y)

B. 45° below $+x$ (toward-y)

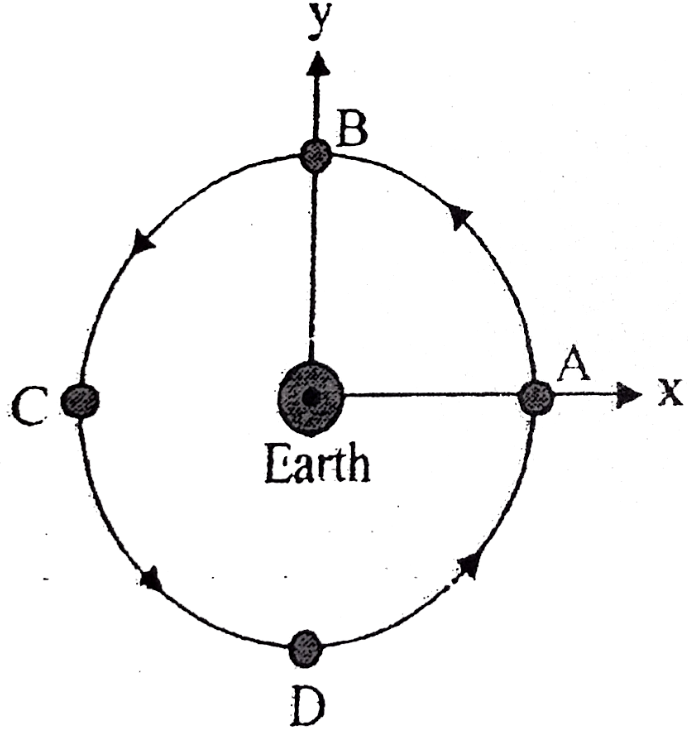
C. 45° above -x (toward1y)

D. 45° below $-x$ (toward - y)

Answer: B

Watch Video Solution

24. Ram and Shyam are two students of ACME couse. One day after the test, they start discussing about the motion of the moon around the earth. The moon is known to take 27 days in competing a circular orbit.



In the figure, the moon moves counterclockwise (ABCD) around the earth. Ram asks Shyam : "What is the direction of the impulse of gravitational force due to earth on moon for one half of an orbit, starting at C and ending at A"?

A. $+x$

B. $+y$

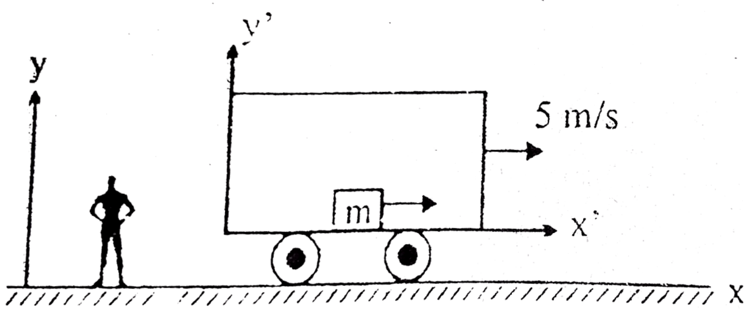
C. -x

D. $-y$

Answer: B

Watch Video Solution

25. Consider two frames of reference, S and S', the first one being fixed to the ground and the second one fixed to a train moving at 5.00 m//s with respect to the ground (figure) A block of mass 4.00 kg, initially at rest with respect to S', is acted upon by a 14.0 N force for 3.00s in the positive x direction. Neglect friction.



According to an observer in S,

A. the initial kinetic energy is of the block is 50 J.

B. final kinetic energy 480.5 J

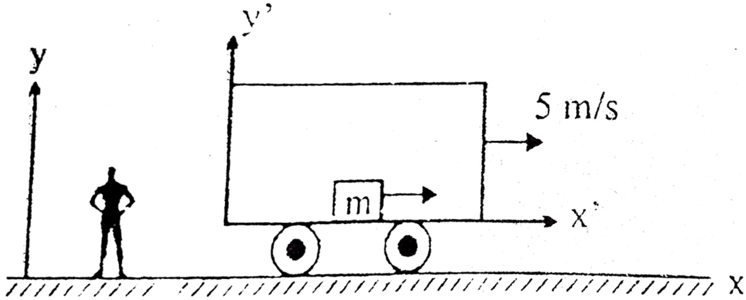
C. the change in kinetic energy is 430.5 J

D. the work done by the force on the block is 430.5 J

Answer: A::B::C::D

Watch Video Solution

26. Consider two frames of reference, S and S', the first one being fixed to the ground and the second one fixed to a train moving at 5.00 m//s with respect to the ground (figure) A block of mass 4.00 kg, initially at rest with respect to S', is acted upon by a 14.0 N force for 3.00s in the positive x direction. Neglect friction.



According to an observer in S,

A. the initial kinetic energy of the block is zero

B. final kinetic energy is 220.5 J

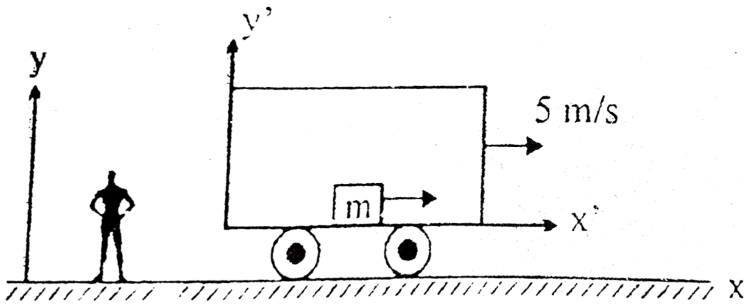
C. the change in kinetic energy is 220.5 J

D. the work done by the force on the block is 220.5 J

Answer: A::B::C::D

Watch Video Solution

27. Consider two frames of reference, S and S', the first one being fixed to the ground and the second one fixed to a train moving at 5.00 m//s with respect to the ground (figure) A block of mass 4.00 kg, initially at rest with respect to S', is acted upon by a 14.0 N force for 3.00s in the positive x direction. Neglect friction.



According to an observer in S,

A. Work energy theorem cannot be applied in frame S'

B. Work energy theorem is derived from Newton is second law

it is valid in all inertial reference frames.

C. Work done by force is same in both the frames.

D. Change in kinetic energy of both the blocks is independent of reference frames S and S'

Answer: B

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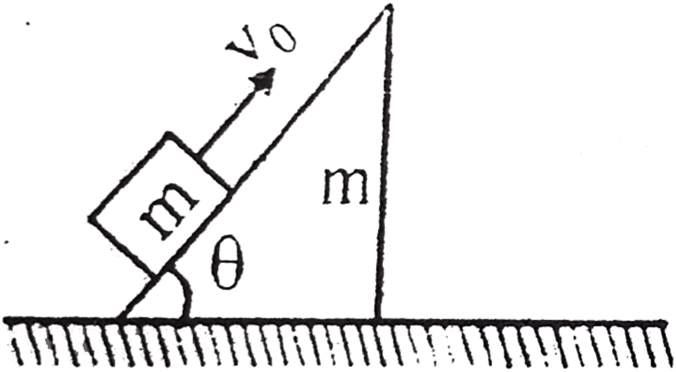
28. Ram is preparing for IIT JEE. He sets on to tackle a typical problem in mechanics. He sees that the wedge is kept on a smooth ground and it's inclined surface is also smooth. A block is projected on it as shown. Both the block and wedge have equal mass. Can you help him find the answer to following three question?



He sets on to find the maximum height attained by the block, assuming the block does not fall off to the other side. Which of the following equation is correct.

A. $mgh = \frac{1}{2}mv_0^2$ (by conservation of energy) where h is maximum height of the block.

B. $0^2 = v_0^2 - 2g\sin\theta \times s$ where is maximum displacement along the inclined surface

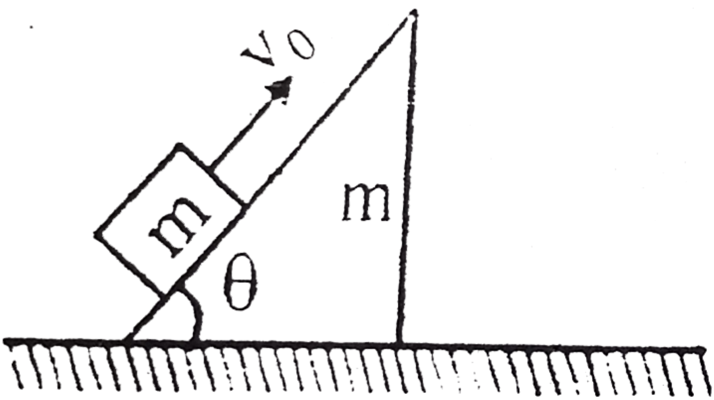
C. $mv_0 = mv + mv$ (by conservation of momentum) and $\frac{1}{2}mv_0^2 = \frac{1}{2}mv^2 + \frac{1}{2}mv^2 + mgh$

D. None of these

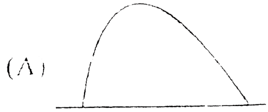
Answer: D

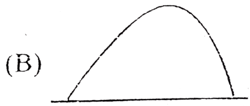
View Text Solution

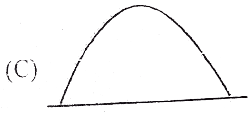
29. Ram is preparing for IIT JEE. He sets on to tackle a typical problem in mechanics. He sees that the wedge is kept on a smooth ground and it's inclined surface is also smooth. A block is projected on it as shown. Both the block and wedge have equal mass. Can you help him find the answer to following three question?

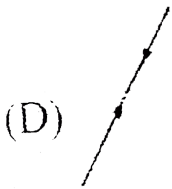


How does the path of block look like as seen from ground.

A. 

B. 

C. 

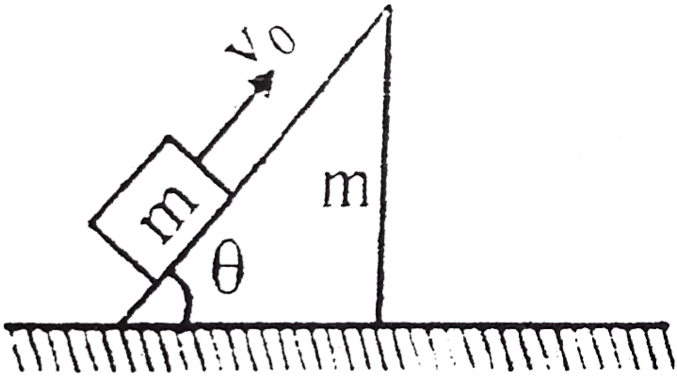


D.

Answer: B

View Text Solution

30. Ram is preparing for IIT JEE. He sets on to tackle a typical problem in mechanics. He sees that the wedge is kept on a smooth ground and it's inclined surface is also smooth. A block is projected on it as shown. Both the block and wedge have equal mass. Can you help him find the answer to following three question?



What is the radius of curvature of it's path at the highest point?

A. 0

B. $\dfrac{v_0^2\cos^2\theta}{g\left(\sin\theta\cos\theta + \sin^2\theta\right)}$

C. $\dfrac{v_0^2\cos^2\theta}{2g\left(1 + \sin^2\theta\right)}$

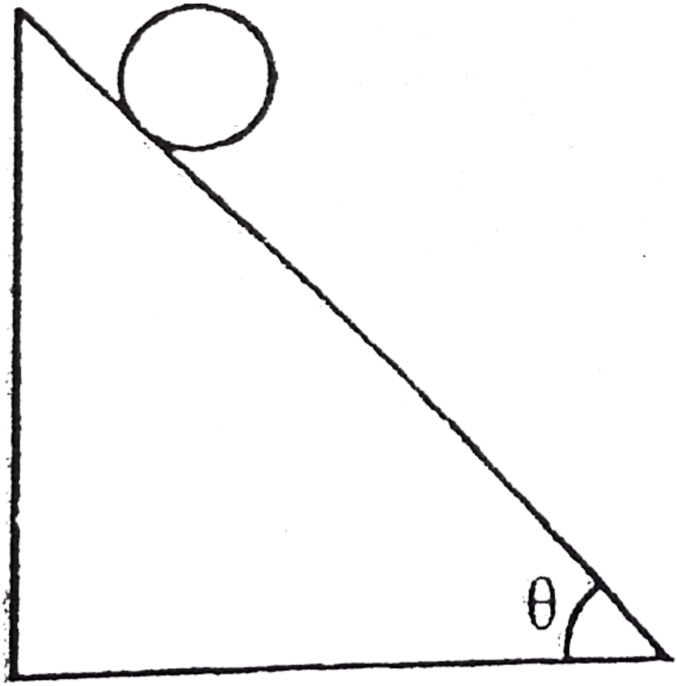
D. None of these

Answer: D

View Text Solution

31. You are to conduct a series of trials. For each trial the inclination of the plane is set to an angle theta, ranging from $0^\circ \rightarrow 90^\circ$ and an object is released from rest at the top of the stationary inclined plane. The coefficient of static friction between the object and the inclined plane is μ_s. In each case below, predict the observed outcome for the trial. In the following equation 'tumble' means 'tip' over and rotate' and 'sliding' means NO tumbling Case1: The object is a sphere and

$\mu_s = 0$



A. The sphere will roll without slipping for small θ and slide down only for θ greater than a certain non-zero value

B. The sphere will remain at rest for small θ and roll without slipping only for θ greater than a certain non-zero value

C. The sphere will slide down for all $\theta > 0^{\circ}$

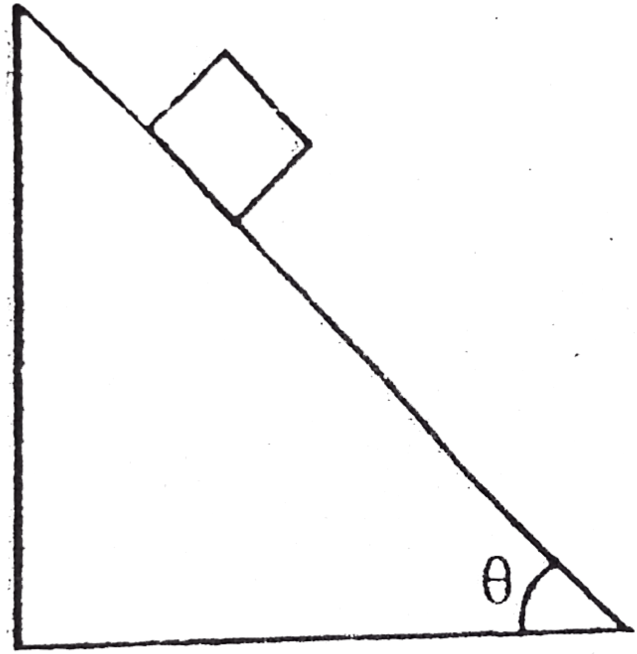
D. The Sphere will roll without slipping for all $\theta > 0^{\circ}$

Answer: C

View Text Solution

32. You are to conduct a series of trials. For each trial the inclination of the plane is set to an angle theta, ranging from $0^\circ \rightarrow 90^\circ$ and an object is released from rest at the top of the stationary inclined plane. The coefficient of static friction between the object and the inclined plane is mu_(s). In each case below, predict the observed outcome for the trial. In the following equation 'tumble' means 'tip' over and rotate' and 'sliding' means NO tumbling Case2 : The object is a cube and $\mu_s = 0$ In this experiment, the angle theta is varied only between

0^(@) and 45^(@)



A. The cube will slide down for all $45^{\circ} > \theta > 0^{\circ}$

B. The cube will remain at rest for small theta and slide down

only for theta greater then a certain non-zero value

C. The cube will roll without slipping for all $45^{\circ} > \theta > 0^{\circ}$

D. The cube will tumble down for all $45^{\circ} > \theta > 0^{\circ}$

Answer: A

View Text Solution

33. You are to conduct a series of trials. For each trial the inclination of the plane is set to an angle theta, ranging from $0^\circ \rightarrow 90^\circ$ and an object is released from rest at the top of the stationary inclined plane. The coefficient of static friction between the object and the inclined plane is μ_s. In each case below, predict the observed outcome for the trial. In the following equation 'tumble' means 'tip' over and rotate' and 'sliding' means NO tumbling Case3 : The object is a cube and mu_(s) is very large $(\mu > > 1)$

A. the cube will remain at rest for small theta and slide down only for theta greater than a certain non-zero value

B. The cube will stay on the incline as if it were glued to it, for all θ

C. The cube will move relative to the inclined plane only for $\theta = 90^\circ$

D. The cube will tumble down only for $\theta > 45^\circ$

Answer: D

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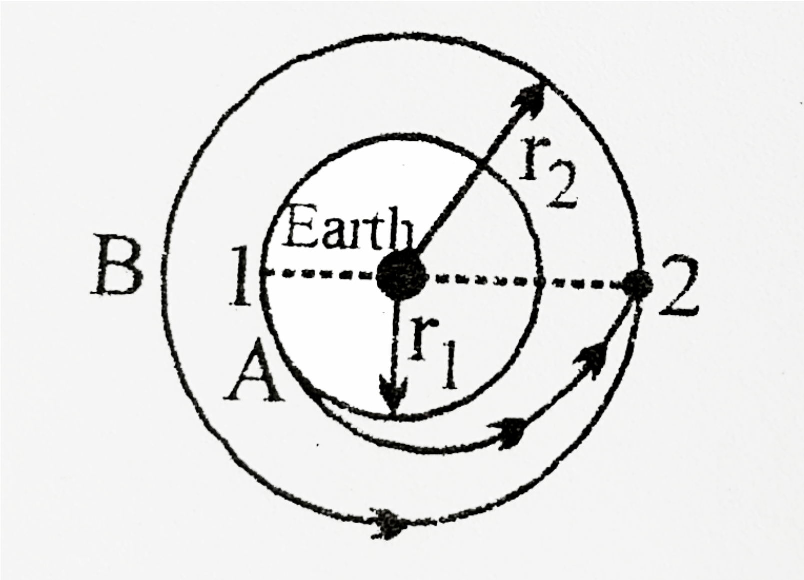
34. Two satellites A and B are revolving around the earth circular orbits of radius r_1 and r_2 respectively with $r_1 < r_2$. Plane of motion of the two are same. At position 1, A is given an impulse in the direction of velocity by firing a rocket so that it follows an elliptical path to meet B at position 2 as shown. A?t position 2, A is given another impluse so that velocities of A and B at 2 become equal and the move together.



For any elliptical path of the satellite of the time period of revolution is given by Kepler's planetary law as $T^2 \alpha r^3$ where a is semi major axis of the ellipse which is $\frac{r_1 + r_2}{2}$ in this case. Also angular mopmentum of any satellite revolving around the Earth will remain a constant about EArth's centre as force of gravity on the satellite which keeps it in elliptical path is along its position vector relative to the earth centre.

If $r_2 = 3r_1$ and time period of revolution for B be T than time taken by A in moving from position 1 to position 2

A. A,B and earth's centre are in same straight line

B. B is ahead of A angularly

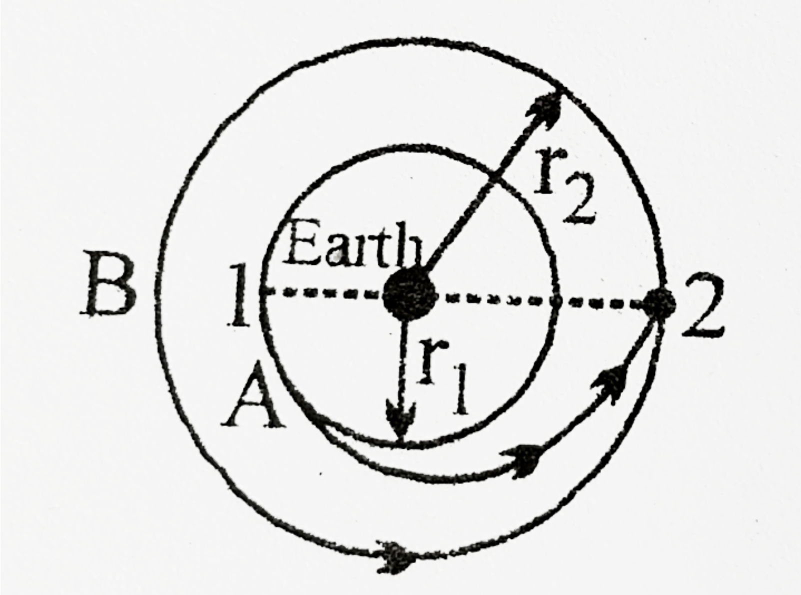
C. B is behing A angularly

D. none of these

Answer: B

Watch Video Solution

35. Two satellites A and B are revolving around the earth circular orbits of radius r_1 and r_2 respectively with $r_1 < r_2$. Plane of motion of the two are same. At position 1, A is given an impulse in the direction of velocity by firing a rocket so that it follows an elliptical path to meet B at position 2 as shown. A?t position 2, A is given another impluse so that velocities of A and B at 2 become equal and the move together.



For any elliptical path of the satellite of the time period of revolution is given by Kepler's planetary law as $T^2 \alpha r^3$ where a is semi major axis of the ellipse which is $\frac{r_1 + r_2}{2}$ in this case. Also angular mopmentum of any satellite revolving around the Earth will remain a constant about EArth's centre as force of gravity on the satellite which keeps it in elliptical path is along its position vector relative to the earth centre.

If the two have same mass

A. A would have more potential energy than B while on their initial circular paths.

B. A would have more kinetic energy than B while on their initial circular paths.

C. Relative to Earth's centre angular momentum of A when it is in elliptical path would be less than angular momentum of B.

D. During the whole process angular momentum for B would be more than angular momentum of A.

Answer: B::C

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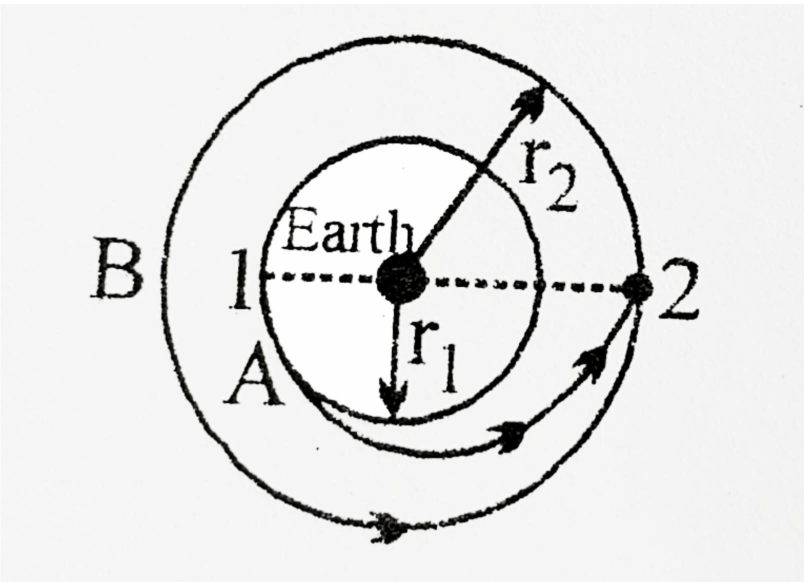
36. Two satellites A and B are revolving around the earth circular orbits of radius r_1 and r_2 respectively with $r_1 < r_2$. Plane of motion of the two are same. At position 1, A is given an impulse in the direction of velocity by firing a rocket so that it follows an elliptical path to meet B at position 2 as shown. A?t position 2, A is given another impluse so that velocities of A and B at 2 become equal and the move together.



For any elliptical path of the satellite of the time period of revolution is given by Kepler's planetary law as $T^2 \alpha r^3$ where a is semi major axis of the ellipse which is $\frac{r_1 + r_2}{2}$ in this case. Also angular mopmentum of any satellite revolving around the Earth will remain a constant about EArth's centre as force of gravity on the satellite which keeps it in elliptical path is along its position vector relative to the earth centre.

If $r_2 = 3r_1$ and time period of revolution for B be T than time taken by A in moving from position 1 to position 2

A. $T\frac{\sqrt{3}}{\sqrt{2}}$

B. $T\frac{\sqrt{3}}{2}$

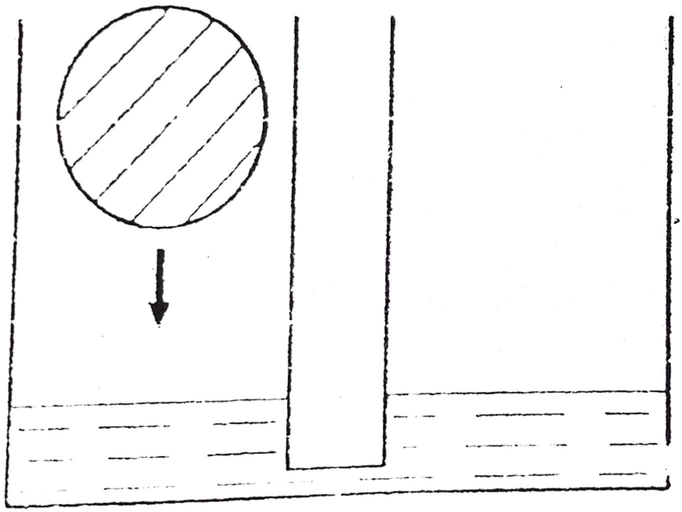
C. $\frac{T\sqrt{2}}{3\sqrt{3}}$

D. $\frac{T\sqrt{2}}{3}$

Answer: C

Watch Video Solution

37. In two identical communicating vessel we poured water (see picture). In one of them we put an ice ball of volume $V = 100cm^3$ which gets exactly half immersed in the water. The density of water $\rho_w = 1000kg/m^3$ the density of ice $\rho_i = 900kg/m^3$



Select the correct statement (s). Soon after placing the ice ball in left vessel.

A. The volume of water flowing to the right vessel is 25cc.

B. The volume of water flowing to the right vessel is 50cc

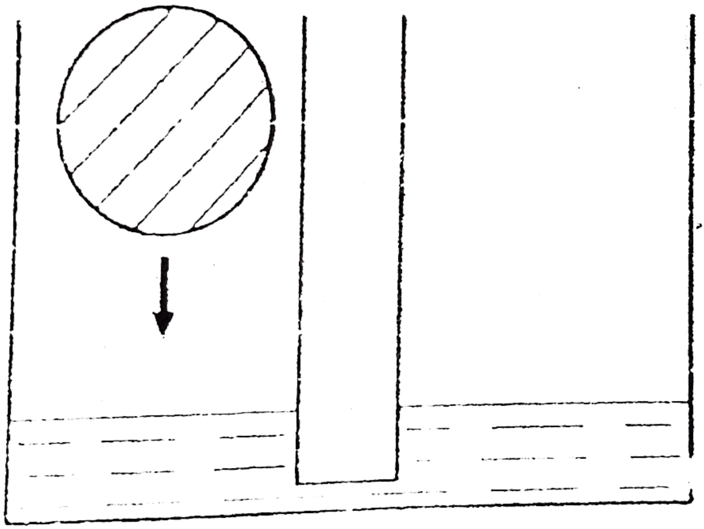
C. The ice ball is resting on the bottom of vessel.

D. The ice ball is floating on the water surface.

Answer: A::C

Watch Video Solution

38. In two identical communicating vessel we poured water (see picture). In one of them we put an ice ball of volume $V = 100cm^3$ which gets exactly half immersed in the water. The density of water $\rho_w = 1000kg/m^3$ the density of ice $\rho_i = 900kg/m^3$



After a long time, select the correct statement (s)

A. If ice melts, the level of water in both vessel will rise.

B. If water freezes, such that ball's radius increase the level of water in both vessel will fall.

C. If ice melts, the level of water in left vessel will rise and level of water in right vessel will fall.

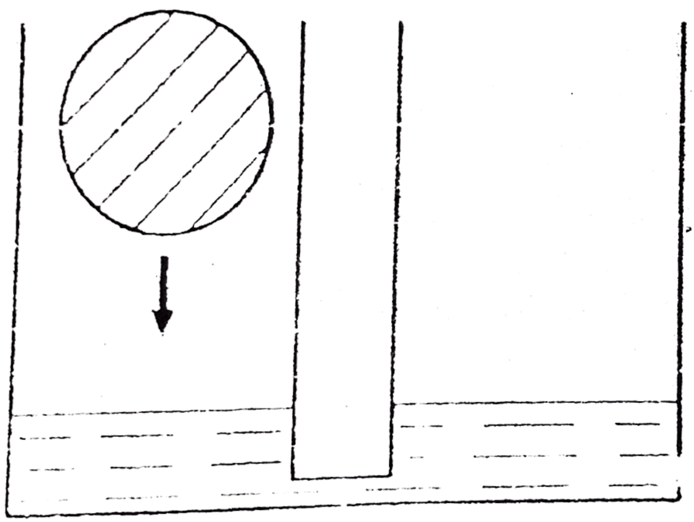
D. If water freeze such that ball radius increase, the level of water in left vessel will fall and level of water in right vessel will rise.

Answer: A::B

Watch Video Solution

39. In two identical communicating vessel we poured water (see picture). In one of them we put an ice ball of volume $V = 100cm^3$

which gets exactly half immersed in the water. The density of water $\rho_w = 1000 kg/m^3$ the density of ice $\rho_i = 900 kg/m^3$



Which of the following actions will raise the water level.

A. Heating the system

B. Putting a coin on top of ice ball.

C. Putting a coin in right vessel

D. Accelerating the system upwards.

Answer: A::C

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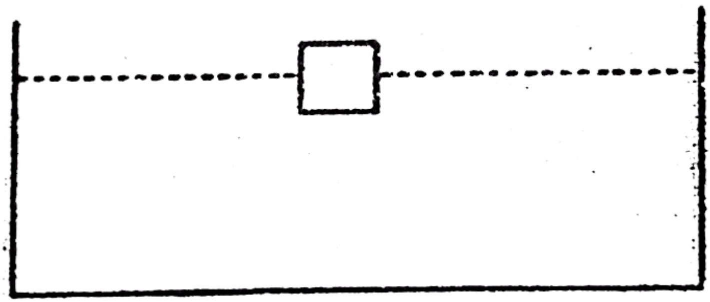
40. A cube made of wood having specific gravity 0.4 and side length a is floated in a large tank full of water.



Which action would change the depth to which block is submerged?

A. more water is added in the tank

B. atmospheric pressure increases

C. the tank is accelerated upwards

D. None of these

Answer: D

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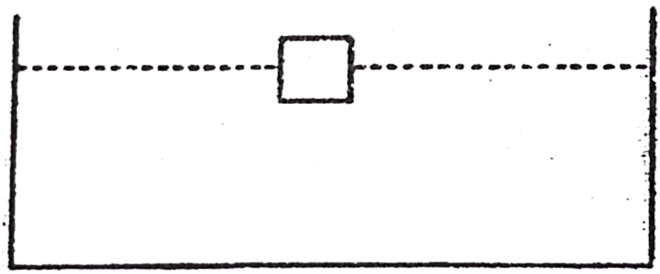
41. A cube made of wood having specific gravity 0.4 and side length a is floated in a large tank full of water.



If the cube is depressed slightly, it excutes SHM from It's position. What is it's time period?

A. $2\pi\sqrt{\frac{a}{g}}$

B. $2\pi\sqrt{\frac{5a}{2g}}$

C. $2\pi\sqrt{\frac{2a}{5g}}$

D. $\frac{4\pi}{5}\sqrt{\frac{a}{g}}$

Answer: C

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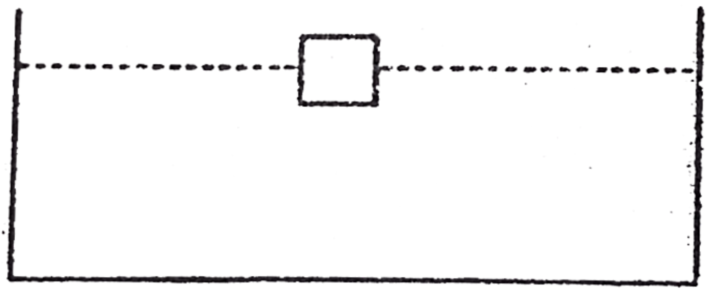
42. A cube made of wood having specific gravity 0.4 and side length a is floated in a large tank full of water.



What can be the maximum amplitude of it's vertical small oxillations?

A. $\frac{a}{2}$

B. 0.4 a

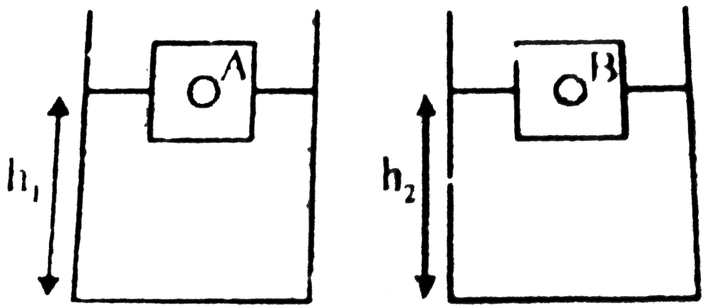
C. 0.6 a

D. 0.2 a

Answer: B

Watch Video Solution

43. Two ice cubes of side 10cm, having cavity of volume $20cm^3$ at centre of cube but filled with different materials A and B respectively. The specific gravity of material B is 1.9 Now these cubes are placed in two different vessels of same base area as shown in figure. The water level before putting blocks in vessels are same Assume that ice melts uniformly from all sides and with same constant rate in both the vessels. (specific gravity of ice=0.9)



Find the

ratio of initial submerged volumes of the blocks containing A and B respectively

A. $\frac{49}{46}$

B. $1:1$

C. $\frac{49}{19}$

D. $4:1$

Answer: A

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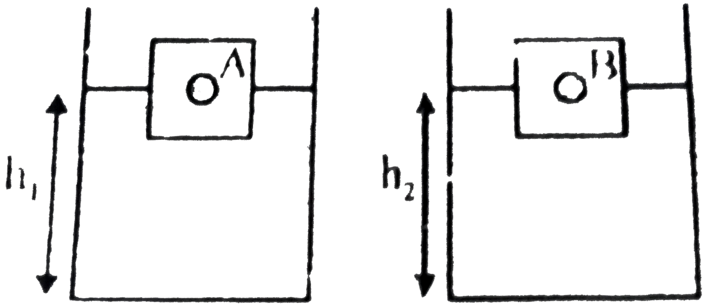
44. Two ice cubes of side 10cm, having cavity of volume $20cm^3$ at centre of cube but filled with different materials A and B respectively. The specific gravity of material B is 1.9 Now these cubes are placed in two different vessels of same base area as shown in figure. The water level before putting blocks in vessels are same Assume that ice melts uniformly from all sides and with same constant rate in both the vessels. (specific gravity of ice=0.9)



Choose the correct statement:

A. Both cubes sink simultaneously

B. A and B sink only after complete melting of ice.

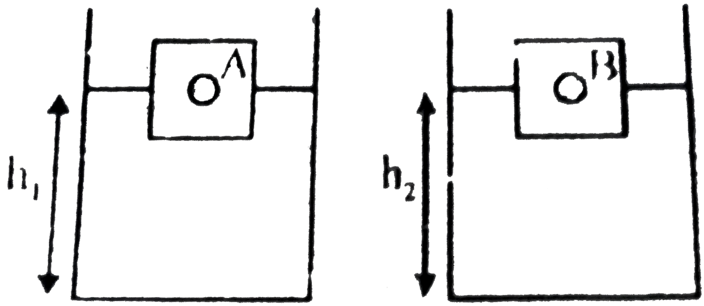
C. A sinks prior to B

D. B sinks prior to A

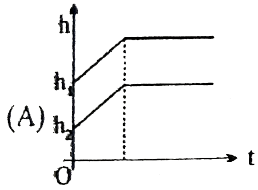
Answer: C

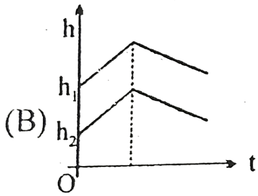
View Text Solution

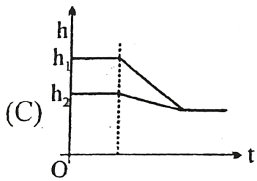
45. Two ice cubes of side 10cm, having cavity of volume $20cm^3$ at centre of cube but filled with different materials A and B respectively. The specific gravity of material B is 1.9 Now these cubes are placed in two different vessels of same base area as shown in figure. The water level before putting blocks in vessels are same Assume that ice melts uniformly from all sides and with same constant rate in both the vessels. (specific gravity of ice=0.9)

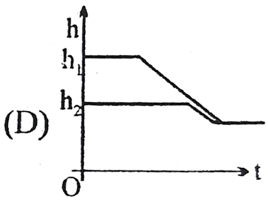


Choose the correct graph showing the variation of heights of water- level in two vessels with time

A. 

B. 

C. 

D. 

Answer: D

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46. In a thermally insulated tube of cross sectional area $4cm^2$ a liquid of thermal expansion coefficeint 10^3K^{-1} is flowing. Its velocity at the entrance is $0.1m/s$. At the middle of the tube a heater of a power of 10 kW is heating the liquid. The specific heat capacity of the liquid is 1.5 kJ/(kg,K), and its density is $1500kg/m^3$ at the entrance.

Q. What is the density of liquid at the exit?

A. $\frac{1000}{9}(\wedge(\circ)C)$

B. $\frac{1}{9}(\wedge(\circ)C)$

C. $\frac{500}{9}(\wedge(\circ)C)$

D. None of these

Answer: A

Watch Video Solution

47. In a thermally insulated tube of cross sectional area $4cm^2$ a liquid of thermal expansion coefficeint $10^3 K^{-1}$ is flowing. Its velocity at the entrance is $0.1 m/s$. At the middle of the tube a heater of a power of 10 kW is heating the liquid. The specific heat capacity of the liquid is 1.5 kJ/(kg,K), and its density is $1500 kg/m^3$ at the entrance.

Q. What is the density of liquid at the exit?

A. 1450

B. 1400

C. 1350

D. None of these

Answer: C

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48. In a thermally insulated tube of cross sectional area $4cm^2$ a liquid of thermal expansion coefficeint $10^3 K^{-1}$ is flowing. Its velocity at the entrance is $0.1m/s$. At the middle of the tube a heater of a power of 10 kW is heating the liquid. The specific heat capacity of the liquid is 1.5 kJ/(kg,K), and its density is $1500 kg/m^3$ at the entrance.

Q. How much bigger is the volume rate of flow at the end of the tube than at the entrance in cubic meters?

A. 9×10^{-5}

B. $\frac{1}{3} \times 10^{-5}$

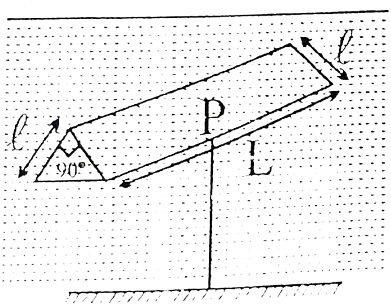
C. $\frac{4}{9} \times 10^{-5}$

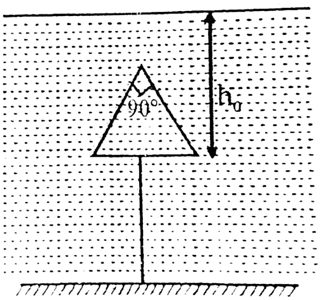
D. None of these

Answer: C

Watch Video Solution

49. A prism shaped styrofoam of density $\rho_{styrofoam}\left(<\rho_{water}\right)$ is held completely submerged in water. It lies with its base horizontal. The base of foam is at depth h_0 below water surface and atmospheric pressure is P_0 Surface of water is open to atmosphere. Styrofoam prism is held in equilibrium by the string attached symmetrically as shown (Take $\rho_{styrofoam}=\rho_f, \rho_{water}=\rho_w\big)$.





Net force exerted by liquid on the styrofoam is

A. $\sqrt{2}\rho_w g l^2 L$

B. $2\rho_w g l^2 L$

C. $\rho_w \dfrac{g\left(l^2 L\right)}{2}$

D. $\rho_w g l^2 L$

Answer: C

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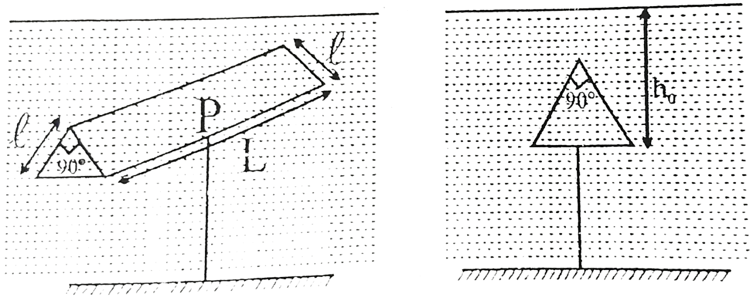
50. A prism shaped styrofoam of density $\rho_{styrofoam}\left(< \rho_{water}\right)$ is held completely submerged in water. It lies with its base horizontal. The base of foam is at depth h_0 below water surface and atmospheric pressure is P_0 Surface of water is open to atmosphere. Styrofoam prism is held in equilibrium by the string attached symmetrically as shown (Take $\rho_{styrofoam} = \rho_f, \rho_{water} = \rho_w\right)$.



Magnitude of force on any one of the slant face of styrofoam is

A. $\left(P_0 + \rho_w g\left(h_0 - \sqrt{2}l\right)\right)Ll$

B. $\left(P_0 + \rho_w g\left(h_0 - \frac{l}{\sqrt{2}}\right)Ll\right.$

C. $\left(P_0 - \rho_w g\left(h_0 - \frac{l}{\sqrt{2}}\right)\right)Ll$

D. $\left(P_0 + \rho_w g\left(h_0 - \frac{l}{2\sqrt{2}}\right)\right)Ll$

Answer: D

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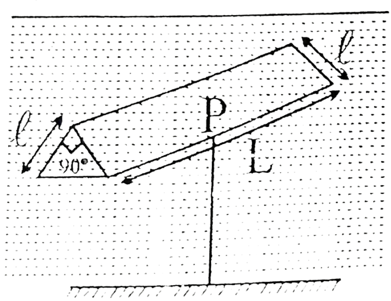
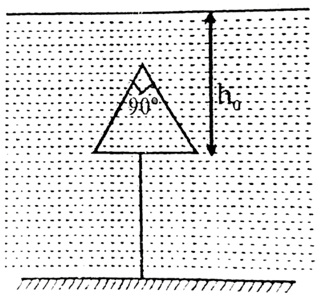
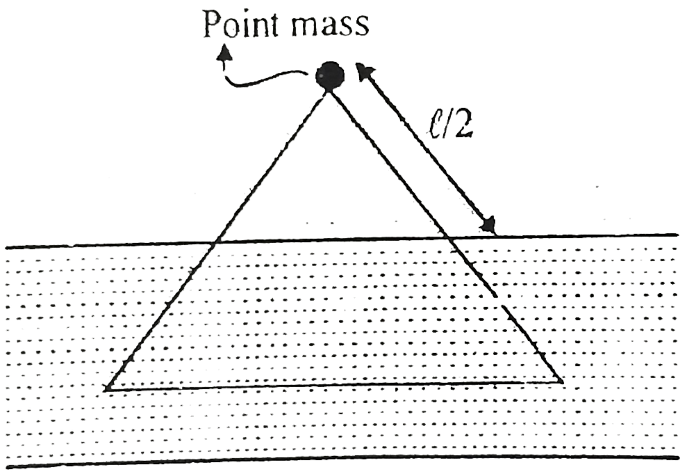
51. A prism shaped styrofoam of density $\rho_{styrofoam}\left(<\rho_{water}\right)$ is held completely submerged in water. It lies with its base horizontal. The base of foam is at depth h_0 below water surface and atmospheric pressure is P_0 Surface of water is open to atmosphere. Styrofoam prism is held in equilibrium by the string attached symmetrically as shown (Take $\rho_{styrofoam}=\rho_f, \rho_{water}=\rho_w\Big)$.





Now string is cut and styrofoam is allowed to come to surface. A point mass is to be placed symmetrically on the upper surface of styrofoam such that it is in equilibrium with its base in horizontal plane. In equilibrium position styrofoam has half of its slant length submerged. Surface tension of water is T. contact angle is 0^(@).

Determine mass m to achieve equilibrium.



A. $\dfrac{\rho_f g L l^2}{2} + \dfrac{3}{4}\rho_w g L l^2 - 2T[L + l]$

B. $\dfrac{-\rho_f g L l^2}{2} + \dfrac{3}{8}\rho_w g L l^2 - \sqrt{2}T[L + l]$

C. $\dfrac{-\rho_f g L l^2}{2} + \dfrac{3}{8}\rho_w g L l^2 - \dfrac{T[L + l)}{\sqrt{2}}$

D. None of these

Answer: B::D

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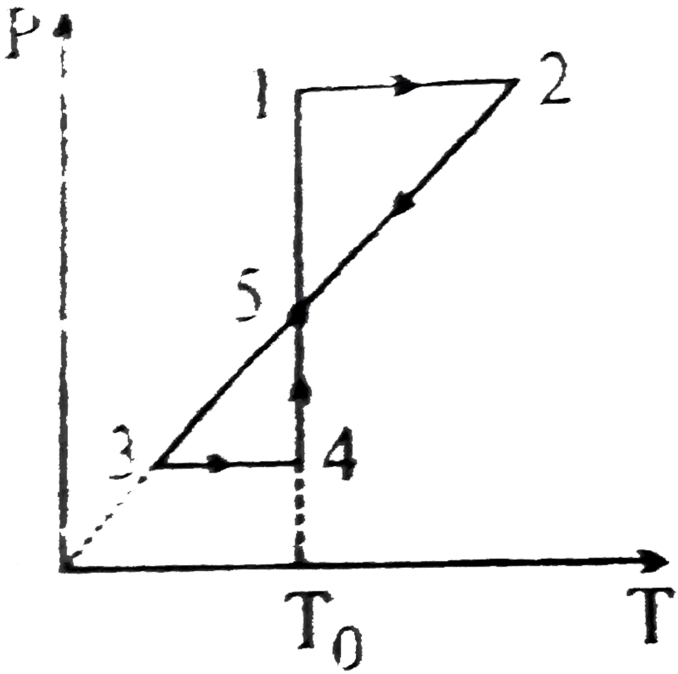
52. Consider PT graph of cyclic process shown in the figure. Maximum pressure during the cycle is twice the minimum pressure. The heat received by the gas in the process 1-2 is equal to the heat received in the process 3-4. The process is done on one mole of monoatomic gas.



What is the heat released in the process 2-3?

A. $\frac{5RT_0}{3}$

B. RT_0

C. $1.5RT_0$

D. $2.5RT_0$

Answer: B

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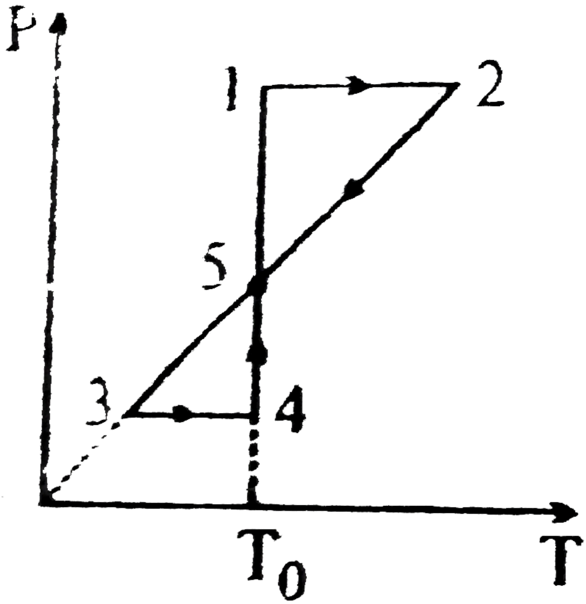
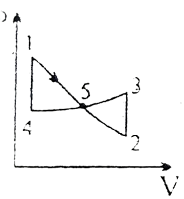
53. Consider PT graph of cyclic process shown in the figure. Maximum pressure during the cycle is twice the minimum pressure. The heat received by the gas in the process 1-2 is equal to the heat received in the process 3-4. The process is done on one mole of monoatomic gas.

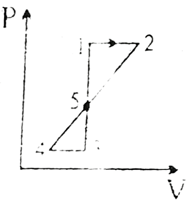


Correct PV diagram for the process is-

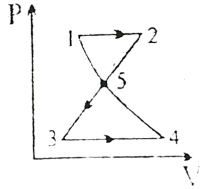
A. (A)



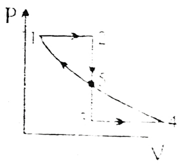
B. (B)



C. (C)



D. (D)



Answer: D

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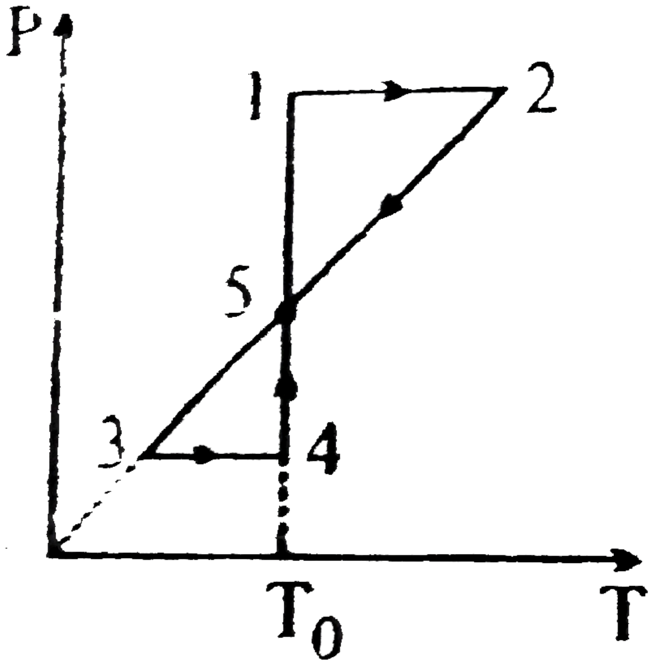
54. Consider PT graph of cyclic process shown in the figure. Maximum pressure during the cycle is twice the minimum pressure. The heat received by the gas in the process 1-2 is equal to the heat received in the process 3-4. The process is done on one mole of monoatomic gas.



If the maximum pressure is P then what is the pressure at the point 5?

A. $2P/3$

B. $4P/5$

C. $3P/4$

D. None

Answer: C

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55. Consider a gas at tmperature T occupying a volume V consisting of a mixture of two gases having. $N_a \& N_b$ atoms of masses $m_a \& m_b$ respspectively.

Give an expression for the total pressure exerted by the gas

A. $\frac{(N_a + N_b)kT}{V}$

B. $\frac{1.5(N_a + N_b)kT}{V}$

C. $\frac{(N_a + N_b)RT}{V}$

D. none

Answer: A

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56. Consider a gas at temperature T occupying a volume V consisting of a mixture of two gases having $N_a \& N_b$ atoms of masses $m_a \& m_b$ respectively.

Suppose that $N_a = N_b$ the different atoms combine at constant volume to form molecules of mass $m_a + m_b$. Once the temperature returns to its original value, what would be the ratio of the pressure after combination to the pressure before?

A. 1

B. $1/3$

C. $1/2$

D. none

Answer: C

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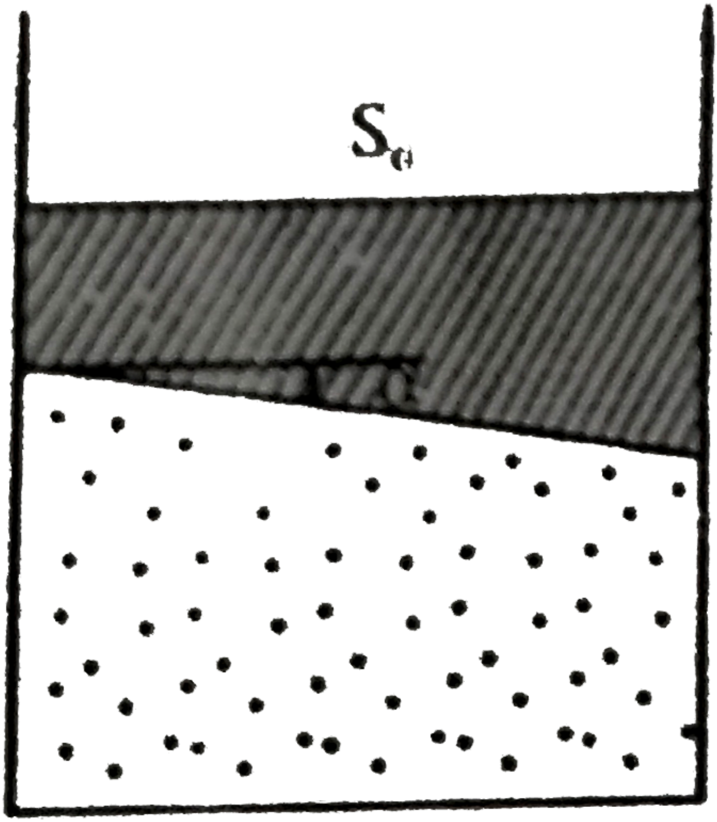
57. In the cylinder shown in the figure, air is enclosed under the piston. Piston mass M=60 kg, crosssectional area of the cylinder $S_0 = 20cm^2$ atmospheric pressure $P_0 = 10^5 pa\alpha = 37\,°$. The air temperature is constant, the friction is negligible.



What is the pressure of the enclosed gas?

A. 3.4×10^5 Pa

B. 4×10^5 Pa

C. 4.75×10^5 Pa

D. 2.8×10^5 Pa

Answer: B

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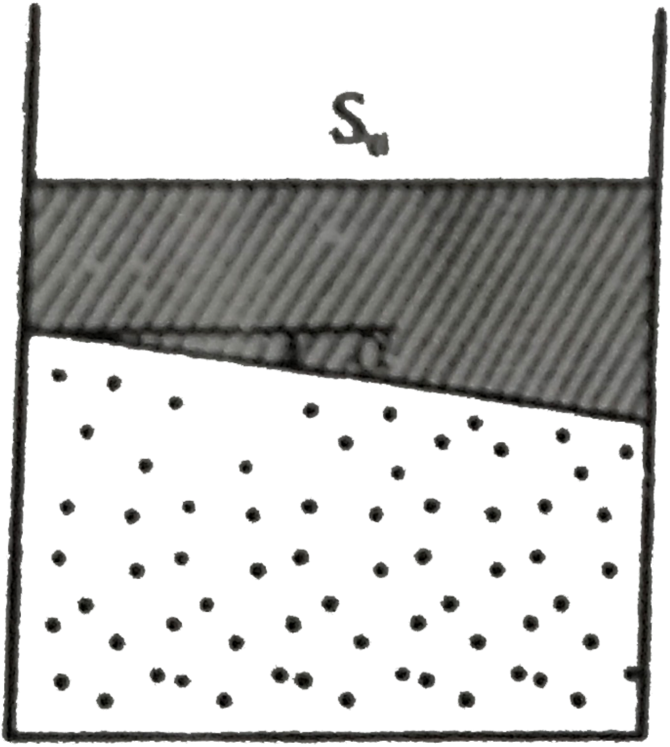
58. In the cylinder shown in the figure, air is enclosed under the piston. Piston mass M=60 kg, crosssectional area of the cylinder $S_0 = 20cm^2$ atmospheric pressure $P_0 = 10^5 pa\alpha = 37°$. The air temperature is constant, the friction is negligible.



What is the mass of the goods that must be put on the piston so that the volume of the gas becomes half?

A. 56kg

B. 80kg

C. 110 kg

D. 92 kg

Answer: B

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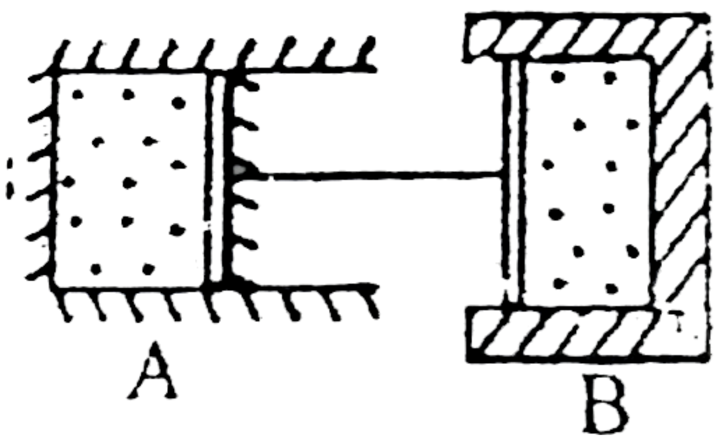
59. Two cylinder A and B having piston conneted by massless rod (as shown in figure). The cross-sectional area two cylinders are same & equal to 'S'.The cylinder A contains m gm of an ideal gas at Pressure P & temperature T_0 The cylinder B contain identical gas at same temperature T_0 but has different mass. The piston is held at the state in the position so that volume of gas in cylinder A & cylinder B are same and is equal to V_0. The walls & piston of cylinder A are thermally insulated, whereas cylinder B is maintained at temperature T_0 reservoir. The whole system is in vacuum. Now the piston is slowly released and it moves towards left & machanical equilibrium is reached at the state when the volume of gas in cylinder A becomes V_(0)/2 Then (here gamma for gas =1.5)



The mass of gas in cylinder B

A. $2\sqrt{2}$ m

B. $3\sqrt{2}$ m

C. $\sqrt{2}$ m

D. none

Answer: B

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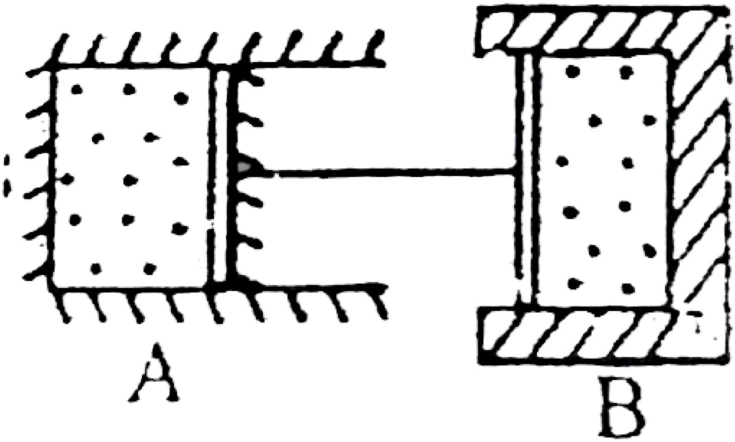
60. Two cylinder A and B having piston conneted by massless rod (as shown in figure). The cross-sectional area two cylinders are same & equal to 'S'.The cylinder A contains m gm of an ideal gas at Pressure P & temperature T_0 The cylinder B contain identical gas at same temperature T_0 but has different mass. The piston is held at the state in the position so that volume of gas in cylinder A & cylinder B are same and is equal to V_0. The walls & piston of cylinder A are thermally insulated, whereas cylinder B is maintained at temperature T_0 reservoir. The whole system is in vacuum. Now the piston is slowly released and it moves towards left & machanical equilibrium is reached at the state when the volume of gas in cylinder A becomes $\frac{V_0}{2}$ Then (here gamma for gas $= 1.5$)



The change in internal energy of gas in cylinder A

A. $\left(\sqrt{2}-1\right)PV_0$

B. $2\left(\sqrt{2}-1\right)PV_0$

C. $\dfrac{PV_0}{\left(\sqrt{2}-1\right)}$

D. none

Answer: B

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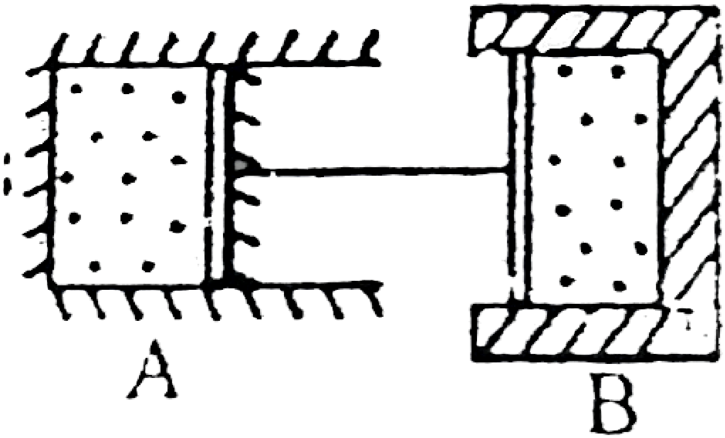
61. Two cylinder A and B having piston conneted by massless rod (as shown in figure). The cross-sectional area two cylinders are same & equal to 'S'.The cylinder A contains m gm of an ideal gas at Pressure P & temperature T_0 The cylinder B contain identical gas at same temperature T_0 but has different mass. The piston is held at the state in the position so that volume of gas in cylinder A & cylinder B are same and is equal to V_0. The walls & piston of cylinder A are thermally insulated, whereas cylinder B is maintained at temperature T_0 reservoir. The whole system is in vacuum. Now the piston is slowly released and it moves towards left & machanical equilibrium is reached at the state when the volume of gas in cylinder A becomes $\frac{V_0}{2}$ Then (here gamma for gas =1.5)



If work done by gas in cylinder B is W_B & work done by gas in cylinder A is W_A then

A. $W_A = - W_B$

B. $|W_A| > |W_B|$

C. $|W_A| < |W_B|$

D. we can't say anything

Answer: C

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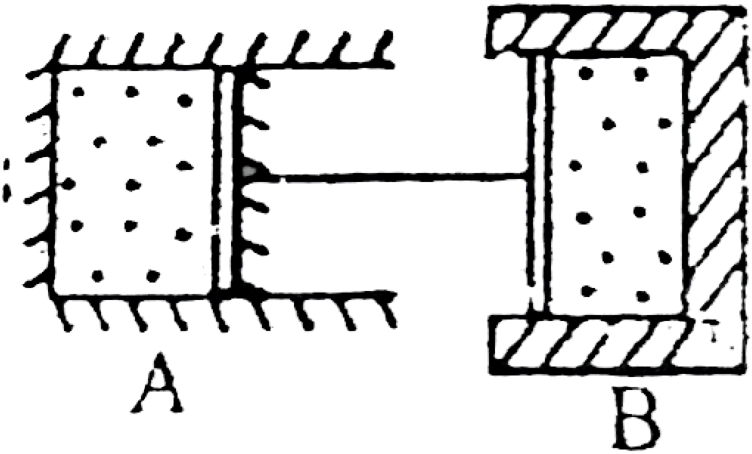
62. Two cylinder A and B having piston conneted by massless rod (as shown in figure). The cross-sectional area two cylinders are same & equal to 'S'.The cylinder A contains m gm of an ideal gas at Pressure P & temperature T_0 The cylinder B contain identical gas at same temperature T_0 but has different mass. The piston is held at the state in the position so that volume of gas in cylinder A & cylinder B are same and is equal to V_0. The walls & piston of cylinder A are thermally insulated, whereas cylinder B is maintained at temperature T_0 reservoir. The whole system is in vacuum. Now the piston is slowly released and it moves towards left & machanical equilibrium is reached at the state when the volume of gas in cylinder A becomes $\frac{V_0}{2}$ Then (here gamma for gas =1.5)



What will be the compressive force in conneting rod at equilibrium

A. PS

B. $\sqrt{2}$ PS

C. $2^{3/2}$PS

D. none

Answer: C

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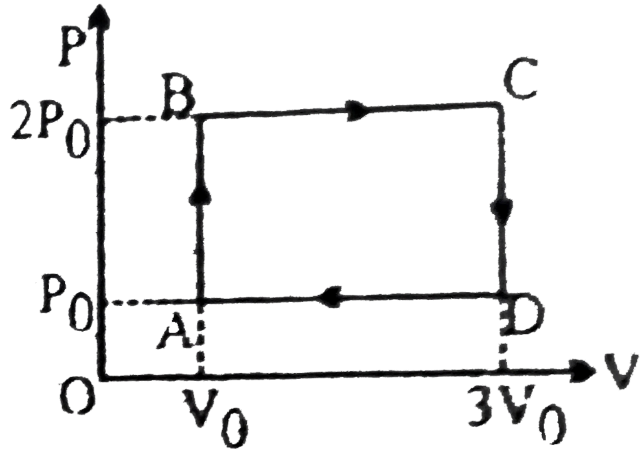
63. The figure shows P - V diagram of a thermodynamic cycle



The work done in the cycle is

A. $2P_0V_0$

B. $3P_0V_0$

C. P_0V_0

D. $6P_0V_0$

Answer: A

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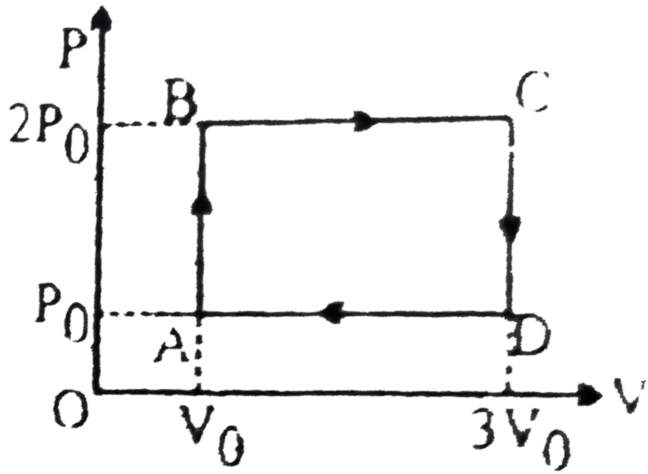
64. The figure shows P - V diagram of a thermodynamic cycle



If T_A, T_B, T_C and T_D are the respective temperature at A,B,C and D. Then, choose the correct statement $T_A = T_0$

A. The maximum temperature during the cycle accurs at C.

B. $T_D = 3T_0$

C. $T_B = 2T_0$

D. all the above

Answer: D

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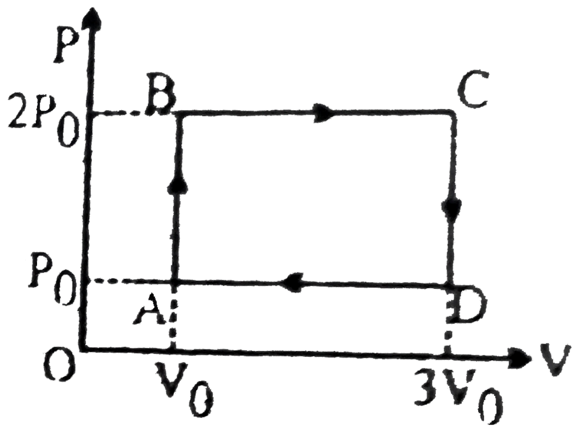
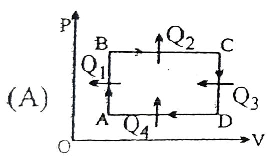
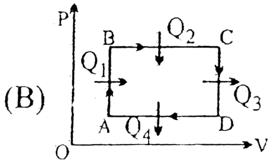
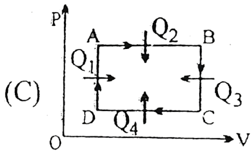
65. The figure shows P - V diagram of a thermodynamic cycle

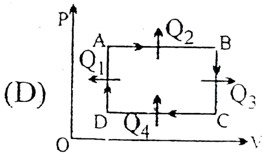


Identify the diagram which correctly represents the heat inflow and outflow of the system

A. 

B. 

C. 

D. 

Answer: B

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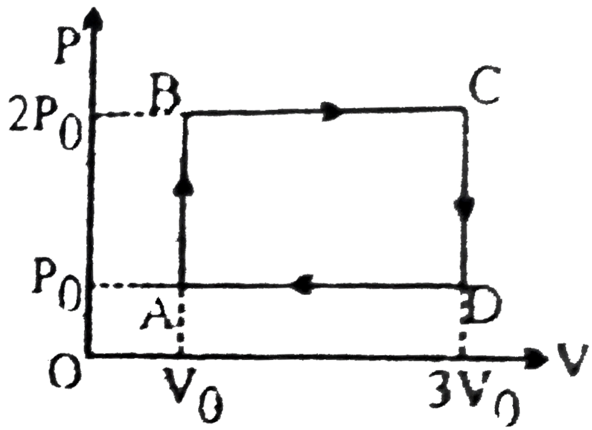
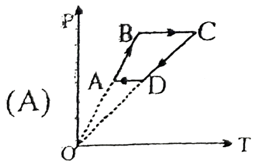
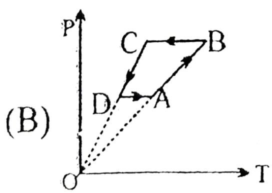
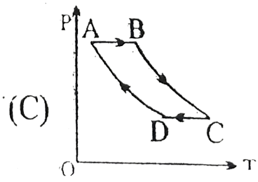
66. The figure shows P - V diagram of a thermodynamic cycle



Choose the correct V - T diagram for the given cyclic process.

A. 

B. 

C. 

D. none of these

Answer: A

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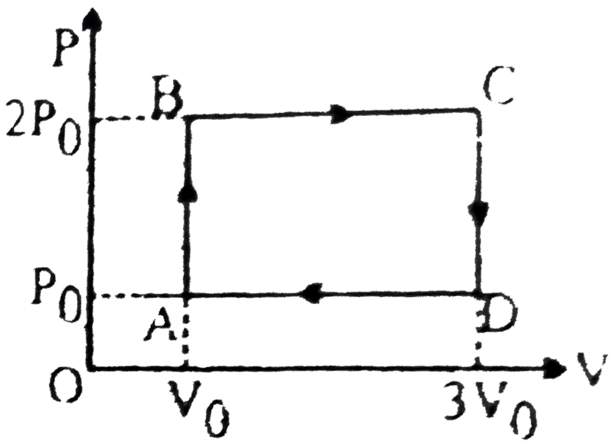
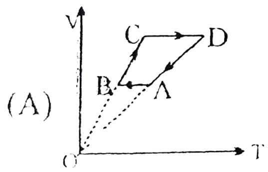
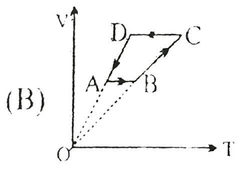
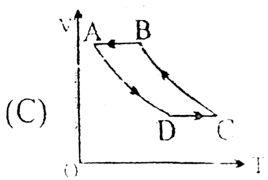
67. The figure shows P - V diagram of a thermodynamic cycle



Choose the correct V - T diagram for the given cyclic process.

A. 

B. 

C. 

D. none of these

Answer: B

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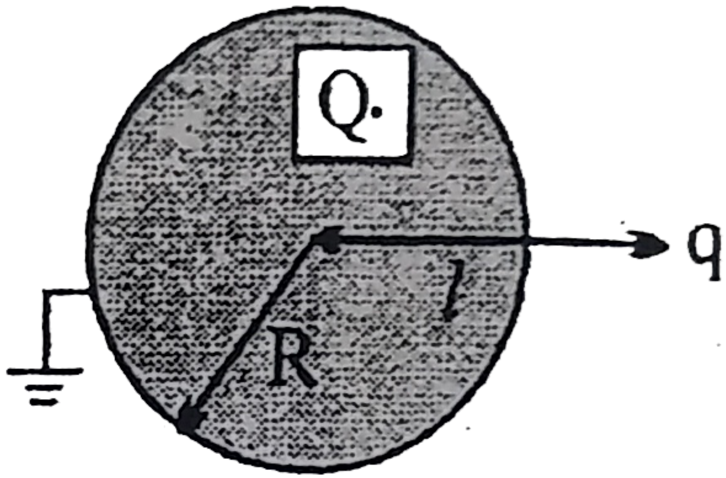
68. There is a cubical cavity inside a conducting sphere of radius R. A positive point charge Q is placed at the centre of the cube and another positive charge q is placed at a distance $1(> R)$ from the centre of the sphere. The sphere is earthed



Net charge on the outer surface of conducting sphere is

A. -Q, uniformly distributed

B. -Q, non-uniformly distributed

C. -$(Q + q)$ non-uniformly distributed

D. none

Answer: B

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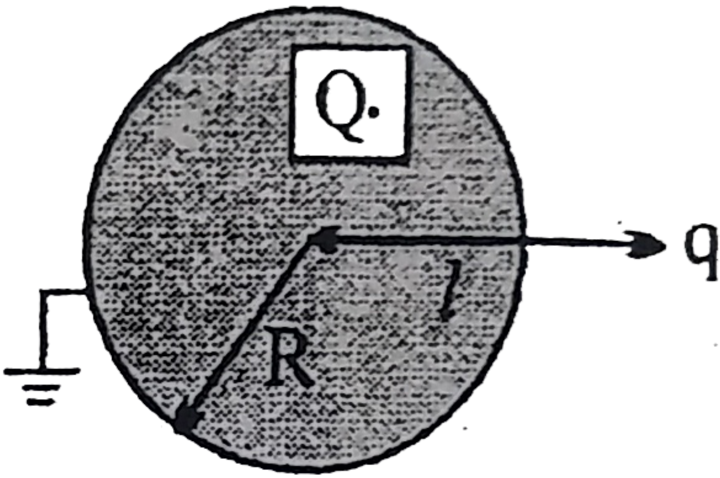
69. There is a cubical cavity inside a conducting sphere of radius R. A positive point charge Q is placed at the centre of the cube and another positive charge q is placed at a distance $1(> R)$ from the centre of the sphere. The sphere is earthed



Net charge on the outer surface of conducting sphere is

A. $+Q$

B. Q - $qR/1$

C. -qR/I

D. none

Answer: C

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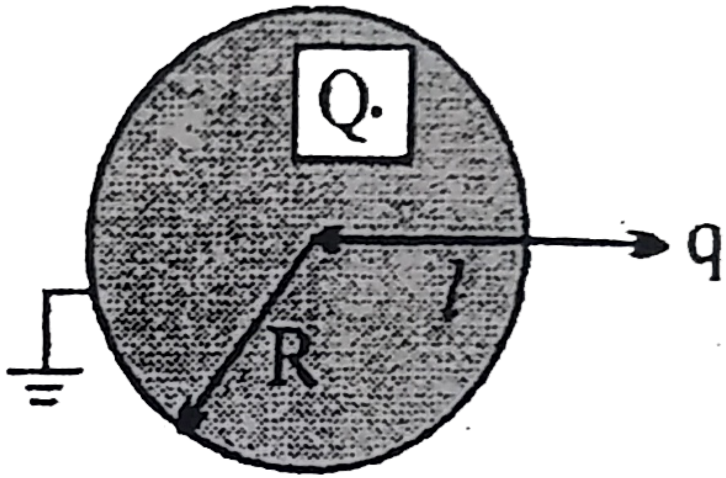
70. There is a cubical cavity inside a conducting sphere of radius R. A positive point charge Q is placed at the centre of the cube and another positive charge q is placed at a distance $1(>R)$ from the centre of the sphere. The sphere is earthed



Net charge on the outer surface of conducting sphere is

A. zero

B. positive

C. negative

D. can not be determined.

Answer: B

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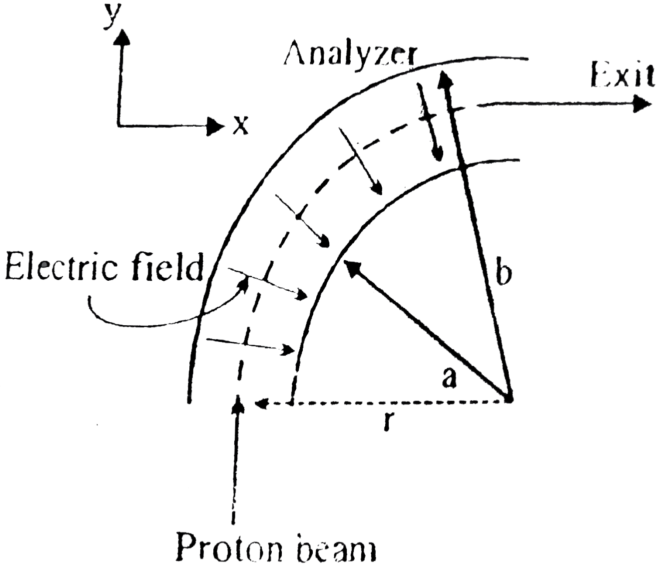
71. Figure shows a schematic view of an electrostatic analyzer. It can sort out charged particles by speed and charge to mass ratio. Spacecraft use such analyzers to characterize charged particles in interplanetary space. Two curved metal plates establish an electric field given by $E = E_0\left(\frac{b}{r}\right)$ where E_0 and b are positive constants with unit of electric field and length. The field points toward the centre of curvature and r is distance from centre. There is no influence of gravity. Proton (change $+e$ mass 'm') enters along y-axis and exits along x-axis while moving along a circular path.



Speed with which protion is to be projected is 'v' and centripetal acceleration of electron is 'a_c' is given by respectively. Mark the correct statement

A. $v = \sqrt{\frac{eE_0 b}{m}}, a_c = \frac{2e}{m}E_0\left(\frac{b}{r}\right)$

B. $v = \sqrt{\frac{2eE_0 b}{m}}, a_c = \frac{e}{2m}E_0\left(\frac{b}{r}\right)$

C. $v = \sqrt{\frac{eE_0 b}{2m}}, a_c = \frac{2e}{m}E_0\left(\frac{b}{r}\right)$

D. $v = \sqrt{\frac{eE_0 b}{m}}, a_c = \frac{e}{m}E_0\left(\frac{b}{r}\right)$

Answer: D

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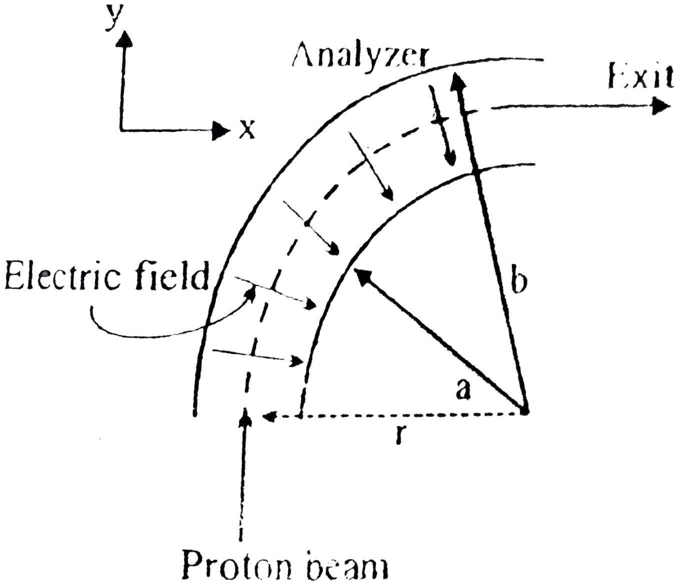
72. Figure shows a schematic view of an electrostatic analyzer. It can sort out charged particles by speed and charge to mass ratio. Spacecraft use such analyzers to characterize charged particles in interplanetary space. Two curved metal plates establish an electric field given by $E = E_0\left(\frac{b}{r}\right)$ where E_0 and b are positive constants with unit of electric field and length. The field points toward the centre of curvature and r is distance from centre. There is no influence of gravity. Proton (change $+e$ mass 'm') enters along y-axis and exits along x-axis while moving along a circular path.



Mark the INCORRECT option:

A. Work done by electric field on proton is zero.

B. If $v = \sqrt{\dfrac{2eE_0b}{m}}$ proton may strike outer surface of analyzer.

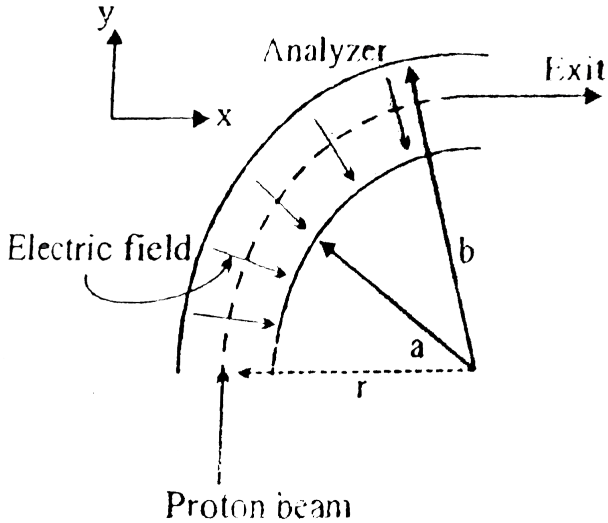
C. if $v = \sqrt{\dfrac{2eE_0b}{m}}$ proton may strike inner surface of analyzer.

D. if an electron is released with zero initial velocity from inner surface of analyzer it will strike outer surface with velocity $v = \sqrt{\dfrac{2eE_0b}{m_e} ln\left(\dfrac{a}{b}\right)}$, *where* m_e is mass of electron.

Answer: C

Watch Video Solution

73. Figure shows a schematic view of an electrostatic analyzer. It can sort out charged particles by speed and charge to mass ratio. Spacecraft use such analyzers to characterize charged particles in interplanetary space. Two curved metal plates establish an electric field given by $E = E_0\left(\frac{b}{r}\right)$ where E_0 and b are positive constants with unit of electric field and length. The field points toward the centre of curvature and r is distance from centre. There is no influence of gravity. Proton (change $+e$ mass 'm') enters along y-axis and exits along x-axis while moving along a circular path.



Mark the correct option.

A. If E_0 is made larger then in order to maintain same trajectory initial speed has to be decreased.

B. If proton enters closer to the inner surface it will require smaller speed to follow circular trajectory.

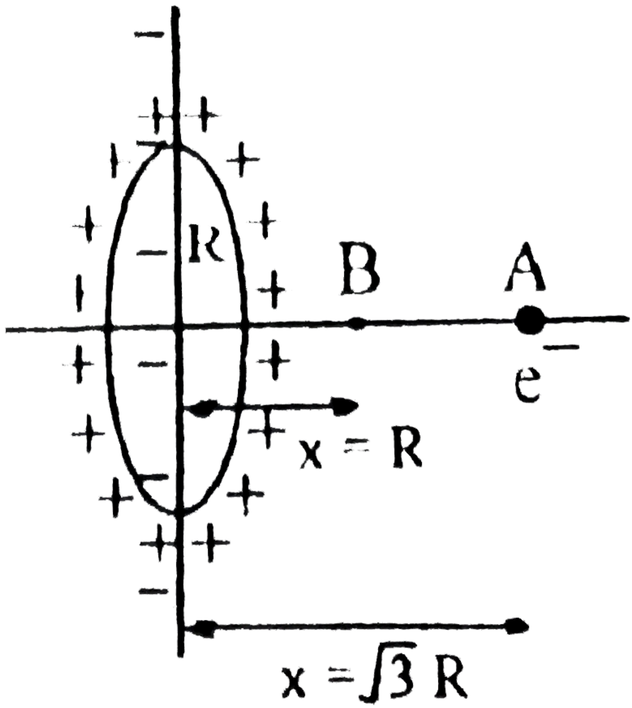
C. It does not matter where the protons enter the device it requires same speed to follow circular trajectory.

D. A deuteron (charge $+e$ mass 2m)will require greater speed as compared to proton to follow circular trajectory.

Answer: C

Watch Video Solution

74. There is a uniformly charged ring having radius R. An infinite line charge (charge per unit length lambda) is placed along a diameter of the ring (in gravity free space). Total charge on the ring $Q = 4\sqrt{2\lambda}R$. An electron of mass m is released from rest on the axis of the ring at a distance $x = \sqrt{3}R$ from the centre.



Magnitude of initial acceleration of the electron.

A. $\frac{e\lambda}{\pi\varepsilon_0 mR}\left(\frac{3-2\sqrt{2}}{4\sqrt{6}}\right)$

B. $\frac{e\lambda}{\pi\varepsilon_0 mR}\left(\frac{3+2\sqrt{2}}{4\sqrt{6}}\right)$

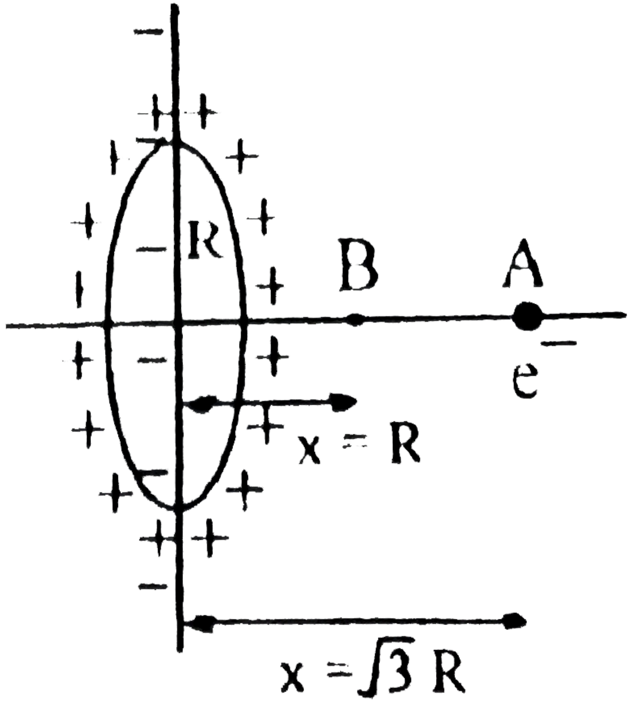
C. $\frac{e\lambda}{\pi\varepsilon_0 mR}\left(\frac{3+2\sqrt{2}}{4\sqrt{3}}\right)$

D. none

Answer: A

Watch Video Solution

75. There is a uniformly charged ring having radius R. An infinite line charge (charge per unit length lambda) is placed along a diameter of the ring (in gravity free space). Total charge on the ring $Q = 4\sqrt{2\lambda}R$. An electron of mass m is released from rest on the axis of the ring at a distance $x = \sqrt{3}R$ from the centre.



The distance from centre of ring on the axis where the net force on the electron is zero.

A. 2R

B. $\sqrt{2}$R

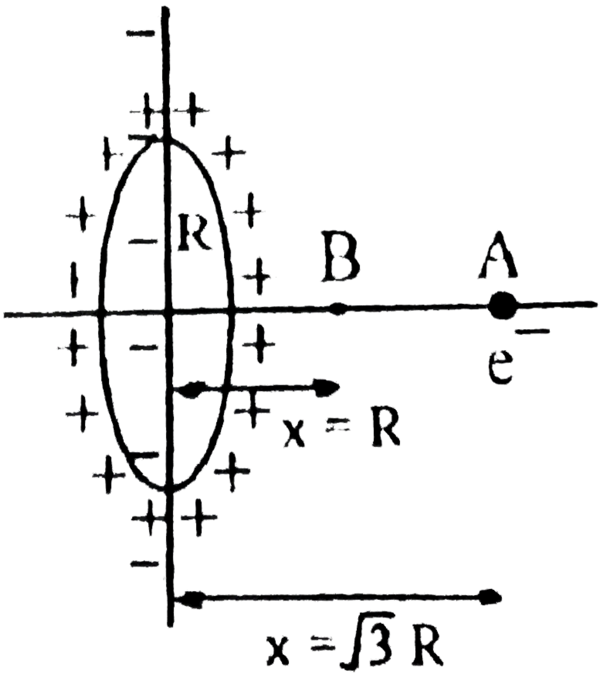
C. R

D. none of these

Answer: C

Watch Video Solution

76. There is a uniformly charged ring having radius R. An infinite line charge (charge per unit length lambda) is placed along a diameter of the ring (in gravity free space). Total charge on the ring $Q = 4\sqrt{2}\lambda R$. An electron of mass m is released from rest on the axis of the ring at a distance $x = \sqrt{3}R$ from the centre.



Potential difference between points $A\left(x = \sqrt{3}R\right)$ and $B(x = R) i.e. \left(V_A - V_B\right)$ is

A. $-\frac{\lambda}{\pi\varepsilon_0}\left[\left(1 - \frac{1}{\sqrt{2}}\right) - \frac{ln3}{4}\right]$

B. $-\frac{\lambda}{\pi\varepsilon_0}\left[\left(1 - \frac{1}{\sqrt{2}}\right) - \frac{ln3}{4}\right]$

C. $-\frac{\lambda}{\pi\varepsilon_0}\left[\left(1 + \frac{1}{\sqrt{2}}\right) - \frac{ln3}{4}\right]$

D. none

Answer: A

Watch Video Solution

77. There is an insulator rod of length L and of negligible mass with two small balls of mass m and electric charge Q attached to its ends. The rod can rotate in the horizontal plane around a vertical axis crossing it at a distance $L/4$ from one of its ends.

At first the rod is in unstable equilibrium in a horizontal uniform electric field of field strength E. Then we gently displace it from this position. Determine the maximum velocity attained by the ball that is closer to the axis in the subsequent motion

A. $\sqrt{\frac{2QEL}{m}}$

B. $\sqrt{\frac{2QEL}{5m}}$

C. $\sqrt{\frac{QEL}{5m}}$

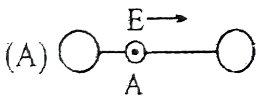
D. $\sqrt{\frac{4QEL}{5m}}$

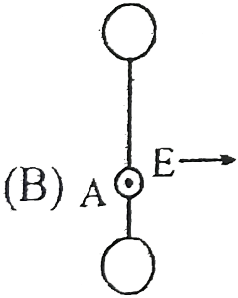
Answer: C

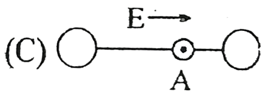
Watch Video Solution

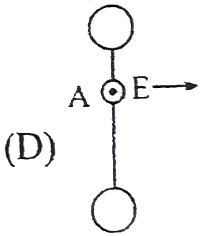
78. There is an insulator rod of length L and of negligible mass with two small balls of mass m and electric charge Q attached to its ends. The rod can rotate in the horizontal plane around a vertical axis crossing it at a $L/4$ distance from one of its ends.

In what position is the rod to be set so that if displaced a little from that position it begins a hormonic oscillation about the axisA?

A. 

B. 

C. 

D. 

Answer: A::D

Watch Video Solution

79. There is an insulator rod of length L and of negligible mass with two small balls of mass m and electric charge Q attached to its ends. The rod can rotate in the horizontal plane around a vertical axis crossing it at a $L/4$ distance from one of its ends.

What is the time period of the SHM as mentioned in previous question?

A. $2\pi\sqrt{\frac{mL}{QE}}$

B. $2\pi\sqrt{\frac{2mL}{3QE}}$

C. $2\pi\sqrt{\frac{5mL}{QE}}$

D. $2\pi\sqrt{\frac{5mL}{4QE}}$

Answer: D

Watch Video Solution

80. It is possible to take a high quality photograph of a very fast moving object by illuminating the object for quite a small fraction of a second. You may have come across photographs of a bullet penetrating a banana or an apple in many text books or magazines. This is called 'stop action' photography because the fast moving object travels a very short distance during the time of illumination. Harold Edgerton, the inventor of stroboscope, was a pioneer of this kind of photography. A normal photographic plate works properly if it receives an energy of 4J during the exposure. To release this energy in a very small fraction of time, huge amount of power is required. Such huge power can not be generated directly from a battery because of its high internal resistance. To produce such power a capacitor is used. The time in which a capacitor discharges can be very short. Although, theoretically it would take a long time for a capacitor to discharge completely, it discharges almost completely in about 10 time constant. Consider the following situation A capacitor of 200muF storing 4J energy is made to discharge through a flash light in 2ms. This setup is used to take the picture of a bullet moving at a speed of $100 m/s$ Assume that the flash light acts as a resistor and there is no other resistance in the circuit.

If we use a lens of power 10 diopters, the lens to photographic plate distance is 15cm and the bullet moves perpendicular to the principal axis, what is the distance covered by bullet as seen on photographic plate.

A. 1 cm

B. 5 cm

C. 10 cm

D. 20 cm

Answer: C

Watch Video Solution

81. It is possible to take a high quality photograph of a very fast moving object by illuminating the object for quite a small fraction of a second. You may have come across photographs of a bullet penetrating a banana or an apple in many text books or magazines. This is called 'stop action' photography because the fast moving object travels a very short distance during the time of illumination. Harold Edgerton, the inventor of stroboscope, was a pioneer of this kind of photography. A normal photographic plate works properly if it receives an energy of 4J during the exposure. To release this energy in a very small fraction of time, huge amount of power is required. Such huge power can not be generated directly from a battery because of its high internal resistance. To produce such power a capacitor is used. The time in which a capacitor discharges can be very short. Although, theoretically it would take a long time for a capacitor to discharge completely, it discharges almost completely in about 10 time constant. Consider the following situation A capacitor of 200muF storing 4J energy is made to discharge through a flash light in 2ms. This setup is used to take the picture of a bullet moving at a speed of $100m/s$ Assume that the flash light acts as a resistor and there is no other resistance in the circuit.

What is the order of energy delivered to the flash light in 0.2 ms(approx).

A. 0.4 J

B. 1.83 J

C. 2.74 J

D. 3.45 J

Answer: D

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82. It is possible to take a high quality photograph of a very fast moving object by illuminating the object for quite a small fraction of a second. You may have come across photographs of a bullet penetrating a banana or an apple in many text books or magazines. This is called 'stop action' photography because the fast moving object travels a very short distance during the time of illumination. Harold Edgerton, the inventor of stroboscope, was a pioneer of this kind of photography. A normal photographic plate works properly if it receives an energy of 4J during the exposure. To release this energy in a very small fraction of time, huge amount of power is required. Such huge power can not be generated directly from a battery because of its high internal resistance. To produce such power a capacitor is used. The time in which a capacitor discharges can be very short. Although, theoretically it would take a long time for a capacitor to discharge completely, it discharges almost completely in about 10 time constant. Consider the following situation A capacitor of 200muF storing 4J energy is made to discharge through a flash light in 2ms. This setup is used to take the picture of a bullet moving at a speed of $100m/s$ Assume that the flash light acts as a resistor and there is no other resistance in the circuit.

What is the initial current in the circuit

A. 200 A

B. 120 A

C. 700 A

D. 3700 A

Answer: A

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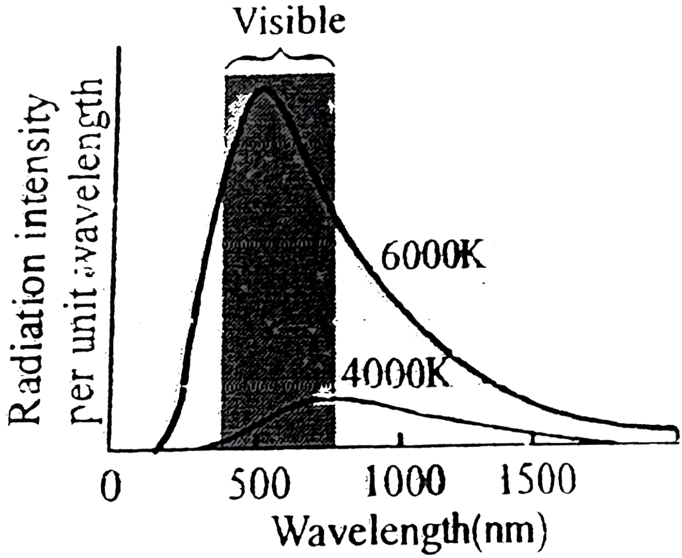
83. All bodies, no matter how hot or cold, continuously radiate photons. At a given temperature, the intensities of the electromagnetic waves emitted by an object vary from wavelength to wavelength throughout the visible, infrared, and other regions of the spectrum. Figure illustrates how the intensity per unit wavelength depends on wavelength for a perfect blackbody emitter. Although this figure can strictly be applied only to a black body, yet this will approximately discribe the behavior of many of the self radiating systems. For example, sun has an approximate temperature of 6000K. it is not a black body, it has an emissivity of nearly 0.6 But its peak almost occurs at a wave length that predicted by Wein's law. Suppose we have a bulb of power 100W. It emits only about 5W as visible light, rest is emitted as infrared radiated. Assume that the bulb filament has a surface area of 10mm^(2) $(hc = 1250eV - nm)$



What is the approximate temperature of the filament?

A. 500 k

B. 350 k

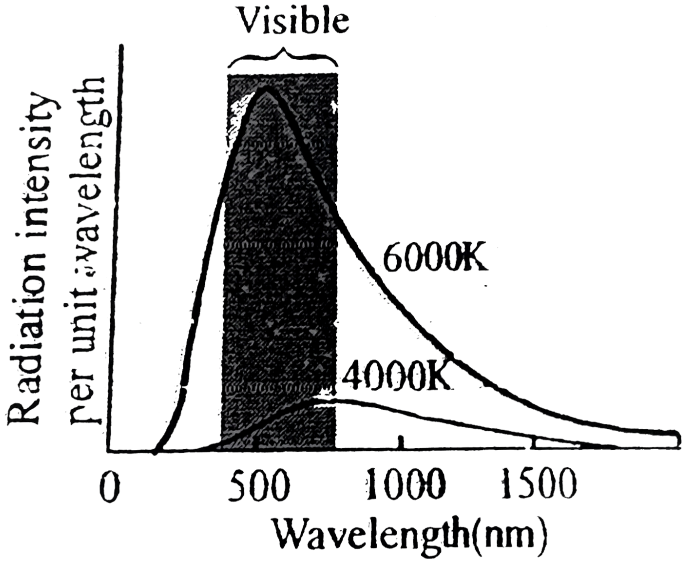
C. 2500 K

D. 10000 K

Answer: C

View Text Solution

84. All bodies, no matter how hot or cold, continuously radiate photons. At a given temperature, the intensities of the electromagnetic waves emitted by an object vary from wavelength to wavelength throughout the visible, infrared, and other regions of the spectrum. Figure illustrates how the intensity per unit wavelength depends on wavelength for a perfect blackbody emitter. Although this figure can strictly be applied only to a black body, yet this will approximately discribe the behavior of many of the self radiating systems. For example, sun has an approximate temperature of 6000K. it is not a black body, it has an emissivity of nearly 0.6 But its peak almost occurs at a wave length that predicted by Wein's law. Suppose we have a bulb of power 100W. It emits only about 5W as visible light, rest is emitted as infrared radiated. Assume that the bulb filament has a surface area of 10mm^(2) $(hc = 1250 eV\text{ - }nm)$



Assume that the light emitted by the bulb in the visible region is entirely of wavelength 500 nm. What is the number of photons emitted per second in the visible region?

A. 1.25×10^{19}

B. 5×10^{19}

C. 2.5×10^{19}

D. 4×10^{19}

Answer: A

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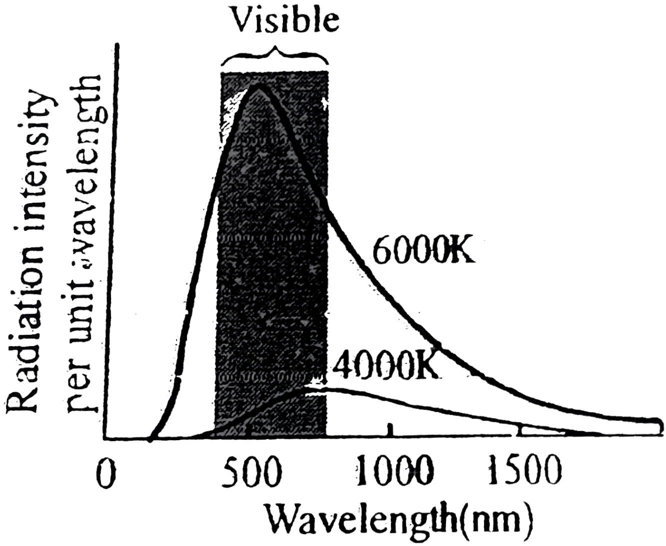
85. All bodies, no matter how hot or cold, continuously radiate photons. At a given temperature, the intensities of the electromagnetic waves emitted by an object vary from wavelength to wavelength throughout the visible, infrared, and other regions of the spectrum. Figure illustrates how the intensity per unit wavelength depends on wavelength for a perfect blackbody emitter. Although this figure can strictly be applied only to a black body, yet this will approximately discribe the behavior of many of the self radiating systems. For example, sun has an approximate temperature of 6000K. it is not a black body, it has an emissivity of nearly 0.6 But its peak almost occurs at a wave length that predicted by Wein's law. Suppose we have a bulb of power 100W. It emits only about 5W as visible light, rest is emitted as infrared radiated. Assume that the bulb filament has a surface area of 10mm^(2) ($hc = 1250 eV$ - nm)



If we want of increase the number of photons emitted by the bulb in the visible region without changing the wattage, which method would be most appropriate?

A. increasing emissivity by a factor of 2

B. increasing the radius of the filament by a factor of 2 and the length by a factor of 4.

C. decreasing the radius of the filament by a factor of 2 and the length by a factor of 4

D. doubling the voltage and decreasing the length of the filament by a factor of 2.

Answer: C

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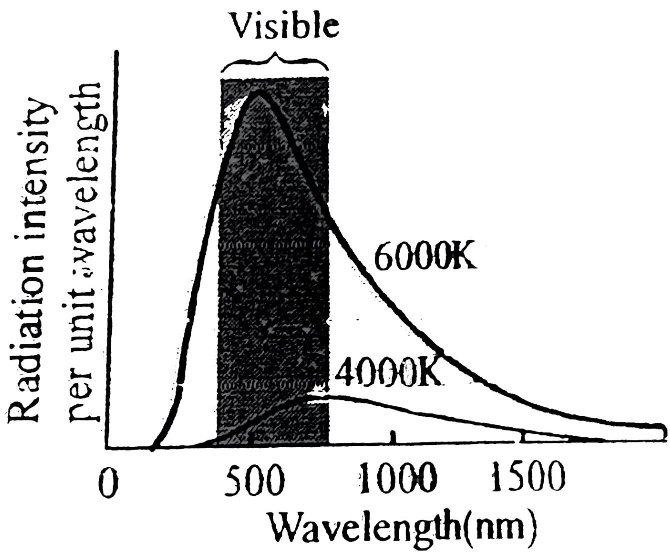
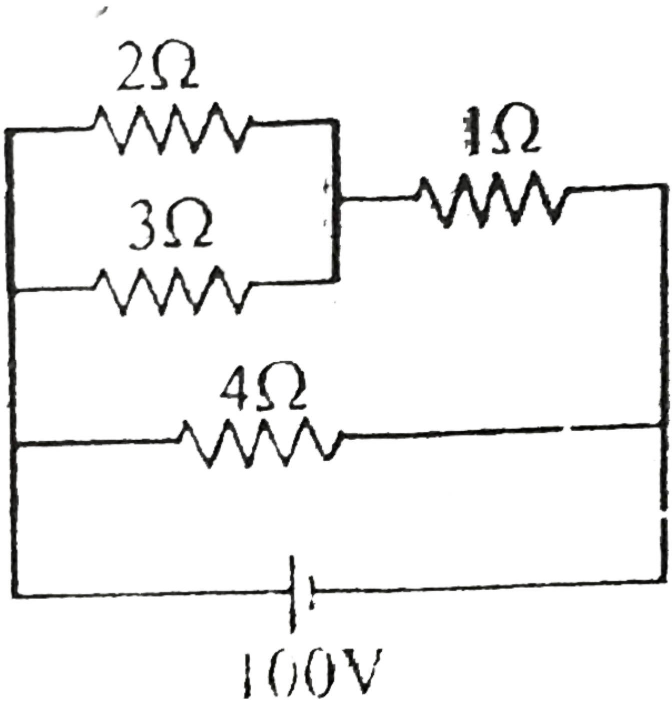
86. All bodies, no matter how hot or cold, continuously radiate photons. At a given temperature, the intensities of the electromagnetic waves emitted by an object vary from wavelength to wavelength throughout the visible, infrared, and other regions of the spectrum. Figure illustrates how the intensity per unit wavelength depends on wavelength for a perfect blackbody emitter. Although this figure can strictly be applied only to a black body, yet this will approximately discribe the behavior of many of the self radiating systems. For example, sun has an approximate temperature of 6000K. it is not a black body, it has an emissivity of nearly 0.6 But its peak almost occurs at a wave length that predicted by Wein's law. Suppose we have a bulb of power 100W. It emits only about 5W as visible light, rest is emitted as infrared radiated. Assume that the bulb filament has a surface area of 10mm^(2) ($hc = 1250 eV$ - nm)



Which of the following resistances would have maximum surface temperature. All of them have a surface area of $10 mm^2$ and same emissivity



A. 1Ω

B. 2Ω

C. 3Ω

D. 4Ω

Answer: D

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87. A fixed resistor is cannected in parallel with a variable resistor, both are connected to a real battery (internal resistance is not negligible). Originally the fixed and variable resistors have the same resistance

As the resistance of the variable resistor is decreased, the current through the fixed resistor

A. increases

B. decreases

C. remains the same

D. cannot be determined without more information

Answer: B

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88. A fixed resistor is cannected in parallel with a variable resistor, both are connected to a real battery (internal resistance is not negligible). Originally the fixed and variable resistors have the same resistance

As the resistance of the variable resistor is decreased, the rate at which energy is trausferred to the fixed resistor

A. increases

B. decreases

C. remains the same

D. cannot be determined without more information

Answer: B

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89. A fixed resistor is cannected in parallel with a variable resistor, both are connected to a real battery (internal resistance is not negligible). Originally the fixed and variable resistors have the same resistance

If the resistance of the variable resistor is decreased slightly, the rate at which energy is transferred to the variable resistor

A. increases

B. decreases

C. remains the same

D. cannot be determined without more information

Answer: A

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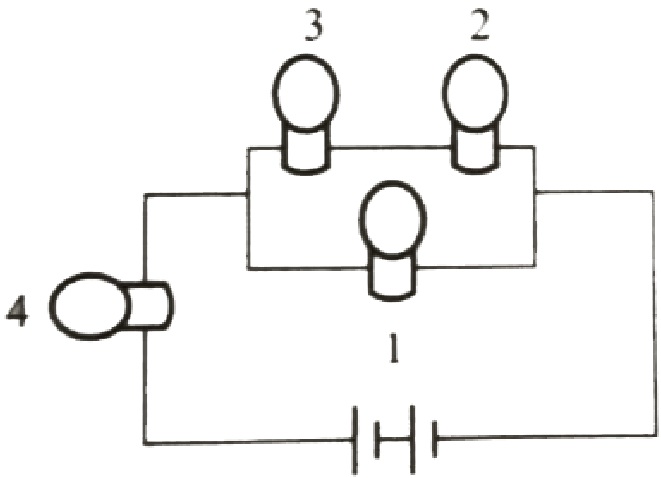
90. All bulbs consume same power. The resistance of bulb 1 is 36Ω. Answer the following questions:



What is the resistance of bulb 3?

A. 4Ω

B. 9Ω

C. 12Ω

D. 18Ω

Answer: B

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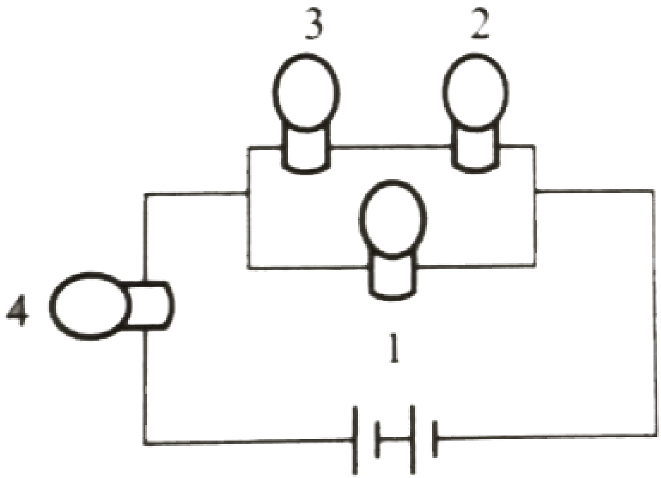
91. All bulbs consume same power. The resistance of bulb 1 is 36Ω. Answer the following questions:



What is the resistance of bulb 4?

A. 4Ω

B. 9Ω

C. 12Ω

D. 18Ω

Answer: A

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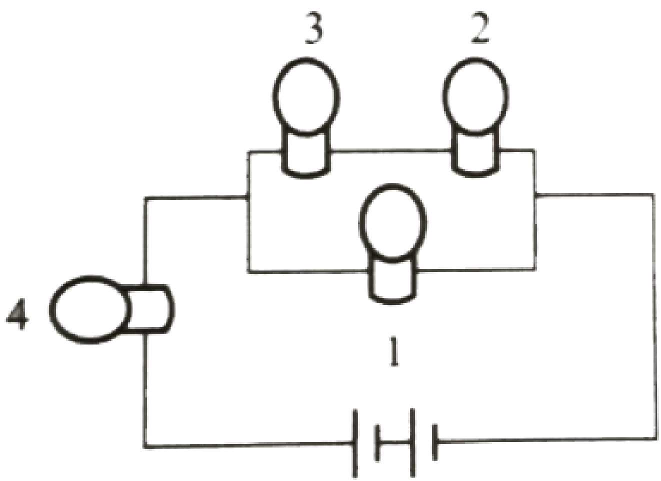
92. All bulbs consume same power. The resistance of bulb 1 is 36Ω . Answer the following questions:



What is the voltage output of the battery if the power of each bulb is $4W$?

A. 12 V

B. 16 V

C. 24 V

D. None of these

Answer: B

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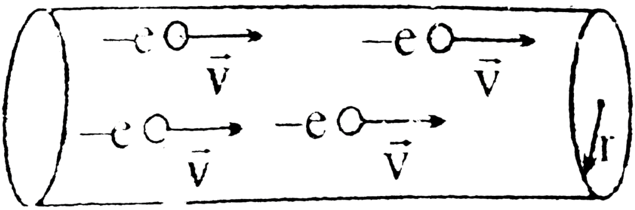
93. A beam of electrons has radius r and contains 'n' electrons per cubic meter moving with velocity $\vec{v}$ along the beam (figure). Assume that a beam that is much longer than its diameter forms a cylinderically symmetric distribution of charge and current. The beam expands if the electric force exceeds the magnetic force. So long as the expansion is slow, the approximations of cylindrical symmetry and static fields remain valid.



What is electric field produced on the edge of the beam?

A. $\vec{E} = \frac{ner}{4\varepsilon_0}\hat{r}$

B. $\vec{E} = \frac{ner}{2\varepsilon_0}\hat{r}$

C. $\vec{E} = \frac{-ner}{4\varepsilon_0}\hat{r}$

D. $\vec{E} = \frac{-ner}{2\varepsilon_0}\hat{r}$

Answer: D

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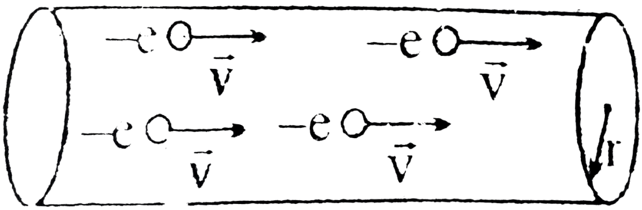
94. A beam of electrons has radius r and contains 'n' electrons per cubic meter moving with velocity $\vec{v}$ along the beam (figure).

Assume that a beam that is much longer than its diameter forms a cylinderically symmetric distribution of charge and current. The beam expands if the electric force exceeds the magnetic force. So long as the expansion is slow, the approximations of cylindrical symmetry and static fields remain valid.



What is net force on the electron at the edge of the beam?

A. $\frac{2ne^2r}{\varepsilon_0}\left(1 - \mu_0\varepsilon_0 v^2\right)\hat{r}$

B. $\frac{ne^2r}{2\varepsilon_0}\left(1 - \mu_0\varepsilon_0 v^2\right)\hat{r}$

C. $\frac{4ne^2r}{\varepsilon_0}\left(1 - \mu_0\varepsilon_0 v^2\right)\hat{r}$

D. $\frac{ne^2r}{4\varepsilon_0}\left(1 - \mu_0\varepsilon_0 v^2\right)\hat{r}$

Answer: B

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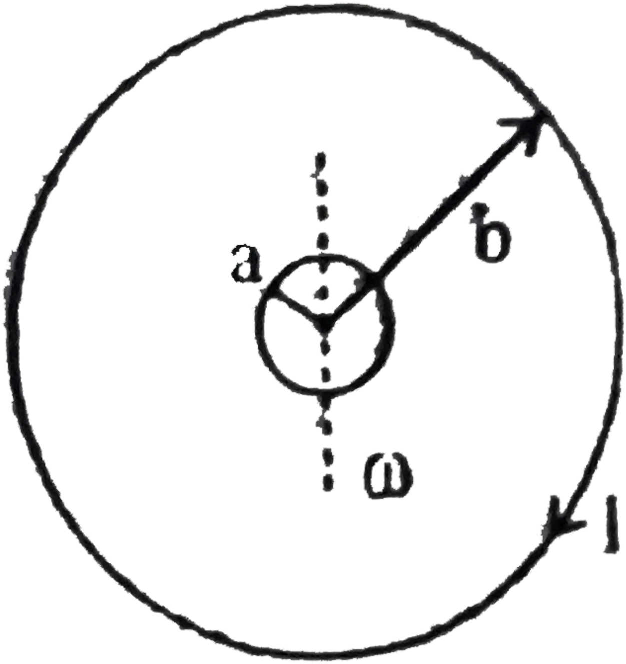
95. A very small circular loop of radius a is initially coplanar & concentric with a much larger circular loop of radius b $(> \ > a)$. A constant current is passed in the large loop which is kept fixed in space & the small loop is rotated with angular velocity omega about a diameter. The resistance of the small loop is R & its self inductance is negligible. The current in the larger loop is clockwise.



Find the current in the small loop as a function of time.

A. $\dfrac{\pi a^2 \mu_0 I \omega \sin\omega t}{2bR}$

B. $\dfrac{\pi a^2 \mu_0 I \omega \cos\omega t}{2bR}$

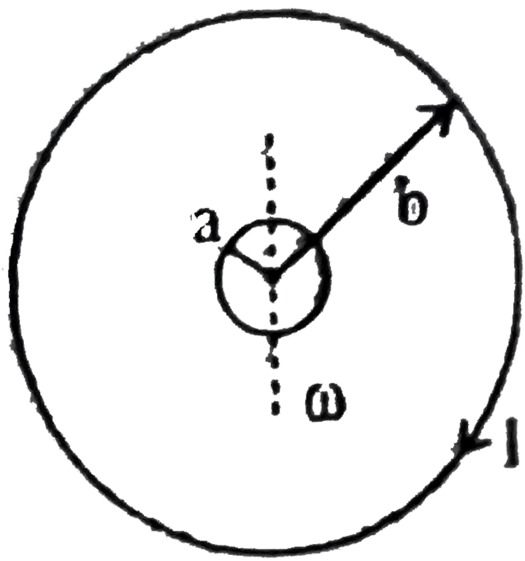
C. $\dfrac{\pi b^2 \mu_0 I \omega \sin\omega t}{2aR}$

D. $\dfrac{\pi b^2 \mu_0 I \omega \cos\omega t}{2aR}$

Answer: A

Watch Video Solution

96. A very small circular loop of radius a is initially coplanar & concentric with a much larger circular loop of radius b ($>\ >a$). A constant current is passed in the large loop which is kept fixed in space & the small loop is rotated with angular velocity omega about a diameter. The resistance of the small loop is R & its self inductance is negligible. The current in the larger loop is clockwise.



Calculate how much torque must be exerted on the small loop to rotate it.

A. $\frac{\omega}{R}\left(\frac{\pi b^2 \mu_0 I \sin\omega t}{2b}\right)^2$

B. $\frac{\omega}{R}\left(\frac{\pi b^2 \mu_0 I}{2b}\right)^2 \sin\omega t \cos\omega t$

C. $\frac{\omega}{R}\left(\frac{\pi a^2 \mu_0 I \sin\omega t}{2b}\right)^2$

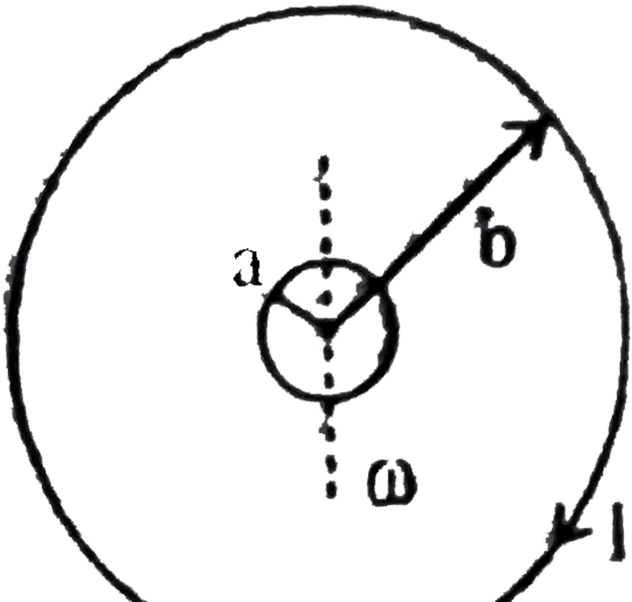
D. None of these

Answer: C

Watch Video Solution

97. A very small circular loop of radius a is initially coplanar & concentric with a much larger circular loop of radius b $(> > a)$.

A constant current is passed in the large loop which is kept fixed in space & the small loop is rotated with angular velocity omega about a diameter. The resistance of the small loop is R & its self inductance is negligible. The current in the larger loop is clockwise.



At the moment both the loops are in the same plane

A. the induced current in small loop is zero.

B. the induced current in small loop is clockwise.

C. the induced current in small loop is in anticlockwise direction.

D. the induced current is clockwise or anticlockwise depending on sense of angular velocity vector.

Answer: A

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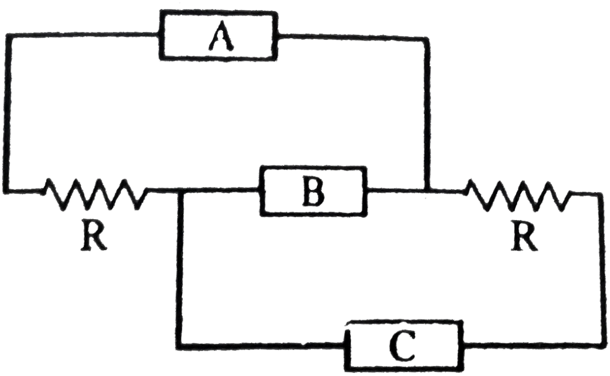
98. A circuit is shown below.



If A is an ideal ammeter, B an ideal Battery of voltage V, and C an ideal volmeter, what will be the reading of C/reading of A ?

A. R

B. 2R

C. R/2

D. 0

Answer: A

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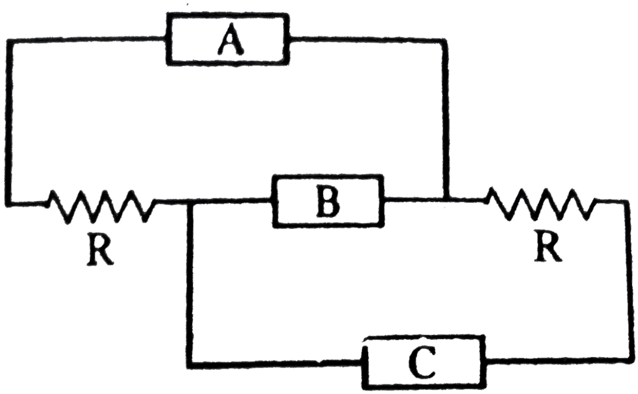
99. A circuit is shown below.



If A is a capacitor, B is an ideal ammeter and C is an ideal battery of voltage V, what is the voltage across the capacitor?

A. V

B. $\frac{V}{2}$

C. 2V

D. 0

Answer: D

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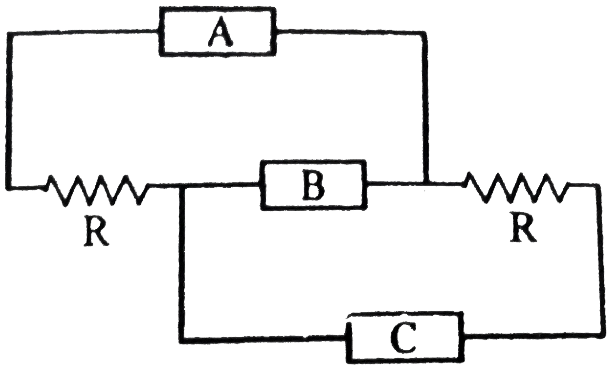
100. A circuit is shown below.



If B is an inductor of inductance L, A an ideal battery of voltage V and C an ideal battery of voltage 2V each connected so that the anode is facing left, what is voltage across B as soon as the circuit is connected:

A. $\frac{V}{2}$

B. V

C. $3\frac{V}{2}$

D. 0

Answer: C

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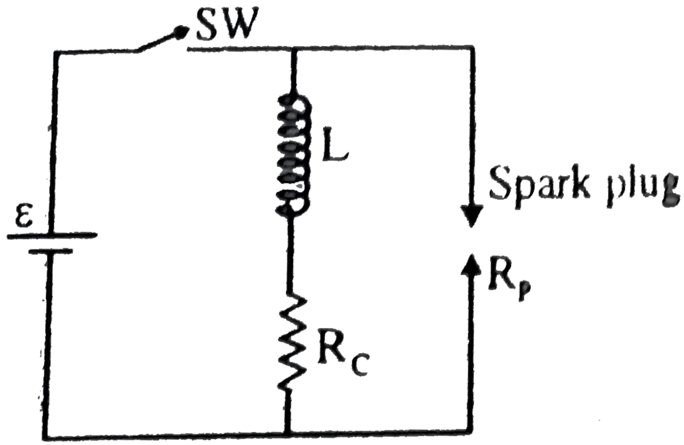
101. The spark plug in an automobile engine is an R - L circuit as shown in figure. The circuit that provides the spark uses an inductor as the energy source. Initially switch is closed and allows current to build through the inductor. When the switch is open the current decreases rapidly through inductor and a large emf is induced by inductor Given $ver\varepsilon = 12V, L = 10mH, Rc = 10\Omega, R_p = 7k\Omega$



If switch must be closed for up to three time constants. Find this time

A. 3 ms

B. 1.5 ms

C. 6 ms

D. 1/3 ms

Answer: A

Watch Video Solution

102. The spark plug in an automobile engine is an R - L circuit as shown in figure. The circuit that provides the spark uses an inductor as the energy source. Initially switch is closed and allows current to build through the inductor. When the switch is open the current decreases rapidly through inductor and a large emf is induced by inductor Given

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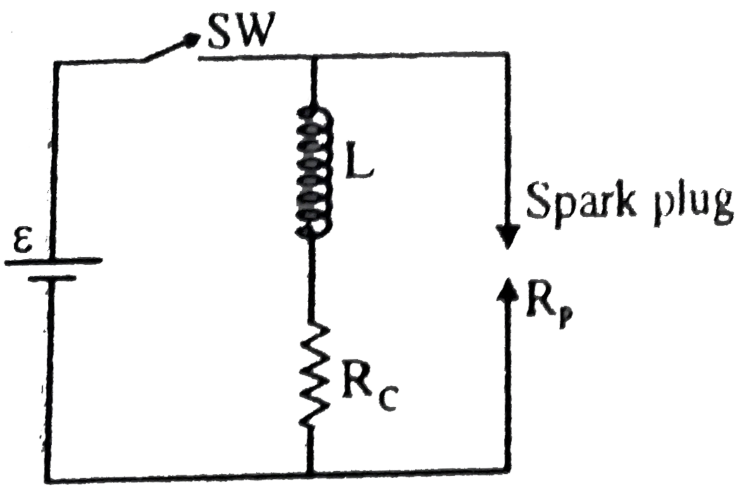

The spark occurs in the spark plug because

A. Spark plug short circuits the inductor.

B. Spark plug short circuits the battery.

C. Due to large induced emf generated by inductor air in the gap in spark plug gets onized.

D. Spark produced is due to conversion of magnetic field energy of inductor to visible electromagnetic radiations.

Answer: C

Watch Video Solution

103. The spark plug in an automobile engine is an R - L circuit as shown in figure. The circuit that provides the spark uses an inductor as the energy source. Initially switch is closed and allows current to build through the inductor. When the switch is open the current decreases rapidly through inductor and a large emf is induced by inductor Given

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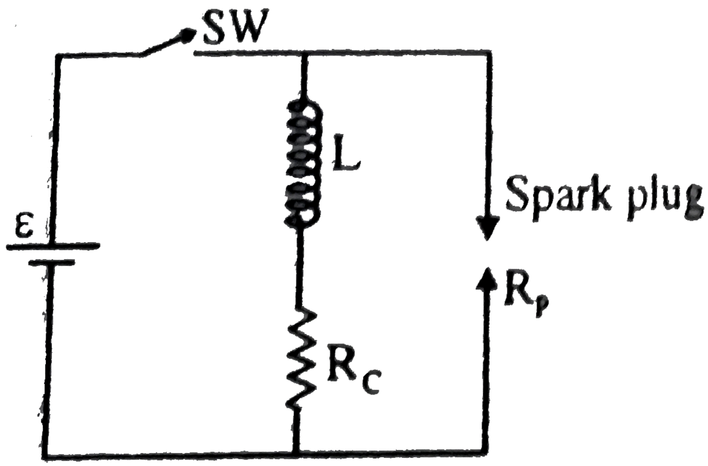


What is maximum heat dissipated in the spark plug?

A. 3.5 mJ

B. 14.4 mJ

C. 7.2 mJ

D. 6 mJ

Answer: C

Watch Video Solution

104. The ciliary muscles of eye control the curvature of the lens in the eye and hence can alter the effective focal length of the system. When the muscles are fully relaxed, the focal length is maximum. When the muscles are strained, the curvature of lens increases. That means radius of curvature decreases and focal length decreases. For a clear vision, the image must be on the retina. The image distance is therefore fixed for clear vision and it equals the distance of retina from eye lens. It is about 2.5cm for a grown up person.

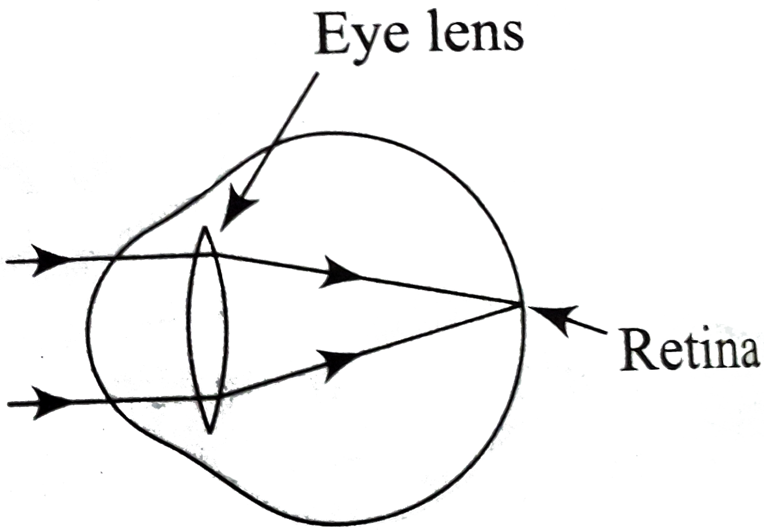
A perosn can theoretically have clear vision of an object situated at any large distance from the eye. The smallest distance at which a person can clearly see is related to minimum possible focal length. The ciliary muscles are most strained in this position. For an average grown up person, minimum distance of the object should be around 25cm.

A person suffering from eye defects uses spectacles (eye glass).

The function of lens of spectacles is to form the image of the objects within the range in which the person can see clearly. The image o the spectacle lens becomes object for the eye lens and whose image is formed on the retina.

The number of spectacle lens used for th eremedy of eye defect is decided by the power fo the lens required and the number of spectacle lens is equal to the numerical value of the power of lens with sign. For example, if power of the lens required is $+3D$ (converging lens of focal length $100/3cm$), then number of lens will be $+3$.

For all the calculations required, you can use the lens formula and lensmaker's formula. Assume that the eye lens is equiconvex lens. Neglect the distance between the eye lens and the spectacle lens.



Q. Maximum focal length of a eye lens of a normal person is

A. 1.2 cm

B. 2.5 cm

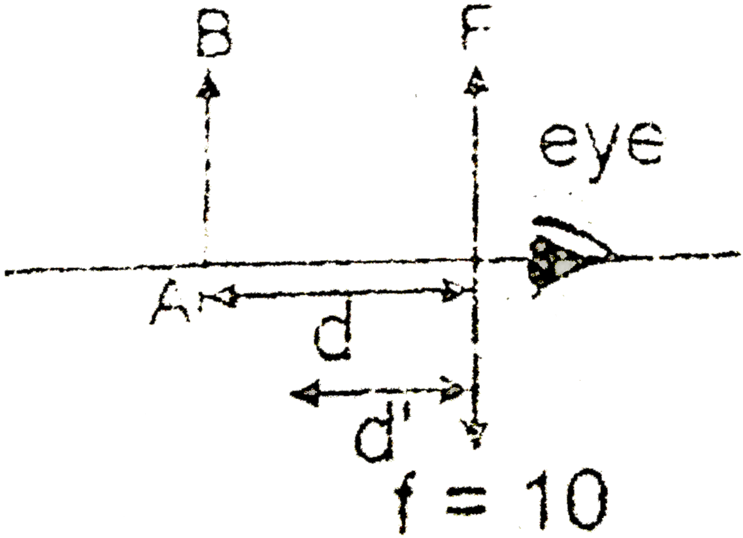
C. ∞

D. $25/11$ cm

Answer: D

Watch Video Solution

105. If the eye is kept very close to a coverging lens (focal length $= 10 cm$) and at the optical centre of the lens and an object is kept at distance 'd' of the object from the lebs so that its image can be seen clearly by the defect free eye is :



A. 10 cm

B. 25 cm

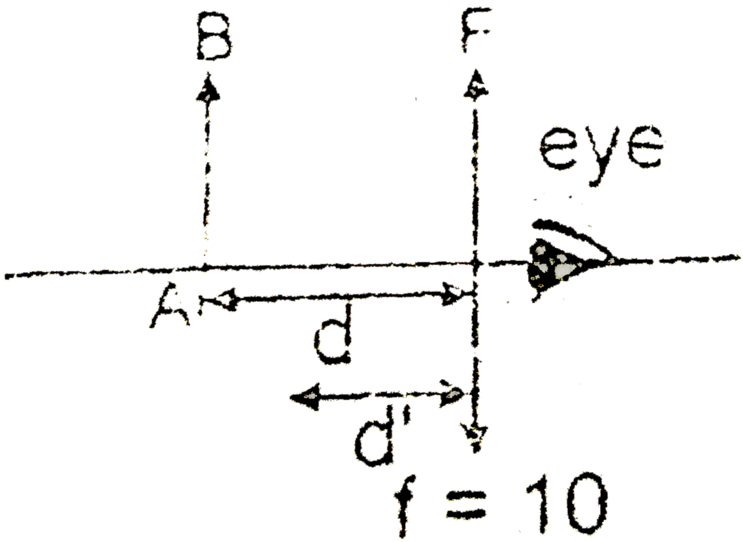
C. $50/3$ cm

D. $50/7$ cm

Answer: A

Watch Video Solution

106. If the eye is kept very close to a coverging lens (focal length $= 10cm$) and at the optical centre of the lens and an object is kept at distance 'd' of the object from the lebs so that its image can be seen clearly by the defect free eye is :



A. 2.5

B. 1.25

C. 5

D. 3.5

Answer: A

Watch Video Solution

107. For a given optical system, the principal axis is x-axis and coordinates of object are $(-30, +1, 0)$ and coordinates of image are $(+20, -2, 0)$ All coordinates are in cm.

If the optical system is a concave mirror, it is located at what point?

A. origin

B. -80 cm

C. $-\frac{40}{3}$ cm

D. $\frac{40}{3} cm$

Answer: B

Watch Video Solution

108. For a given optical system, the principal axis is x-axis and coordinates of object are $(-30, +1, 0)$ and coordinates of image are $(+20, -2, 0)$ All coordinates are in cm.

If the optical system is a convex lens, what is its focal length?

A. 12 cm

B. 10 cm

C. $\frac{100}{3}$ cm

D. $\frac{100}{9}$ cm

Answer: D

Watch Video Solution

109. For a given optical system, the principal axis is x-axis and coordinates of object are $(-30, +1, 0)$ and coordinates of image are $(+20, -2, 0)$ All coordinates are in cm.

If the optical system is a spherical refracting surface, its centre of curvature is at what point?

A. -15 cm

B. $+25$ cm

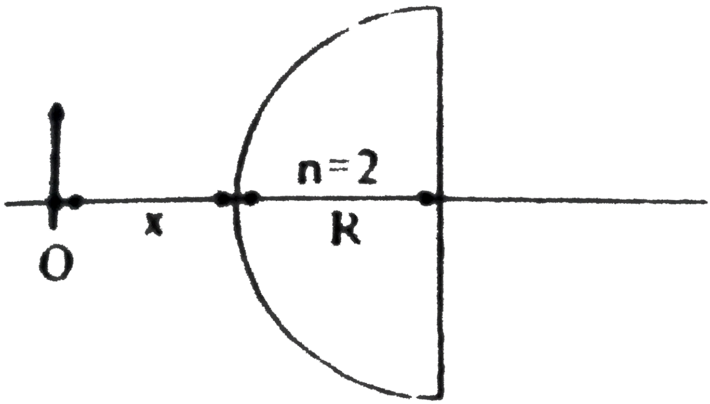
C. $\frac{-40}{3}$ cm

D. -80 cm

Answer: C

View Text Solution

110. Consider a transparent hemisphere $(n = 2)$ in front of which a small object is placed in air $(n = 1)$ as shown.



For which value of x of the following will final image of object at O be virtual

A. 2R

B. 3R

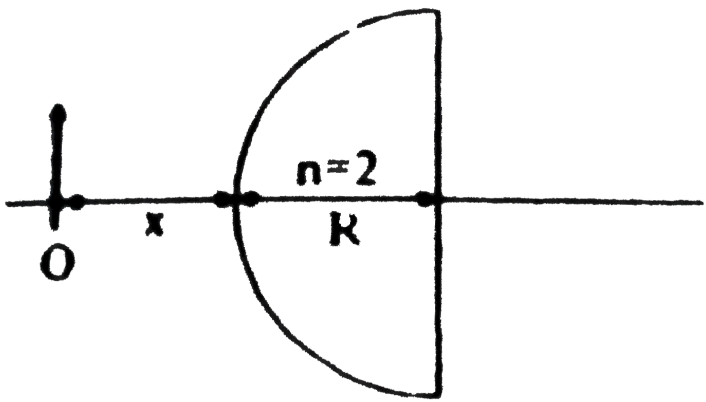
C. $R/2$

D. 1.5 R

Answer: C

View Text Solution

111. Consider a transparent hemisphere $(n = 2)$ in front of which a small object is placed in air $(n = 1)$ as shown.



What is the nature of final image of object $x = 2R$

A. Erect & magnified

B. Inverted & magnified

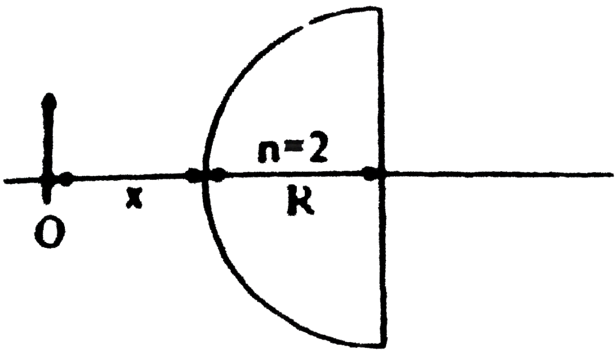
C. Erect & same size

D. Inverted & same size

Answer: D

View Text Solution

112. Consider a transparent hemisphere $(n = 2)$ in front of which a small object is placed in air $(n = 1)$ as shown.



Consider a ray starting from O which strikes the spherical surface at grazing incidence $\left(i = 90^{\circ}\right)$ Taking $x = R$ what will be the angle (from the normal) at which the ray emerges from the plane surface.

A. 90°

B. 0°

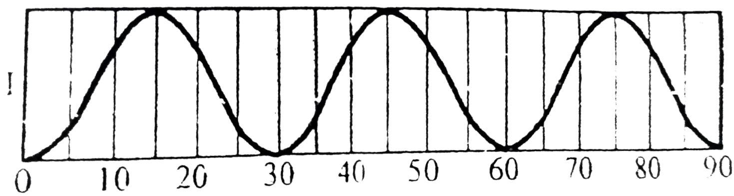
C. 30°

D. 60°

Answer: A

View Text Solution

113. In the front of the upper slit of YDSE apparatus, a thin film of a liquid of refractive index 1.40 is placed. It is a hot day and the liquid starts evaporating from the surface. A beam of light at wavelength 560 nm is incident onto the YDSE apparatus and the intensity I at the centre of the screen is monitored. Figure gives intensity I as a function of time t. The intensity changes because of evaporation from the two sides of the film. Assume that the film is flat and has parallel sides. Also assume that the film's thickness decreases at a constant rate



What can be the initial thickness of the film?

A. $7 \mu m$

B. $4.9 \mu m$

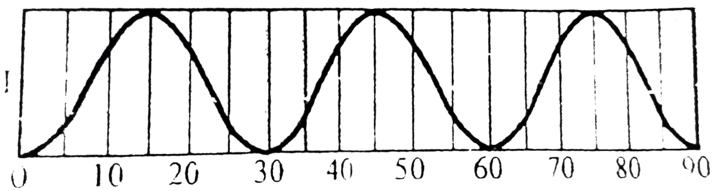
C. $7.7 \mu m$

D. $9.1 \mu m$

Answer: B::C::D

View Text Solution

114. In the front of the upper slit of YDSE apparatus, a thin film of a liquid of refractive index 1.40 is placed. It is a hot day and the liquid starts evaporating from the surface. A beam of light at wavelength 560 nm is incident onto the YDSE apparatus and the intensity I at the centre of the screen is monitored. Figure gives intensity I as a function of time t. The intensity changes because of evaporation from the two sides of the film. Assume that the film is flat and has parallel sides. Also assume that the film's thickness decreases at a constant rate



If the maximum intensity is I_0 then

A. Intensity at $t = 0 \sec is \frac{I_0}{\sqrt{2}}$

B. Intensity at $t = 10 \sec is \frac{3I_0}{4}$

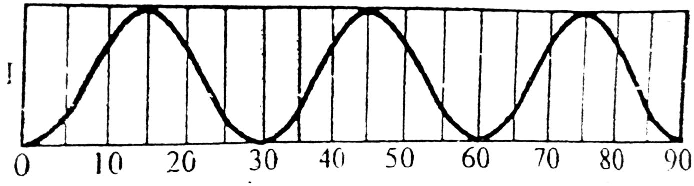
C. Intensity at $t = 5 \sec is \frac{I_0}{4}$

D. Intensity at $t = 5\sec, \frac{I_0}{2\sqrt{2}}$

Answer: B::C

View Text Solution

115. In the front of the upper slit of YDSE apparatus, a thin film of a liquid of refractive index 1.40 is placed. It is a hot day and the liquid starts evaporating from the surface. A beam of light at wavelength 560 nm is incident onto the YDSE apparatus and the intensity I at the centre of the screen is monitored. Figure gives intensity I as a function of time t. The intensity changes because of evaporation from the two sides of the film. Assume that the film is flat and has parallel sides. Also assume that the film's thickness decreases at a constant rate



The rate of change of thickness can be

A. $\frac{140}{3} nm/\sec$

B. $70 nm/\sec$

C. $\frac{28}{3} nm/\sec$

D. $\frac{56}{3} nm/\sec$

Answer: A

View Text Solution

116. A 500 g teapot and an insulated thermos are in a $20^{\circ}C$ room. The teapot is filled with 1000 g of the boiling water. 12 tea bags are then placed into the teapot. The brewed tea is allowed to cool to $80\,^{\circ}$C, then 250 g of the tea is poured from the teapot into the thermos. The teapot is then kept on an insulated warmer that transfers 500 $cal/\min$ to the tea. Assume that the specific heat of brewed tea is the same as that of pure water, and that the tea bags have a very small mass compared to that of the water, and a negligible effect on the temperature. The specific heat of teapot is $0.17J/g$ K and that of water is $4.18J/g$ K. The entire procedure is done under atmospheric pressure. There are 4.18 J in one calorie.

After the tea is added to the thermos, the temperature of the liquid quickly falls from $80\,^{\circ}$C to $75\,^{\circ}$C as it reaches thermal equilibrium with the thermos flask. What is the heat capacity of the thermos?

A. $9.5J/K$

B. $14J/k$

C. $95J/K$

D. $878J/K$

Answer: C

View Text Solution

117. A 500 g teapot and an insulated thermos are in a 20°C room. The teapot is filled with 1000 g of the boiling water. 12 tea bags are then placed into the teapot. The brewed tea is allowed to cool to 80°C, then 250 g of the tea is poured from the teapot into the thermos. The teapot is then kept on an insulated warmer that transfers 500 $cal/\min$ to the tea. Assume that the specific heat of brewed tea is the same as that of pure water, and that the tea bags have a very small mass compared to that of the water, and a negligible effect on the temperature. The specific heat of teapot is $0.17J/g$ K and that of water is $4.18J/g$ K. The entire procedure is done under atmospheric pressure. There are

4.18 J in one calorie.

An alternative method for keeping the tea hot would be, to place the teapot on a 10 pound block that has been heated in an oven to $300\,^{\circ}$C. A block of which of the following substances would best be able to keep the tea hot?

A. copper (specific heat $= 0.39 J/gK$)

B. granite (specific heat $= 0.79 J/gK$)

C. iron (specific heat $= 0.45 J/gK$)

D. pewter (specific heat $= 0.17 J/gK$)

Answer: B

View Text Solution

118. A 500 g teapot and an insulated thermos are in a $20\,^{\circ}$C room. The teapot is filled with 1000 g of the boiling water. 12 tea bags are then placed into the teapot. The brewed tea is allowed to cool to $80\,^{\circ}$C, then 250 g of the tea is poured from the teapot into the thermos. The teapot is then kept on an insulated warmer that transfers 500 $cal/\min$ to the tea. Assume that the specific heat of brewed tea is the same as that of pure water, and that the tea bags have a very small mass compared to that of the water, and a negligible effect on the temperature. The specific heat of teapot is $0.17 J/g$ K and that of water is $4.18 J/g$ K. The entire procedure is done under atmospheric pressure. There are 4.18 J in one calorie.

If, after some of the tea has been transferred to the thermos (as described in the passage), the teapot with its contents (at a temperature of $80\,^{\circ}$ C)was placed on the insulated warmer, what would be the temperature at the end of this 5 minute period? (Assume that no significant heat transfer occurs with the surroundings)

A. $80.7\,^{\circ}$ C

B. $82.5\,^{\circ}$ C

C. $83.2\,^{\circ}$C

D. $95.2\,^{\circ}$C

Answer: C

View Text Solution

119. In a container of negligible heat capacity 200 gm ice at $0\,^{\circ}$C and 100 gm steam at $100\,^{\circ}$C are added to 200 gm of water that has temperature $55\,^{\circ}$C. Assume no heat is lost to the surroundings and the pressure in the container is constant of $1.0 atm \left(L_f = 80 cal/gm, L_v = 540 cal/gm, s_w = 1 cal/gm\,^{\circ}C\right)$

What is the final temperature of the system ?

A. $48\,^{\circ}$C

B. 72° C

C. 94° C

D. 100° C

Answer: D

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120. In a container of negligible heat capacity 200 gm ice at 0° C and 100 gm steam at 100° C are added to 200 gm of water that has temperature 55° C. Assume no heat is lost to the surroundings and the pressure in the container is constant of $1.0atm\left(L_f = 80cal/gm, L_v = 540cal/gm, s_w = 1cal/gm^{\circ}C\right)$

At the final temperature, mass os the total water present in the system, is

A. 472.6 gm

B. 483.3 gm

C. 493.6 gm

D. 500 gm

Answer: B

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121. In a container of negligible heat capacity 200 gm ice at $0\,^{\circ}$C and 100 gm steam at $100\,^{\circ}$C are added to 200 gm of water that has temperature $55\,^{\circ}$C. Assume no heat is lost to the surroundings and the pressure in the container is constant of $1.0 atm\left(L_f = 80 cal/gm, L_v = 540 cal/gm, s_w = 1 cal/gm\,^{\circ}C\right)$

Amount of the steam left in the system, is equal to

A. 16.7 gm

B. 12.0 gm

C. 8.4 gm

D. 0gm, as there is no steam left

Answer: A

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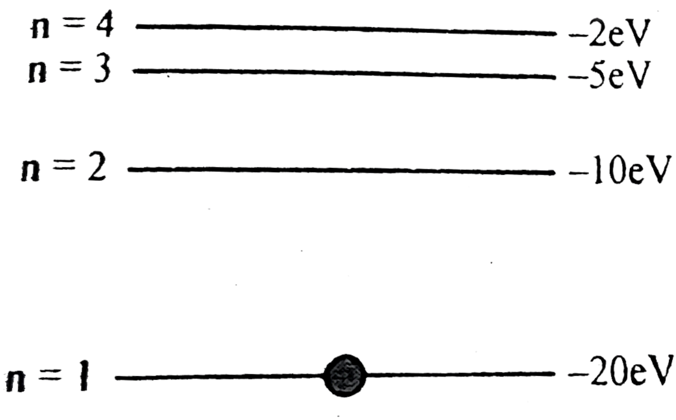
122. The energy-level scheme for the hypothetical one electron element Bansalium is shown in figure. The potential energy is taken to be zero for an electron at an infinite distance from the nucleus.



A sample of atoms Bansalium are in all the 3 excited state shown above. What is the possible wavelength that can be emitted by atom in visible range?

A. 414 nm

B. 620 nm

C. 124 nm

D. 920 nm

Answer: A

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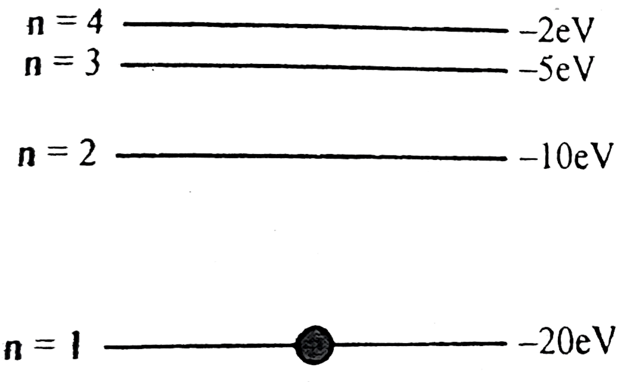
123. The energy-level scheme for the hypothetical one electron element Bansalium is shown in figure. The potential energy is taken to be zero for an electron at an infinite distance from the nucleus.



If a Bansalium atom is in ground state, which of the following photons cannot excite the atom to a higher state?

A. 10 eV

B. 15 eV

C. 18 eV

D. 12 eV

Answer: D

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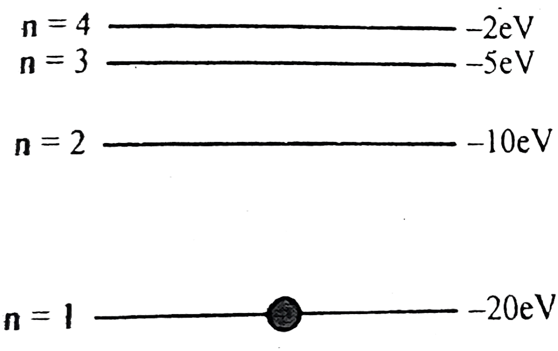
124. The energy-level scheme for the hypothetical one electron element Bansalium is shown in figure. The potential energy is taken to be zero for an electron at an infinite distance from the nucleus.



If photons emitted from Bansalium transitions $n = 4 \rightarrow n = 2$ and $omn = 2 \rightarrow n = 1$ will eject photoelectrons from an unknown metal but the photon emitted from the transition $n = 3 \rightarrow n = 2$ will not, what are the limits (maximum and minimum possible values) of the work function of the metal ?

A. $8eV < \phi < 10eV$

B. $5eV < \phi < 10eV$

C. $5eV < \phi < 8eV$

D. $5eV < \phi < 12eV$

Answer: C

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125. The first nuclear reaction ever observed was by ernest Rutherford in 1919. It was triggered by alpha particles incident on an isotope of nitrogen $._{7}^{14}$N. He observed a proton was emitted along with another element x. Let us assume that $._7^{14}$ N nucleus was initially stationary. For this reaction to occur, alpha-particle must touch the nitrogen nucleus. The distance between their centres at this moment is d. For this problem, we will neglect the effect of outer electrons in $._7^{14}$ N. Symbols have their usual meanings.

X is an isotope of

A. Nitrogen

B. Oxygen

C. Fluorine

D. Carbon

Answer: B

Watch Video Solution

126. The first nuclear reaction ever observed was by ernest Rutherford in 1919. It was triggered by alpha particles incident on an isotope of nitrogen $._{7}^{14}$ N. He observed a proton was emitted along with another element x. Let us assume that $._{7}^{14}$ N nucleus was initially stationary. For this reaction to occur, alpha-particle must touch the nitrogen nucleus. The distance between their centres at this moment is d. For this problem, we will neglect the effect of outer electrons in $._{7}^{14}$ N. Symbols have their usual meanings.

Value of d is

A. $R_0\left(2^{1/3} + 7^{1/3}\right)$

B. $R_0\left(2^{2/3} + 7^{2/3}\right)$

C. $R_0\left(2^{2/3} + 14^{2/3}\right)$

D. $R_0\left(2^{2/3+14^{1/3}}\right.$

Answer: D

Watch Video Solution

127. The first nuclear reaction ever observed was by ernest Rutherford in 1919. It was triggered by alpha particles incident on an isotope of nitrogen $._{7}^{14}$ N. He observed a proton was emitted along with another element x. Let us assume that $._{7}^{14}$ N nucleus was initially stationary. For this reaction to occur, alpha-particle must touch the nitrogen nucleus. The distance between their centres at this moment is d. For this problem, we will neglect the effect of outer electrons in $._{7}^{14}$ N. Symbols have their usual meanings.

The minimum initial kinetic energy of alpha-particle so that reaction can occur is

A. $\dfrac{18ke^2}{R_0\left(2^{2/3}+14^{2/3}\right)}$

B. $\dfrac{14ke^2}{R_0\left(2^{2/3}+14^{1/3}\right)}$

C. $\dfrac{18ke^2}{R_0\left(2^{2/3}+14^{1/3}\right)}$

D. $\dfrac{14ke^2}{R_0\left(2^{2/3}+7^{2/3}\right)}$

Answer: C

View Text Solution

128. $._{29}^{64}$ Cu can decay by β^- or β^+ emmision, or electron capture. It is known that $._{29}^{64}$ Cu has a half life of 12.8 hrs with 40% probability of β^- decay 20% probability of β^+ decay and 40% probability of electron capture. The mass of $._{29}^{64}$ Cu is $63.92977 a\mu while.$_(30)^(64) Zn is 63.92914 amu and ._(28)^(64) Ni is 63.92796 amu`.

What is the half life for electron capture?

A. 5.12 Hrs.

B. 32 Hrs.

C. 2.56 Hrs.

D. 16 Hrs.

Answer: B

View Text Solution

129. $._{29}^{64}$ Cu can decay by β^{-} or β^{+} emmision, or electron capture. It is known that $._{29}^{64}$ Cu has a half life of 12.8 hrs with 40% probability of β^{-} decay 20% probability of β^{+} decay and 40% probability of electron capture. The mass of $._{29}^{64}$ Cu is

63.92977*aμwhile*._(30)^(64) Zn is 63.92914 amu and ._(28)^(64) Ni is 63.92796 amu. $\hat{W}$*istheQvalueof*beta^(-)` decay?

A. 0.587 MeV

B. 0.077 MeV

C. 1.686 Me V

D. 0.666 Me V

Answer: A

View Text Solution

130. $._{29}^{64}$ Cu can decay by β^- or β^+ emmision, or electron capture. It is known that $._{29}^{64}$ Cu has a half life of 12.8 hrs with 40% probability of β^- decay 20% probability of β^+ decay and 40% probability of electron capture. The mass of $._{29}^{64}$ Cu is 63.92977*aμwhile*._(30)^(64) Zn is 63.92914 amu and ._(28)^(64) Ni is 63.92796 amu. $If \in itiallytherewas$10^(22)$a \rightarrow msof$._(29)^(64) $Cu, \hat{w}isthe \in itialrateatwhiche \neq rgyisbe \in g \prod uceddue \rightarrow$ beta^(+)` decay ?

A. 5.8×10^4 W

B. 3.2×10^3 W

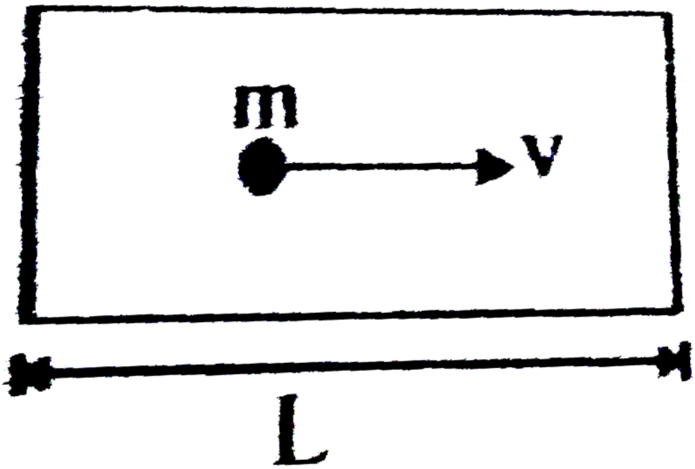
C. 8.4×10^2 W

D. 1.6×10^4 W

Answer: B

View Text Solution

131. De-Broglie hypothesized that material particles have wave like properties. Figure shows a small particle in a box. The particle simply bounces back and forth at constant speed. As particles also have wave like properties it can be considered to be a wave reflecting back and forth from the ends of the box. The reflections will create a standing wave analogous to standing wave on a string tied at both ends. Since a standing wave confined to a region can have only selected wavelength, momentum of the particle is quantized. We can safely assume that such a particle only has kinetic energy. This energy must also be quantized.



What is momentum of particle in n^(th) mode of standing wave ?

A. $\frac{nh}{2L}$

B. $\frac{nh}{L}$

C. $\frac{2nh}{L}$

D. $\frac{2\ln}{h}$

Answer: A

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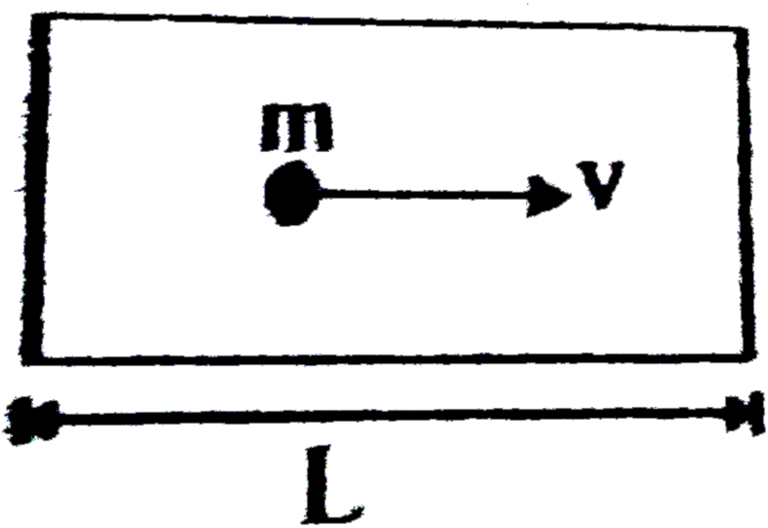

What is the particle's energy in n^(th) state?

A. $\frac{h^2n^2}{8mL^2}$

B. $\frac{h^2n^2}{4mL^2}$

C. $\frac{h^2n^2}{2mL^2}$

D. $\frac{4h^2n^2}{mL^2}$

Answer: A

Watch Video Solution

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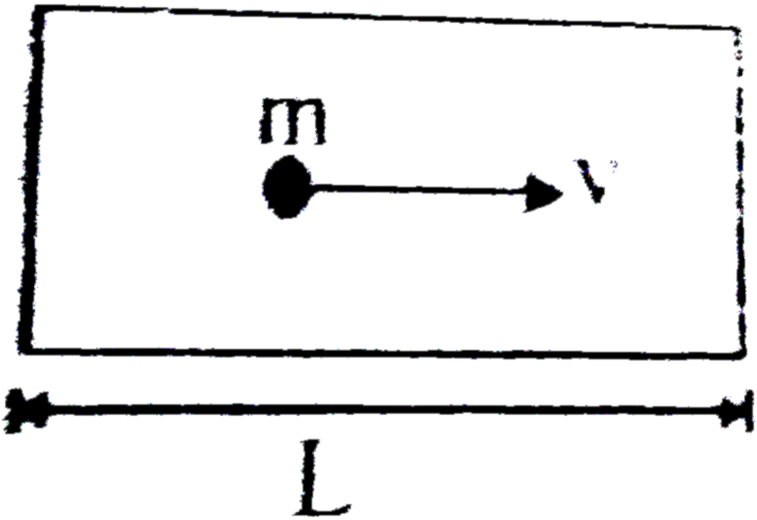

Mark the incorrect option.

A. confined particle has only centain discrete values of energy.

B. Particle in box behaves as stading wave.

C. The particle cannot be at rest.

D. Matter waves are electromagnetic in nature.

Answer: D

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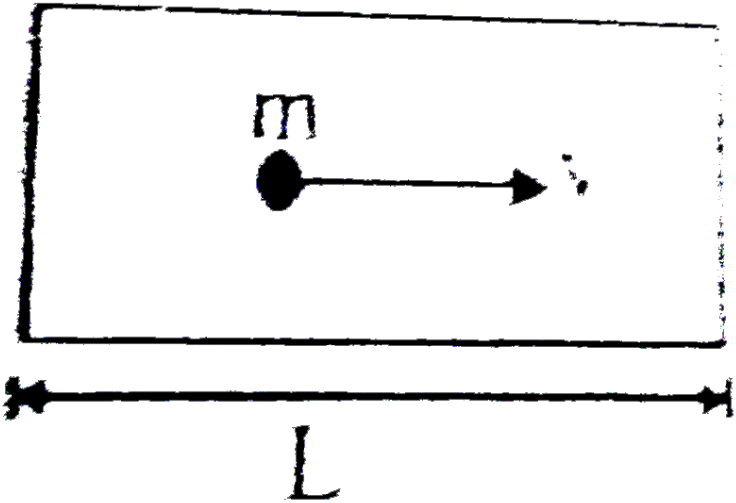
134. De-Broglie hypothesized that material particles have wave like properties. Figure shows a small particle in a box. The particle simply bounces back and forth at constant speed. As particles also have wave like properties it can be considered to be a wave reflecting back and forth from the ends of the box. The reflections will create a standing wave analogous to standing wave on a string tied at both ends. Since a standing wave confined to a region can have only selected wavelength, momentum of the particle is quantized. We can safely assume that such a particle only has kinetic energy. This energy must also be quantized.



Bohr model is applied to signly ionized helium He^+ Consider the lines that lie in the visible region of the spectrum. Which of the following transitions can given a photon of visible light?

A. $n = 5$ to $n = 4$

B. $n = 7$ to $n = 4$

C. $n = 4$ to $n = 3$

D. $n = 8$ to $n = 3$

Answer: B

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Reasoning

1. Statement-1: The numerical value (n)of a physical quantity is inversely proportional to size of unit (u) being used to measure it.

Statement-2:The magnitude of physical quantity does not change by changing the units.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement -2 is NQT the correct explanation for statement-1.

C. Statement-1 is true, statement -2 is false.

D. Statement-1 is false, statement -2 is true.

Answer: A

Watch Video Solution

2. Figure shows sequence of large number of photograph of on object moving vertically under gravity. A motion picture of this photograph is run backward.

Statement-1: In time reversal sequence the gravitational acceleration will appear to be upward.

Statement-2: A time reversal operation changes every $\vec{v} \rightarrow -\vec{v}$.

A. Statement -1 is true, statement-2 is true and statement-2 is correct explanation for statement-1

B. Statement-1 is true, statement-2 is true and statement -2 is NOT the correct explanation for statement-1

C. Statement-1 is true, statement-2 is false.

D. Statement-1 is false, statement -2 is true.

Answer: D

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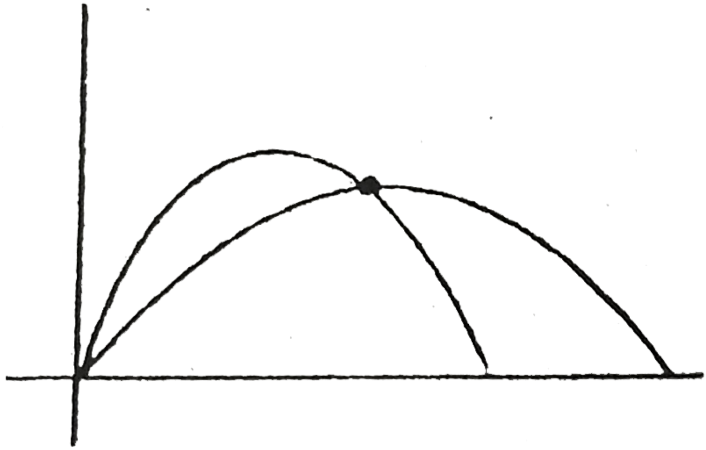
3. Statement-1: Two stones were projected simultaneously from same point with same speed at different angles from horizontal as shown. They may collide at the point of intersection of their paths.



Statement-2: For two particles to collide they must be at the same point in space simultaneously.

A. Statement -1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement -1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement -1.

C. Statement -1 is true, statement-2 is false.

D. Statement-1 is false, statement-2 is true.

Answer: D

Watch Video Solution

4. Statement-1: During flight under action of gravity, the change in velocity of a projectile in same time interval is same. (Neglect air friction) Statement-2: Neglecting air friction, the acceleration of projectile is constant during flight.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement -2 is true and statement -2 is NOT the correct explanation for statement-1.

C. Statement -1 is true, statement-2 is false.

D. Statement-1 is false, statement -2 is true.

Answer: A

Watch Video Solution

5. Statement-1: A hot air balloon is being carried away due north, flags on its bucket will fly due South.

Statement-2: The flag on a moving vehicle points in direction of wind flow relative to the vehicle.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

6. Two stones are thrown in same verticle plane from different floors of the same building simultaneously so as to hit the ground simultaneously. Statement-1: They may collide in air. Statement-2: The two stones may have been projected with same horizontal component of speed.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

7. Statement-1: Tension in a massless string may be different at different points.

Statement-2: Net force on a massless object is zero.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: B

Watch Video Solution

8. Statement-1: A man is standing on a bathroom scale. Suddenly he squats (sits down) with accleration a The scale reading will increase.

Statement-2: Man pushes down on the scale while squantting.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

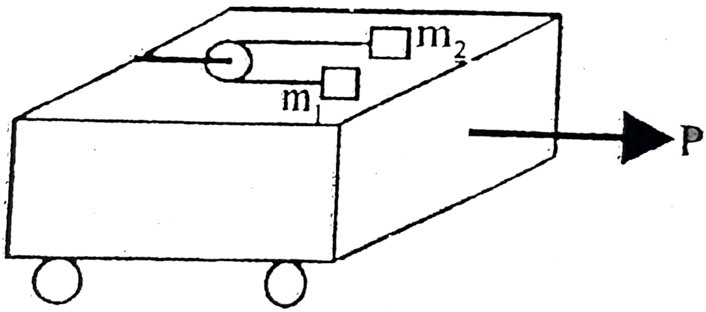
D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

Watch Video Solution

9. figure shows a smooth cart on a smooth surface (with small wheels) with an atwood machine on it. An external force P acts on cart. Following statements are based on given situation. The system starts from rest.



Statement-1: The magnitudes of velocities of blocks m_1 and m_2 with respect pulley are same.

Statement-2: If the string connecting the two blocks is to remain taut, relative to the centre of the pulley, velocities of blocks must be equal and opposite.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: B

Watch Video Solution

10. Statement-1: A man can not walk by himself on frictionless floor.

Statement-2: In the absence of frinction we can not push the floor tangentially backward.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: A

Watch Video Solution

11. Statement -1: A horse can pull a cart on a horizontal surface only if it exerts force greater than limiting static friction.

Statement-2: An external force exceeding limiting friction is required to make a block slide on rough horizontal surface

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

View Text Solution

12. Statement-1: Two particles of mass 1 kg and 3 kg move towards each other under their mutual force of attraction. No other force acts on them. When the relative velocity of approach of the two particles is $2m/s$, their centre of mass has a velocity of $0.5m/s$. When the relative velocity of approach becomes $3m/s$ the velocity of the centre of mass is $0.75 m/s$.

Statement-2: The total kinetic energy as seen from ground is $\frac{1}{2}\mu v_{rel}^2 + \frac{1}{2}mv_c^2$ and in absence of external force, total energy remains conserved.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

13. Statement-1: Two particles acted by same net force for same time always have same change in kinetic energy.

Statement-2: Two particles acted by same net force having same displacement always have same change in kinetic energy.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

14. Statement-1: Two particles acted by same net force for same time always have same kinetic energy

Statement-2: Two particles acted by same net force having same displacement always have same kinetic energy.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is false.

Answer: D

Watch Video Solution

15. Statement-1 and 2 are on a situation of a frog jumping vertically up on a rigid floor.

Statement-1: Due to work done by normal reaction of floor frog gains kinetic energy.

Statement-2: Normal reaction by ground accelerates centre of mass of frog

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

16. Statement-1: If the centre of mass of a system is at the origin then the total mass to the right of origin is same as total mass to left of origin.

Statement-2: $x_{cm} = \dfrac{\Sigma m_i x_i}{\Sigma m_i}$

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

17. Statement-1: In centre of mass frame the linear momentum of system is conserved only if no external forces are present

Statement-2: In presence of external force, the centre of mass has acceleration in inertial frame equal to $\frac{\Sigma \vec{F}_{ext}}{m_{\rightarrow tal}}$

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

18. Statement-1: If we want to throw a bottle from a moving train so that danger of being brolen on hitting ground is least. We should throw bottle in forward direction

Statement-2: While jumping out from side of a moving carriage it is safer to jump in forwards direction.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

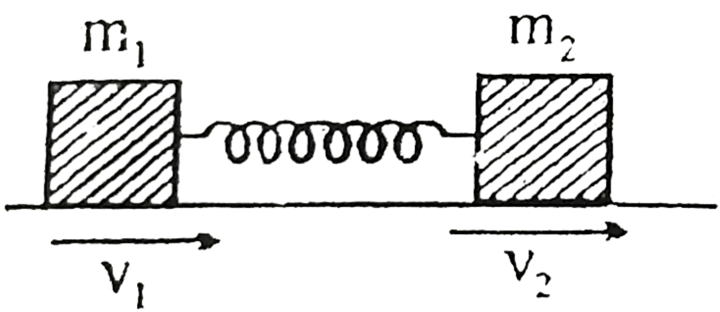
C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

19. Two blocks are connected by a spring and given velocity v_1 and v_2 as shown in figure when spring is unstrected



Statement-1: In centre of mass frame, both the blocks come to rest simultaneously

Statement-2: Momentum of a system in centre of mass frame is always zero.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: A

Watch Video Solution

20. Statement-1: Total kinetic energy during an elastic collision between two isolated bodies, is always constant.

Statement-2: Total linear momentum during a collision between isolated bodies, is always constant.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

21. Statement-1: If the resultant of all the forces acting on a system is zero then the torque on the system about any point is same.

Statement-2: If the resultant of the forces acting on a system is zero then acceleration of its centre of mass is zero.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

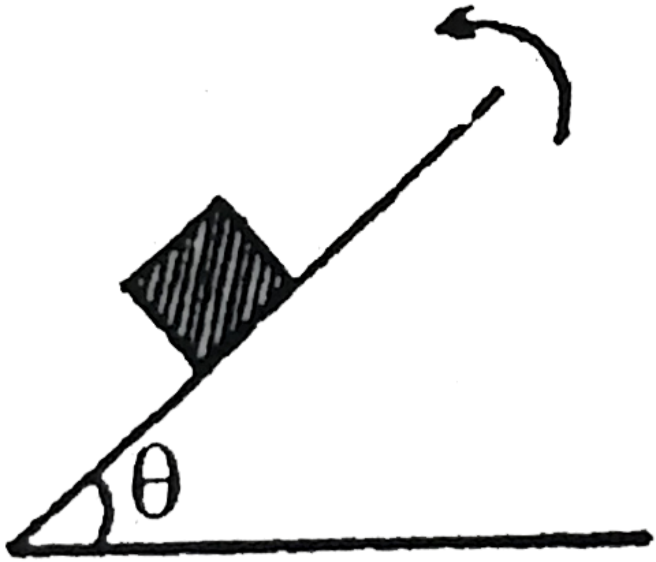
C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: B

Watch Video Solution

22. Consider the arrangement shown in figure. The block is initially at rest. Now θ is slowly increased (consider $0 < thetha < 90^{\circ}$)



Statement-1: If sliding starts before toppling and θ is kept on increasing even after that then block won't topple thereafter.

Statement-2: Line of action of resultant normal force shifts to keep the block from toppling.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

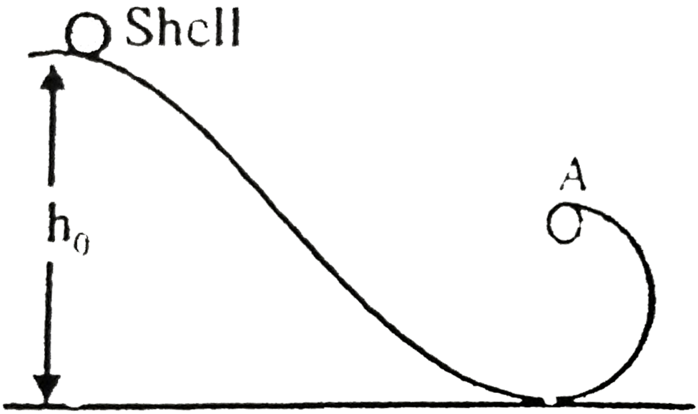
C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: A

Watch Video Solution

23. A thin walled hollow spherical shell of mass m and radius r starts from rest and moves along atrack as shown in figure assume that shell successfully negotiates the loop.



Statement-1: Normal reaction at A is greater when friction is absent on the track as compared to the case when sphere executes pure rolling.

Statement-2: Due to frictional torque shell have larger translational velocity at A in case of pure rolling.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

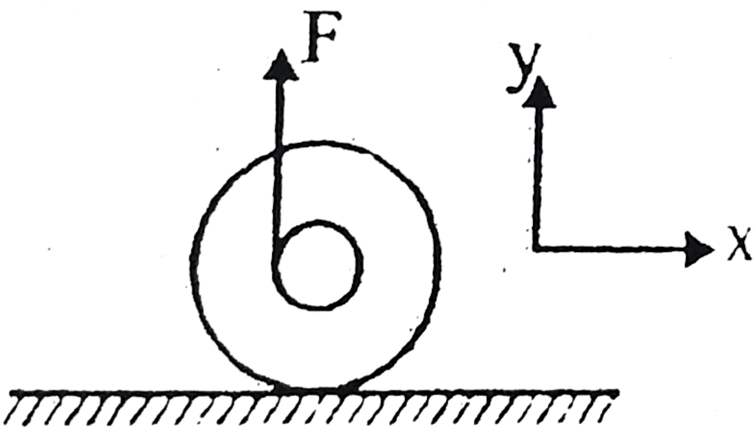
C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: C

Watch Video Solution

24. Figure shows a yo-yo placed on a rough surface friction is sufficient for pure rolling. After force F acts pure rolling begins



Statement-1: Angular acceleration of yo-yo is in clockwise sense.

Statement-2: Torque due to F must be larger than the torque due to friction.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: A

Watch Video Solution

25. Statement-1: Friction is necessary for a body to roll purely on a level horizontal ground.

Statement-2: When the body is rolling purely, the velocity of the point of contact should be zero relative to the surface in contact.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

26. Statement-1: When a sphere is rolling without sliding it is possible that no point on it is at rest

Statement-2: For rolling without sliding $v_{CM} = \omega R$ ($\omega \& R$ have usual meaning & v_{CM} is w.r.t. ground)

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

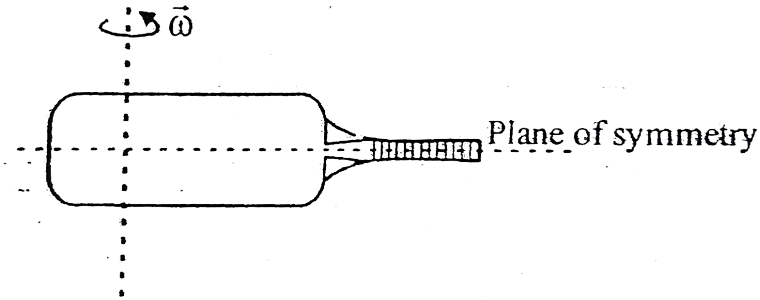
C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: C

Watch Video Solution

27. Figure shows a rigid body that is mirror symmetric about a plane and rotates about an axis perpendicular to that plane.



Statement-1: Angular momentum of above mentioned rigid body can be expressed by $\vec{L} = I\vec{\omega}$ where I is moment of inertia about rotation axis.

Statement-2: $\_\ (\vec{L}) = I\vec{\omega}$ can be applied only for those rigid bodies that have rotational symmetry about an axis and rotate about that symmetry axis.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: C

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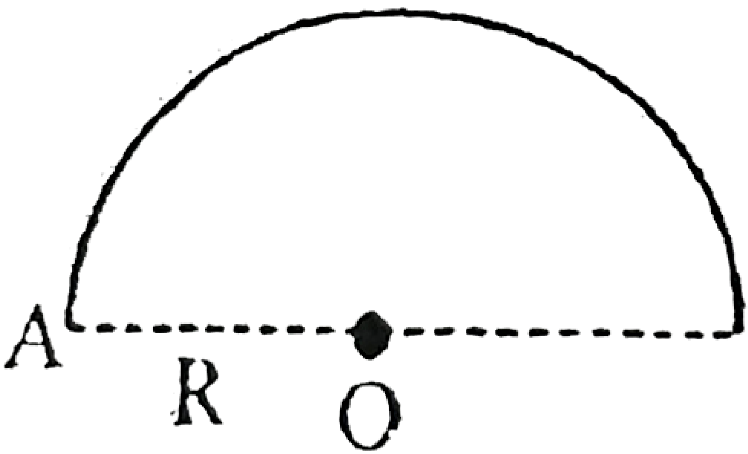
28. Consider a semicircular ring with mass m and radius R as shown in figure.



Statement-1: The moment of inertia of semi - circular ring about an axis passing through A and perpendicular to plane is $2mR^2$

Statement-2: According to parallel axis theorem: $I_A = 1_{cm} + mR^2$

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: C

View Text Solution

29. Statement-1: For the calculation of gravitational force between any two uniform spherical shells, they can always be replaced by particles of same mass placed at respective centres.

Statement-2: Gravitational field of a uniform spherical shell out side it is same as that of particle of same mass placed at its centre of mass.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

View Text Solution

30. Statement-1: Assuming zero potential at infinity, the gravitational potential at a point can never be positive.

Statement-2: The magnitude of gravitational force between two particles has inverse square dependence on the distance between two particles.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: B

View Text Solution

31. Statement-1: Period of revolution of satellite in circular orbit around earth is inversely proportional to its orbital speed

Statement-2: Period of revolution in uniform circular motion is given by $T = \frac{2\pi r}{v}$ where r is radius of orbit and v is speed.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

View Text Solution

32. Statement-1: It takes more fuel for a spacecraft to travel from the earth to moon than for the return trip.

Statement-2: Potential energy of spacecraft at moon's surface is greater than that at earth surface.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: A

View Text Solution

33. A block of ice on earth floats on water with 9//10 of its volume submerged.

Statement-1: On moon the block of ice would float on water with less than 9//10 of its volume submerged.

Statement-2: The acceleration due to gravity on moon surface is less than that on earth.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

34. Statement-1: When an object is completely submerged in a liquid, the buoyant force and weight of object are action reaction pair.

Statement-2: Magnitude of Buoyant force equals the weight of fluid displaced by object.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

35. Statement-1: Coefficient of viscosity of liquid decreases while that of a gas increase, with increasing temperature.

Statement-2: Density of a liquid and tht of a gas vary opposite manner with increase in temperature.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: C

Watch Video Solution

36. In a standard resonance column experiment assuming negligible end correction

Statement-1: The length of air column in first and second resonances are in ratio $1:3$

Statement-2: The wavelength at first and second resonance are in ratio $1:3$

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: C

Watch Video Solution

37. Two tunning forks produce a beat frequency of 2 Hz in air The same tuning forks are put in water.

Statement-1: The beat frequency in water is higher than in air

Statement-2: The velocity of sound in water is higher than in air.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

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38. Statement-1: Due to the motion of listener, the frequency of the sound waves (as received by listener) emitted by stationary source is affected

Statement-2: Due to the motion of source, wavelength of the sound waves (emitted by source) as received by stationary listener is affected.

Statement-3: If recever and source both are moving, the observed frequency must be different from the original frequency of source. Treat motion of source or listener as always along a line joining them for all above cases.

A. All the three statements are correct

B. Only all three statements are wrong

C. Only Statements-1 and 2 are correct

D. Only Statements -2 and 3 are correct

Answer: C

Watch Video Solution

39. Statement-1: If the atmospheric pressure increases, sound travels faster in room

Statement-2: $V_{sound} = \sqrt{\frac{\gamma P}{\rho}}$

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

40. Statement-1: The level of water (initially at 0°C) in a vessel (which does not expand on heating) begins to decrease on putting it on a gas stove

Statement -2 : Density of water initially increases when its temperature rises from 0° C.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: A

Watch Video Solution

41. Statement-1: At a steelworks, molten iron is heated to 1500°C to remove impurities. It is say that molten iron contains more heat than solid iron.

Statement-2: Solid iron at melting point needs to be supplied heat corresponding to its latent heat of fusion for phase change.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

42. Statement-1: Evaporation cools our body.

Statement-2: When a body radiates, some energy is lost to the surroundings.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: B

Watch Video Solution

43. Two identical objects A and B are at temperature T_A and T_B respectively. Both objects are placed in a room with perfectly absorbing walls maintained at temperature $T\left(T_A > T > T_B\right)$.

Statement-1: The objects A and B attain the temperature T eventually

Statement-2: A only emits radiation while B only absorbs until radiation both attain the temperature T

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: C

Watch Video Solution

44. Statement-1: A body is emitting primarily red light. As the temperature of body is increased it may emit primarily yellow light.

Statement-2: Rate of radiation emitted by a body increases as the temperature increases.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

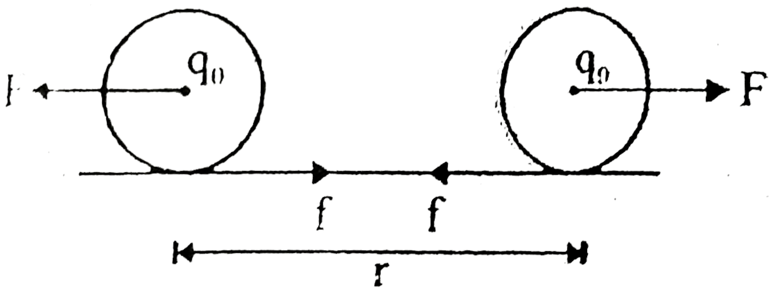
C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: B

Watch Video Solution

45. Statement-1: Two rigid, identical and uniformly charged non conducting spheres with same charge are placed on a sufficiently rough surface, then spheres must be in equilibrium.



Statement-2: If net force on a point charge is zero it is in equilibrium.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

View Text Solution

46. Statement-1: Suppose that a Gaussian surface enclose no net charge. Gauss law requires that electric field equals zero for all points on the surface.

Statement-2: If electric field equals zero everywhere on the surface, Gauss law requires that there be no net charge inside.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

47. Consider a conductor with a spherical cavity in it. A point charge q_0 is placed at the centre of cavity and a point charge Q is placed outside conductor.

Statement-1: Total charge induced on cavity wall is equal and opposite to the charge inside

Statement-2: If cavity is surrounded by a Gaussian surface, where all parts of Gaussian surface are located inside the conductor, $\oint \vec{E} d\vec{A} = 0$ hence $q_{\in duceed} = -q_0$

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: A

View Text Solution

48. Statement-1: The maximum charge that can be given to a conductor of fixed volume depends on its shape.

Statement-2: If the electric field near the condutor is sufficient for dielectric breakdown of air, no more charge can be transferred to it.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: A

Watch Video Solution

49. Statement-1: The electrostatic force between the plates of a charged isolated capacitor decreases when dielectric fills whole space between plates.

Statement-2: The electric field between the plates of a charged isolated capacitance decreases when dielectric fills whole space between plates.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

50. Statement-1: When a wire is stretched with in the proportionality limit such that its length becomes n times that of its initial value, the resistance of wire may become n^2 times of its initial resistance

Statement-2: The poisson's ratio of the wire's material can be 1//2.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: A

View Text Solution

51. Statement-1: Conductivity of a metallic conductor decreases with increases in temperature.

Statement-2: On increasing temperature, collision of electrons becomes more frequent and number of free electrons in the metallic conductor decreases.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: C

Watch Video Solution

52. Statement-1: As the temperature decreases, the electrical resistivity in metallic conductors diminishes.

Statement-2: Thermal oscillations of atoms which hinder motion of free electrons under the influences of an external electric field become insignificant as the temperature decreases.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: A

Watch Video Solution

53. Statement-1: Knowing that rating is done at steady state of the filament, an electric bulb connected to a source having rated voltage consumes more than rated power just after it is switched on.

Statement-2: When filament is at room temperature its resistance is less than its resistance is less than its resistance when the bulb is fully illuminated

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: A

Watch Video Solution

54. Statement-1: When a battery is supplying power to a circuit, work done by electrostatic forces on electrolyte ions inside the battery is positive

Statement-2: Electric field is directed from positive to negative electrode inside a battery

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

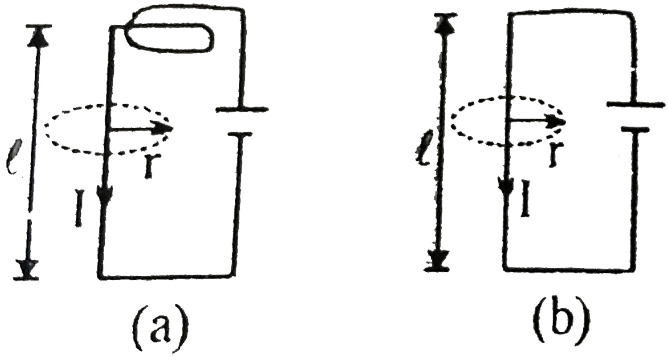
Answer: D

Watch Video Solution

55. For the following situation of (a) and (b), current is same.

Statement-1: In case of figure (a) and (b) $\oint \vec{B} d \vec{l}$ for two loops shown will be different.

Statement-2: In case of figure (a) and (b) magnitude of magnetic field at similar points on amperian loop may be different.



A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

View Text Solution

56. Statement -1: When lightning strikes a metal pipe, the pipe tends to contact.

Statement-2: Parallel current attract each other.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: A

Watch Video Solution

57. Statement-1: Peak voltage across the resistance can be greater than the peak voltage of the source in an series LCR circuit.

Statement-2: Peak voltage across the inductor can be greater than the peak voltage of the source in an series LCR circuit.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

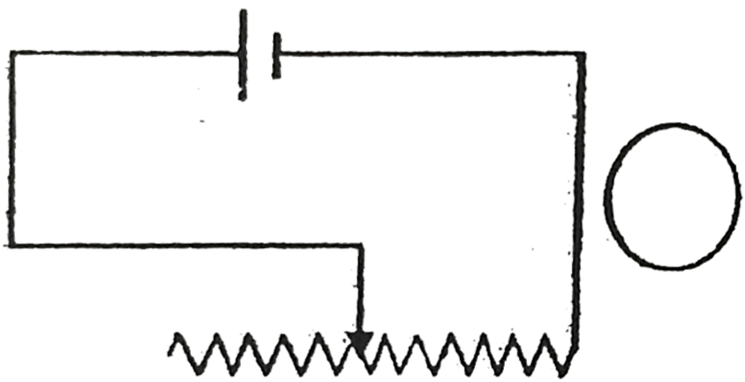
D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

58. Statement-1: When resistance of rheostat is increased, clockwise current is induced in the ring.

Statement-2: Magnetic flux through the ring is out of the page and decreasing.



A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: C

Watch Video Solution

59. Statement-1: The mutual inductance of two concentric conducting rings of different radii is maximum if the rings are also coplanar.

Statement-2: For two coaxial conducting rings of different radii, the magnitude of magnetic flux in one ring due to current in other ring is maximum when both rings are coplanar.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: B

Watch Video Solution

60. Statement-1: Position of image approaches focus of a lens, only when object approaches infinity,

Statement-2: Paraxial rays incident parallel to principal axis intersect at the focus after refraction from lens.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

61. Statement-1: The image focus $\left(2^{nd}\right.$focus) and the object $(1^{st}$ focus) for a biconvex lens are on the opposite side of the lens.

Statement-2: The centre of curvature of a biconvex lens are on the opposite side of the lens.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: B

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62. Statement-1: Light from an objects falls on a concave mirror forming a real image. The complete system is submerged deep inside water then the image will be formed at the same position relative to the mirror.

Statement-2: Formation of image by reflection does not depend on surrounding medium, provided it is also formed inside surrounding medium.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: A

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63. Statement-1: You see a geostationary satellite above the horizon. You desire to communicate with the satellite by sending a beam of laser light. You should aim your laser slightly higher than the line of sight of the satellite.

Statement-2: Light bends away from the normal while moving from denser to rarer medium.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

64. Statement-1: When the upper half of a converging lens is missing, a real image formed by the lens for a real object will lack its lower half.

Statement-2: The real image formed by a thin lens for a real object will be always inverted.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

65. Statement-1: Paraxial rays are always parallel to the axis of a mirror or lens.

Statement-2: A parallel beam close to principal axis converges at the focal point.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

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66. Statement-1: Light from two coherent sources that are not in phase does not produce an interference pattern.

Statement-2: Incoherent sources do not produce a sustained interference pattern.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

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67. Statement-1: The quantity of heat in a solid body determines its temperature.

Statement-2: Whenever heat is supplied to a solid body which is not undergoing, phase change the temperature of the solid body increases.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

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68. Statement-1: At a steelworks, molten iron is heated to $1500\,^{\circ}C$ to remove impurities. It is say that molten iron contains more heat than solid iron.

Statement-2: Solid iron at melting point needs to be supplied heat corresponding to its latent heat of fusion for phase change.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

69. Statement-1: Evaporation cools our body.

Statement-2: when a body radiates, some energy is lost to the surroundings.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: B

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70. Two identical objects A and B are at temperature T_A and T_B respectively. Both objects are placed in a room with perfectly absorbing walls maintained at temperature $T\left(T_A > T > T_B\right)$

Statement-1: The objects A and B attain the temperature T eventually.

Statement-2: A only emits radiation while B only absorbs until radiation both attain the temperature T

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: C

Watch Video Solution

71. Statement-1: Colour of a glowing black body changes on increasing its temperature.

Statement-2: Spectral emissive power associated with each wavelength does not increase in same proportion on increasing temperature of the Black Body.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: A

View Text Solution

72. Statement-1: Two metallic spheres of same size, one of copper and the other of aluminium, heated to the same temperature, will cool at the same rate when they are suspended in the same enclosure.

Statement-2: The rate of cooling of a body depends on the excees of temperature of the body over the surroundings.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

Watch Video Solution

73. Statement-1: The smaller the wavelength of a photon, the more energy it has.

Statement-2: The smaller the wavelength of a photon, the more momentum it has.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is not the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: B

Watch Video Solution

74. Statement-1: If an electron has the same wavelength as a photon, they have the same energy.

Statement-2: by debroglie hypothesis $p = \frac{h}{\lambda}$ for both the electron and the photon.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is not correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: D

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75. Statement-1: It is easier to remove an orbital electron from an atom, but quite difficult to remove a nucleon from a nucleus.

Statemet-2: An electron is much lighter than a nucleon.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is not correct explanation for statement-1

C. Statement-1 is true, statement-2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: B

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Multiple objective

1. The quantity// quantities that does //do not have mass in its// their dimentions (when we take standard 7 quantities as fundmental) is//are:

A. specific heat

B. latent heat

C. luminous intensity

D. mole

Answer: A::B::C::D

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2. Although choice of standard quantity is arbitrary, however several criteria must be met if a standard is to be useful as possible. Choose the correct criteria.

A. Measurements made at diefferent times using the same standard can be meaningfully compared only if standard does not vary with time.

B. Measurement made at different places can be compared if standard is reproducible.

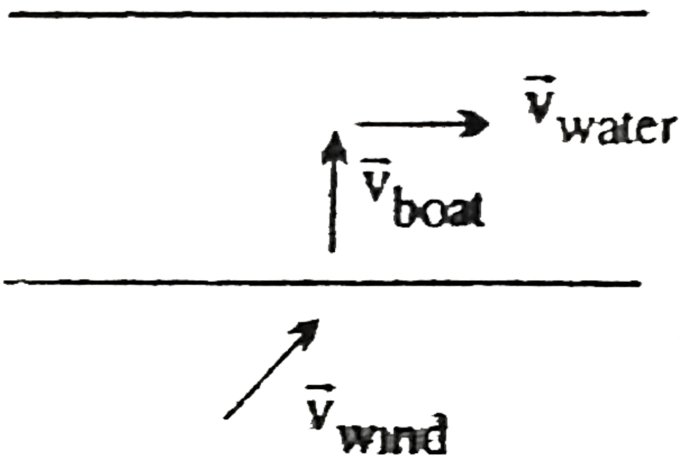
C. The standard should be safe from all possible causes of damage

D. The standard should be readily accessible to every one who needs to use it.

Answer: A::B::C::D

Watch Video Solution

3. A boat is being rowed in a river. Wind is also blowing. Direction of velocity vectors of boat, water and wind in ground frame are as shown in diagram.



Mark the correct statement(s)

A. Direction in which boat is being steered may be represented by arrow leftarrow

B. Direction in which boat is being steered may be represented by arrow rightarrow

C. Direction in which a flag on the boat may flutter may be represented by arrow rightarrow

D. Direction in which a flag on the boat may flutter may be represented by arrow rightarrow

Answer: A::C::D

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4. Initially two particles A and B are present at (0,0) and (d,0) respectively They start moving with speed $V_A = V\hat{i} + V\hat{j}$ and $V_B = -V\hat{j}$ If R is magnitude of relative separation between them and T_0 be the time when separation between them is minimum, then

A. $T_0 = \frac{d}{5V}$

B. $R_{\min} = \frac{2d}{\sqrt{5}}$

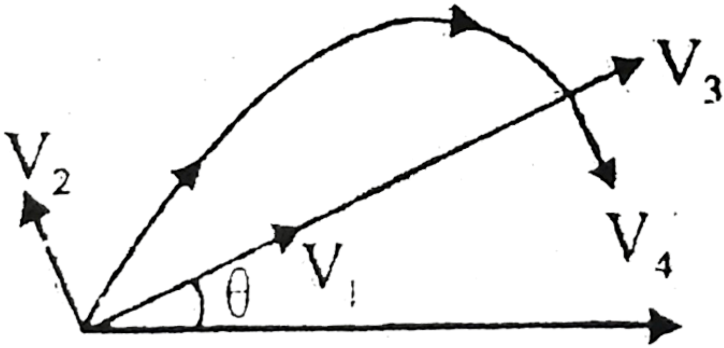
C. Graph of R versus time is straight line

D. Graph of R versus time is circle.

Answer: A::B

Watch Video Solution

5. A projectile is projected on the inclined plane as shown $V_1 \& V_2$ are components of it's initial velocity along the incline and perpendicular to incline and $V_3 \& V_4$ are components of it's final velocity along the incline and perpendicular to incline. {Here we are comparing the magnitudes only}



A. $V_1 > V_3$

B. $V_1 = V_3$

C. $V_2 = V_4$

D. $V_2 > V_4$

Answer: A::C

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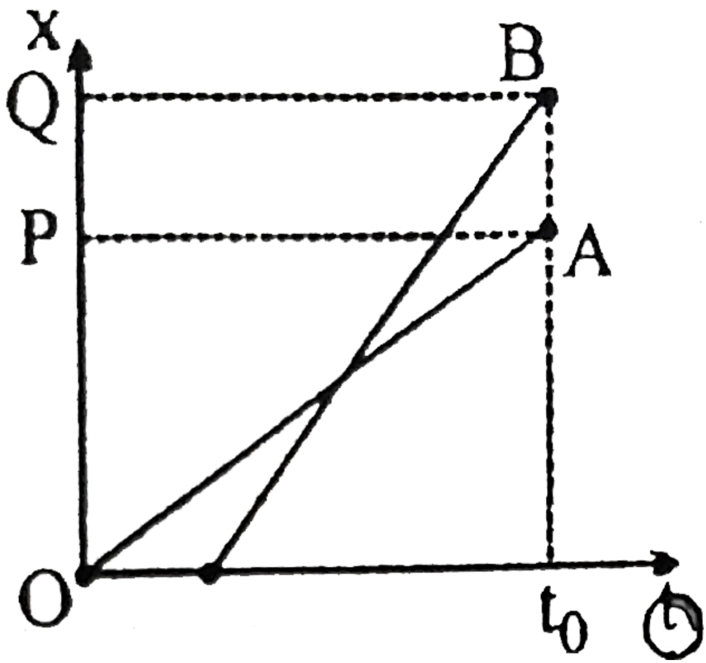
6. The position- time (x-t) graphs for two rabbits A and B moving from their carrot field O to their homes P and Q respectively along straight line path (taken as x axis) are shown in figure below. Choose the correct statement(s):



A. A lives closer to the carrot field than B

B. A starts from the carrot field earlier than B

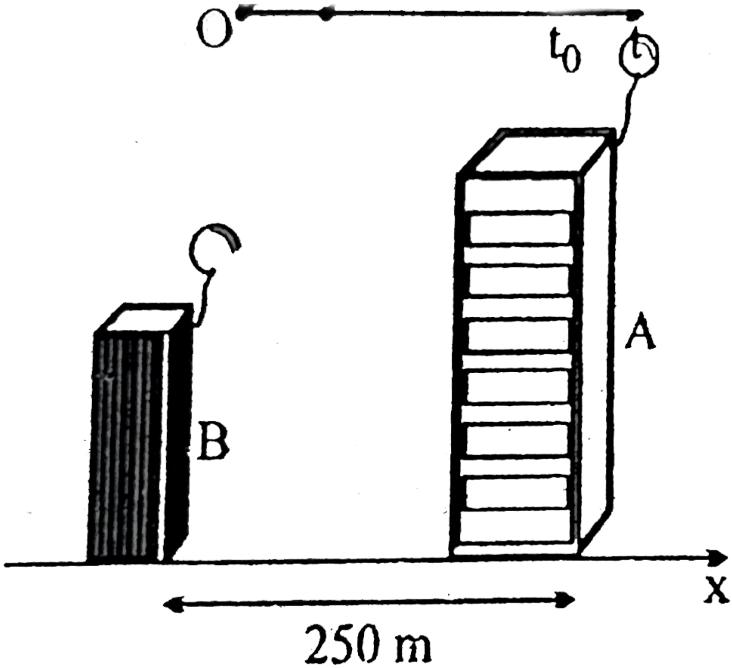
C. A and B have equal average velocities from $0 \to t_0$

D. B overtakes A on the way

Answer: A::B::D

Watch Video Solution

7. Two ballons are simultaneously released from two buildings A and B. Balloon from A rises with constant velocity $10ms^{-1}$ While the other one rises with constant velocity of $20ms^{-1}$ Due to wind the balloons gather horizontal velocity $V_x = 0.5$ y, where 'y' is the height from the point of release. The buildings are at a distance of 250 m & after some time 't' the balloons collide.



A. $t = 5$sec

B. difference in height of buildings in 100m

C. difference in height of buildings is 500

D. $t = 0$ sec

Answer: B::D

Watch Video Solution

8. A particle has an initial velocity of $4\hat{i} + 4\hat{j}$m//s and an acceleration of -$0.4\ \hat{i}$ m//s^(2) at what time will its speed be 5 m//s?

A. 2.5 sec

B. 17.5 sec

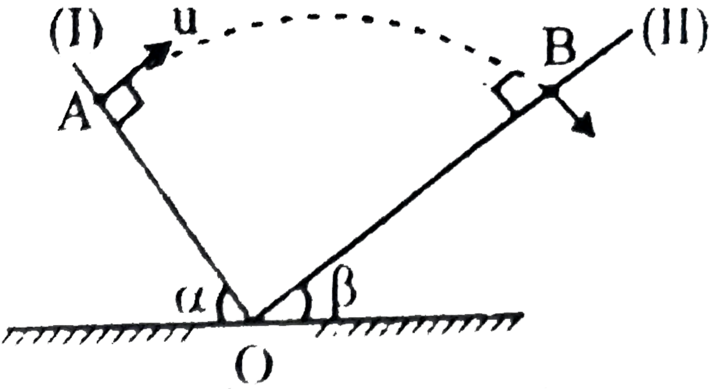
C. $7\sqrt{2}$ sec

D. 8.5 sec

Answer: A::B

Watch Video Solution

9. Two inclined planes (I) and (II) have inclination alpha and beta respectively with horizontal (where $\alpha + \beta = 90^\circ$)intersect each other at point O as shown in figure A particle is projected from point A with velocity u along a direction perpendicular to plane (I) If the particle strikes (II) perpendicularly at B, then:



A. time of flight $= u/g\sin\beta$

B. time of flight $= u/g\sin\alpha$

C. distance OB $= u^2/2g\sin\beta$

D. distanceOB $= u^2/2g\sin\alpha$

Answer: A::C

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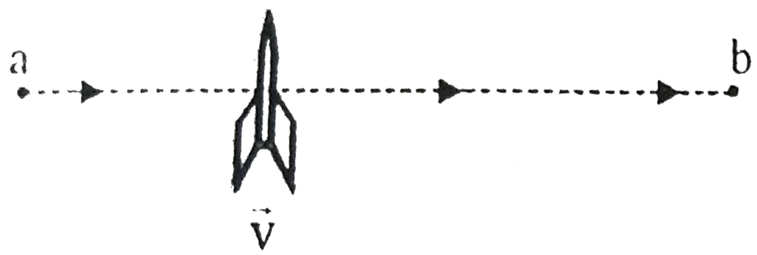
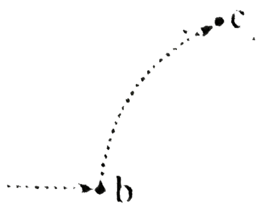
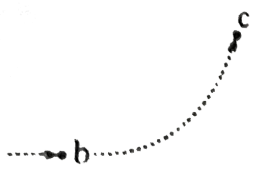
10. A rocket drifting sideways in outer spaces from position 'a' to position 'b' with constant velocity. At 'b' the rocket's engine starts to produce constant thrust at right angles to line 'ab'. The engine turns off again as the rocket reaches some point 'c'. Assume that rocket is subjected to no other forces.



A. The path of rocket from point b to c will be



B. The path of rocket from point b to c will be



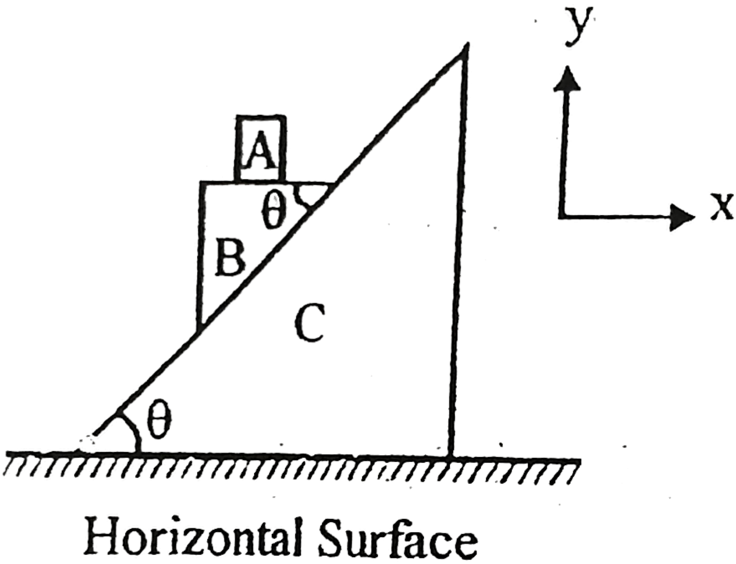
C. The path of rocket beyond c will be 

D. The speed continuously increases from b to c.

Answer: B::C::D

Watch Video Solution

11. In the figure shown all the surface are smooth. All the blocks A, B and C are movable, x-axis is horizontal and y-axis verticle as shown. Just after the system is released from the position as shown.



A. Acceleration of 'A' relative to ground is in negative y-direction

B. Acceleration of 'A' relative to B is in positive x-direction

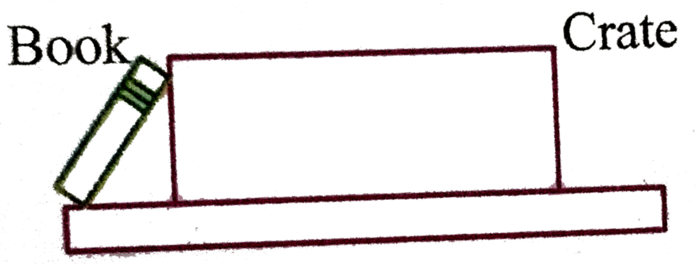
C. The horizontal acceleration of 'B' relative to ground is in negative x-direction

D. The acceleration of 'C' relative to 'B' is directed along the inclined surface

Answer: A::B::C::D

Watch Video Solution

12. A book leans against a crate on a table. Neither is moving Which of the following statements concerning this situation is/are incorrect.



A. The force of the book on the crate is less than that of crate on the book.

B. Although there is no friction acting on the crate, there must be friction acting on the book or else it will fall.

C. The net force acting on the book is zero.

D. The direction of the frictional force acting on the book is in the same direction as the frictional force acting on the crate.

Answer: A::B::D

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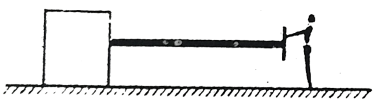
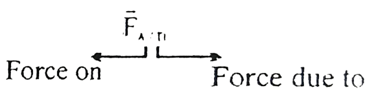
13. Figure shows a man pulling on a string attached to a block kept on a rough block surface. Man is heavier than block. Coefficient of friction is same for both block and man. Subscripts R, B and M denote rope block and man respectively, taking string to be light. Mark the correct statement(s).





A. $\vec{F}_{R/B}$ - $\vec{F}_{M/R}$ always

B. Block begins to move earlier than man if man continues to increase his pull from zero.

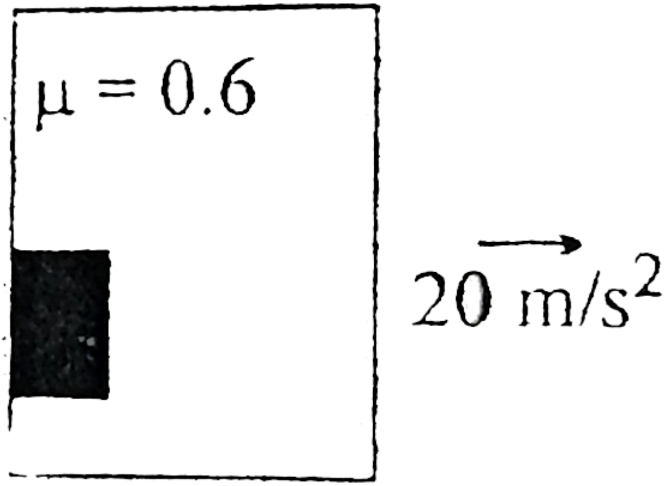
C. $\vec{F}_{R/B}$ and $\vec{F}_{M/R}$ can be action reaction pairs.

D. Block can remain static if man walks with constant speed while letting string to pass through his hand.

Answer: A::B::D

View Text Solution

14. A box is accelerating with acceleration $= 20 m/s^2$. A block of mas 10 kg placed inside the box and is in contact with the verticle wall as shown. The friction coefficient between the block and the wall is $\mu = 0.6$ and take g=10 m//s^(2)`



A. The acceleration of the block will be $20 m/s^2$

B. The friction force acting on the block will be 100 N

C. The contact force between the verticle wall and the block will be $100\sqrt{5}$ N

D. The contact force between the verticle wall and the block is only electromegnetic in nature

Answer: A::B::C::D

Watch Video Solution

15. Consider the following statements, regarding a girl who wants to jump vertically upward from a hard horizontal floor. Symbolic representation of forces is given below. $\vec{F}_M$ = force developed in leg muscles, $\vec{F}_W$ = Weight, $\vec{F}_N$ = Normal reaction

A. Total force on floor is $\vec{F}_M + \vec{f}_w$.

B. Resultant force on girl is $\left(-\vec{F}_M\right)$ while girl is in contact with floor.

C. Floor exerts a force $\vec{F}_N$ on girl.

D. The harder the girl pushes down, the greater the resulting acceleration of girl.

Answer: C::D

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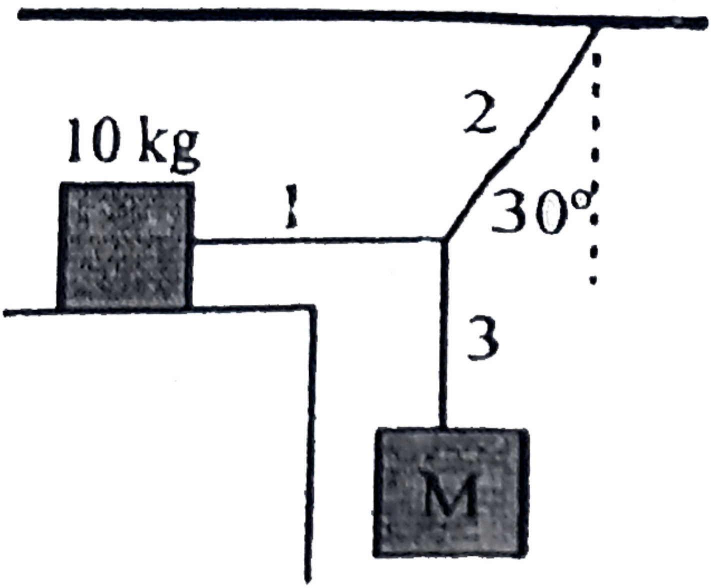
16. A 10 kg block is at rest as shown on a horizontal surface having a coefficient of static friction of 0.7 String -1 is horizontal and string-2 makes an angle of 30° with the verticle. A mass M hangs from String- 3. Which of the following statement(S) about this situation is //are ? $\left(g = 10m/s^2\right)$



A. The largest possible to tension in string 1 is 70 N

B. The ratio T_1 / T_3 is equal to $\tan 30^\circ$

C. The largest possible value of M is approximately 12 kg

D. It is impossible to determine the largest possible value of M

Answer: A::B::C

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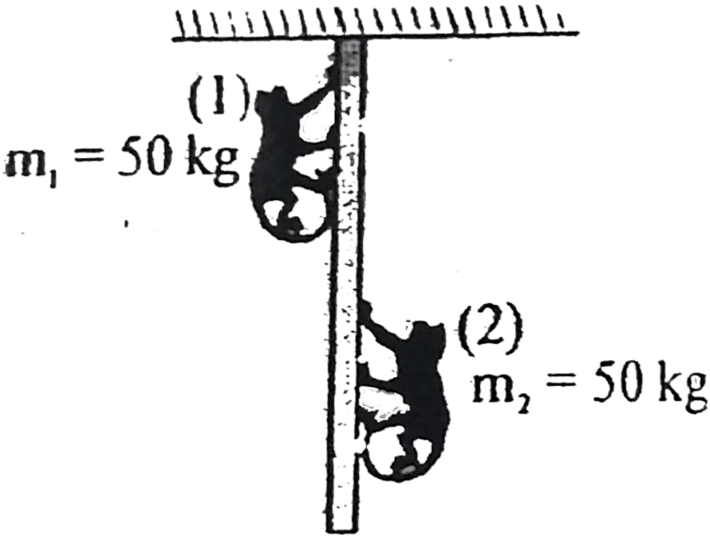
17. Monkey (1) is climbing up a light rope with acceleration of $a_1 = 2m/s^2$ and monkey (2) is climbing upto the same rope with acceleration of $a_2 m/s^2$ Choose incorrect options.



A. Tension is same in all parts of rope.

B. a_1 must be equal to a_2

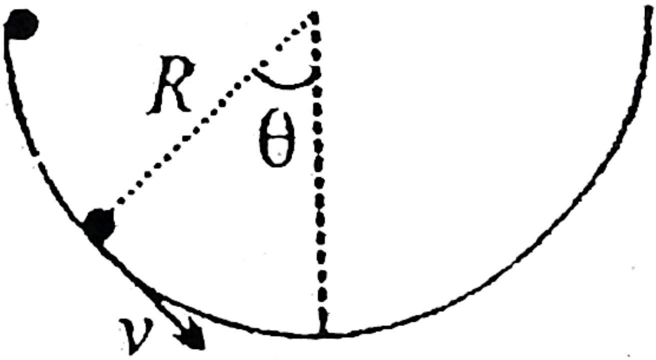
C. a_2 must be zero.

D. Two monkeys can have different velocities.

Answer: A::B::C

View Text Solution

18. A particle of mass m is going along surface of smooth hemisphere of radius R in verticle plane. At the moment shown its speed is v. Choose correct option(s).



A. $mg - N\cos\theta = m\left(g\sin^2\theta - \frac{v^2}{R}\cos\theta\right)$

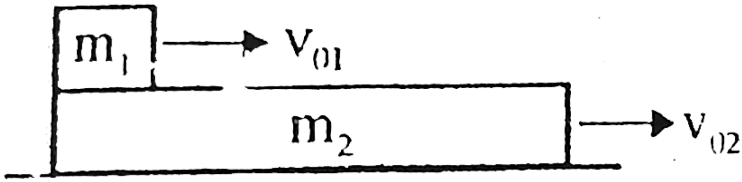
B. $N - mg\cos\theta = \frac{mv^2}{R}$

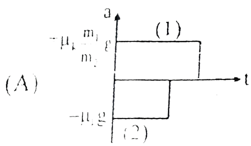
C. $mg - N\sin\theta = \frac{mv^2}{R}$

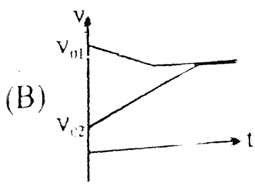
D. $N\sin\theta = m\left(g\sin\theta\cos\theta - \frac{v^2}{R}\sin\theta\right)$

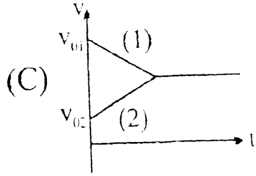
Answer: A::B

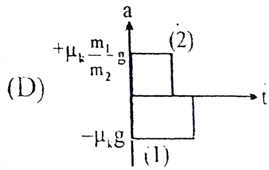
19. Block m_1 is projected on a long plank of mass m_2 plank is placed on a smooth horizontal surface. There is friction between block and plank, coefficient of friction is mu. Block m_1 has initial velocity v_{01} and plank has initial velocity v_{02} with $(v_{01} > v_{02})$. Which of following graphs is correct.



A. 

B. 

C. 

D. 

Answer: C

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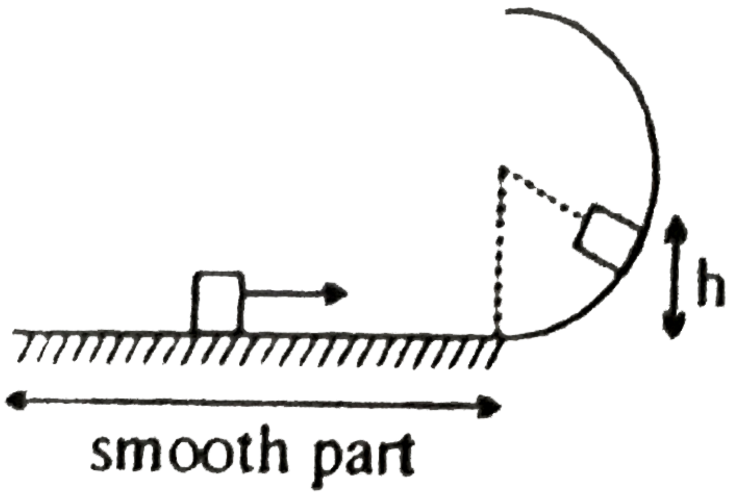
20. An object of mass m is slowly pushed some partway up a verticle up a verticle loop ending at a point a height $h < R$ above the bottom. The coefficient of friction between the object and the track is a constant mu. Find work that has to be done against friction.



A. $2\mu mg\left(2hR - h^2\right)^{1/2}$

B. $\mu mg\left(hR - 2h^2\right)^{1/2}$

C. $4\mu mg\left(2hR - h^2\right)^{1/2}$

D. $\mu mg\left(2hR - h^2\right)^{1/2}$

Answer: D

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21. A block of mass 1 kg kept on a rough horizontal surface $(\mu = 0.4)$ is attached to a light spring (force constant $= 200$ N//m) whose other end is attached to a verticle wall. The block is pushed to compress the spring by a distance d and released. Find the value(s) of 'd' for which (spring + block) system loses its entire mechanical energy in form of heat.

A. 4 cm

B. 6 cm

C. 8 cm

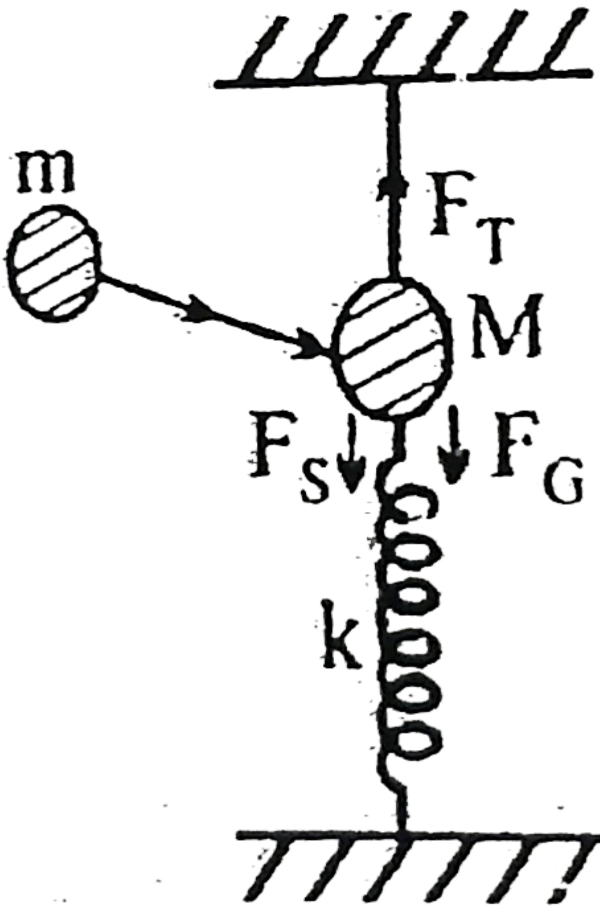
D. 10 cm

Answer: A::C

View Text Solution

22. Consider the situation in which smooth ball of mass M is hanging in equilibrium with a string and a spring as shown in figure. If another small ball of mass m collides it than which of the following are correct statement(s) F_T=is tention force due to inextensible string F_G = is gravitational force F_S = is spring force

F_N = is normal force due to collision between m and M.



A. Tension force due to inextensible string F_T is impulsive force

B. Spring force F_S is non impulsive force

C. Gravitational force F_G is conservative force

D. Normal force due to collision between m and M, F_N is contact force

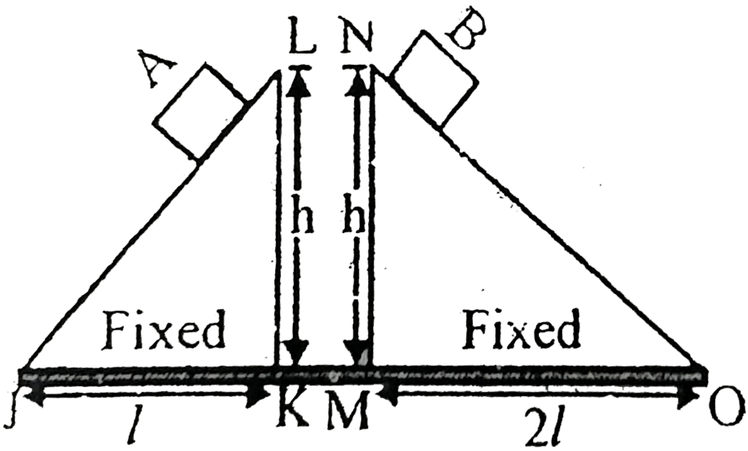
Answer: A::B::C::D

Watch Video Solution

23. Two identicle blocks A and B are placed on two inclined planes as shown in diagram. Neglect air resistance and friction Read the following statement and choose the correct options Statement-1: Kinetic energy of 'A' on sliding to J will be greater than the kinetic energy of B on falling vertically to M.

Statement-2: Acceleration of 'A' will be greater then acceleration of 'B' when both are released to slide on inclined planes.

Statement-3: Work done by external agent to move block slowly from position B to O is negative



A. Statement 1 is true

B. Statement 2 is true

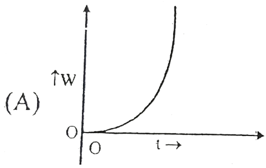
C. Statement 3 is true

D. No statement is true

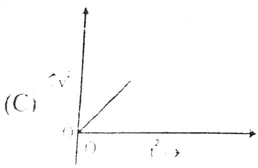
Answer: B::C

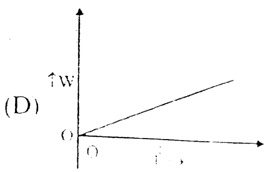
Watch Video Solution

24. A particle initially at rest on a smooth horizontal surface, is acted on by a constant horizontal force at time $t = 0$ then if W= work, done t=time and v=speed of the particle, the nearly correct graph (s) is //are

A. 

B.

C. 

D. 

Answer: A::B::C::D

View Text Solution

25. A particle of mass m suspended by a string of length l revolves in a horizontal circle (θ is the angle the string makes with vertical). Which of the following statement(s) is // are correct?

A. Tension in string $= mg\cos\theta$

B. Speed v of particle $= \sqrt{\dfrac{lg\sin^2\theta}{\cos\theta}}$

C. Period T $= 2\pi\sqrt{\dfrac{l\cos\theta}{g}}$

D. Centripetal acceleration $a = \dfrac{F\sin\theta}{m}$ where F is tension

Answer: B::C::D

Watch Video Solution

26. For a curved track of radius R, banked at angle θ

A. a vehicle moving with a speed v_0 is able to negotiate the curve without calling friction into play at all

B. a vehicle moving with any speed $V > V_0$ is always able to negotiate the curve, with friction called into play

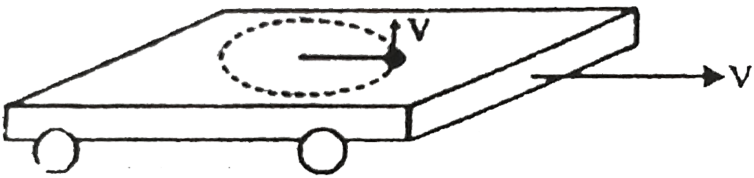
C. a vehicle moving with any speed $V < V_0$ must have the force of friction into play

D. the minimum value of the angle of banking for a vehicle parked on the banked road can stay there without slipping, is given by $\theta = \tan^{-1}\mu_0\left(\mu_0 =\right.$ coefficient of static friction)

Answer: A::C

Watch Video Solution

27. On a train moving along east with a constant speed v, a boy revolves a bob with string of length l on smooth surface of a train, with equal constant speed v relative to train. Mark the correct option(s).



A. Maximum speed of bob is 2v in ground frame.

B. Tension is string conneting bob is $\frac{4mv^2}{l}$ at an instant.

C. Tension in strings is $m\frac{v^2}{l}$ at all the moments

D. Minimum speed of bob is zero in ground frame.

Answer: A::C::D

Watch Video Solution

28. A heavy particle is attached to one end of a string 1m long whose other end is fixed at O. It is projected from it lowest position horizontally with a velocity V:

A. If $V^2 > 5$ g the particle will describe complete circular motion in the vertical plane

B. If $V^2 = 3.5$ g the tension in the string will become zero after the string has turned through 120°

C. If $V^2 = 2$ g, the tension in the string becomes zero the velocity of the particle also becomes zero

D. If $V^2 = g$ the velocity of the particle becomes zero after the string turns through 60°

Answer: A::B::C::D

Watch Video Solution

29. A chain of length L and mass per unit length ρ is piled on a horizontal surface. One end of the chain is lifted vertically with constant velocity by a force P.

A. P as function of height x of the end above the surface will be $\rho\left(gx+v^2\right)$

B. no energy will loss in this process.

C. work done by force will be $\frac{1}{2}\rho g L^2 + \rho v^2 L$

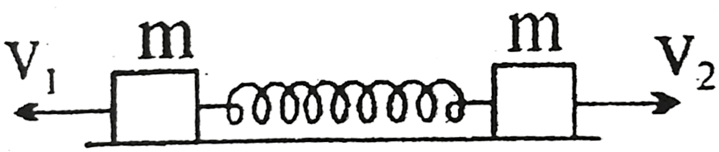
D. loss in energy $\frac{1}{2}\rho g L v^2$

Answer: A::C::D

View Text Solution

30. Two students were given a physics problem for finding maximum extension of spring if blocks are imparted velocities v_1

& V_2 when spring is unstrected.



By Students A: $\frac{1}{2}m\left(v_1+v_2\right)^2=\frac{1}{2}kx^2$

By Students B: $\frac{1}{2}mv_1^2+\frac{1}{2}mv_2^2=\frac{1}{2}kx^2$

A. Student A is correct, Student B is wrong

B. Student B is correct, Student A is wrong

C. both are correct

D. both are wrong

Answer: D

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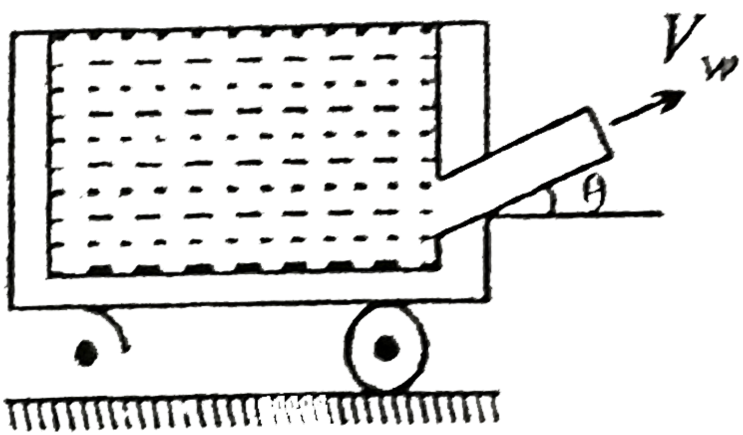
31. Consider a cart of mass M on a frictionless surface that can hold a full tank of water with mass M.A fire-hose sprays water with a constant ejection speed V_w at a constant mass rate $r = \frac{dm}{dt}$ and at an angle θ relative to the horizontal.



A. The acceleration at any time t of the cart while it is spraying water is given by $\frac{V_w r\cos\theta}{M - rt}$

B. The speed of the cart as a function of time $\left(t < \frac{M}{r}\right)$ is $\frac{V_w rt\cos\theta}{M - rt}$

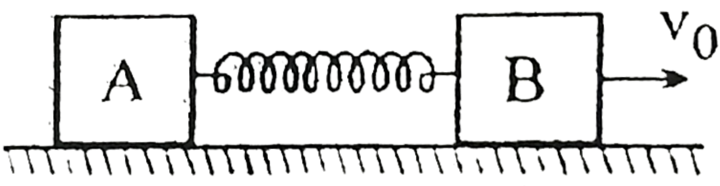
C. The speed of the cart as a function of time $\left(t < \frac{M}{r}\right)$ is $V_w \cos\theta \ln(M - rt)$

D. The external horizontal force that must be applied to keep the cart stationary while spraying water is $rV_w \cos\theta$

Answer: A::D

Watch Video Solution

32. Two blocks A and B of the same mass are connected to a light spring and placed on a smooth horizontal surface B is given velocity v_0 (as shown in the figure) when the spring is in natural length. In the subsequent motion.



A. the maximum velocity of B will be v_0

B. as seen from ground, A can move towards right only

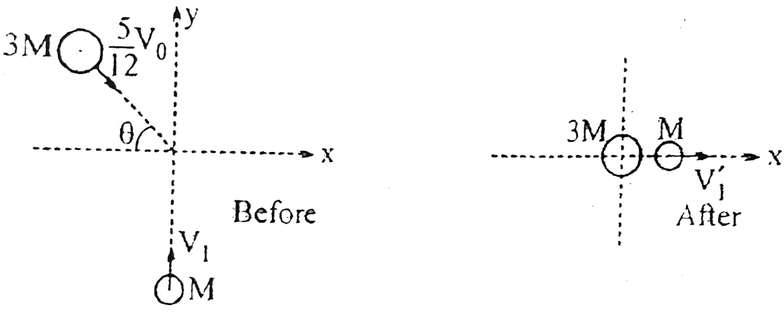
C. the spring will have maximum extension when A and B both stop

D. the spring will be at natural length again when B is at rest

Answer: A::B::D

Watch Video Solution

33. Two masses M and 3M collide on a horizontal frictionless surface as shown. Before the collision the mass M has a velocity V_1 in the y-direction. The mass 3M has a velocity $(5/12)V_0$ making an angle $thetha$ to the x-axis as shown. After the collision the mass 3M comes to rest and the mass M moves along the x-axis with the velocity V_1 (Given $\sin thetha = 3/5$) Neglect gravity.



A. The speed V_1 of mass M before collision is $\frac{3}{4}V_0$

B. The speed V_1 of mass M before collision is $\frac{V_0}{4}$

C. The speed V_1 of mass M after collision is $\frac{V_0}{2}$

D. The speed V_1 of mass M after collision is V_0

Answer: A::D

Watch Video Solution

34. Object A strikes the stationary object B with a certain give speed u head-on in an elastic collision. The mass of A is fixed, you may only choose the mass of B appropriately for following cases. Then after the collision:

A. for B to have the greatest speed, choose $m_B = m_A$

B. for B to have the greatest momentum, choose $m_B < < m_A$

C. for B to have the greatest speed, choose $m_B < < m_A$

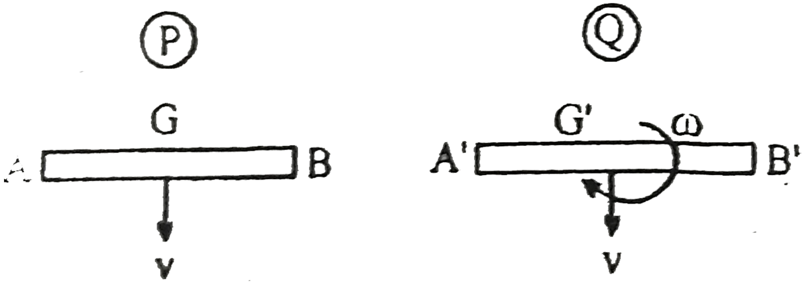
D. for B to have the greatest kinetic energy, choose $m_B = m_A$

Answer: C::D

Watch Video Solution

35. Two equal uniform rods P and Q move with the same velocity v as shown in the figure. The second rod has an angular velocity

$\omega(< 6v/l)$ (clockwise) about G in addition to v.



A. If the ends A and A' are suddenly fixed simultaneously both rods will rotate with the same angular velocity

B. If the ends A and A' are suddenly fixed simultaneously the rod Q will rotate with greater angular velocity

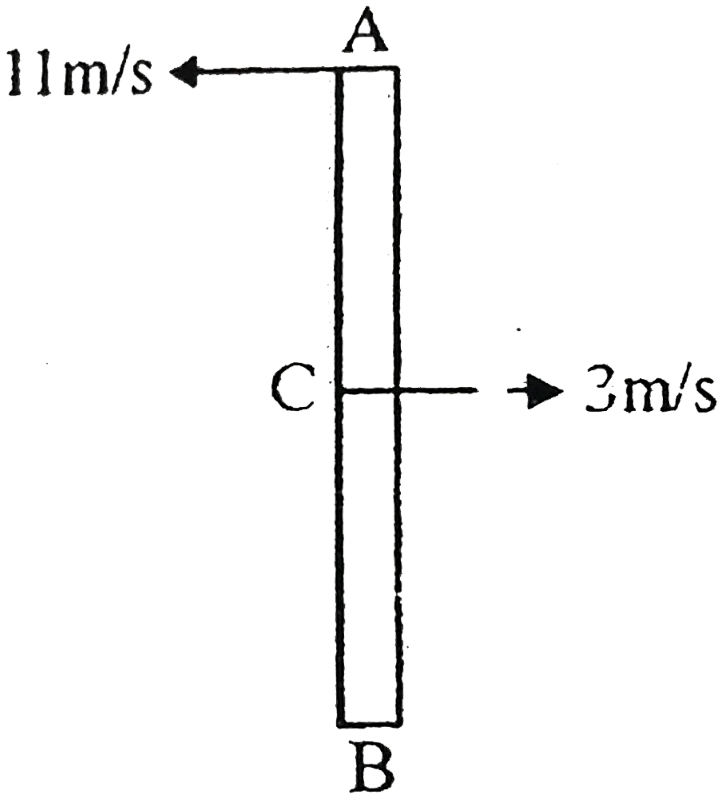
C. If the ends B and B' are suddenly fixed simultaneously both rods will rotate with the same angular velocity

D. If the ends B and B' are suddenly fixed simultaneously, the rod P will rotate with greater angular velocity

Answer: B::D

Watch Video Solution

36. A uniform rod AB of length 7 m is undergoing combined rotational and translational motion such that, at some instant of time, velocities of end point A and centre A are both perpendicular to the rod and opposite in direction, having magnitude $11m/s$ and $3m/s$ respectively as shown in the figure. Velocity of centre C and angular velocity of the rod remains constant



A. acceleration of point A is $56 m/s^2$

B. acceleration of point B is $56 m/s^2$

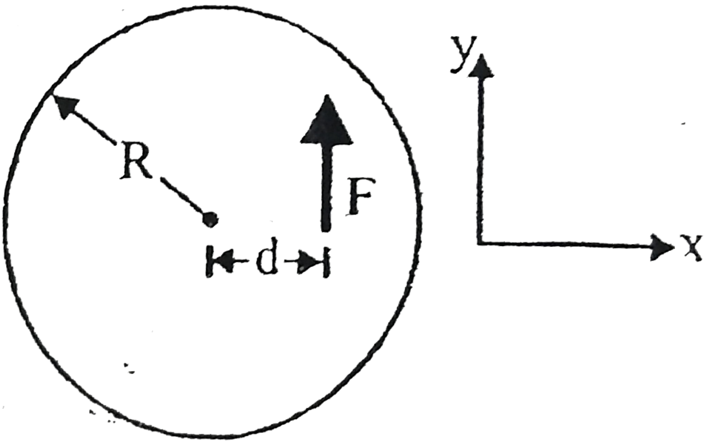
C. at the instant shown in the figure acceleration of point B is more than that of point A.

D. angular velocity of the rod is $4 rad/sec$

Answer: A::B::C

Watch Video Solution

37. A uniform thin flat isolated disc is floating in spece. It has radius R and mass m. A force F is applied to it a distanced $= \frac{R}{2}$ from the centre in the y-direction Treat this problem as two-dimensional. At the instant shown the:



A. acceleration of the centre of the disc is f/m

B. angular acceleration of the disk is F/mR

C. acceleration of leftmost point on the disc is zero

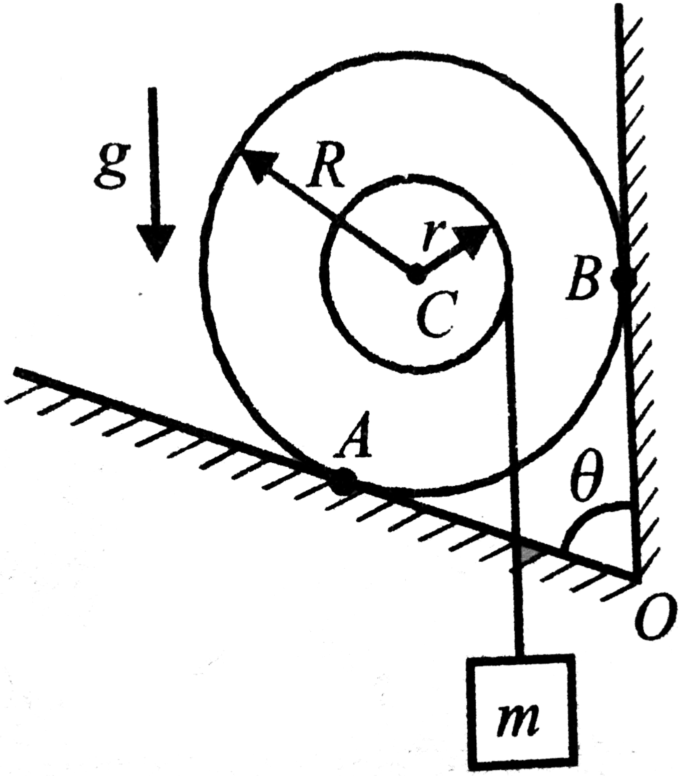
D. Point which is instantaneously unaccelerated is the rightmost point.

Answer: A::B::C

Watch Video Solution

38. A massless spool of inner radius r outer radius R is placed against a vertical wall and a titled split floor as shown. A light inextensible thread is tightly wound around the spool through which a mass m is hainging. There exists no friction at point A, while the coefficient of friction between the spool and point B is

μ. The angle between the two surface is θ



A. the magnitude of force on the spool at B in order to maintain equilibrium is mg$\sqrt{\left(\frac{r}{R}\right)^2 + \left(1 - \frac{r}{R}\right)^2 \frac{1}{\tan^2 thetha}}$

B. the magnitude of force on the spool at B in order to maintain equilibrium is mg$\left(1 - \frac{r}{R}\right)\frac{1}{\tan thetha}$

C. the minimum value of mu for the system to remain in equilibrium is $\frac{\cot\theta}{(R/r)-1}$

D. the minimum value of mu for the system to remain in equilibrium is $\frac{\tan thetha}{(R/r)-1}$

Answer: A::D

Watch Video Solution

39. A constant external torque τ acts for a very brief period $\triangle t$ on a rotating system having moment of inertia I then

A. The angular momentum of the system will change by $\tau\Delta t$

B. The angular velocity of the system will change by $\frac{\tau\Delta t}{I}$

C. If the system was intially at rest, it will acquire rotational kinetic anergy $\frac{(\tau\Delta t)^2}{2I}$

D. The kinetic energy of the system will change by $\frac{(\tau \Delta t)^2}{I}$

Answer: A::B::C

Watch Video Solution

40. Which of the following statement is // are true

A. work done by kinetic friction on a rigid body may be positive

B. a uniform sphere rolls up an inclined plane without sliding. The friction force on it will be up the incline. (only contact force and gravitational force is acting)

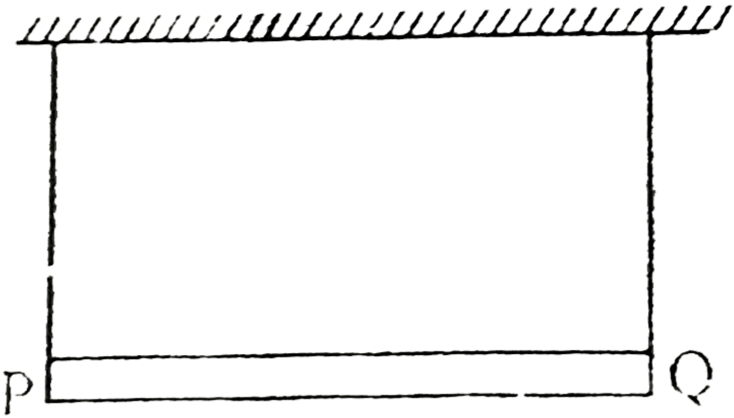
C. a uniform sphere rolls down an inclined plane without sliding. The fricition force on it will be up the incline. (only contact force and gravitational force is acting)

D. a uniform sphere is left from rest from the top of rough inclined plane. It moves down the plane with slipping. The friction force on it will be up the incline.

Answer: A::B::C::D

View Text Solution

41. A horizontal rod of mass M and length L is tied to two verticle string symmetrically as shown in the figure. One of the strings at end Q is cut at $t = 0$ and the rod starts rotating about the other and P then



A. At $t=0$ angular acceleration of rod about P is $3g/2L$

B. At $t=0$ angular acceleration of rod about C.M. of rod is $3g/2L$

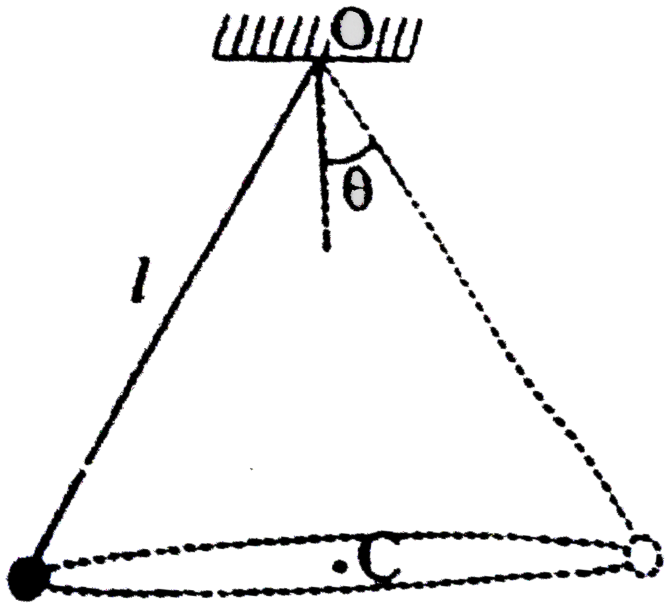
C. At $t=0$ acceleration of C.M. of rod is $3g/4$ in downward direction.

D. At $t=0$ tension in the string at P is $Mg/4$

Answer: A::B::C::D

Watch Video Solution

42. A particle of mass m is suspended from point O and undergoes circular motion in horizontal plane as conical pendulum as shown in figure.



A. Angular momentum of particle about point of suspension does not remains constant.

B. Angular momentum of particle about centre of circle remains constant.

C. Average force during half rotation is $\frac{2mg\tan thetha}{\pi}$

D. Average torque about axis OC during half rotation is zero

Answer: A::B::C::D

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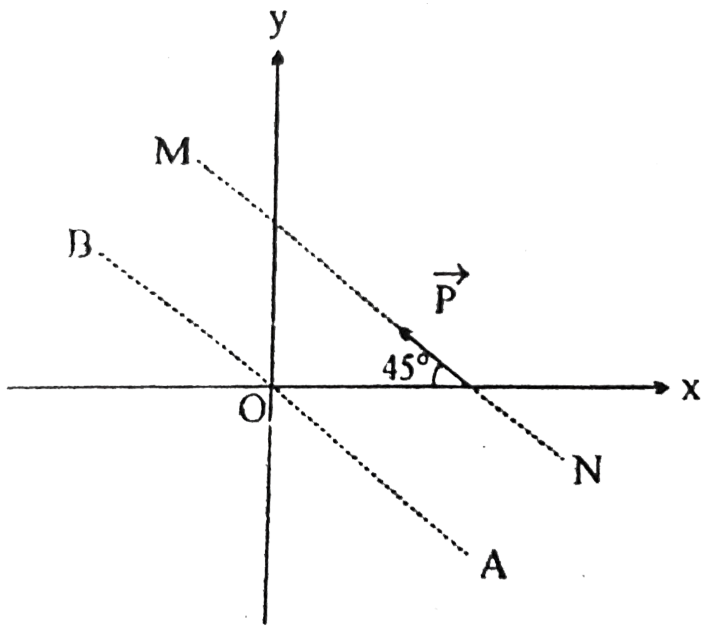
43. A particle is moving with constant momentum $\vec{P}$ along line MN as shown in figure. Line AB is parallel to MN. Mark the correct statements



A. Angular momentum of particle about any point on line MN is zero.

B. For any reference point on line AB angular momentum vector of particle is constant.

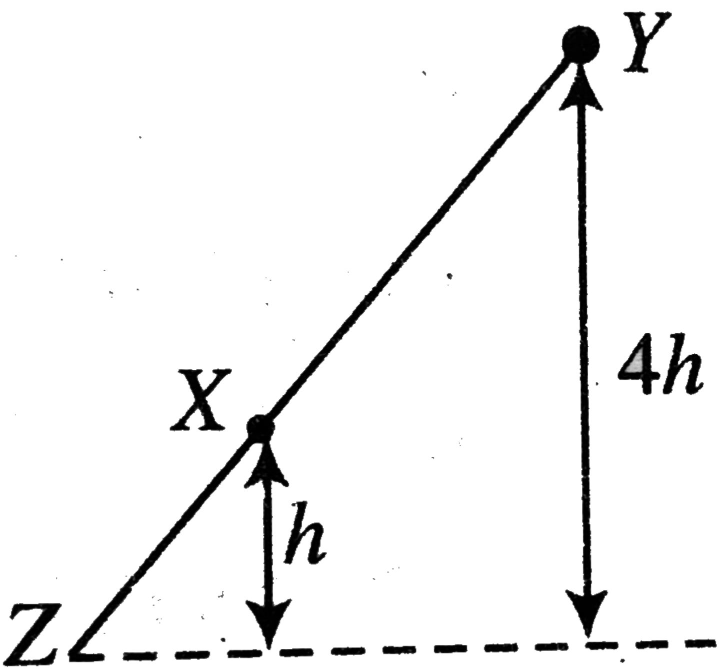
C. For any reference point in xy-plane in third quadrant angular momentum vector of the particle is in positive z direction

D. For any reference point in xy-plane in third quadrant momentum vector of the particle is in negative z direction

Answer: A::B::C

Watch Video Solution

44. Two wheels A and B are released from rest from points X and Y respectively on an inclined plane as shown in the figure. Which of the following statement(s) is/are incorrect?



A. wheel B takes twice as much time to roll from Y to Z than

that of wheel A from X to Z

B. at point Z velocity of wheel A is four times that of wheel b

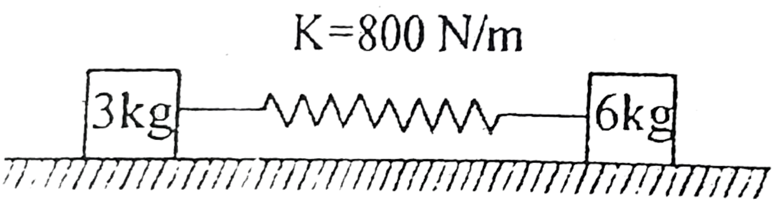
C. acceleration of the wheel A is twice that of the wheel B

D. both wheel take same time to arrive at point Z

Answer: B::C::D

Watch Video Solution

45. The system shown in the figure can move on a smooth surface. The spring is initially compressed by 6 cm and then released.



A. the particles perform SHM with time period $\frac{\pi}{10}$ sec

B. the block of mass 3 kg perform SHM with amplitude 4 cm

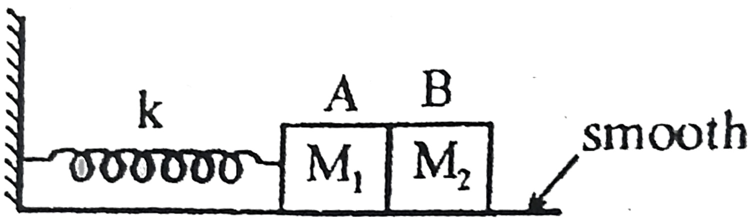
C. the block of mass 6 kg will have maximum momentum $2.40 kgm/s$

D. none of these

Answer: A::B::C

Watch Video Solution

46. Initially spring is compressed by x_0 and blocks are in contact when system is released, then block starts moving and after some time contact between blocks, then



A. Blocks will separated at natural length of spring.

B. After seperation block A perform SHM of amplitude $x_0\sqrt{\dfrac{m_1}{m_1+m_2}}$

C. After seperation maximum velocity of block A is

$x_0\sqrt{\frac{k}{m_1+m_2}}$

D. After seperation block A will perform SHM of amplitude x_0

Answer: A::B::C

Watch Video Solution

47. Three simple harmonic motions in the same direction having each of amplitude "a" and the same period are superposed. If each differs in phase from the next by $\pi/4$ then

A. Resultant amplitude is $\left(\sqrt{2}+1\right)$ a

B. Phase of resultant motion relative to first is 90°

C. The energy associated with the resulting motion is $\left(3+2\sqrt{2}\right)$ time the energy associated with any single motion

D. Maximum speed of resultant SHM will be more than double of the initial SHM's

Answer: A::C::D

Watch Video Solution

48. Starting from the mean position a body oscillates simple harmonically with a period of 2 s.

A. Its kinetic energy will become 75% of the total energy after $\frac{1}{6}$ s

B. Its kinetic energy will become 75% of the total energy after $\frac{1}{12}$ s

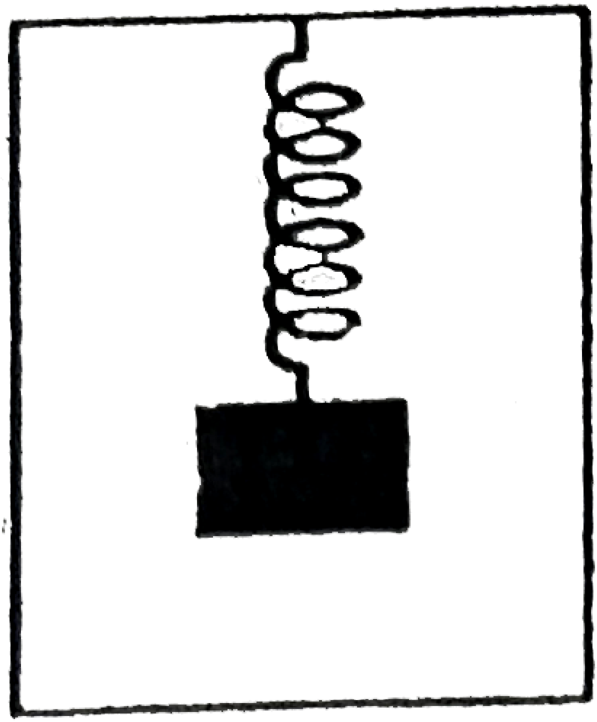
C. Magnitude of its momentum will become half of initial after $\frac{1}{3}$ s

D. Magnitude of its momentum will become half of initial after $\frac{1}{6}$ s

Answer: A::C

Watch Video Solution

49. A spring mass system is hanging from the ceiling of an elevator in equilibrium. The elevator suddenly starts accelerating upwards with acceleration a, consider all the options in the reference frame of elevator.



A. the frequency of oscillation is $\frac{1}{2\pi}\sqrt{\frac{k}{m}}$

B. the amplitude of the resulting SHM is $\left(m\frac{a}{k}\right)$

C. amplitude of resulting SHM is $\left(m\frac{g+a}{k}\right.$

D. maximum speed of block during oscillation is $\left(\sqrt{\frac{m}{k}}\right)a$

Answer: A::B::D

Watch Video Solution

50. Two objects of masses m and $4m$ are at rest at an infinite separation. They move towards each other under mutual gravitational attraction. If G is the universal gravitaitonal constant, then at separation r

A. the total mechanical energy of the two objects is zero

B. Their relative velocity is $\sqrt{\frac{10GM}{r}}$

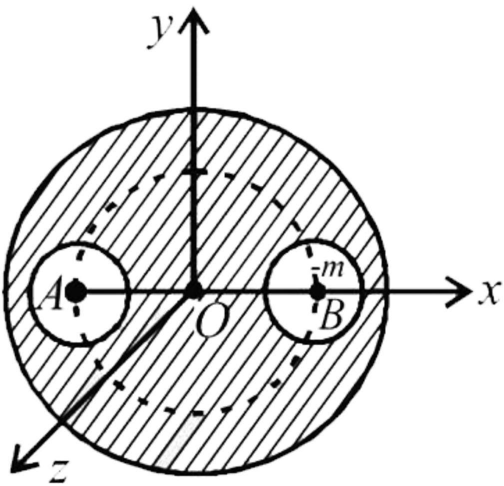
C. the total kinetic energy of the objects is $\frac{4Gm^2}{r}$

D. their relative velocity is zero.

Answer: A::B::C

Watch Video Solution

51. A solid sphere of uniform density and radius 4 units is located with its centre at the origin O of coordinates. Two sphere of equal radii 1 unit, with their centres at A(-2,0 ,0) and B(2,0,0) respectively, are taken out of the solid leaving behind spherical cavities as shown if fig Then:



A. the gravitational force due to this object at the origin is zero

B. the gravitational force at the point B $(2, 0, 0)$ is zero

C. the gravitational potential is the same at all poitns of the circle $y^2 + z^2 = 36$

D. the gravitational potential is the same at all points of the circle $y^2 + z^2 = 4$

Answer: A::C::D

Watch Video Solution

52. The spherical planets have the same mass but densities in the ratio $1:8$. For these planets the :

A. acceleration due to gravity will be in the ratio $4:1$

B. acceleration due to gravity will be in the ratio $1:4$

C. escape velocities from their surfaces will be in the ratio $\sqrt{2}:1$

D. escape velocities from their surfaces will be in the ratio $1 : \sqrt{2}$

Answer: B::D

Watch Video Solution

53. A particle at a distance r from the centre of a uniform spherical planet of mass M radius R (ltr) has a velocity of magnitude v.

A. for $0 < v < \sqrt{\frac{GM}{r}}$ trajectory may be ellipse

B. for v $= \sqrt{\frac{GM}{r}}$ trajectory may be ellipse

C. for $\sqrt{\frac{GM}{r} < v < \sqrt{\frac{2GM}{r}}}$ trajectory may be ellipse.

D. for v `=sqrt((GM)/r trajectory may be circle

Answer: A::B::C::D

Watch Video Solution

54. In a solid sphere two small symmetrical cavities are created whose centres lie on a diameter AB of sphere on opposite sides of the centre.

A. The gravitational field at the centre of the sphere is zero

B. The gravitational potential at the centre remains unaffected if cavitiesare not present

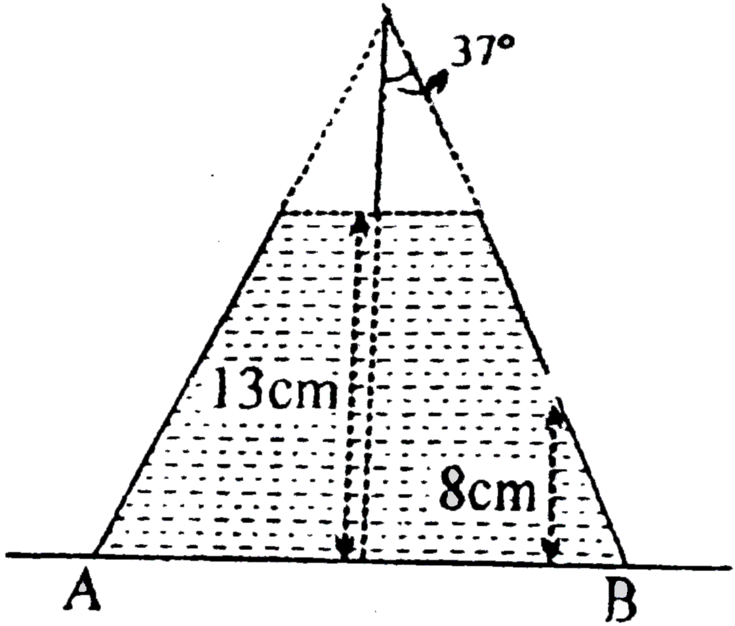
C. A circle at which all points have same potential is in the plane of diameter AB

D. A circle at which all points have some potential is in the plane perpendicular to the diameter AB

Answer: A::D

View Text Solution

55. Curved surface of a vessel has shape of a truneated cone having semivertex angle 37° Vessel is full of water (density $\rho = 1000$ kg//m^(3)) upto a height of 13 cm and is placed on a smooth horizontal plane. Upper surface is opened to atmosphere. A hole of 1.5 cm^(2) is made on curved wall at a height of 8 cm from bottom as shown in figure. Area of water surface in the vessel is large as compared to the area of hole



A. Initial velocity of efflux is 1m//sec

B. Initial horizontal range of water jet from point B is 6.65 cm

C. Horizontal force required to keep the vessel in static equilibrium is 0.15 N.

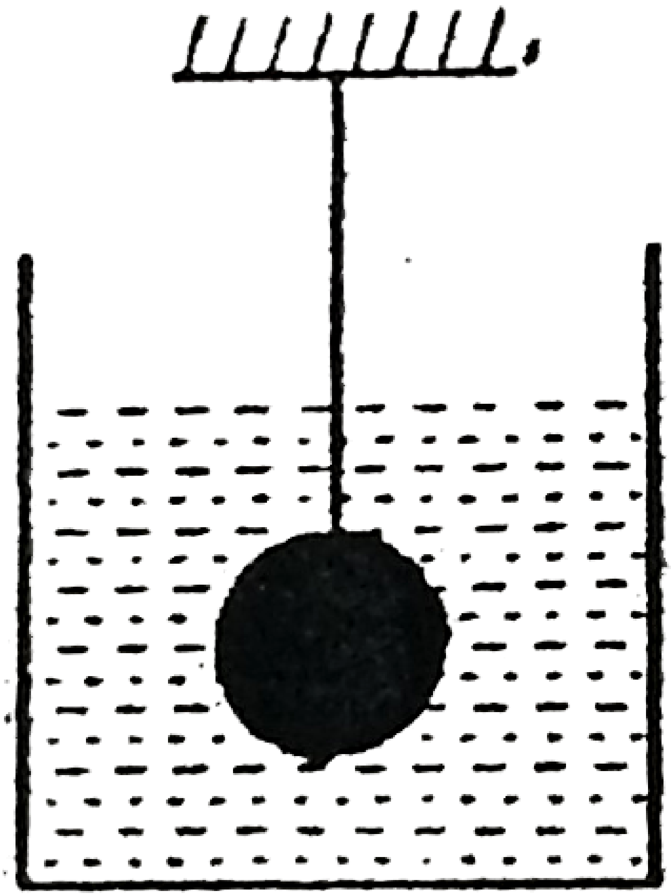
D. Horizontal force required to keep the vessel in static equilibrium is 0.12 N

Answer: A::D

View Text Solution

56. A solid sphere of mass m, suspended through a string in a liquid as shown. The string has some tension Magnitudes of net force due to liquid on upper hemisphere and that on lower hemisphere are F_A and F_B respectively. Which of the following is

// are true.



A. Density of material of the sphere is greater than density of

liquid

B. Difference of F_B and F_A is dependent of atmoshperic

pressure

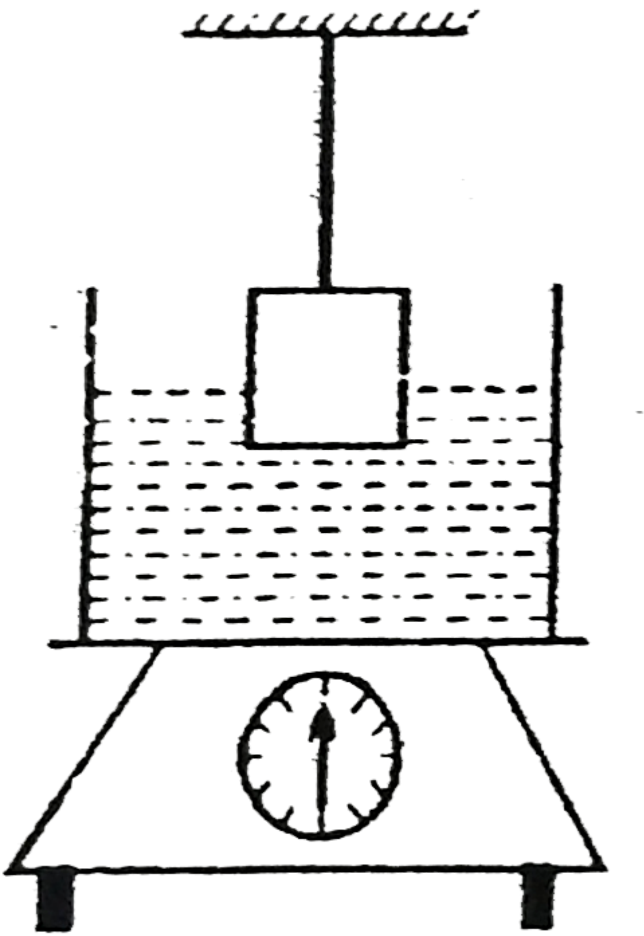
C. F_B - $F_A = mg$

D. F_B - $F_A < mg$

Answer: A::D

Watch Video Solution

57. The mass of block is m_1 and that of liquid with the vessel is m_2 The block is suspended by a string (tension T) partically in the liquid. The reading of the weighing machine placed below the vessel



A. can be $\left(m_1 + m_2\right)g$

B. can be greater than $\left(m_1 + m_2\right)g$

C. is equal to $\left(m_1g + m_2 - T\right)$

D. can be less than $\left(m_1 + m_2\right)g$

Answer: A::C::D

Watch Video Solution

58. A body floats on water and also on an oil of density 1.25. Which of the following is/are true?

A. The body loses more weight in oil than in water

B. The volume of water displaced is 1.25 times that of oil displaced.

C. The body experiences equal upthrust from water and oil

D. to make the body just sink, one will need 1.25 times load in case of oil than in case of water

Answer: B::C

Watch Video Solution

59. Each of the following system begins moving upwards with a constant acceleration. Select these cases in which quantity will change due to this upward acceleration:

A. time period of simple pendulum.

B. fraction of floating body submerged in a liquid

C. time period of a spring block system.

D. pressure on the base of a container containing liquid.

Answer: A::D

Watch Video Solution

60. Water jet coming out of a stationary horizontal tube at speed v strikes horizontally a massive wall moving in opposite direction with same speed. Water comes to rest relative to wall after striking. Treating A as cross-section of jet and density of water as ρ Select the correct alternative(s)

A. force exerted on the wall is $2\rho A v^2$

B. force exerted on the wall is $4\rho A v^2$

C. rate of change of kinetic energy of water jet striking the wall is $8\rho A v^3$

D. rate of change of kinetic energy of water jet striking the wall is zero.

Answer: B::D

Watch Video Solution

61. Consider standing wave formed due to superposition of two plane waves having the same amplitude, frequency and moving in opposite direction. Mark the correct statements:

A. the energy of a standing wave transforms completely into potential energy and at some other instant into kinetic energy during a part of complete cycle.

B. kinetic energy and potential energy attain their maximum and minimum values simultaneously

C. there is transition of energy from each node to its adjacent antinodes and back.

D. the time averaged energy flux in any cross section of the wave is zero.

Answer: A::C::D

Watch Video Solution

62. In a resonance tube experiment, an 80 cm air column in resonance with a turning fork in first overtone. Which equation can represent correct pressure variation in the air column (x=0 is the top point of the tube, neglect end correction, speed of sound =320 m//sec)

A. $A\sin\frac{15\pi}{8}x\cos 600\pi t$

B. $A\cos\frac{15\pi}{8}x\sin 600\pi t$

C. $A\cos\frac{15\pi}{8}x\sin 300\pi t$

D. $A\sin\frac{15\pi}{x}\sin 300\pi t$

Answer: A

Watch Video Solution

63. Two particles of a medium disturbed by the wave propagtion are at $x_1 = 0$ and $x_2 = 1$ cm The wave is propagating in positive x-direction The displacement of the particles is given by the equation: $y_1 = (2\sin 3\pi t)$ cm and $y_2 = 2\sin(3\pi t - \pi/8)$ cm (t is in seconds)

A. The frequency of wave is 1.5 Hz

B. Wavelength of the wave can be 16 cm

C. Velocity of the wave can be 24 cm//s

D. Wave equation can be $y = (2)\sin\left[\frac{2\pi}{16}(24t - x)\right]$ cm.

Answer: A::B::C::D

Watch Video Solution

64. The particle displacement of a travelling longitudional wave is represented by $\xi = \xi(x, t)$. The midpoints of a compression zone and an adjacent rarefaction zone are represented by the letter 'C' and 'R' Which of the following is true?

A. $|\partial\xi/\partial X|_C = |\partial\xi/\partial x|_R$

B. $|\partial\xi/\partial t|_C = |\partial\xi/\partial t|_R = 0$

C. $(pressure)_C$ - $(pressure)_R = 2|\partial\xi/\partial\xi|_C$ xBulk modulus of air.

D. Particles of air are stationary mid-way between 'C' and 'R'.

Answer: A::C::D

View Text Solution

65. A gas is filled in an organ pipe and it is sounded in fundamental mode. Choose the correct statement(s)

(T=constant)

A. If gas is changed from $H_2 \rightarrow O_2$, the resonant frequency will increase

B. If gas is changed from $O_2 \rightarrow N_2$, the resonant frequency will increase

C. if gas is changed from $N_2 \rightarrow He$, the resonant frequency will decrease

D. If gas is changed from $He \rightarrow CH_4$,the resonant frequency will decrease

Answer: B::D

Watch Video Solution

66. Two coherent waves represented by $y_1 = A\sin\left(\frac{2\pi}{\lambda}x_1 - \omega t + \frac{\pi}{6}\right)$ and $y_2 = A\sin\left(\frac{2\pi}{\lambda}x_2 - \omega t + \frac{\pi}{6}\right)$ are superposed. The two waves will produce

A. constructive interference at $\left(x_1 - x_2\right) = 2\lambda$

B. constructive interference at $\left(x_1 - x_2\right) = \frac{23}{24}\lambda$

C. destructive interference at $\left(x_1 - x_2\right) = 1.5\lambda$

D. destructive interference at $\left(x_1 - x_2\right) = \frac{11}{24}\lambda$

Answer: B::D

Watch Video Solution

67. Which of the following actions would make a pulse travel faster along a stretched string?

A. Move your hand up and down more quickly as you generate the pulse.

B. Use a heavier string of the same length, under the same tension.

C. Use a lighter string of the same length, under the same tension.

D. Stretch the string tighter to increase the tension.

Answer: C::D

Watch Video Solution

68. A wave equation which gives the displacement along the y direction is given by $y = 10^{-4}\sin(60t + 2x)$, where x and y are in meters and t is time in seconds This represents a wave

A. travelling with a velocity of $30ms^{-1}$ in the negative x direction

B. of wavelength pim

C. of frequency $30/\pi$ Hz

D. of amplitude 10^{-4} m

Answer: A::B::C::D

Watch Video Solution

69. A hollow copper sphere & a hollow copper cube of same surface area & negligible thickness , are filled with warm water of same temperature and placed in an enclosure of constant temperature a few degrees below that of the bodies. Then in the beginning:-

A. the rate of energy lost by the sphere is greater than that by the cube

B. the rate of energy lost by the two are equal

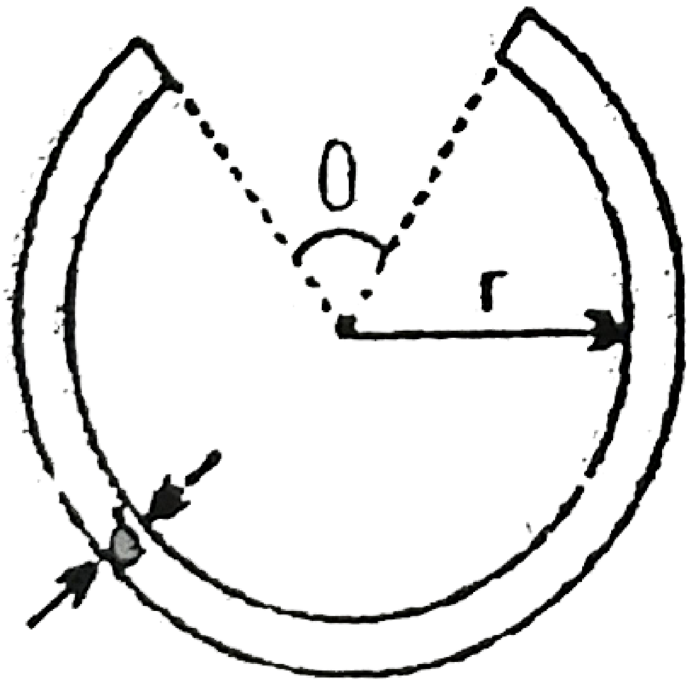
C. the rate of energy lost by the sphere is less than that by the cube

D. the rate of fall of temperature for sphere is less than that for the cube.

Answer: B::D

Watch Video Solution

70. A thin cylindrical metal rod is bent into a ring with a small gap as shown in figure. On heating the system



A. θ decreases,r and d increases

B. θ increases

C. d & r increases

D. θ is constant,

Answer: C::D

Watch Video Solution

71. The extension produced in a wire of length L when under tension T is l. One of the notes emitted by the wire when it is used in sonometer is (d=density Y=Young's modulus mass per unit length $= \mu, \alpha\rho\varepsilon\alpha = A$)

A. $f = \frac{2}{3L^{3/2}}\sqrt{\frac{Yl}{d}}$

B. $f = \frac{2}{L^{3/2}}\sqrt{\frac{Yl}{d}}$

C. $f = \frac{1}{2L}\sqrt{\frac{AYl}{L\mu}}$

D. $f = \frac{1}{4L}\sqrt{\frac{AYl}{\mu L}}$

Answer: B::C

Watch Video Solution

72. A unifom cylinder of steel of mass M radius R is placed on frictionless bearings and sct to rotate about its axis with angular velocity ω_0 After the cylinder has reached the specified state of rotation, it is heated from temperature $T_0 \rightarrow \left(T_0 + \Delta T\right)$ without any mechanical contact. If (DeltaI)/I is the fractional change in moment of inertia of the cylinder and $\frac{\Delta\omega}{\omega_0}$ be the fractional change in the angular velocity of the cylinder and alpha be the coefficient of linear expansion, then

A. $\frac{\Delta I}{I} = \frac{2\Delta R}{R}$

B. $\frac{\Delta I}{I} = \frac{2\Delta\omega}{\omega_0}$

C. $\frac{\Delta\omega}{\omega_0} = -2\alpha\Delta T$

D. $\frac{\Delta I}{I} = -\frac{2\Delta R}{R}$

Answer: A::C

Watch Video Solution

73. A U-tube filled with a liquid of volumetric expansion coefficient $10^{-5}/^{\circ}C$ lies in a vertical plane. The height of liquid column in the left vertical limb is 100 cm. The liquid in the left vertical limb is maintained at a temperature $=^{\circ}$C while the liquid in the right limb is maintained at a temperature $= 100^{\circ}$ C The difference in levels in the two limbs is

A. 0.1 cm

B. 0.2 cm

C. 0.2 cm

D. zero

Answer: A

View Text Solution

74. Due to thermal expansion, with rise in temperature

A. metallic scale reading becomes lesser than true value (alpha of the metal is greater then alpha of the object)

B. Pendulum clock becomes slower

C. A floating body sinks a little more (assuming temperature of liquid remains unchanged)

D. The apparent weight of a body in a liquid may decrease (assuming temperature of liquid remains unchanged)

Answer: A::B::D

Watch Video Solution

75. Which of the following statements is // are correct?

A. A real gas approaches perfect gas behaviour at high temperature and low pressure

B. Molecules of ideal gas posses only translational kinetic energy at all temperatures

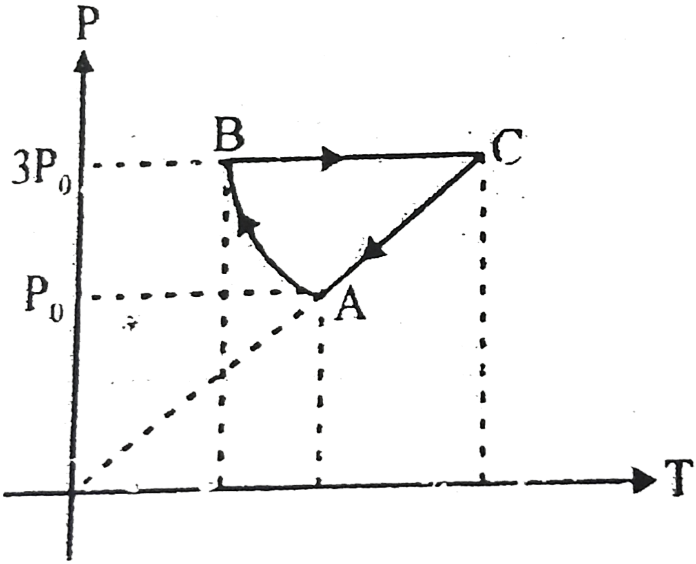
C. An ideal gas would never condense into the liquid state

D. The average translational kinetic energy per molecule at any given temperature is independent of the type of ideal gas

Answer: A::C::D

Watch Video Solution

76. One mole of monoatomic gas is taken through cyclic process shown below $T_A = 300$ K.Process AB is defined as PT=constant.



A. Work done in process AB is -400 R.

B. Change in internal energy in process CA is 900 R.

C. Heat transferred in the process BC is 2000R.

D. Change in internal energy in process CA is -900 R.

Answer: A::C::D

View Text Solution

77. A metal cylinder of mass 0.5 kg is heated electrically by a 12 W heater in a room at 15° C. The cylinder temperature rises uniformly to 25° C in 5 min and finally becomes constant at 45° C Assuming that the rate of heat losss is proportional to the excees temperature over the surroundings,

A. the rate of loss of heat of the cylinder to surrounding at 20° C is 2W

B. the rate of loss of heat of the cylinder to surrounding at 45° C is 12W

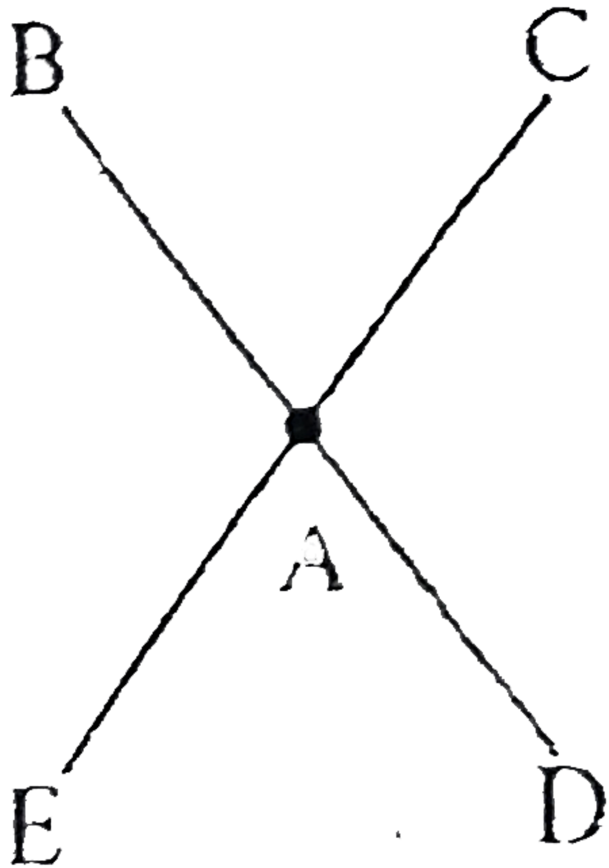
C. the rate of loss of heat of the cylinder to surrounding at 20° C is 5W

D. the rate of loss of heat of the cylinder to surrounding at 45° C is 30W.

Answer: A::B

Watch Video Solution

78. Four identical rods which have thermally insulated lateral surfaces are joined at point A. Points B,C,D & E are connected to large reservoirs. If heat flows into the junction from point B at rate of 1W and from point C at 3 W inside, flows out from D at 5 w, which relation (s) is//are correct for temperature of these points?



A. $T_A < T_E$

B. $T_B = T_C$

C. $T_C > T_D$

D. $T_B = T_E$

Answer: A::C::D

View Text Solution

79. Which of the following quantities is the same for all ideal gases at the same temperature?

A. the total translational kinetic energy of the molecules in 1 mole gas

B. the kinetic energy of 1 gm

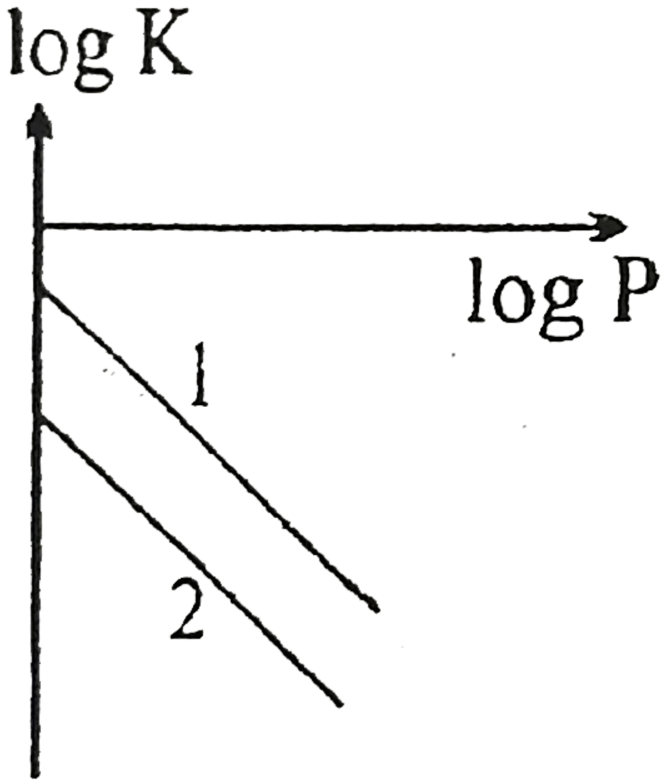
C. the number of molecules in 1 mole

D. the number of molecules in 1 gm

Answer: A::C

Watch Video Solution

80. Figure represents on the log-log scale pressure (P) dependence of adiabatic compressibility (K) of two gasses. Mark the correct option/s.



A. Line 1 & 2 may represent monoatomic and diatomic gas respectively.

B. Line1 & 2 may represent diatomic and monoatomic gasses respectively.

C. Degree of freedom for the gas represented by line 1 is more then the degree of freedom for line 2

D. Degree of freedom for the gas represented by line 2 is more than the degree of freedom for line 1.

Answer: B::C

Watch Video Solution

81. Two moles of $O_2\left(\gamma = \frac{7}{5}\right)$ at temperature T_0 and 3 moles of $CO_2\left(\gamma = \frac{4}{3}\right)$ at temperature $2T_0$ are allowed to mix together in a rigid closed adiabatic vessel. The resulting mixture finally comes in thermal equilibrium. Then,

A. final temperature of the mixture is $\frac{23T_0}{14}$

B. final temperature of the mixture is $\frac{31T_0}{19}$

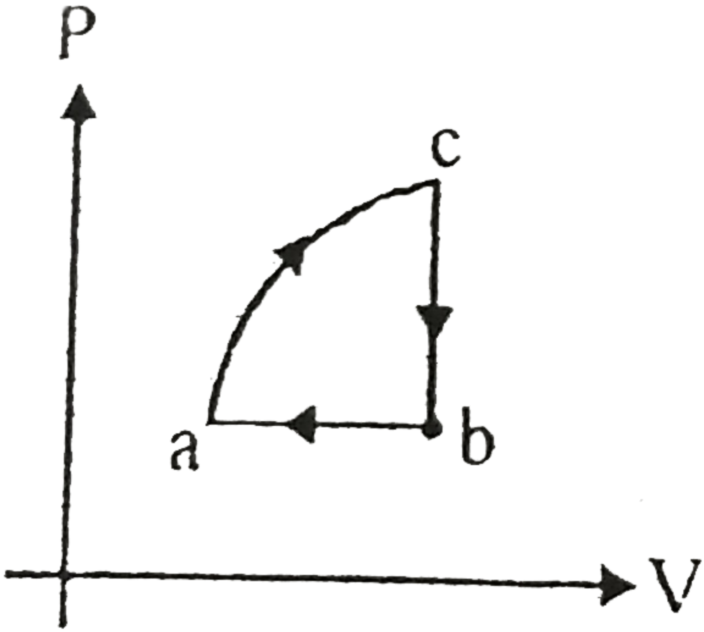
C. adiabatic exponent of the mixture formed is 14/3

D. adiabatic exponent of the mixture formed is $\frac{19}{14}$

Answer: A::D

Watch Video Solution

82. In the given cyclic process from c to b 40 J heat is exchanged from b to a 130 J heat is exchanged and work done is 80 J from a to c, 400 J heat is exchanged, then:



A. Work done in process a to c is 310 J

B. Net work done in cycle is 230 J

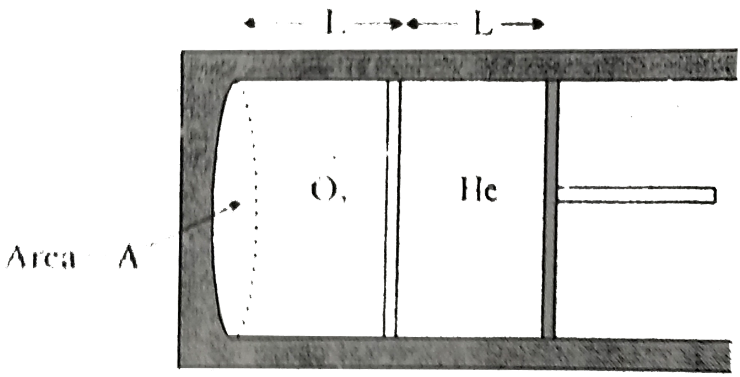
C. Net change in internal energy in cycle is 130 J

D. Efficiency of cycle 57.5 %

Answer: A::B::D

Watch Video Solution

83. An insulating cylinder contains equal volumes of He and O_2 separated by a massless freely moving adiabatic piston as shown. The gas is compressed by moving the insulating piston so that volume of He becomes half. Select the correct alternative(s).



A. Pressure in He chamber will be equal to pressure in O_2 chamber

B. Pressure in He chamber will be less then pressure in O_2 chamber

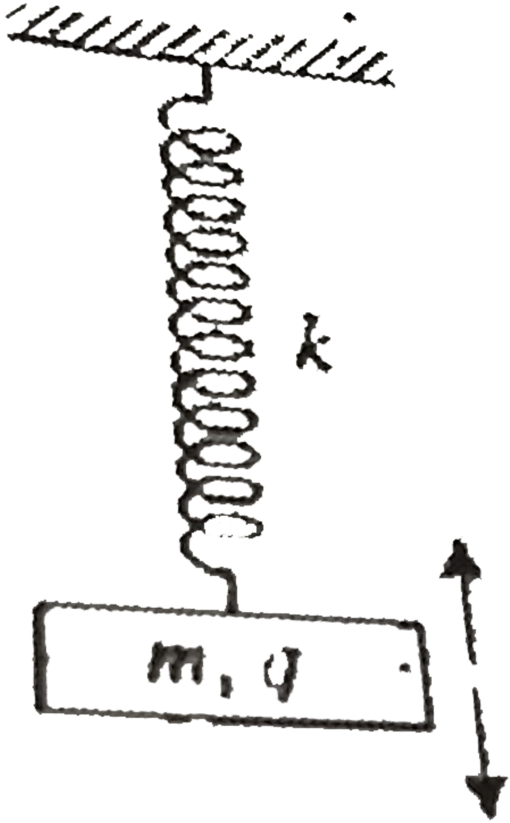
C. Volume of He chamber will be equal to volume of O_2 chamber

D. Volume of O_2 chamber will be $\frac{(LA)}{(2)^{25/21}}$

Answer: A::D

Watch Video Solution

84. The following figure-I .427 shows a block of mass m suspended from a fixed point by means ofa vertical spring. The block is oscillating simple harmonically and carries a charge q. There also exists a uniform electric field in the space. Consider four different cases. The electric field is zero, in case-I, $E = mg/q$ downward in case-2, $E = mg/q$ upward in case-3 and $E = 2mg/q$ downward in case-4. The speed at mean position of block is same in all cases. Select which of the following statements is/ are correct :



A. Time periods of oscillation are equal in case-1 and case-3

B. Amplitudes of displacement are same in case-2 and case-3

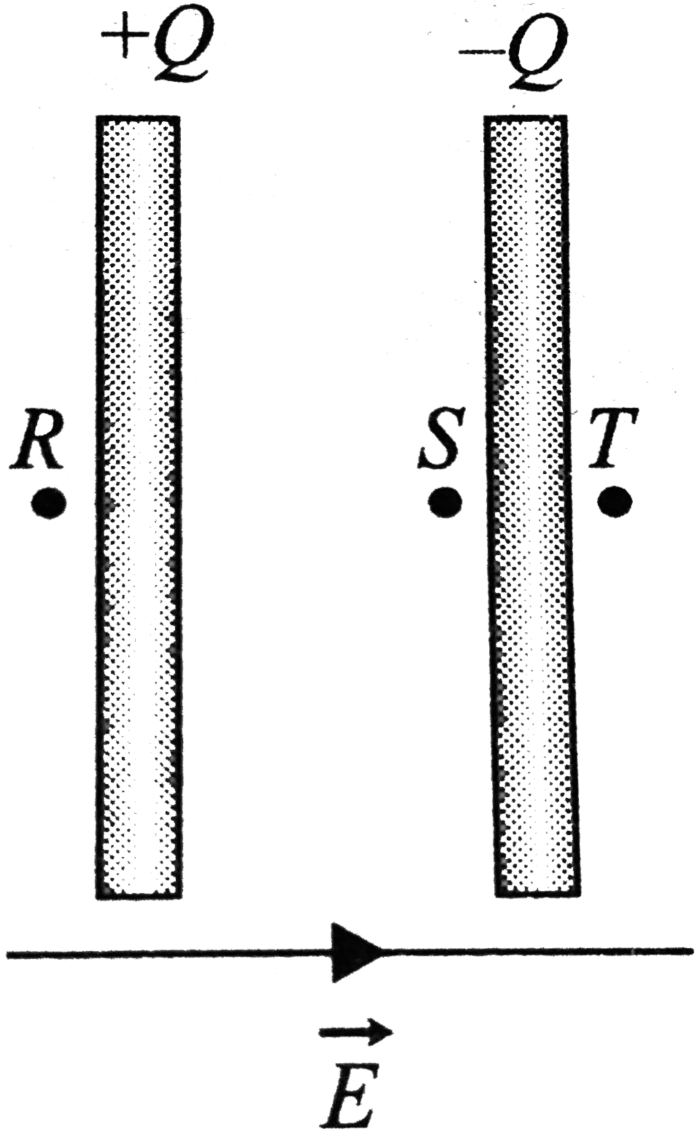
C. The maximum elongation (increment in length from natural length) is maximum in case-4.

D. Time periods of oscillation are equal in case-2 and case-4

Answer: A::B::C::D

Watch Video Solution

85. Two large thin conducting plates with a small gap in between are placed in a uniform electric field E (perpendicular to the plates.)The area of each plate is A, and charges $+Q$ and $-Q$ are given to these plates as shown in figure. If R,S, and T are three points in space, then the



A. field at point R is E

B. field at point S is E

C. field at point T is $\left(E + \dfrac{Q}{\in_0 A}\right)$

D. field at point S is $\left(E + \dfrac{Q}{A \in_0}\right)$

Answer: A::D

Watch Video Solution

86. A fixed point charge Q is at origin At $t = 0$ a charge q with m is at $x = a$ with leftward velocity V_0 which satisfies $\dfrac{kQq}{a} = 3mV_0^2$ The particle turns around and starts to move right ward at the position b lt a

A. the ratio $\dfrac{b}{a}$ is $\dfrac{6}{7}$

B. the ratio $\dfrac{b}{a}$ is $\dfrac{3}{7}$

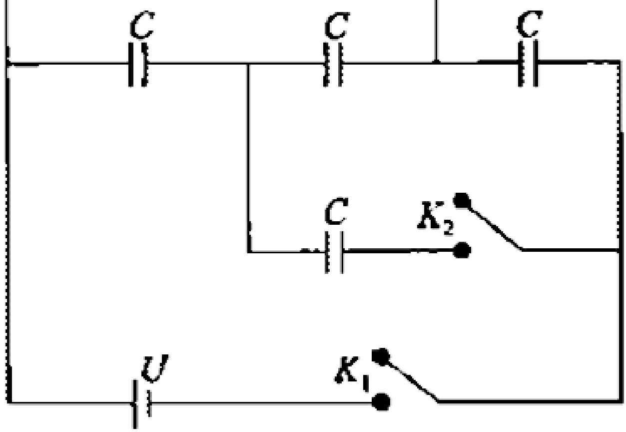
C. the velocity of the particle at a large distance from the origin is $\sqrt{7}V_0$

D. the velocity of the particle at a large distance from the origin is zero

Answer: A::C

Watch Video Solution

87. How does the total energy stored in the capacitors in the circuit shown in the figure change when first switch K_1 is closed (process-1) and then switch K_2 is also closed (process-2), Assume that all capacitor were initially uncharged?



A. Increases in process-1

B. Increases in process-2

C. Decreases in process-2

D. Magnitude of change in process -2 is less than that in process-1

Answer: A::B::D

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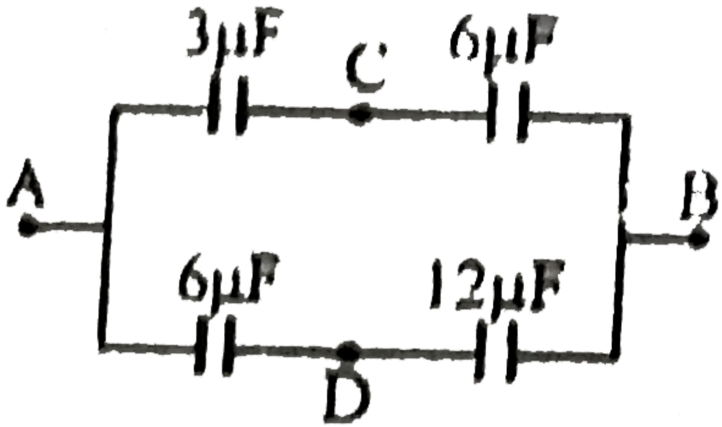
88. In the circuit shown, some potential difference is applied between A and B If C is joined to D



A. no charge will flow between C and D

B. some charge will flow between C and D

C. the equivalent capacitance between A and B will not change

D. the equivalent capacitance between A and B will change.

Answer: A::C

Watch Video Solution

89. How does the total energy stored in the capacitors in the circuit shown in the figure change when first switch K_1 is closed (process-1) and then switch K_2 is also closed (process-2) Assume that all capacitor were initially uncharged?

A. Increases in process-1

B. Increases in process-2

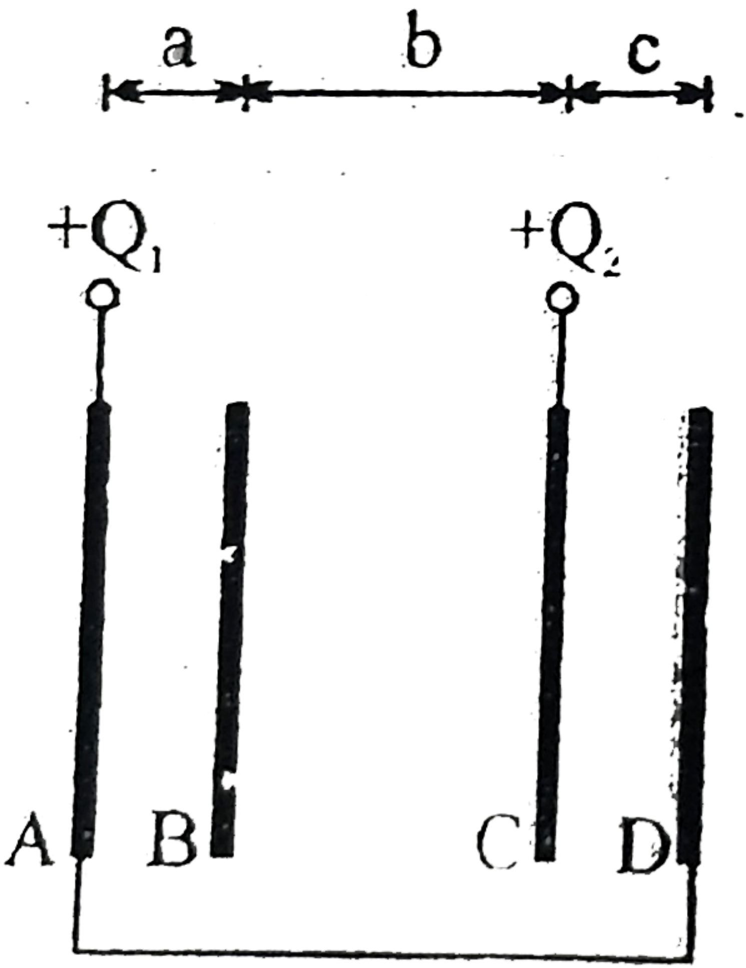
C. Decreases in process-2

D. Magnitude of change in process-2 is less than that in process-1

Answer: A::B::D

View Text Solution

90. Figure shows an arrangement of four identical ractangular plates A, B ,C and D each of area S. Find the charges appearing on each face (from left to right) of the plates. Ignore the separation between the plates in comparison to the plate dimensions.



A. Potential difference between plastes A & B is independent

of Q_1

B. Potential difference between plastes C & D is independent of Q_1

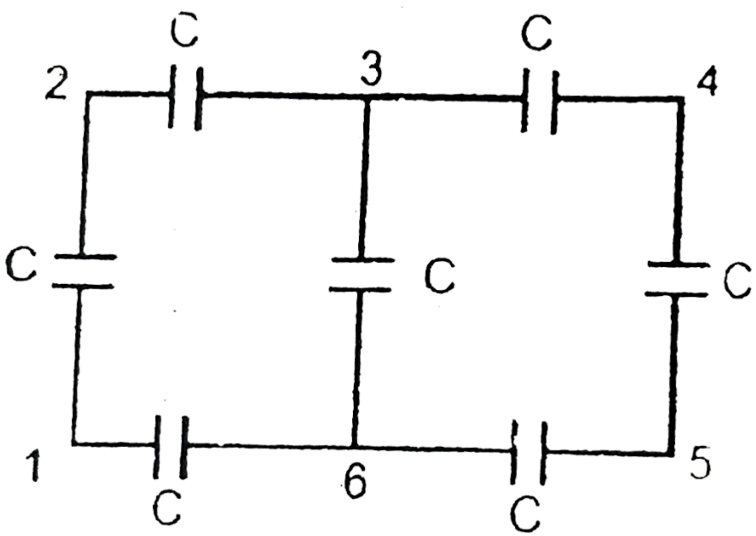
C. Potential difference between plastes A & B is independent of Q_2

D. Potential difference between plastes C & D is independent of Q_2

Answer: A::B

View Text Solution

91. For the given circuit, select the correct alternative(s)



A. The equivalent capacitance between points $1\&2 is \frac{15C}{11}$

B. The equivalent capacitance between poits $3\&6 is \frac{5C}{3}$

C. The equivalent capacitance between points $1\&3 is \frac{15C}{14}$

D. The equivalent capacitance between points $3\&5 is \frac{14C}{15}$

Answer: A::B::C

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92. A capacitor of capacity C_0 is conneted to a battery of emfV_0 When steady state is attained a dielectric slab of dielectric constant K is slowly introduced in the capacitor to fill the capacitor completely. Mark the correct statement(s), in final stady state.

A. Magnitude of induced charge on the each surface of slab is $C_0V_0(K-1)$

B. Electric force due to induced charges on any plate is zero.

C. Force of attraction between plates of capacitor is $\dfrac{K\left(C_0V_0\right)^2}{2\in_0A}$

D. Field due to induced charges in dielectric slab is $\dfrac{(K-1)C_0V_0}{\in_0A}$

Answer: A::B::D

Watch Video Solution

93. A dielectric slab fills the space between the plates of a parallel-plate capacitor. The magnitude of the bound charge on the slab is

75% *ofthemagnitudeoftheeechar* $\geq$ *ontheplates*. *The* $\cap$ *acitanceis*

480muf and *the* max *iμmchar* $\geq$ *tĉanbes* $\rightarrow$ *redonthe* $\cap$ *aci* $\rightarrow$ *ris*

240varepsilon_(0)L^(2) E_(max)*where*E_(max)` is the breakdown field.

A. the dielectric constant for the dielectric slab is 4

B. without the dielectric, the capacitance of the capacitor would be $360\mu F$

C. the plate area is $60L^2$

D. If the dielectric slab is having the same area as the capacitor plate but the width half that of the capacitor, the capacitance would be $192\mu F$

Answer: A::C::D

View Text Solution

94. A galvanometer has a resistance of 96Ω and full scale deflection of 100μA. It can be used as ammeter provided a resistance is added to it. Pick up the correct range and resistance combination(s)

A. 1.3 m A range with $25K\Omega$ resistance in parallel

B. 1.3 mA range with 8Ω resistance in parallel

C. 2.5 mA range with 2.5 Omega resistance in parallel

D. 2.5 mA range with 4Ω resistance in parallel

Answer: B::D

Watch Video Solution

95. When a galvanometer is shunted with a 4Ω resistance the deflection is reduced to$1/5$. If the galvanometer is further shunted with a 2Ω wire the new deflection will be (assuming the main current remains the same)

A. $\frac{5}{9}$ of the deflection when shunted with 4Ω only

B. $\frac{5}{13}$ of the deflection when shunted with 4Ω only

C. $\frac{1}{13}$ of the original deflection only

D. $\frac{1}{9}$ of the original deflection only

Answer: B::C

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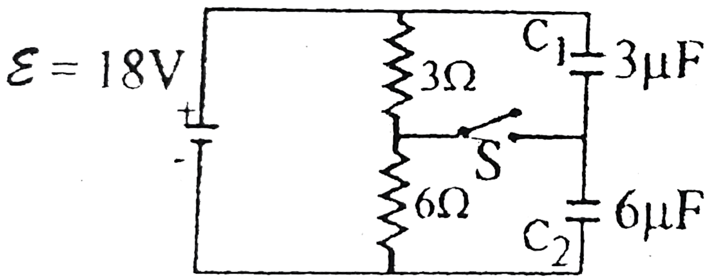
96. In the circuit shown, which of the following statements is correct?



A. When S is open, charge on $C_1 is 36 \mu C$

B. When S is open, charge on $C_2 is 36 \mu C$

C. When S is closed, the charges on C_1 and C_2 do not change

D. When S is closed, charge on both C_1 and C_2 change

Answer: A::B::D

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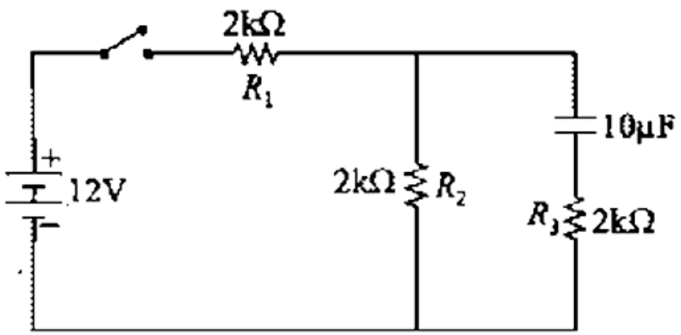
97. In the circnit shown, capacitor is initially uncharged till the switch is turned on at time $t = 0$. Then



A. at $t = 0$ current supplied by battery is 4 mA

B. at $t = 0$, current in R_3 is 2mA

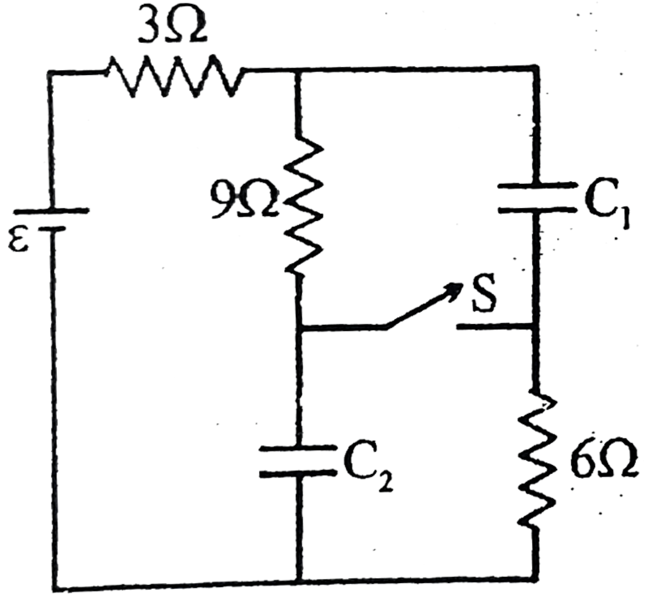
C. in the steady state current supplied by battery is 3 mA

D. in the steady state current in R_3 is zero

Answer: A::B::C::D

Watch Video Solution

98. In the circuit shown there is steady state with the switch closed. The switch is opened at $t = 0$ Choose the correct option(s) (Given $\varepsilon = 24V, C_1 = 3F$ and $C_2 = 2F$)



A. The voltage across C_1 before the switch is open is 12V

B. The voltage across C_1 after a long time after the switch is open is 12V

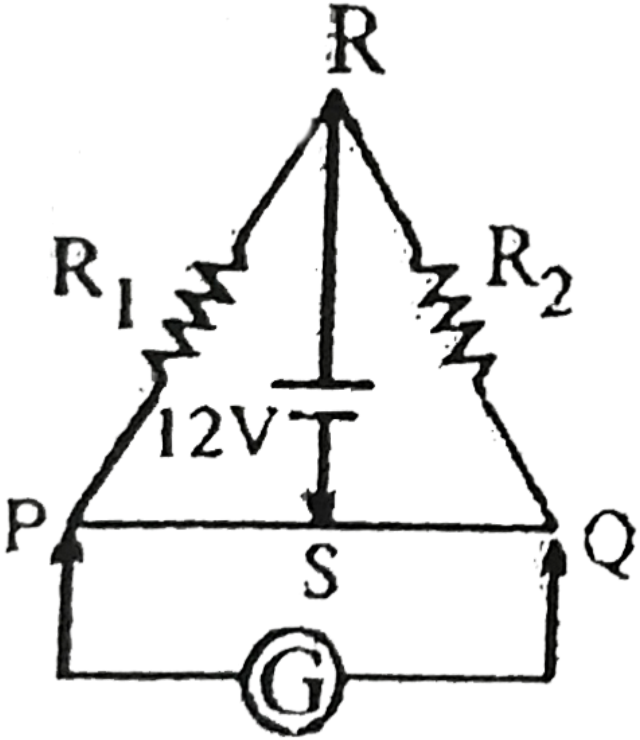
C. The voltage across C_2 after a long time after the switch is open is 24V

D. The voltage across C_2 before the switch is open is 8V

Answer: A::C::D

Watch Video Solution

99. In the circuit shown $R_1 = R_2 = 10\Omega$ and resistance per unit length of wire $PQ = 1\Omega/cm$ and length PQ =10 cm if R_2 is made 20Ω the to get zero deflection in galvanometer. S is midpoint of wire PQ.



A. The jockey at P can be moved towards right 2 cm

B. The jockey at Q can be moved towards right 2 cm

C. The jockey at S can be moved towards left a distance 5//3

cm

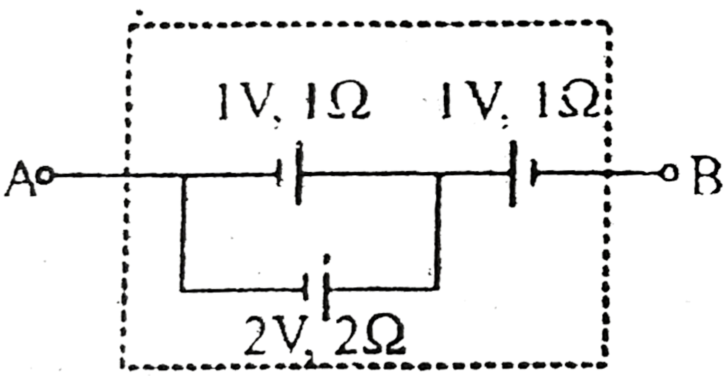
D. The jockey at all positions fixed and R_(1) should be made

20Ω

Answer: A::C::D

View Text Solution

100. An electric box contains three e.m.f sources as shown in the figure



A. emf of the electric box is $\frac{1}{3}$ V

B. point B is at higher potential than point A

C. internal resistance of the box is $\frac{5}{3}\Omega$

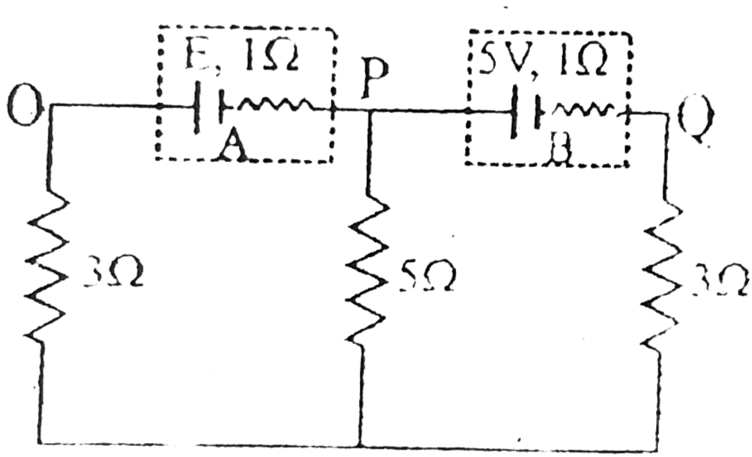
D. terminal voltage for $2V$ source is $\frac{4}{3}$v

Answer: A::B::C::D

View Text Solution

101. Two batteries A and B and three resistors are conneted Internal resistence of both batteries is 1Ω each as shown. EMF of battery B is 5V The potential difference between P and Q is zero.

Which of following is/are TRUE



A. the current through $5\Omega is 3$A

B. the current through the battery A is 8A

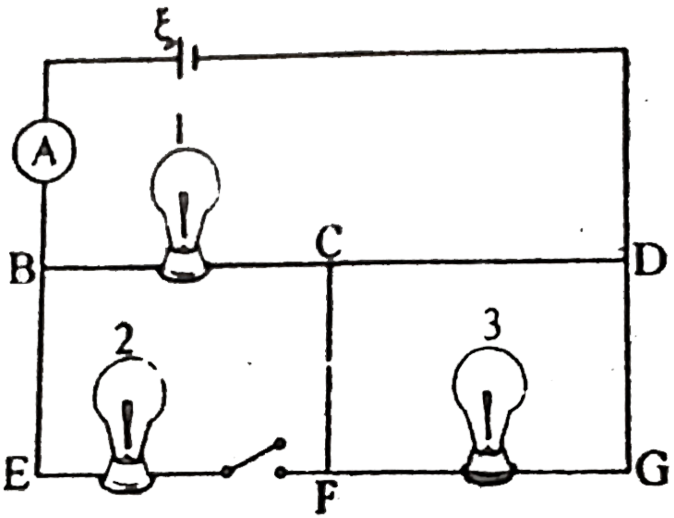
C. the emf of the source A is 47V

D. the p.d. between O and p is 8V

Answer: A::B::C

Watch Video Solution

102. For the circuit shown, the ammeter reading is initially I. The switch in the circuit then is closed. Consequently (Battery and ammeter are ideal)



A. the ammeter reading decreases

B. the potential difference between E and F increases

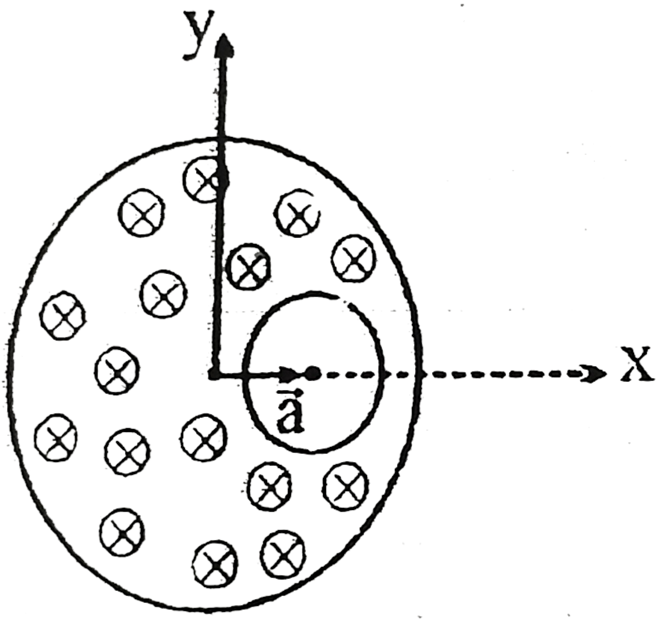
C. the potential difference between E and F stays the same

D. bulb 3 lights up more brightly.

Answer: C

View Text Solution

103. Figure shows crosssection view of a infinite cylindrical wire with a cavity, current density is uniform $\vec{j} = -j_0\hat{k}$ as shown in figure



A. magnetic field inside cavity is uniform

B. magnetic field inside cavity is along $\vec{a}$

C. magnetic field inside cavity is perpendicular to $\vec{a}$

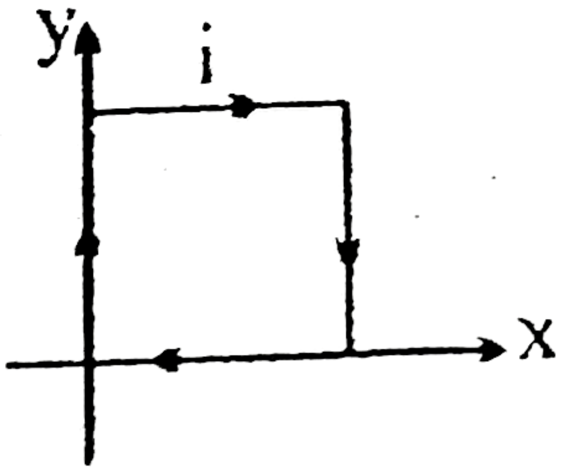
D. If an electron is projected with velocity $v_0\hat{j}$ inside the cavity it will move undeviated.

Answer: A::C::D

View Text Solution

104. Figure shows sqare current caarrying coil of edge lengthL. The magnetic field on the coil is given by $\vec{B} = \frac{B_0 y}{L}\hat{i} + \frac{B_0 x}{L}\hat{j}$ where

B_0 is a positive constant.



A. If coil is free to rotate about x axis torque on the coil is given by $\frac{1}{2}iAB_0\hat{i}$

B. If coil is free to rotate about y-axis torque on coil is given by - $\frac{1}{2}iAB_0\hat{j}$

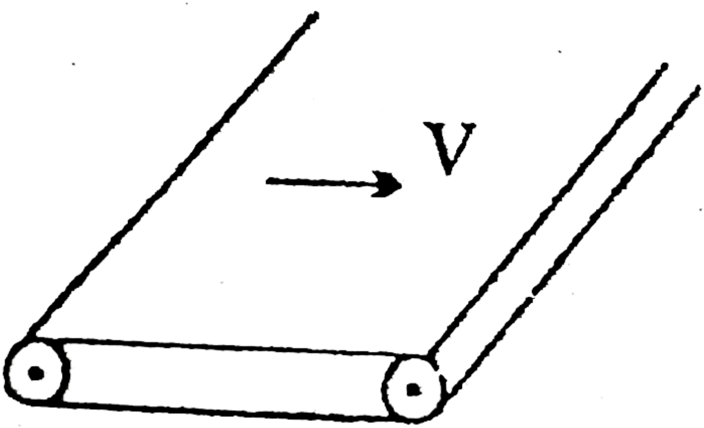
C. Resultant force on coil is zero.

D. Equation for the torque $\vec{\mu} \times \vec{B}$ where mu is magnetic moment of coil is not valid on the coil.

Answer: A::B::C::D

View Text Solution

105. Charge is sprayed onto a large non conducting belt above the left hand roller. The belt carries charge with a uniform surface charge density delta, as it moves with a speed v between the rollers as shown. The charge is removed by a wiper at right hand roller. For a point just above the sheet mark the correct option.



A. magnetic field is $\frac{\mu_0 \sigma v}{2}$, out of the plane of the page, parallel to axis of roller.

B. magnetic field is $\mu_0 \sigma$, out of the plane of the page perpendicular to axis

C. electric field is $\frac{\varepsilon_0 \sigma}{2}$ perpendicular to the plane of sheet

D. If an electron moves parallel to V just above the sheet it will experience an upward magnetic force.

Answer: A::D

Watch Video Solution

106. In the Hall effect, we have a current flowing in the presence of a uniform magnetic field, and we get a potential difference across the conductor. Which is incorrect statement?

A. a changing magnetic field produces an induced EMF

B. charges are bent from their paths until an electric field is built up transverse to the wire to stop them from bending

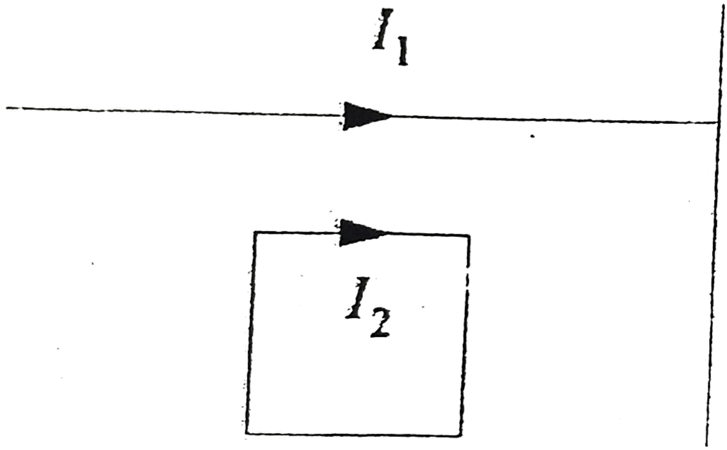
C. the charges in the wire are moving. So the electric fields are changing with time.

D. the charges produced by the current repel each other, and produce a build up of charge on the surface of the conductor.

Answer: A::C::D

View Text Solution

107. A long straight wire carries a steady current I_(1) Nearby is a rectangular loop that carries a steady current I_2 The directions of the two currents are shown in the figure.



Which statement is /are false?

A. The loop is attracted to the wire

B. There is no net force on the loop from the wire

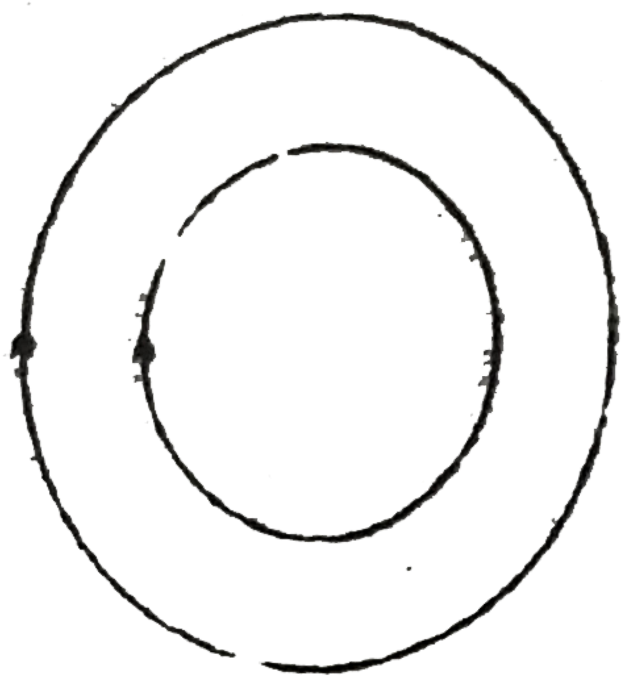
C. The loop is attracted to the wire If $I_1 > I_2$ otherwise it is repelled

D. The loop is repelled from the wire if $I_1 > I_2$ otherwise it is attracted

Answer: B::C::D

Watch Video Solution

108. Two concentric, coplanar circular loop of wire, with different diameter carry current in the same sense as shown in the figure. Which of the following statement(s) is //are correct?



A. the magnetic force exerted by the outer loop on a short portion of the inner loop is radially outward

B. the magnetic force exerted by the outer loop on a short portion of the inner loop is radially inward

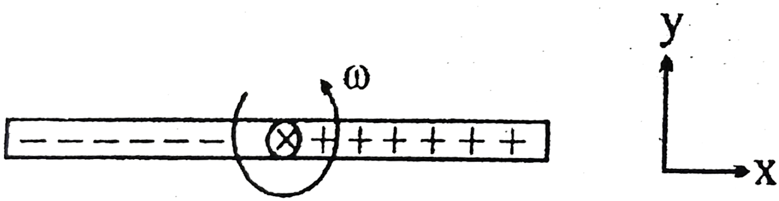
C. the net megnetic force exerted by the outer loop on a whole inner loop is non zero and is radially outward

D. the net magnetic force exerted by the outer loop on a whole inner loop is zero

Answer: A::D

View Text Solution

109. A charged rod having charge as shown is rotating with angular velocity omega about on hinge at its centre. At the instant shown rod is along x- axis Consider effect of field at the instant shown.



A. A magnetic field $B_0\hat{i}$ will slow down rod.

B. An electric field $E_0\hat{j}$ will slow down rod.

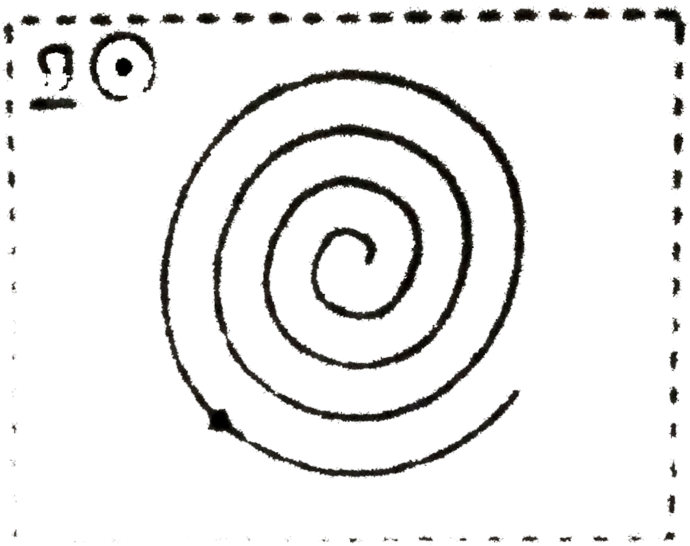
C. An electric field $E_0\left(-\hat{j}\right)$ will slow down rod.

D. A magnetic field can not slow down the rod.

Answer: C::D

View Text Solution

110. A uniform field is exists in the region directed away from the page. A charged particle, moving in the plane of the page follows a anticlockwise spiral of increasing radius as shown. True explanation is:



A. the charge is positive and slowing down

B. the charge is negative and slowing down

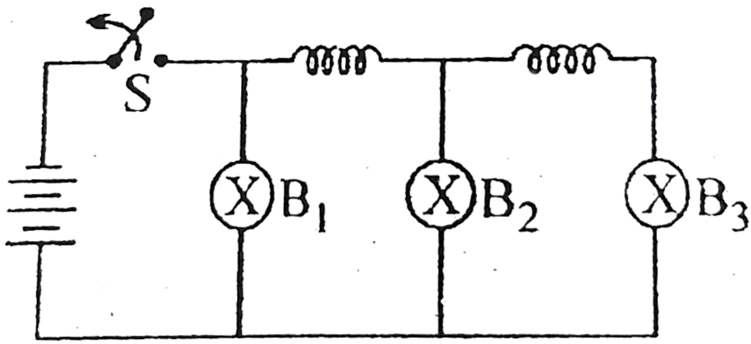
C. the charge is positive and speeding up

D. the charge is negative and speeding up

Answer: A

Watch Video Solution

111. The circuit shown in figure consisting of three identical lamps and two coils is connected to a direct current source. The ohmic resistance of the coils is negligible After some time switch S is opened. Which of the following statement(s) is // are correct for the instant immediately after opening the switch?



A. All the lamps are turned off

B. Brightness of $B_2 \& B_3$ remains unchanged

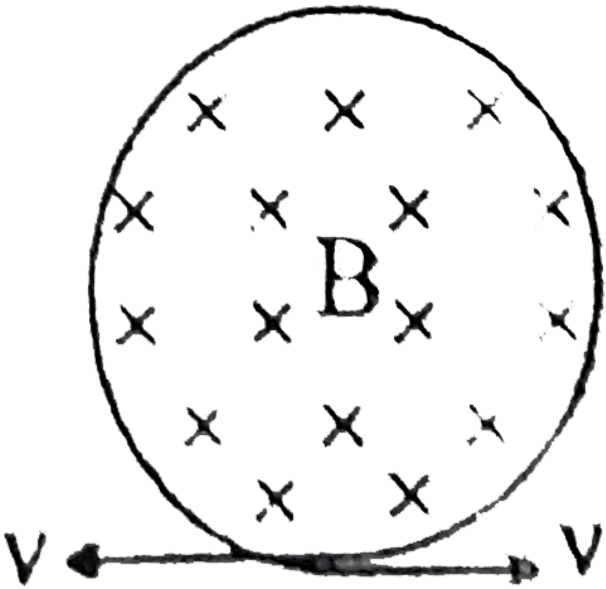
C. Brightness of B_1 suddenly increases

D. Insufficient data to draw any conclusion.

Answer: B::C

View Text Solution

112. A circular conducting loop of radius r_0 and having resistance per unit length lamba as shown in the figure is placed in a magnetic field B which is constant in space and time. The ends of the loop are crossed and pulled in opposite directions with a velocity v such that the loop always remains circular and the radius of the loop goes on decreasing then



A. Radius of the loop changes with r as $r = r_0 - vt/\pi$

B. EMF induced in the loop as a function of time is

$e = 2Nv\left[r_0 - vt/\pi\right]$

C. Current induced in the loop is $I = \dfrac{Bv}{2\pi\lambda}$

D. Current induced in the loop is $I = \dfrac{Bv}{\pi\lambda}$

Answer: A::B::D

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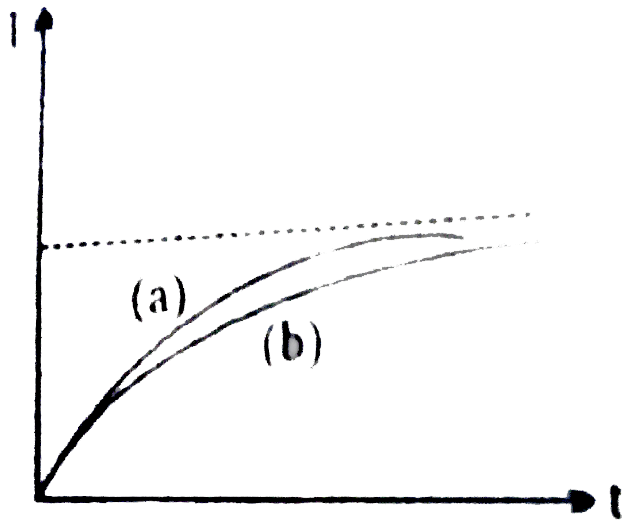
113. A circuit cosisting of a constant e.m.f. 'E' a self induction 'L' and a resistance 'R' is closed at $t = 0$ The relation between the current I in the circuit and time t is as shown by curve 'a' in the fig. When one or more of paraments E,R & L are changed, the curve 'b' is obtained The steady state current is same in both the cases Thenit is possible that:



A. E & R are kept constant & L is increased

B. E & R are kept constant & L is decreased

C. E & R are both halved and L is kept constant

D. E & R are kept constant and R is decreased

Answer: A::C

View Text Solution

114. Resonance occures in a series LCR circuit when the frequency of the applied emf is 1000 Hz.

A. when f=900Hz, the circuit behaves as a capacitative circuit

B. the impedance of the circuit is maximum at f=1000 Hz

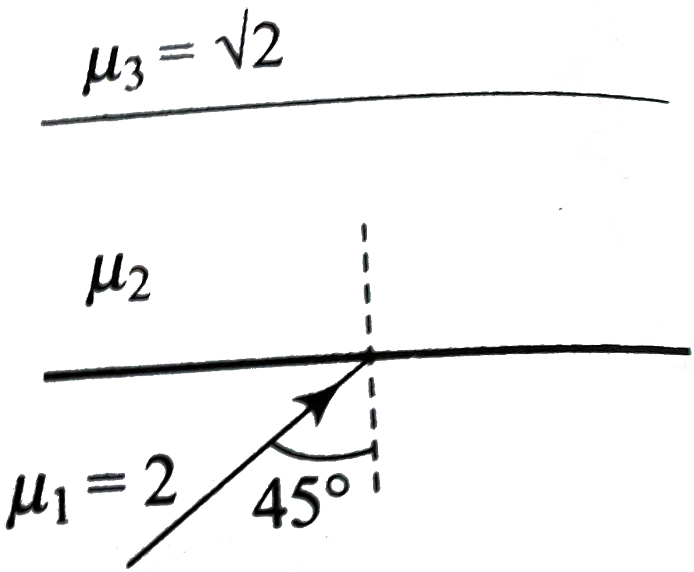
C. at resonance the voltage across L and voltage across C differ in phase by 180°

D. if the value of C is doubled resonance occurs at f=2000 Hz

Answer: A::C

Watch Video Solution

115. Figure, a light ray is incident on the lower medium boundary at an angle if 45° with the normal. Which of the following statement *is/are* true?



A. If $\mu_2 > \sqrt{2}$ then angle of deviation is 45°

B. If $\mu_2 < \sqrt{2}$ then angle of deviation is 90°

C. If $\mu_2 < \sqrt{2}$ then angle of deviation is 135°

D. If $\mu_2 > \sqrt{2}$ then angle of deviation is 0°

Answer: A::B

Watch Video Solution

116. A point object is kept at (1,0,0). A circular plane mirror of radius 1m is kept in yz-plane such that its centre is at the origin. The reflecting side faces positive x-axis At which of the following points can the image of the object be seen?

A. (-0.5,0,0.5)

B. (2,2,2)

C. (1,1.5,1.5)

D. (1,-1,1.5)

Answer: B::D

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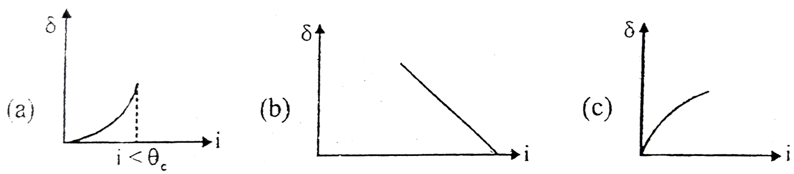
117. Following are graphs of angle of deviation versus angle of incidence.



Based on the above graphs mark the correct options.

A. Graph-a may be a part of the graph for ray of light that travels from denser to rarer medium

B. Graph-b may be for ray of light that is totally internally reflected from a denser to rarer medium boundary.

C. Graph-c may be a part of the graph for ray of light that travels from rarer to denser medium.

D. Graph-b may be a part of the graph for ray of light that is reflected from a plane mirror.

Answer: A::B::D

View Text Solution

118. An object and a screen are kept at a distance of 120 cm A lens of focal length 22.5 cm is kept between them so that a real image is formed on the screen Find the possible location (s) of the lens.

A. 90cm from object

B. 30cm from object

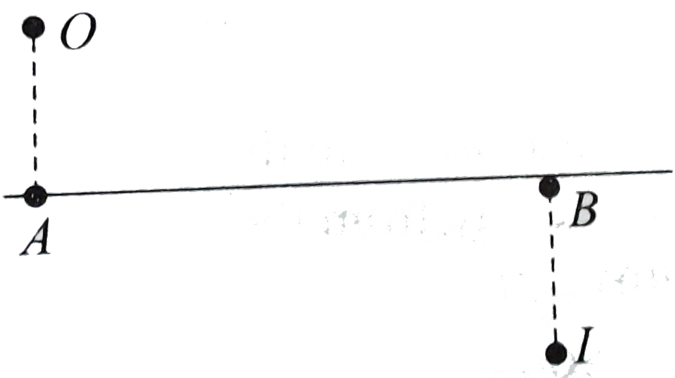
C. 40cm from object

D. 80cm from object

Answer: A::B

Watch Video Solution

119. A luminous point object is placed at O, whose image is formed at I as shown in Figure. Line AB is optical axis. Which of the following statement is/are correct?



A. If a lens is used to obtain the image, then it must be a diverging lens and its optical centre will be the intersection point of line AB and OI.

B. If a lens is used to obtain the image, then it must be a converging lens and its optical centre will be the intersection point of line AB and OI.

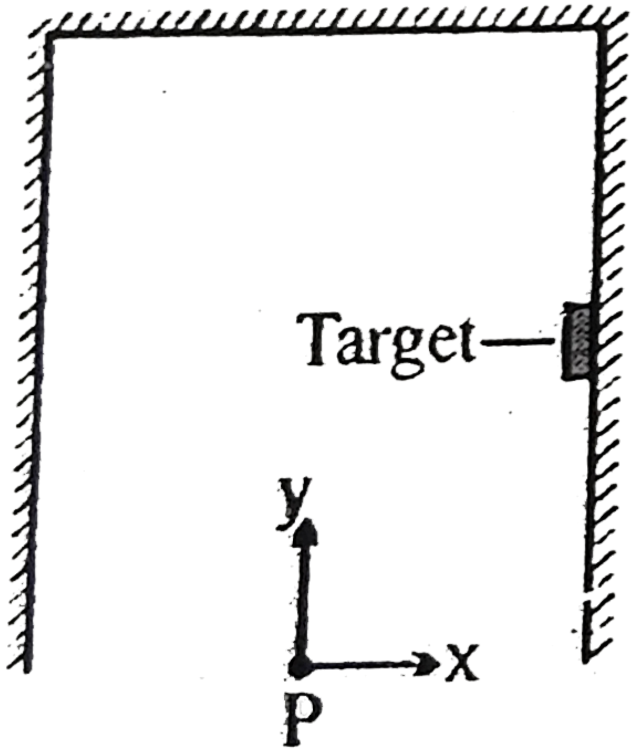
C. If a mirror is used to obtain the image then the mirror must be concave and object and image subtend equal angles at the pole of the mirror.

D. I is a real image.

Answer: B::C::D

Watch Video Solution

120. The drawing shows a top view of a square room. One wall is missing and the other three are each mirrors. From point p in the centre of the open side, a laser is fired, with the intent of hitting a small target located at the centre of one wall. Identify vector in whose direction the laser can be fired and score a hit, assuming that the light does not strike any mirror more than once.



A. $\frac{\hat{i}}{3} + \hat{j}$

B. $\hat{i} + \hat{j}$

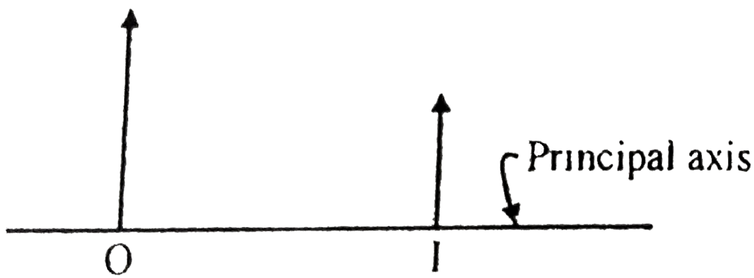
C. $-\hat{i} + \hat{j}$

D. $-\hat{i} + \frac{\hat{j}}{3}$

Answer: A::B::C::D

View Text Solution

121. The figure shows positions of object O and its diminished image I. This is possible If:



A. a convex mirror is placed to the right of I

B. a convex mirror is placed between O and I

C. a convex lens is placed to the right of I

D. a convex lens is placed between O and I

Answer: B::C

View Text Solution

122. In Young's double slit experiment, phase difference between the waves at a point on screen having intensity less than the average intensity on screen may be

A. $\pi/4$

B. $2\pi/3$

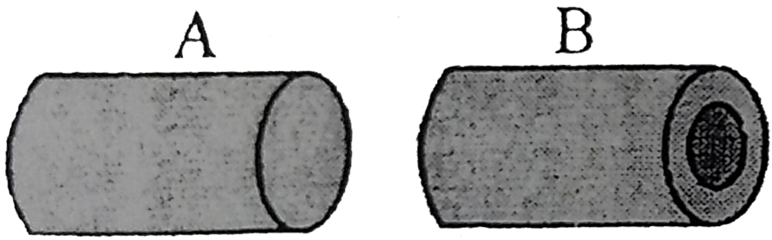
C. π

D. $7\pi/8$

Answer: B::C::D

Watch Video Solution

123. The drawing shows two cylinders. They are identicle in all respects, except one is hollow. In a setup like that in figure identical forces are applied to the right end of each cylinder while the left end is fixed.



A. The elongation of A is morethan that of B

B. The elongation of B is morethan that of A

C. The energy stored in B is more than is A

D. The energy stored in A is more than that in B

Answer: B::C

Watch Video Solution

124. A unifom cylinder of steel of mass M radius R is placed on frictionless bearings and sct to rotate about its axis with angular velocity ω_0 After the cylinder has reached the specified state of rotation, it is heated from temperature $T_0 \rightarrow \left(T_0 + \Delta T\right)$ without any mechanical contact. If (DeltaI)/I is the fractional change in moment of inertia of the cylinder and $\frac{\Delta\omega}{\omega_0}$ be the fractional change in the angular velocity of the cylinder and alpha be the coefficient of linear expansion, then

A. $\frac{\Delta I}{I} = \frac{2\Delta R}{R}$

B. $\frac{\Delta I}{I} = \frac{2\Delta\omega}{\omega_0}$

C. $\frac{\Delta\omega}{\omega_0} = -2\alpha\Delta T$

D. $\frac{\Delta I}{I} = -\frac{2\Delta R}{R}$

Answer: A::C

Watch Video Solution

125. which of the following experiment in Photoelectric effect will support particle nature of light?

A. Photocurrent is set up almost instaneously even with faint light of sufficiently small wavelength.

B. Existence of cut off potential which depends upon wavelength of radiation incident on emitter

C. Existence of thresold wavelength for incident radiation above which no photocurrent can be set up.

D. Existence of saturation current which increase with increase in intensity of radiation incident on emitter.

Answer: A::B::C

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126. which of the following are not dependent on the intensity of the incident radiation in a photoelectric experiment?

A. Amount of photoelectric current

B. Stopping potential to reduce the photoelectric current to zero

C. Work function of the surface

D. Maximum kinetic energy of photoelectrons

Answer: B::C::D

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127. Suppose frequency of emitted photon is f_0 when the electron of a stationary hydrogen atom jumps from a higher state m to a lower state n. If the atom is moving with a velocity $v(< < c)$ and emits a photon of frequency f during the same transition,then which of the following statement are possible?

A. f may be equal to f_0

B. f may be greater then f_0

C. f may be less then f_0

D. f cannot be equal to f_0

Answer: A::B::C

Watch Video Solution

128. Negative charge is revolving around is fixed positive charge in a circular orbit If the classical idea of an accelerating charge rediating energy is valid, then the negative charge will:

A. spiral towards the positive charge, with increasing kinetic energy

B. spiral towards the positive charge with potential energy decreasing at a faster rate then increase in its kinetic energy.

C. spiral away from the positive charge and finally escape from the binding of the positive charges

D. revolve around the positive charge with increasing frequency of revolution.

Answer: A::B::D

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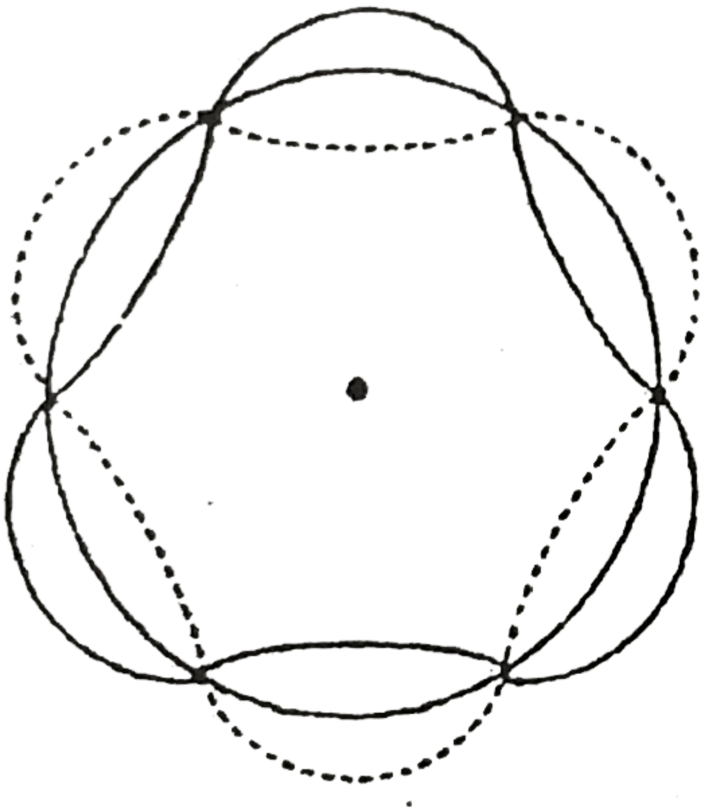
129. The figure shows electronic wave function for a hydrogen atom.



A. The quantum number of this state is 6

B. The wavelength of this electron is $6\pi r_0$ (r_(0) is radius of ground state)

C. It can go to ground state by emitting 3 different photons

D. On deexcitation it emits at least one line in infra red region of spectrum.

Answer: B::C

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130. If the accelerating voltage across an x-ray tube is doubled

A. The wavelength of characteristic lines are halved.

B. The minimum wavelength of x-rays is halved

C. The x-rays are probably becomes more penetrating

D. The target metal will get heat up earlier.

Answer: B::C::D

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131. $._{92}U^{235}$ is α (alpha) active. Then in a large quantity of the element:

A. the probability of a nucleus disintegrating during one second is lower in the first half life and greater in the fifth half life

B. the probability of a nucleus disintegrating during one second remains constant for all time

C. more then half of U^{235} will remain even after the average life

D. the energy of the emitted 'alpha' particle is less then disintegration energy of the U^{235} nucleus.

Answer: B::D

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Subjective

1. In a given system of unit standard measurement of mass is 100 gm standard measurement of length is 200 cm and standard measurement of time is 5 sec 10 J energy in the given system of unit has value N, then value of N is

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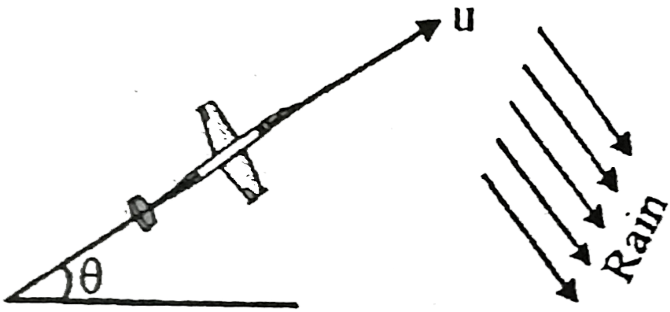
2. Rain is falling with speed $12\sqrt{2}$ m//s at an angle of 45° with vertical line A man in a glider going at a speed of v at angle of 37° with respect to ground find the speed (in m//s) of glider so that rain apears to him falling vertically Consider motion of glider and rain drops in same vertical plane.



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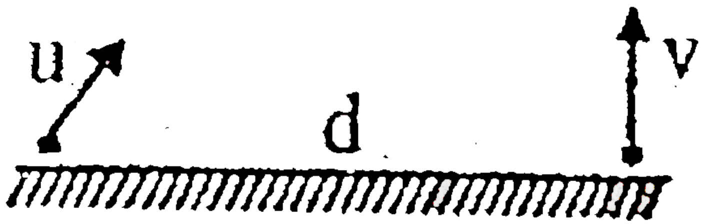
3. Two balls are fired form ground level,a distance d apart. The right one is fired vertically with speed v. You wish to simultancously fire the left one at appropriate velocity u so that collides with the right ball when they reach their highest point. Value of horizontal $\left(u_x\right)$ and vertical $\left(u_y\right)$components of u are respectively: -



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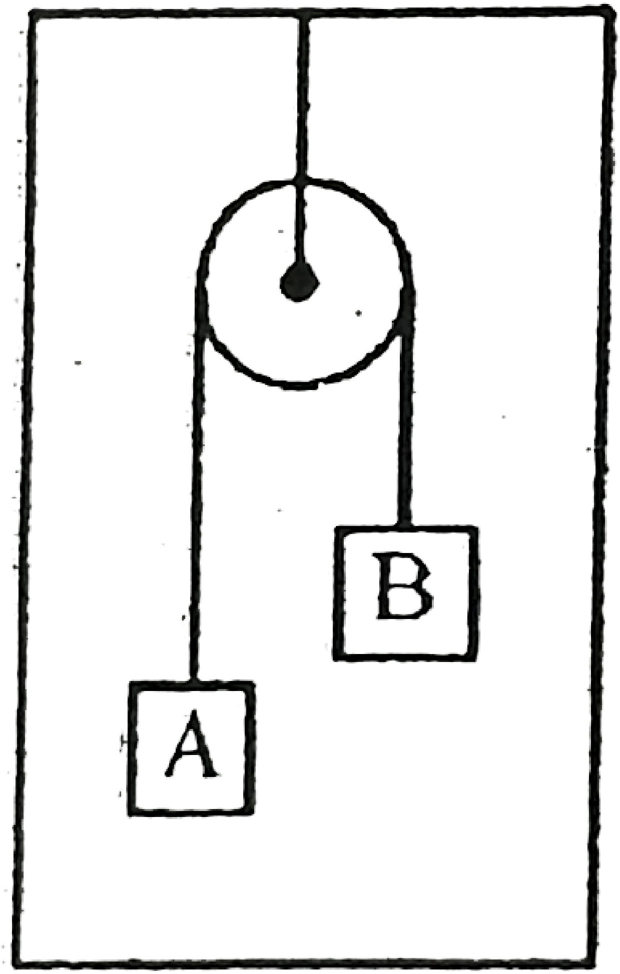
4. An atwood machine is setup in an elevator moving upward at $5m/s$ and slowing down at $2m/s^2$ The initial velocity of block B is $2m/s$ upward and the acceleration of block A is $3m/s^2$ downwards Find the time (in sec) at which block B will return to its initial position. Assume the string remains taut and the acceleration of the elevator does not change during the required time interval



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5. A car is travelling in steady rain with constant acceleration in a straight line When is begins to move the driver sees that the raindrops make track at an angle of 37° with the vertical on the side window. After 20 sec., the raindrops make track at an angle of 53° with vertical in same direction Find the acceleration of the car in cm/s^2 Rain is falling at $3m/s$.

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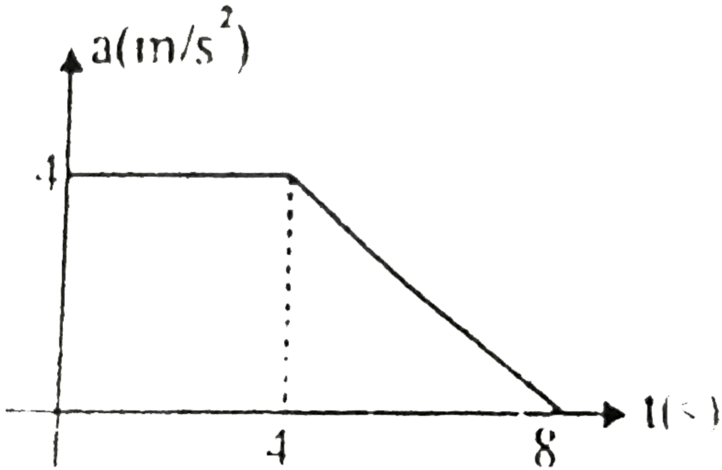
6. The acceleration - time graph of a particle is as shown in figure Initial velocity of particle is $10m/s$ Displacement of the particle (in

m) at the end of 8 sec is ___ Round off to nearest integer.



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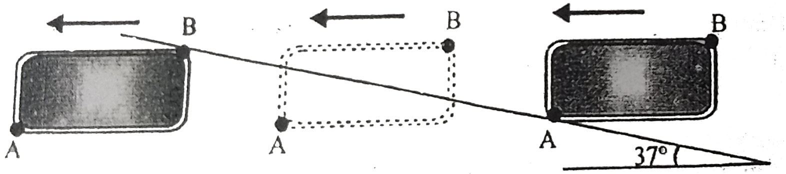
7. A train is travelling at vm//s along a level straight track Very near and parallel to the track is a wall On the wall a naughty boy has drawn a straight line that slopes upward at a 37° angle with the horizontal A passanger in the train is observing the line out of window (0.90 m high 1.8 wide as shown in figure) The line first appears at window corner A and finally disappears at window corner B if it takes 0.4 sec between appearance at A and disappearance of the line at B what is the value of v (in cm//s)?



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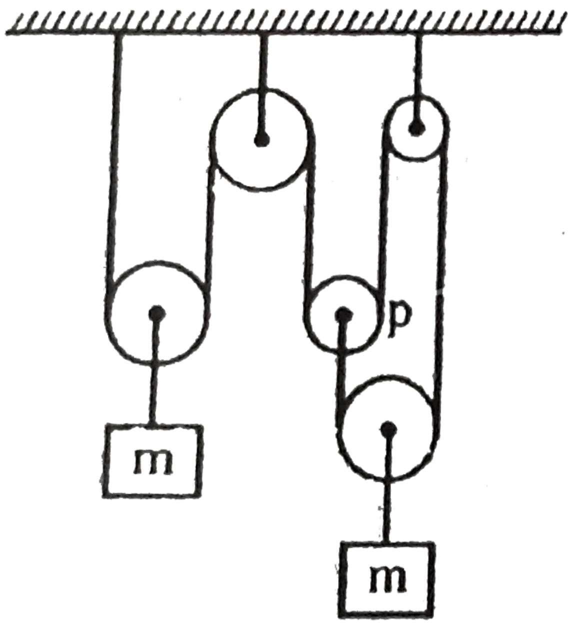
8. All pulleys are massless The string is light and inextensible

Find acceleration of centre of pulley $'p' \in m/s^2$



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9. A certain person nicknamed "Raju" encountered an automatic staircase (i.e. escalator) at a shopping complex, which was moving upward at a constant rate. Just for the fun of it he decided to walk up this escalator at the rate of one step a second Twenty steps brings him to the top Next day he goes up at two steps a second and reaches the top in 32 steps How many steps are there in the escalator?

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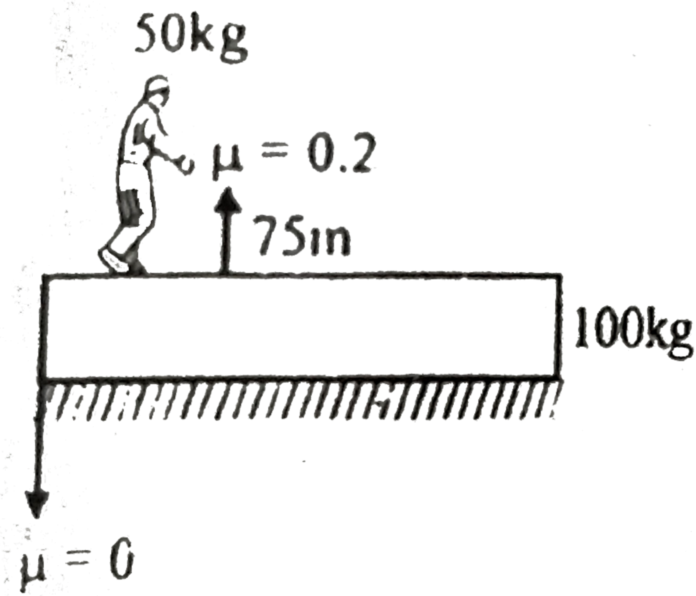
10. A man of mass 50 kg is standing on one end of a stationary wooden plank resting on a frictionless surface. The mass of the plank is 100 kg its length is 75 m and the coefficient of friction between the man the plank is 0.2 Find the least possible time (in

sec) in which the man reach the other end starting from rest and stopping at the other end.



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11. A vertical rod of mass 4 kg is hanging on a rope and a 3kg cat is grasping the bottom end of the rod The rope is cut off and the frightened cat begins to run up on the rod. While the rod is falling vertically the cat remains at the same height with respect to the ground. If the acceleration of the rod is n (g//4) m//s^(2) then what is value of n.

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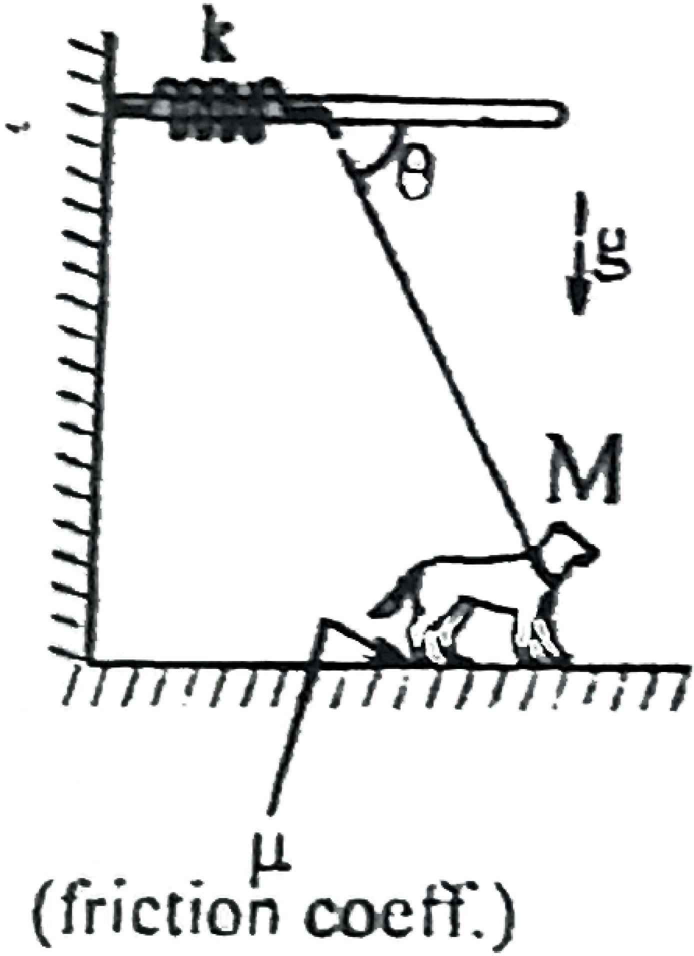
12. A dog with mass M has its string attached to one end of a spring which runs without friction along a horizontal overhead rod. The other end of the springs is fixed to a wall The spring constant is K. The string is massless and inextensible and it maintains a constant angle θ with the overhead rod, even when the dog moves. There is friction with coefficient mu between the dog and the gound What is the maximum distance (in cm) that the dog moving slowly can stretch the spring beyond its natural length? Use M=30 kg,$\theta = 400N/m$ and $\mu = \frac{1}{3}$



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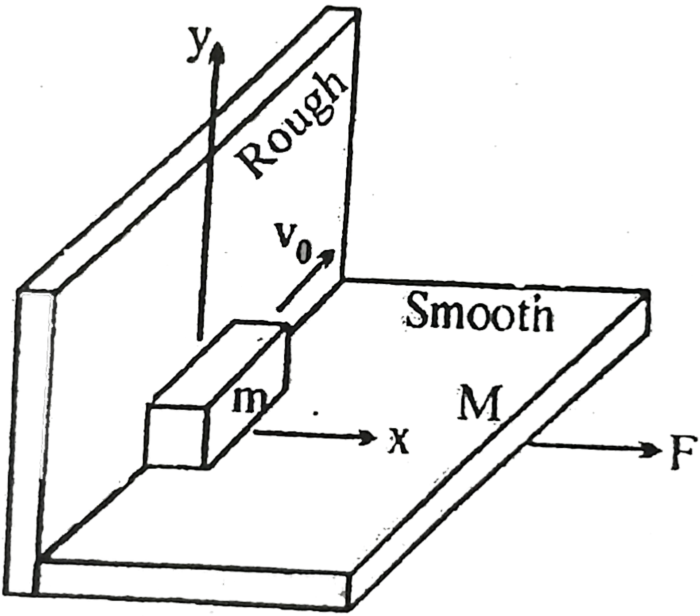
13. Figure shows a block placed on a bracket. Bracket is placed on a smooth floor, it is pulled by a force F=6N horizontally Block is projected with velocity v_(0) relative to bracket as shown in figure. Find time in second after which it stops relative to bracket. Horizontal surface of bracket is smooth while vertical surface is rough (Given $m = 1kgM = 5kgv_0 = 5m/s\mu = 0.5$)

(Round off nearest integer)



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14. Two identical cubes of mass 1.5 M each are kept almost touching the faces on a smooth horizontal surface On top of them we neatly placed a smooth ball of mass M, which begins to move vertically downwards, pushing the cubes sideways. Find the velocity of the ball ($\in m/s$) just before impact on the horizontal surface The initial velocity of the ball is negligible Radius of the ball is 5m side of cube 2.5 m

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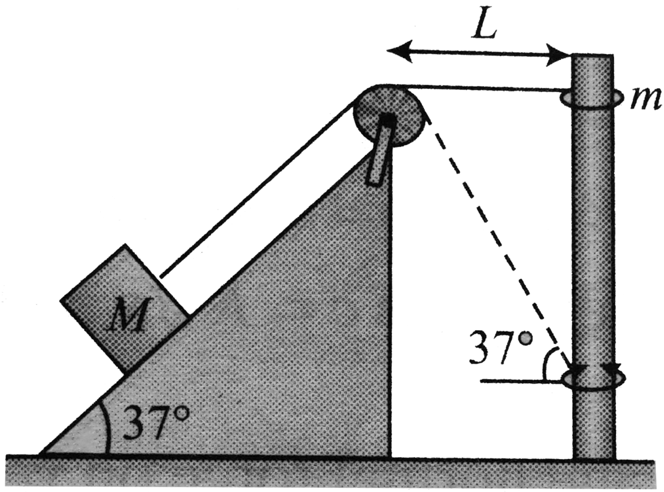
15. A ring of mass $m = 1kg$ can slide over a smooth vertical rod. A light string attached to the ring passing over a smooth fixed pulley at a distance of $L = 0.7m$ from the rod as shown in figure.



At the other end of the string mass $M = 5kg$ is attached, lying over a smooth fixed inclined plane of inclination angle 37°. The ring is held in level with the pulley and released. Determine the velocity of ring when the string makes an angle $\left(\alpha = 37^\circ\right)$ with the horizontal. $\left[\sin 37^\circ = 0.6\right]$

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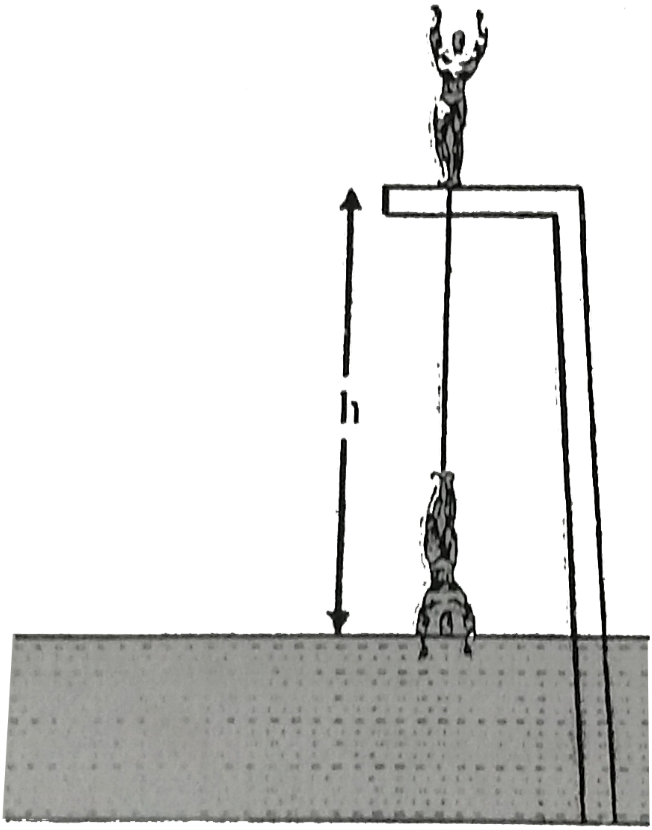
16. A man of height $h_0 = 2m$ is bungee jumping from a platform situated at a height h = 25 m above a lake One end of an elastic

rope is attached to his foot and the other end is fixed to the platform He starts falling from rest in vertical position. The length and elastic properties of the rope are chosen so that his speed will have been reduced to zero at instant when his head reaches the surface of water. Ultimetely the jumper is hanging from the rope with his head 8m above the water. Find the maxima acceleration acheived during the jump in m/s^2)



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17. At what angle θ_0 with the horizontal, should a shell be fired if at the top of its trajectory its path has a radius of curvature equal to twice the maximum height of the trajectory

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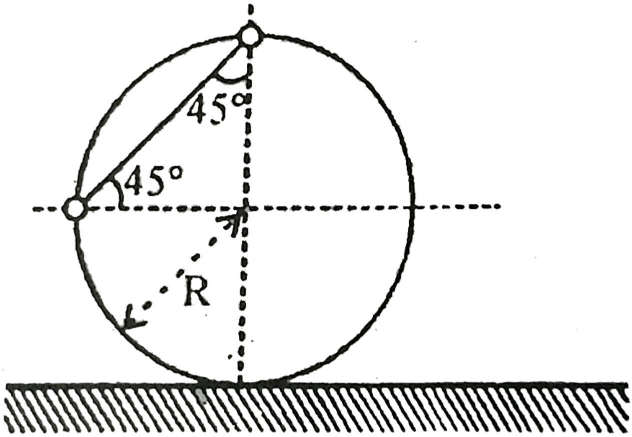
18. Two beads connected by a light inextensible string are placed over fixed vertical rings as shown in figure If mass of each bead is 100 gms and all surfaces are frictionless if the tension (T) in the string just after the beads are released from the shown position, then find $100T^2 \left(\in N^2 \right)$



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19. An object A of mass 2 kg is moving on a frictionless horizontal track has perfectly inelastic collision with another object B of mass 3 kg made of the same material and moving in front of A in same direction their common speed after the collision is $4m/s$ Due to the collision the temperature of the two objects which was initially the same, is increased though only by $0.006\,^\circ$ C What was the initial speed ($\in m/s$) of the colliding object A before the collision?

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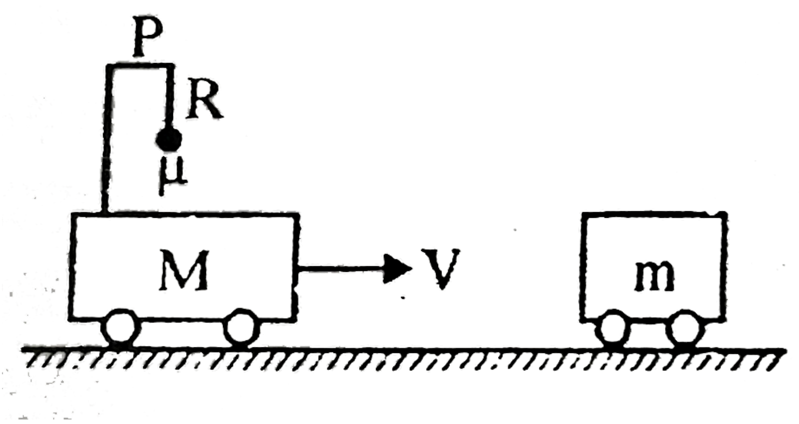
20. A cart of mass M has a pole on it from which a ball of mass mu hangs from a thin string attached at point P the cart and ball have initial velocity V the cart crashes onto another cart of mass m and sticks to it (figure) If the length of the string is R, the smallest initial velocity (in m//s) for which the ball can go in circles around point P is Neglect friction and assume M, $m > > \mu$

Given $m = 1kgM = 2kgR = 2m$



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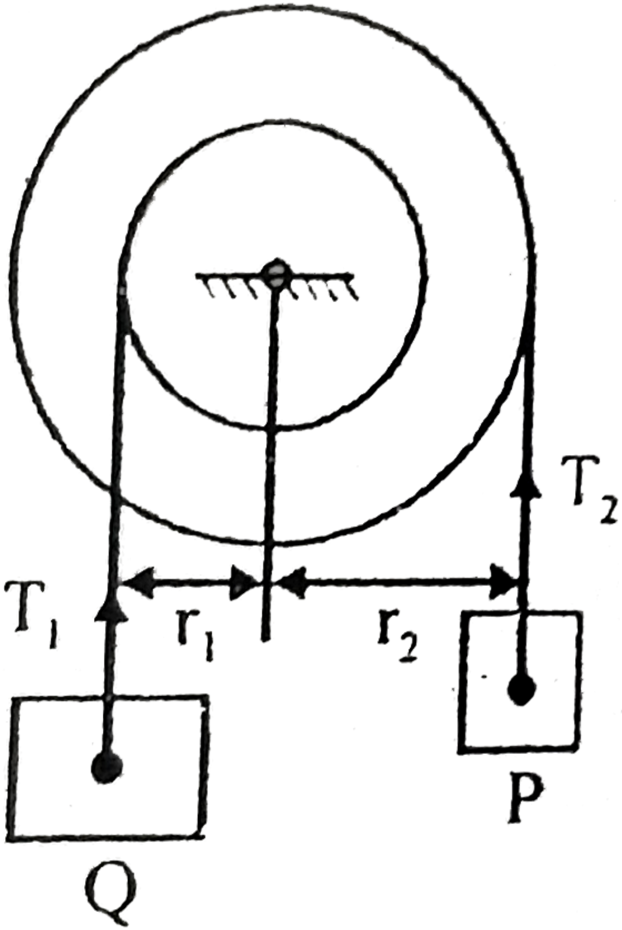
21. Neglecting friction at the axle and the inertia of the two step pulley shown in figure find the acceleration 'a' of the falling weight P in $\left(m/s^2\right)$ (assume P=2 kg Q=2 kg & $r_2 = 2r_1$)



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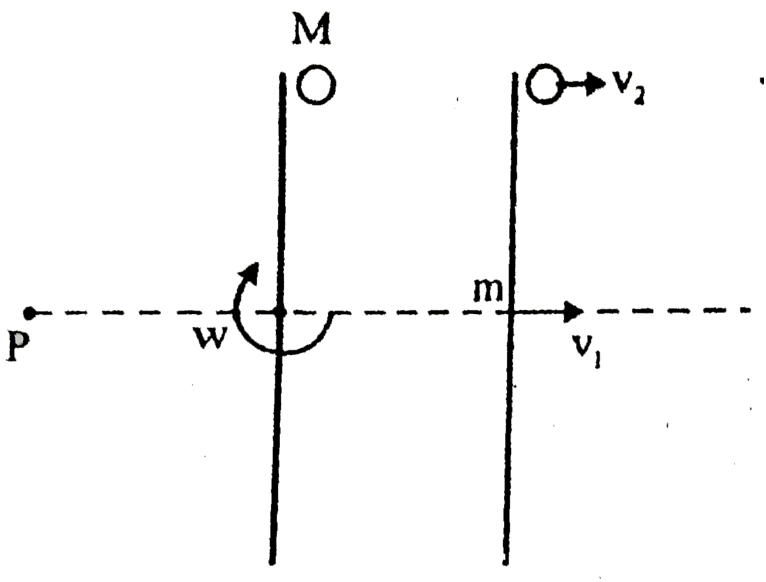
22. A uniform stick of mass m and length l with $I = \frac{1}{12}ml^2$ spins around on a frictionless horizontal plane, with its CM stationary A mass M is placed on the plane, and the stick collides elastically with it, as shown (with the contact point being the end of the stick) What should be the ratio of m//M be so that after the collision the stick has translational motion but no rotational motion?



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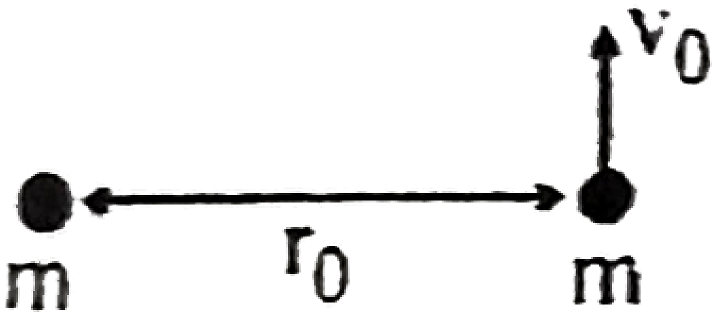
23. Two equal masses are situated at a separation r_0 One of them is imparted a velocity $v_0 = \sqrt{\frac{GM}{r_0}}$ perpendicular to the line joining them both are free to move Treating motion only under mutual gravitational force find the ratio of maximum and minimum separation between them. [Hint Solve in CM frame]



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24. A spherical planet has uniform density $\frac{\pi}{2} \times 10^4 kg/m^3$. Find out the minimum period for a satellite in a circular orbit around it in seconds (Use $G = \frac{20}{3} \times 10^{-11} \frac{N - m^2}{kg^2}$).

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25. Two particles of mass 'm' and 3 m are initially at rest an infinite distance apart. Both the particles start moving due to gravitational attraction. At any instant their relative velocity of approach is $\sqrt{\frac{\neq Gm}{d}}$ where 'd' is their separation at that instant. Find ne.

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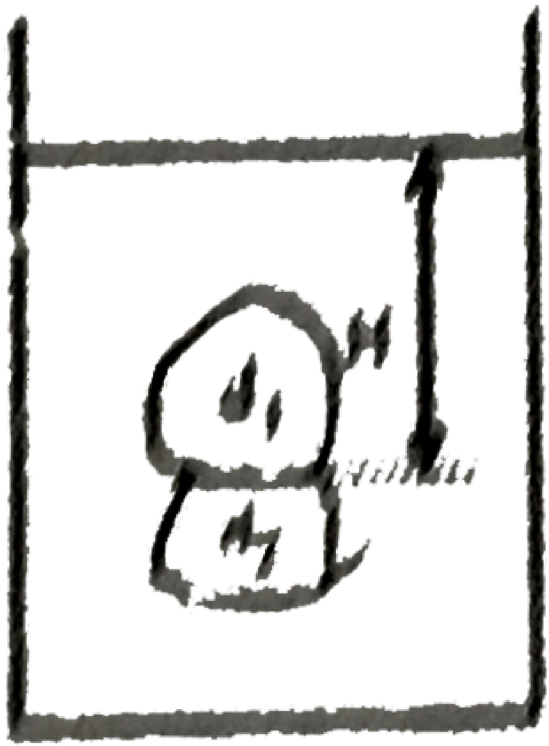
26. Two objects of equal volume $V = 1m^3$ and different densities $d_1 = 500kg/m^3$ and $d_2 = 1000kg/m^3$ are gluod to each other so that their contact surface is flat and has an area $A = 0.1m^2$ When the objects are submerged in a certain liquid they float in stable equilibrium the contact surface being parallel to the surface of the liquid (see the diagram) How deep (H in meters) can the contact surface be in the liquid so that the objects are not torn apart? The maximum force that the glue can with stand is `F=250

N (Neglect atmospheric pressure)



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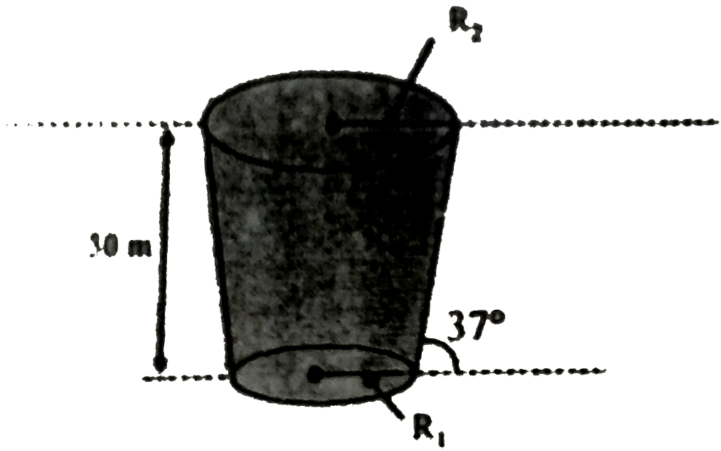
27. The figure shows a pond full of water having the shape of a truncated cone. The depth of the pond is 30 m. The atmospheric pressure above the pond is 1.0×10^5 Pa. The circular top surface

$\left(radius = R_2\right)$ and circular bottom surface $\left(radius = R_1\right)$ of the pond are both parallel to the ground The magnitude of the force acting on the top surface is the same as the magnitude of the force acting on the bottom surface. Obtain



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28. A block of wood weights 16 kg in air. A lead block which has apparent weight of 28 kg in water is attached to the block of wood, and both of them are submerged in water If their combined apparent weight in water is 19 kg find the density of wooden block in kg/m^3 Take density of water $= 1000kg/m^3$.

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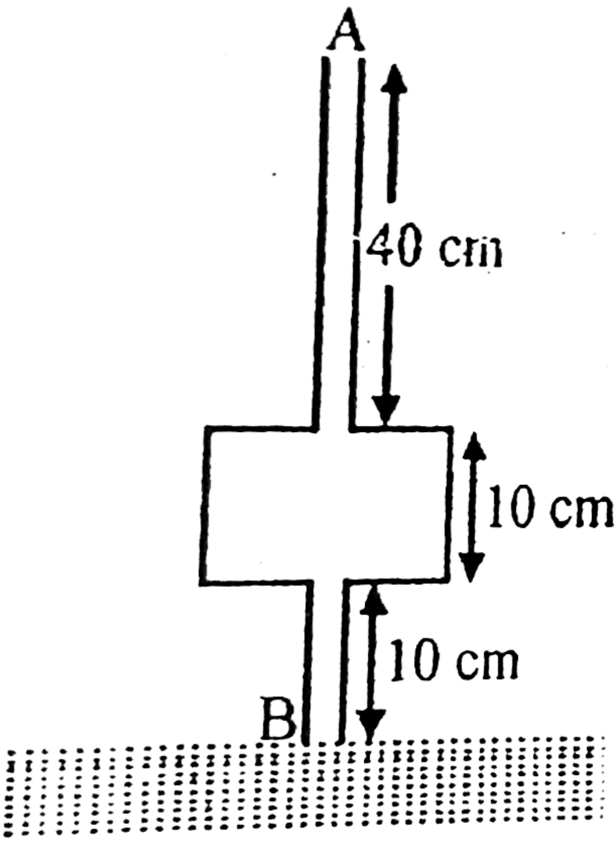
29. Water (density $1gm/c$) is to be sucked upto point A. The area of the barrow tube is $1cm^2$. In this situation, minimum work required to be done is w_1. When the tube is inverted and water is to be sucked upto point B, the minimum work required to be done is w_2. Find $(w_2 - w_1)$ in Joule Fill 100 $(w_2 - w_1)$ in OMR sheet.



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30. A block of wood is floating in water such that $1/2$ of it is submerged in water when the same block is floated in alcohol, $1/3^{rd}$ of it's volume is submerged Now a mixture of water and alcohol is made taking equal volume of both and block is floated in it. What is the % of it's volume that is now submerged?

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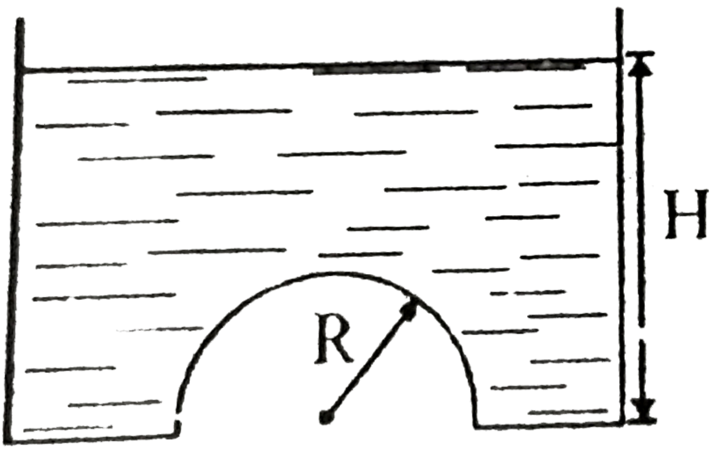
31. A hole in the horizontal bottom of the container is closed by a hemispherical cap of radius R (see figure) The vessel is filled with liquid of density d. Bottom is at a depth of H. Find the force with which the cap presses down on the bottom of the vessel. Neglect atmospheric pressure. If the force is api N, fill 'a' in the OMR sheet (Take $d = 10^3 kg/m^3, H = 1m, R = 30cm$)



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32. Two solid balls have different radii but are made of same material. The balls are linked together with a long thin thread and released from a large height. At the terminal velocity, the thread is under tension. The larger ball has a fixed mass, but we have choice of the smaller ball with different masses. At what ratio of larger and smaller mass will this tension be maximum?

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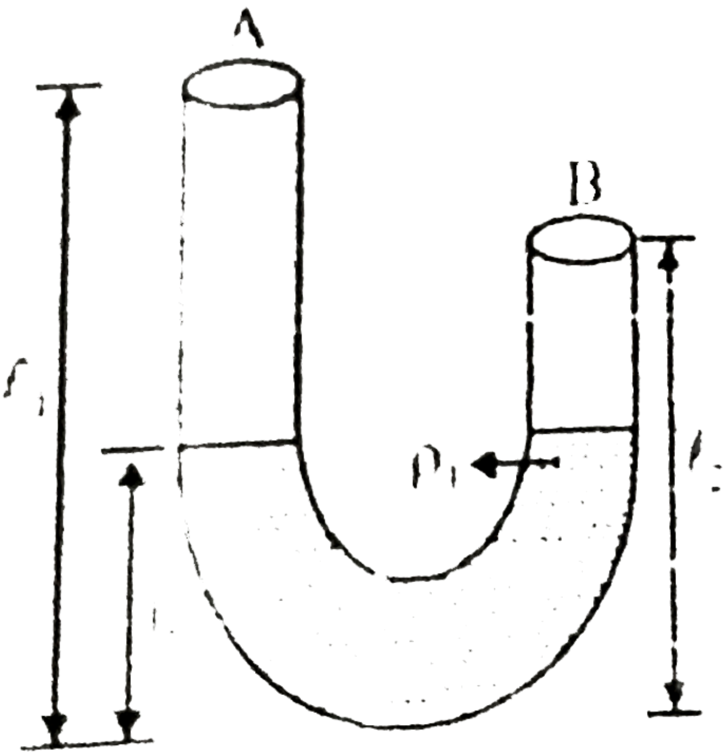
33. A U-tube having uniform cross-section but unequal arm length $I_1 = 100$ cm and $I_2 = 50$ cm has same liquid of density ρ_1 filled in it upto a height h=30 cm as shown in figure. Another liquid of density $\rho_2 = \rho_1/2$ is poured in arm. A Both liquids are immiscible What length of the second liquid (in cm) should be

poured in A so that second overtone of A is in unison with fundamental tone of B. (Neglect end correction)



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34. A point source of sound is located somewhere along the x-axis. Experiments show that the same wave front simultaneously

reaches listeners at x=-8 m and $x = + 2.0m$ A third listener is positioned along the positive y-axis What is her y-coordinate (in m) if the same wave front reaches her at the same instant as it does the first two listeners?

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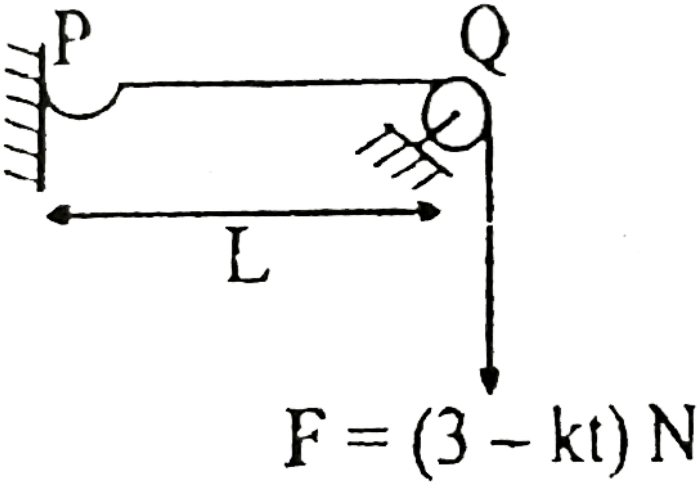
35. In the given figure a string of linear mass density 3×10^{-2} kg//m and length $L = 1$ m, is stretched by a froce $F = (3 - kt)N$, where k is a constant and t is time in sec. At the time $t = 0$, a pulse is generated at the end P of the string Find the value of k (in N//s) if the value of force becomes zero as the pulse reaches point Q.



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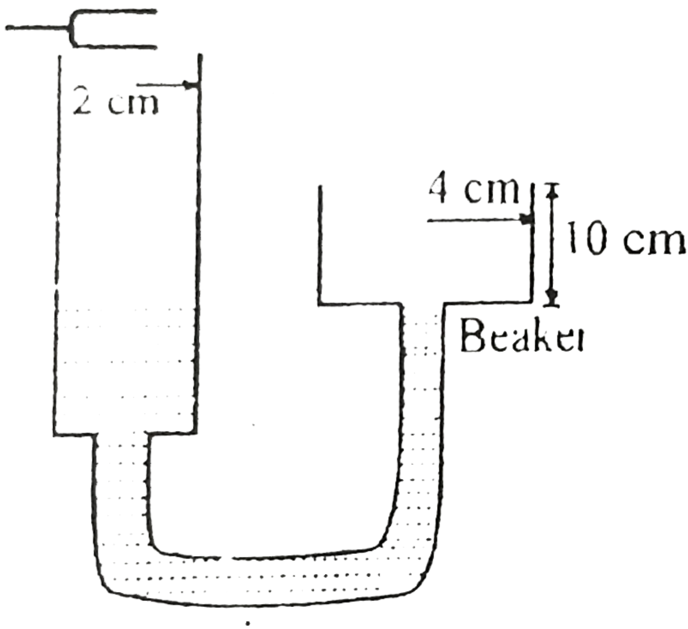
36. In a resonance column apparatus, first resonance is obtained when the water filling beaker (of cylindrical shape) is just empty as shown The water filling beaker is lowered down and it is seen that second resonance is obtained when beaker is filled upto brim. If the tunning fork has a frequency 420 Hz What is the velocity (in m//s) of sound in air ?



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37. Shin Chan and his mother have a tin whistle each. The pipe length of Shin chan's tin whistle is 52 cm long while the pipe length of mother's tin whistle is 50 cm long. They both play at the same time, sounding the whistles at their fundamental resonant frequencies. They note that they are not in tune with each other. The velocity of sound in air is $325 m/s$. Assume the whistle is a pipe with one end open find the beat frequency (in Hz) that is heard when both whistles are playing simultaneously. (Round off to nearest integer)

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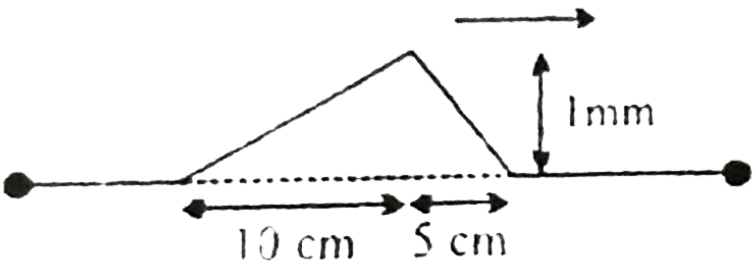
38. If the kinetic energy of pulse travelling in a taut string is $K \times 10^{-2}$ mJ then find the value of K (Given $T = 10 N \& \mu = 0.1 kg/m$



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39. Two cylinders of equal masses, one made of material A and the other of material B, are heated to 50° C and placed on two large blocks of ice at 0° C If both the cylinders have the same height, find the ratio $\left(h_A / h_B\right)$ of their maximum depth of penetration in the ice. Assume that no heat is lost to the surroundings and change in gravitational potential energy is not considered $S_A = 0.2calg^{-1}\left(C^{\circ}\right), \rho_A = 4gcm^{-3}$

$S_B = 0.1calg^{-1}\left(C^{\circ}\right), \rho_B = 2gcm^{-3}$

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40. In two calorimeters we poured 200 g of water each- at temperatures of $+30^{\circ}$ C and $+40^{\circ}$ C. From the "hot" calorimeter 50 g of water, is poured into "cold" calorimeter and stirred. Then, from "cold" calorimeter 50 g of water is poured in "hot" and again stirred. How many times do you have to pour the same portion of water back and forth so that the temperature difference between water in the calorimeters becomes less than 3° C? Heat loss during the transfer and heat capacity of calorimeters is neglected.

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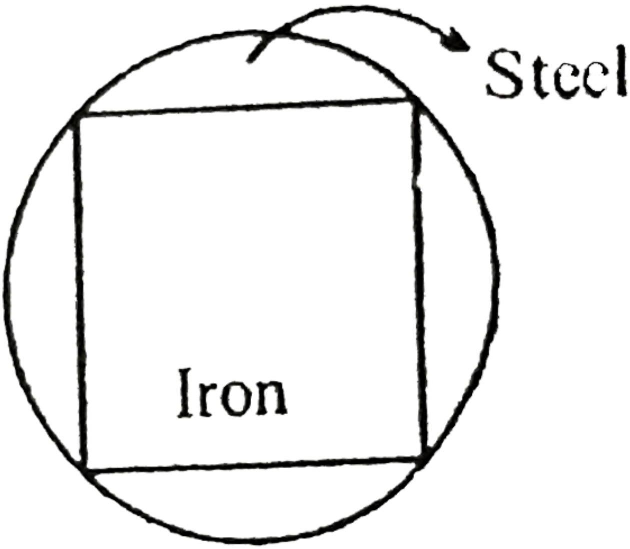
41. A composite rod is made from stainless steel and iron and has a length of 0.5 m The cross-section of this composite rod consists of a square within a circle. The square is 1 cm on a side $k_{steel} = 14 W/m^\circ$ C, $k_{iron} = 80 W/m^\circ$ C One end of the rod is at 78° C and other end is in melting ice. Find the amount of ice melted in 7 minutes (in gm). (Take $\pi = 22/7$)



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42. A small sphere (emissivity $= 0.9$, $radius = r_1$) is located at the centre of a spherical asbestos shell (thickness $= 5.0$ cm , outer radius $= r_2$) The thickness of the shell is small compared to the inner and outer radii of the shell. The temperature of the small sphere is 800 K while the temperature of the inner surface of the shell is 600 K The temperature of small sphere is maintained constant. Assuming that $\frac{r_2}{r_1} = 10.0$ and ignoring any air inside the shell, find the temperature (in k) of the outer surface of the shell Take : $K_{asbes \to r} = 0.085 W/m^{\circ}$ C $\sigma = \frac{17}{3} \times 10^{-8} W/m^2 k^4$

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43. A room is heated by a radiator that has a constant temperature T (unknown). When the outside temperature is 260 K, the room temperature is 300 K. However, when the outside temperature drops to 240 K, the room temperature is only 290 K. Estimate the radiator temperature T.

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44. One mole of an ideal monoatomic gas is taken from state A to state B through the process $P = \frac{3}{2} T^{1/2}$ It is found that its temperature increases by 100 K in this process. Now it is taken from state B to C through a process for which internal energy is related to volume as $U = \frac{1}{2}V^{1/2}$ Find the total work performed by the gas (in Joule) if it is given that volume at B is $100m^3$ and at C it is $1600m^3$ [Use $R = 8.3J/mol\text{-}K$]

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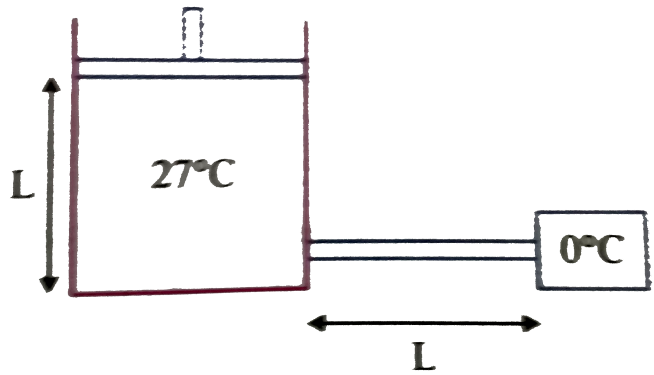
45. 0.5 mole of an ideal gas at constant temperature $27^\circ C$ kept inside a cylinder of length L and cross-section area A closed by a massless piston The cylinder is attached with a conducting rod of length L cross-section area $(1/9)m^2$ and thermal conductivity k whose other end is maintained at $0^\circ C$ If piston is moved such that rate of heat flow through the conducing rod is constant then find velocity of piston when it is at height $L/2$ from the bottom of cylinder [Neglect any kind of heat loss from system



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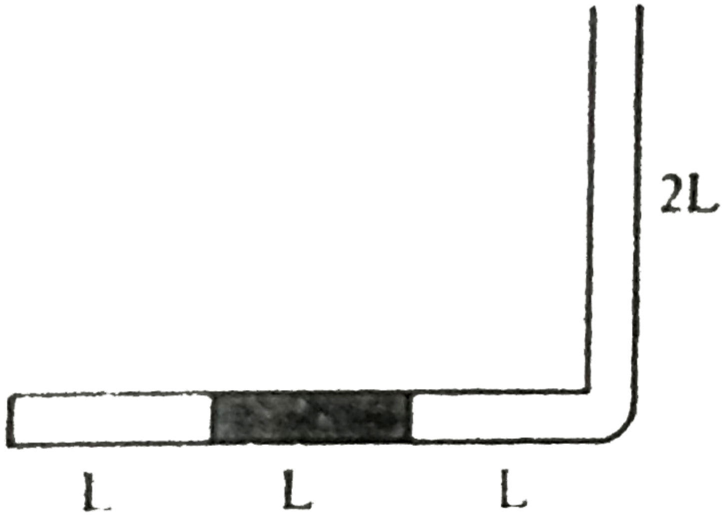
46. The narrow tube with one of its ends sealed as shown in the figure, is in a vertical plane. In the 3L long horizontal part of the tube a mercury column of length L blocks some oxygen gas of length L. The outside air - pressure of p_0 equals with the pressure of a mercury column of height L. Increasing the temperature of the surrounding, the volume of the blocked gas doubles while the gas absorbs $Q = 7J$ of heat from its surroundings. How much work (in Joule) is done by the expanding gas?



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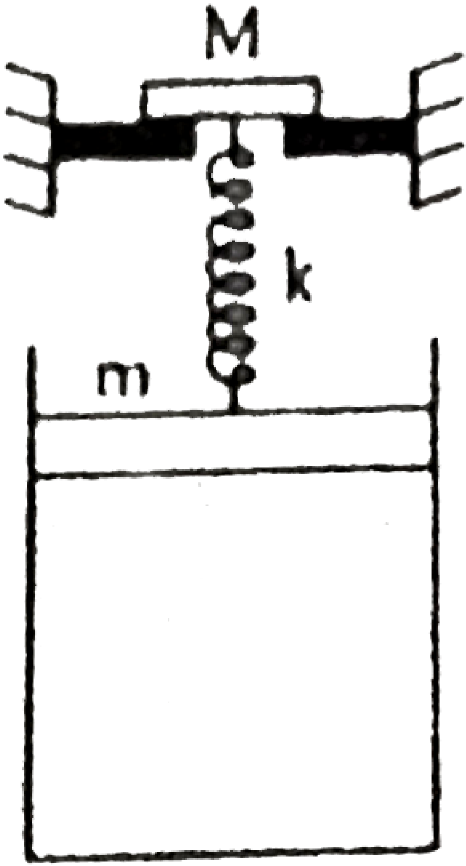
47. 0.01 moles of an ideal diatomic gas is enclosed in an adiabatic cylinder of cross-sectional area $A = 10^{-4}m^2$ In the arrangement shown, a block of mass $M = 0.8$ kg is placed on a horizontal support, and piston of mass $m = 1$ kg is suspended from a spring of stiffness constant $k = 16N/m$ Initially, the springs is relaxed and the volume of the gas is $V = 1.4 \times 10^{-4}m^3$ When the gas in the cylinder is heated up the piston starts moving up and the spring gets compressed so that the block M is just lifted up.

Determine the heat supplied (in Joule) Take atmospheric pressure

$P_0 = 10^5 Nm^{-2}, g = 10 m/s^2$



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48. A sample of ideal gas is taken through the cyclic process shown in the figure. The temerauture of the gas in state A is T_A =200 K. In states B and C the temperature of the gas is the same.

What is the greastes temperature of the gas during the cyclic process ?

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49. A diatomic ideal gas is taken through the cyclic process shown in the figure in state 1 the pressure of the gas is 100 kPa and its temperature is 350 K in state 2 the pressure is 300 kPa What is the efficiency of the cycle in percent rounded to nearest integer$[Take ln 3 = 12/11]$

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50. In a linear particle accelerator two large plane uniformly charged are placed parallel to each other as shown in the figure.

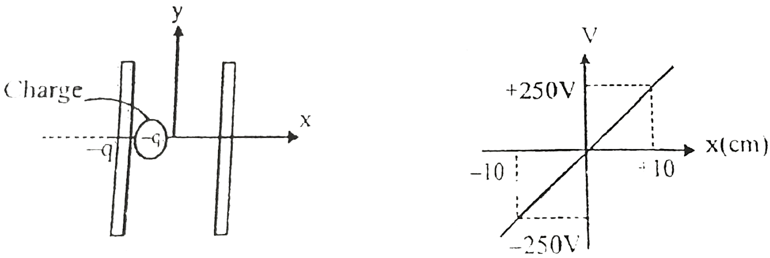

figure also shows variation of potential between planes A charged particle carrying a charge $q = 1.6 \times 10^{-19}$ C and having mass m $= 16 \times 10^{-31}$ kg is released from rest at $x = -10$ cm determine time taken (in ns) by particle to strike the other plane Neglect relativistic considerations.

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51. A thin spherical soap bubble has surface tension S . It's surface is charged with charge Q, its's volume is V it is found that when $Q^2 = n\pi\varepsilon_0 SV$ the excees pressure inside the bubble becomes zero find n.

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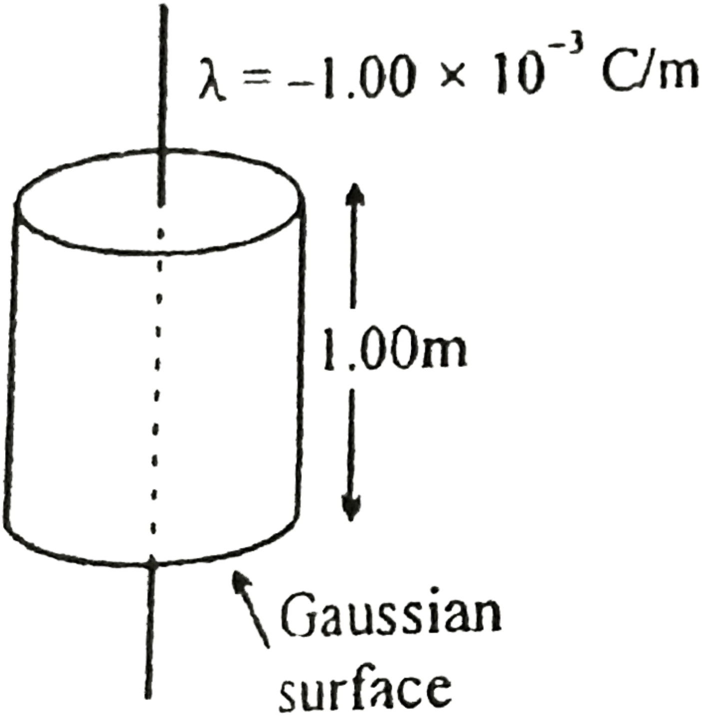
52. The visible portion of a lightning strike is preceded by an invisible stage in which a column of electrons extends downward from a cloud to the ground Assume the linear charge density along the column is $1.00 \times 10^{-3} C/m$ Treat the column of charge as if it were straight and infinitely long. At what distance (in m) from the column of electrons does the electric field have a magnitude of $3.00 \times 10^6 V/m$ the dielectric strength for air? This is an estimate of the radius of a visible lightning bolt. (Round off to nearest integer) (value of $\in_0 is 8.85 \times 10^{-12} C^2/Nm^2$)



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53. An electric field is given by $\vec{E} = 4\hat{i} + 3(y^2 + 2)\hat{j}$ pierces gaussian cube of side 1 m placed at origin such that one of its corners is at origin & rest of sides are along positive side of coordinate axis. If the magnitude of net charge enclosed is n ε_0 then n (in SI units) will be equal to

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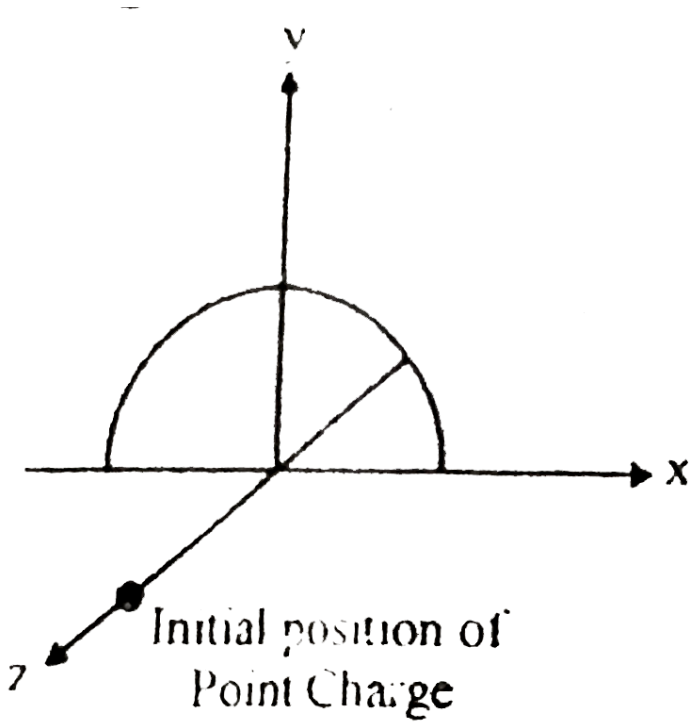
54. The diagram shows a semicircular ring carrying uniformly distributed charge $+2\mu C$ on it. The radius of the ring is 4 cm A point charge $+2\mu C$ is taken slowly from the point (0,0,8cm) to (0,8cm,0). The manitude of work done is equal to 4J After fixing the charge at its new position, the ring is rotated in anticlockwise sense about the x-axis as seen from (16cm,0,0) by an angle $\pi/2$ What is the magnitude of work done by electric field during the rotation of the ring?



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55. A particle is unchanged and is thrown vertically upward from ground level with a speed of $5\sqrt{5}$ m//s in a region of space having uniform electric field As a result, it attains a maximum height h. The particle is then given a positive charge +q and reaches the same maximum height h when thrown vertically upward with a speed of $13m/s$ Finally the particle is given a negative charge -q Ignoring air resistance determine the speed (in m//s) with which the negatively charged particle must be thrown vertically upward, so that it attains exactly the same maximum height h.

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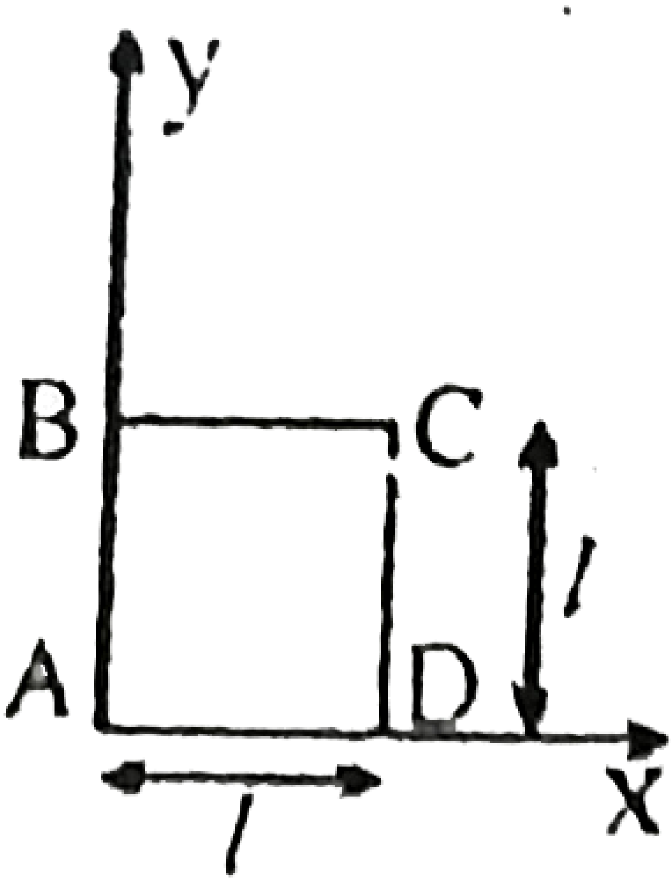
56. A square loop of side 'l' each side having uniform linear charge density 'lambda' is placed in 'xy' lane as shown in the figure There exists a non uniform electric field $\vec{E} = \frac{a}{l}(x + l)\hat{i}$ where a and l are constants and x is the position of the point from origin along x-axis. Find the resultant electric force on the loop (in Newtons) if $l = 10cm\lambda = 20\mu C/m$ and $a = 5 \times 10^5 N/C$.



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57. A positive charge $+q_1$ is located to the left of a negative charge -q_2 On a line passing through the two charges, there are two places where the total potential is zero. The reference is assumed to be at infinity The first place is between the charges and is 4.00 cm to the left of the negative charge. The second place is 7.00cm to the right of the negative charge if $q_2 = -12\mu C$, what is the value of charge $q_1 \in \mu C$

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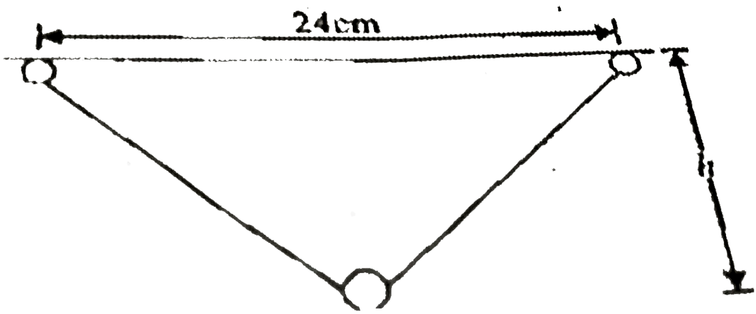
58. The two ends of a rubber string of negligible mass and having unstretched length $24cm$ are fixed at the some height as shown. A small object is attached to the string in its midpoint due to which the depression h of the object in equilibrium is $5cm$. Then the small object is charged and a vertical electric field E_1 is switched on in the region. The equilibrium depression of the object increases to $9cm$, now the electric field is changed to E_2 and the depression of object in equilibrium increases to $16cm$. What is the ratio of electric field in the second case to that of in the first case ?



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59. 2 conducting objects one with charge of +Q and another with -Q are kept on x-axis at $x = -3$ and $x - +4$ respectively. The electric field on the x - axis is given by $3Q\left(x^2 + \frac{4}{3}\right)$ What is the capacitance C of this configuration of objects. Fill $\frac{1}{C}$ (in F^{-1}) in OMR sheet.

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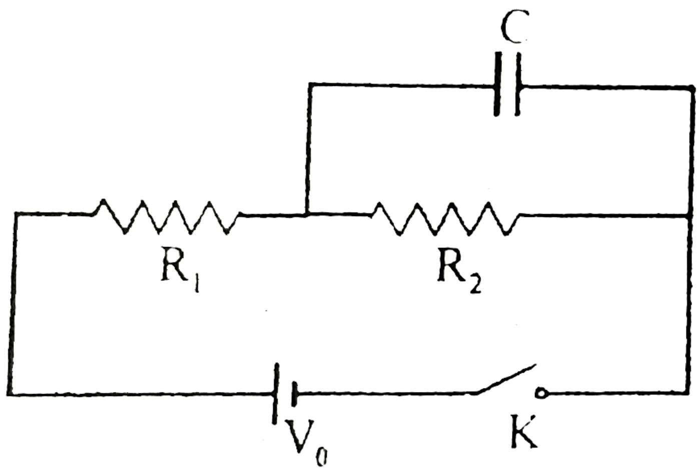
60. In the connection shown in the figure the switch K is open and the capacitor is uncharged. Then we close the switch and let the capacitor charge up to the maximum and open the switch



again. Then

(a) the current through R_1 be I_1 immediately after closing the switch,

(b) the current through R_2 be I_3 immediately after reopening the switch, Find $\frac{I_1}{I_2 I_3}$ (in $ampere^{-1}$) (Use the following data: $V_0 = 30V R_1 = 10 K\Omega R_2 = 5 k\Omega$)

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61. An electrometer is charged to 3 kV. Then the electrometer is touched with a neutral metal ball, mounted on an isulating rod and then the metal ball is taken away and earthed The process is done for 10 times and finally the electrometer reads 1.5 kV. After this, at least how many times must the above process be repeated in order that the electrometer reads less than 1 kV?

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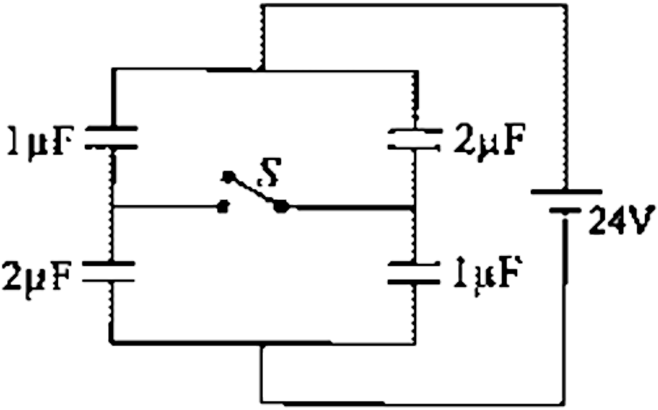
62. Four uncharged capacitors are charged by $24V$ battery as shown in the figure. How much charge flows through switch S

when it is closed?



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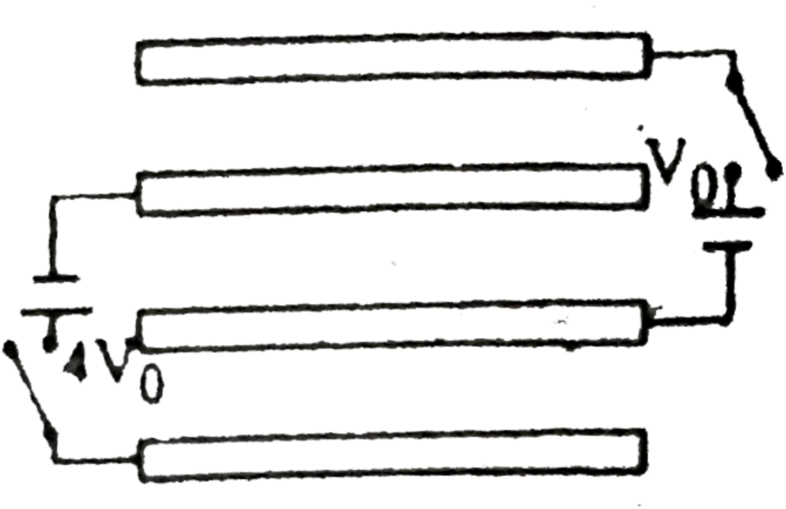
63. The figure shows four identical conducting plates each of area A the seperation between the consecutive plates is equal to L. When both the switches are closed, if charge present on the upper surface of the lowest plate from the top is written as $\frac{xV_0 vareosilon_0 A}{L}$ then what is the value of x? Treat symbols as having usual meaning



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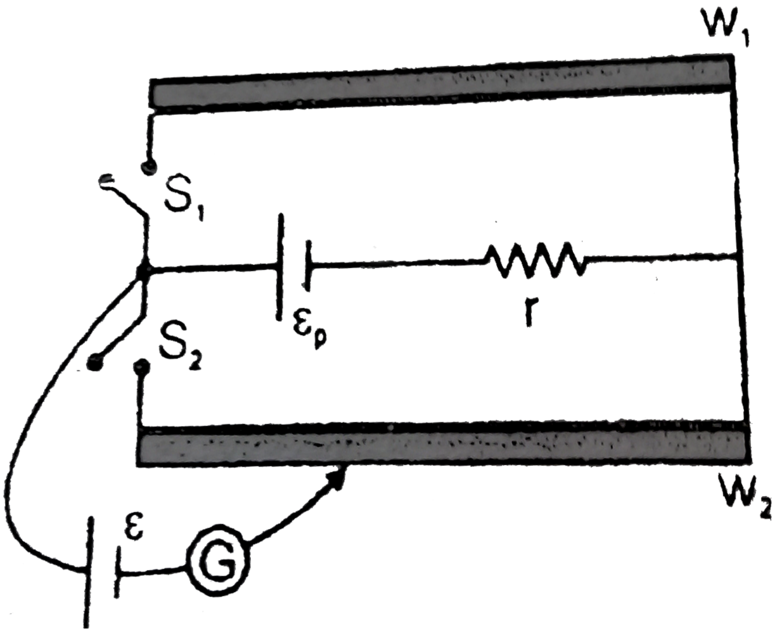
64. Two potentiometer wires w_1 and w_2 of equal length l connected to a battery of emf ε_P and internal resistance 'r' as shown through two switches s_1 and s_2. A battery of emf ε is balanced on these potentiometer wires. if potentiometer wire w_1 is of resistance 2r and balancing length on w_1 is $l/2$ when only s_1 is closed and s_2 is open. On closing s_2 and opening s_1 the balancing length on w_2 is found to be $\left(\frac{2l}{3}\right)$ then find the resistance of potentiometer wire w_2



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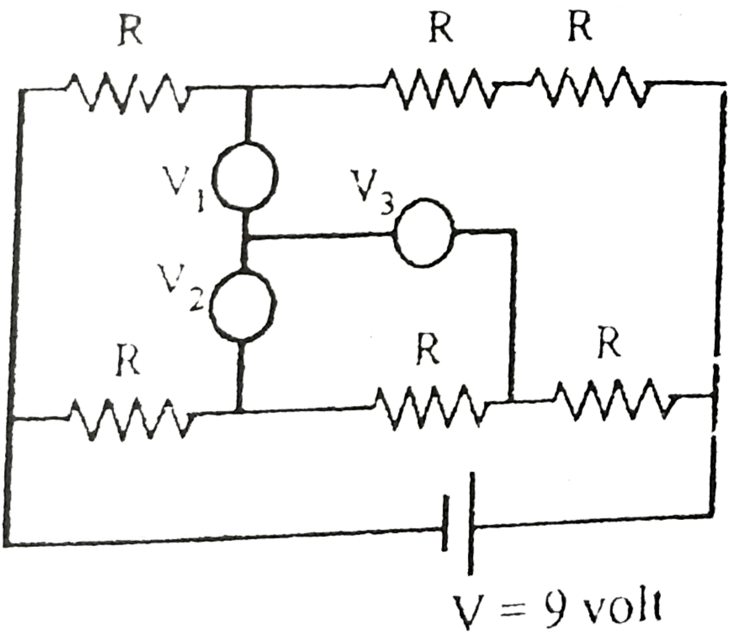
65. In the circuit shown below, all the three voltmeters are identical and have very high resistance. Each resistor has the same resistance The voltage of the ideal battery shown is 9 V

Find the reading of voltmeter V_3 (in volts)



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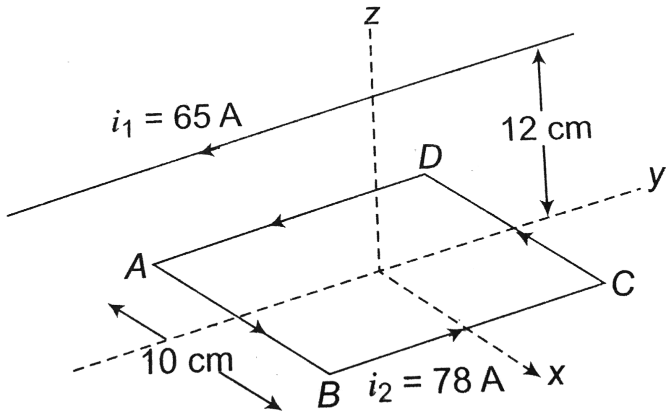
66. Figure shows a square loop $10cm$ on each side in the x - y plane with its centre at the origin. An infinite wire is at $z = 12cm$ above y-axis.



What is torque on loop due to magnetic force?

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67. A long straight wire lies on y-axis and carries a current of 8 A in - y direction. In addition to the magnetic field produced by the wire, a uniform magnetic field of $1.4 \times 10^{-6} T\hat{i}$ is also present. What is the magnitude of net magnetic field at (1,1,1) Express your answer in $a \times 10^{-7} T$ and fill a in OMR sheet.

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68. At a certain place, the angle of dip is $\tan^{-1}(4/5)$ and angle of declination is 37° The earth's magnetic field has a horizontal component of 0.1 T at that point. A square coil of side 2m is kept in a vertical plane such that its normal points in the true north direction. If the coil is made of 4 rods each of mass 3 kg and the coil is free to rotate about any axis. If the angular acceleration $\left(\in rad/s^2\right)$ of the coil is $k \times 10^{-2}$ when a current of 1A passes through it. Find the value of k.

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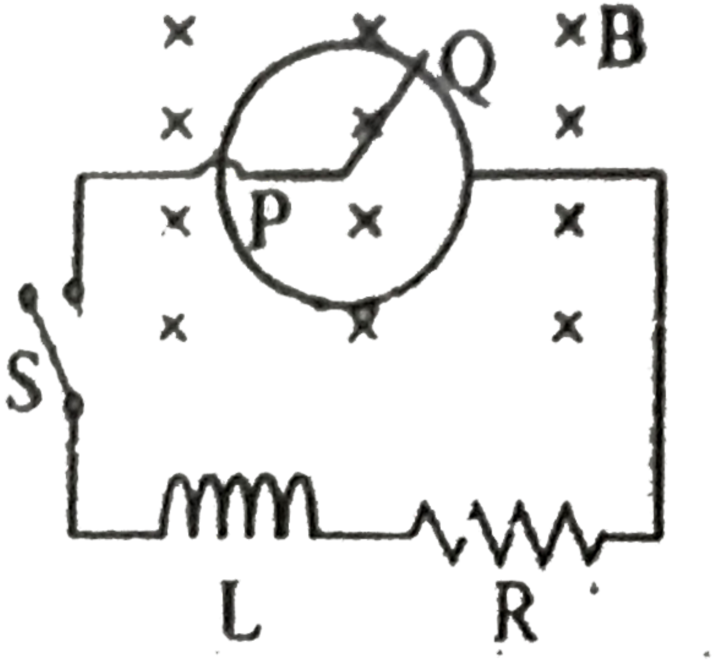
69. The diagram shows a circuit having a coil of resistance $R = 10\Omega$ and inductance L connected to a conducting rod PQ which can slide on a perfectly conducting circular ring of radius 10 cm with its centre at 'P' Assume that friction & gravity are absent and a constant uniform magnetic field of 5 T exists as shown in figure. At $t = 0$ the circuit is switched on and simultaneously a time varying external torque is applied on the rod so that it rotates about P with a constant angular velocity 40 rad//s Find magnitude of this torque (in mu Nm) when current reaches half of its maximum value. Neglect the self inductance of the loop formed by the circuit.



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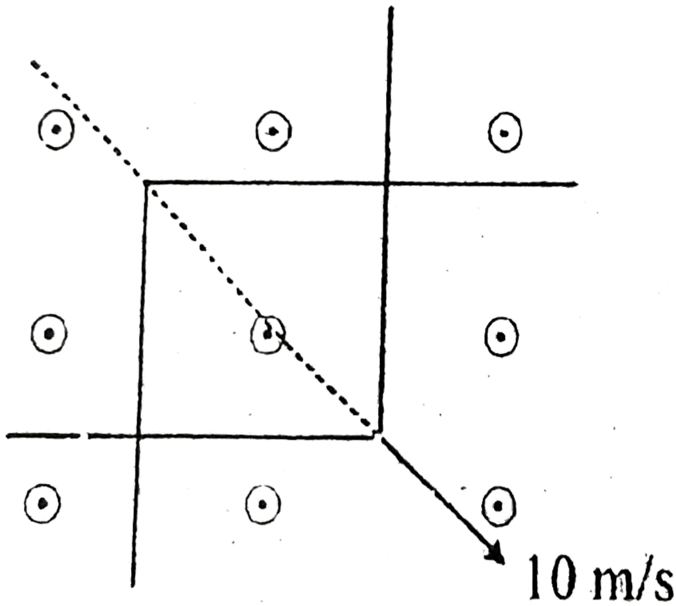
70. The L-shaped conductor as shown in figure moves a $10 m/s$ across a stationary L-shaped conductor in a 0.10 T magnetic field. The two vertices overlap so that the enclosed area is zero at t - 0 The conductor has resistance of 0.010 ohms per meter. What is current (in Amp) at $t = 0$ 10 sec (Round off to nearest integer)



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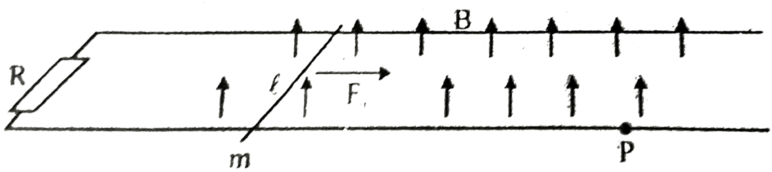
71. The long, horizontal pair of rails shown in the figure is connected using resistance R. The distance between the rails is l, the electrical resistance of the rails is negligible. A conducting wire of mass m and length l can slide without friction on the pair of rails, in a vertical, homogeneous magnetic field of induction B.



A force of magnitude F_0 is exerted for sufficiently long time onto the conducting wire, so that the speed of the wire becomes nearly constant. The force F_0 is now removed at a certain point P What distance (inm) does the conducting wire cover on rails from point P before stopping? (Given $F_0 = 20N, m = 1.6gm, R = 0.01\Omega l = 19cm, B = 0.1T)$

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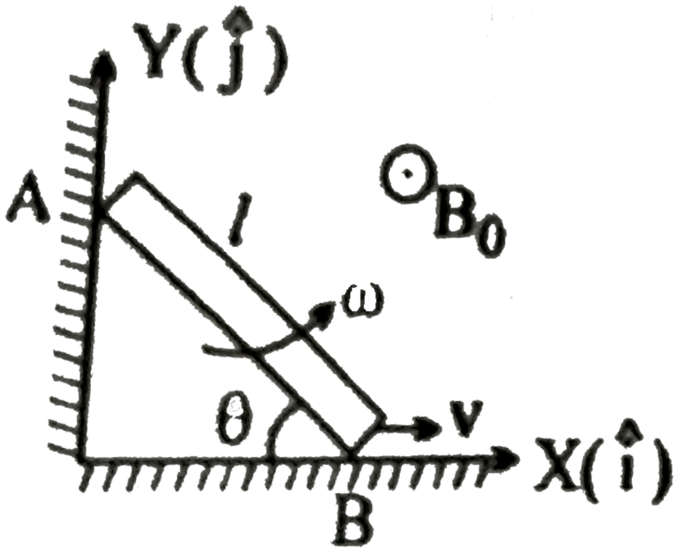
72. A thin conducting rod of length $l = 5m$ is moved such that its end B moves along the X-axis while end A moves along the Y-axis

A uniform magnetic field $B = 6\hat{k}$ T exists



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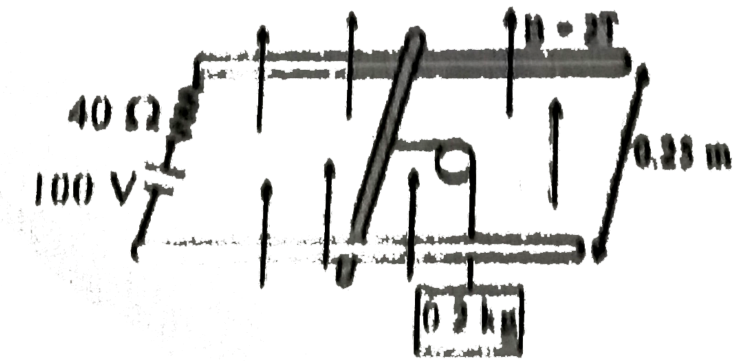
73. A conducting frame is placed in a horizontal plane as shown in the figure. The two sides are parallel and separated by a distance of 0.25 m. A massless conducting rod can slide without friction on the frame. The total resistance of the circuit is 40

Omega. The rod is connected to a 0.2 kg mass by a massless cord which passes over a massless and frictionless pulley. A uniform magnetic field of 2T points vertically upward. The voltage of the bettery is 100 V. Find the constant velocity in m//s with which the rod and mass eventually move.



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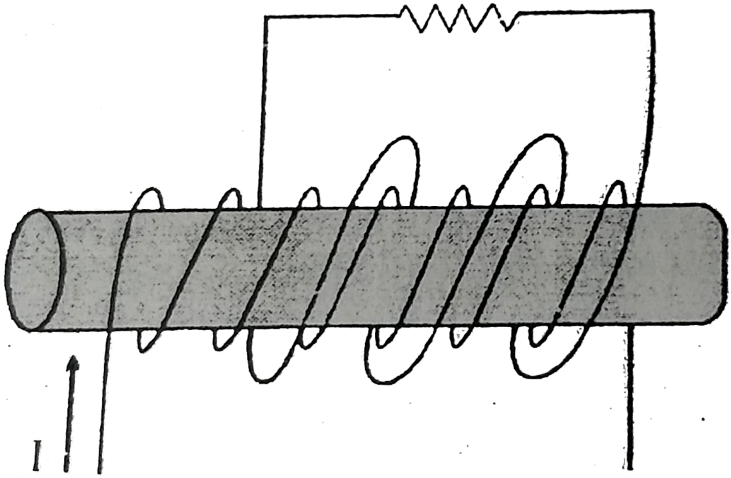
74. A coil with 1500 turns, a radius of 5.0 cm and a resistance of 12Ω surrounds a solenoid with $240 turns/cm$ and a radius of 4 cm , see figure. The current in the solenoid changes at a constant rate from 0 to 20 A in 0.10 s. Calculate the magnitude of the induced current (in mA) in the 1500 turn coil ($\pi^2 = 10$ Neglect self inductance of the coil).



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75. An RLC circuit includes a 1.6 H inductor and a $250\mu F$ capacitor rated at 400 V. The circuit is connected across a sine - wave generator whose peak voltage is 32 V. What minimum resistace must the circuit have to ensure that the capacitor voltage does not exceed its rated value when the generator is at the resonant frequency? Fill 10 R in OMR sheet.

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76. If an AC voltage 100 V is applied between points A and B, then current of 1 A and phase difference between current and voltage will be $\Delta\phi = 37^{\circ}$. IF the same voltage is applied between points B and C, then current of 5 A and $\Delta\phi = 53^{\circ}$ What will be the impedance ($\in \Omega$) in the chain, if the same voltage is applied between points A and C? Round off to nearest integer.

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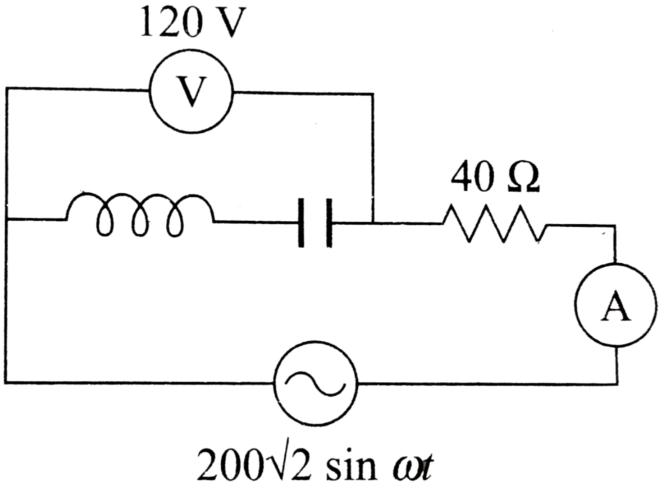
77. In the given LCR series circuit find the reading (in A) of the hot wire ammeter. (there all hot wire meters are ideal)



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78. A beam of light parallel to the principal axis is focused on a screen with the help of lens, forming a circular spot with a diameter of A. If we put a plane - parallel glass plate of thickness h and refractive index n between the lens and the screen, the diameter of the bright spot on the screen increases. The diameter of the lens is d and focal length F. Find the new diameter in mm. (Take F=10 cm, A = 1 cm, n=1.5,d=2 cm, h=3 cm)

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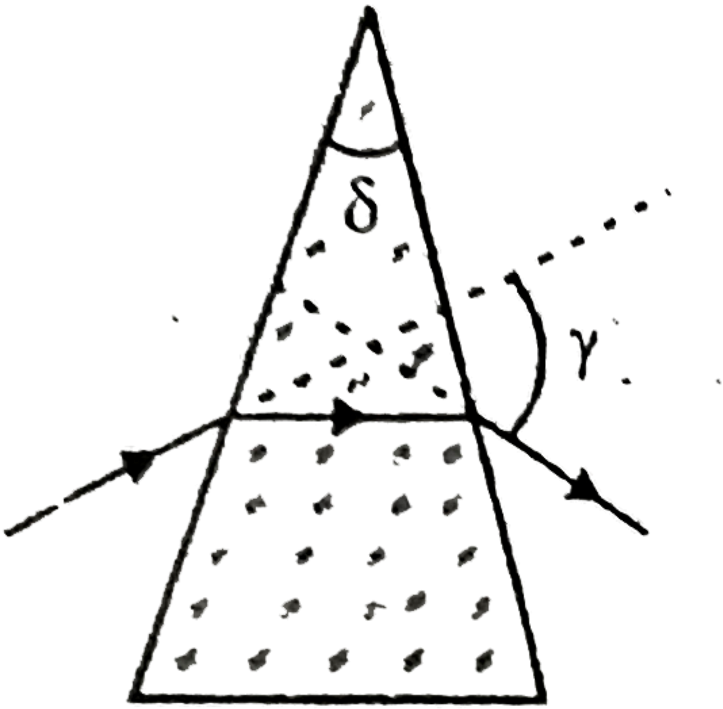
79. Figure shows the path of a light beam in an isosceles prism with apex angle $\delta = 60^{\circ}$ (inside the prism beam is parallel to the base). Find the angle of deflection in degrees. The refractive index of prism material is 1.732



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80. Along the main optical axis of a converging lens with focal length F = 5 cm two fireflies are moving towards each other. They are on opposite sides of the lens. The speed of the fireflies is the same $V = 2cm/\sec$ After what minimum time (in sec) does the first firefly meet the image of the second, if at the initial time they were at distances 20 cm and 30 cm from the lens repectively? Round off to nearest integer.

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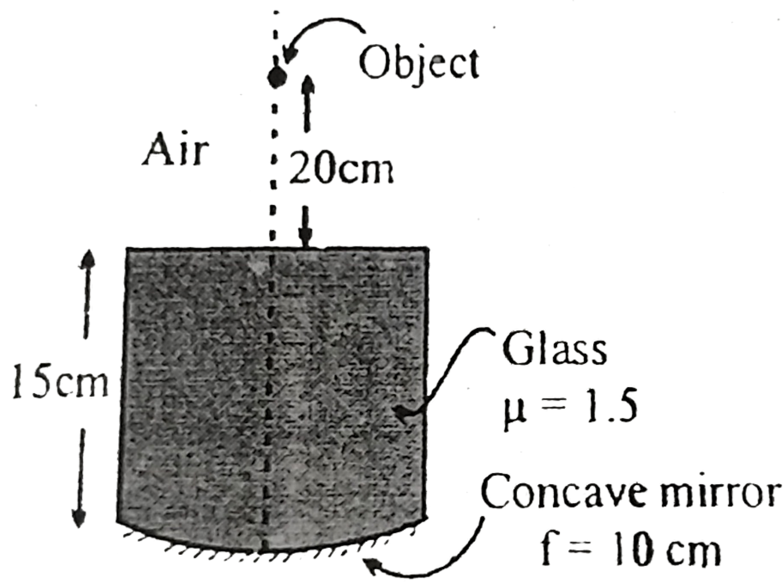
81. After all possible reflection and refractions the final image is located at a distance 'x' cm from air-glass interface. Then value of

7x is



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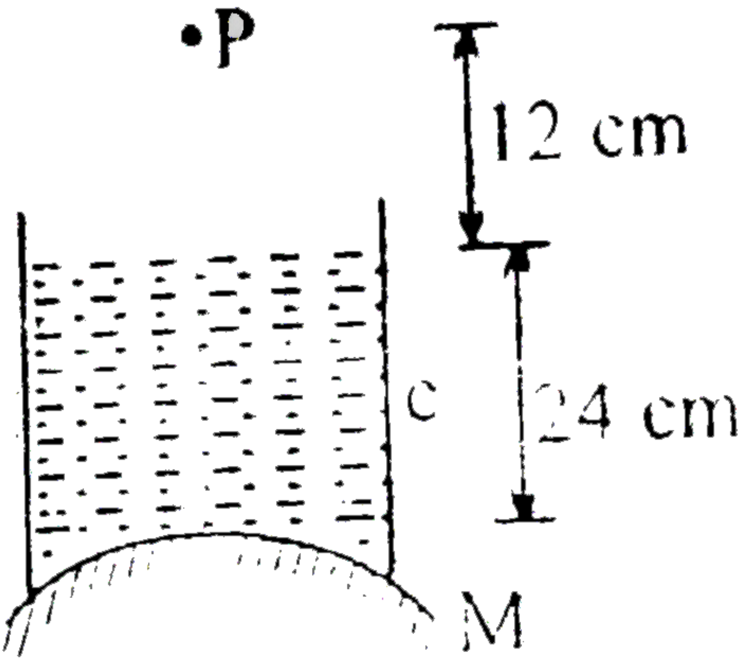
82. An insect at point 'P' sees its two images in the water mirror system as shown in the figure. One image is formed due to direct partical reflection from water surface and the other image is formed due to refraction, reflection & again refraction by water mirror system in order. Find the separation (in cm) between the two images. Mirror M has focal length 60 cm $\left[Take \mu_w = 4/3\right]$



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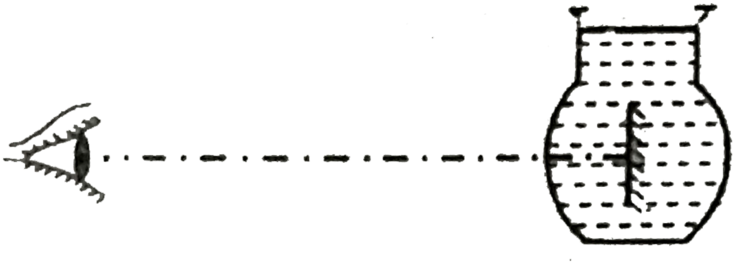
83. A plane mirror is suspended vertically at the center of a large thin-walled spherical flask filled with water. The diameter of the flask is 10 inches. An observer whose eye is 35 inches from the mirror as shown in figure tries to see an image of his own eye.

What is distance of the image from the eye (in inches). The effect of the thin glass walls of the flask may be neglected. Take $\mu_{water} = \frac{4}{3}$



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84. A light ray parallel to the x-axis strikes the outer reflecting surface of a sphere at a point (2,2,0). Its center is at the point (0,0,-1). The unit vector along the direction of the reflected is $x\hat{i} + y\hat{j} + z\hat{k}$ Find the value of $y\frac{z}{x^2}$

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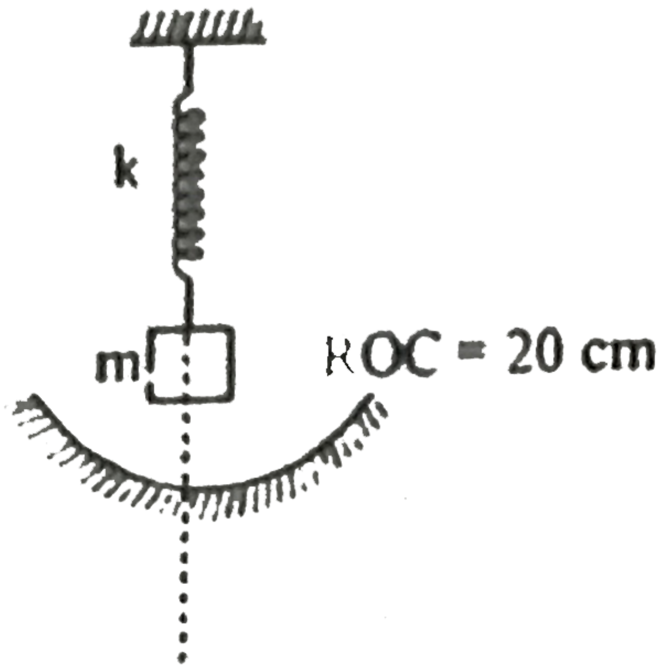
85. A block of mass 'm' is attached to a spring. Block is released from rest, when spring is in natural length. Block is along the pricipal axis of concave mirror and size of block is very small. When spring is in natural length then block is at a distance of 20 cm from the mirror, distance (in cm) in which the image formed by mirror oscillates is (mass of the block $= 5 \times 10^{-2}$ kg, spring constant k=20 N//m)



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86. A vessel, whose bottom is flat and perfectly reflecting, is filled with water ($\in dex = 4/3$) upto a height = 40 cm . A point object in air above is moving towards the water surface with a constant speed $= 4m/s$ What is the relative speed of its final image ($\in m/s$), as seen by the object itself, at a moment when the object is 30 cm above the water surface?

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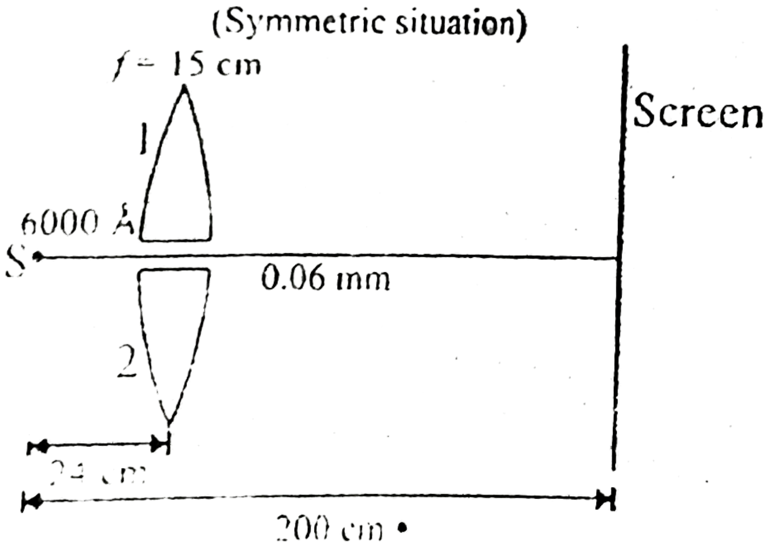
87. Interference frings of yellow light of wavelength 6000 A are formed by Billet split lenses. The distance from source to lens is 24 cms. The focal length of lens is 15 cm The lens halves are separated by 0.06 mm. The distance of source to screen is 200 cms. Calculate the fringe width (in mm) Round off the answer to nearest integer.



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88. For an achromatic combination, three different lenses are combined. Dispersive power of their material are $0.066, 0.055$ and 0.040 and their main focal length are - 22 cm, -11cm, and 'f' respectively then find the value of 'f' (in cm.)

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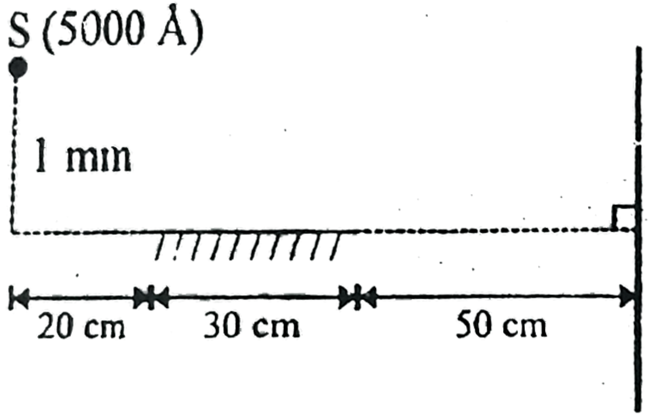
89. Find the total number of fringes formed on screen in the L loyd's mirror arrangement shown.



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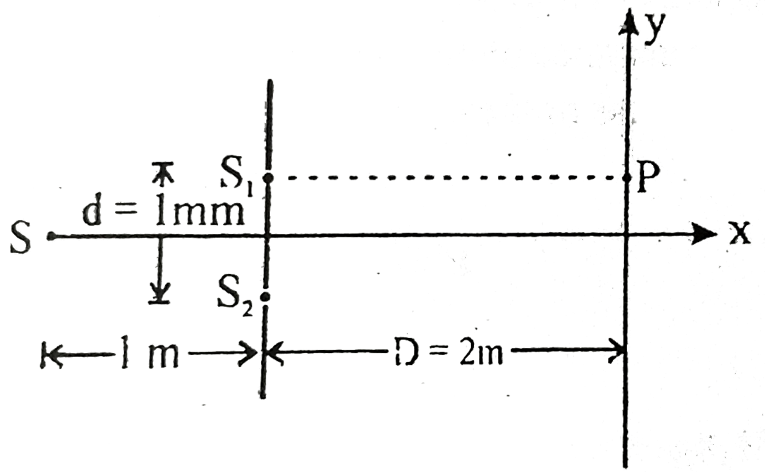
90. In a modified YDSE the sources S of wavelength 5000 A oscillates about axis of setup according to the equation $y = 0.5\sin\left(\frac{\pi}{6}\right)t$ where y is in millimeter and t in second. At what time ti will the intensity at P, a point exactly in front of slit S_1 be maximum for the first time?



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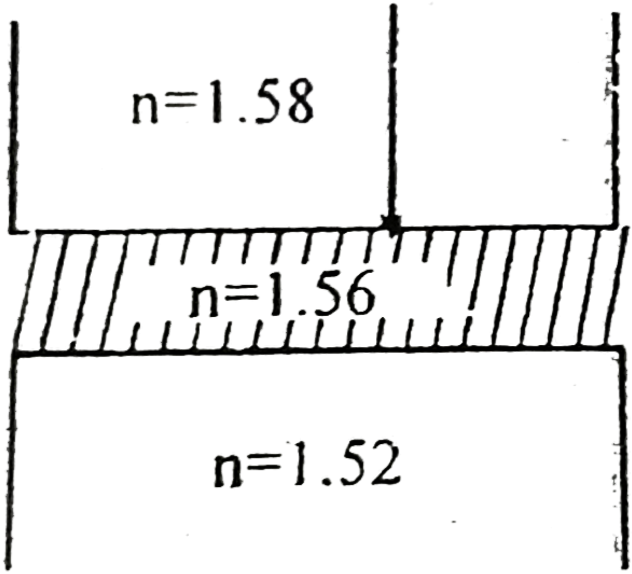
91. A thin film of plastic $(n = 1.56)$ is $0.25 \mu m$ thick. It is sandwiched between two glass slabs with refractive indice of 1.58 and 1.52 respectively White light (400-700nm) is first incident normally on the slab for which $n = 1.58$ Which visible wavelength (in nm) is missing in the reflected light?



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92. Visible light of variable wavelength is incident normally on a thin sheet of plastic in air. The reflected light has a minima only for $lamba = 512$ nm and $\lambda = 640$ nm in the visible spectrem. What is the minimum thickness (in mum) of the film $(\mu = 1.28)$?

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93. Visible light of variable wavelength is incident normally on a thin sheet of plastic in air. The reflected light has a minima only for $lamba = 512$ nm and $\lambda = 640$ nm in the visible spectrem. What is the minimum thickness (in mum) of the film $(\mu = 1.28)$?

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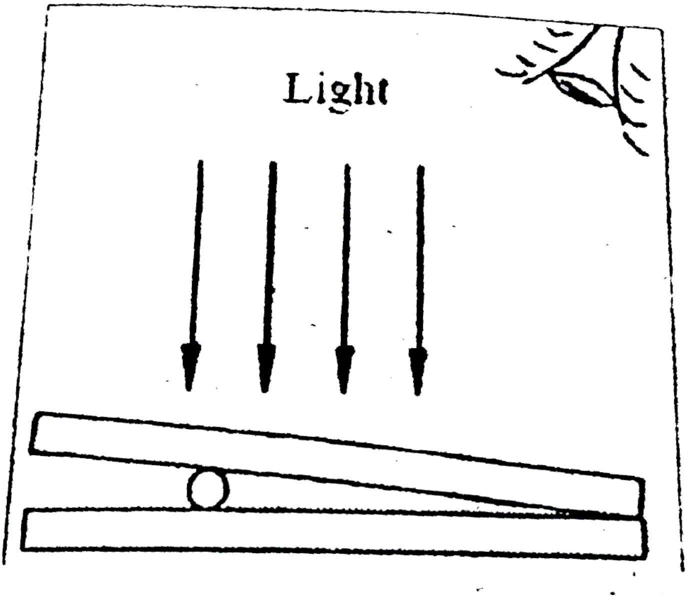
94. A very fine hair-like fiber is stuck between two microscope slides. As a result of this, there is a wedge of air between them. When the slides are illuminated normally (from above) with light of wavelength 550 nm. Bright and dark interference bands are formed. The fiber is seen to lie at the position of fifth dark band counting from the common edge. What is the diameter (in nm)

of the fiber?



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95. A flat bottomed metal tank filled with water is dragged along a horizontal floor at the rate of $20m/s$ The tank is of mass 100 kg and contains 900 kg of water and all the heat produced in the dragging is conducted to the water through the bottom plate of the tank. If the bottom plate has an effective area of conduction $1m^2$ and thickness 5 cm and the temperature of water in the tank remains constant at 50° C, calculate the temperature of the bottom surface of the tank. Given the coefficient of friction between the tank and the floor is 0.5 and K for the material of the tank is $100 J/m \sec$ K.

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96. A rod PQ of length l=1 m is pivoted at an end P and is freely rotating in a horizontal plane at an angular speed ω about a vertical axis passing through P. If coefficient of linear expansion of material of rod is $\alpha = 2 \times 10^{-4} / {}^\circ C$ then calculate percentage change in its angular speed (in multiple of 10^{-1}) if the temperature of system is increased by $\Delta T = 10^\circ$ C.

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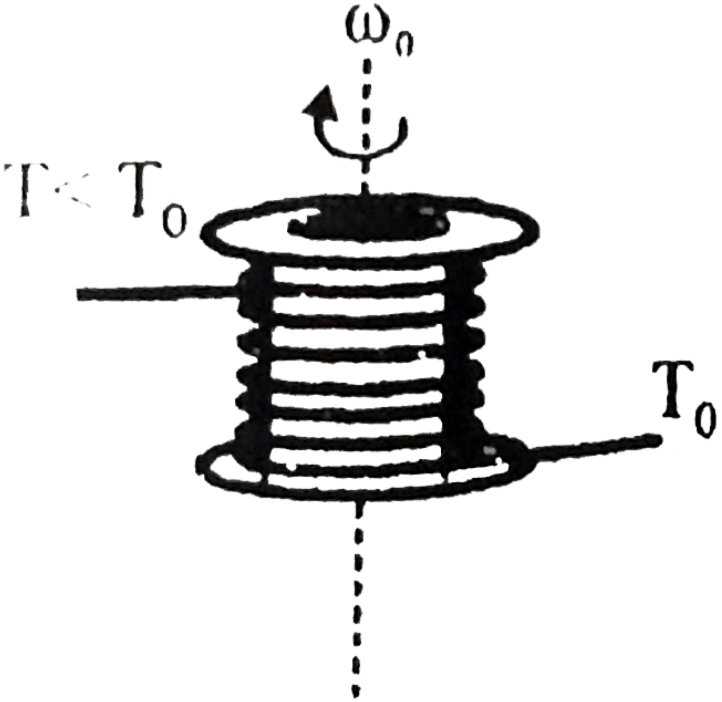
97. A capstan is a rotating drum (cylinder) over which a rope or cord slides in order to increase the tension due to friction. If the difference in tension between the two ends of the rope is 500 N and the capstan has a diameter of 10 cm and rotates with angular velocity $10 rad/s$. Capstan is made of iron and has mass 5 kg, specific heat $1000 J/kg$ K. At what rate does temperature rise? Assume that the temperature in the capstan is uniform and all the thermal energy generated flows into it. Express your answer as $\times x10^{-4} \wedge (\circ)C$ Fill up value of x.



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98. In a slow reaction, heat is being evolved at a rate about 10 m W in a liquid. If the heat were being generated by the decay of^{32} P, a radioactive isotope of phosphorus that has half-life of 14 days and emits only beta-particles with a mean energy of 700KeV, estimate the number of^{32} P atoms in the liquid. Express your answer in form of $A \times 10^{15}$ and fill A in OMR sheet. Round off A to nearest integer [Take:l n$2 = 0.7$]

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99. In a sample initially there are equal number of atoms of two radioactive isotopes A and B. 3 days later the number of atoms of A is twice that of B. Half life of B is 1.5 days. What is half life of isotope A? (in days)

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100. The reaction $\_(3)^7 Li + {}_1^1 H \rightarrow {}_4^7 Be + {}_0^1 n$ is endothermic. Assuming that Li nuclei is free and at rest. What is the minimum kinetic energy (in keV) of incident proton so that this reaction occurs? Take Q value of this reaction as -1645 keV.

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101. Water kept in a porcus pot evaporates through the walls of pot. Rate of evaporation is proportional to volume of water. When water is kept in the pot 75% water get evaporated in 16 hrs. A suction mechanism attached in the pot sucks water at the rate which is also proportional to volume of water in the pot. Without evaporations, half of the water kept in pot is sucked in 24 hr The pot is filled with 16 kg of water, with evaporation and suction acting simultaneously , what amount of water (in kg) will be left is pot after one day.

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102. An X-ray tube operated at a DC potential difference of 40 kV, produces heat at a rate of 3136 W. Assume that 2% of energy of the electron is converted into X-rays. The number of electrons per second striking the target is $n \times 10^{17}$ fill n in your OMR sheet.

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103. When the voltage applied to an X-ray tube increased from $V_1 = 15.5kV$ to $V_2 = 31kV$ the wavelength interval between the K_α line and the cut-off wavelength of te continuous X-ray spectrum increases by a factor of 1.3. If te atomic number of the element of the target is z. Then the value of $\frac{z}{13}$ will be: (take $hc = 1240eVnm$ and $R = 1 \times \frac{10^7}{m}$)

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104. If the de-Broglie wavelength of an electron beam is 5×10^{-10} m, then what is the retarding potential (in volt) necessary to completely stop the beam. (Round off to nearest integer)

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105. The peak emission from a black body at a certain temperature occurs at a wavelength of 6200 A. On increasing its temperature, the total radiation emitted is increased 16 times. These radiations are allowed to fall on a metal surface. Photoelectrons emitted by the peak radiation at higher temperature can be bought to rest by applying potential equivalent to the excitation potential corresponding to the transition for the level n=4 to n=2 in the Bohr's hydrogen atom. The work function of the metal is given by $\frac{\alpha}{100}eV$ where alpha is the numerical constant. Find the value of alpha.

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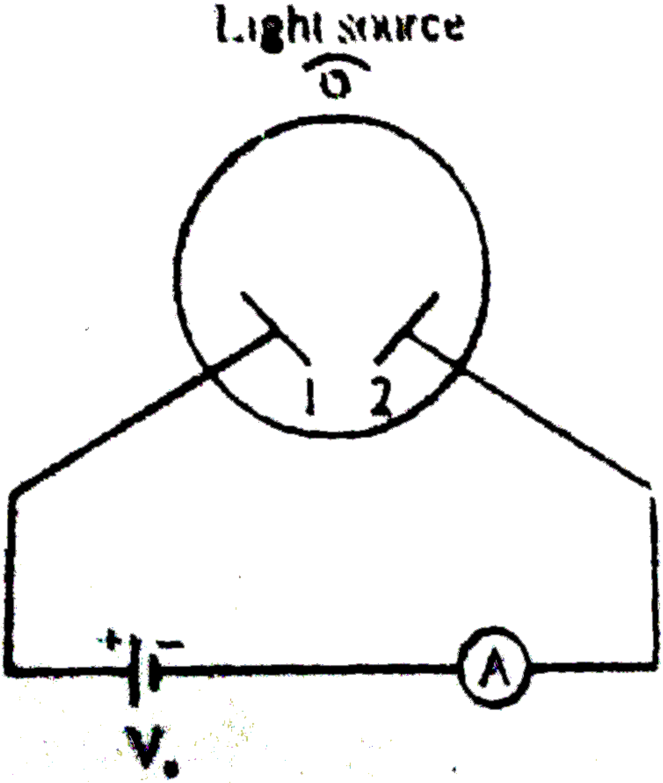
106. The figure below shows a vaccum tube containing electrodes made of different metals, 1 and 2 whose work functions are ϕ_1 and ϕ_2 The electrodes are illuminated simultaneously. The maximum kinetic energy of photoelectrons reaching plate 2 is 1 eV and maximum kinetic energy of photoelectrons reaching plate 1 is 3 eV. Assume that photoelectron emitted from either plate do not interact with each other $\phi_1 = 1.5$ eV and $\phi_2 = 0.7$ eV. Find wavelength (in nm) of the electromagnetic wave used



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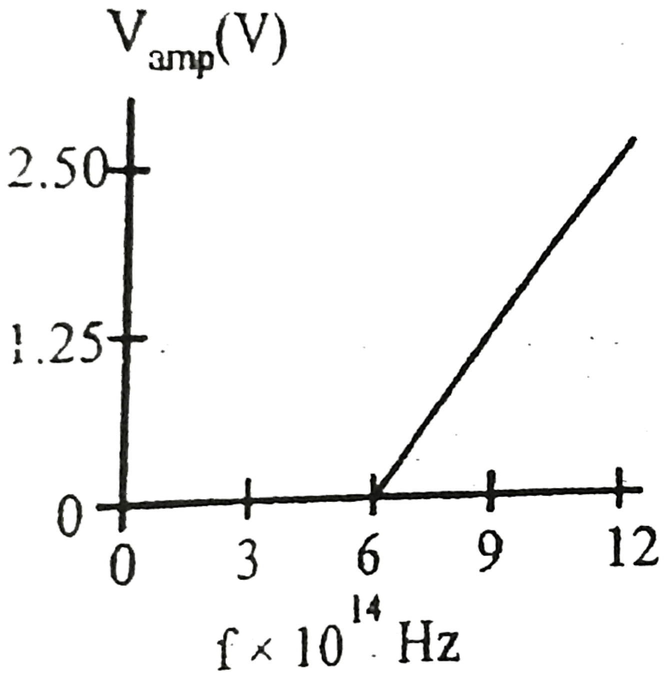
107. Figure shows the stopping potential versus the light frequency for a metal cathode used in a photoelectric-effect experiment. Suppose this cathode is now illuminated with 6.63μ W of 300 nm light and that the efficiency of converting photons to photoelectrons is 10% Take $h = 6.63 \times 10^{-34}$ Jsec, $c = 3 \times 10^{8} ms^{-1}$



What is the power (in watt) of emitted photoelectron beam assuming that on an average, each photoelectron emitted has energy $\frac{5K_{max}}{6}$ Assume that anode potential is sufficiently positive. Express your answer in from of $'X' \times 10^{-9}$ W fill 'X' in OMR sheet after rounding off to nearest integer.

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Additional topic

1. The manifestation of band structure in solids is due to

A. Bohr's correspondence principal

B. Pauli's exclusion principal

C. Heisenberg's uncertainty principal

D. Boltzmann's law

Answer: B

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2. When p - n junction diode is forward biased then

A. both the deplection region and barrier height are reduced

B. the depletion region is widened and barrier is reduced

C. the deplection region is reduced and barrier height is increased

D. both the depletion region and barrier height are increased

Answer: A

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3. If the ratio of the concentration of electron to that of holes in a semiconductor is $\frac{7}{5}$ and the ratio of current is $\frac{7}{4}$ then what is the ratio of their drift velocities ?

A. $\frac{5}{4}$

B. $\frac{4}{7}$

C. $\frac{5}{8}$

D. $\frac{4}{5}$

Answer: A

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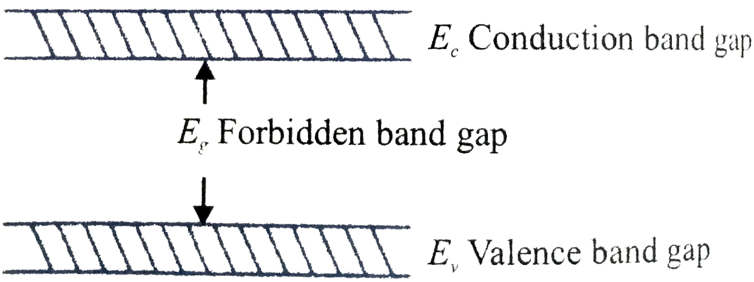
4. If the lattice constant of this semiconductor is decreased, then which of the following is correct ?



A. E_c and E_v decrease, but E_g increases

B. All E_c, $E_g E_v$ decrease

C. All E_c, E_g, E_v increase

D. E_c and E_v increase, but E_g decreases

Answer: D

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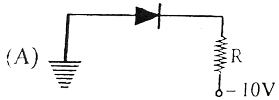
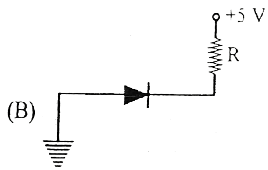
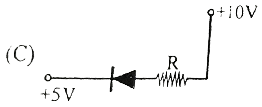
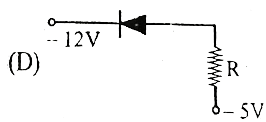
5. In the following, which one of the diodes is reverse biased ?

A. 

B. 

C. 

D. 

Answer: B

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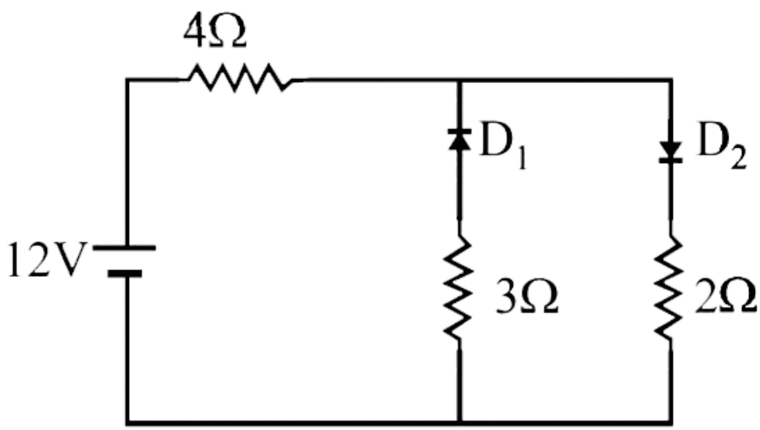
6. The circuit has two oppositively connected ideal diodes in parallel what is the current flowing in the circuit ?



A. 2.31 A

B. 1.33 A

C. 1.71 A

D. 2.00 A

Answer: D

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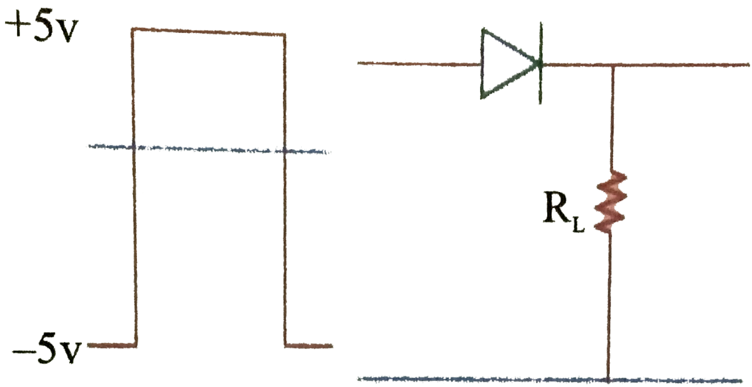
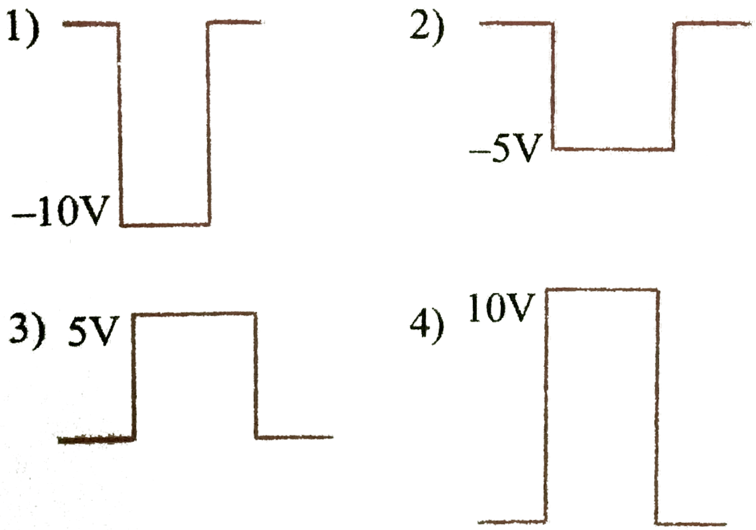
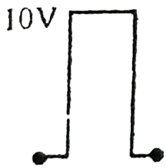
7. If a p - n junction diode, a square input signal of $10V$ is applied as shown.



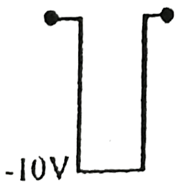
Then the out put signal across R_L will be



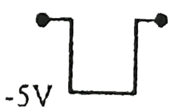
A. (A)



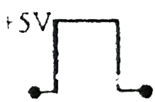
B. (B)



C. (C)



D. (D)



Answer: D

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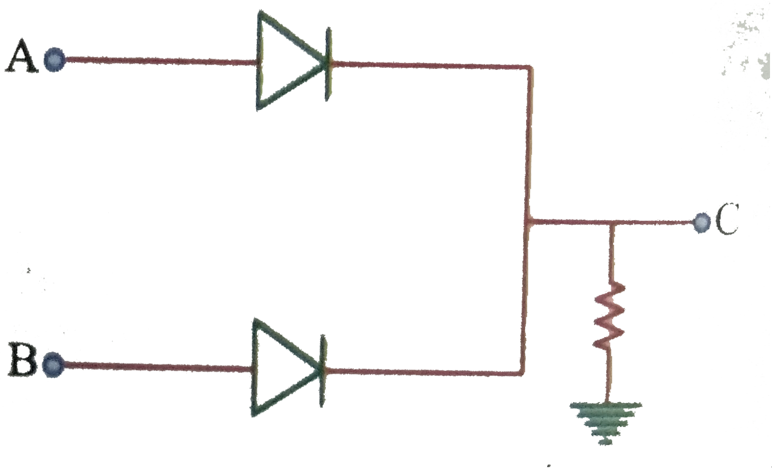
8. In the circuit below, A and B represents two inputs and C represents the output, the circuit represents.



A. AND gate

B. NAND gate

C. OR gate

D. NOR gate

Answer: C

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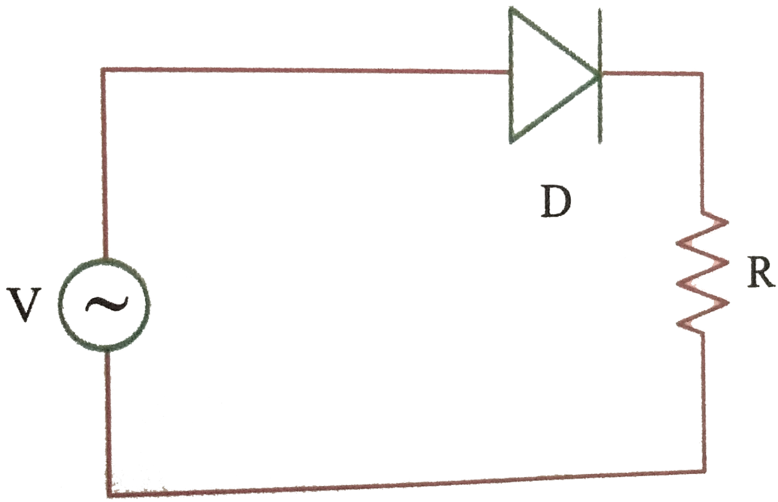
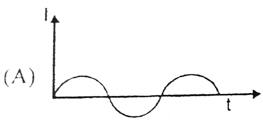
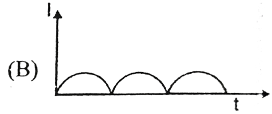
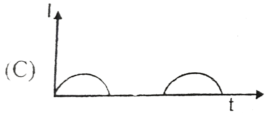
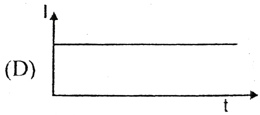
9. A p - n junction (D) shown in the figure can act as a rectifier. An alternating current source (V) is connected in the circuit.



A. 

B. 

C. 

D. 

Answer: C

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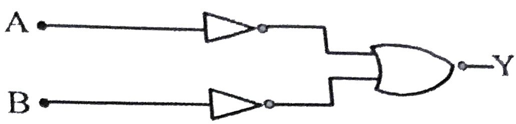
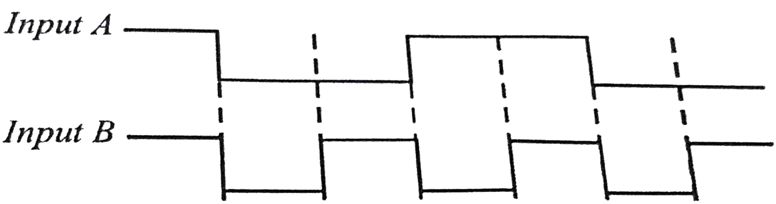
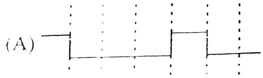
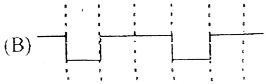
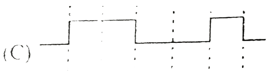
10. The logic circuit shown below has the input waveforms 'A' and 'B' as shown. Pick out the correct output waveform

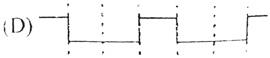




A. 

B. 

C. 

D. 

Answer: A

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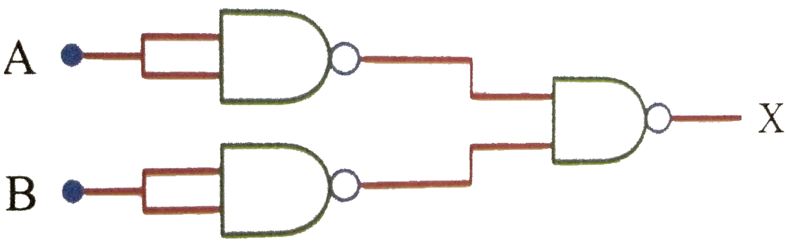
11. The combination of gates shown below yields



A. XOR gate

B. NAND gate

C. OR gate

D. NOT gate

Answer: C

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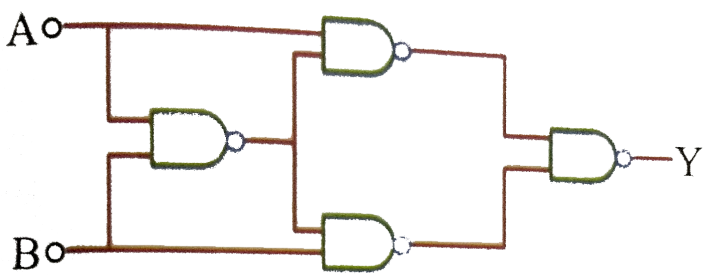
12. Truth table for system of four $NAND$ gates as shown in figure is :



.

	A	B	Y
	0	0	1
A.	0	1	1
	1	0	0
	1	1	0

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

B.

C.

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

D.

A	B	Y
0	0	0
0	1	0
1	0	1
1	1	1

Answer: C

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13. In semiconductor the concentrations of electron and holes are $8 \times 10^{18} / m^3$ and $5 \times 10^{18} / m$ respectively. If the mobilities of electrons and hole are $2.3m^2$/volt-sec and $0.01m^2$/ volt-sec respectively, then semicondutor is

A. N - type and its resistivity is 0.34 ohm-metre

B. P - type and its resistivity is 0.034 ohm-metre

C. N - type and its resistivity is 0.034 ohm-metre

D. P - type and its resistivity is 3.40 ohm-metre

Answer: A

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14. A potential difference of $2V$ is applied between the opposite faces of a Ge crystal plate of area $1cm^2$ and thickness $0.5mm$. If the concentration of electrons in Ge is $2 \times 10^{19}/m^3$ and mobilities of electrons and holes are $0.36\frac{m^2}{volt\text{ - sec}}$ and

$0.14 \frac{m^2}{volt\text{ - }\sec}$ respectively, then the current flowing through the plate will be

A. 0.25 A

B. 0.45 A

C. 0.56 A

D. 0.64 A

Answer: D

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15. The main cause of avalence breakdown is

A. collision ionisation

B. high doping

C. recombination of electron and holes

D. none of these

Answer: A

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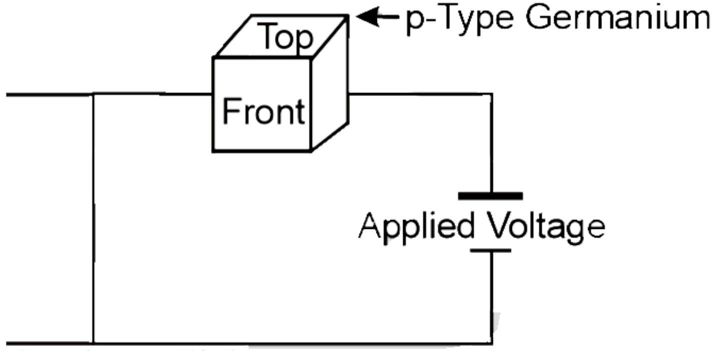
16. A cube of germanium is placed between the poles of a magnet and a voltage is applied across opposite faces of the cube as shown in Figure. Magnetic field is directed vertical downward in the plane of the paper :

What effect will occur at the surface of the cube ?



A. The top surface of cube will become negative charged

B. The front surface of the cube will become positively charged

C. The front surface of the cube will become negative charged

D. Both top and front surface of cube will become positively charged

Answer: B

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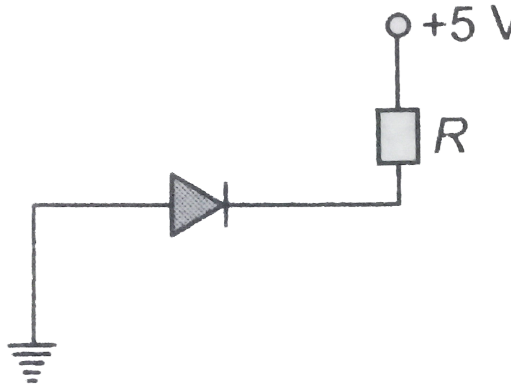
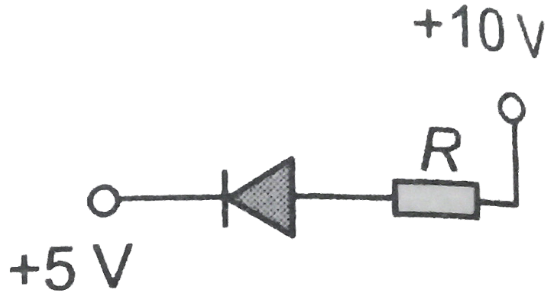
17. In the given figure, which of the diodes are forward biased?

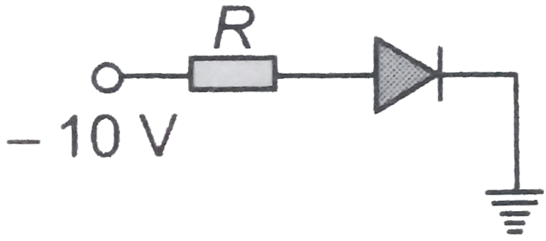
1.



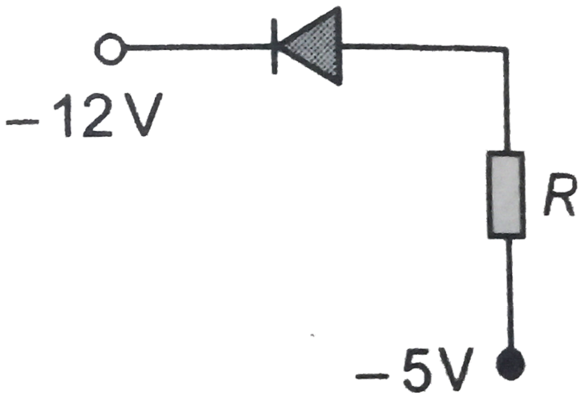
2.



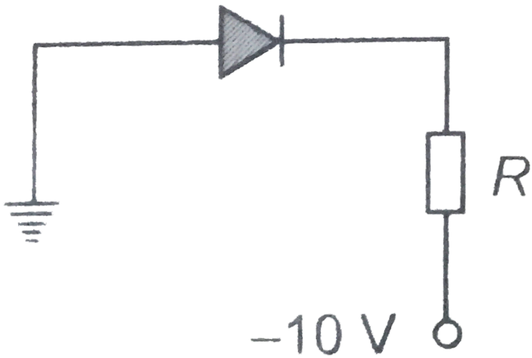
3.



4.



5.



A. 1,2,3

B. 2,4,5

C. 1,3,4

D. 2,3,4

Answer: B

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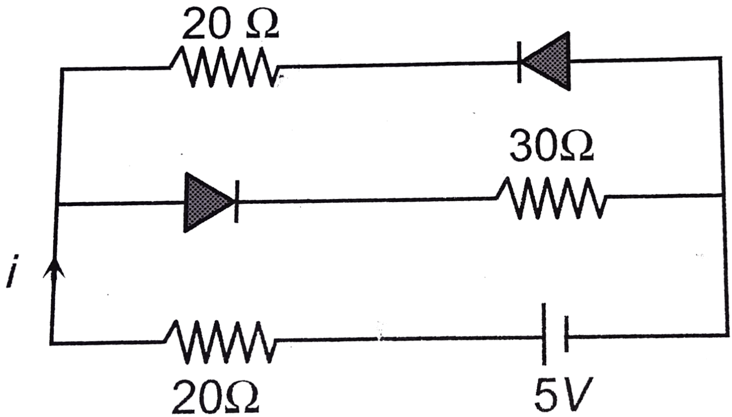
18. Current in the circuit will be



A. 5/40 A

B. 1/10 A

C. 5/10 A

D. 5/20 A

Answer: B

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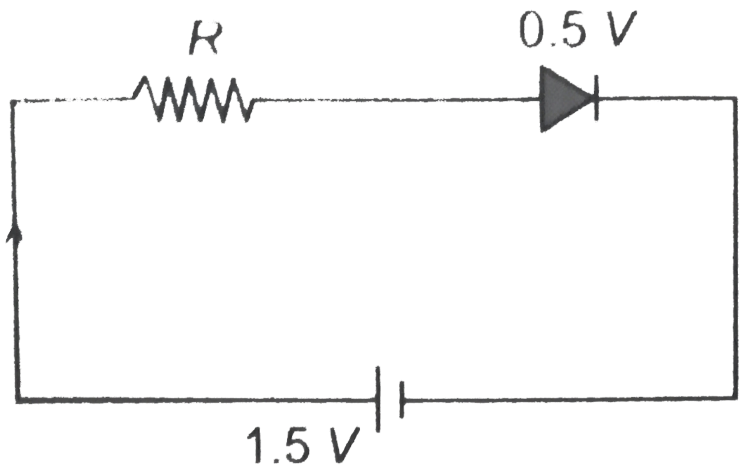
19. The diode used in the circuit shown in the figure has a constant voltage drop of $0.5V$ at all currents and a maximum power rating fo 100 milliwatts. What should be the value of the resistor R, connected in series with the diode for obtaining maximum current?



A. 1.5Ω

B. 5Ω

C. 6.67Ω

D. 200Ω

Answer: B

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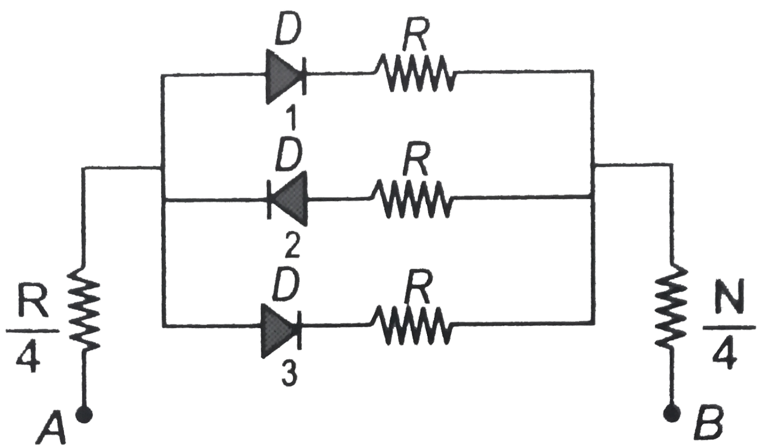
20. In the following circuits PN-junction diodes D_1, D_2 and D_3 are ideal for the following potential of A and B, the correct increasing order to resistance between A and B will be



$(i) - 10V, \ - 5V (ii) - 5V, \ - 10V$

$(iii) - 4V, \ - 12V$

A. (1)lt(2)lt(3)

B. (3)lt(2)lt(1)

C. (2)=(3)lt(1)

D. (1)=(3)lt(2)

Answer: C

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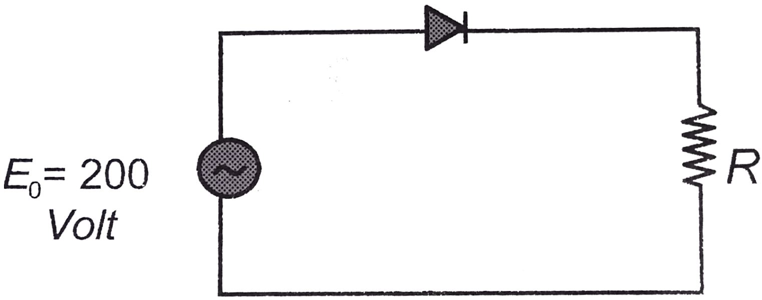
21. A sinusoidal voltage of peak value 200 volts is connected to a diode and resistor R in the circuit shown so that half wave rectification occurs. If the forward resistance of the diode is negligible compared to R the rms voltage (in volt) across R is approximately



(b) 100

A. 200

B. 100

C. $\frac{200}{\sqrt{2}}$

D. 280

Answer: B

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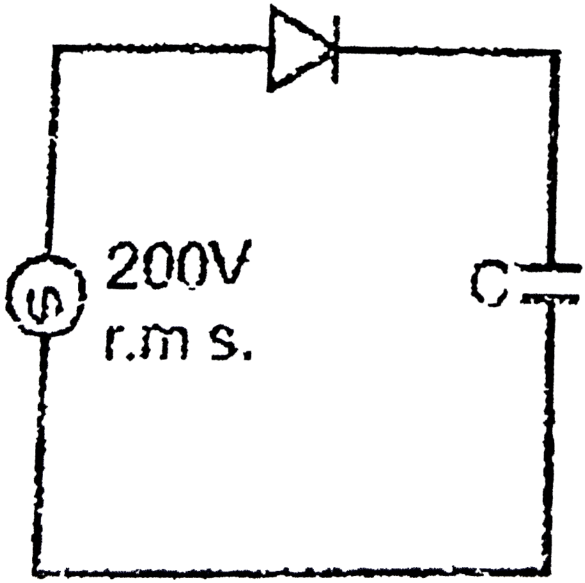
22.



In the figure an A.C of rms voltage 200 volt is appled to the circuit containing diode and the capacitor and it is being rectified. The maximum potential across the capacitor C in volt will be

A. 500 V

B. 200 V

C. 283 V

D. 141 V

Answer: C

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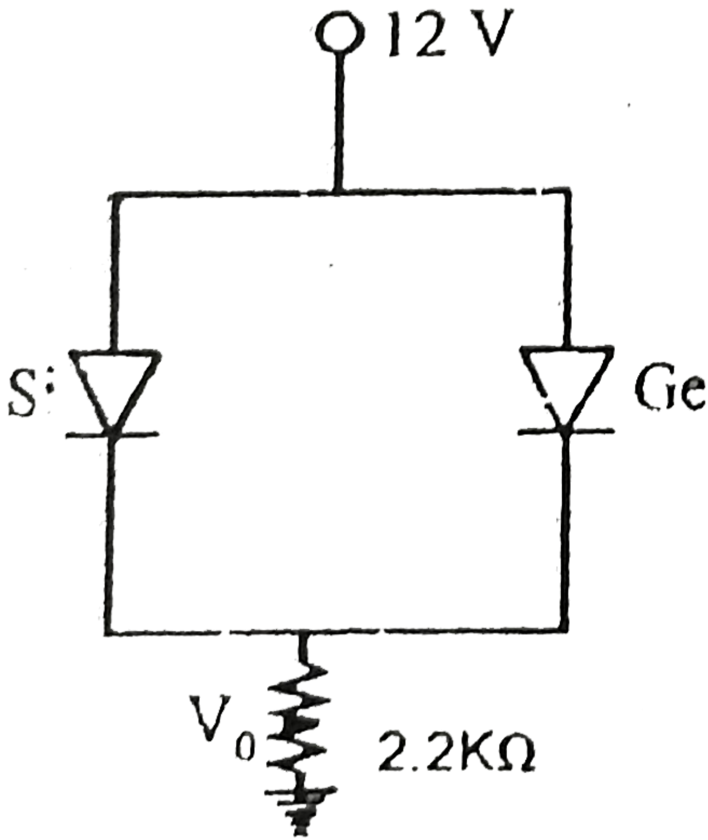
23. In the circuit shown in figure, Voltage V_0 is



A. 11.7 volt

B. 11.3 volt

C. 0

D. None

Answer: A

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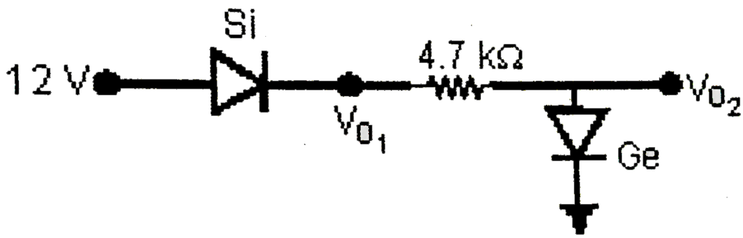
24.



In the given circuit $V_{O_1} \& V_{O_2}$ are

A. 11.3 V & 0.3 V

B. 0.3 V & 11.3 V

C. 11.3 V & 11.3 V

D. 0.3 V & 0.3 V

Answer: A

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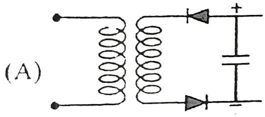
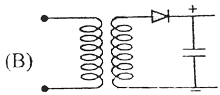
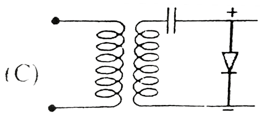
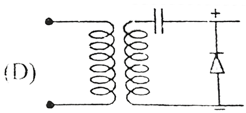
25. Which is the correct diagram of a half- wave reactifier?

A. 

B. 

C. 

D. 

Answer: B

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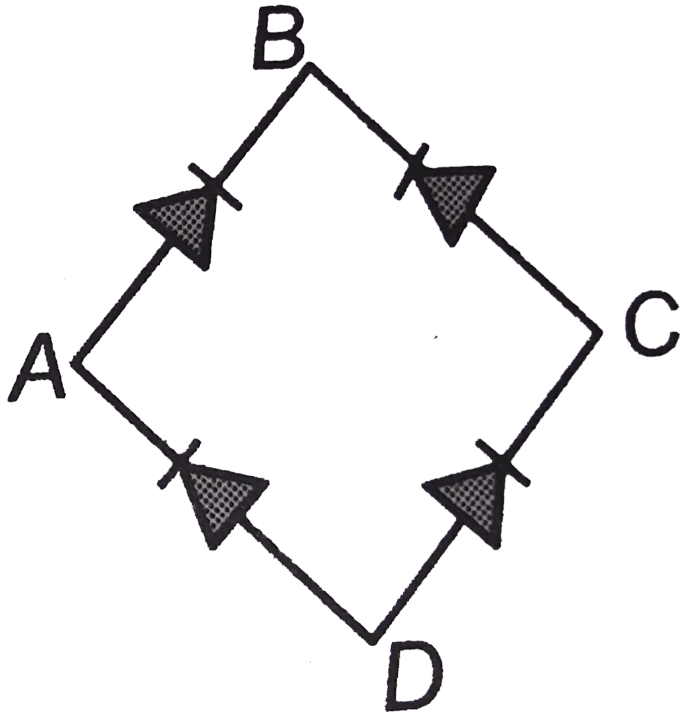
26. In the diagram, the input is across the terminals A and C and the output is across the terminals B and D, then the outputs is



A. zero

B. same as input

C. full wave rectifier

D. half wave rectifier

Answer: C

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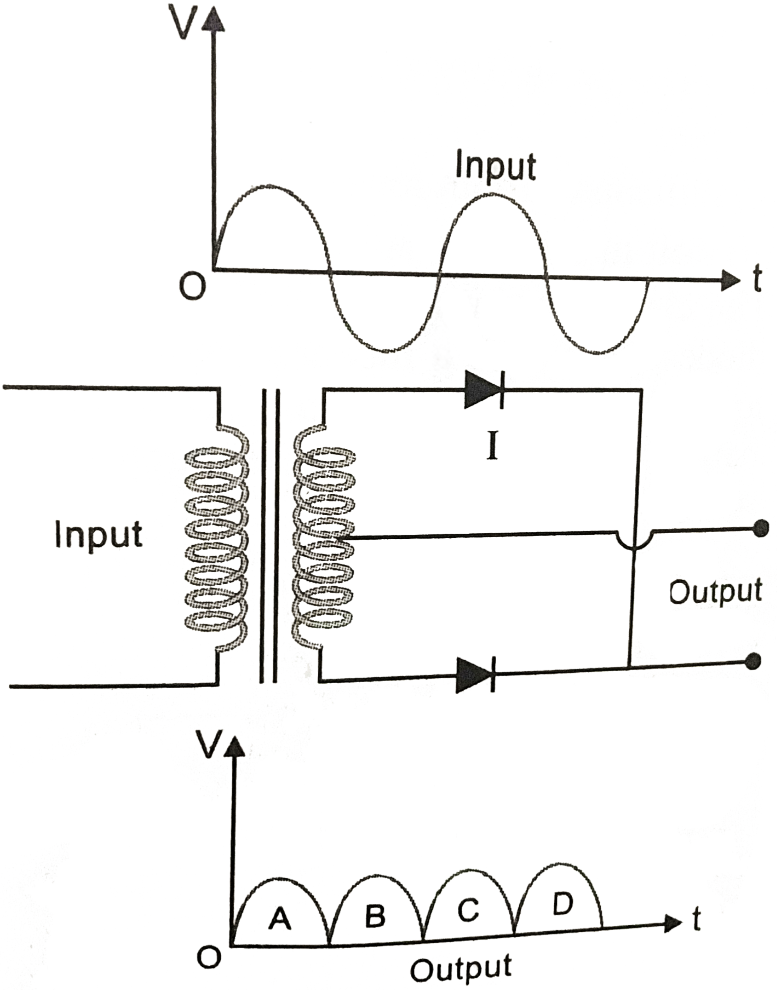
27. A full wave rectifier circuit along with the input and output are shown in Fig. the concentrations from the diode I is (are)



A. A,C

B. B,D

C. B,C

D. A,D

Answer: B

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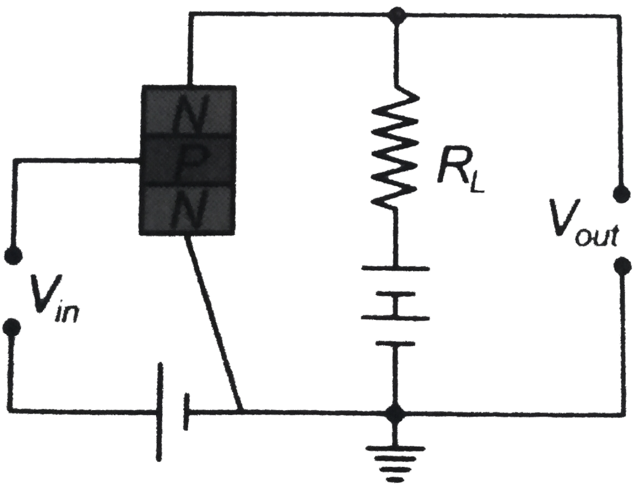
28. An NPN-transistor circuit is arranged as shown in figure. It is



A. a common-base amplifier circuit

B. a common-emitter amplifier circuit

C. a common-collector amplifier circuit

D. none of the above

Answer: B

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29. Given below are four logic gates symbol (figure). Those for OR, NOR and NAND are respectively

A. 1,4,3

B. 4,1,2

C. 1,3,4

D. 4,2,1

Answer: C

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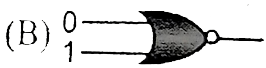
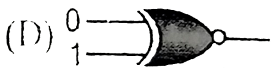
30. Which of the following gates will have an output of 1

A. 

B. 

C. 

D. 

Answer: C

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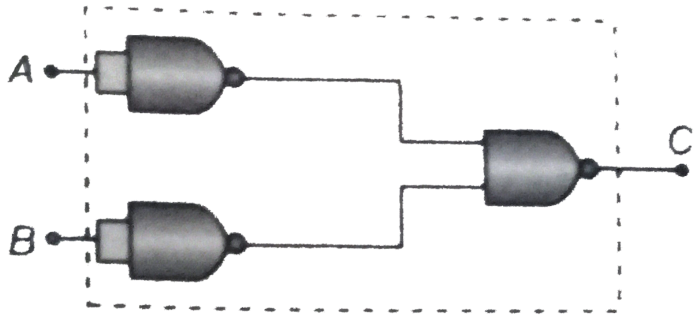
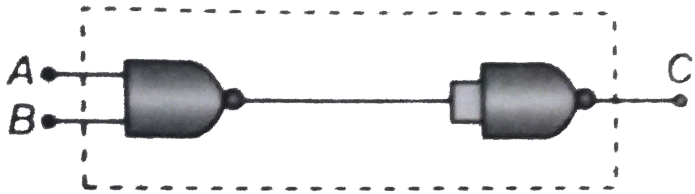
31. The combination of $'NAND'$ gates shown here under (figure) are equivalent to





A. An OR gate and an AND gate respectively

B. An AND gate and a NOT gate respectively

C. An AND gate and an OR gate respectively

D. An OR gate and a NOT gate respectively

Answer: A

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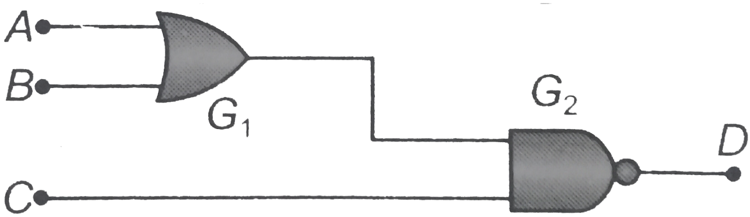
32. For the given combination of gates, if the logic states of inputs $A, B, C,$ are as follows $A = B = C = 0$ and $A = B = 1, C = 0$ then the logic states of output D are



A. 0,0

B. 0,1

C. 1,0

D. 1,1

Answer: D

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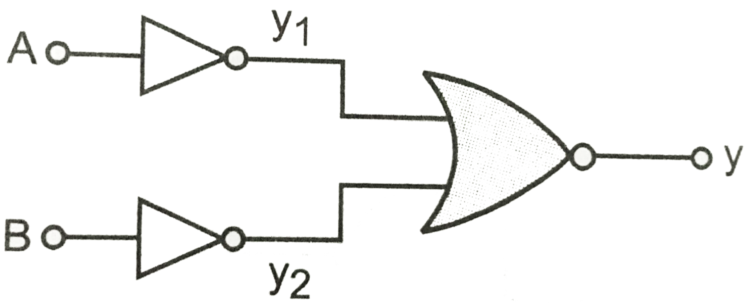
33. Which logic gate is represented by the following combination of logic gates



A. OR

B. NAND

C. AND

D. NOR

Answer: C

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34. A. The energy band of valence electrons is called Valence band B. The energy band of free electrons or loosely bound electrons is called conduction band.

A. A is true, B is wrong

B. B is true, A is wrong

C. Both are true

D. None is true

Answer: C

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35. A Both Valance band and conduction band can accommodate equal number of electrons. B. Conduction band has less energy then Valance band.

A. A is true, B is wrong

B. B is true, A is wrong

C. Both are true

D. None is true

Answer: A

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36. A. it is impossible to get a completely filled conduction band.

B. It is impossible to get completely empty Valance band.

A. Both are true.

B. Both are false

C. Only A is true

D. Only B is true

Answer: A

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37. A.A diode merely converts A.C. into D.C.B.A diode cannot given amplifiction.

A. Both A and B are correct

B. A incorrect B is wrong

C. A is wrong B is correct

D. None

Answer: A

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38. Statement 1: Conductivity of semiconductor increases with increase in temperature.

Statement 2: Forbidden energy gap is highest for semiconductors.

A. Both Statement-1 and Statement-2 are true, and Statement-2 is the correct explanation of Statement-1.

B. Both Statement-1 and Statement-2 are true but Statement-2 is not the correct explanation of Statement -1.

C. Statement-1 is true but Statement-2 is false.

D. Statement-1 is false but Statement-2 is true.

Answer: C

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39. Statement 1: Conductivity of semiconductors decreases with increase in temperature

Statement-2: More electron goes from valance band to conduction band with increase in temperature.

A. Both Statement-1 and Statement-2 are true, and Statement-2 is the correct explanation of Statement-1.

B. Both Statement-1 and Statement-2 are true but Statement-2 is not the correct explanation of Statement-1.

C. Statement-1 is true but Statement-2 is false.

D. Statement-1 is false but Statement-2 is true.

Answer: D

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40. Statement 1: In semiconductors current is obtained due to motion of electrons and holes.

Statement-2: Breaking up of covalent bond produces holes in valance band and electrons in conduction band.

A. Both Statement-1 and Statement-2 are true, and Statement-2 is the correct explanation of Statement-1.

B. Both Statement-1 and Statement-2 are true but Statement-2 is not the correct explanation of Statement-1.

C. Statement-1 is true but Statement-2 is false.

D. Statement-1 is false but Statement-2 is true.

Answer: A

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41. Statement 1: Doping concentration is maximum in emitter in transistor.

Statement 2: Maximum number of electrons flows from emitter to base in n-p-n transistor.

A. Both Statement-1 and Statement-2 are true, and Statement-2 is the correct explanation of Statement-1.

B. Both Statement-1 and Statement-2 are true but Statement-2 is not the correct explanation of Statement-1.

C. Statement-1 is true but Statement-2 is false.

D. Statement-1 is false but Statement-2 is true.

Answer: B

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42. The ratio waves of frequency $300MHz$ to $3000MHz$ belong to

A. High frequency band

B. Very high frequency band

C. Ultra high frequency band

D. Super high frequency band

Answer: C

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43. Which of these statements correctly describes the orientation of the electric field $\left(\vec{E}\right)$ the magnetic field $\left(\vec{B}\right)$ and velocity of propagation $\left(\vec{v}\right)$ of an electromagnetic wave?

A. $\vec{E}$ is perpendicular to $\vec{B}$, $\vec{v}$ may have any orientation relative to $\vec{E}$

B. $\vec{E}$ is perpendicular to $\vec{B}$, $\vec{v}$ may have any orientation perpendicular to $\vec{E}$

C. $\vec{E}$ is parallel to $\vec{B}$, $\vec{v}$ is perpendicular to both $\vec{E}$ and $\vec{B}$

D. Each of the three vectors is perpendicular to the other two.

Answer: D

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44. A dipole radio transmitter has its rod-shaped antenna oriented vertically. At a point due south of the transmitter, the radio waves have their magnetic field.

A. oriented north-south

B. oriented east-west

C. oriented vertically

D. oriented in any horizontal direction

Answer: B

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45. A vertical electric dipole antenna

A. radiates uniformly in all direction

B. radiates uniformly in all horizontal directions but more strongly in the vertical direction.

C. does not radiate in the horizontal directions.

D.

Answer: C

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46. Consider the following two statements regarding a linearly polarized, plane electromagnetic wave:

The electric field and the magnetic field have equal average values.

The electric energy and the magnetic energy have equal average values.

A. both a and b are true

B. a is false but b is true

C. b is false but a is true

D. both a and b are false

Answer: B

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47. The rms value of the electric field of the light from the sun is $720N/C$ The total energy density of the electromagnetic wave is

A. $4.58 \times 10^{-6} J/m^3$

B. $6.37 \times 10^{-9} J/m^3$

C. $81.35 \times 10^{-12} J/m^3$

D. $3.3 \times 10^{-3} J/m^3$

Answer: A

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48. A plane electromagnetic wave travels in free space along x-axis. At a particular point in space, the electric field along y-axis is $9.3Vm^{-1}$. The magnetic induction (B) along z-axis is

A. 3.1×10^{-8}T

B. 3×10^{5}T

C. 3.1×10^{6} T

D. 9.3×10^{6} T

Answer: A

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49. A plane e.m. wave travelling along the x-direction has a wavelength of 3mm. The variation in the electric field occurs in the y-direction with an amplitude $66Vm^{-1}$. The equation for the electric and magnetic fields as a function of x and t are respectively

A.

$$E_y = 33\cos\pi \times 10^{11}\left(t - \frac{x}{c}\right), B_z = 1.1 \times 10^{-7}\cos\pi \times 10^{11}\left(t - \frac{x}{c}\right)$$

B.

$$E_y = 11\cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right), B_y = 11 \times 10^{-7}\cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right)$$

C.

$$E_x = 33\cos\pi \times 10^{11}\left(t - \frac{x}{c}\right), B_x = 11 \times 10^{-7}\cos\pi \times 10^{11}\left(t - \frac{x}{c}\right)$$

D.

$$E_y = 66\cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right), B_z = 2.2 \times 10^{-7}\cos 2\pi \times 10^{11}\left(1 - \frac{x}{c}\right)$$

Answer: D

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50. The process of changing some characteristic of a carrier wave in accordance with the intensity of the signal is called.

A. amplification

B. recrification

C. modulation

D. none of these

Answer: C

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51. Modulation factor determines-

A. only the strength of the transmitted signal

B. only the quality of the transmitted signal

C. both the strength and quality of the signal

D. none of the above

Answer: C

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52. if the maximum and minimum voltage of AM wave are V_{max} and V_{min}, respectively then modulation factor

A. $m = \frac{V_{max}}{V_{max} + V_{min}}$

B. $m = \frac{V_{min}}{V_{max} + V_{min}}$

C. $m = \frac{V_{max} + V_{min}}{V_{max} - V_{min}}$

D. $m = \frac{V_{max} - V_{min}}{V_{max} + V_{min}}$

Answer: D

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53. The AM wave contans three frequencies viz:

A. $\frac{f_c}{2}, \frac{f_c + f_s}{2}, \frac{f_c - f_s}{2}$

B. $2f_c 2(f_c + f_s), 2(f_c - f_s)$

C. $f_c, (f_c + f_s), (f_c - f_s)$

D. f_c, f_c, f_c

Answer: C

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54. Which of the following is/are the limitations of amplitude modulation?

A. Clear reception

B. High efficiency

C. Small operating range

D. Good audio quality

Answer: C

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55. The frequency above which radiation of electrical energy is practical is

A. 0.2 kHz

B. 2 kHz

C. 20 kHz

D. 10 kHz

Answer: C

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56. For a carrier frequency of 100 kHz and a modulating frequency of 5kHz what is the width of AM transmission-

A. 5 kHz

B. 10 kHz

C. 20 kHz

D. 200 KHz

Answer: B

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57. In which of the region of earth's atmosphere temperature decreases with height?

A. Ionosphere

B. Stratosphere

C. Troposphere

D. Mesosphere

Answer: C

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58. In an amplitude modulated wave for audio frequency of $500 \text{cycle}/\text{sec}ond$,the appropriate carrier frequency will be

A. $50cyc \le s/\text{sec}$

B. $100 cyc \leq s/\sec$

C. $500 cyc \leq s/\sec$

D. $50, 000 cyc \leq s/\sec$

Answer: D

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59. The T.V. transmission tower in Delhi has a height of 240 m. The distance up to which the broadcast can be received, (taking the radius of earth to be $6.4 \times 10^6 m$) is

A. 100 km

B. 60 km

C. 55 km

D. 50 km

Answer: C

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60. Range of frequencies allotted for commercial FM radio broadcast is

A. 88 to 108 MHz

B. 88 to 108 kHz

C. 8 to 88 MHz

D. 88 to 108 GHz

Answer: A

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61. For a carrier frequency of 100 kHz and a modulating frequency of 5kHz what is the width of AM transmission-

A. 5 kHz

B. 10 kHz

C. 20 kHz

D. 200 kHz

Answer: A

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62. Statement-1 surface wave and sky wave can not be observed on moon.

Statement-2: Atmosphere of variable refractive index is require for propagation of surface & sky wave.

A. Both Statement-1 and Statement-2 are true, and Statement-2 is the correct explanation of Statement-1.

B. Both Statement-1 and Statement-2 are true but Statement -2 is not the correct explanation of Statement-1

C. Statement-1 is true but Statement-2 is false.

D. Statement-1 is false but Statement-2 is true.

Answer: A

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63. Statement 1: In ground wave transmission the radio signals die out after travelling some distance.

Statement-2: Radio signals have a very short wavelength and hence are scattered away by the dust particles and molecules of gases in the atmosphere.

A. Both Statement-1 and Statement-2 are true, and Statement-2 is the correct explanation of Statement-1.

B. Both Statement-1 and Statement-2 are true but Statement -2 is not the correct explanation of Statement-1

C. Statement-1 is true but Statement-2 is false.

D. Statement-1 is false but Statement-2 is true.

Answer: A

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64. Statement 1: Ground wave communication is effective only at low frequencies in the range 500 kHz to about 1500 kHz

Statement 2: The decrease in the intensity of the signal due to absorption by the earth and its atmosphere is higher for higher frequencies.

A. Both Statement-1 and Statement-2 are true, and Statement-2 is the correct explanation of Statement-1.

B. Both Statement-1 and Statement-2 are true but Statement -2 is not the correct explanation of Statement-1

C. Statement-1 is true but Statement-2 is false.

D. Statement-1 is false but Statement-2 is true.

Answer: A

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65. Statement 1: The refractive index of the ionosphere increases as we go from the lower to upper layers in the ionosphere.

Statement 2: The degree ofionization is higher at the upper layers then at the lower layers of the ionosphere.

A. Both Statement-1 and Statement-2 are true, and Statement-2 is the correct explanation of Statement-1.

B. Both Statement-1 and Statement-2 are true but Statement -2 is not the correct explanation of Statement-1

C. Statement-1 is true but Statement-2 is false.

D. Statement-1 is false but Statement-2 is true.

Answer: D

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66. Statement 1: Sky wave communication is not suitable for frequencies greater than 30 MHz

Statement 2: High frequency signals die out before reaching the ionosphere.

A. Both Statement-1 and Statement-2 are true, and Statement-2 is the correct explanation of Statement-1.

B. Both Statement-1 and Statement-2 are true but Statement -2 is not the correct explanation of Statement-1

C. Statement-1 is true but Statement-2 is false.

D. Statement-1 is false but Statement-2 is true.

Answer: C

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67. Statement 1: Microwaves and not radiowaves are used in satellite communication

Statement 2: The wavelength of microwaves is much shorter then that of radiowaves Hence microwaves do not disperse or diffract like radiowaves.

A. Both Statement-1 and Statement-2 are true, and Statement-2 is the correct explanation of Statement-1.

B. Both Statement-1 and Statement-2 are true but Statement -2 is not the correct explanation of Statement-1

C. Statement-1 is true but Statement-2 is false.

D. Statement-1 is false but Statement-2 is true.

Answer: A

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68. Statement 1: Long distance radio broadcasts use short wave bands.

Statement 2: Short wavelength signals are reflected by the ionosphere.

A. Both Statement-1 and Statement-2 are true, and Statement-2 is the correct explanation of Statement-1.

B. Both Statement-1 and Statement-2 are true but Statement -2 is not the correct explanation of Statement-1

C. Statement-1 is true but Statement-2 is false.

D. Statement-1 is false but Statement-2 is true.

Answer: A

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69. Statement 1: Sky wave communication is not used to transmit TV signals

Statement 2: The ionosphere does not reflect TV signals, it transmits tham.

A. Both Statement-1 and Statement-2 are true, and Statement-2 is the correct explanation of Statement-1.

B. Both Statement-1 and Statement-2 are true but Statement -2 is not the correct explanation of Statement-1

C. Statement-1 is true but Statement-2 is false.

D. Statement-1 is false but Statement-2 is true.

Answer: A

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70. The question has statement - 1 and statement - 2 Of the four choices given after the statements , choose the one that best describes the two statements

statement - 1 : Sky wave signals are used for long distance radio communication . These signals are in generel , less stable then ground wave signals

statement - 2 : The state of inosphere varies from to hour day and season to season .

A. Statement-1 is true, Statement-2 is false

B. Statement-1 is true, Statement-2 is true and Statement -2 is the correct explanation of Statement-1

C. Statement-1 is true , Statement -2 is true and Statement-2 is not the correct explanation of Statement-1

D. Statement-1 is false but Statement-2 is true.

Answer: B

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