PHYSICS

BOOKS - NTA MOCK TESTS

JEE MOCK TEST 2

Physics

1. A road is banked at an angle of 30° to the horizontal for negotiating a curve of radius $10\sqrt{3}$ m. At what velocity will a car experience

no friction while negotiating the curve? Take $g = 10ms^{-2}$

A. 54 kmph

B. 75 kmph

C. 36 kmph

D. 18 kmph

Answer: C

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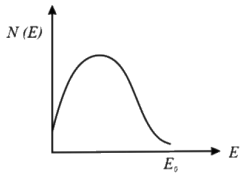
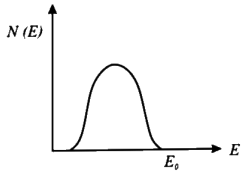
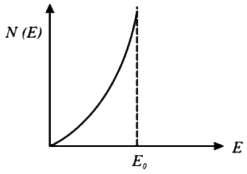
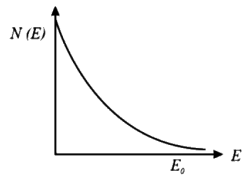
2. The energy spectrum of β - particle [number $N(E)$ as a function of β - energy E] emitted from a radioactive source is

A. 

B. 

C. 

D. 

Answer: A

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3. Two particles of equal masses have velocities $\vec{v}_1 = 4\hat{i}ms^{-1}$ and $\vec{v}_2 = 4\hat{j}ms^{-1}$. First particle has an acceleration $\vec{a}_1 = \left(5\hat{i} + 5\hat{j}\right)ms^{-2}$, while the acceleration of the other particle is zero. The centre of mass of the two particles moves in a path of

A. Straight line

B. Parabola

C. Circle

D. Ellipse

Answer: A

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4. Some ideal monoatomic gas A in an enclosure has a pressure P and the temperature T . Another ideal monoatomic gas

B enclosed in a container of the same volume has a pressure of $2P$ and temperature $\frac{T}{2}$. The ratio of the average kinetic energy per molecule of gas A to gas B is

A. $4:1$

B. $2:1$

C. $1:2$

D. $1:4$

Answer: B

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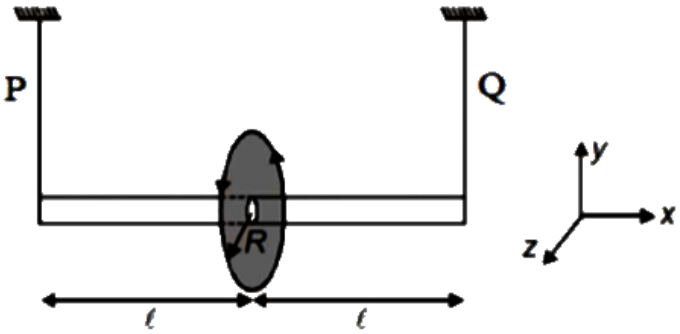
5. A rod of mass m and length 2l is connected to two massless strings as shown in figure. A wooden disk of same mass m is fixed at the mid - point of the rod in such a way that the plane of disk is perpendicular to the rod. A massless wire is wrapped around disk and having current I . There is vertically upward magnetic field B at the location of disk . (sense of current in the loop when seen from string P side is clockwise)



The tension in the string P is

A. $mg + \frac{I\pi R^2 B}{2l}$

B. $mg - \frac{I\pi R^2 B}{2l}$

C. mg

D. 2mg

Answer: A

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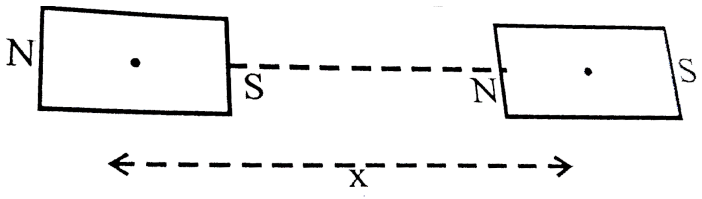
6. The mid points of two small magnetic dipoles of length d in end-on positions, are separated by a distance x, $(x >> d)$. The force between them is proportional to x^{-n}, where n is:



A. 3

B. 4

C. 2

D. 1

Answer: B

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7. A chain of mass m forming a circle of radius R is slipped on a smooth round cone with half-angle θ. Find the tension in the chain if it rotates with a constant angular velocity ω

about a vertical axis coinciding with the symmetry axis of the cone .

A. $\left(R\omega^2 + g\cot\theta\right)\frac{m}{2\pi}$

B. $\left(R\omega^2 - g\cot\theta\right)\frac{m}{2\pi}$

C. $\left(R\omega^2 + g\cot\theta\right)\frac{m}{\pi}$

D. $\left(R\omega - g\cot\theta\right)\frac{m}{2\pi}$

Answer: A

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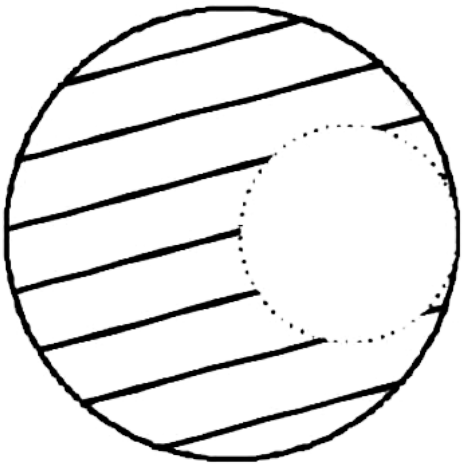
8. From a solid sphere of mass M and radius R, a spherical portion of radius R/2 is removed, as shown in the figure Taking gravitational potential $V = 0$ at $r = \infty$, the potential at the centre of the cavity thus formed is (G = gravitational constatn)



A. $\frac{-2GM}{R}$

B. $\frac{-GM}{2R}$

C. $\frac{-GM}{R}$

D. $\frac{-2GM}{3R}$

Answer: C

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9. Monochromatic radiation of wavelength λ is incident on a hydrogen sample in ground state. Hydrogen atoms absorb a fraction of

light and subsequently emit radiations of six different wavelength . Find the wavelength λ.

A. $102nm$

B. $100nm$

C. $97.5nm$

D. $94.5nm$

Answer: C

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10. A horizontal uniform glass tube of $100cm$ length is sealed at both ends contains $10cm$ mercury column in the middle , the temperature and pressure of air on either side of mercury column are repectively $31^\circ C$ and $76cm$ of mercury, if the air column at one end is kept at$0^\circ C$ and the other end at $273^\circ C$ then pressure if air which is $0^\circ C$ is

(in cm of Hg)

A. 76

B. 88.2

C. 102.4

D. 12.2

Answer: C

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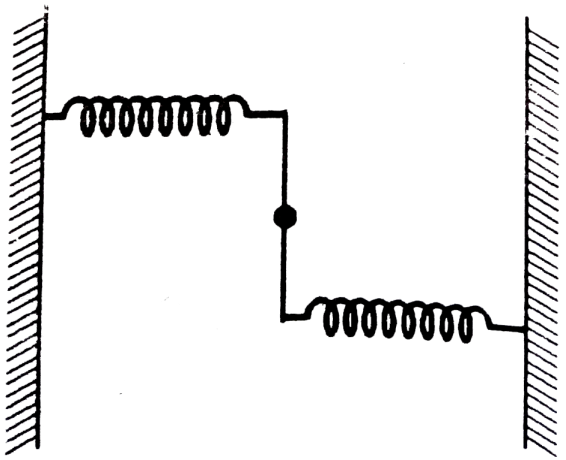
11. A uniform rod of length L and mass M is pivoted at the centre. Its two ends are attached to two springs of equal spring constants k. The springs as shown in the figure, and the rod is free to oscillate in the

horizontal plane. the rod is gently pushed through a small angle θ in one direction and released. the frequency of oscillation is-



A. $\frac{1}{2\pi}\sqrt{\frac{k}{M}}$

B. $\frac{1}{2\pi}\sqrt{\frac{2k}{M}}$

C. $\frac{1}{2\pi}\sqrt{\frac{3k}{M}}$

D. $\frac{1}{2\pi}\sqrt{\frac{6k}{M}}$

Answer: D

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12. A partical of mass m is driven by a machine that deleveres a constant power k watts. If the partical starts from rest the force on the partical at time t is

A. $\sqrt{\frac{mk}{2}}t^{-\frac{1}{2}}$

B. $\sqrt{mk}T^{-\frac{1}{2}}$

C. $\sqrt{2mk}t^{-\frac{1}{2}}$

D. $\frac{1}{2}\sqrt{mk}t^{-\frac{1}{2}}$

Answer: A

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13. A block of mass m is resting on a smooth horizontal surface. One end of a uniform rope of mass $\frac{m}{3}$ is fixed to the block, which is pulled in the horizontal direction by applying

force F at the other end. The tension in the middle of the rope is

A. $\frac{8}{6}F$

B. $\frac{1}{8}F$

C. $\frac{1}{5}F$

D. $\frac{7}{8}F$

Answer: D

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14. A solenoid has 2000 turns wound over a length of $0.3m$. Its cross-sectional area is equal to $1.2 \times 10^{-3} m^2$. Around its central cross-section a coil of 300 turns in wound. If an initial current of $2A$ flowing in the solenoid is reversed in $0.25s$, the emf induced in the coil is

A. $8.6 \times 10^{-2} V$

B. $4.8 \times 10^{-2} V$

C. $1.2 \times 10^{-2} V$

D. $6.0 \times 10^{-2} V$

Answer: B

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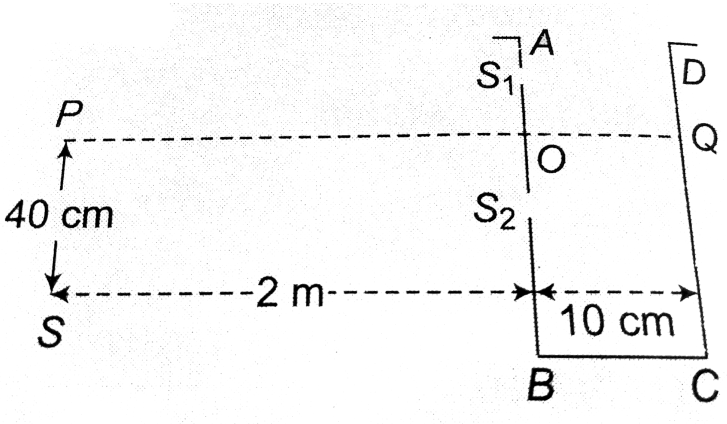
15. A vessel ABCD of $10cm$ width has two small slits S_1 and S_2 sealed with identical glass plates of equal thickness. The distance between the slits is $0.8mm$. POQ is the line perpendicular to the plane AB and passing through O, the middle point of S_1 and S_2, A

monochromatic light source is kept at S, $40cm$ below P and $2m$ from the vessel, to illuminate the slits as shown in the figure. Calculate the position of the central bright fringe on the other wall CD with respect of the line OQ. Now, a liquid is poured into the vessel and filled up to OQ. The central bright fringe is fiund to be at Q. Calculate the refractive index of the liquid.



A. 1.0016

B. 2.0032

C. 1.0010

D. 1.0026

Answer: A

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16. A sphere and a cube of same material and same total surface area are placed in the same evacuated space turn by turn after they are

heated to the same temperature. Find the ratio of their initial rates of cooling in the enclosure.

A. $\sqrt{\frac{\pi}{6}}:1$

B. $\sqrt{\frac{\pi}{3}}:1$

C. $\frac{\pi}{\sqrt{6}}:1$

D. $\frac{\pi}{\sqrt{3}}:1$

Answer: A

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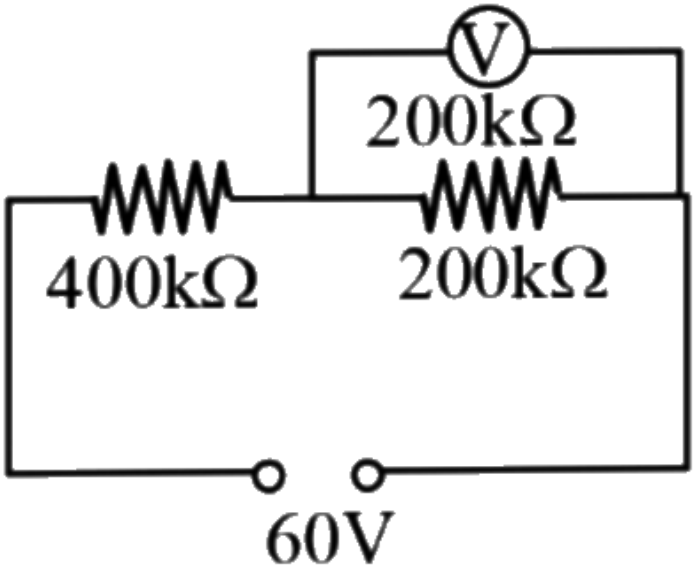
17. A constant 60 V supply is connected across the two resistors as shown in diagram. Calculate the reading of the voltmeter which has a resistance of 200 $K\Omega$



A. 12V

B. 15V

C. 20V

D. 30V

Answer: A

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18. Rain droplets are falling in vertically downward direction with velocity $5m/s$. A cyclist is moving in northward direction with velocity 10 m/s. The rain droplets will appear to the cyclist to be coming from

A. $\tan^{-1}(2)$ above south horizon

B. $\tan^{-1}\left(\frac{1}{2}\right)$ above north horizon

C. Vertically downward

D. $\tan^{-1}$ (2) above north horizon

Answer: B

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19. A hollow cylinder of mass m made heavy at its bottom is floating vertically in water. It is tilted from its vertical position through an

angle θ and is left. The restoring force acting on it is

A. $mg\cos\theta$

B. $mg\sin\theta$

C. $mg\left[\frac{1}{\cos\theta}-1\right]$

D. $mg\left[\frac{1}{\cos\theta}+1\right]$

Answer: C

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20. An organ pipe open at one end is vibrating in first overtone and is in resonance with another pipe open at both ends and vibrating in third harmonic. The ratio of length of two pipes is–

A. $1:2$

B. $4:1$

C. $8:3$

D. $3:8$

Answer: A

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21. A particle goes from A to B with a speed of $40km/h$ and B to C with a speed of $60Km/h$. If $AB = 6BC$, the average speed in km/h between A and C is-

[Hint : Average speed $= \frac{\text{total distance travelled}}{\text{time taken}}$]

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22. The position vector of a particle is determined by the expression $\vec{r} = 2t^2\hat{i} + 3t\hat{j} + 9\hat{k}$. The magnitude of its displacement (in m) in first two seconds is

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23. A particle of mass 10^{-3} kg and charge 1.0 c is initially at rest .At time t=0 the particle comes under the influence of an electric field $\vec{E}(t) = E_0 \sin \omega t \hat{i}$ where $E_0 = 1.0NC^{-1}$

and $\omega = 10^3 rads^{-1}$. consider the effect of only the electrical force on the particle. Then the maximum speed in ms^{-1} attained by the particle at subsequent times is _____

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24. Let ε_0 denote the dimensional formula of the permittivity of vacuum. If M= mass , L=length , T=time and A=electric current , then dimension of permittivity is given as $[M^p L^q T^r A^s]$. Find the value of $\frac{p-q+r}{s}$

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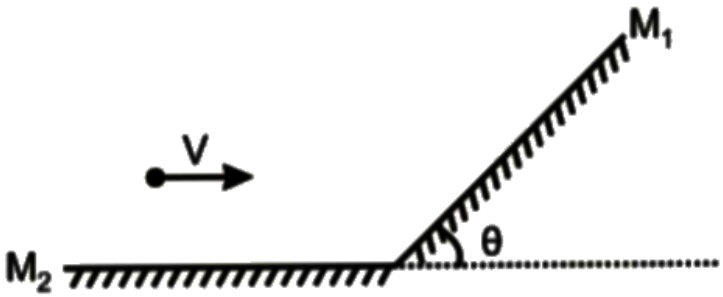
25. A point object is moving with a speed V in front of an arrangement of two mirrors as show in figure. If the velocity of image in mirror M_1 with respect to image in mirror M_2 is $n(v\sin\theta)$, find n



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26. When the angle of incidence on a material is 60°, the reflected light is completely polarised. The velocity of the refracted ray inside the materials is (in m/s)

A. $3 \times 10^8 m/s$

B. $\sqrt{3} \times 10^8 m/s$

C. $\frac{3}{\sqrt{2}} \times 10^8 m/s$

D. $\frac{1}{3} \times 10^8 m/s$

Answer: B

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27. A convex, rearview mirror of focal length 20cm, is fitted in a car. A second car 2 m broad and 1.6m high is 6m away from the first car and overtakes the first car at a relative speed of $15ms^{-1}$, then the speed of the first car is

A. $0.016ms^{-1}$

B. $0.257ms^{-1}$

C. $0.162ms^{-1}$

D. $0.0073ms^{-1}$

Answer: A

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28. The electrical conductivity of a semiconductor increases when electromagnetic radiation of wavelength shorter than $2480nm$ is incident on it. The band gap in (eV) for the semiconductor is.

A. $0.5eV$

B. $0.7eV$

C. $1.1eV$

D. $2.5eV$

Answer: A

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29. A coil having inductance and L and resistance R is connected to a battery of emf $\in$ at $t = 0$. If t_1 and t_2 are time for $90\,\%$ and

$99\,\%$ completion of current growth in the circuit, then $\frac{t_1}{t_2}$ will be-

A. $1:2$

B. $2:1$

C. $\frac{\log_e 10}{2}$

D. $2\log_e 10$

Answer: A

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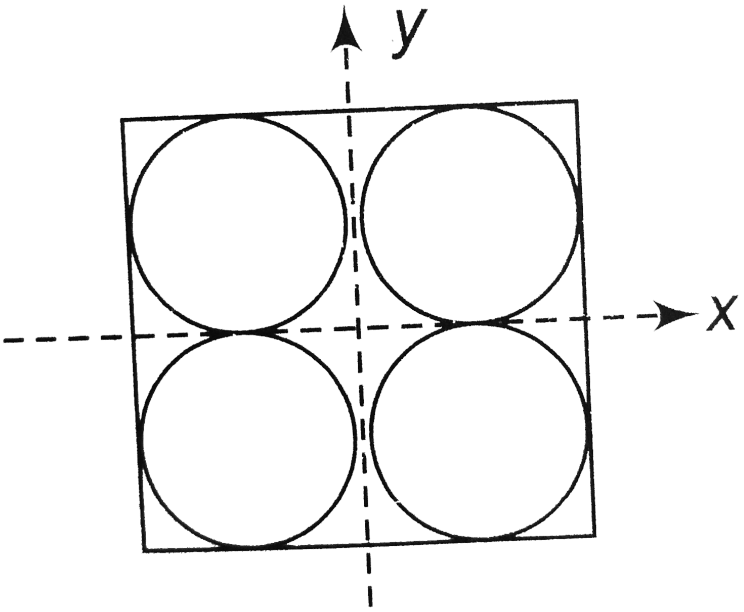
30. Four holes of radius R are cut from a thin square plate of side $4R$ and mass M. The moment of inertia of the remaining portion about z-axis is :



A. $\frac{\pi}{12}MR^2$

B. $\left(\frac{4}{3}-\frac{\pi}{4}\right)MR^2$

C. $\left(\frac{8}{3}-\frac{10\pi}{16}\right)MR^2$

D. $\left(\frac{4}{3}-\frac{\pi}{6}\right)MR^2$

Answer: C

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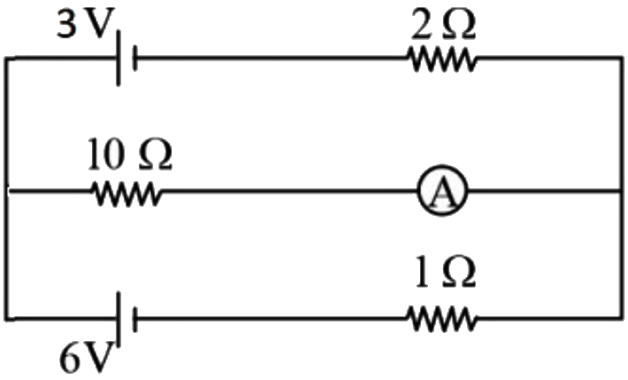
31. The ammeter reading in the given circuit is



A. $\frac{14}{33}A$

B. $\frac{15}{32}A$

C. $\frac{17}{33}A$

D. $\frac{15}{31}$ A

Answer: B

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32. A long thin magnet of moment M is bent into a semi circle. The decrease in the magnetic moment is

A. $\frac{2M}{\pi}$

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

C. $\frac{M(\pi-2)}{\pi}$

D. $\frac{M(2-\pi)}{2}$

Answer: C

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33. The current gain in the common emitter mode of a transistor is 10. The input impedance is $20k\Omega$ and load of resistance is $100k\Omega$. The power gain is

A. 300

B. 500

C. 200

D. 100

Answer: B

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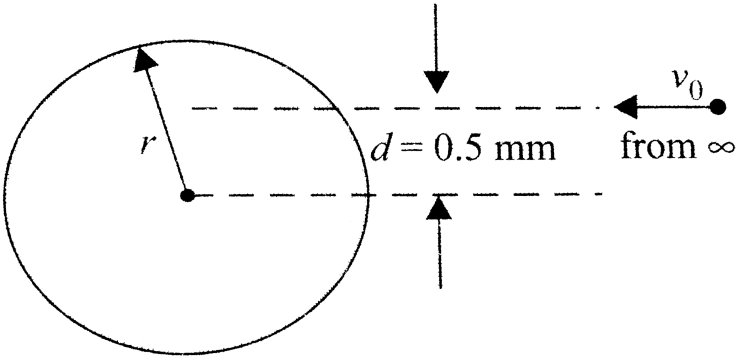
34. A particle of mass $1kg$ and charge $1/3\mu C$ is projected toward a nonconducing fixed spherical shell of radius $r = 1mm$ having the same charge uniformly distributed on its surface. Find the minimum initial velocity of projection requires if the particle just grazes

the shell.



A. $\sqrt{\frac{2}{3}} ms^{-1}$

B. $2\sqrt{\frac{2}{3}} ms^{-1}$

C. $\frac{2}{3} ms^{-1}$

D. $1 ms^{-1}$

Answer: B

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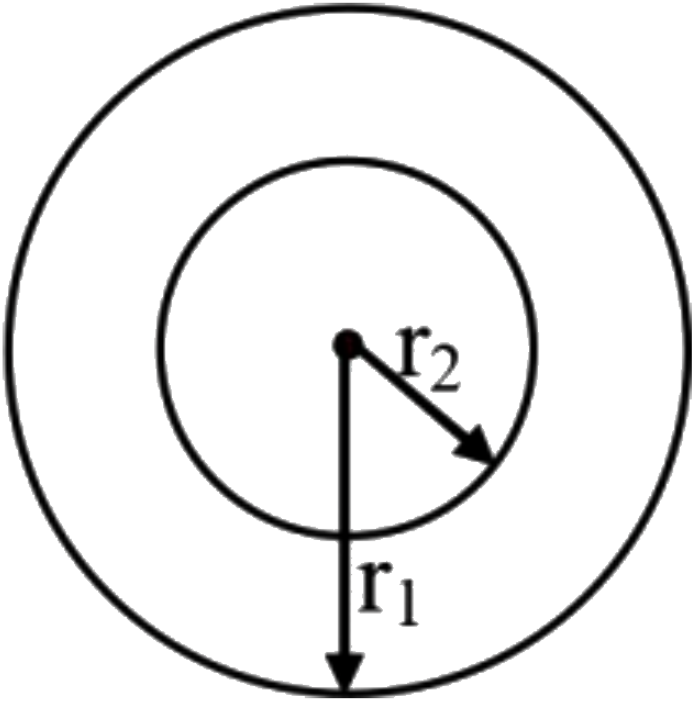
35. A charge is uniformly distributed inside a spherical body of radius $r_1 = 2r_0$ having a concetric cavity of radius $r_2 = r_0$ (ρ is charge density inside the sphere). The potential of a

point P at a distance $\frac{3r_0}{2}$ from the centre is



A. $\frac{7\rho r_0^2}{6\varepsilon_0}$

B. $\frac{101\rho r_0^2}{72\varepsilon_0}$

C. $\frac{17\rho r_0^2}{72\varepsilon_0}$

D. none of these

Answer: B

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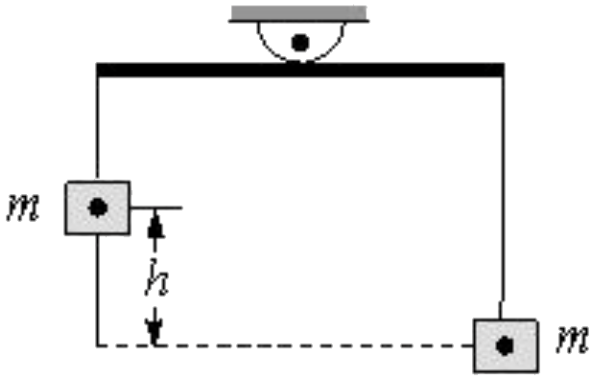
36. Two identical blocks of mass m are suspended from a beam balance whose scale pans differ in vertical height by $h(h << R)$, if R and ρ are the radius and density of the

earth, then the error in weighing is



A. $\frac{2}{3}\pi\rho R^3 Gm$

B. $\frac{8}{3}\pi\rho Gmh$

C. $\frac{8}{3}\pi\rho R^3 Gm$

D. $\frac{4}{3}\pi\rho Gm^2 h$

Answer: B

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37. Two objects P and Q, travelling in the same direction start from rest. While the object P starts at time t = 0 and object Q starts later at t = 30 min. The object P has an acceleration of $40km/h^2$. To catch P at a distance of 20 km, the acceleration of Q should be

A. $40km/h^2$

B. $80km/h^2$

C. $100km/h^2$

D. $160 km / h^2$

Answer: D

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38. When a liquid in a glass vessel is heated, its apparent expansion coefficient is $10.30 \times 10^{-4}.^{\circ} C^{-1}$. When the same liquid is heated in a metal vessel, its apparent expansion coeffiecient is $10.06 \times 10^{-4}.^{\circ} C^{-1}$. If the coefficient of linear expansion of glass =

$9 \times 10^{-6}.^{\circ} C^{-1}$, what is the coefficient of linear expansion of metal?

A. $51 \times 10^{-6}.^{\circ} C^{-1}$

B. $17 \times 10^{-6}.^{\circ} C^{-1}$

C. $25 \times 10^{-6}.^{\circ} C^{-1}$

D. $43 \times 10^{-6}.^{\circ} C^{-1}$

Answer: B

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39. A Carnot engine efficiency is equal to $\frac{1}{7}$. If the temperature of the sink is reduced by 65 K , the efficiency becomes $\frac{1}{4}$. The temperature of the source and the sink in the first case are respectively

A. 620 K , 520 K

B. 520 K , 606.67 K

C. 606.67 K, 520 K

D. 520 K, 610 K

Answer: C

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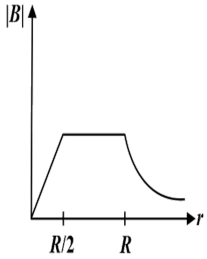
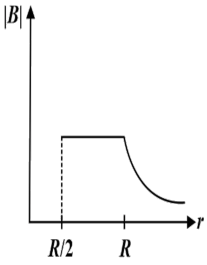
40. An infinitely long hollow coducting cylinder with inner radius $\frac{R}{2}$ and outer radus R carries a uniform current density along its length. The magnitude of the magnetic field $|B|$ as a function of the radial distance r from the axis is best represented by

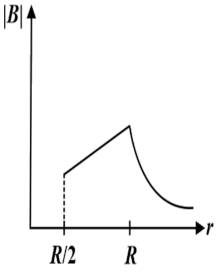
A.



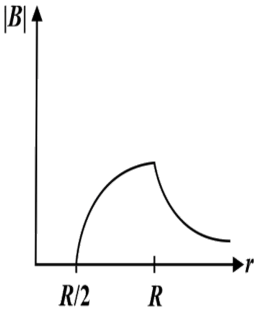
B.



C.



D.



Answer: D

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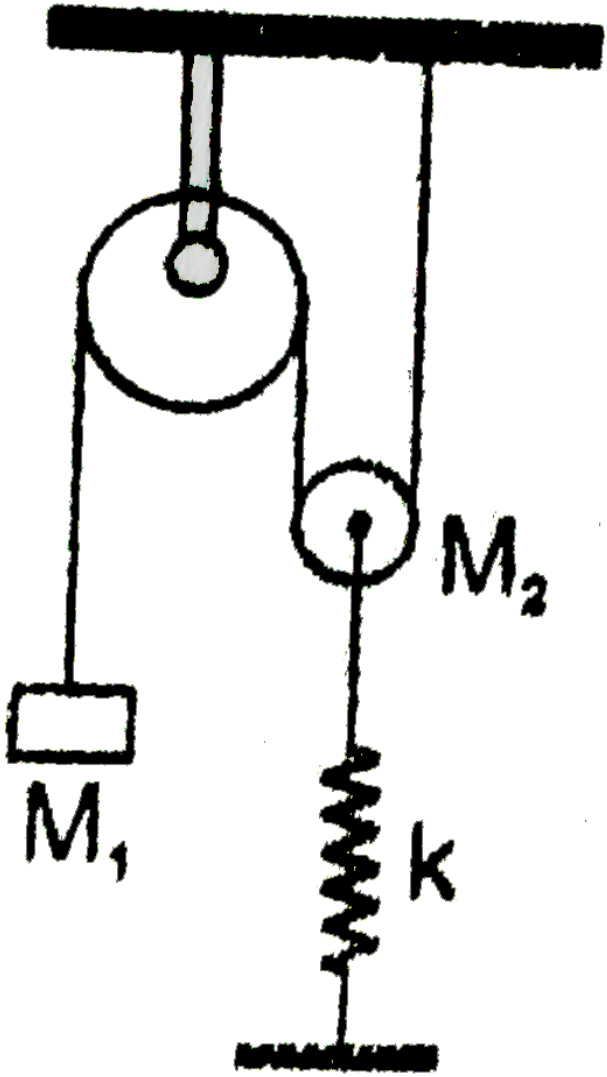
41. What would be the period of the free oscillations of the system shown here if mass M_1 is pulled down a little force constant of the spring is k, mass of fixed pulley is

negligible and movable pulley is smooth



A. $2\pi\sqrt{\frac{4M_1+M_2}{k}}$

B. $2\pi\sqrt{\frac{4M_2+M_1}{k}}$

C. $4\pi\sqrt{\frac{4M_1+M_2}{k}}$

D. $\pi\sqrt{\frac{4M_1+M_2}{k}}$

Answer: A

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42. A parallel beam of light is incident normally on a plane surface absorbing 40% of the light and reflecting the rest. If the incident

beamm carries 60 W of power, the force exerted by it on the surface is

A. $3.2 \times 10^{-8} N$

B. $3.2 \times 10^{-7} N$

C. $5.12 \times 10^{-7} N$

D. $5.12 \times 10^{-8} N$

Answer: B

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43. One of the square faces of a metal slab of side 50 cm and thickness 20 cm is rigidly fixed on a horizontal surface. If a tangential force of 30 N is applied to the top face and it is known that the shear modulus of the material is $4 \times 10^{10} N/m^2$, then the displacement (in m) of the top face is

A. 4×10^{-12}m

B. 4×10^{-10}m

C. 6×10^{-10}m

D. 8×10^{-10}m

Answer: C

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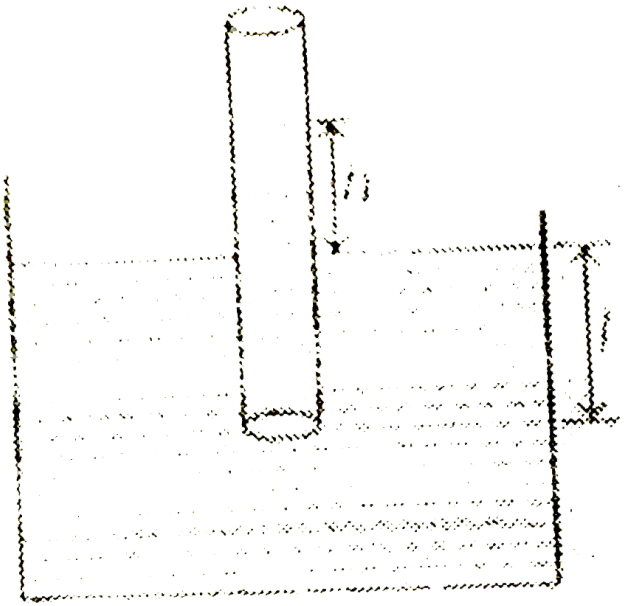
44. A capillary tube is dipped in water to a depth and the water rises to a height $h(<l)$ in the capillary tube. The lower end of the tube is closed in water by putting a lower over it. The tube is now taken out and the thumb is removed from the lower end and it kept open.

The length of liquid column in the tube will be



A. 1

B. $1 + h$

C. h

D. $2h$

Answer: D

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45. A ray of light is incident normally on one of the faces of a prism of apex angle 30 degree and refractive index $\sqrt{2}$. The angle of deviation of the ray in degrees is

A. 30°

B. 45°

C. 15°

D. none of these

Answer: C

Watch Video Solution

46. An installation consists of an electric motor which drives a water pump to lift 75 L of water per second to a height of 5m, where water is disbursed at neglible speed. If the motor consumes a power of 5 kW, then what is

the efficiency (%) of the installation?

$[g = 10ms^{-2}]$

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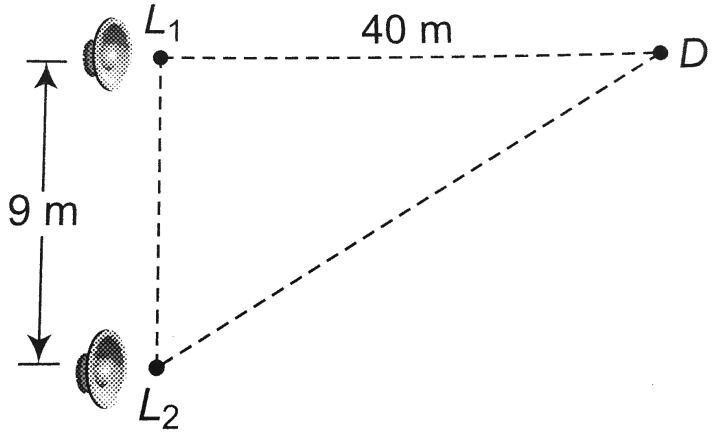
47.



Two loudspeakers L_1 and L_2 driven by a common oscillator and amplifier, are arranged as shown. The frequency of the oscillator is

gradually increased from zero and the detector at D records a series of maxima and minima. If the speed of sound is $330ms^{-1}$ then the frequency at which the first maximum is observed is

Watch Video Solution

48. In the Coolidage tube experiment, if the applied voltage is increased to three times, the short wavelength limit of continuous X-

ray spectrum shift by 20 pm. What is the intial voltage (in kV) applied to the tube?

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49. A sphere of mass m moving with velocity v collides head-on with another sphere of the same mass at rest. If the coefficient of resistitution $e = 1/2$, then what is the ratio of final velocity of the second sphere to the intial velocity of the first sphere ?

Watch Video Solution

50. Two unknown resistances are connected in two gaps of a meter-bridge. The null point is obtained at 40 cm from left end. A 30Ω resistance is connected in series with the smaller of the two resistances, the null point shifts by 20 cm to the right end. The value of smaller resistance in Ω is

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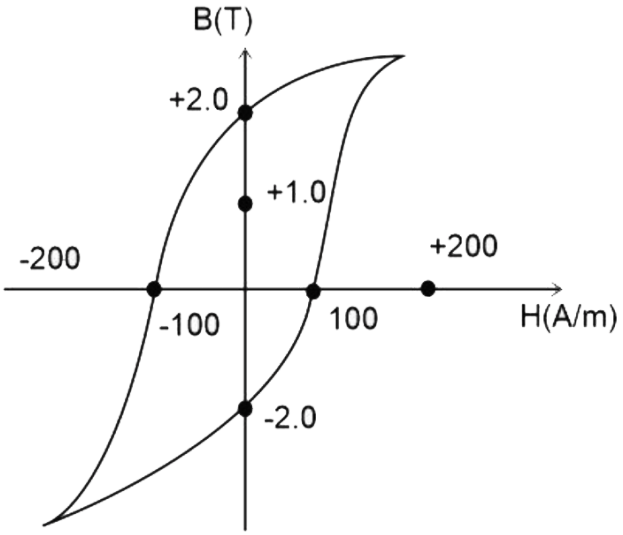
51. The B-H curve for a ferromagnet is shown in the figure. The ferromagnet is placed inside a long solenoid with 1000 turns/cm. The current that should be passed in the solenoid to demagnetise the ferromagnet completely is :



A. 2 mA

B. $20\mu A$

C. $1mA$

D. $40\mu A$

Answer: C

Watch Video Solution

52. A cell of emf E and internal resistance r supplies currents for the same time t through external resistances $R_1 = 100\Omega$ and $R_2 = 40\Omega$ separately. If the

heat developed in both cases is the same, then the internal resistance of the cell is

A. 28.6Ω

B. 80Ω

C. 63.3Ω

D. 140Ω

Answer: C

 Watch Video Solution

53. Two point white dots are 1mm apart on a black paper. They are viewed by eye of pupil diameter 3mm. Approximately, what is the maximum distance at which these dots can be resolved by the eye? [Take wavelelngth of light =500nm]

A. 6 m

B. 3m

C. 1m

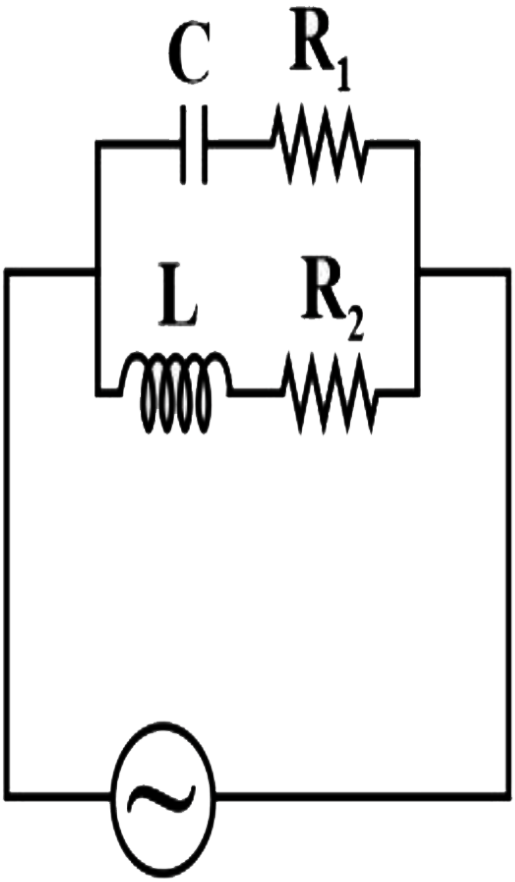
D. 5m

Answer: D

Watch Video Solution

54. In the given circuit the R.M.S values of voltages across the capacitor C, inductor L and resistor R_1 are 12V, 10V and 5 V respectively.

Then the peak voltage across R_2 is



A. $7\sqrt{2}V$

B. $\sqrt{69}V$

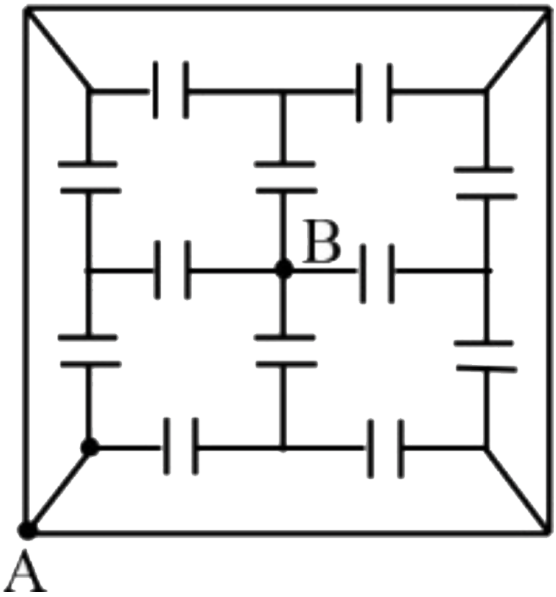
C. $\sqrt{138}V$

D. none of these

Answer: C

Watch Video Solution

55. If each capacitor has capacitance C, then equivalent capacitance between A and B is



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

B. $\frac{8C}{3}$

C. $12C$

D. $\frac{5C}{12}$

Answer: B

Watch Video Solution

56. A $10\mu F$ capacitor is charged to a potential difference of $50V$ and is connected to another uncharged capacitor in parallel. Now the common potential difference becomes 20 volt. The capacitance of second capacitor is

A. $15\mu F$

B. $30\mu F$

C. $20\mu F$

D. $10\mu F$

Answer: A

Watch Video Solution

57. A particle of mass $2 \times 10^{-5} kg$ moves horizontally between two horizontal plates of a charged parallel plate capacitor between which there is an electric field of $200NC^{-1}$ acting upward. A magnetic induction of 2.0 T is applied at right angles to the electric field in a

direction normal to both $\overrightarrow{B}$ and $\overrightarrow{v}$. If g is $9.8ms^{-2}$ and the charge on the particle is $10^{-6}C$, then find the velocity of charge particle so that it continues to move horizontally

A. $2ms^{-1}$

B. $20ms^{-1}$

C. $0.2ms^{-1}$

D. $100ms^{-1}$

Answer: A

Watch Video Solution

58. Two identical vessels contain two different ideal gases at the same temperature. If the average speed of gas molecules in the first vessel is euqal to the most probable speed of molecules in the second vessel, then the ratio of the mass of gas molecules in the first vessel to that in the second vessel is

A. $\frac{4}{\pi}$

B. $\frac{8}{\pi}$

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

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

Answer: A

 Watch Video Solution

59. The K_α line obtained for molybdenum $(Z = 42)$ is 0.71 Å. Then, the wavelength of the K_α line of copper (Z = 29) is

A. 2.14 Å

B. 1.52 Å

C. 1.04 Å

D. 1.71 Å

Answer: B

 Watch Video Solution

60. Wire having tension 225 N produces six beats per second when it is tuned with a fork. When tension changes to 256 N, it is tuned with the same fork, the number of beats

remain unchanged. The frequency of the fork will be

A. 186 Hz

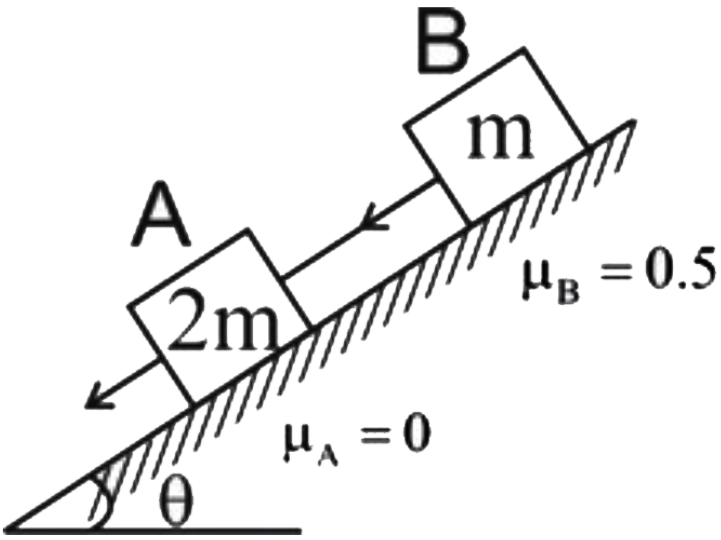
B. 225 Hz

C. 256 Hz

D. 280 Hz

Answer: A

61. The arrangement is released from rest. The minimum angle θ at which block A starts sliding downwards is



A. $\tan\theta = 0$

B. $\tan\theta = 0.5$

C. $\tan\theta = \frac{1}{6}$

D. $\tan\theta = \frac{1}{3}$

Answer: C

Watch Video Solution

62. The length and breadth of a metal sheet are 3.124m and 3.002m respectively. The area of this sheet upto correct significant figure is

A. $9.378m^2$

B. $9.37m^2$

C. $9.378248m^2$

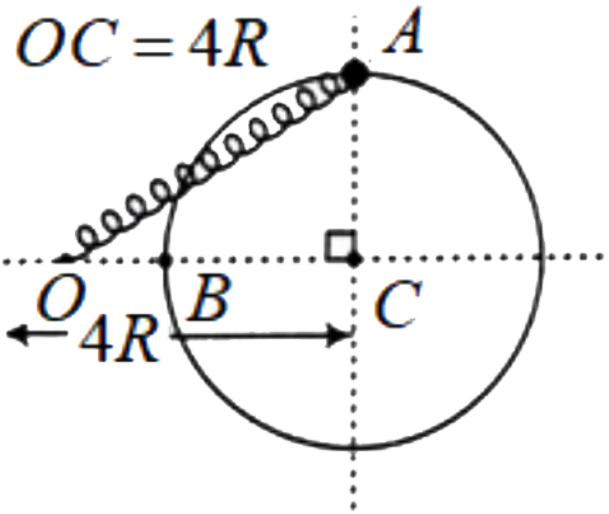
D. $9.3782m^2$

Answer: A

 Watch Video Solution

63. A bead of mass m can slide without friction on a fixed circular horizontal ring of radius 3R having a centre at the point C. The bead is attached to one of the ends of spring of

spring constant k. Natural length of spring is R and the other end of the spring is R and the other end of the spring is fixed at point O as shown in the figure. If the bead is released from position A, then the kinetic energy of the bead when it reaches point B is



A. $\frac{25}{2}kR^2$

B. $\frac{9}{2}kR^2$

C. $8kR^2$

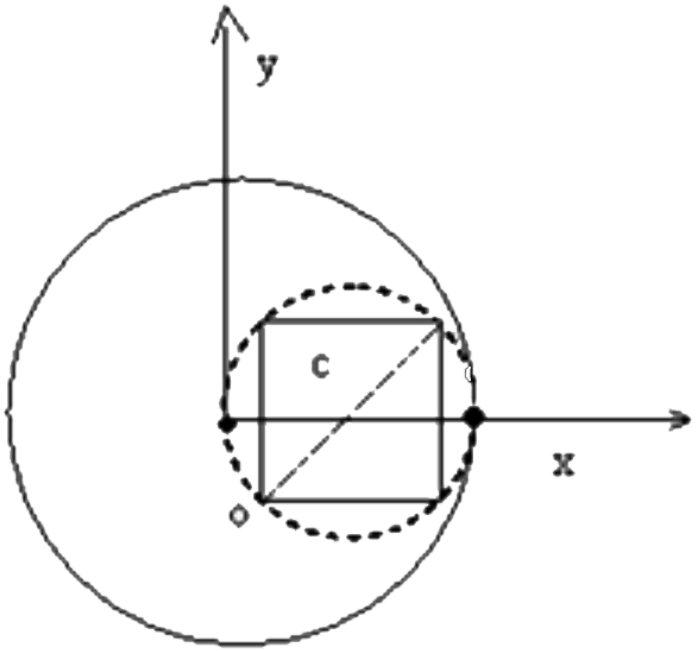
D. $12KR^2$

Answer: C

Watch Video Solution

64. There is a thin uniform disc of radius R and mass per unit area σ in which a hole of radius $R/2$ has been cut out as shown in the figure. Inside the hole, a square plate of same mass

per unit area σ is inserted so that its corners touch the periphery of the hole. The distance of the centre of mass of the system from the origin is



A. $\frac{R(2-\pi)}{2(3\pi+2)}$

B. $\frac{R(1-\pi)}{2(2\pi+1)}$

C. $\frac{2R\pi}{2(3\pi+2)}$

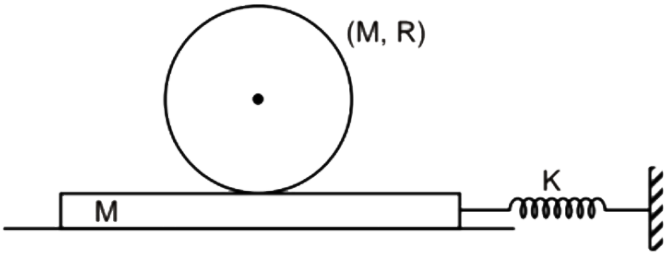
D. $\frac{3R\pi}{2(2\pi+1)}$

Answer: A

Watch Video Solution

65. A cylinder of mass M and radius R lies on a plank of mass M as shown. The surface between plank and ground is smooth, and between cylinder and plank is rough.

Assuming no slipping between cylinder and plank, the time period of oscillation (When displaced from equilibrium) of the system is



A. $2\pi\sqrt{\frac{m}{3k}}$

B. $4\pi\sqrt{\frac{2m}{3k}}$

C. $4\pi\sqrt{\frac{M}{3k}}$

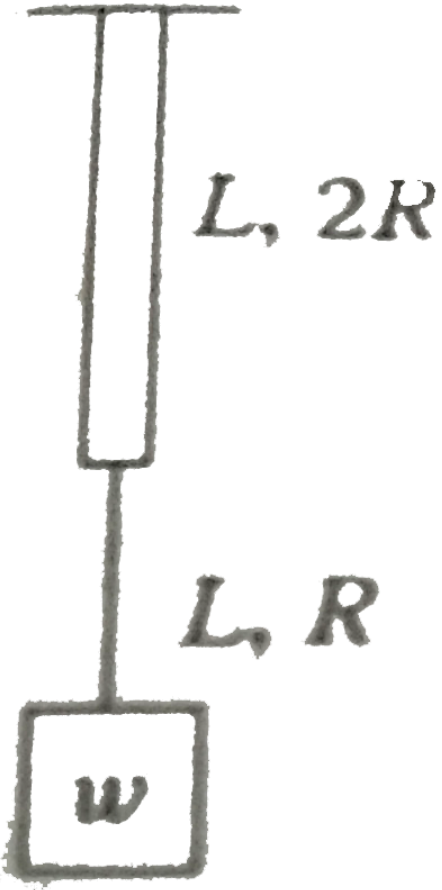
D. $4\pi\sqrt{\frac{3M}{2k}}$

Answer: C

Watch Video Solution

66. Two wires of the same material (Young's modulus=Y) and same length L but radii R and 2R respectively are joined end to end and a weight w is suspended from the combination as shown in the figure. The elastic potential

energy in the system is



A. $\dfrac{3w^2L}{4\pi R^2Y}$

B. $\dfrac{3w^2L}{8\pi R^2Y}$

C. $\frac{5w^2L}{8\pi R^2Y}$

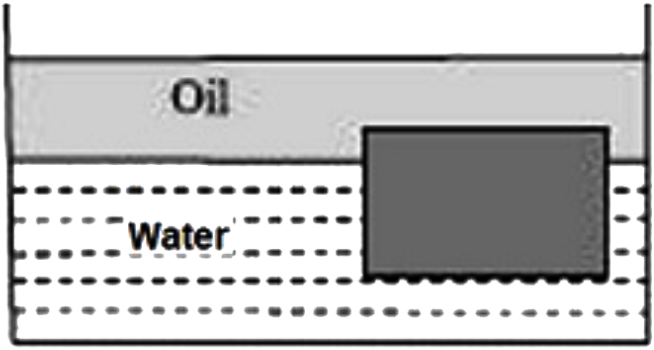
D. $\frac{w^2L}{\pi R^2Y}$

Answer: C

Watch Video Solution

67. A layer of oil with density 724 kg m^{-3} floats on water of density $1000kgm^{-3}$. A block floats on the oil-water interface with $1/6$ of its volume in oil and $5/6$ of its volume in water, as shown in the figure. What is the density of

the block?



A. $1024kgm^{-3}$

B. $1276kgm^{-3}$

C. $776kgm^{-3}$

D. $954kgm^{-3}$

Answer: D

Watch Video Solution

68. A uniform ball of radius r rolls without slipping down from the top of a sphere of radius R Find the angular velocity of the ball at the moment it breaks off the sphere. The initial velocity of the ball is negligible.

A. $\sqrt{\frac{10g(R+r)}{17r^2}}$

B. $\sqrt{\frac{10g(R-r)}{17r^2}}$

C. $\sqrt{\frac{10g(R+r)}{17}}$

D. $\sqrt{\frac{10(R+r)}{17}}$

Answer: A

Watch Video Solution

69. A vessel contains two non-reactive gases neon (monoatomic) and oxygen (diatomic). The ratio of their partial pressures is 3:2. Estimate the ratio of

(i) number of molecules, and

(ii) mass density of neon and oxygen in the

vessel.

Atomic mass of neon = 20.2 u, and molecular mass of oxygen = 32.0 u.

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

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

C. $\frac{1}{3}$

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

Answer: A

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70. In a transistor, the collector current varies by 0.49 mA and emitter current varies by 0.50 mA. Then current gain β is

A. 49

B. 150

C. 99

D. 100

Answer: A

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71. If in nuclear fission, a piece of uranium of mass 6.0 g is lost, the energy obtained (in kWh) is $n \times 10^7$. Find the value of n.

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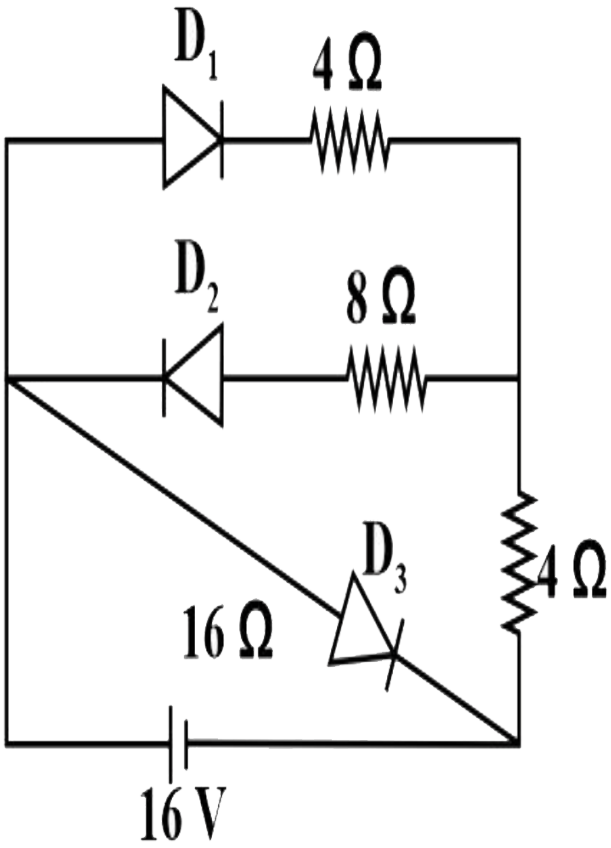
72. In the given circuit, what is the current (in A) through the battery?



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73. A galvanometer coil has a resistance 90Ω and full scale deflection current $10mA$. A 910Ω resistance is connected in series with the galvanometer to make a voltmeter. If the least count of the voltmeter is $0.1V$ the number of divisions on its scale is

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74. At what distance from a convex mirror of focal length 2.5 m should a body stand so that

his image has a height equal to half the original height ? The principal axis is perpendicular to the height.

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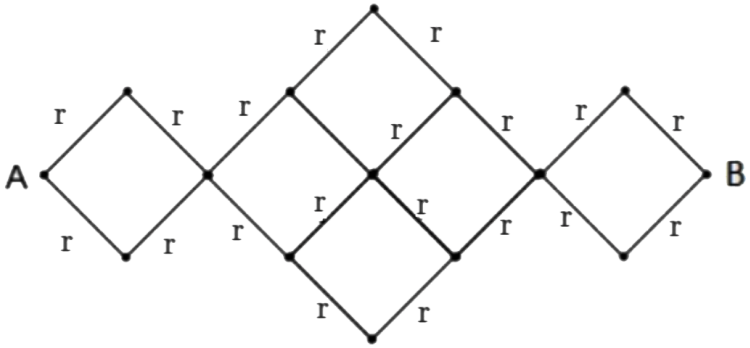
75. The resistance of each straight section $r = 2\Omega$. Find the equivalent resistance (in

ohms) between A and B.



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76. A proton is bombarded on a stationary lithium nucleus. As a result of the collision, two α-particles are produced. If the direction of motion of the α-particles with the initial

direction of motion makes an angles $\cos^{-1}(1/4)$, find the kinetic energy of the striking proton. Given, binding energies per nucleon of Li^7 and He^4 are 5.60 and $7.06MeV$, respectively.

(Assume mass of proton $\approx$ mass of neutron).

A. 17.28 MeV

B. 17.36 MeV

C. 17.58 MeV

D. 17.44 MeV

Answer: A

Watch Video Solution

77. At a certain place, the angle of dip is 30° and the horizontal component of earth's magnetic field is $50\mu T$. The total magnetic field (in μT) of the earth at this place, is

A. $100\sqrt{3}\mu T$

B. $100\mu T$

C. $\frac{100}{\sqrt{3}}\mu T$

D. $200\mu T$

Answer: C

Watch Video Solution

78. A battery of 10V is connected to a resistance of 20Ω through a variable resistance R. If the variable resistance R is increased at the rate of $5\Omega \ \ \min^{-1}$, then the amount of charge that passes through the battery in 4 min is

A. $120C$

B. $120 \log_e(2) C$

C. $\frac{120}{\log_e(2)} C$

D. $\frac{60}{\log_e(2)} C$

Answer: B

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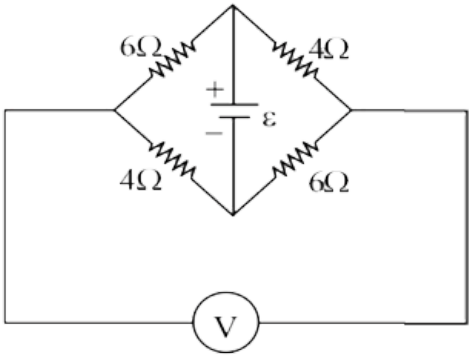
79. In the circuit shown below, the voltmeter is of large resistance. The E.M.F. of the cell is ε.

The reading of the voltmeter is



A. zero

B. $\frac{\varepsilon}{10}$

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

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

Answer: C

Watch Video Solution

80. An AC circuit drawing power from a source of angular frequency $50\,\mathrm{rad\,s^{-1}}$ has a power factor of 0.6. In this condition, a resistance of 100Ω is present and the current is lagging behind the voltage. If a capacitor is connected in series, then the required capacitance that will result in a power factor of unity is

A. $30\mu F$

B. $150\mu F$

C. $50\mu F$

D. $200\mu F$

Answer: B

 Watch Video Solution

81. Consider a solid cube made up of insulating material having a uniform volume charge density. Assuming the electrostatic potential to be zero at infinity, the ratio of the

potential at a corner of the cube to that at the centre will be

A. $1:1$

B. $1:2$

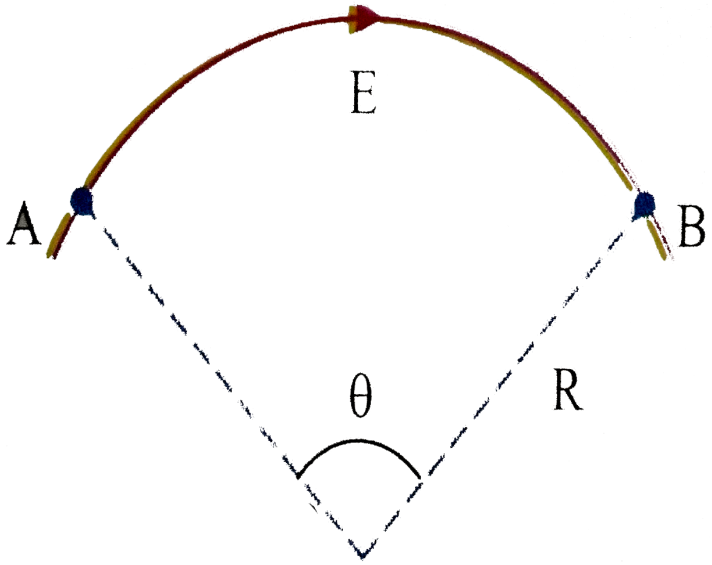
C. $1:4$

D. $1:8$

Answer: B

Watch Video Solution

82. Figures shows an electric line of force which curves along a circular arc.The magnitude of electric field intensities is same at all points on this curve and is equal to E.If the potential at A is V ,the potential at B is



A. $V - ER\theta$

B. $V - 2ER \sin. \frac{\theta}{2}$

C. $V + ER\theta$

D. $V + 2ER \sin. \frac{\theta}{2}$

Answer: A

Watch Video Solution

83. The main scale of a vernier callipers reads $10mm$ in 10 divisions. Ten divisions of vernier scale coincide with nine divisions of the main scale. When the two jaws of the callipers touch

each other, the fifth division of the vernier coincides with 9 main scale divisions and zero of the vernier is to the right of zero of main scale, when a cylinder is tightly placed between the two jaws, the zero of the vernier scale lies slightly to the left of $3.2cm$ and the fourth vernier division coincides with a main scale division. Find diameter of the cylinder.

A. 3.19 cm

B. 3.14 cm

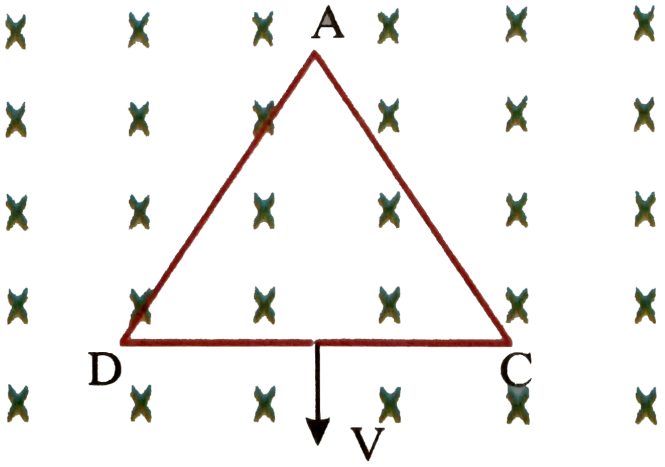
C. 3.04 cm

D. None of these

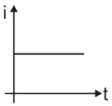
Answer: A

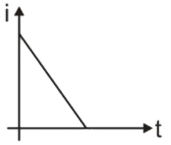
Watch Video Solution

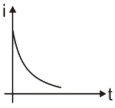
84. An equilateral triangular loop ADC having some resistance is pulled with a constant velocity v out of a uniform magnetic field directed inot the paper. At time $t = 0$, side DC of the loop at is at edge of the magnetic field.

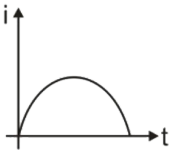


The induced current (i) versus time (t) graph will be as

A. 

B. 

C. 

D. 

Answer: B

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85. The kinetic energy of a particle executing SHM is 16J. When it is in its mean position. If the amplitude of oscillation is 25cm and the mass of the particle is 5.12 kg, the time period of its oscillation in second is

A. $20\pi s$

B. $2\pi s$

C. $\pi / 5 s$

D. $5\pi s$

Answer: C

Watch Video Solution

86. The energy that should be added to an electron to reduce its de-Broglie wavelength from 1 nm to 0.5 nm is

A. four times the initial energy

B. equal to the initial energy

C. twice the initial energy

D. thrice the initial energy

Answer: D

Watch Video Solution

87. A U - tube having a horizontal arm of length 20 cm, has a uniform cross - sectional area $1cm^2$. It is filled with water of volume 60

cc. The volume of a liquid of density $4\,\mathrm{g\,cc}^{-1}$ required to be poured in one arm of the U - tube so that no water is left in the horizontal arm of the tube is $\left(\text{take g} \quad = 9.8ms^{-2}\right)$

A. 60 cc

B. 45 cc

C. 50 cc

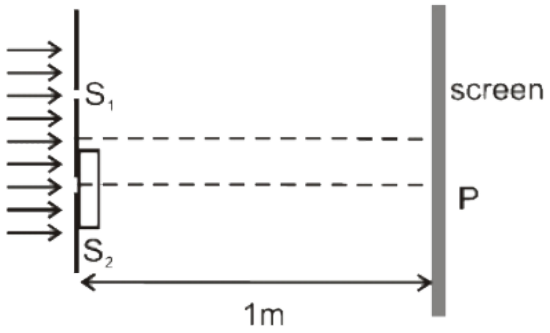
D. 35 cc

Answer: D

Watch Video Solution

88. In standard Young's double - slit experiment, visible light $\lambda \in (350nm, 750nm)$ is used in both the slits. Distance between the slits is 2 mm, and the distance of the screen from the slits is 1 m. A thin glass slab $(\mu = 1.5)$ of thickness $6\mu m$ is placed in front of slit S_2. Which among the following wavelength is missing at point P, which is directly in front of slit S_2? (Neglect dispersion

of light)



A. 400 nm

B. 500 nm

C. 600 nm

D. 700 nm

Answer: A

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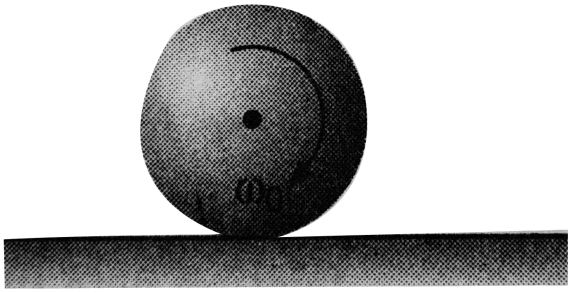


89.

solid sphere of radius r is gently placed on a rough horizontal ground with an initial angular speed ω_0 and no linear velocity. If the coefficient of friction is μ, find the time t when the slipping stops. in addition state the linear

velocity v and angular velocity ω at the end of slipping

A. $\frac{2}{7}\frac{r\omega_0}{\mu g}$

B. $\frac{3}{7}\frac{r\omega A_0}{\mu g}$

C. $\frac{3}{7}\frac{r\omega_0}{\mu g}$

D. $\frac{r\omega_0}{\mu g}$

Answer: A

Watch Video Solution

90. A piece of copper and another of germanium are cooled from room temperature to 77 K, the resistance of -

A. each of them increases

B. each of them decreases

C. copper decreases and of germanium increases

D. copper increases and of germanium decreases

Answer: C

Watch Video Solution

91. Which among the following statements is correct regarding the dependence of voltage gain of an amplifier on the frequency of the signal?

A. does not depend upon frequency of the signal

B. increases with frequency of the signal

C. decreases with frequency of the signal

D. initially constant and then decreases with frequency of the signal

Answer: D

 Watch Video Solution

92. If P, Q and R are physical quantities, having different dimensions, which of the following combination can never be a meaningful quantity?

A. $\frac{PQ - Q^2}{R}$

B. $(PQ - R)$

C. $\frac{PQ}{R}$

D. $\left(\frac{PR - Q^2}{R}\right)$

Answer: A

Watch Video Solution

93. Assuming that the human pupil has a radius of 0.25 cm and a comfortable viewing distance of 25 cm. The minimum separation

between two point object that the human eye can resolve for the light of wavelength 500 nm is

A. $300\mu m$

B. $1\mu m$

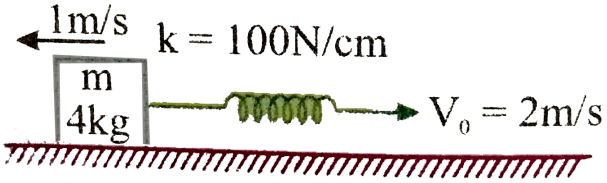
C. $30\mu m$

D. $100\mu m$

Answer: C

Watch Video Solution

94. The spring block system lies on a smooth horizontal surface. The free end of the spring is being pulled towards right with constant speed $v_0 = 2m/s$. At $t = 0\,\text{sec}$, the spring of constant $k = 100N/cm$ is unstretched and the block has a speed $1m/s$ to left. The maximum extension of the spring is.



(A) 2 cm (B) 4 cm (C) 6 cm

A. 2 cm

B. 4 cm

C. 6 cm

D. 8 cm

Answer:

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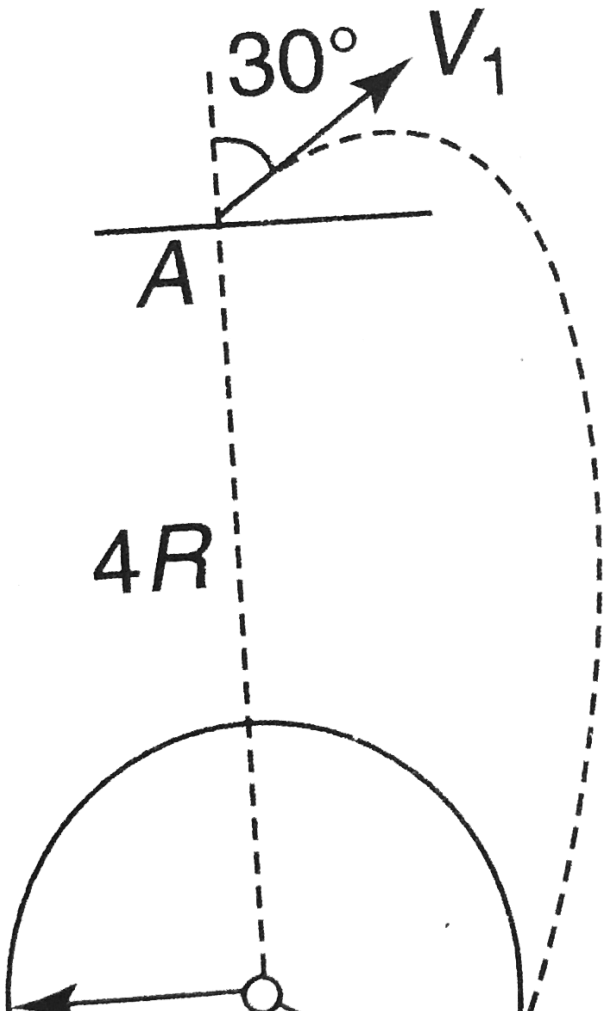
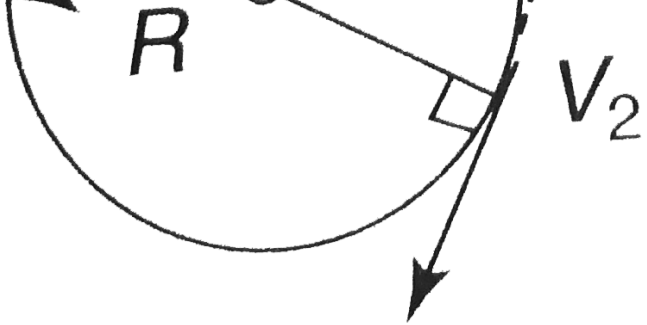
95. A particle is projected from point A, that is at a distance $4R$ form the centre of the earth, with speed V_1 in a direction making 30° with the line joining the centre of the earth and point A, as shown. Consider gravitational

interaction only between these two. (Use $\frac{GM}{R} = 6.4 \times 10^7 m^2/s^2$). The speed V_1 if particle pasess grazing the surface of the earth is





A. $4\sqrt{2}\text{km s}^{-1}$

B. $3\sqrt{2}\text{km s}^{-1}$

C. $6\sqrt{2}\text{km s}^{-1}$

D. $5\sqrt{2}\text{km s}^{-1}$

Answer: A

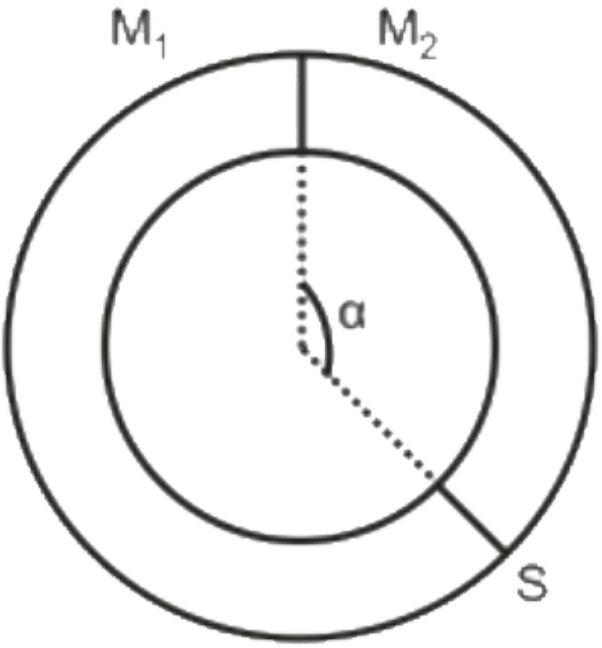
Watch Video Solution

96. A hill is $500m$ high. Supplies are to be across the hill using a canon that can hurl packets at a speed of $125m/s$ over the hill . The canon is located at a distance of $800m$ from the foot to hill and can be viewed on the ground at a speed of 2 m//s , so that its distance from the hill can be adjusted. What is the shortest time (in second) in which a packet can reach on the ground across the hill ? $g = 10m/s^2$.

 Watch Video Solution

97. A ring - shaped tube contains two ideal gases with equal masses and relative molar masses $M_1 = 32$ and $M_2 = 28$. The gases are separated by one fixed partition and another movable stopper S which can move freely without friction inside the ring . What is the value of the angel α (in degree) at equilibrium

?



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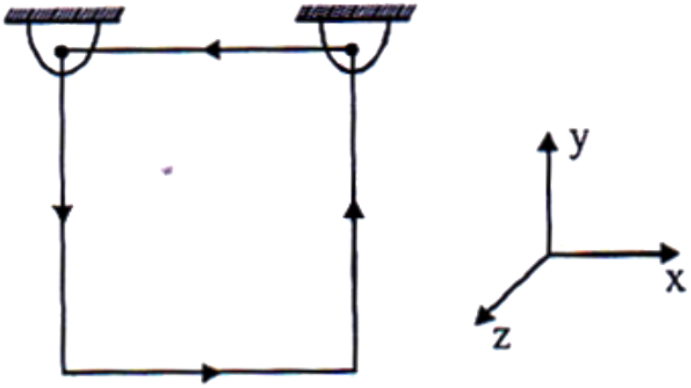
98. A current - carrying uniform square frame is suspended from hinged support as shown

in the diagram such that it can freely rotate about its upper side. The length and mass of each side of the frame are 2 m and 4 kg respectively. A uniform magnetic field $\vec{B} = \left(3\hat{i} + 4\hat{j}\right)$ is applied. When the wireframe is rotated to 45° from vertical and released it remains in equilibrium. What is the magnitude of current (in A) in the wire frame ?



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99. A plane is in level flight at a constant speed such that the speed of the air below the wings is $144\,\mathrm{km\,h^{-1}}$ and above the wing is $180\,\mathrm{km\,h^{-1}}$. If each of its wings has an area of $25\,\mathrm{m^2}$, then the mass (in kg) of the plane is $\left[\rho_{\text{air}} = 1\,\mathrm{kg\,m^{-3}}, g = 10 ms^{-2}\right]$

Watch Video Solution

100. An thin rod of negligible mass and area of cross - section $4 \times 10^{-6} m^2$, suspended vertically from one end, has a length of 0.5 m at $100^\circ C$. The rod is cooled to $0^\circ C$ but prevented from contracting by attaching a mass at the lower end. The value of this mass is (in Kg)

(Given, coefficient of linear expansion is $10^{-5^\circ} C^{-1}$, Young's modulus is $Y = 10^{11} Nm^{-2}$ and $g = 10 ms^{-2}$)

Watch Video Solution

101. Which of these materials requires the least value of magnetic field strength to magnetize it ?

A. Nickel

B. Silver

C. Tungsten

D. Sodium Chloride

Answer: A

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102. A current of 2A flows through a 2Ω resistor when connected across a battery. The same battery supplies a current of 0.5A when connected across a 9Ω resistor The internal resistance of the battery is

A. $\frac{1}{3}\Omega$

B. $\frac{1}{4}\Omega$

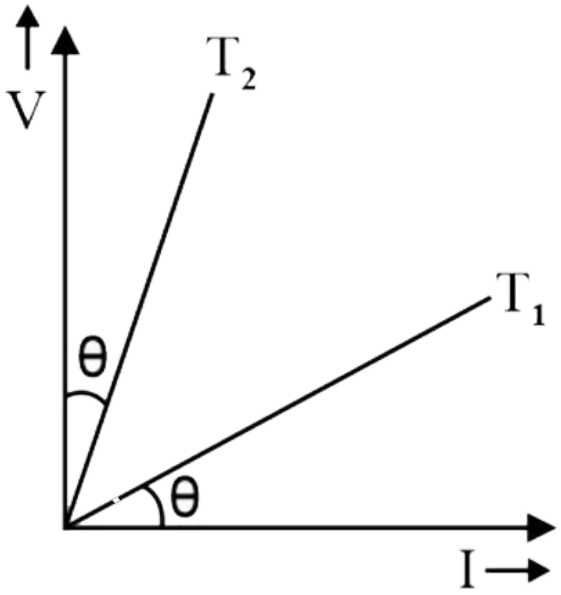
C. 5Ω

D. 0.5Ω

Answer: A

Watch Video Solution

103. The V - I graphs for a conductor at temperature T_1 and T_2 are shown in the figure $(T_2 - T_1)$ is proportional to



A. $\tan\theta$

B. $\sin\theta$

C. $\cot 2\theta$

D. $\cos 2\theta$

Answer: C

Watch Video Solution

104. A superconducting loop of radius R has self inductance L, A uniform & constant magnetic field B is applied perpendicular to

the plane of the loop.Initially current in this loop is zero.The loop is rotated about its diameter by 180°.Find the current in the loop after rotation.

A. zero

B. $\frac{B\pi R^2}{L}$

C. $\frac{2B\pi R^2}{L}$

D. $\frac{B\pi R^2}{2L}$

Answer: C

Watch Video Solution

105. A solid sphere of radius R has a charge Q distributed in its volume with a charge density $\rho = kr^a$, where k and a are constants and r is the distance from its centre. If the electric field at $r = \frac{R}{2}$ is $\frac{1}{8}$ times that $r = R$, find the value of a.

A. 2

B. 3

C. 2.5

D. 0.2

Answer: A

Watch Video Solution

106. Two balls with equal charge are in a vessel with ice at - $10^{\circ}C$ at a distance of 25 cm from each other. On forming water at $0^{\circ}C$, the balls are brought nearer to 5 cm for the interaction between them to be same. If the dielectric constant of water at $0^{\circ}C$ is 80 , the dielectric constant of ice at $-10^{\circ}C$ is

A. 40

B. 3.2

C. 20

D. 6.4

Answer: B

Watch Video Solution

107. A circular coil of radius R carries a current i. The magnetic field at its centre is B. The

distance from the centre on the axis of the coil where the magnetic field will be $B/8$ is

A. $R\sqrt{2}$

B. $R\sqrt{3}$

C. 2R

D. 3R

Answer: B

Watch Video Solution

108. A Carnot engine, having an efficiency of $\eta = \frac{1}{10}$ as heat engine, is used as a refrigerator. If the work done on the system is 10 J, the amount of energy absorbed from the reservoir at lower temperature is

A. 99 J

B. 90 J

C. 1 J

D. 100 J

Answer: B

Watch Video Solution

109. Two bodies of specific heats s_1 and s_2 having same heat capacities are combinated to form a single composite body. Find the specific heat of the composite body.

A. $S_1 + S_2$

B. $\frac{S_1 + S_2}{2}$

C. $\frac{2S_1S_2}{S_1 + S_2}$

D. $\frac{1}{S_1} + \frac{1}{S_2}$

Answer: C

Watch Video Solution

110. The phase difference between two points separated by 0.8 m in a wave of frequency 120 Hz is 0.5π . The wave velocity is

A. $144ms^{-1}$

B. $384ms^{-1}$

C. $256ms^{-1}$

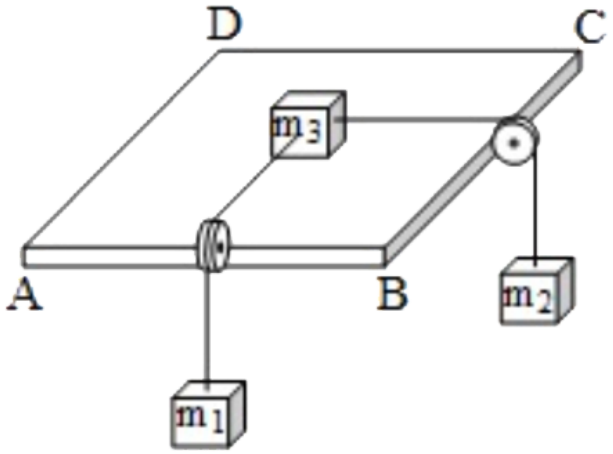
D. $720ms^{-1}$

Answer: B

Watch Video Solution

111. Three blocks are arranged on a horizontal table ABCD as shown in the figure . The strings and pulleys are massless and both the pulleys stand vertical . The strings connecting blocks m_1 and m_2 are also vertical and are perpendicular to faces AB and BC which are mutually perpendicular to each other . If m_1 and m_2 are 3 kg and 4 kg respectively.

Coefficient of friction between the block $m_3 = 10kg$ and the surface is $\mu = 0.6$ then, frictional force on m_3 is



A. 30 N

B. 40 N

C. 50 N

D. 60 N

Answer: C

Watch Video Solution

112. Two gold pieces, each of mass 0.035 g are placed in a box of mass 2.3 g. The total mass of the box with gold pieces is

A. 2.3 g

B. 2.4 g

C. 2.37 g

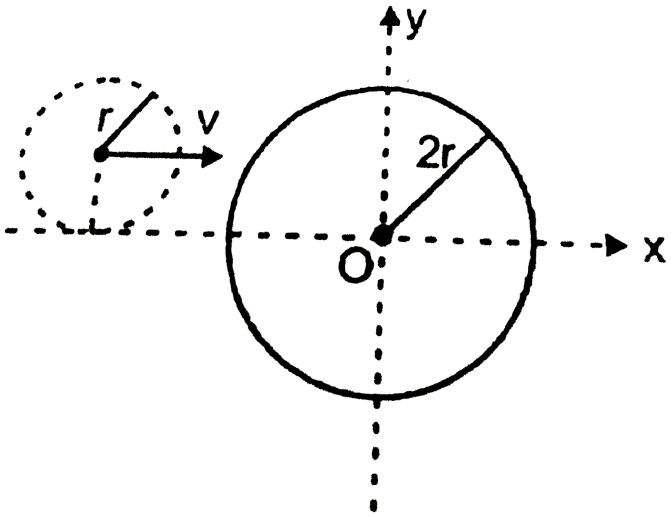
D. 2.370 g

Answer: B

Watch Video Solution

113. A small smooth disc of mass m and radius moving with an initial velocity $'v'$ along the positive $x-$ axis collided with a big disc of mass $2m$ and radius $2r$ which was initially at rest with its centre at origin as shown in

figure.



If the coefficient of restitution is 0 then velocity of larger disc after collision is

A. $\frac{8}{27}v\hat{i} - \frac{2\sqrt{2}}{27}v\hat{j}$

B. $\frac{8}{27}v\hat{i} - \frac{\sqrt{2}}{27}v\hat{j}$

C. $\frac{v}{3}\hat{i}$

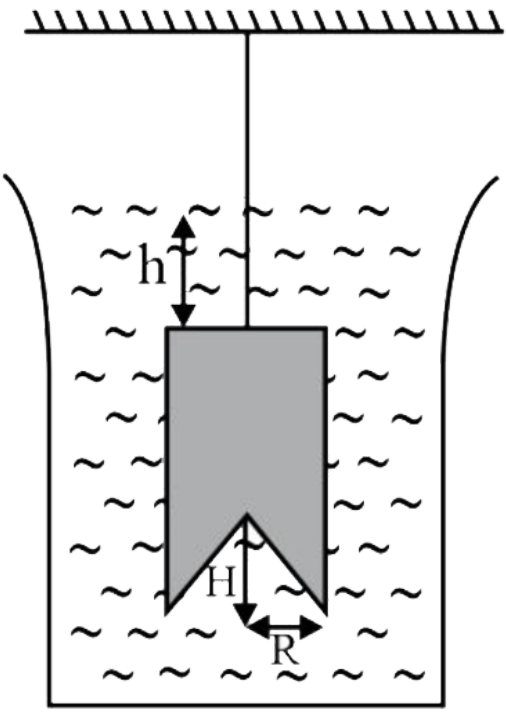
D. $\frac{2\sqrt{2}}{27}v\hat{i} - \frac{8}{27}v\hat{j}$

Answer: A

Watch Video Solution

114. A conical portion of radius R and height H is removed from the bottom of a cylinder of radius R. The volume of the remaining cylinder is V and its mass is M. It is suspended by a string in a liquid of density ρ where it stays vertical . The upper surface of the cylinder is at

depth h below the liquid surface . The force on the bottom of the cylinder by the liquid is



A. Mg

B. $Mg - V\rho g$

C. $Mg + \pi R^2 h\rho g$

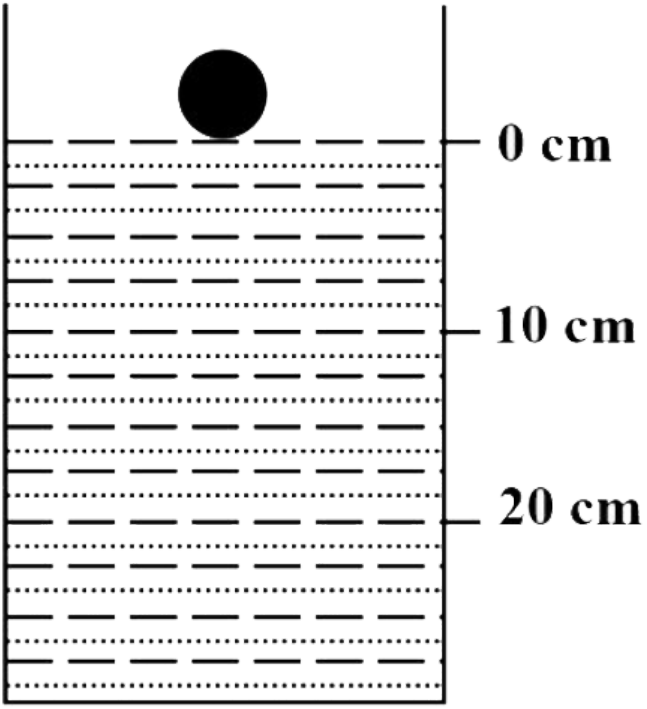
D. $\rho g\left(V + \pi R^2 h\right)$

Answer: D

Watch Video Solution

115. A spherical ball of density ρ and radius 0.003m is dropped into a tube containing a viscous fluid , filled up to the 0 cm mark as shown in the figure . Viscosity of the fluid $= 1.260 Nm^{-2}s^{-1}$ and its density

$\rho_L = \rho/2 = 1260 kgm^{-3}$. Assume the ball reaches a terminal speed by the 10 cm mark. Find the time taken by the ball to traverse the distance between the 10 cm and 20 cm mark . [g = acceleration due to gravity $= 10 ms^{-2}$]



A. 2s

B. 3s

C. 5s

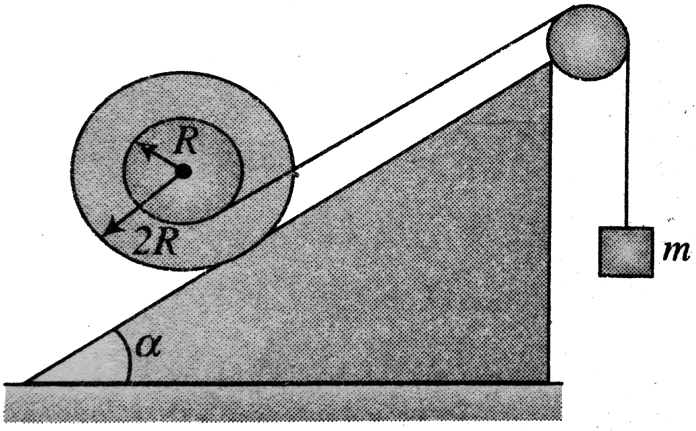
D. 1.5 s

Answer: C

Watch Video Solution

116. A spool of mass M and radius $2R$ lies on an inclined plane as shown in the figure. A light thread is wound around the connecting

tube of the spool and its free end carries a weight of mass m. The value of m so that system is in equilibrium is



A. $2M \sin \alpha$

B. $M \sin \alpha$

C. $2M \tan \alpha$

D. $M \cos \alpha$

Answer: A

 Watch Video Solution

117. A carrier wave of peak voltage 12 V is used to transmit a message signal . The peak voltage of the modulating signal in order to have a modulation index of 75 % is

A. 8 V

B. 6 V

C. 7 V

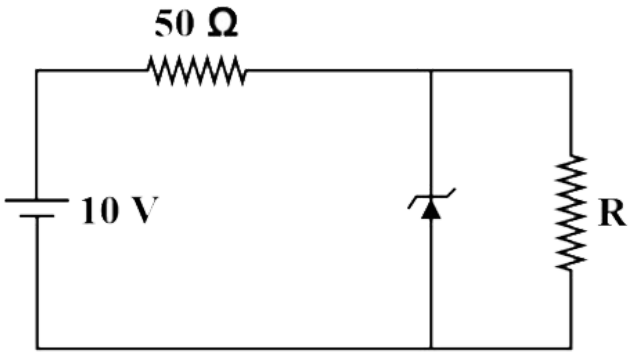
D. 9 V

Answer: D

Watch Video Solution

118. The 6 V Zener diode shown in the figure has negligible resistance and a knee current of 5 mA. The minimum value of R (in Ω) so that

the voltage across it does not fall below 6 V is



A. 40

B. 60

C. 72

D. 80

Answer: D

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119. For a material medium, the values of refractive index for violet and colours are given as $n_v = 1.56$ and $n_r = 1.44$. The dispersive power of a prism made out of this material is

A. 0.06

B. 0.24

C. 0.03

D. none of these

Answer: B

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120. A ray of light is incident from a denser to a rarer medium. The critical angle for total internal reflection is θ_{ic} and Brewster's angle of incidence is θ_{iB} such that $\frac{\sin\theta_{ic}}{\sin\theta_{iB}} = \eta = 1.28$. The relative refractive index of the two media is

A. 0.4

B. 0.2

C. 0.9

D. 0.8

Answer: D

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121. Power supplied to a mass $2kg$ varies with time as $P = \frac{3t^2}{2}$ watt. Here t is in second . If velocity of particle at t = 0 is v = 0, the velocity of particle at time $t = 2s$ will be:

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122. A spring of force constant $200Nm^{-1}$ has a block of mass 10 kg hanging at its one end and the other end of the spring is attached to the celling of an elevator. The elevator is rising upwards with an acceleration of $\frac{g}{4}$ and the block is in equilibrium with respect to the elevator . when the acceleration of the elevator suddenly ceases , the block starts oscillating . What is the amplitude (in m) of these oscillations ?

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123. If the first excitation energy of a hydrogen - like atom is 27.3 eV , then ionization energy of this atom will be

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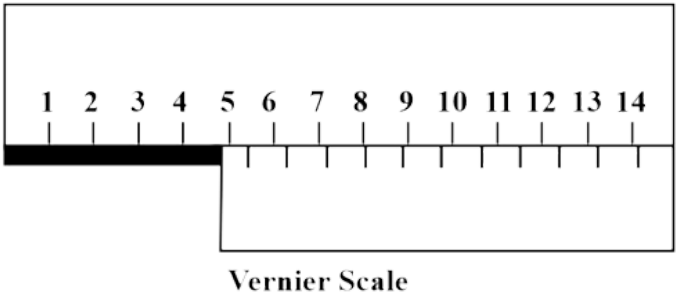
124. Consider the vernier callipers shown below. The instrument has no zero error.

If 1 m.s. d = 1 mm and 7 m.s.d = 8 v.s.d, of the

rod shown in the figure ? [Given , the 4^{th} v.s.d coincides with m.s d]



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125. The electric field associated with a light wave is given by $E = E_0 \sin\left[\left(1.57x10^7 m^{-1}(x - ct)\right]\right.$. Find the stopping potential when this light is used

in an experiment on photoelectric affect with a metal having work - function 1.9 eV.

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126. A magnetised wire of magnetic moment $'M'$ and length $'l'$ is bent in the form of a semicircle of radius $'r'$. The new magnetic moment is

A. $\frac{2M}{\pi}$

B. 2M

C. $\frac{M}{\pi}$

D. zero

Answer: A

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127. Two cells, having the same emf, are connected in series through an external resistance R. Cells have internal resistance r_1 and $r_2(r_1 > r_2)$ respectively. When the circuit

is closed, the potential difference across the first cell is zero the value of R is

A. $\frac{r_1 + r_2}{2}$

B. $\frac{r_1 - r_2}{2}$

C. $r_1 + r_2$

D. $r_1 - r_2$

Answer: D

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128. In a magnetic field of $0.05T$, area of a coil changes from $101cm^2$ to $100cm^2$ without changing the resistance which is 2Ω. The amount of charge that flow during this period is

A. $2.5 \times 10^{-6}C$

B. $2 \times 10^{-6}C$

C. $10^{-6}C$

D. $8 \times 10^{-6}C$

Answer: A

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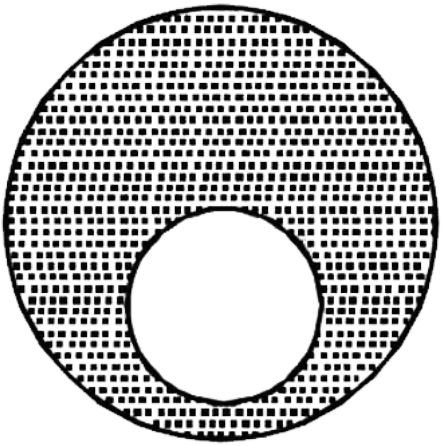
129. A spherical portion has been removed from a solid sphere having a charge distributed uniformly in its volume as shown in the figure. The electric field inisde the emptied space is



A. zero everywhere

B. non - zero and uniform

C. non - uniform

D. zero only at its centre

Answer: B

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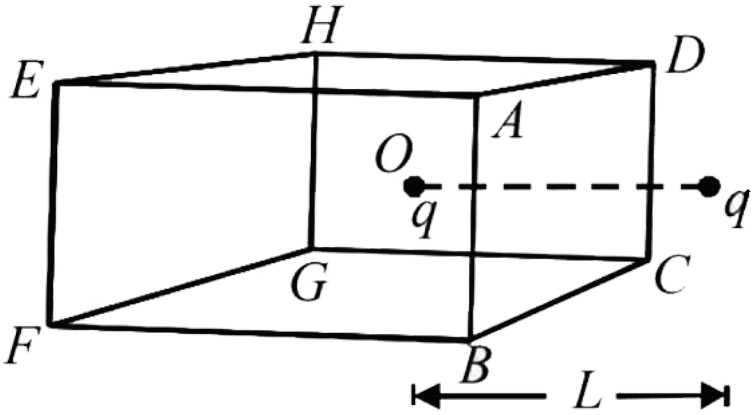
130. A charged particle q is placed at the centre O of cube of length L(A B C D E F G H). Another same charge q is placed at a distance

L from O. Then the electric flux through ABCD is



A. $\frac{q}{4\varepsilon_0}$

B. $\frac{q}{6\varepsilon_0}$

C. $\frac{q}{2\varepsilon_0}$

D. $\frac{q}{3\varepsilon_0}$

Answer: B

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131. A disc of radius R rotates with constant angular velocity ω about its own axis. Surface charge density of this disc varies as $\sigma = \alpha r^2$, where r is the distance from the centre of disc. Determine the magnetic field intensity at the centre of disc.

A. $\mu_0 a \omega R^3$

B. $\frac{\mu_0 a\omega R^3}{6}$

C. $\frac{\mu_0 a\omega R^3}{8}$

D. $\frac{\mu_0 a\omega R^3}{3}$

Answer: B

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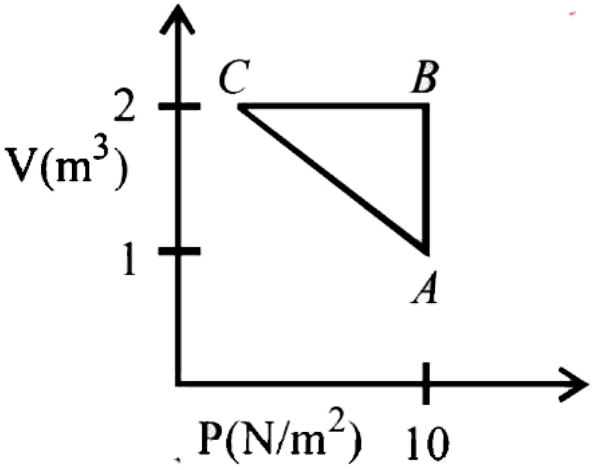
132. An ideal gas is taken through the cycle $A \to B \to C \to A$, as shown in the figure, If the net heat supplied to the gas in the cycle is 5J, the work done by the gas in the process C

to A is



A. $-5J$

B. $-10J$

C. $-15J$

D. $-20J$

Answer: A

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133. The displacement of particle in a medium can be expressed as $y = 10^{-6}\sin(100t - 20x + \pi/4)$m, where t is in seconds and x in meters. The speed of the wave is

A. $2000ms^{-1}$

B. $5ms^{-1}$

C. $20ms^{-1}$

D. $5\pi s^{-1}$

Answer: B

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134. The upper half of an inclined plane with inclination ϕ is perfectly smooth while the lower half is rough. A body starting from rest at the top will again come to rest at the bottom if the coefficient of friction for the lower half is given by

A. $\tan\phi$

B. $2\tan\phi$

C. $2\cos\phi$

D. $2\sin\phi$

Answer: B

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135. Which one of the following represents the correct dimensions of the coefficient of viscosity?

A. $\left[ML^{-1}T^{-2}\right]$

B. $\left[MLT^{-1}\right]$

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

D. $\left[ML^{-2}T^{-2}\right]$

Answer: C

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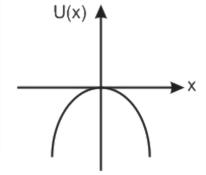
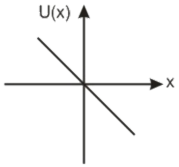
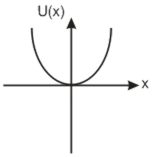
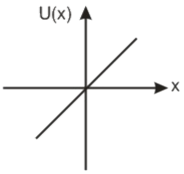
136. A particle is placed at the origin and a force F=Kx is acting on it (where k is a positive constant). If $U_{(0)} = 0$, the graph of $U(x)$

verses x will be (where U is the potential energy function.)

A. 

B. 

C. 

D. 

Answer: A

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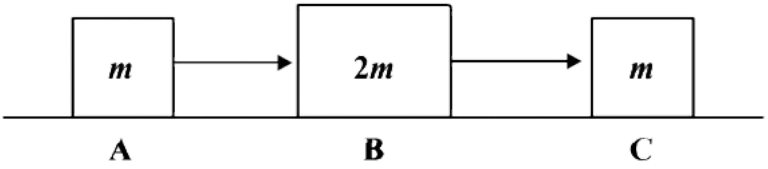
137. Three object A, B and C are kept is a straight frictionless horizontal surface . These have masses m, $2m$ and m repectively . The object A move toward B with a speed $9m/s$ and makes an elastic collision with a there after B makes complately inclesis with C . All motion over on the same straight line . Find

the first speed of the object C



A. 4

B. 7

C. 10

D. 12

Answer: A

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138. A large tank filled with water to a height h is to be emptied through a small hole at the bottom. The ratio of times taken for the level of water to fall from h to $\frac{h}{2}$ and from $\frac{h}{2}$ to zero is

A. $\sqrt{2}$

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

C. $\sqrt{2}-1$

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

Answer: C

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139. A wire fixed at the upper & stretches by length l by applying a force F. What is the work done by stretching the wire ?

A. $\frac{F}{2l}$

B. Fl

C. 2Fl

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

Answer: D

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140. Which among the following has a hydrogen-like spectrum and whose lines have wavelengths four times shorter that those of atomic hydrogen?

A. Helium ion

B. Beryllium ion

C. Lithium ion

D. None of these

Answer: A

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141. Name the electromagnetic waves used for studying crystal structure of solids. What is its frequency range?

A. Microwave

B. visible radiation

C. Ultraviolet

D. X - rays

Answer: D

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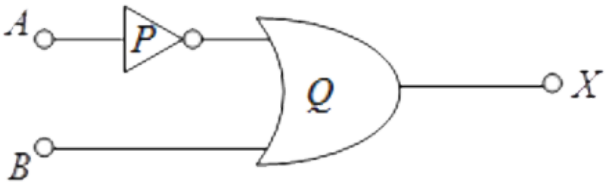
142. Write down the output at X for the inputs

A = 0 , B = 0 and A = 1 , B = 1



A. x = 0 and 0

B. x = 0 and 1

C. x = 1 and 0

D. x = 1 and 1

Answer: D

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143. A battery is connected between two points A and B on the circumference of a uniform conducting ring of radius r and

resistance R . One of the arcs AB of the ring subtends an angle θ at the centre . The value of the magnetic induction at the centre due to the current in the ring is

A. proportional to $(180^\circ - \theta)$

B. inversely proportional to r

C. zero , only if $(\theta = 180^\circ)$

D. zero for all values of θ

Answer: D

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144. In an experiment to determine the focal length (f) of a concave mirror by the $u - v$ method, a student places the object pin A on the principal axis at a distance x from the pole P. The student looks at the pin and its inverted image from a distance keeping his/her eye in line with PA. When the student shifts his/her eye towards left, the image appears to the right of the object pin. Then,

A. $x < f$

B. $f < x < 2f$

C. x = 2f

D. $x > 2f$

Answer: B

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145. Yellow light is used in a single slit diffraction experiment with slit width of 0.6 mm. If yellow light is replaced by X-rays, then the observed pattern will reveal,

A. that the central maximum is narrower

B. more number of fringes

C. less number of fringes

D. no diffraction pattern

Answer: D

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146. Two cylindrical wire A and B have the same resistance . The ratio of their specific resistances and diameters are 1 : 2 each, then

what is the ratio of the length of B to the length of A ?

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147. Earth receives $1400 W m^{-2}$ of solar power. If all the solar energy falling on lens of area $0.2 m^2$ is focussed on to a block of ice of mass 280 g , then what is the time (in min) taken by the ice to melt completely ? $\left[L_{\text{fusion}} = 3.3 \times 105 J kg^{-1}\right]$

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148. Consider a pair of identical pendulums, which oscillate with equal amplitude independently such that when one pendulum is at its extreme position making an angle of 2° to the right with the vertical , the other pendulum makes an angle of 1° to the left of the vertical. What is the phase difference between the pendulums?

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149. A metre stick is balanced on a knife edge at its centre. When two coins, each of mass $5g$ are put one on of the other at the $12cm$ mark, the stick is found to balanced at $45cm$. The mass of the metre stick is.

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150. Graviational acceleration on the surface of planet is $\frac{\sqrt{6}}{11}g$. where g is the gravitational acceleration on the surface of the earth. The

average mass density of the planet is $\frac{2}{3}$ times that of the earth. If the escape speed on the surface of the earth is taken to be $11kms^{-1}$ the escape speed on the surface of the planet in kms^{-1} will be

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