PHYSICS

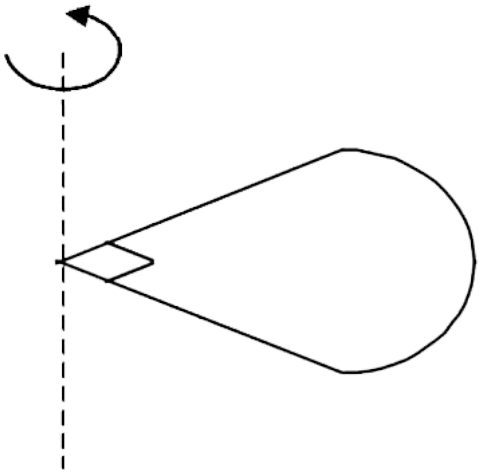
BOOKS - KVPY PREVIOUS YEAR

MOCK TEST 5

Exercise

1. One quarter sector is cut from a uniform circular disc of radius R. This sector has mass M. it is made to rotate about a line

perpendicular to its plane and passing through the center of the original disc. Its moment of inertia about the axis of rotation is



A. $\frac{1}{2}MR^2$

B. $\frac{1}{4}MR^2$

C. $\frac{1}{8}MR^2$

D. $\sqrt{2}MR^2$

Answer:

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2. A gaseous mixture enclosed in a vessel consists of one gram mole of a gas A with $\gamma = \left(\frac{5}{3}\right)$ and some amount of gas B with $\gamma = \frac{7}{5}$ at a temperature T.

The gases A and B do not react with each other and are assumed to be ideal. Find the number of gram moles of the gas B if γ for the gaseous mixture is $\left(\frac{19}{13}\right)$.

A. 3

B. 2

C. 4

D. 6

Answer:

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3. v31

A. $\frac{2mu\varepsilon_0 \sin\alpha}{q\sigma}$

B. $\frac{mu\varepsilon_0 \sin\alpha}{q\sigma}$

C. $\frac{mu\varepsilon_0 \sin\alpha}{2q\sigma}$

D. $\frac{mu\varepsilon_0 \sin\alpha}{4q\sigma}$

Answer:

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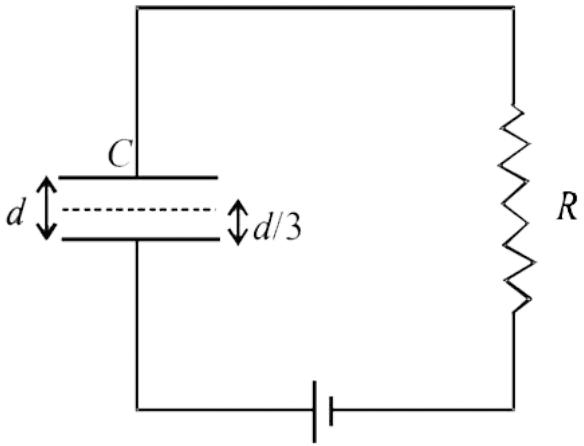
4. A parallel plate capacitor C with plates of unit area and separation d is filled with a liquid of dielectric constant $K = 2$. The level of liquid is $d/3$ initially. Suppose the liquid

level decreases at a constant speed v, the time constant as a function of time t is-



A. $\frac{6 \in_0 R}{5d + 3vt}$

B. $\frac{(15d + 9vt) \in_0 R}{2d^2 - 3dvt - 9v^2t^2}$

C. $\frac{6 \in_0 R}{5d - 3vt}$

D. $\frac{(15d - 9vt) \in_0 R}{2d^2 + 3dvt - 9v^2t^2}$

Answer:

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5. A vessel of volume V is evacuated by means of a piston air pump. One piston stroke captures the volume v_0. The pressure in the vessel is to be reduced to $\left(\frac{1}{n}\right)$ of its original pressure ,P_0. If the process is assumed to be isothermal and air is considered an ideal gas, the number of strokes needed in the process is

A. $\left[\frac{\ell nn}{\ell n\left(1-\frac{v_0}{V}\right)}\right]$

B. $\left[\frac{\ell nn}{\ell n\left(1+\frac{v_0}{V}\right)}\right]$

C. $\left[\frac{\ell n\left(1-\frac{v_0}{V}\right)}{\ell n}\right]$

D. None of these

Answer:

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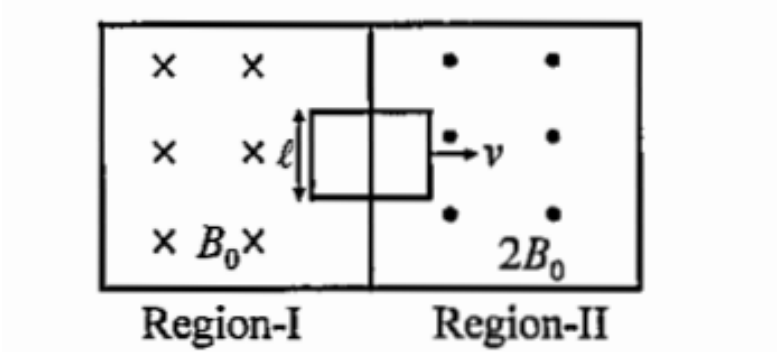
6. A conducting loop is being pulled with speed v from region I of magnetic field to region II. If resistance of the loop is R, current induced in the loop at the instant shown is



A. $\frac{B_0 \ell v}{R}$, clockwise

B. $\frac{B_0 \ell v}{R}$, anticlockwise

C. $\frac{3B_0 \ell v}{R}$, clockwise

D. $\frac{3B_0\ell v}{R}$,anticlockwise

Answer:

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7. The current transfer ratio β of a transistor is 50. The input resistance of the transistor when used in common emitter mode is 1 kilo ohm. The peak value of the collector alternating current for an input peak voltage of 0.01 volt is

A. 100 μA

B. .01mA

C. 500 μA

D. 25mA

Answer:

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8. A metre long narrow bore held horizontally (and close at one end) contains a 76 cm long mercury thread, which traps a 15 cm column of

air. What happens if the tube is held vertically with the open end at the bottom?

A. 23.8 cm of mercury flows out

B. 27.8 cm of mercury flows out

C. 32.8 cm of mercury flows out

D. None of these

Answer:

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9. A thin uniformring of radius R carrying uniform charge Q and mass M rotates about its axis with angular velocity ω. The ratio of its magnetic moment and angular momentum is:

A. $\frac{Q}{M}$

B. $\frac{M}{Q}$

C. $\frac{Q}{2M}$

D. $\frac{M}{2Q}$

Answer:

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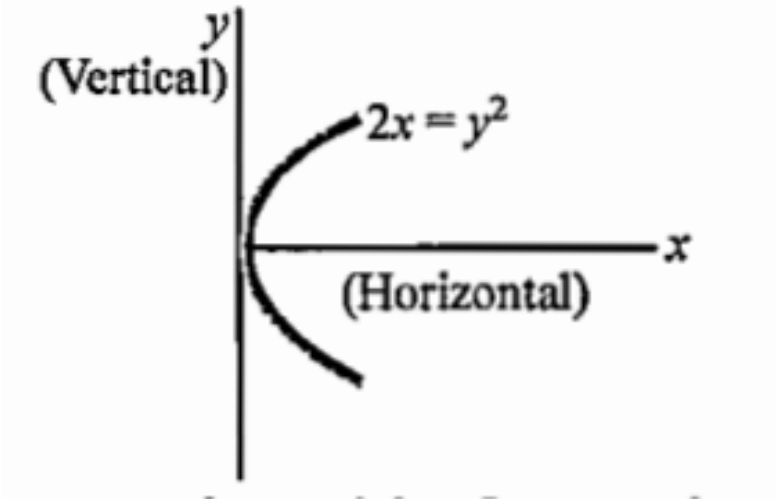
10. The reflecting surface is represented by the equation $2x = y^2$ as shown in the figure. A ray travelling horizontal becomes vertical after reflection. The co-ordinates of the point of incidence are



A. (1/2,1)

B. (1,1/2)

C. (1/2, 1/2)

D. none

Answer:

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11. The potential energy of a particle of mass m is given by $U(x)\begin{cases} E_0 & 0 \leq x < 1 \\ 0 & x > 1 \end{cases}$

λ_1 and λ_2 are the de-Broglie wavelength of the particle, when $0 \leq x \leq 1$ and $x > 1$ respectively. If the total energy of particle is $2E_0$, then the ratio $\frac{\lambda_1}{\lambda_2}$ will be

A. 2

B. 1

C. $\sqrt{2}$

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

Answer:

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12. A cylinder rolls up an inclined plane, reaches some height, and then rolls down (without slipping throughout these motions). The directions of the frictional force acting on the cylinder are.

A. up the incline while ascending and down the incline descending.

B. up the incline while ascending as well as descending.

C. down the incline while ascending and up the incline while descending.

D. down the incline while ascending as well as descending.

Answer:

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13. The escape velocity of a body on the Earth's surface is v_e. A body is thrown up with a speed $\sqrt{5}v_e$. Assuming that the Sun and planets do

not influence the motion of the body,the velocity of the body at infinite distance is v_∞ .Then, the value of $\frac{v_\infty}{v_e}$ is

A. zero

B. 1

C. 2

D. 3

Answer:

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14. A $10kW$ drilling machine is used to drill a bore in a small aluminium block of mass $8.0kg$. How much is the rise in temperature of the block in 2.5 minutes, assuming $50\,\%$ of power is used up in heating the machine itself or lost to the surrounding? Specific heat of aluminium $= 0.91J/g^\circ C$.

A. $100^\circ C$

B. $103^\circ K$

C. $103^\circ C$

D. $50^\circ C$

Answer:

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15. A strip of wood of length l is placed on a smooth horizontal surface. An insect starts from one end of the strip, walks with constant velocity and reaches the other end in time t_1. It then flies off vertically. The strip moves a further distance l in time t_2.

A. $t_1 = t_2$

B. $t_1 > t_2$

C. $t_1 < t_2$

D. none

Answer:

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16. A wind - powered generator convets and energy into electrical energy . Assume that the generator convents a fixed fraction of the wind energy intercepited by to blades into

electrical energy for wind speed V , the electrical power output will be propertional to

A. v

B. v^2

C. v^3

D. v^4

Answer:

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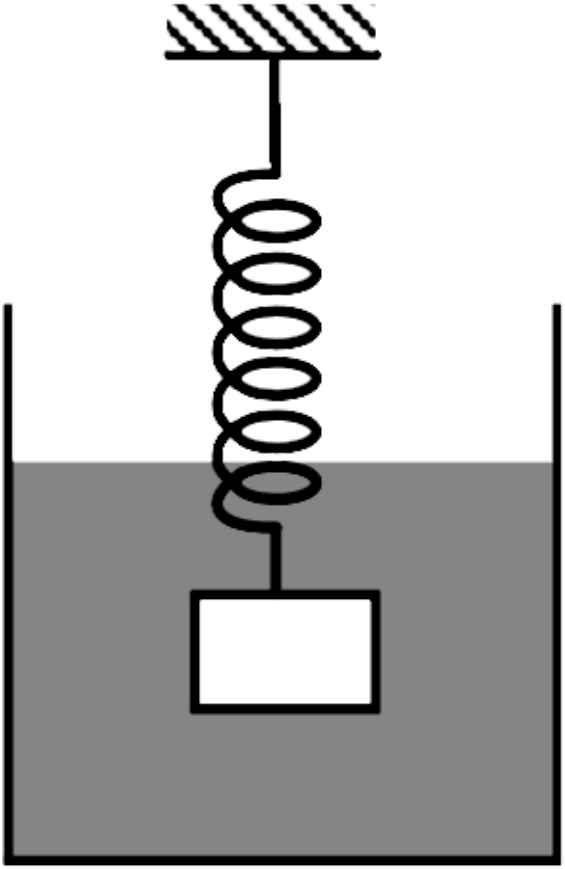
17. An object with uniform density ρ is attached to a spring that is known to stretch linearly with applied force as shown below. When the spring-object system is immersed in a liquid of density ρ_1 as shown in the figure, the spring stretches by an amount $x_1 (\rho > \rho_1)$. When the experiment is repeated in a liquid of density $\rho_2 > \rho_1$, the spring stretches by an amount x_2. Neglecting any buoyant force on

the spring, the density of the object is



A. $\rho = \dfrac{\rho_1 x_1 - \rho_2 x_2}{x_1 - x_2}$

B. $\rho = \dfrac{\rho_1 x_2 - \rho_2 x_1}{x_2 - x_1}$

C. $\rho = \dfrac{\rho_1 x_2 + \rho_2 x_1}{x_1 + x_2}$

D. $\rho = \dfrac{\rho_1 x_1 + \rho_2 x_2}{x_1 + x_2}$

Answer:

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18. A tiny spherical oil drop carrying a net charge q is balanced in still air with a vertical uniform electric field of strength $\dfrac{81\pi}{7} \times 10^5 Vm^{-1}$. When the field is switched off, the drop is observed to fall with terminal

velocity $2 \times 10^{-3} ms^{-1}$. Given $g = 9.8 ms^{-2}$, viscoisty of the air $= 1.8 \times 10^{-5} Nsm^{-2}$ and the denisty of oil $= 900 kgm^{-3}$, the magnitude of q is

A. $1.6 \times 10^{-19} C$

B. $2.2 \times 10^{-19} C$

C. $4.8 \times 10^{-19} C$

D. $8.0 \times 10^{-19} C$

Answer:

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19. The flow of blood in a large artery of an anaeshetized dog is diverted through a venturimeter. The wider part of the meter has a cross sectional area equal to that of the artery i.e. $8mm^2$. The narrower parts has an are $4mm^2$. The pressure dorp in the artery is $24Pa$. what is the speed of the blood in the artery ? Given that density of the blood = $1.06 \times 10^3 kg/m^3$

A. 0.5m/s

B. 0.125m/s

C. 1.25m/s

D. 2.5m/s

Answer:

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