PHYSICS

BOOKS - DISHA PUBLICATION PHYSICS (HINGLISH)

JEE MAINS- 2019 (HELD ON :9TH APRIL 2019 (SHIFT-I))

Questions

1. In the density measurement of a cube, the mass and edge length are measured as (10.00 ± 0.10)kg and $(0.10 \pm 0.01)m$, respectively. The relative error in the measurement of density is:

A. $0.01kg/m^3$

B. $0.10kg/m^3$

C. $0.31kg/m^3$

D. $0.07kg/m^3$

Answer: c

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2. The stream of a river is flowing with a speed of 2 km/h. A swimmer can swim at a speed of 4 km/h. What should be the direction of the swimmer with respect to the flow of the river to cross the river straight?

A. 90°

B. 150°

C. 120°

D. 60°

Answer: c

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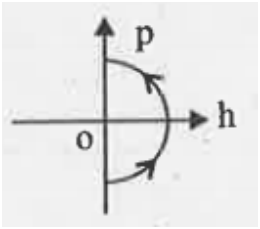
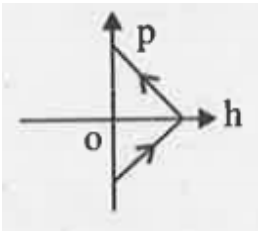
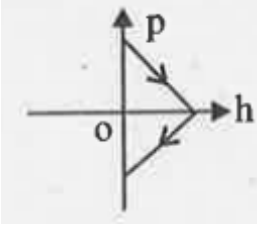
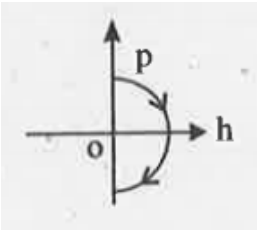
3. A ball is thrown vertically up (taken as + z-axis) from the ground. The correct momentum-height (p-h) diagram is:

A. 

B. 

C. 

D. 

Answer: d

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4. A uniform cable of mass 'M' and length 'L' is placed on a horizontal surface such that its $\left(\frac{1}{n}\right)^{th}$ part is hanging below the edge of the

surface. To lift the hanging part of the cable upto the surface, the work done should be:

A. $\frac{Mgl}{2n^2}$

B. $\frac{Mgl}{n^2}$

C. $\frac{2Mgl}{n^2}$

D. nMgl

Answer: b

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5. A body of mass 2 kg makes an elastic collision with another body at rest and continues to move in the original direction but with one - fourth its original speed . What is the mass of the body it collides with ?

A. 1.0Kg

B. 1.5 kg

C. 1.8 kg

D. 1.2 kg

Answer: d

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6. A stationary horizontal disc is free to rotate about its axis. When a torque is applied on it, its kinetic energy as a function of θ, where θ is the angle by which it has rotated, is given as $k\theta^2$ If its moment of inertia is I then the angular acceleration of the disc is

A. $\frac{k}{4I}\theta$

B. $\frac{k}{I}\theta$

C. $\frac{k}{2I}\theta$

D. $\frac{2k}{I}\theta$

Answer: d

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7. The following bodies are made to roll up (without slipping) the same inclined plane from a horizontal plane : (i) a ring of radius R, (ii) a solid cylinder of radius $\frac{R}{2}$ and (iii) a solid sphere of radius $\frac{R}{4}$ If, in each case, the speed of the center of mass at the bottom of the incline

is same, the ratio of the maximum heights they climb is

A. $4:3:2$

B. $10:15:7$

C. $14:15:20$

D. $2:3:4$

Answer: c

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8. A solid sphere of radius a and mass m is surrounded by cocentric spherical shell of thickness $2a$ and mass $2m$ the gravitational field at a distance 3a from their centres is

A. $\frac{2GM}{9a^2}$

B. $\frac{GM}{9a^2}$

C. $\frac{GM}{3a^2}$

D. $\frac{2GM}{3a^2}$

Answer: c

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9. A capillary tube of radius R is immersed in water and water rises in it a height H. Mass of water in capillary tube is M. If the radius of the tube is doubled, mass of water that will rise in capillary tube will be

A. M

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

C. 4M

D. 2M

Answer: d

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10. Following figure shows two processes A and B for a gas. If ΔQ_A and ΔQ_B are the amount of heat absorbed by the system in two cases, and ΔU_A and ΔU_B are changes in internal energies, respectively, then:

A. $\Delta Q_A < \Delta Q_B, \Delta U_A < \Delta U_B$

B. $\Delta Q_A > \Delta Q_B, \Delta U_A > \Delta U_B$

C. $\Delta Q_A > \Delta Q_B, \Delta U_A = \Delta U_B$

D. $\Delta Q_A = \Delta Q_B, \Delta U_A = \Delta U_B$

Answer: c

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11. For a given gas at 1 atm pressure, rms speed of the molecules is 200 m/s at $127^\circ C$. At 2 atm pressure and at $227^\circ C$, the rms speed of the molecules will be:

A. $100m/s$

B. $80\sqrt{5}m/s$

C. $100\sqrt{5}m/s$

D. $80m/s$

Answer: c

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12. An HCl molecule has rotational, translational and vibrational motions. If the rms velocity of HCl molecules in its gaseous phase is $\vec{v}$, m is

its mass and k_s is Bolzmann constant, then its temperature will be $\frac{mv^2}{nk_B}$, where n is _____ .

A. $\frac{mv^2}{6k_B}$

B. $\frac{mv^2}{3k_B}$

C. $\frac{mv^2}{7k_B}$

D. $\frac{mv^2}{5k_B}$

Answer: a

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13. A simple pendulum oscillating in air has period T. The bob of the pendulum is completely immersed in a non-viscous liquid. The density of the liquid is $\frac{1}{16}th$ of the material of the bob. If the bob is inside liquid all the time, its period of oscillation in this liquid is :

A. $2T\sqrt{\frac{1}{10}}$

B. $2T\sqrt{\frac{1}{14}}$

C. $4T\sqrt{\frac{1}{15}}$

D. $4T\sqrt{\frac{1}{14}}$

Answer: c

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14. The pressure wave, $P = 0.01\sin[1000t - 3x]Nm^{-2}$, corresponds to the sound produced by a vibrating blade on a day when atmospheric temperature is $0^{\circ}C$. On some other day when temperature is T, the speed of sound produced by the same blade and at the same frequency is found to be $336ms^{1}$. Approximate value of T is:

A. $4^\circ C$

B. $11^\circ C$

C. $12^\circ C$

D. $15^\circ C$

Answer: a

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15. A string is clamped at both the ends and it is vibrating in its 4^{th} harmonic. The equation of the stationary wave is

$Y = 0.3\sin(0.157x)\cos(200\pi t)$. The length of the string is: (All quantities are in SI units.)

A. 20m

B. 80m

C. 40m

D. 60m

Answer: b

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16. A system of three charges are placed as shown in the figure:

If $D > \ > d$ the potential energy of the system is best given by

A. $\frac{1}{4\pi\varepsilon_0}\left[\frac{-q^2}{d} - \frac{-qQd}{2D^2}\right]$

B. $\frac{1}{4\pi\varepsilon_0}\left[\frac{-q^2}{d} + \frac{2qQd}{D^2}\right]$

C. $\frac{1}{4\pi\varepsilon_0}\left[\frac{+q^2}{d} + \frac{qQd}{D^2}\right]$

D. $\frac{1}{4\pi\varepsilon_0}\left[\frac{-q^2}{d} - \frac{qQd}{D^2}\right]$

Answer: d

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17. Determine the charge on the capacitor in the following circuit:

A. $60\mu C$

B. 2muC`

C. $10\mu C$

D. $200\mu C$

Answer: d

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18. A capacitor with capacitance $5\mu F$ is charged to $5\mu C$. If the plates are pulled apart to reduce the capacitance to $2\mu F$, how much work is done?

A. 6.25×10^{-6} J

B. 3.75×10^{-6}J

C. 2.16×10^{-6}J

D. 2.55×10^{-6} J

Answer: b

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19. A wire of resistance R is bent to form a square ABCD as shown in the figure. The effective resistance between E and C is: (E is mid-point of arm CD)

A. R

B. $\frac{7}{64}R$

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

D. $\frac{1}{16}R$

Answer: b

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20. A rectangular coil (Dimension $5cm \times 2.5cm$) with 100 turns, carrying a current of A in the origin and in the X-Z plane. A magnetic field of 1 T is applied along X-axis. If the coil is tilted

through 45° about Z-axis, then the torque on the coil is :

A. 0.38 Nm

B. 0.55 Nm

C. 0.42 Nm

D. 0.27 Nm

Answer: d

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21. A rigid square of loop of side 'a' and carrying current I_2 is lying on a horizontal surface near a long current I_1 carrying wire in the same plane as shown in figure. The net force on the loop due to the wire will be:

A. Repulsive and equal to $\frac{\mu_0 I_1 I_2}{2\pi}$

B. Attractive and equal to $\frac{\mu_0 I_1 I_2}{3\pi}$

C. Repulsive and equal to $\frac{\mu_0 I_1 I_2}{4\pi}$

D. Zero

Answer: c

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22. A moving coil galvanometer has resistance 50Ω and it indicates full deflection at 4 mA current. A voltmeter is made using this galvanometer and a $5k\Omega$ resistance. The maximum voltage, that can be measured using this voltmeter (in volts) will be _____.

A. 40 V

B. 15 V

C. 20V

D. 10V

Answer: c

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23. The total number of turns and cross-section area in a solenoid is fixed. However, its length L is varied by adjusting the separation between

windings. The inductance of solenoid will be proportional to:

A. L

B. L^2

C. $\frac{1}{L^2}$

D. $\frac{1}{L}$

Answer: d

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24. The magnetic field of a plane electromagnetic wave is given by: $\overrightarrow{B} = B_0\hat{i} - [\cos(kz - \omega t)] + B_1\hat{j}\cos(kz + \omega t)$ where $B_0 = 3 \times 10^{-5}T$ and $B_1 = 2 \times 10^{-6}T$. The rms value of the force experienced by a stationary charge $Q = 10^{-4}C$ at $z = 0$ is close to:

A. 0.6N

B. 0.1N

C. 0.9N

D. $3 \times 10^{-2}N$

Answer: a

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25. A signal $A\cos\omega t$ is transmitted using $v_0\sin\omega_0 t$ modulated (AM) signal is:

A. $$v_0\sin\omega_0 t+\frac{A}{2}\sin(\omega_0-\omega)t+\frac{A}{2}(\omega_0+\omega)t$$

B. $v_0\sin[\omega_0(1+0.01A\sin\omega t)t]$

C. $v_0\sin\omega_0 t+A\cos\omega t$

D. $(v_0+A)\cos\omega t\sin\omega_0 t$

Answer: a

26. A concave mirror used for face viewing has focal length of $0.4m$. The distance at which you hold the mirror from your face in order to see your image upright with a magnification of 5 is _____ (in m).

A. $0.24m$

B. 1.60 m

C. 0.32 m

D. 0.16 m

Answer: c

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27. The figure shows a Young's double slit experimental setup. It is observed that when a thin transparent sheet of thickness t and refractive index μ is put in front of one of the slits, the central maximum gets shifted by a

distance equal to n fringe widths. If the wavelength of light used is λ, t will be:

A. $\frac{nD\lambda}{a(\mu-1)}$

B. $\frac{2nD\lambda}{a(\mu-1)}$

C. $\frac{D\lambda}{a(\mu-1)}$

D. $\frac{2D\lambda}{a(\mu-1)}$

Answer:

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28. The electric field of light wave is given as $\overrightarrow{E} = 10^{-3}\cos\left(\frac{2\pi x}{5\times 10^{-7}} - 2\pi\times 6\times 10^{14}t\right)\widehat{x}\frac{N}{C}$. This light falls on a metal plate of work function 2 eV. The stopping potential of the photo-electrons is:

Given, E (in eV) $= \frac{12375}{\lambda(\text{in}\text{Å})}$

A. 2.0 V

B. 0.48 V

C. 0.72 V

D. 2.48 V

Answer: c

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29. Taking the wavelength of first Balmer line in hydrogen spectrum ($n = 3$ to $n = 2$) as 660 nm, the wavelength of the 2^{nd} Balmer line ($n = 4$ to $n = 2$) will be:

A. 889.2 nm

B. 488.9 nmn

C. 642.7 nm

D. 388.9 nm

Answer: b

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30. An NPN transistor is used in common emitter configuration as an amplifier with $1k\Omega$ load resistance. Signal voltage of 10 mV is applied across the base-emitter. This produces a 3 mA change in the collector current and $15\mu A$ change in the base current of the amplifier. The input resistance and voltage gain are:

A. $0.33k\Omega$, 1.5

B. $0.67k\Omega$, 300

C. $0.67k\Omega$, 200

D. $0.33k\Omega$, 300

Answer: b

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