1. Which one of the following quantities do not have the same dimensions as that of Pressure ?

(1) Stress

(2) Coefficient of Bulk modulus

(3) Thrust

(4) Energy density

2. Match the **List - I** with **List - II** and select the correct answer :

	List - I (Expression)		**List - II (Physical Quantity)**
(A)	$\frac{R}{L}$	(p)	Time
(B)	RC	(q)	Frequency
(C)	$\frac{E}{B}$	(r)	Speed
(D)	$\sqrt{\mu_0 \varepsilon_0}$	(s)	$(\text{Speed})^{-1}$

	(A)	(B)	(C)	(D)
(1)	(p)	(q)	(r)	(s)
(2)	(q)	(p)	(r)	(s)
(3)	(p)	(q)	(s)	(r)
(4)	(s)	(r)	(q)	(p)

3. Which one quantity of the following physical quantities has a unit but not the dimension ?

(1) Moment of Inertia

(2) Angle

(3) Strain

(4) Young's Modulus

4. A small ball is moving with a uniform speed v in a circle of radius R. The acceleration of the ball (in terms of its angular speed ω) is :

(1) $\omega^2 R$ and is directed towards the centre.

(2) $\omega^2 R$ and is directed away from the centre.

(3) $\left(\frac{\omega}{2\pi}\right)^2 R$ and is directed towards the centre.

(4) $\left(\frac{\omega}{2\pi}\right)^2 R$ and is directed away from the centre.

5. The position x (in meter) of four objects A, B, C and D are given by following equations where time t is in second.

(A) $x = 1.0 + 2.0t^2$

(B) $x = 2.0t$

(C) $x = 2.0t + 3.0t^2$

(D) $x = 1.0 + 2.0t + 3.0t^2$

Which of them is moving with a uniform speed ?

(1) (A)

(2) (B)

(3) (C)

(4) (D)

6. The velocity v (in m/s) of a particle changes with time t (in second) as

$v = 1.0 + 2.0t + 1.0t^2$

The average acceleration of the particle for the duration $t = 0$ s to $t = 2.0$ s is :

(1) 1.0 m/s^2

(2) 3.0 m/s^2

(3) 4.0 m/s^2

(4) 5.0 m/s^2

7. Consider two vectors $\vec{A}$ and $\vec{B}$, as given below.

$\vec{A} = 2\hat{i} + 1\hat{j}$

$\vec{B} = 1\hat{i} + 4\hat{j}$

Where $\hat{i}$ and $\hat{j}$ are unit vectors along x - axis and y - axis respectively.

The angle between $\vec{A}$ and $\vec{B}$, when their tails coincide is :

(1) $\cos^{-1}\left(\frac{2}{\sqrt{85}}\right)$

(2) $\cos^{-1}\left(\frac{4}{\sqrt{85}}\right)$

(3) $\cos^{-1}\left(\frac{6}{\sqrt{85}}\right)$

(4) $\cos^{-1}\left(\frac{10}{\sqrt{85}}\right)$

8. A small ball is projected from (0 m, 0 m) in x - y plane at t = 0 s. Its velocity $\vec{v}$ (in m/s) at t = 1.0 s is $\vec{v} = 32\hat{i} + 14\hat{j}$. Here $\hat{i}$ and $\hat{j}$ are unit vectors along x - axis and y - axis respectively. The horizontal range of the ball is : (take g = 10 m/s^2)

(1) 38.4 m

(2) 76.8 m

(3) 153.6 m

(4) 192 m

9. Mohan is cycling on a level circular road of radius 8.0 m. The coefficient of static friction between the tyres and the road is 0.2. The maximum speed with which he can cycle without slipping is : (take g = 10 m/s^2)

(1) 1.0 m/s

(2) 2.0 m/s

(3) 3.0 m/s

(4) 4.0 m/s

10. A girl (mass 50 kg) stands on a weighing scale in a lift which is moving downwards with a uniform acceleration of 5 m/s^2. The reading on the weighing scale will be :
(take g = 10 m/s^2)

(1) 25 kg

(2) 50 kg

(3) 75 kg

(4) 100 kg

11. Two forces $\vec{F}_1$ and $\vec{F}_2$, given by

$\vec{F}_1 = (16\text{ N})\hat{i}$ and $\vec{F}_2 = (12\text{ N})\hat{j}$ act simultaneously on a object of mass 5.0 kg. Here $\hat{i}$ and $\hat{j}$ are unit vectors along x - axis and y - axis respectively. The acceleration of the object has a magnitude _____ and it makes an angle of _____ with the x-axis.

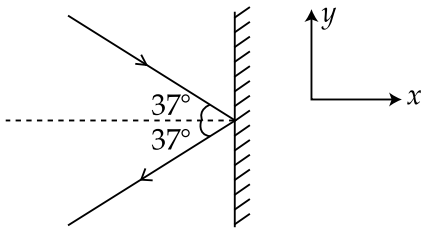
(1) 2.0 m/s^2, $\tan^{-1}\left(\frac{3}{4}\right)$

(2) 2.0 m/s^2, $\tan^{-1}\left(\frac{4}{3}\right)$

(3) 4.0 m/s^2, $\tan^{-1}\left(\frac{3}{4}\right)$

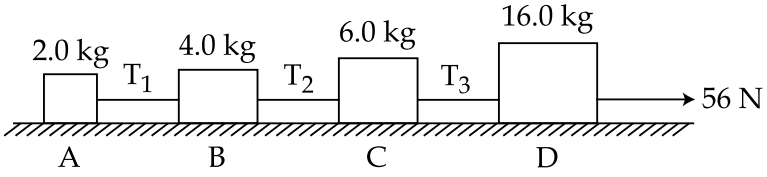
(4) 4.0 m/s^2, $\tan^{-1}\left(\frac{4}{3}\right)$

12. A ball of mass 0.10 kg strikes a rigid wall with a speed of 5.0 m/s and is reflected with the same speed, as shown in the figure. The magnitude of impulse imparted to the ball by the wall is : $\left(\tan 37^\circ = \frac{3}{4}\right)$



(1) 0
(2) 0.50 N s
(3) 0.80 N s
(4) 1.0 N s

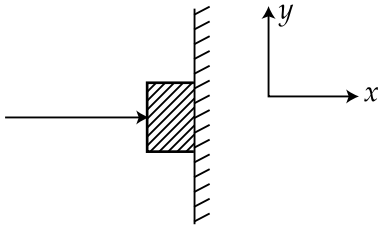
13. Four boxes A(2.0 kg), B(4.0 kg), C(6.0 kg) and D(16.0 kg) are lying on



a horizontal smooth surface and are connected by light strings, as shown in the figure. A force of 56 N is applied horizontally to the box D. T_1, T_2 and T_3 are tensions in strings, as shown. The ratio $\left(\frac{T_2}{T_3}\right)$ is :

(1) $\frac{1}{4}$
(2) $\frac{1}{2}$
(3) 1
(4) 2

14. A box of mass 0.60 kg is pressed against a wall by a force of 12 N, as shown in figure. The coefficient of static friction between the box and the wall is 0.6. The magnitude of net force exerted by the wall on the box is close to : (take $g = 10\ m/s^2$)



(1) 6.0 N
(2) 12.0 N
(3) 13.4 N
(4) 18.0 N

15. A ball of mass 250 g is uniformly whirled on a horizontal circular path of radius 1 m. The speed of the ball is 2 m/s. The work done on the ball during one complete rotation is :

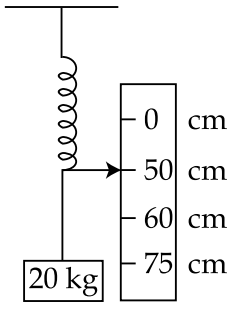
(1) 6.28 N.m

(2) 360 N.m

(3) 3.14 N.m

(4) 0 N.m

16. A spring of mass m is hung from a rigid roof. On attaching a mass of 20 kg from the spring the pointer attached to spring indicates 50 cm mark on the attached scale, as shown in the figure. On attaching a mass of 40 kg from the spring, the points indicates 75 cm mark. When an unknown mass of P kg is attached to the spring, the pointer indicates 60 cm mark on the scale. If acceleration due to gravity is 10 m/s^2 at the place of experiment, which one of the following could be the value of P ?



(1) 30 kg

(2) 28 kg

(3) 25 kg

(4) 22 kg

17. The amount of work done required to stop a moving object on a frictionless path is equal to :

(1) The mass of the object times its acceleration

(2) The potential energy of the object

(3) The kinetic energy of the object

(4) The mass of the object times the square of its speed

18. An object moves in a straight line under the influence of a constant force 30 N. The displacement (x) of the object may be given as a function of time (t) as $t = \sqrt{x} + 3$. Here x and t are in meters and seconds respectively. What is the amount of work done by the force during t = 3 to t = 6 s ?

(1) 270 N.m

(2) 180 N.m

(3) 90 N.m

(4) Zero

19. A lift that can carry a maximum load of 700 kg is moving upwards with a uniform speed of 2.0 m/s. The mass of the lift is 600 kg. If the minimum power that is delivered to the lift by the motor is 30 kW, what is the amount of frictional force opposing the motion of the lift ? (The acceleration due to gravity = 10 m/s^2).

(1) 4000 N

(2) 2000 N

(3) 1000 N

(4) 500 N

20. A solid disc having a non - uniform mass density has the centre of mass located inside it. A hole is drilled on the disc which is not near the centre of mass. After the hole is drilled, the centre of mass of the remaining disc moves from the original position :

(1) away from the hole

(2) towards the hole

(3) remains unchanged

(4) in random direction

21. A flywheel is rotating at a uniform angular speed of 6 revolution per second. It is subjected to a retarding force to bring it to rest within 10 s. What is the angular acceleration in rad/s^2 of the wheel during its retarding motion ?

(1) 3π

(2) -6π

(3) $+\frac{6\pi}{5}$

(4) $-\frac{6\pi}{5}$

22. An ant of mass 'm' is sitting on a horizontal disc which is rotating on its own axis with an angular velocity $\vec{\omega}$. The position of the ant on the rotating disc remains fixed and given by vector $\vec{r}$ when measured from the axis of rotation of the disc. The quantity $\vec{v}$ represents the linear velocity of the ant at any instant. The vector defined by $m\vec{\omega} \times \left(\vec{\omega} \times \vec{r}\right)$ is proportional to :

(1) $\frac{r}{v^2}$

(2) r^2

(3) $\frac{v^2}{r}$

(4) vr

23. Two rotating circular discs A and B have equal angular momenta. The two disc have equal mass and thickness but made from different materials. The disc B has higher moment of inertia than that of disc A. Which one of the following statements is true in this context ?

(1) The kinetic energy of disc A is more than that of the disc B.

(2) The kinetic energy of disc A is less than that of the disc B.

(3) The kinetic energies of the two discs are equal.

(4) The angular speeds of two discs are equal.

24. Two objects A and B are placed in vacuum at a distance 'r'. If the symbols F_{AB} and F_{BA} represent the magnitude of gravitational forces on A from B and on B from A, respectively, then what will happen if the mass of object A is doubled while that of B is kept unchanged ?

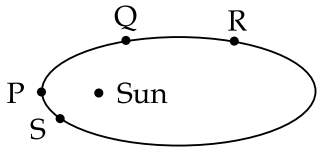
(1) Both F_{AB} and F_{BA} will double.

(2) F_{AB} will be doubled but F_{BA} will remain the same.

(3) F_{AB} will remain the same but F_{BA} will be doubled.

(4) Both F_{AB} and F_{BA} will remain unchanged.

25. A planet revolves around the Sun in an elliptical orbit as shown in the diagram. The magnitude of velocity of the planet is :



(1) maximum at point R

(2) minimum at point P

(3) maximum at point P

(4) same at all the points P, Q, R and S

26. A space - ship is revolving around the earth (radius = 6400 km) at a distance of 6400 km from the surface of the earth. An astronaut in the space-ship happens to launch an equipment of mass 100 kg towards the centre of the earth with a speed of 500 m/s. Neglecting all frictional forces, what is the approximate speed of the equipment through which it enters the earth's atmosphere at a height of 100 km from the earth surface ? (The mass of the earth $\simeq 6 \times 10^{24}$ kg; the universal gravitational constant $G = 6.67 \times 10^{-11}$ N.m^2/kg^2)

(1) 16000 m/s

(2) 12000 m/s

(3) 10000 m/s

(4) 8000 m/s

27. Two cylindrical metallic wires A and B of same material having radii r and 2r and length L and 2L respectively are stretched within the proportional elastic limits by the same force F. If the wire A is stretched by 1 cm, the stretch in wire B would be :

(1) 0.25 cm

(2) 0.50 cm

(3) 1.00 cm

(4) 2.00 cm

28. Match **List - I** with **List - II**.

List - I (Physical Quantity)		**List - II (Dimensions)**	
(A)	Coefficient of viscosity	(p)	$[M^2L^{-1}T^{-2}]$
(B)	Surface tension	(q)	$[ML^0T^{-2}]$
(C)	Energy per unit volume of a fluid	(r)	$[ML^{-1}T^{-2}]$
(D)	Modulus of elasticity	(s)	$[ML^{-1}T^{-1}]$

	(A)	(B)	(C)	(D)
(1)	(p)	(q)	(r)	(s)
(2)	(s)	(q)	(r)	(r)
(3)	(q)	(r)	(s)	(p)
(4)	(p)	(r)	(q)	(s)

29. The root - mean square speed of molecules of a gas would become double If the root - mean square speed at 27 °C at temperature :

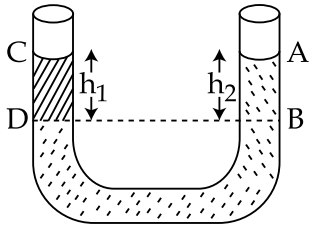
(1) 300 K

(2) 1200 K

(3) 900 K

(4) 600 K

30. In a U - tube experiment as shown, a column AB of water is balanced by a column CD of paraffin. The relative density of paraffin is :



(1) $\frac{h_1}{h_2}$

(2) $\frac{h_2}{h_1}$

(3) $\frac{h_2 - h_1}{h_1}$

(4) $\frac{h_2}{h_1 + h_2}$

31. A pan filled with hot eatables cools from 78 °C to 72 °C in 120 s. The room temperature is at 4 °C. How long will it take to cool from 66 °C to 62 °C ?

(1) About 42 s

(2) About 80 s

(3) About 93 s

(4) About 104 s

32. The second law of thermodynamics is related to :

(1) conservation of energy

(2) conservation of momentum

(3) conservation of heat

(4) conservation of heat to work

33. The correct expression between coefficient of performance (α) and efficiency (η) of a refrigerator that follows the Carnot's cycle, is :

(1) $\alpha = \frac{\eta}{1-\eta}$

(2) $\alpha = \frac{1-\eta}{\eta}$

(3) $\alpha = \eta$

(4) $\alpha = 1 + \eta$

34. Zeroth law of thermodynamics is physical interpretation of which of the following physical quantity ?

(1) Temperature

(2) Entropy

(3) Pressure

(4) Internal energy

35. A Carnot engine working between 27 °C and 127 °C takes up 800 J heat from the source in a cycle. The amount of work done by the engine per cycle is :

(1) 158 J

(2) 200 J

(3) 2960 J

(4) 3760 J

36. The mass of 1 mole of air is 2.90×10^{-2} kg. The ratio of specific heat of air at constant pressure to that at constant volume is $\frac{7}{5}$. The speed of a longitudinal wave in air at standard temperature and pressure is close to :

(1) 342 m/s

(2) 330 m/s

(3) 300 m/s

(4) 280 m/s

37. Two travelling sinusoidal waves A and B interfere to produce a wave that can be represented as $y(x, t) = Y \sin(kx + \omega t + \phi)$.

Here all symbols have their usual meanings. For an appropriately chosen value of ϕ', the waves A & B could respectively be :

(1) $y_A(x, t) = 0.6Y \sin(kx + \omega t)$ and $y_B(x, t) = 0.2Y \sin(kx + \omega t + \phi')$

(2) $y_A(x, t) = 0.6Y \sin(kx + \omega t)$ and $y_B(x, t) = 0.6Y \sin(kx + \omega t + \phi')$

(3) $y_A(x, t) = \frac{Y}{3} \sin(kx + \omega t)$ and $y_B(x, t) = \frac{Y}{3} \sin(kx + \omega t + \phi')$

(4) $y_A(x, t) = 0.6Y \sin(kx - \omega t)$ and $y_B(x, t) = 0.6Y \sin(kx + \omega t + \phi')$

38. A source producing sound of frequency 650 Hz is moving towards an observer, with a speed of 18 km/h. The speed of sound in air is 330 m/s. If the observer starts moving with a speed of 54 km/h, away from the source, the frequency of sound heard by the observer is :

(1) 611 Hz

(2) 630 Hz

(3) 669 Hz

(4) 690 Hz

39. A spring having spring constant of 90 N/m is attached with a block of mass 200 g. It oscillates in a surrounding viscous medium having 40 g/s damping constant. The time period of oscillation and the time taken for its amplitude of vibrations to drop to half of its initial value are respectively about :

(1) 3 s; 7 s

(2) 3 s; 12 s

(3) 0.3 s; 7 s

(4) 0.3 s; 12 s

40. A pendulum bob is executing a simple harmonic motion in a medium. Its acceleration in harmonic motion at the mid point of its path must be :

(1) less than acceleration due to gravity

(2) more than the acceleration due to gravity

(3) zero

(4) randomly changing the sign

41. The sound waves produced in a gas are always _____.

(1) transverse

(2) stationary

(3) longitudinal

(4) electromagnetic

42. Which one of the following waves has amplitude 5 cm and time period 2 s ?
(Symbols here have their usual meanings)

(1) $y = 2 \sin 3\pi \frac{t}{2}$

(2) $y = 5 \sin 2\pi \frac{t}{2}$

(3) $y = 5 \sin 2\pi \frac{t}{\omega}$

(4) $y = \sin 2\pi t$

43. Two charges A (1.0 μC) and B (3.0 μC) are located at points (0 cm, 0 cm) and (−4 cm, 3 cm) respectively. The force exerted by charge A on charge B is (Here $\hat{i}$ and $\hat{j}$ are unit vectors along x - axis and y - axis respectively and $\left(\frac{1}{4\pi\varepsilon_0}\right) = 9 \times 10^9 \text{ N m}^2/\text{C}^2$)

(1) $-(8.64 \text{ N})\hat{i} + (6.48 \text{ N})\hat{j}$

(2) $-(8.64 \text{ N})\hat{i} - (6.48 \text{ N})\hat{j}$

(3) $-(6.48 \text{ N})\hat{i} + (8.64 \text{ N})\hat{j}$

(4) $-(6.48 \text{ N})\hat{i} - (8.64 \text{ N})\hat{j}$

44. An electric dipole consists of two equal and opposite charges q and $-q$, separated by distance 2a. The magnitude of electric field at a distance r from the centre of the dipole, on its axis, is proportional to :

(1) $\frac{1}{r}$

(2) $\frac{1}{r^2}$

(3) $\frac{1}{r^3}$

(4) r

45. Three charges A (9 μC), B (18 μC) and C (27 μC) are located at points (0 cm, 0 cm, 0 cm), (0 cm, 3 cm, 0 cm) and (0 cm, 6 cm, 0 cm) respectively. A sphere of radius 2 cm is drawn with its centre at (0 cm, 0 cm, 0 cm). The electric flux through this sphere is :
(take $\varepsilon_0 = 9 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{m}^{-2}$)

(1) 1.0×10^6 V m

(2) 2.0×10^6 V m

(3) 3.0×10^6 V m

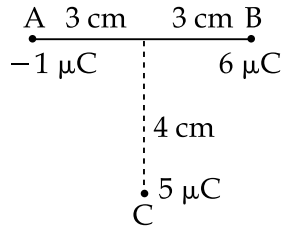
(4) 6.0×10^6 V m

46. A 100 μF capacitor is charged to 1.0 mC. The energy stored in a capacitor is :

(1) 3.0 mJ
(2) 4.0 mJ
(3) 5.0 mJ
(4) 6.0 mJ

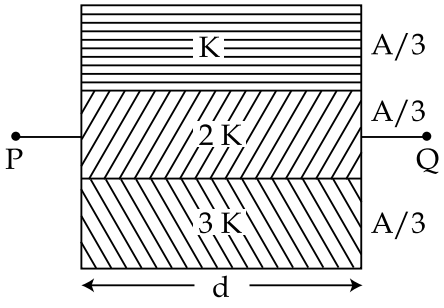
47. Three charges of -1 μC, 6 μC and 5 μC are located at points A, B and C respectively, as shown in the figure. The potential energy of this system of charges is :

$\left(\text{take } \left[\frac{1}{4\pi\varepsilon_0}\right] = 9 \times 10^9 \text{ N m}^2/\text{C}^2\right)$



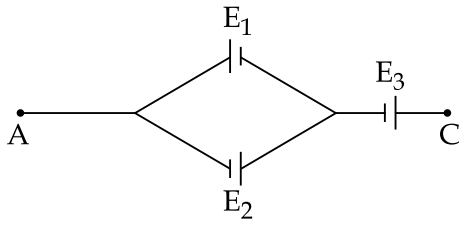
(1) 0.36 J
(2) 0.72 J
(3) 3.6 J
(4) 7.2 J

48. A parallel plate capacitor of plate area A and plate separation d is filled with three dielectric slabs, each of area $\left(\frac{A}{3}\right)$, and of dielectric constants K, 2 K and 3 K respectively as shown in figure. C_o and C are the capacitance of the capacitor without slabs and with slabs. Then the ratio $\left[\frac{C}{C_o}\right]$ is :



(1) 2 K
(2) 3 K
(3) 4 K
(4) 6 K

49. Three cells E_1, E_2 and E_3, having emfs 3ε, ε and ε and internal resistances $\left(\frac{r}{4}\right)$, $\left(\frac{r}{2}\right)$ and $\left(\frac{r}{3}\right)$ are connected as shown in the figure. The equivalent emf of the combination, between points A and C is :



(1) $5\ \varepsilon$

(2) $\left(\frac{8}{3}\right)\ \varepsilon$

(3) $\left(\frac{2}{3}\right)\ \varepsilon$

(4) $\left(\frac{1}{3}\right)\ \varepsilon$

50. Kirchoff's voltage law is based on :

(1) conservation of energy

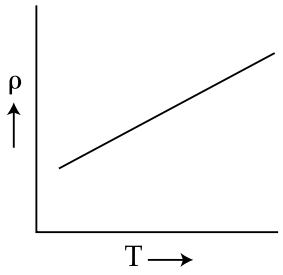
(2) conservation of charge

(3) conservation of momentum

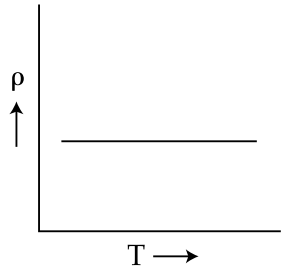
(4) conservation of angular momentum

51. Which one of the following graphs correctly shows the temperature dependence of resistivity for a copper wire ?

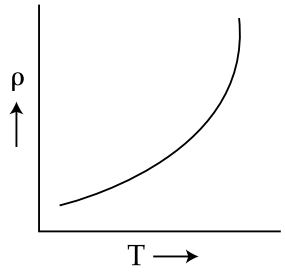
(1)



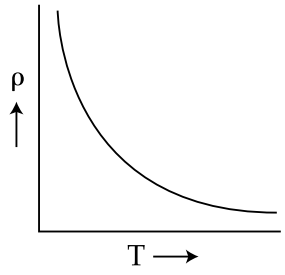
(2)



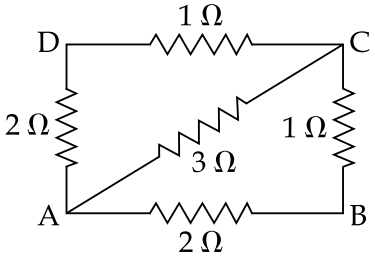
(3)



(4)



52. In the given figure below :



The equivalent resistance between points A and B is close to :

(1) 3 Ω

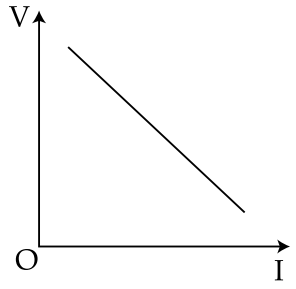
(2) 2 Ω

(3) 1 Ω

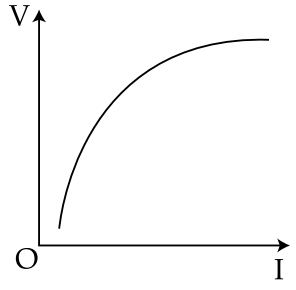
(4) 1.5 Ω

53. In an electric circuit, a resistor is connected in series with a variable power source. The current through the resistor is set to a minimum value. Which one of the following diagram correctly shows the variation of current with voltage through the resistor.

(1)



(2)



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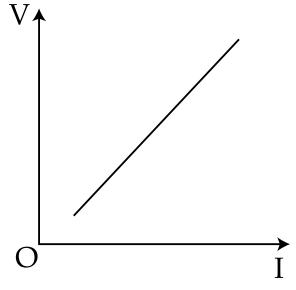

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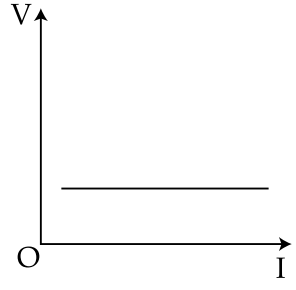


54. Pieces of Aluminium and germanium are placed at room temperature. These are now cooled. How will their resistances be changed ?

(1) These will increase in both the pieces

(2) These will decrease in both the pieces

(3) Resistance of aluminium will decrease while that of germanium will increase

(4) Resistance of aluminium will increase while that of germanium will decrease

55. Which one of the following is a diamagnetic substance ?

(1) Aluminium

(2) Lead

(3) Calcium

(4) Iron

56. A current of 5.0 A is maintained in a long straight wire. The magnitude of magnetic field at a distance of 5 cm from the wire is : ($\mu_0 = 4\pi \times 10^{-7}$ Tm/A)

(1) 10 μT

(2) 20 μT

(3) 62.8 μT

(4) 125.6 μT

57. A square coil of side 5.0 cm, with 40 closely wound turns, carries a current of 1.0 A. It is suspended vertically in a uniform magnetic field of 0.50 T such that the plane of the coil makes an angle of 60° with the field. The magnitude of torque experienced by the coil is :

(1) 1.25×10^{-3} N m

(2) 2.17×10^{-3} N m

(3) 2.5×10^{-2} N m

(4) 4.3×10^{-2} N m

58. Two long straight parallel conductors A and B, separated by 20 cm, carry currents of 5 A and 10 A respectively in opposite directions. The force exerted by conductor A on 10 cm segment of conductor B is ($\mu_0 = 4\pi \times 10^{-7}$ Tm/A)

(1) attractive with a magnitude of 5.0 μN

(2) repulsive with a magnitude of 5.0 μN

(3) attractive with a magnitude of 10 μN

(4) repulsive with a magnitude of 10 μN

59. A 0.8 cm straight segment of a wire (part of a circuit) is lying along *x*-axis centred at (0 cm, 0 cm) It carries a current of 2.0 A along *x*-axis. The magnetic field at a point (0 cm, 8 cm) is : ($\hat{i}$, $\hat{j}$ and $\hat{k}$ are unit vectors along *x*-axis, *y*-axis and *z*-axis respectively and $\mu_0 = 4\pi \times 10^{-7}$ Tm/A)

(1) $-(0.25\ \mu T)\hat{k}$

(2) $(0.25\ \mu T)\hat{k}$

(3) $-(0.50\ \mu T)\hat{k}$

(4) $(0.50\ \mu T)\hat{k}$

60. An ac voltage $v = v_m \sin \omega t$ is applied across a pure capacitor. The current in the capacitor :

(1) lags the voltage by one-quarter of a cycle.

(2) leads the voltage by one-quarter of a cycle.

(3) lags the voltage by one-half of a cycle.

(4) leads the voltage by one-half of a cycle.

61. A solenoid of cross-sectional area 4.0×10^{-4} m^2 and length 1.2 m consists of 50 turns per unit length. The self-inductance of the solenoid is : ($\mu_0 = 4\pi \times 10^{-7}$ Tm/A)

(1) 0.24π μH

(2) 0.48π μH

(3) 2.4π μH

(4) 4.8π μH

62. A 1.0 m long metallic rod is rotated with a frequency of 10 rev/sec about an axis perpendicular to the rod passing through its one end. The other end of the rod is in contact with a circular metallic ring. A constant and uniform magnetic field of 4.0 T exists in the region parallel to the axis. The emf developed between the centre and the ring is :

(1) 20 V

(2) 40 V

(3) 20π V

(4) 40π V

63. A sinusoidal voltage of peak value 282 V and frequency 50 Hz is applied to a series LCR circuit ($R = 8\ \Omega$, $X_L = 12\ \Omega$ and $X_C = 6\ \Omega$, symbols have their usual meanings). The power dissipated in the circuit and the power factor are respectively :

(1) 3.2 kW, 0.6

(2) 3.2 kW, 0.8

(3) 6.4 kW, 0.6

(4) 6.4 kW, 0.8

64. Consider the following statements for the real images formed by the spherical mirrors :

(a) These are formed on the same side of the mirror as the object

(b) These can be focussed on a screen

(c) These are always inverted in nature

Which of these statement(s) is/are always true in the given context ?

(1) (b) only

(2) (a) and (b) only

(3) (b) and (c) only

(4) All (a), (b) and (c)

65. The radius of a curvature of a convex spherical surface is 10 cm. The refractive index of this medium is 1.5. A beam of monochromatic light, propagating in air incident parallel to the principal axis of current surface would focus at a point :

(1) 6.7 cm from the surface on the principal axis

(2) 10 cm from the surface on the principal axis

(3) 20 cm from the surface on the principal axis

(4) 30 cm from the surface on the principal axis

66. Which one of the following optical device does **not** use total internal reflection ?

(1) Prism

(2) Optical - fiber

(3) Compound microscope

(4) Diamond

67. Which one of the following phenomenon can be explained using corpuscular model of light ?

(1) Interference of light

(2) Diffraction of light

(3) Refraction of light

(4) Polarisation of light

68. The objective lens of a refracting telescope has a focal length of 15 m. What will be the angular magnification of the telescope if an eye-piece of focal length 1.0 cm is used ?

(1) $+1500$

(2) -1500

(3) $+15$

(4) -15

69. In a single-slot diffraction pattern experiment, a parallel monochromatic beam of light ($\lambda \cong 600$ nm) is incident normally on the slit. The resultant pattern is seen on a screen placed perpendicular to the direction of incident beam. What is the path difference between the rays coming from the two edges of the slit at the first minimum of the diffraction pattern ?

(1) ~600 nm

(2) ~400 nm

(3) ~300 nm

(4) ~150 nm

70. Which one of the following statements is true for a photoelectric effect apparatus ?

(1) There exists a certain minimum cut-off frequency of incident radiation for every photosensitive material for which the stopping potential is zero.

(2) There exists a certain minimum cut-off frequency of incident radiation, same for all photosensitive materials, for which the stopping potential is zero.

(3) The stopping potential is same for all photosensitive materials.

(4) The stopping potential neither varies with the intensity nor with the frequency of incident radiation for a given photosensitive material.

71. The power of a monochromatic light beam emitted by a source is 2.0×10^{-3} W. The wavelength of each photon is 500 nm. The energy of a photon in the light beam and the number of photons emitted by the source per second on an average, respectively are :
(Plank's Constant = 6.63×10^{-34} J.s)

(1) 3.98×10^{-19} J; 5.02×10^{15}

(2) 6.33×10^{-20} J; 5.02×10^{14}

(3) 3.98×10^{-18} J; 5.02×10^{16}

(4) 6.33×10^{-20} J; 5.02×10^{15}

72. A particle X and a nucleon (mass $\cong 1.68 \times 10^{-27}$ kg) are travelling along a straight line. The nucleon is moving three times as fast as the particle X. The ratio of the de Broglie wavelength associated with the nucleon to that of the particle X is about 1.81×10^{-4}. What could be the particle X ?

(1) An electron only

(2) A positron only

(3) A beta particle

(4) A dutron

73. Which one of the following statements about the nuclear forces is true ?

(1) They depend on the electric charge on the nucleons.

(2) These forces too follow inverse-square law.

(3) The nuclear force between two nucleons falls rapidly to zero as their distance is more than a few femtometer.

(4) These are stronger than coulomb forces but weaker than gravitational forces.

74. Which one of the following statements is true for the probability of a particle ?

(1) The amplitude of the matter waves associated with the particle at a point determines the probability of the particle at that point.

(2) The square of the amplitude of the matter waves associated with the particle at a point determines the probability density of the particle at that point.

(3) The amplitude of the matter wave associated with the particle cannot determine the probability density of the particle at any point.

(4) The intensity of matter wave associated with the particle in a region has nothing to do with the probability of the particle being found in that region.

75. Which one of the following nuclear reactions correctly represents the beta-decay ?
(Here all symbols carry their usual meanings.)

(1) ${}_{54}Xe^{120} + {}_{-1}e^{0} \rightarrow {}_{53}I^{120} + \nu$

(2) ${}_{6}C^{11} + {}_{+1}e^{0} \rightarrow {}_{5}B^{11} + \bar{\nu}$

(3) ${}_{15}P^{32} \rightarrow {}_{16}S^{32} + {}_{-1}e^{0} + \bar{\nu}$

(4) ${}_{+1}e^{0} + {}_{-1}e^{0} \rightarrow \gamma + \gamma$

76. From a nuclear fission power reactor, which is operating with 20% efficiency, an output power of 200 MW is sought. If the mass lost per unit gram of uranium fuel in the fission process is 0.8 mg, how much uranium is needed per hour ? ($c = 3 \times 10^8$ m/s)

(1) 10 mg

(2) 500 mg

(3) 1.0 g

(4) 50 g

77. In an alpha-particle scattering experiment, an alpha-particle of 8 MeV approaches a gold ($Z = 79$) nucleus. What is the distance of closest approach of the particle before it comes momentarily to rest and reverse its direction ?

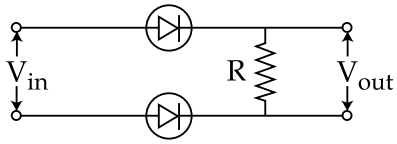
$$\left(e = 1.6 \times 10^{-19}\ C\ ;\ 4\pi\epsilon_0 = \frac{1}{(9 \times 10^9)} \text{ in SI units}\right)$$

(1) about 2.8 fm
(2) about 2.8×10^{-14} cm
(3) about 2.8×10^{-12} cm
(4) about 1.4×10^{-14} m

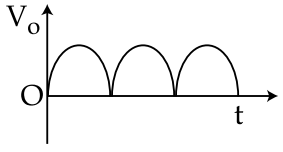
78. Which one of the following statements is true for a bipolar junction transistor ?
(1) The emitter region is thinner than the base region in a bipolar junction transistor
(2) The collector region is largest in a bipolar junction transistor
(3) The base region is heavily doped, emitter is moderately doped as collector is lightly doped.
(4) There are structural differences between pnp and npn transistors

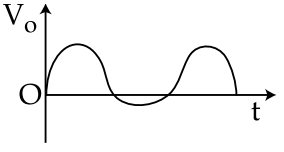
79. Which of the following are found in the depletion layer of a p-n junction diode ?
(1) Only holes
(2) Only electrons
(3) Electrons and holes both
(4) Neither holes nor electrons

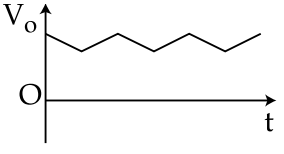
80. An ac signal (V_{in}) is applied to the p-n junction diodes as shown in the figure below.



Here R represents the load resistance and V_o represents the output signal. Which one of the following graphs correctly shows V_o as a function of time t ?

(1) 

(2) 

(3) 

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