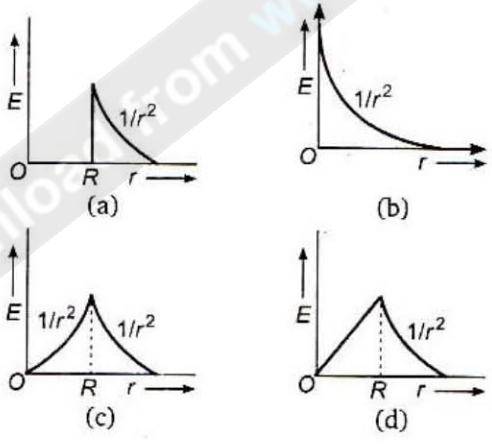
1. The length of a simple pendulum is about 100 cm known to an accuracy of 1 mm. It's period of oscillation is 2 s determined by measuring the time for 100 oscillations using a clock of 0.1 s resolution. What is the accuracy in the determined value of g ?
(a) 0.2% (b) 0.5%
(c) 0.1% (d) 2%

2. Young's modulus of the material of a wire is Y. On pulling the wire by a force F, the increase in its length is x. The potential energy of the stretched wire is
(a) $\frac{1}{2}Fx$ (b) $\frac{1}{2}Yx$
(c) $\frac{1}{2}Fx^2$ (d) None of these

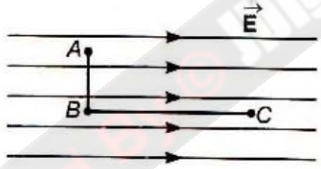
3. A charge situated at a certain distance along the axis of an electric dipole experiences a force F. If the distance of the charge from the dipole is doubled, the force acting on it will become
(a) $2F$ (b) $F/2$
(c) $F/4$ (d) $F/8$

4. Which of the following plots represents the variation of the electric field with distance from the centre of a uniformly charged non-conducting sphere of radius R ?



5. A certain electrical conductor has a square cross-section, 2.0 mm on a side, and is 12 m long. The resistance between its ends is 0.072 Ω. The resistivity of its material is equal to
(a) 2.4×10^{-6} Ω-m (b) 1.2×10^{-6} Ω-m
(c) 1.2×10^{-8} Ω-m (d) 2.4×10^{-8} Ω-m

6. Figure shows three points A, B and C in a region of uniform electric field $\vec{E}$. The line AB is perpendicular and BC which is parallel to the field lines. Then, which of the following holds good ?

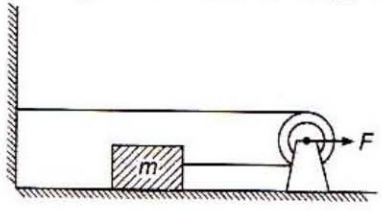


(a) $V_A = V_B = V_C$ (b) $V_A = V_B > V_C$
(c) $V_A = V_B < V_C$ (d) $V_A > V_B = V_C$
where V_A, V_B and V_C represent the electric potentials at the points A, B and C respectively.

7. The (x, y, z) coordinates of two points A and B are given respectively as $(0, 3, -1)$ and $(-2, 6, 4)$. The displacement vector A to B may be given by
(a) $-2\hat{i} + 6\hat{j} + 4\hat{k}$ (b) $-2\hat{i} + 3\hat{j} + 3\hat{k}$
(c) $-2\hat{i} + 3\hat{j} + 5\hat{k}$ (d) $2\hat{i} - 3\hat{j} - 5\hat{k}$

8. In the first second of its flight, rocket ejects $\frac{1}{60}$ of its mass with a velocity of 2400 ms^{-1}. The acceleration of the rocket is
(a) 19.6 ms^{-2} (b) 30.2 ms^{-2}
(c) 40 ms^{-2} (d) 49.8 ms^{-2}

9. In the given figure the pulley is assumed massless and frictionless. If the friction force on the object of mass m is f, then its

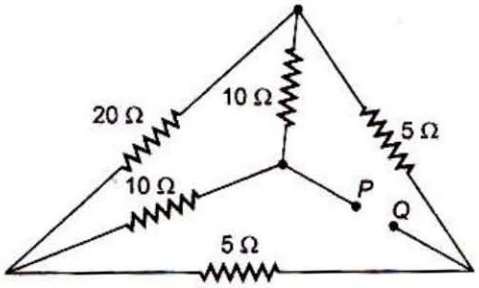


acceleration in terms of the force F will be equal to

(a) $\frac{(F-f)}{m}$ (b) $\frac{\left(\frac{F}{2}-f\right)}{m}$

(c) $\frac{F}{m}$ (d) None of these

10. The equivalent resistance between the points P and Q in the network shown in the figure is given by



(a) 2.5 Ω (b) 7.5 Ω

(c) 10 Ω (d) 12.5 Ω

11. The magnetic field amplitude of an electromagnetic wave is 2×10^{-7} T. It's electric field amplitude if the wave is travelling in free space is

(a) 6 Vm^{-1} (b) 60 Vm^{-1}

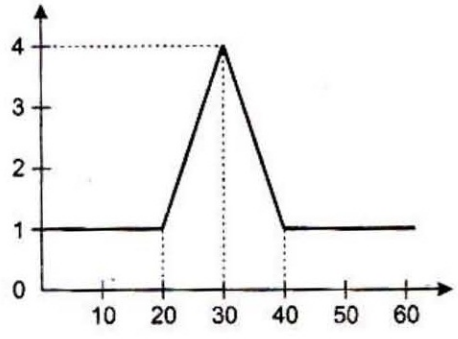
(c) $\frac{10}{6}$ Vm^{-1} (d) None of these

12. A cart is moving horizontally along a straight line with constant speed 30 m/s. A projectile is to be fired from the moving cart in such a way that it will return to the cart after the cart has moved 80 m. At what speed (relative to the cart) must the projectile be fired ?
(Take $g = 10$ m/s^2)

(a) $10\sqrt{8}$ m/s (b) $12\sqrt{8}$ m/s

(c) $\frac{40}{3}$ m/s (d) None of these

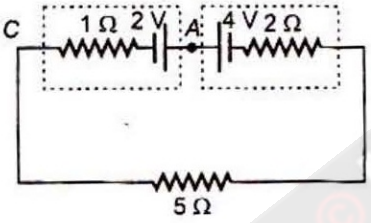
13. Velocity-time (v-t) graph for a moving object is shown in the figure. Total displacement of the object during the time interval when there is non-zero acceleration and retardation is



(a) 60 m (b) 50 m

(c) 30 m (d) 40 m

14. What is the potential drop between points A and C in the following circuit ?



Resistances 1 Ω and 2 Ω represent the internal resistances of the respective cells

(a) 1.75 V (b) 2.25 V

(c) $\frac{5}{4}$ V (d) $\frac{4}{5}$ V

15. The escape velocity of a projectile on the earth's surface is 11.2 km s^{-1}. A body is projected out with thrice this speed. The speed of the body far away from the earth will be

(a) 22.4 km s^{-1} (b) 31.7 km s^{-1}

(c) 33.6 km s^{-1} (d) None of these

16. A body moves along a circular path of radius 10 m and the coefficient of friction is 0.5. What should be its angular velocity in rad/s, if it is not to slip from the surface ? ($g = 9.8$ ms^{-2})

(a) 5 (b) 10

(c) 0.1 (d) 0.7

17. One end of a string of length l is connected to a particle of mass m and the other to a small peg on a smooth horizontal table. If the particle moves in a circle with speed v, the net force on the particle (directed towards the centre) is
(T is the tension in the string)

(a) T (b) $T - \frac{mv^2}{l}$

(c) $T + \frac{mv^2}{l}$ (d) 0

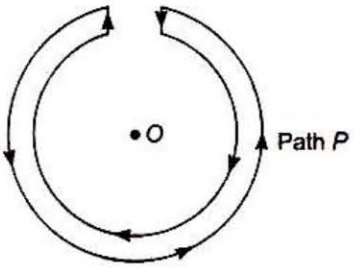
18. A body is initially at rest. It undergoes one dimensional motion with constant acceleration. The power delivered to it at time t is proportional to

(a) $t^{1/2}$ (b) t

(c) $t^{3/2}$ (d) t^2

(a) 5.5 cm (b) 7.5 cm
(c) 12.0 cm (d) 20.0 cm

19. In the figure shown a closed path P. A long straight conductor carrying a current I passes through O and perpendicular to the plane of the paper. Then, which of the following holds good ?



(a) $\int_p \vec{B} \cdot dl = 0$ (b) $\int_p \vec{B} \cdot dl = \mu_0 I$

(c) $\int_p \vec{B} \cdot dl > \mu_0 I$ (d) None of these

20. A long hollow copper tube carries a current I. Then, which of the following will be true ?

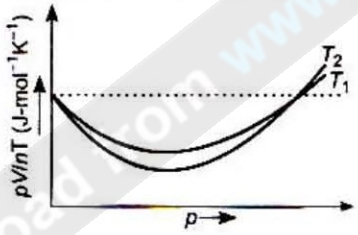
(a) The magnetic field B will be zero at all points inside the tube

(b) The magnetic field B will be zero only at points on the axis of the tube

(c) The magnetic field B will be maximum at points on the axis of the tube

(d) The magnetic field will be zero at any point outside the tube

21. The figure below shows the plot of $\frac{pV}{nT}$ *versus* p for oxygen gas at two different temperatures.



Read the following statements concerning the above curves.

(i) The dotted line corresponds to the ideal gas behaviour.

(ii) $T_1 > T_2$

(iii) The value of $\frac{pV}{nT}$ at the point where the curves meet on the y-axis is the same for all gases.

Which of the above statements is true ?

(a) (i) only

(b) (i) and (ii) only

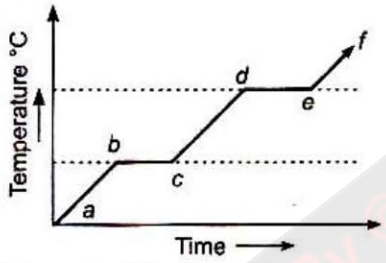
(a) $\lambda_e > \lambda_p$ (b) $\lambda_p > \lambda_\alpha$

(c) $\lambda > \lambda$ (d) $\lambda < \lambda < \lambda$

(c) All of the above

(d) None of the above

22. The following figure represents the temperature *versus* time plot for a given amount of a substance when heat energy is supplied to it at a fixed rate and at a constant pressure.



Which parts of the above plot represent a phase change ?

(a) a to b and e to f (b) b to c and c to d

(c) d to e and e to f (d) b to c and d to e

23. A bar magnet has a coercivity 4×10^3 A-m^{-1}. It is desired to demagnetise it by inserting it inside a solenoid 12 cm long and having 60 turns. The current carried by the solenoid should be

(a) 8 A (b) 6 A

(c) 4.5 A (d) 2 A

24. In a series L-C-R circuit the frequency of a 10 V AC voltage source is adjusted in such a fashion that the reactance of the inductor measures 15 Ω and that of the capacitor 11 Ω. If $R = 3\,\Omega$, the current across the series combination will be

(a) 1 A (b) 2 A

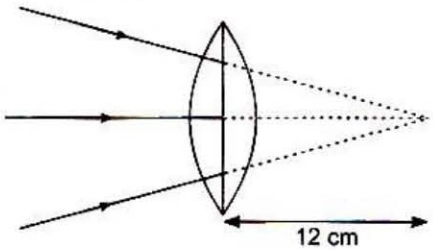
(c) 10 A (d) 20 A

25. A circuit draws 330 W from a 110 V, 60 Hz AC line. The power factor is 0.6 and the current lags the voltage. The capacitance of a series capacitor that will result in a power factor of unity is equal to

(a) 31 μF (b) 54 μF

(c) 151 μF (d) 201 μF

26. If the focal length of the lens is 20 cm, what is the distance of the image from the lens in the following figure ?



(a) 5.5 cm (b) 7.5 cm
(c) 12.0 cm (d) 20.0 cm

27. An open U-tube contains mercury. When 11.2 cm of water is poured into one of the arms of the tube, how high does the mercury rise in the other arm from its initial level ?
(a) 0.56 cm (b) 1.35 cm
(c) 0.41 cm (d) 2.32 cm

28. The change in the entropy of a 1 mole of an ideal gas which went through an isothermal process from an initial state (p_1, V_1, T) to the final state (p_2, V_2, T) is equal to
(a) zero (b) $R \ln T$
(c) $R \ln \frac{V_1}{V_2}$ (d) $R \ln \frac{V_2}{V_1}$

29. An unpolarized beam of light is incident on a glass surface at an angle of incidence equal to the polarizing angle of the glass. Read the following statements.
(i) The reflected beam is completely polarized.
(ii) The refracted beam is partially polarized.
(iii) The angle between the reflected and the refracted beams is 90°.
Which of the above statements is/are true ?
(a) (i) only
(b) (ii) only
(c) (i) and (iii)
(d) All the statements are correct

30. The threshold frequency for certain metal is 3.3×10^{14} Hz. If light of frequency 8.2×10^{14} Hz is incident on the metal, the cut-off voltage of the photoelectric current will be
(a) 4.9 V (b) 3.0 V
(c) 2.0 V (d) 1 V

31. Frequencies higher than 10 MHz were found not being reflected by the ionosphere on a particular day at a place. The maximum electron density of the ionosphere on the day was near to
(a) 1.5×10^{10} m^{-3}
(b) 1.24×10^{12} m^{-3}
(c) 3×10^{12} m^{-3}
(d) None of the above

32. The de-Broglie wavelength of an electron, α-particle and a proton all having the same kinetic energy is respectively given as λ_e, λ_α and λ_p. Then, which of the following is not true ?
(a) $\lambda_e > \lambda_p$ (b) $\lambda_p > \lambda_\alpha$
(c) $\lambda_e > \lambda_\alpha$ (d) $\lambda_\alpha < \lambda_p < \lambda_e$

33. What is the disintegration constant of Radon, if the number of its atoms diminishes by 18% in 24 h ?
(a) 2.1×10^{-3} s^{-1} (b) 2.1×10^{-4} s^{-1}
(c) 2.1×10^{-5} s^{-1} (d) 2.1×10^{-6} s^{-1}

34. Which of the following statement is true for an n-type semiconductor ?
(a) The donor level lies closely below the bottom of the conduction band
(b) The donor level lies closely above the top of the valence band
(c) The donor level lies at the halfway mark of the forbidden energy gap
(d) None of the above

35. Carbon, silicon and germanium have four valence electrons each. These are characterized by valence and conduction bands separated by energy band gap respectively equal to $(E_g)_C$, $(E_g)_{Si}$ and $(E_g)_{Ge}$. Which of the following statements is true ?
(a) $(E_g)_C = (E_g)_{Si} = (E_g)_{Ge}$
(b) $(E_g)_C > (E_g)_{Si} > (E_g)_{Ge}$
(c) $(E_g)_C < (E_g)_{Ge} > (E_g)_{Si}$
(d) $(E_g)_{Si} < (E_g)_{Ge} > (E_g)_C$

36. A particle executes SHM of amplitude 25 cm and time period 3 s. What is the minimum time required for the particle to move between two points 12.5 cm on either side of the mean position ?
(a) 0.5 s (b) 1.0 s
(c) 1.5 s (d) 2.0 s

37. The speed of a wave on a string is 150 m/s when the tension is 120 N. The percentage increase in the tension in order to raise the wave speed by 20% is
(a) 44% (b) 40%
(c) 20% (d) 10%

38. A straight rod of length L has one of its ends at the origin and the other at $x = L$. If the mass per unit length of the rod is given by Ax where A is constant, where is its mass centre ?
(a) $\frac{L}{3}$ (b) $\frac{L}{2}$
(c) $\frac{2L}{3}$ (d) $\frac{3L}{4}$

39. The image of a small electric bulb fixed on the wall of a room is to be obtained on the opposite wall 4 m away by means of a large convex lens.

The maximum possible focal length of the lens required for this purpose will be

(a) 0.5 m (b) 1.0 m

(c) 1.5 m (d) 2.0 m

40. The total energy of a satellite moving with an orbital velocity v around the earth is

(a) $\frac{1}{2}mv^2$ (b) $-\frac{1}{2}mv^2$

(c) mv^2 (d) $\frac{3}{2}mv^2$

Answer – Key

1. a	2. a	3. d	4. d	5. d	6. b	7. c	8. c	9. d	10. b
11. b	12. c	13. b	14. b	15. b	16. d	17. a	18. b	19. b	20. d
21. c	22. d	23. a	24. b	25. b	26. b	27. c	28. d	29. c	30. c
31. b	32. a	33. a	34. a	35. b	36. a	37. a	38. b	39. b	40. b