PHYSICS

BOOKS - BITSAT GUIDE

QUESTION-PAPERS-2016

Physics

1. What should be the velocity of earth due to rotation about its own axis so that the weight

at equator become 3/5 of initial value. Radius of earth on equator is 6400 km

A. 8.7×10^{-1} rad/s

B. 7.8×10^{-4} rad/s

C. 6.7×10^{-4} rad/s

D. 7.4×10^{-3} rad/s

Answer: B

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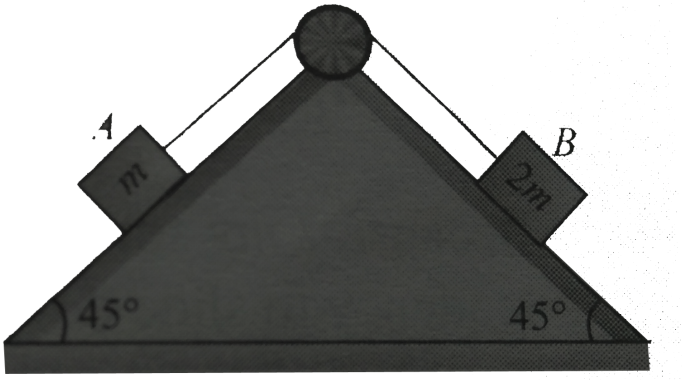
2. Block A of mass m and block B of mass $2m$ are placed on a fixed triangular wedge by means of a light and inextensible string and a frictionless pulley as shown in fig . The wedge is inclined at 45° to the horizontal on both sides . The coefficient of friction between the block $A$and the wedge is $2/3$ and that between the block B and the wedge is $1/3$ .If the system of A and B is released from rest then find .

a. the acceleration of A

b. tension in the string

c.the magnitude and direction of the frictional force acting on A



A. $-1ms^{-2}$

B. $1.2ms^{-2}$

C. $0.2ms^{-2}$

D. zero

Answer: D

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3. The surface charge density of a thin charged disc of radius R is σ. The value of the electric field at the centre of the disc is $\frac{\sigma}{2 \in_o}$. With respect to the field at the centre, the electric field along the axis at a distance R from the centre of the disc reduces by

A. reduces by 70.7%

B. reduces by 29.3%

C. reduces by 9.7%

D. reduces by 14.6%

Answer: A

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4. The molecules of a given mass of a gas have rms velocity of $200m/sat27^\circ C$ and $1.0 \times 10^5 N/m_2$ pressure. When the temperature and pressure of the gas are respectively

$127^\circ C$ and $0.05 \times 10^5 Nm^{-2}$, the rms velocity of its molecules in ms^{-1} is

A. $100\sqrt{2}$

B. $\frac{400}{\sqrt{3}}$

C. $\frac{100\sqrt{2}}{3}$

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

Answer: B

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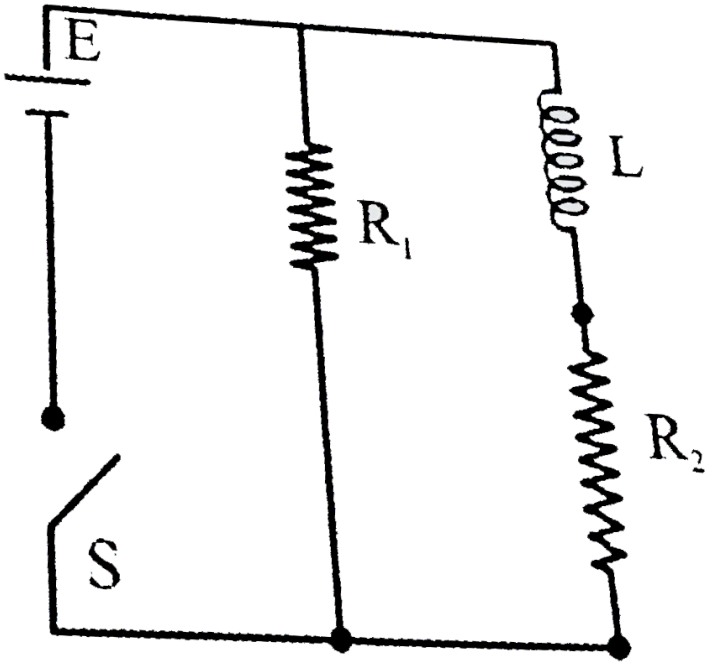
5. An inductor of inductance L = 400 mH and resistors of resistance $R_1 = 2\Omega$ and $R_2 = 2\Omega$ are connected to a battery of emf 12 V as shown in the figure. The internal resistance of the battery is negligible. The switch S is closed at $t = 0$. The potential drop across L as a

function of time is



A. $\frac{12}{t}e^{-3t}V$

B. $6\left(1-e^{-t/0.2}\right)V$

C. $12e^{-5t}V$

D. $6e^{-5t}V$

Answer: C

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6. Two wires are made of the same material and have the same volume. However wire 1 has cross-sectional area A and wire 2 has cross-sectional area 3A. If the length of wire 1 increases by Δx on applying force F, how much force is needed to stretch wire 2 by the same amount?

A. 4F

B. 6F

C. 9F

D. F

Answer: C

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7. 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. $5:4$

C. $25:8$

D. $8:25$

Answer: D

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8. A biconvex lens has a radius of curvature of magnitude $20cm$. Which one of the following options describes best the image formed of an object of height $2cm$ place $30cm$ from the lens ?

A. Virtual, upright, height = 1 cm

B. Virtual, upright, height = 0.5 cm

C. Real, inverted, height = 4 cm

D. Real, inverted, height = 1cm

Answer: C

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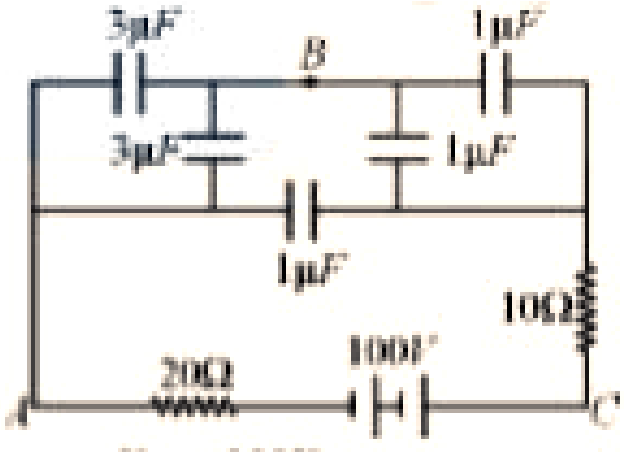
9. In the figure below, what is the potential difference between the point A and B and between B and C respectively in steady state



A. $V_{AB} = V_{BC} = 100V$

B. $V_{AB} = 75V, V_{BC} = 25V$

C. $V_{AB} = -25V, V_{BC} = -75V$

D. $V_{AB} = V_{BC} = 50V$

Answer: C

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10. A radioactive element X converts into another stable element Y. Half-life of X is $2h$. Initially, only X is present. After time t, the

ratio of atoms of X and Y is found to be $1:4$

Then t in hours is .

A. 2

B. 4

C. between 4 and 6

D. 6

Answer: C

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11. The approximate depth of an ocean is 2700 m. The compressibility of water is $45.4 \times 10^{-11} Pa^{-1}$ and density of water is $10^3 kg/m^3$. What fractional compression of water will be obtained at the bottom of the ocean ?

A. 1.0×10^{-2}

B. 1.2×10^{-2}

C. 1.4×10^{-2}

D. 0.8×10^{-2}

Answer: B

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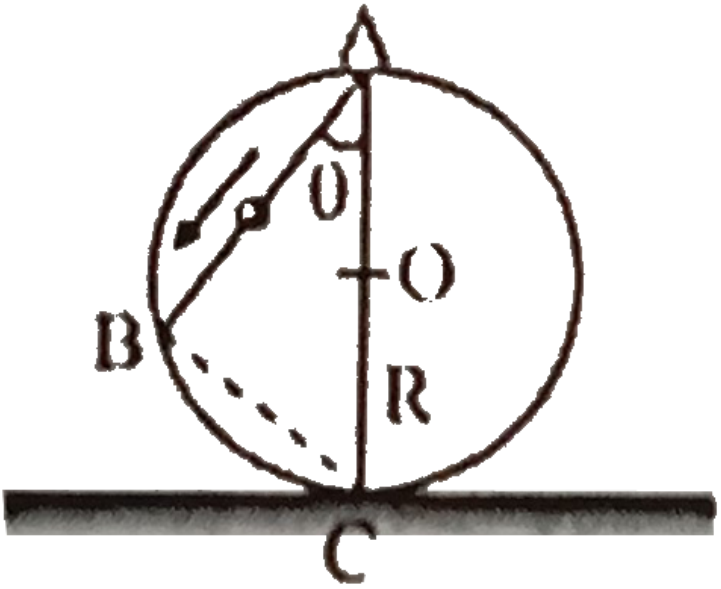
12. A friction wire AB is fixed on a sphere of radius R. A very small spherical ball slips on this wire. The time taken by the ball to slip

from A to B.



A. $\frac{\sqrt{2gR}}{g\cos\theta}$

B. $2\sqrt{gR}.\ \frac{\cos\theta}{g}$

C. $2\sqrt{\frac{R}{g}}$

D. $\frac{gR}{\sqrt{g\cos\theta}}$

Answer: C

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13. A string of length l is fixed at both ends. It is vibrating in its 3^{rd} overtone with maximum amplitude 'a'. The amplitude at a distance l/3 from one end is

A. a

B. 0

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

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

Answer: C

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14. A deutron of kinetic energy 50 keV is describing a circular orbit of radius 0.5 meter in a plane perpendicular to magnetic field $\overrightarrow{B}$. The kinetic energy of the proton that describes a circular orbit of radius 0.5 meter in the same plane with the same $\overrightarrow{B}$ is

A. 25 keV

B. 50 keV

C. 200 keV

D. 100 keV

Answer: D

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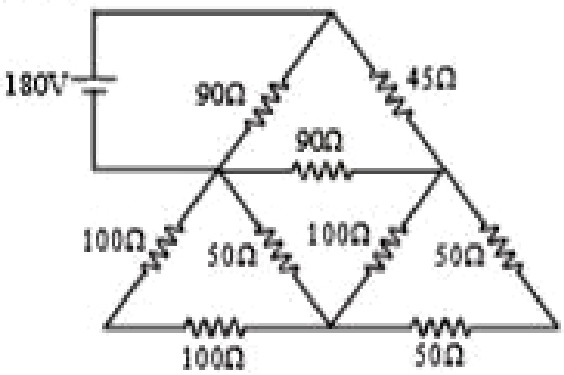
15. In the circuit shown in the figure, find the current in 45Ω



A. 4A

B. 2.5 A

C. 2A

D. None of these

Answer: C

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16. Kepler's third law states that square of period revolution (T) of a planet around the sun is proportional to third power of average distance i between sun and planet i.e. $T^2 = Kr^3$

here K is constant

if the mass of sun and planet are M and m respectively then as per Newton's law of gravitational the force of alteaction between them is $F = \frac{GMm}{r^2}$, here G is gravitational constant. The relation between G and K is described as

A. $GMK = 4\pi^2$

B. $K = G$

C. $K = \frac{1}{G}$

D. $GK = 4\pi^2$

Answer: A

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17. Find the number of photons emitted per second by a 25 W source of monochromatic light of wavelength 6600Å. What is the

photoelectric current assuming 3% efficiency for photoelectric effect. Given $h = 6.6 \times 10^{-34} Js$.

A. $\frac{25}{3} \times 10^{19}$ J, 0.4 amp

B. $\frac{25}{4} \times 10^{19}$ J, 6.2 amp

C. $\frac{25}{2} \times 10^{19}$ J, 0.8 amp

D. None of these

Answer: A

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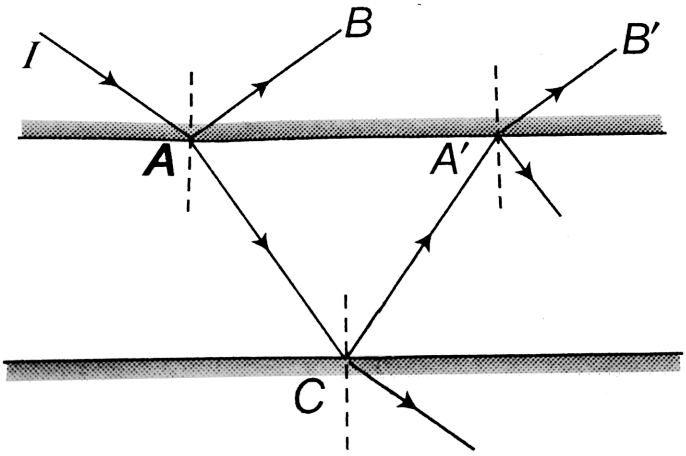
18. A ray of light intensity I is incident on a parallel glass-slab at a point A as shown in figure. It undergoes partial reflection and refraction. At each reflection $25\,\%$ of incident energy is reflected. The rays AB and $A'B'$ undergo interference. The ratio $I_{\max}\,/\,I_{\min}$ is



A. $49:1$

B. $7:1$

C. $4:1$

D. $8:1$

Answer: A

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19. A capillary tube of radius r is immersed vertically in a liquid such that liquid rises in it to height h (less than the length of the tube). Mass of liquid in the capillary tube is m. If

radius of the capillary tube is increased by 50%, then mass of liquid that will rise in the tube, is

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

B. m

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

D. $\frac{9}{4}m$

Answer: C

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20. The drift velocity of electrons in silver wire with cross-sectional area $3.14 \times 10^{-6} m^2$ carrying a current of 20 A is. Given atomic weight of Ag = 108, density of silver = $10.5 \times 10^3 kg/m^3$

A. 2.798×10^{-4} m/sec

B. 67.98×10^{-4} m/sec

C. 0.67×10^{-4} m/sec

D. 6.798×10^{-9} m/sec

Answer: D

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21. A parallel plate capacitor of area 'A' plate separation 'd' is filled with two dielectrics as shown. What is the capacitance of the arrangement ?

A. $\frac{3K\varepsilon_0 A}{4d}$

B. $\frac{4K\varepsilon_0 A}{3d}$

C. $\frac{(K+1)\varepsilon_0 A}{2d}$

D. $\frac{K(K+3)\varepsilon_0 A}{2(K+1)d}$

Answer: D

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22. In the Young's double-slit experiment,the intensity of light at a point on the screen where the path difference is λ is K (λ being the wave length of light used).The intensity at a point where the path difference is $\frac{\lambda}{4}$, will be

A. K

B. K/4

C. K/2

D. Zero

Answer: C

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23. The mass of ${}_7N^{15}$ is 15.00011 amu, mass of ${}_8O^{16}$ is 15.99492 amu and $m_P = 1.00783$ amu. Determine binding energy of last proton of

A. $2.13MeV$

B. $0.13MeV$

C. $10MeV$

D. $12.13MeV$

Answer: D

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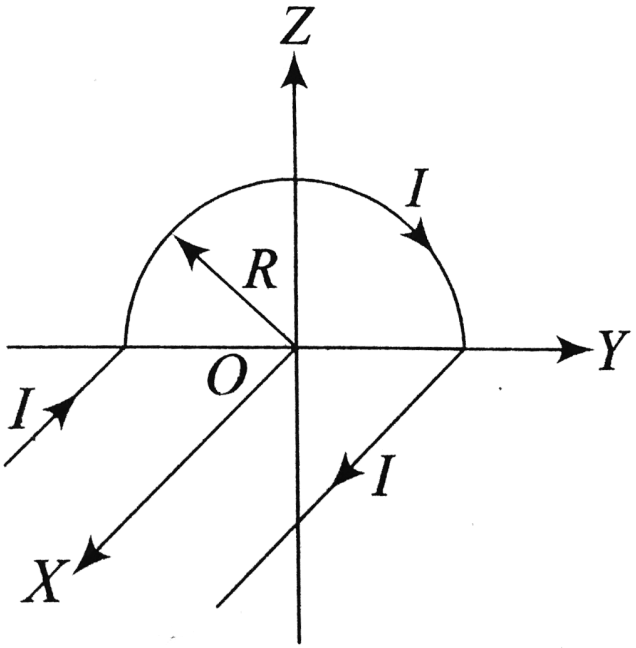
24. A wire carrying current I has the shape as shown in the adjoining figure. Linear parts of the wire are very long and parallel to X-axis

while semicicular portion of radius R is lying in $Y-Z$ plane. Magnetic field at point O is



A. $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}\left(\mu\hat{i} \times 2\hat{k}\right)$

B. $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}\left(\mu\hat{i} + 2\hat{k}\right)$

C. $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} - 2\hat{k}\right)$

D. $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} + 2\hat{k}\right)$

Answer: B

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25. A stone projected with a velocity u at an angle (theta)with the horizontal reaches maximum heights H_1. When it is projected with velocity u at an angle $\left(\frac{\pi}{2} - \theta\right)$ with the horizontal, it reaches maximum height H_2. The

relations between the horizontal range R of the projectile, H_1 and H_2, is

A. $R = 4\sqrt{H_1 H_2}$

B. $R = 4(H_1 - H_2)$

C. $R = 4(H_1 + H_2)$

D. $R = \frac{H_1^2}{H_2^2}$

Answer: A

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26. If the series limit wavelength of the Lyman series for hydrogen atom is 912Å, then the series limit wavelength for the Balmer series for the hydrogen atom is

A. 912 Å

B. $912 \times 2A$

C. 912×4 Å

D. $\frac{912}{2}A$

Answer: C

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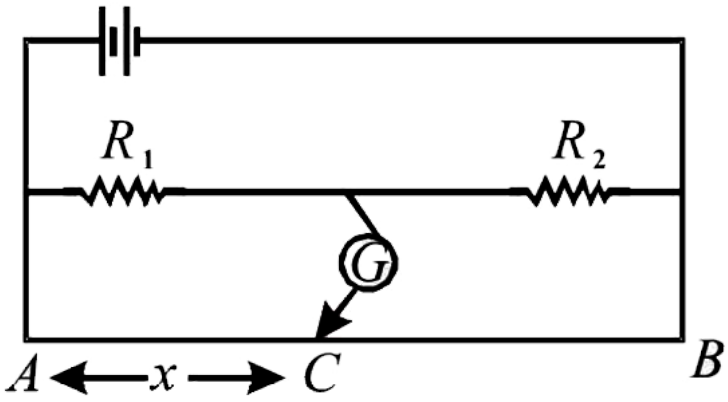
27. In the shown arrangement of the experiment of the meter bridge if AC corroesponding to null deflection of galvanometer is x, what would be its value if the radius of the wire AB is doubled?



A. x

B. $\frac{x}{4}$

C. $4x$

D. $2x$

Answer: A

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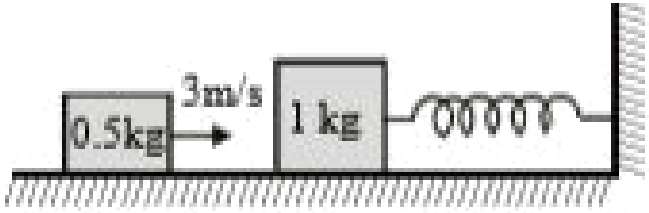
28. A 1 kg mass is attached to a spring of force constant 600 N/m and rests on a smooth horizontal surface with other end of the

spring tied to wall as shown in figure. A second mass of 0.5 kg slides along the surface towards the first at 3m/s. If the masses make a perfectly inelastic collision, then find amplitude and time period of oscillation of combined mass.



A. $5cm, \frac{\pi}{10}s$

B. $5cm, \frac{\pi}{5}s$

C. $4cm, \frac{2\pi}{5}s$

D. $4cm, \frac{\pi}{3}s$

Answer: A

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29. The frequency of vibration of string is given by $v = \frac{p}{2l}\left[\frac{F}{m}\right]^{1/2}$. Here p is number of segments in the string and l is the length. The dimensional formula for m will be

A. $\left[M^0LT^{-1}\right]$

B. $\left[ML^0T^{-1}\right]$

C. $\left[ML^{-1}T^0\right]$

D. $\left[M^0L^0T^0\right]$

Answer: C

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30. For the angle of minimum deviation of a prism to be equal to its refracting angle, the prism must be made of a material whose refractive index

A. lies between $\sqrt{2}$ and 1

B. lie between 2 and $\sqrt{2}$

C. is less than 1

D. is greater than 2

Answer: B

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31. Consider elastic collision of a particle of mass m moving with a velocity u with another particle of the same mass at rest. After the

collision the projectile and the struck particle move in direction making angles θ_1 and θ_2 respectively with the initial direction of motion. The sum of the angles. $\theta_1 + \theta_2$, is

A. 45°

B. 90°

C. 135°

D. 180°

Answer: B

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32. A conducting circular loop is placed in a uniform magnetic field $0.04T$ with its plane perpendicular to the magnetic field. The radius of the loop starts shrinking at $2mm/\sec$. The induced emf in the loop when the radius is $2cm$ is

A. $4.8\pi\mu V$

B. $0.8\mu\pi V$

C. $1.6\pi\mu V$

D. $32.\ \pi\mu V$

Answer: D

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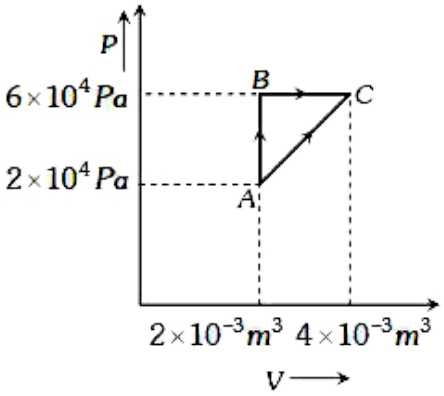
33. Figure below shows two paths that may be taken by a gas to go from a state A to a state C. In process AB, 400 J of heat is added to the system and in process BC, 100 J of heat is added to the system. The heat absorbed by

the system in the process AC will be



A. 500 J

B. 460 J

C. 300 J

D. 380 J

Answer: B

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34. Two equal resistance at $0^\circ C$ with temperature coefficient of resistance α_1 and α_2 joined in series act as a single resistance in a circuit the temperature coefficient of their single resistance will be

A. $\alpha_1 + \alpha_2$

B. $\dfrac{\alpha_1 \alpha_2}{\alpha_1 + \alpha_2}$

C. $\dfrac{\alpha_1 - \alpha_2}{2}$

D. $\dfrac{\alpha_1 + \alpha_2}{2}$

Answer: D

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35. Two identical charged spheres suspended from a common point by two mass-less strings of length l are initially at a distance d ($d << l$) apart because of their mutual repulsion . The charge begins to leak from both the spheres at a constant rate. As a result the charge approach each other with a

velocity v. Then as a function of distance x between them .

A. $v \propto x^{\frac{1}{2}}$

B. $v \propto x$

C. $v \propto x^{\frac{1}{2}}$

D. $v \propto x^{-1}$

Answer: C

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36. A point particle of mass $0.1kg$ is executing SHM of amplitude $0.1m$. When the particle passes through the mean position, its kinetic energy is $8 \times 10^{-3}J$. Obtain the equation of motion of this particle if the initial phase of oscillation is 45°.

A. $Y = 0.1\sin\left(\pm 4t + \frac{\pi}{4}\right)$

B. $Y = 0.2\sin\left(\pm 4t + \frac{\pi}{4}\right)$

C. $Y = 0.1\sin\left(\pm 2t + \frac{\pi}{4}\right)$

D. $Y = 0.2\sin\left(\pm 2t + \frac{\pi}{4}\right)$

Answer: A

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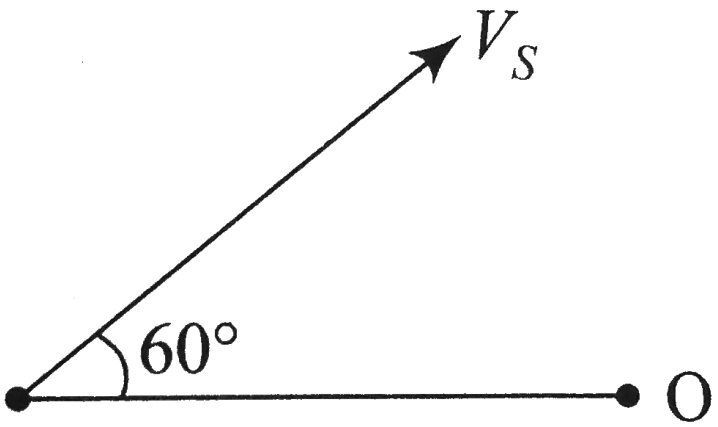

37.

A source of sound S emitting waves of frequency $100Hz$ and an observer O are located at some distance from each other. The source is moving with a speed of $19.4ms^{-1}$ at

an angle of 60° with the source observer line as shown in the figure. The observer is at rest. The apparent frequency observed by the observer (velocity of sound in air $330ms^{-1}$) is

A. 103 Hz

B. 106 Hz

C. 94 Hz

D. 100 Hz

Answer: A

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38. A resistor of resistance R, capacitor of capacitance C and inductor of inductance L are connected in parallel to AC power source of voltage ε_0 sin ωt. The maximum current through the resistance is half of the maximum current through the power source. Then value of R is

A. $\frac{\sqrt{3}}{\left|\omega C - \frac{1}{\omega L}\right|}$

B. $\sqrt{3}\left|\frac{1}{\omega C} - \omega L\right|$

C. $\sqrt{5}\left|\frac{1}{\omega C} - \omega L\right|$

D. None of these

Answer: A

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39. A lens haivng focal length and aperture of diameter d forms an image of intensity I. Aperture of diameter $\frac{d}{2}$ in central region of lens is covered by a black paper. Focal length of lens and intensity of image now will be respectively.

A. f and $\frac{I}{4}$

B. $\frac{3f}{4}$ and $\frac{I}{2}$

C. f and $\frac{3I}{4}$

D. $\frac{f}{2}$ and $\frac{I}{2}$

Answer: C

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40. A circular disc of radius R and thickness $R/6$ has moment of inertia I about an axis passing through its centre and perpendicular

to its plane. It is melted and recast into a solid sphere. The $M.I$ of the sphere about its diameter as axis of rotation is

A. I

B. $\frac{2I}{8}$

C. $\frac{I}{5}$

D. $\frac{I}{10}$

Answer: C

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