PHYSICS

BOOKS - KVPY PREVIOUS YEAR

MOCK TEST 7

Exercise

1. An ice cube floats on water in a beaker with 9/10 th of its volume submerged under water. What fraction of its volume will be submerged,

if the beaker of water is taken to the Moon where the gravity is 1/6th that on the Earth?

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

B. $\frac{27}{50}$

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

D. Zero

Answer:

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2. N divisions on the main scale of a vernier calliper coincide with (N + 1) divisions of the vernier scale.If each division ofmain scale is 'a' units, then the least count of the instrument is

A. a

B. $\frac{a}{N}$

C. $\frac{N}{N+1} \times a$

D. $\frac{a}{N+1}$

Answer:

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3. A cubical block of steel of each side equal to 1 is floating on mercury in vessel. The densities of steel and mercury are ρ_s and ρ_m. The height of the block above the mercury level is given by

A. $\ell\left(1+\frac{\rho_s}{\rho_m}\right)$

B. $\ell\left(1-\frac{\rho_s}{\rho_m}\right)$

C. $\ell\left(1+\frac{\rho_m}{\rho_s}\right)$

D. $\ell\left(1-\frac{\rho_m}{\rho_s}\right)$

Answer:

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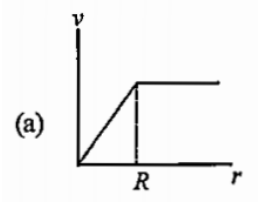
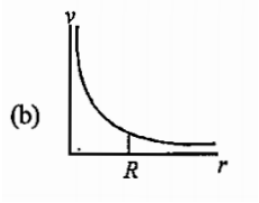
4. A spherically symmetric gravitational system of particles has a mass density $\rho=\begin{cases}\rho_0 & f\ \text{or}\ r<R\\ 0 & f\ \text{or}\ r>R\end{cases}$ where ρ_0 is a constant. A test mass can undergo circular motion under the influence of the gravitational field of particles. Its speed v as a

function of distahce $r(0 < r < OO)$ form the centre of the system is represented by

A.



B.



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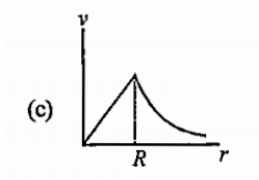
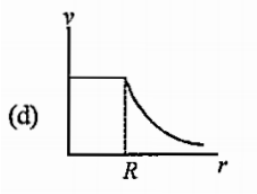


D.



Answer:

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5. In a thermally isolated system, two boxes filled with an ideal gas are connected by a valve. When the valve is in closed position, states of the box 1 and 2, respectively, are (1

atm, V, T) and (0.5 atm, 4V, T). When the valve is opened, the final pressure of the system is approximately

A. 0.5atm

B. 0.6atm

C. 0.45atm

D. 1.0atm

Answer:

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6. A clock which keeps correct time at $20^{\circ}C$ is subjected to $40^{\circ}C$. If coefficient of linear expansion of the pendulum is $12 \times 10^{-6}/^{\circ}C$. How much will it gain or loss in time ?

A. 10.3 s/day

B. 20.6s/day

C. 5 s/day

D. 20min./day

Answer:

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7. A small asteroid is orbiting around the sun in a circular orbit of radius r_0 with speed V_0. A rocket is launched from the asteroid with speed $V = \alpha V_0$, where V is the speed relative to the sun. The highest value of α for which the rocket will remain bound to the solar system is (ignoring gravity due to the asteroid and effects of other planets) –

A. $\sqrt{2}$

B. 2

C. $\sqrt{3}$

D. 1

Answer:

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8. An energy of $24.6eV$ is required to remove one of that electrons from a neutal helium atom. The enegy (in eV)required to remove

both the electrons from a netural helium atom is

A. 79.0

B. 51.8

C. 49.2

D. 38.2

Answer:

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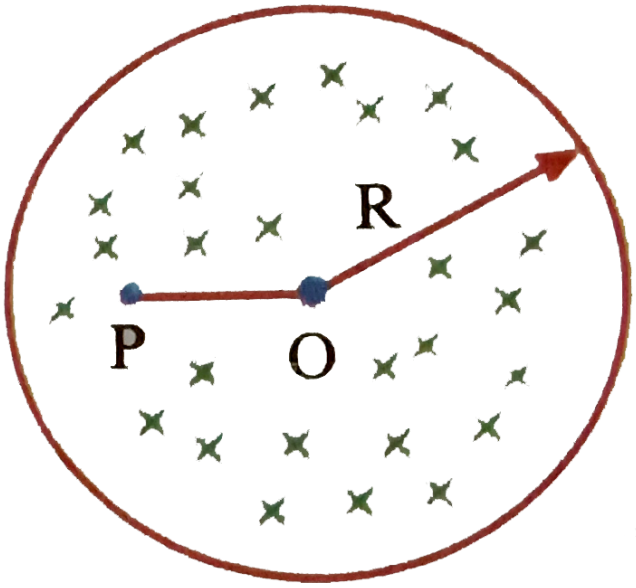
9. In a cylinder region of radius R, a uniform magnetic field is there which is increasing with time, according as $B = B_0 t^2$. A positive point charge q is released from rest at $P\left(OP = \frac{R}{2}\right)$ at $t = 0$ [the instant the field is switched on]



The force experienced by, the point charge at $t = 1s$, is $(R = 2m)$

A. qB_0,anti-clockwise

B. qB_0, clockwise

C. $2qB_0$,anti-clockwise

D. $2qB_0$,clockwise

Answer:

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10. A particle of charge $-q$ and mass m moves in a circular orbits of radius r about a fixed charge $+Q$.The relation between the radius of the orbit r and the time period T is

A. $r = \dfrac{Qq}{16\pi^2 \in_0 m} T^2$

B. $r^3 = \dfrac{Qq}{16\pi^3 \in_0 m} T^2$

C. $r^2 = \dfrac{Qq}{16\pi^3 \in_0 m} T^3$

D. $r^2 = \dfrac{Qq}{4\pi^3 \in_0 m} T^3$

Answer:

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11. Moment of inertia of a uniform-disc of mass m about an axis $x = a$ is mk^2, where k is the radius of gyration. What is its moment of inertia about an axis $x = a + b$:

A. $mk^2 + m(a+b)^2 - ma^2$

B. $mk^2 + m\frac{(a+b)^2}{2}$

C. $mk^2 + m\frac{b^2}{2}$

D. $mk^2 + mb^2$

Answer:

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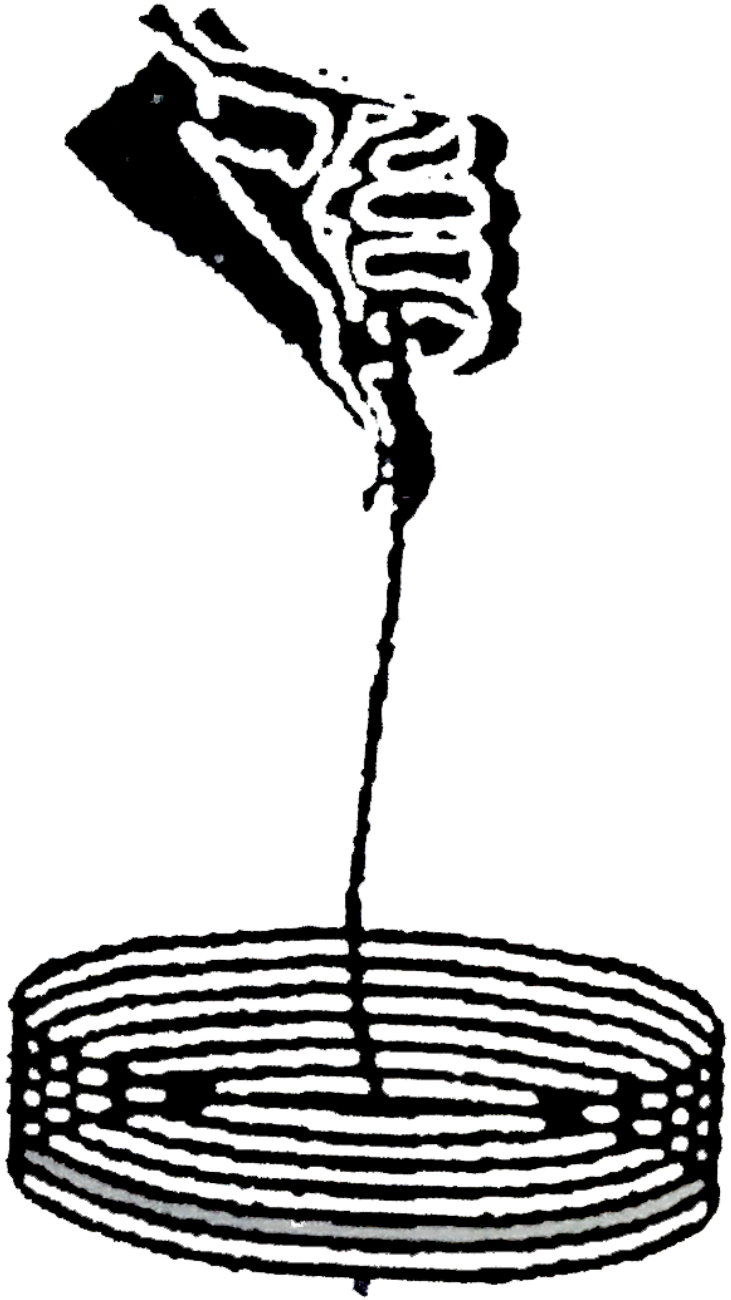
12. A uniform rope of linear mass density λ and length l is coiled on a smooth horizontal surface. One end is pulled up with constant velocity v. Then the average power applied by the external agent in pulling the entire rope

just off the ground is :-



A. $\frac{1}{2}\lambda\ell v^2 + \frac{\lambda\ell^2 g}{2}$

B. $l\ell gv$

C. $\frac{1}{2}\lambda v^3 + \frac{\lambda\ell vg}{2}$

D. $\lambda\ell vg + \frac{1}{2}\lambda v^3$

Answer:

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13. Water flows steadily through a horizontal pipe of a variable cross-section. If the pressure of water is p at a point where the velocity of

flow is v, what is the pressure at another point where the velocity of flow is 2v, ρ being the density of water?

A. $\rho - \frac{3}{2}\rho v^2$

B. $\rho + \frac{3}{2}\rho v^2$

C. $\rho - 2\rho v^2$

D. $\rho + 2\rho v^2$

Answer:

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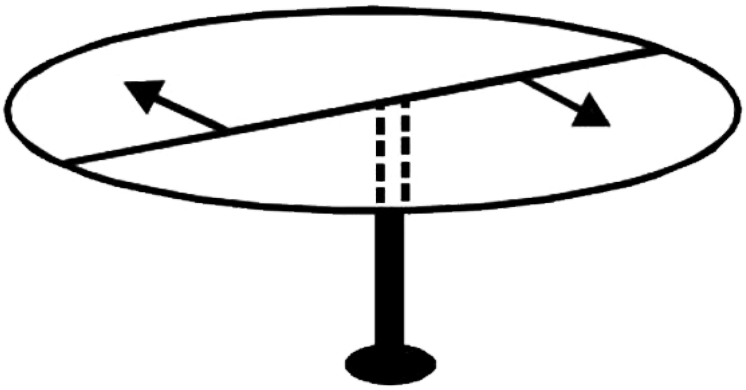
14. A horizontal circular platform of radius 0.5 m and mass axis. Two massless spring toy-guns, each carrying a steel ball of mass 0.05 kg are attached to the platform at a distance 0.25m from the centre on its either sides along its diameter (see figure). Each gun simultaneously fires the balls horizontally and perpendicular to the diameter in opposite directions. After leaving the platform, the balls have horizontal speed of $9ms^{-1}$ with respect to the ground. The rotational speed of the platform in $rads^{-1}$ after the balls leace the

platform is



A. 2

B. 3

C. 5

D. 4

Answer:

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15. An ideal gas is expanding such that $PT^2 =$ constant. The coefficient of volume expansion of lthe gas is:

A. $\frac{1}{T}$

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

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

D. $\frac{4}{T}$

Answer:

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16. A wall is made of equally thick layers A and B of different matierals. Thermal conduvtivity of A is twice that of B. In the stedy state, the temperature difference across the wall is $36^\circ C$. The temperature difference across the layer A is

A. $6^\circ C$

B. $12^\circ C$

C. $18^\circ C$

D. $24^\circ C$

Answer:

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17. A particle performs SHM in a straight line. In the first second, starting from rest, it travels a distance a and in the next second it travels a distance b in the same direction. The amplitude of the SHM is

A. a-b

B. $\frac{(2a-b)}{3}$

C. $\frac{2a^2}{(3a-b)}$

D. None of these

Answer:

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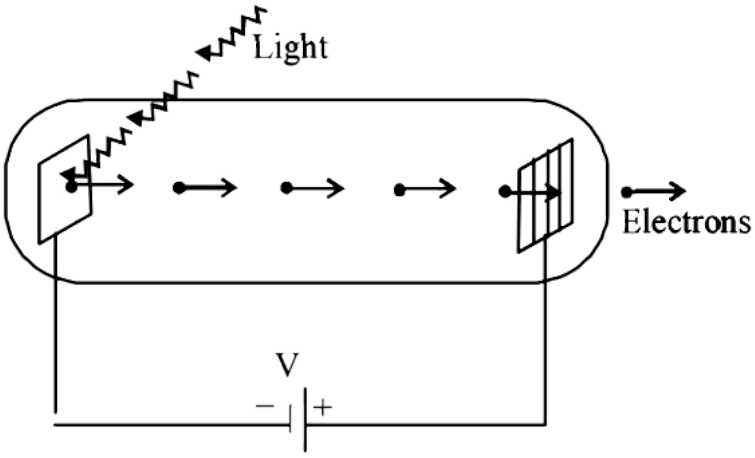
18. Light of wavelength λ_{ph} falls on a cathode plate inside a vacuum tube as shown in the figure .The work function of the cathode surface is ϕ and the anode is a wire mesh of

conducting material kept at distance d from the cathode. A potential different V is maintained between the electrodes. If the minimum de Broglie wavelength of the electrons passing through the anode is λ_e which of the following statement (s) is (are) true?



A. λ_e decreases with increase in ϕ and λ_{ph}

B. λ_e is approximately halved, if d is doubled

C. For large potential difference $(V >> \phi/e), \lambda_e$ is approximately halved if V is made four times

D. λ_e increases at the same rate as λ_{ph} for $\lambda_{ph} < hc/\phi$

Answer:

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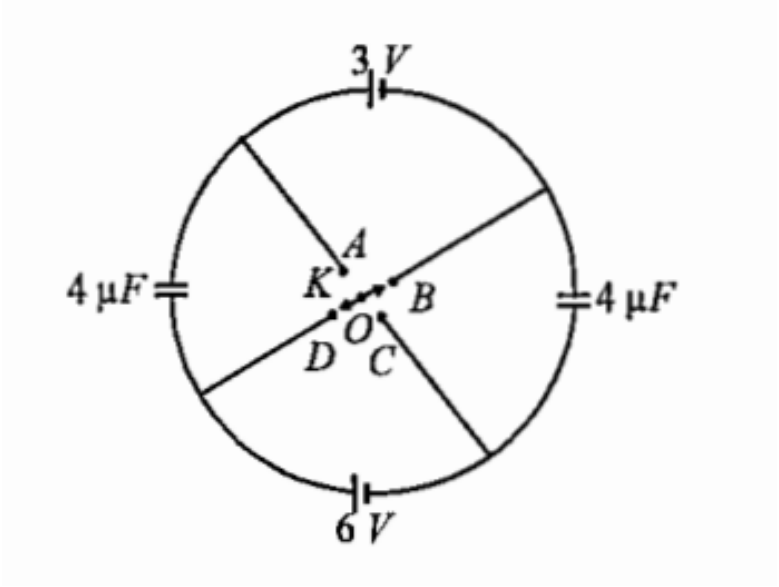
19. In figure, there is a four way key at the middle.If key is shown from situation BD to AD,then how much charge will flow through point O?



A. $24\mu C$

B. $36\mu C$

C. $72\mu C$

D. $12\mu C$

Answer:

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20. A solid square plate is spun around different axes with the same angular speed. In which of the following choice of axis of rotation will the kinetic energy of the plate be the largest?

A. Through the centre, normal to the plate

B. Along one of the diagonals of the plate

C. Along one of the edges of the plate

D. Through one corner normal to the plate

Answer:

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21. Water stands at a depth H in a tank whose side walls are vertical. A hole is made in one of the walls at a height h below the water

surface. The stream of water emerging from the hole strikes the floor at a distance R from the tank, where R is given by

A. $R = \sqrt{h(H-h)}$

B. $R = \sqrt{h(H+h)}$

C. $R = 2\sqrt{h(H-h)}$

D. $R = 2\sqrt{h(H+h)}$

Answer:

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