PHYSICS

BOOKS - KVPY PREVIOUS YEAR

MOCK TEST 10

Exercise

1. A uniform rod of density ρ is placed in a wide tank containing a liquid of density $\rho_0 (\rho_0 > \rho)$. The depth of liquid in the tank is

half the length of the rod. The rod is in equilibrium, with its lower end resting on the bottom of the tank. In this position the rod makes an angle θ with the horizontal.

A. $\frac{1}{2}\sqrt{\frac{\sigma}{\rho}}$

B. $\frac{1}{2}\frac{\sigma}{\rho}$

C. $\sqrt{\frac{\rho}{\sigma}}$

D. $\sqrt{\frac{\sigma}{\rho}}$

Answer:

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2. A plano convex lens of refractive index 1.5 and radius of curvature 30cm. Is silvered at the curved surface. Now this lens has been used to form the image of an object. At what distance from this lens an object be placed in order to have a real image of size of the object.

A. 20cm

B. 30 cm

C. 60cm

D. 80cm

Answer:

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3. A micture of light, consisting of wavelength 590nm and an unknown wavelength, illuminates Young's double slit and gives rise to two overlapping interference patterns on the scree. The central maximum of both lights coincide. Further, it is obseved that the third bright fringe of known light coincides with the 4th bright fringe of the unknown light. From

this data, the wavelength of the unknown light is:

A. 393.4nm

B. 885.0nm

C. 442.5nm

D. 776.8nm

Answer:

4. A diatomic ideal gas is used in a Carnot engine as theworking substance. If during the adiabatic expansion part of the cycle the volume of the gas increases from V to 32 V, the efficiency of the engine is

A. 0.5

B. 0.75

C. 0.99

D. 0.25

Answer:

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5. A very long (length L) cylindrical galaxy is made of uniformly distributed mass and has radius R $(R << L)$ A star outside the galaxy is orbiting the galaxy in a plane perpendicular to the galaxy and passing through its centre. If the time period of star is T and its distance from the galaxy's axis is r, then-

A. $T \propto r$

B. $T \propto \sqrt{r}$

C. $T \propto r^2$

D. $T^2 \propto r^3$

Answer:

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6. A point source of constant power P is emitting photon of wavelength λ. What is the intensity of photons at r distance from the source ?(speed of light = c)

A. $\frac{P\lambda}{2\pi r^2 hc}$

B. $\frac{P\lambda}{4\pi r^2 hc}$

C. $\frac{P\lambda}{hc}$

D. $\frac{P\lambda}{r^2 hc}$

Answer:

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7. A car,starting from rest, accelerates at the rate f through a distance s, then continuous at constant speed for time t and then

decelerates at the rate $\frac{f}{2}$ come to rest. If the total distance traversed is 5 s,then :

A. $s = \frac{1}{4}ft^2$

B. $s = \frac{1}{2}ft^2$

C. $s = \frac{1}{6}ft^2$

D. $s = ft$

Answer:

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8. A barometer kept in an elevator accelerating upward reads 76 cm. The air pressure in the elevator is

A. equal to 76 cm of Hg

B. less than 76 cm of Hg

C. greater than 76 cm of Hg

D. zero

Answer:

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9. The binding energy of deuteron $._1^2 H$ is $1.112 MeV$ per nucleon and an $\alpha -$ particle $._2^4 He$ has a binding energy of $7.047 MeV$ per nucleon. Then in the fusion reaction $._1^2 H + ._1^2 h \rightarrow ._2^4 He + Q$, the energy Q released is.

A. 1 MeV

B. 11.9MeV

C. 23.8MeV

D. 931MeV

Answer:

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10. The magnetic field in a region is given by $B = B_0\left(1 + \frac{x}{a}\right)\hat{k}$.A square loop of edge-length d is placed with its edges along the x and y-axes. The loop is moved with a constant velocity $v = v_0\hat{i}$.The emf induced in the loop is:

A. zero

B. $v_0 B_0 d$

C. $\frac{v_0 B_0 d^3}{a^2}$

D. $\frac{v_0 B_0 d^2}{a}$

Answer:

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11. An ideal Black-body at room temperature is thrown into a furnace. It is observed that

A. Initially it is the darkest body and at later timesthe brightest

B. It is the darkest body at all times

C. It cannot be distinguished at all times

D. Initially it is the darkest body and at later times it cannot be distinguished

Answer:

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12. A particle of charge q and mass m starts moving from the origin under the action of an electric field $\overrightarrow{E} = E_0\hat{i}$ and $\overrightarrow{B} = B_0\hat{i}$ with velocity $\overrightarrow{v} = v_0\hat{j}$. The speed of the particle will become $2v_0$ after a time

A. $t = \dfrac{2mv_0}{qE}$

B. $t = \dfrac{2Bq}{mv_0}$

C. $t = \dfrac{\sqrt{3}Bq}{mv_0}$

D. $t = \dfrac{\sqrt{3}mv_0}{qE}$

Answer:

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13. A train has just completed a U-curve in a trach which is a semi circle. The engine is at the forward end of the semi circular part of the trach while the last carriage is at the rear end of the semi circular track. The driver blows a whistle of frequency 200 Hz. Velocity of sound is $340\frac{m}{s}$. Then the apparent frequency as observed by a passenger in the middle of the train, when the speed of the train is 30 m/s, is

A. 209Hz

B. 288Hz

C. 200Hz

D. 181Hz

Answer:

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14. Four person K,L,M and N are initally at the corners of a square of side of length d. If every person starts moving, such that K always

heads towards L, L heads towards M, M heads directly towards N and N heads towards K, then the four perons will meet after

A. $\frac{d}{v}\sec$

B. $\frac{\sqrt{2}d}{v}\sec$

C. $\frac{d}{\sqrt{2}v}\sec$

D. $\frac{d}{2v}\sec$

Answer:

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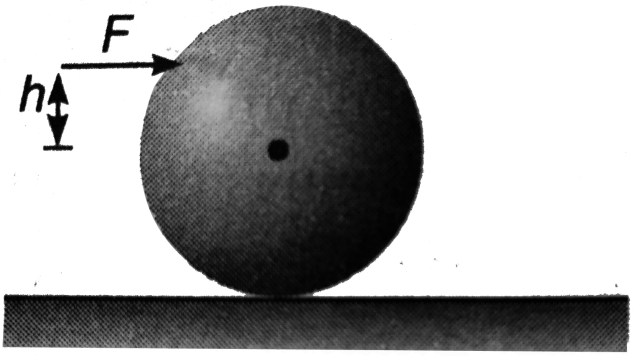

15.

A billiard ball, initially at rest, is given a sharp impulse by a cue. The cue is held horizontally a distance h above the centre line as shown in figure. The ball leaves the cue with a speed v_0 and because of its backward slipping eventually acquires a final

speed $\frac{9}{7}v_0$ show that $h = \frac{4}{5}R$

Where R is the radius of the ball.

A. R/5

B. 5R/4

C. 4R/5

D. R/4

Answer:

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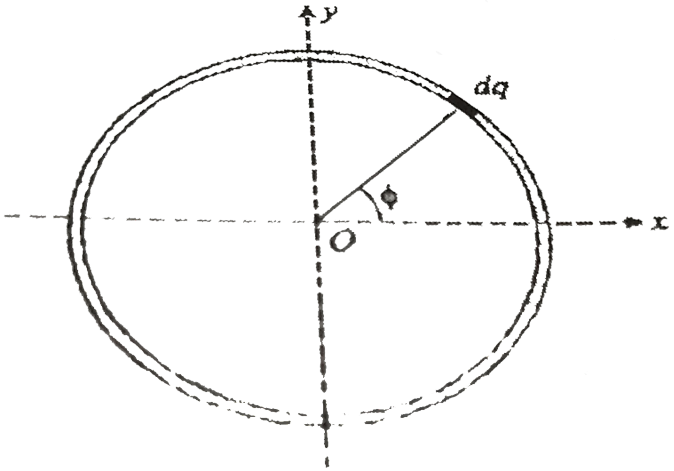
16. A thin non-conducting ring or radius a has a linear charge density $\lambda = \lambda_0 \sin\phi$. A uniform electric field $E_0\hat{i} + E_0\hat{j}$ exist in the region . .Net torque acting on ring is given as :



A. $E_0\sqrt{2}\pi a^2\lambda_0$

B. $E_0\pi a^2\lambda_0$

C. $2E_0\pi a^2\lambda_0$

D. zero

Answer:

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17. A particle of mass m undergoes oscillations about x = 0 in a potential given by $V(x) = \frac{1}{2}kx^2 - v_0\cos\left(\frac{x}{a}\right)$, where V_0,K,a are constants. If the amplitude of oscillation is

much smaller than a, the time period is given by-

A. $2\pi\sqrt{\frac{ma^2}{ka^2+V_0}}$

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

C. $2\pi\sqrt{\frac{ma^2}{V_0}}$

D. $2\pi\sqrt{\frac{ma^2}{ka^2-V_0}}$

Answer:

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18. A carpet of mass M is rolled along its length so as to from a cylinder of radius R and is kept on a rough floor. When a negligibly small push is given to the cylindrical carpet, it stars unrolling itself without sliding on the floor. Calculate horizontal velocity of cylindrical part of the carpet when its radius reduces to $R/2$.

A. $\sqrt{\frac{14}{3}gR}$

B. $\sqrt{\frac{3}{14}gR}$

C. $\sqrt{\frac{4}{3}gR}$

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

Answer:

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19. The angle substanded by the first diffraction minimum for a point source viewed in the hydrogen line at 1420 MHz with a radio telescope having an aperture of 25 m is:

A. 0.8°

B. 0.64°

C. 1.2°

D. 2.2°

Answer:

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20. A simple pendulum is hanging from a peginserted in a vertical wall. Its bob is strteched to horizontal position form wall and left freee to move, the bob hits the wall. If

coefficient of restitution is $\frac{2}{\sqrt{5}}$. After how many collisions the amplitude of vibration will becomes less then 60°.

A. 6

B. 3

C. 4

D. 5

Answer:

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