PHYSICS

BOOKS - MTG-WBJEE PHYSICS (HINGLISH)

MODEL TEST PAPTER

Mcqs

1. A ball rolls of the top of a stair way with a horizontal velocity u m s^{-1}. If the steps are h

metre high and b metre wide, the time taken by the ball to hit the edge of n^{th} step, is

A. $\frac{hu}{gb}$

B. $\frac{2hu}{gb}$

C. $\frac{2hu^2}{gb}$

D. $\frac{hu^2}{2gb}$

Answer: B

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2. If momentum (P), area (A) and time (T) are taken to be fundamental quantities, then energy has the dimensional formula

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

B. $\left[P^2A^1T^1\right]$

C. $\left[P^1A^{-1/2}T^1\right]$

D. $\left[P^1A^{1/2}T^{-1}\right]$

Answer: D

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3. The ratio between kinetic and potential energies of a body executing simple harmonic motion, when it is at a distance of $\frac{1}{N}$ of its amplitude from the mean position is

A. $N^2 + 1$

B. $\frac{1}{N^2}$

C. N^2

D. $N^2 - 1$

Answer: D

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4. A particle moves in x-y plane. The position vector of particle at any time t is $\overrightarrow{r} = \left\{(2t)\hat{i} + \left(2t^2\right)\hat{j}\right\}$ m. The rate of change of θ at time t = 2 s (where θ is the angle which its velocity vector makes with positive x-axis) is

A. $\frac{2}{17}\text{rad s}^{-1}$

B. $\frac{1}{14}\text{rad s}^{-1}$

C. $\frac{4}{7}\text{rad s}^{-1}$

D. $\frac{6}{5}\text{rad s}^{-1}$

Answer: A

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5. The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is

A. $c:1$

B. $c^2:1$

C. $1:1$

D. $\sqrt{c}:1$

Answer: C

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6. A block of mass 10 kg is moving horizontally with a speed of 1.5 m s^{-1} on a smooth plane. If a constant vertical force 10 N acts on it, the displacement of the block from the point of application of the force at the end of 4 second is

A. 5 m

B. 20 m

C. 12 m

D. 10 m

Answer: D

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7. The electron emitted in beta radiation originates from

A. inner orbits of atoms

B. free electrons existing in nuclei

C. decay of a neutron in a nuclei

D. photon escaping from the nucleus

Answer: C

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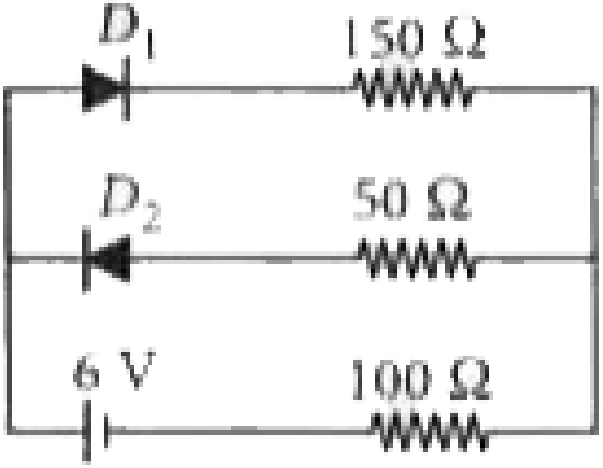
8. The circuit shown in the figure contains two diodes each with a forward resistance of 50 ohm and with infinite backward resistance. If the battery voltage is 6 V, the current through

the 100 ohm resistance (in ampere) is



A. zero

B. 0.02

C. 0.03

D. 0.033

Answer: B

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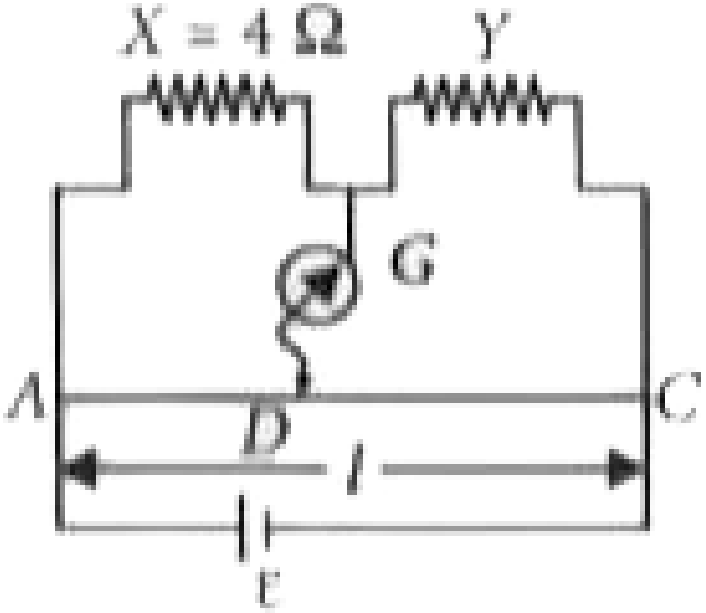
9. Figure shows a meter bridge, wire AC has uniform cross section. The length of wire AC is 100 cm X is a standard do resistor of 4 Ω and Y is a coil. When Y is immersed in melting ice, the null point is at 40 cm from point A. When the coil Y is heated to 100°C, a 100 Ω resistor has to be connected in parallel with Y in order to keep the bridge balanced at the same point. Temperature coefficient of resistance of the

coil is



A. $6.3 \times 10^{-4} K^{-1}$

B. $4.3 \times 10^{-4} K^{-1}$

C. $8.3 \times 10^{-4} K^{-1}$

D. $2.3 \times 10^{-4} K^{-1}$

Answer: A

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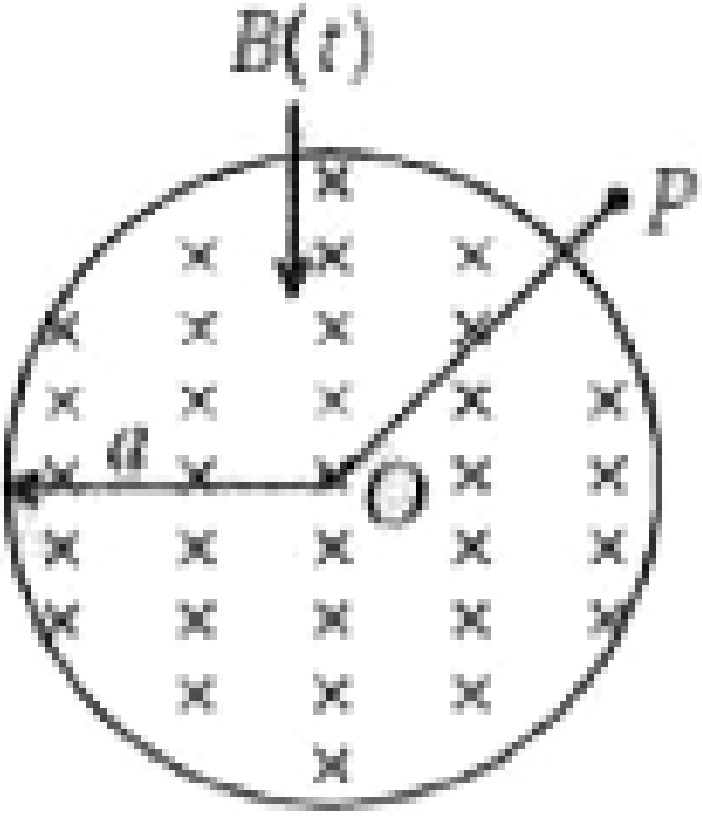
10. A uniform but time-varying magnetic field B(t) exists in a circular region of radius a and is directed into the plane of the paper, as shown in the figure. The magnitude of the induced electric field at point P at a distance r

from the centre of the circular region



A. is zero

B. decreases as $\frac{1}{r}$

C. increases as r

D. decreases as $\frac{1}{r^2}$

Answer: B

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11. A boat which has a speed of 5 km h^{-1} in still water crosses a river of width 1 km along the shortest possible path in 15 minutes. The velocity of the river water in km h^{-1} is

A. 1

B. 3

C. 4

D. $\sqrt{41}$

Answer: B

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12. Imagine a light planet revolving around a very massive star in a circular orbit of radius R with a period of revolution T. If the gravitational force of attraction between the

planet and the star is proportional to $R^{-5/2}$, then T^2 is proportional to

A. R^3

B. $R^{7/2}$

C. $R^{3/2}$

D. $R^{7/3}$

Answer: B

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13. A circular platform is mounted on a frictionless vertical axle. Its radius R=2 m and its moment of inertia about the axle is 200 kg m^2. It is initially at rest. A 50 kg man stands on the edge of the platform and begins to walk along the edge at the speed of 1 m s^{-1} relative to the ground. Time taken by the man to complete one revolution with respect to disc is

A. πs

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

C. $2\pi s$

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

Answer: C

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14. 5 mole of an ideal gas with γ = 7/5 initially at STP are compressed adiabatically so that its temperature becomes $400^\circ C$. The increase in the internal energy of gas in kJ is

A. 21.55

B. 41.55

C. 65.55

D. 50.55

Answer: B

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15. A resistor R and 2 μF capacitor in series are connected through a 200 V direct supply. Across the capacitor is a neon bulb that lights

up at 120 V. Find the value of R to make the bulb light up 5 s after the switch has been closed. (Take $\log_{10}$ 2.5=0.4)

A. $1.7 \times 10^5 \Omega$

B. $2.7 \times 10^6 \Omega$

C. $3.3 \times 10^7 \Omega$

D. $1.3 \times 10^4 \Omega$

Answer: B

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16. A fork A has frequency 2% more than the standard fork and B has a frequency 3% less than the frequency of same standard fork. The forks A and B when sounded together produced 6 beats s^{-1} . The frequency of fork A is

A. 116.4 Hz

B. 120 Hz

C. 122.4 Hz

D. 238.8 Hz

Answer: C

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17. A coil of resistance 400 Ω is placed in a magnetic field. If the magnetic flux ϕ (Wb) linked with the coil varies with time t (s) as $\phi = 50t_2 + 4$. The current in the coil at t=2 s is

A. 0.5 A

B. 0.1 A

C. $2A$

D. $1A$

Answer: A

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18. When a wire of length 10 m is subjected to a force of 100 N along its length, the lateral strain produced is 0.01×10^{-3}. The Poisson's ratio was found to be 0.4. If the area of cross-section of wire is 0.025 m^2, its Young's modulus is

A. $1.6 \times 10^{8} Nm^{-2}$

B. $2.5 \times 10^{10} Nm^{-2}$

C. $1.25 \times 10^{11} Nm^{-2}$

D. $16 \times 10^{9} Nm^{-2}$

Answer: A

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19. On shining light of wavelength 6.2×10^{-6} m on a metal surface photo-electrons are emitted. The work function of the metal is 0.1

eV. Find the kinetic energy of a photo-electron (in eV)

A. 0.1

B. 0.2

C. 0.3

D. 0.4

Answer: A

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20. Let $\rho(r) = \frac{Qr}{\pi R^4}$ be the charge density distribution for a solid sphere of radius R and total charge Q. For a point P inside the sphere at a distance r_1 from the centre of the sphere, the magnitude of electric field is

A. $\frac{Q}{4\pi\varepsilon_0 r_1^2}$

B. $\frac{Qr_1^2}{4\pi\varepsilon_0 R^4}$

C. $\frac{Qr_1^2}{3\pi\varepsilon_0 R^4}$

D. zero

Answer: C

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21. An insulated container containing n moles of monoatomic gas of molar mass m is moving with a velocity v_0. If the container is suddenly stopped, find the change in temperature.

A. $\frac{mnv_0^2}{3R}$

B. $\frac{mv_0^2}{3nR}$

C. $\frac{mnv_0^2}{R}$

D. $\frac{mv_0^2}{2R}$

Answer: A

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22. The earth's magnetic field at a given point is $0.5 \times 10^{-5} \mathrm{Wb\,m^{-2}}$. This field is to be annulled by magnetic induction at the centre of a circular loop of radius 5 cm. The current required to be flown in the loop is nearly

A. 0.2 A

B. 0.4 A

C. $4A$

D. $40A$

Answer: B

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23. In refrigerator one removes heat from a lower temperature and deposits to the surroundings at a higher temperature. In this process, mechanical work has to be done, which is provided by an electric motor. If the

motor is of 1 kW power, and heat is transferred from $3^{\circ}C$ to $27^{\circ}C$, find the heat taken out of the refrigerator per second assuming its efficiency is 50% of a perfect engine.

A. 14 J

B. 12 J

C. 19 J

D. 20 J

Answer: C

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24. A block of mass 0.50 kg is moving with a speed of 2.0 m s^{-1} on a smooth surface. It strikes another stationary block of mass 1.0 kg and then move together as a single body. The energy loss during the collision is

A. 0.16 J

B. 1.00 J

C. 0.67 J

D. 0.34 J

Answer: C

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25. A particle of charge q and mass m moves in a circular orbit of radius r with angular speed ω. The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

A. ω and q

B. ω,q and m

C. q and m

D. ω and m

Answer: C

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26. Water is boiled in flat bottom kettle placed on a stove. The area of the bottom is 3000 cm^2 and the thickness is 2 mm. If the amount of steam produced is 1 g min^{-1} , the difference of temperature between the inner

and outer surfaces of the bottom is (Given : Thermal conductivity of the material of kettle is 0.5 cal $^{\circ}C^{-1}s^{-1}\mathrm{cm}^{-1}$ and latest heat of steam is 540 cal g^{-1})

A. $2.1 \times 10^{-3}{}^{\circ}C$

B. $3.1 \times 10^{-3}{}^{\circ}C$

C. $1.2 \times 10^{-3}{}^{\circ}C$

D. $2.5 \times 10^{-3}{}^{\circ}C$

Answer: C

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27. When in hydrogen like ion, electron jumps from n = 3 to n = 1, the emitted photon has frequency 2.7×10^{15} Hz. When electron jumps from n=4 to n=1, the frequency is

A. 1.6×10^{15} Hz

B. 2.8×10^{15} Hz

C. 6.4×10^{15} Hz

D. 4.8×10^{15} Hz

Answer: B

View Text Solution

28. Two cells of same emf ε but of different internal resistances r_1 and r_2 are connected in series with an external resistance R. The potential drop across the first cell is found to be zero. The external resistance R is

A. $r_1 + r_2$

B. $r_1 - r_2$

C. $r_2 - r_1$

D. r_1^2 / r_2

Answer: B

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29. What should be the minimum value of refractive index of a prism of refractive angle A, so that there is no emergent ray irrespective of angle of incidence?

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

B. $\cos\frac{A}{2}$

C. $\text{cosec}\frac{A}{2}$

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

Answer: C

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30. A polyster fibre rope of diameter 3 cm has a breaking strength of 150 kN. If it is required to have 600 kN breaking strength. What should be the diameter of similar rope?

A. 12 cm

B. 6 cm

C. 3 cm

D. 1.5 cm

Answer: B

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31. Distance between the centres of two stars is 10a. The masses of these stars are M and 16M and their radii a and 2a respectively. A body of mass m is fired straight from the

surface of the larger star towards the smaller star. The minimum initial speed for the body to reach the surface of smaller star is

A. $\frac{2}{3}\sqrt{\frac{Gm}{a}}$

B. $\frac{3}{2}\sqrt{\frac{5Gm}{a}}$

C. $\frac{2}{3}\sqrt{\frac{5Gm}{a}}$

D. $\frac{3}{2}\sqrt{\frac{Gm}{a}}$

Answer: B

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32. Two point masses of 0.3 kg and 0.7 kg are fixed at the ends of a rod of length 1.4 m and of negligible mass. The rod is set rotating about an axis perpendicular to its length with a uniform angular speed. The point on the rod through which the axis should pass in order that the work required for rotation of the rod is minimum, is located at a distance of

A. 0.42 in from mass of 0.3 kg

B. 0.70 m from mass of 0.7 kg

C. 0.98 m from mass of 0.3 kg

D. 0.98 m from mass of 0.7 kg.

Answer: C

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33. An object of specific gravity ρ is hung from a thin steel wire. The fundamental frequency for transverse standing waves in the wire is 300 Hz. The object is. immersed in water so that one half of its volume is submerged. The

new fundamental frequency in Hz is (Take density of water = 1 g cm^{-3})

A. $300\left(\frac{2\rho-1}{2\rho}\right)^{1/2}$

B. $300\left(\frac{2\rho}{2\rho-1}\right)^{1/2}$

C. $300\left(\frac{2\rho}{2\rho-1}\right)$

D. $300\left(\frac{2\rho-1}{2\rho}\right)$

Answer: A

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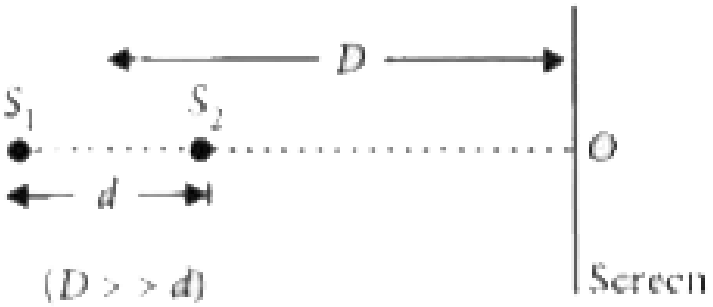
34. Two point monochromatic and coherent sources of light of wavelength λ are each placed as shown in the figure below. The initial phase difference between the sources is zero. Select the incorrect statement.



A. If $d = \dfrac{7\lambda}{2}$, O will be minima

B. If $d = \lambda$, only one maxima can be observed on screen .

C. If d=4.8λ, then total 10 minimas would be there on screen.

D. If $d = \frac{5\lambda}{2}$, then intensity at O would be maximum.

Answer: D

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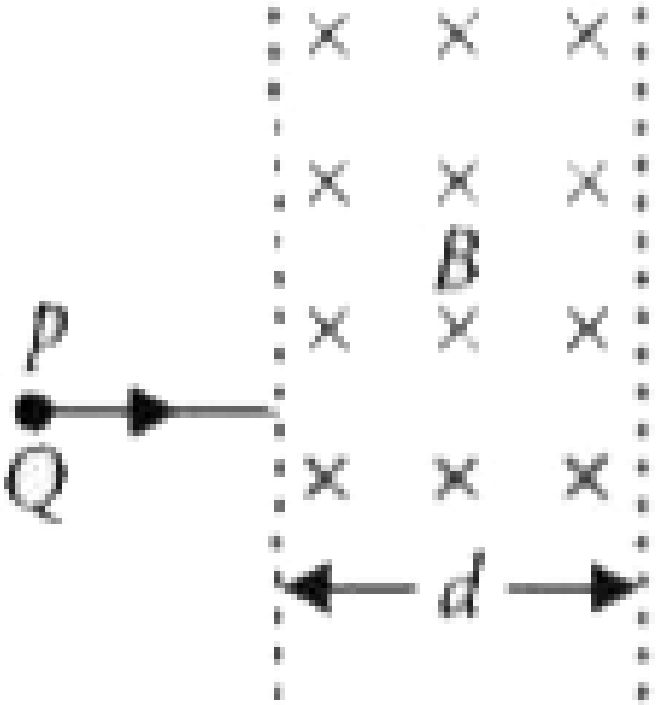
35. A particle with charge Q, moving with a momentum p, enters a uniform magnetic field normally. The magnetic field has magnitude B

and is confined to a region of width d, where $d < \frac{P}{BQ}$. The particle is deflected by an angle θ in crossing the field. Then



A. $\sin\theta = \frac{BQd}{p}$

B. $\sin\theta = \frac{p}{BQd}$

C. $\sin\theta = \frac{Bp}{Qd}$

D. $\sin\theta = \frac{pd}{BQ}$

Answer: A

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36. A rocket is launched vertically from the surface of the earth with an initial velocity v. How far above the surface of earth will it go? Neglect the air resistance. (where R is the radius of the earth)

A. $R\left(\frac{2gR}{v^2}-1\right)^{-1/2}$

B. $R\left(\frac{2gR}{v^2}-1\right)$

C. $R\left(\frac{2gR}{v^2}-1\right)^{-1}$

D. $R\left(\frac{2gR}{v^2}-1\right)^{2}$

Answer: C

View Text Solution

37. A particle of charge q and mass m moves rectilinearly under the action of an electric

field $E = \alpha - \beta x$. Here, α and β are positive constants and x is the distance from the point where the particle was initially at rest. Then, the

A. motion of the particle is oscillatory

B. amplitude of the particle is (α / β)

C. mean position of the particle is at $x = (\alpha / \beta)$

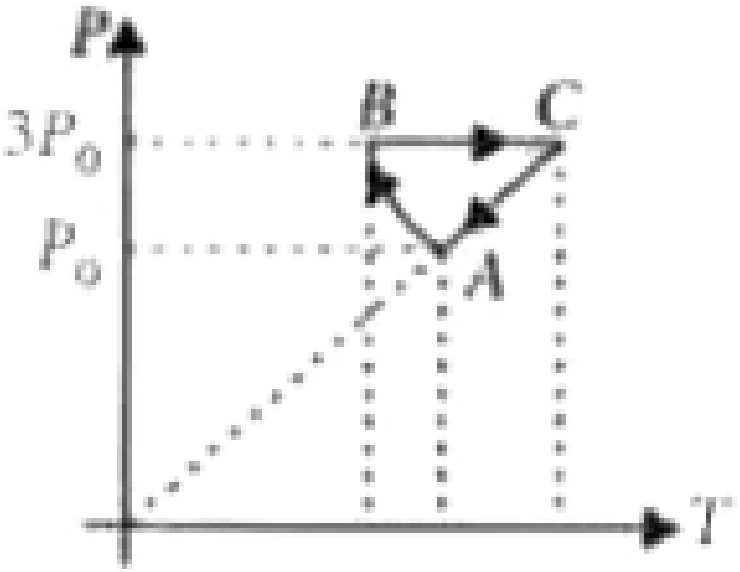
D. maximum acceleration of the particle is $\frac{q\alpha}{m}$.

Answer: A::B::C::D

View Text Solution

38. One mole of monoatomic gas is taken through cyclic processas shown in the diagram. T_A=300 K. PL Process AB is defined

PT=constant. Select the correct statements.



A. Work done in process AB is - 400 R

B. Change in intert, al energy in process CA is 800 R.

C. Heat transferred in the process BC is 2000 R

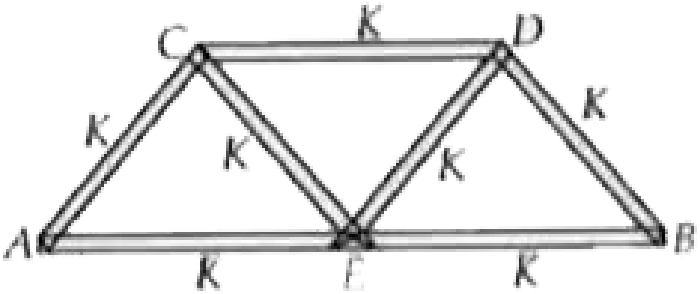
D. Change in internal energy in process CA is -900 R.

Answer: A::C::D

View Text Solution

39. Seven identical rods of material of thermal conductivity K are connected as shown in figure. All the rods are of identical length L

and cross sectional area A_1. If one end A is kept at $100^\circ C$ and the other end B is kept at $0^\circ C$, what would be the temperature of the junctions C, D and E (T_C, T_D and T_E) in the steady state?



A. $T_C > T_E > T_D$

B. $T_C = T_D = 37.5^\circ C, T_E = 50^\circ C$

C.

$$T_C = 62.5^\circ C, T_D = 37.5^\circ C, T_E = 50^\circ C$$

D. $T_C = 60^\circ C, T_D = 40^\circ C, T_E = 50^\circ C$

Answer: A::C

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40. The potential energy of a particle in a certain field has the form $U = \frac{a}{r^2} - \frac{b}{r}$, where a and b are positive constants, r is the distance from the center of the field. Then

A. At $r = \frac{2a}{b}$, particle is in steady equilibriumn.

B. At $r = \frac{2a}{b}$, particle is in unsteady equilibrium.

C. Maximum magnitude of force of attraction is $\frac{b^3}{27a^2}$

D. Maximum magnitude of force of attraction is $\frac{27b^3}{a^2}$

Answer: A::C

View Text Solution

41. A system consists of a uniformly charged sphere of radius R and a surrounding medium filled by a charge with the volume density $\rho = \frac{\alpha}{r}$, where α is a positive constant and r is the distance from the centre of the sphere. Find the charge of the sphere for which the electric field intensity E outside the sphere is independent of R.

A. $\frac{\alpha}{2\varepsilon_0}$

B. $\frac{2}{\alpha\varepsilon_0}$

C. $2\pi\alpha R^2$

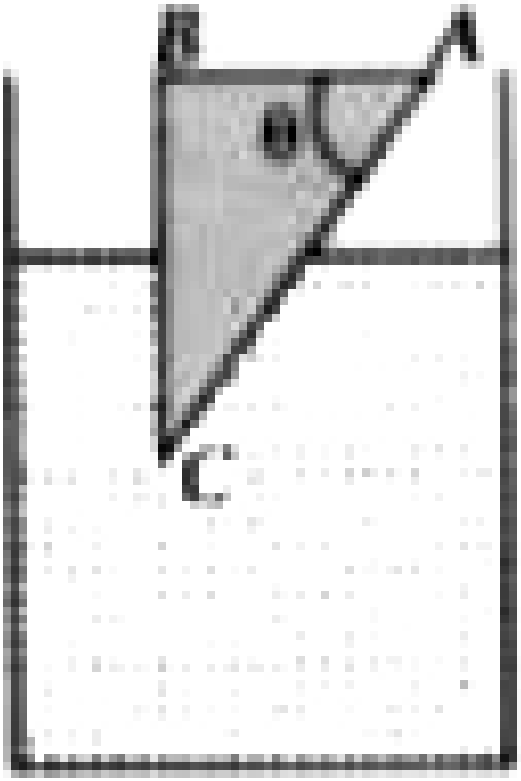
D. None of these

Answer: C

View Text Solution

42. A glass prism of refractive index 1.5 is immersed in water (refractive index 4/3). A light beam incident normally on the face AB is

totally reflected to reach on the face BC if



A. $\sin\theta \geq \frac{8}{9}$

B. $\frac{2}{3} < \sin\theta < \frac{8}{9}$

C. $\frac{1}{2} < \sin\theta < \frac{8}{9}$

D. None of these

Answer: A

View Text Solution

43. A hypothetical experiment conducted to determine Young's modulus, gave the formula, $Y = \frac{\cos\theta T^x \tau}{l^3}$ If T=time period , τ = torque and l=length , then the value of x is

A. 0

B. 1

C. 2

D. 3

Answer: A

View Text Solution

44. Two radioactive materials X_1 and X_2 have decay constants 10λ and λ respectively. If initially they have the same number of nuclei,

then the ratio of the number of nuclei of X_1 to that of X_2 will be 1/e after a time

A. $\frac{1}{10\lambda}$

B. $\frac{1}{11\lambda}$

C. $\frac{11}{10\lambda}$

D. $\frac{1}{9\lambda}$

Answer: D

View Text Solution

45. The intensity of magnetic field at a point X on the axis of a small magnet is equal to the field intensity at another point Y on its equatorial axis. The ratio of distances of X and Y from the centre of the magnet will be

A. $(2)^{-3}$

B. $(2)^{-1/3}$

C. 2^3

D. $2^{1/3}$

Answer: D

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46. The rms value of the electric field of the light coming from the sun is 720 N C^{-1}. The average total energy density of the electromagnetic wave is

A. $3.3 \times 10^{-3} Jm^{-3}$

B. $4.58 \times 10^{-6} Jm^{-3}$

C. $6.37 \times 10^{-9} Jm^{-3}$

D. $81.35 \times 10^{-12} Jm^{-3}$

Answer: B

View Text Solution

47. The rms value of the electric field of the light coming from the sun is 720 N C^{-1}. The average total energy density of the electromagnetic wave is

A. $C_V = \frac{3}{2}R$ for a monoatomic gas

B. $C_V > \frac{3}{2}R$ for a monoatomic gas

C. $C_V > \frac{5}{2}R$ for a diatomic gas

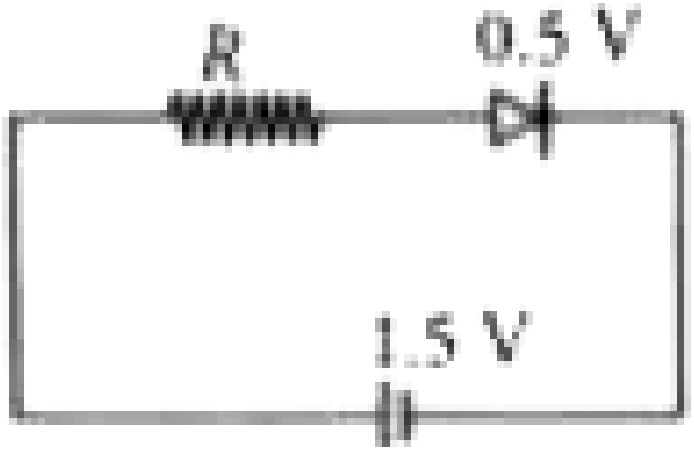
D. $C_V = \frac{5}{2}R$ for a diatomic gas

Answer: C

View Text Solution

48. The diode used in the circuit shown in the figure has a constant voltage drop at 0.5 V at all currents and a maximum power rating of 100 milliwatts. What should be the value of the resistor R, connected in series with diode,

for obtaining maximum current?



A. 6.76 Ω

B. 20 Ω

C. 5 Ω

D. 5.6 Ω

Answer: C

View Text Solution

49. A mass of 0.2 kg is attached to the lower end of a massless spring of force constant 200 N m^{-1} , the upper end of which is fixed to a rigid support. Which of the following statement is not true? (Take $g = 10ms^{-2}$)

A. The frequency of oscillation will be nearly 5 Hz.

B. In equilibrium, the spring will be stretched by 2 cm.

C. If the mass is raised till the spring is in unstretched state and then released, it will go down by 2 cm before moving upward.

D. If the system is taken to a planet, the frequency of oscillation will be the same as on the earth.

Answer: B

View Text Solution

50. A charge is distributed with a linear density λ over the length L along radius vector drawn from the point where a point charge q is located. The distance between q and the nearest point on linear charge is R. The electrical force experienced by the linear charge due to q is

A. $\frac{q\lambda L}{4\pi\varepsilon_0 R^2}$

B. $\frac{q\lambda L}{4\pi\varepsilon_0 R(R+L)}$

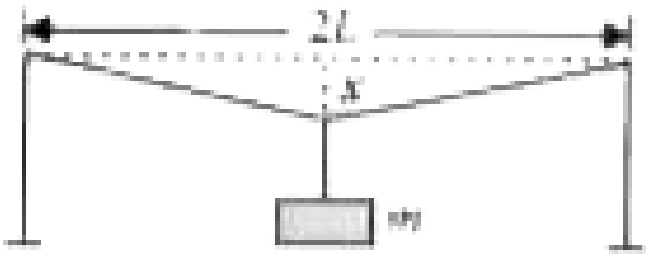
C. $\frac{q\lambda L}{4\pi\varepsilon_0 RL}$

D. $\frac{q\lambda L}{4\pi\varepsilon_0 L^2}$

Answer: B

View Text Solution

51. A mild steel wire of length 2L and cross-sectional area A is stretched, well within elastic limit, horizontally between two pillars,



A mass m is suspended from the midpoint of the wire. Strain in the wire is

A. $\frac{x^2}{2L^2}$

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

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

D. $\frac{x^2}{2L}$

Answer: A

View Text Solution

52. A student uses a simple pendulum of exactly 1 m length to determine g, the acceleration due to gravity. He uses a stop

watch with the least count of 1 s for this and records 40 s for 20 oscillations. For this observation, which of the following statements is true?

A. Error ΔT in measuring T, the time period, is 0.02 seconds.

B. Error ΔT in measuring T, the time period, is 1 second

C. Percentage error in the deterinination of g is 5%.

D. Percentage error in the determination of g is 2.5%.

Answer: C

View Text Solution

53. A particle is moving three times as fast as an electron. The ratio of the de Broglie wavelength of the particle to that of the electron is 1.813×10^{-4}. The mass of the particle is (Mass of electron = 9.1×10^{-31} kg)

A. 1.67×10^{-27} kg

B. 1.67×10^{-31} kg

C. 1.67×10^{-30} kg

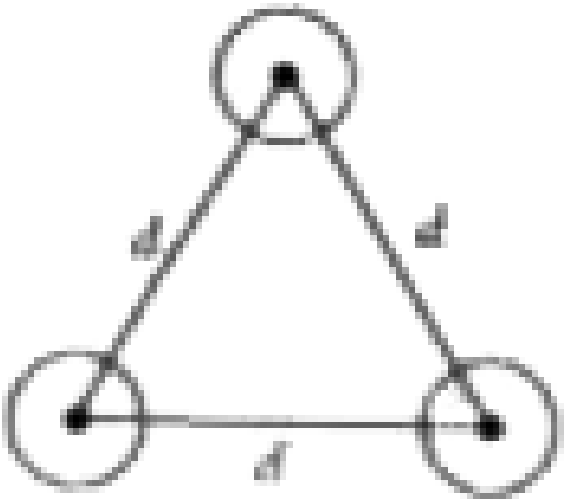
D. 1.67×10^{-32} kg

Answer: A

View Text Solution

54. Three solid spheres each of mass m and radius R are released from the position shown in figure. The speed of any one sphere at the

time of collision would be



A. $\sqrt{Gm\left(\frac{1}{d}-\frac{3}{R}\right)}$

B. $\sqrt{Gm\left(\frac{3}{d}-\frac{1}{R}\right)}$

C. $\sqrt{Gm\left(\frac{2}{R}-\frac{1}{d}\right)}$

D. $\sqrt{Gm\left(\frac{1}{R}-\frac{2}{d}\right)}$

Answer: D

View Text Solution

55. In an n-p-n transistor, the collector current is always less than the emitter current because

A. collector side is reverse biased and the emitter side is forward biased

B. a few electrons are lost in the base and only remaining ones reach the collector

C. collector being reverse biased, attracts less electrons

D. collector side is forward biased and emitter side is reverse biased.

Answer: B

View Text Solution

56. A bat flies at a steady speed of 4 m s^{-1} emitting 90 kHz sound waves and is flying

towards a wall. It detects a reflected signal at a frequency (Take speed of sound = 340 m s^{-1})

A. 90.1 kHz

B. 91.1 kHz

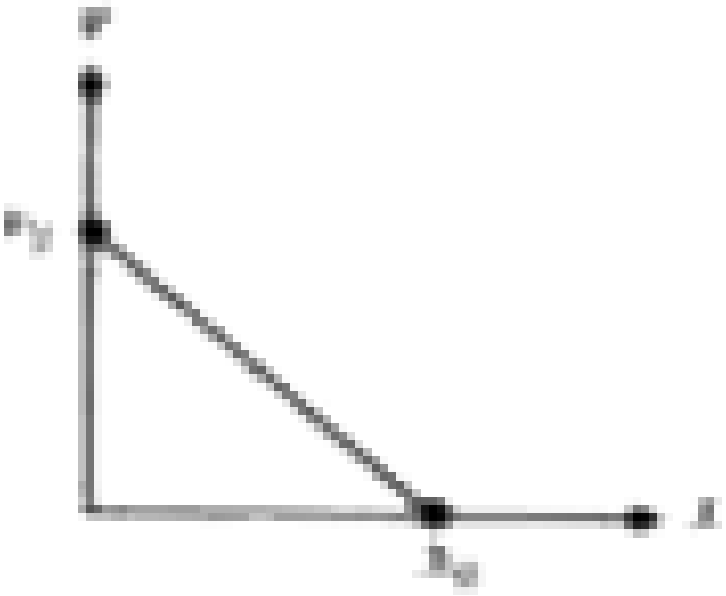
C. 92.1 kHz

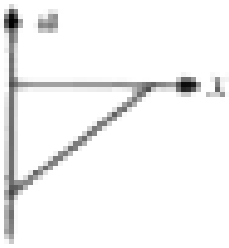
D. 93.1 kHz

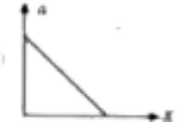
Answer: C

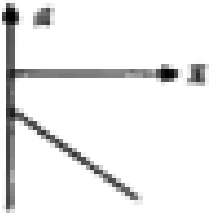
View Text Solution

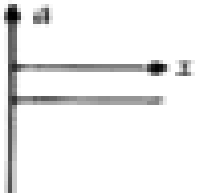
57. The velocity-displacement graph of a particle moving along a straight line is shown. The most suitable acceleration-displacement graph will be



A. 

B. 

C. 

D. 

Answer: A

View Text Solution

58. A sphere of mass m moving with a velocity u hits another stationary sphere of same mass. If e is the coefficient of restitution, what is the ratio of the velocities of two spheres after the collision?

A. 1

B. e

C. $\frac{1+e}{1-e}$

D. $\frac{2-e}{1+e}$

Answer: C

View Text Solution

59. A constant voltage is applied between the two ends of a uniform inetallic wire. Some heat is developed in it. The heat developed is doubled if

A. both the length and radius of the wire are halved

B. both the length and radius of the wire are doubled

C. the radius of the wire is doubled

D. the length of the wire is doubled.

Answer: B

View Text Solution

60. At 1 atm pressure, 1 g of water having a volume of 1 cm^3 becomes 1671 cm^3 of steam when boiled. The heat of vaporization of water at 1 atm is 539 cal g^{-1} . What is the change in internal energy during the process?

A. 539 cal

B. 417 cal

C. 498.5 cal

D. 835.5 cal

Answer: C

View Text Solution

61. Power supplied to a particle of mass 2 kg varies with time as $P = \frac{3t^2}{2} W$, where t is in

seconds. If velocity of particle at t=0 is zero, then the velocity of particle at t=2 s will be

A. 1 m s^{-1}

B. 4 m s^{-1}

C. $2ms^{-1}$

D. $2\sqrt{2}ms^{-1}$

Answer: C

View Text Solution

62. What is the number of significant figures in 0.310×10^3 ?

A. 2

B. 3

C. 4

D. 5

Answer: B

View Text Solution

63. The ratio of the angular velocities of the earth about its own axis and the hour hand of a watch is

A. $1:2$

B. $2:1$

C. $1:12$

D. $12:1$

Answer: A

View Text Solution

64. The magnetic susceptibility of a material of a rod is 299. The permeability of the material of the rod is $\left(\mu_0 = 4\pi \times 10^{-7} Hm^{-1}\right)$

A. $3771 \times 10^{-5} Hm^{-1}$

B. $3771 \times 10^{-6} Hm^{-1}$

C. $3771 \times 10^{-7} Hm^{-1}$

D. $3771 \times 10^{-8} Hm^{-1}$

Answer: C

View Text Solution

65. A 50 μF capacitor is connected to an ac source V = 220 sin50t where V is in volt and t is in second. The rms current is

A. 0.55 A

B. $\frac{0.55}{\sqrt{2}}A$

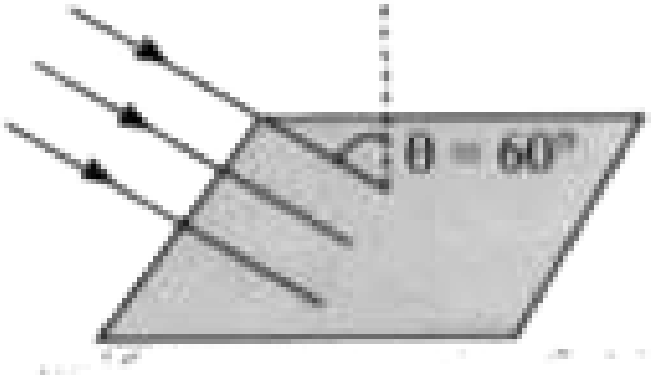
C. $\frac{\sqrt{2}}{0.55}A$

D. $\sqrt{2}$ A

Answer: B

View Text Solution

66. A square loop of wire of side 5 cm is lying on a horizontal table. An electromagnet above and to one side of the loop is turned on, causing a uniform magnetic field downwards at an angle of 60° to the vertical as shown in figure. The magnetic induction is 0.50 T. The average induced emf in the loop, if the field increases from zero to its final value in 0.2 s is



A. 5.4×10^{-3} V

B. 3.12×10^{-3} V

C. 0

D. 0.25×10^{-3} V

Answer: B

View Text Solution

67. In a Young's double slit experiment, d=0.5 mm and D = 100 cm. It is found that 9^{th} bright fringe is at a distance of 7.5 mm from the

second dark fringe of fringe pattern. The wavelength of light used is (in Å)

A. $\frac{2500}{7}$

B. 2500

C. 5000

D. $\frac{5000}{7}$

Answer: C

View Text Solution

68. A man throws a ball at an angle of 45° with the horizontal plane from a height of 15 m. If the shot strikes the ground at a horizontal distance of 30 in, the velocity of throw is (Take $g = 10ms^{-2}$)

A. 10 m s^{-1}

B. $10\sqrt{2}ms^{-1}$

C. $20ms^{-1}$

D. $20\sqrt{2}ms^{-1}$

Answer: B

View Text Solution

69. A satellite is moving in a circular orbit at a certain height above the earth's surface. It takes 5.26×10^3 s to complete one revolution with a centripetal acceleration equal to 9.32 m s^{-2}. The height of the satellite orbit above the earth's surface is (Take radius of earth = 6.37×10^6 m)

A. 70 km

B. 170 km

C. 190 km

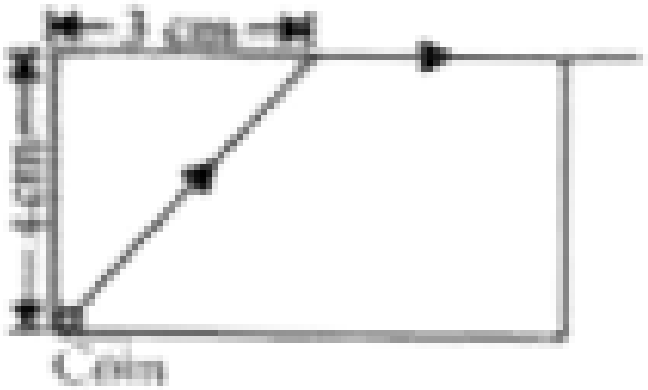
D. 220 km

Answer: B

View Text Solution

70. A small coin is resting on the bottom of a beaker filled with liquid. A ray of light from the coin travels upto the surface of the liquid and moves along its surface. How fast is the light

travelling in the liquid?



A. $2.4 \times 10^8 ms^{-1}$

B. $3.0 \times 10^8 ms^{-1}$

C. $1.2 \times 10^8 ms^{-1}$

D. $1.8 \times 10^8 ms^{-1}$

Answer: D

View Text Solution

71. A hollow sphere of outer radius R is rolling down an inclined plane without slipping and attains a speed v_0 at the bottom. Now the inclined plane is made smooth and the sphere is allowed to slide without rolling. Now it attains a speed $\frac{5v_0}{4}$. What is the radius of gyration of sphere?

A. $\sqrt{\frac{2}{5}}R$

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

C. $\frac{4}{5}R$

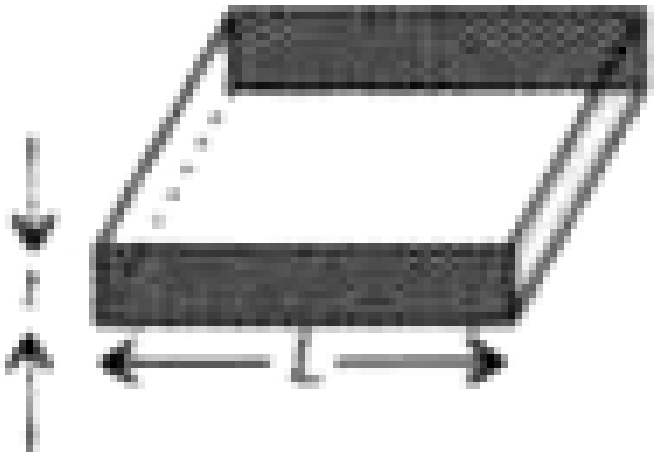
D. $\sqrt{\frac{2}{3}}R$

Answer: B

View Text Solution

72. Consider a thin square sheet of side L and thickness t, made of a material of resistivity ρ. The resistance between two opposite faces,

shown by the shaded areas in the figure is



A. directly proportional to L

B. directly proportional to t

C. independent of L

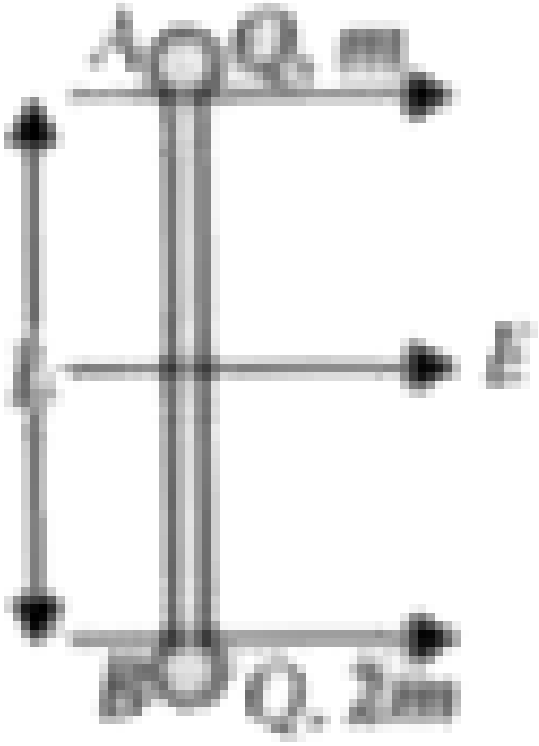
D. independent of t.

Answer: C

View Text Solution

73. Two small balls A and B of positive charge Q each and masses m and 2m respectively are connected by a non conducting light rod of length L. This system is released in a uniform electric field of strength E as shown. Just after the release (assume no other force acts on the

system)



A. rod has zero angular acceleration

B. rod has angular acceleration $\frac{QE}{2mL}$ in anti-clockwise direction.

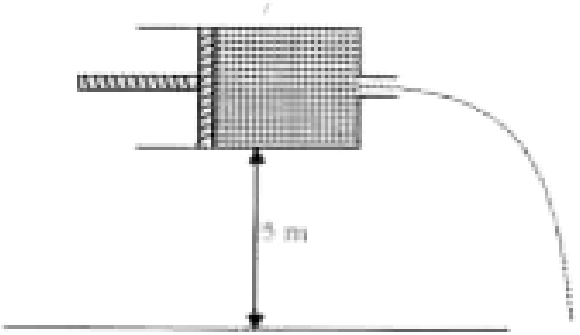
C. acceleration of point A is $\frac{2QE}{3m}$ towards right

D. acceleration of point A is $\frac{QE}{m}$ towards right.

Answer: D

View Text Solution

74. A syringe of diameter 1 cm having a nozzle of diameter 1 mm, is placed horizontally at a height 5 m from the ground as shown below. An incompressible non-viscous liquid is filled in the syringe and the liquid is compressed by moving the piston at a speed of 0.5 m s^{-1}, the horizontal distance travelled by the liquid jet is $\left(g = 10ms^{-2}\right)$



A. 12.5 m

B. 25 m

C. 50 m

D. 75 m

Answer: C

View Text Solution

75. The differential equation of charging of a capacitor is as given below:

$$\frac{1}{K_1}\frac{dq}{dt} + K_2 q = K_3$$

The time constant and steady state charge are

respectively

A. $\frac{1}{K_1}$ and K_3

B. $\frac{1}{K_1 K_2}$ and $\frac{K_3}{K_2}$

C. $\frac{K_2}{K_1}$ and $K_2 K_3$

D. $\frac{1}{K_1 K_2}$ and $\frac{K_3}{K_1}$

Answer: B

View Text Solution

76. It is observed that only 0.39% of the original radioactive sample remains undecayed after eight hours. Select the correct options.

A. The half-life of that substance is 1 hour.

B. The mean life of the substance is $\frac{1}{\ln 2}$ hour.

C. Decay constant of the substance is ln 2 per hour.

D. If the number of radioactive nuclei of this substance at a given instant is 10^8 then the number left after 30 min would be $\sqrt{2} \times 10^7$

Answer: A::B::C

View Text Solution

77. Which of the following statements is/are correct?

A. Average speed of a particle in a given time period is never less than the magnitude of average velocity

B. It is possible to have situations in which $\left|\frac{d\vec{v}}{dt}\right| \neq 0$, but $\frac{d\left|\vec{v}\right|}{dt} = 0$

C. It is possible to have situations in which $\frac{d\left|\vec{v}\right|}{dt} \neq 0$, but $\left|\frac{d\vec{v}}{dt}\right| = 0$

D. If the average velocity of a particle is zero in a time interval, then it is possible

that the instantaneous velocity is never zero in that interval.

Answer: A::B::D

View Text Solution

78. Magnetic field at the centre of a Bohr's hypothetical hydrogen atom in the n^{th} orbit of the electron is

A. directly proportional to charge of electron e

B. directly proportional to e^2

C. inversely proportional to n^5

D. directly proportional to n^5

Answer: C

View Text Solution

79. One end of a string of length l is tied to the ceiling of a lift accelerating upwards with an acceleration g/2. The linear mass density of the string is $\mu(x) = \mu_0 x^{1/2}$ where, x is measured from the bottom. The time taken by a pulse to reach from bottom to top is

A. $\sqrt{\frac{3l}{g}}$

B. $2\sqrt{\frac{l}{g}}$

C. $\sqrt{\frac{l}{g}}$

D. $\sqrt{\frac{l}{3g}}$

Answer: B

View Text Solution

80. Water is flowing smoothly through a closed pipe system. At one point A, the speed of the water is $3.0ms^{-1}$ while at another point B, 1.0 m higher, the speed is 4.0 m s^{-1}. The pressure at A is 20 kPa when the water is flowing and 18 kPa when the water flow stops. Then

A. the pressure at B when water is flowing is 6.7 kPa.

B. the pressure at B when water is flowing is 8.2 kPa.

C. the pressure at B when water stops flowing is 10.2 kPa.

D. the pressure at B when water stops flowing is 8.2 kPa.

Answer: A::D

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