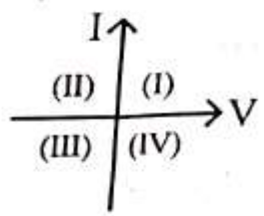
R5

# NEET 2024
## Physics

**Section – A (Compulsory)**

**1. Consider the following statements A and B and identify the correct answer:**




**A.** For a solar-cell, the I-V characteristics lies in the IV quadrant of the given graph.

**B.** In a reverse biased pn junction diode, the current measured in (μA), is due to majority charge carriers.

(1) A is incorrect but B is correct.
(2) Both A and B are correct.
(3) Both A and B are incorrect.
(4) A is correct but B is incorrect.

**Solution:**

**(4) A is correct but B is incorrect**

A. IV characteristics of solar cell

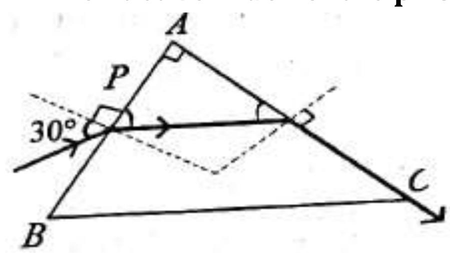
Current I is supplied by the solar cell and not drawn by it

B. Reverse biased pn-junction diode

I (μA)

- Drift current
- Minority charge carriers of both n & p-side

**2. A light ray enters through a right angled prism at point P with the angle of incidence 30° as shown in figure. It travels through the prism parallel to its base BC and emerges along the face AC. The refractive index of the prism is:**




(a) $\frac{\sqrt{5}}{2}$ (b) $\frac{\sqrt{3}}{4}$

(c) $\frac{\sqrt{3}}{2}$ (d) $\frac{\sqrt{5}}{4}$

**Solution:**

**(a)** $\frac{\sqrt{5}}{2}$

$A = r_1 + r_2$

$r_1 + r_2 = 90^o$

$r_2 = 90 - r_1 \quad \ldots. \quad (1)$

At surface AB:

$M_1 \sin I = M_2 \sin r_1$

$1 \cdot \sin 30^o = M \sin r_1$

$\sin r_1 = \frac{1}{2M}$

At surface AC:

$M \sin r_2 = 1 \cdot \sin 90^o$

$\sin r_2 = \frac{1}{M}$

$\sin (90 - r_1) = \frac{1}{M}$

$\cos r_1 = \frac{1}{M}$

Now,

$\sin^2 r_1 + \cos^2 r_1 = \left(\frac{1}{2M}\right)^2 \left(\frac{1}{M}\right)^2$

$1 = \frac{1}{4M^2} + \frac{1}{M^2}$

$1 = \frac{1}{M^2}\left[\frac{1}{4} + \frac{1}{6}\right]$

$M^2 = \frac{5}{4}$

$M = \frac{\sqrt{5}}{2}$

**3. A particle moving with uniform speed in a circular path maintains:**

(1) constant acceleration.

(2) constant velocity but varying acceleration.

(3) varying velocity and varying acceleration.

(4) constant velocity.

**Solution:**

**(3)** Varying velocity and varying acceleration

In U.C.M., particle move with varying velocity and varying acceleration

**4. In an ideal transformer, the turns ratio is $\frac{N_p}{N_s} = \frac{1}{2}$. The ratio $V_s : V_p$ is equal to (the symbols carry their usual meaning):**

(1) 2 : 1 (2) 1 : 1

(3) 1 : 4 (4) 1 : 2

**Solution:**

**(1) 2 : 1**

$\frac{V_s}{V_p} = \frac{N_s}{N_p} = \frac{2}{1}$

**5. At any instant of time t, the displacement of any particle is given by 2t – 1 (SI unit) under the influence of force of 5N. The value of instantaneous power is (in Sl unit):**

(1) 5 (2) 7

(3) 6 (4) 10

**Solution:**

**(4) 10**

Date:

$S = 2t - 1$

$F = 5N$

Soln:

$V = \frac{ds}{dt} = \frac{d}{dt}(2t - 1)$

$= 2(1)$

$V = 2$

$\therefore$ $P = F \cdot v$

$= 5 \times 2$

$P = 10$ Watt

**6. The moment of inertia of a thin rod about an axis passing through its mid point and perpendicular to the rod is 2400 g cm². The length of the 400 g rod is nearly:**

(1) 17.5 cm (2) 20.7 cm

(3) 72.0 cm (4) 8.5 cm

**Solution:**

(4) 8.5 cm

$I = \frac{ML^2}{12}$

$L^2 = \frac{12I}{M}$

$L^2 = \frac{12 \times (2400)}{400}$

$L = \sqrt{72}$

$L = 8.48$ cm

7. **Match List I with List II.**

| | List-I (Spectral Lines of Hydrogen for transitions from) | | List-II (Wavelengths (nm)) |
|---|---|---|---|
| **A.** | $n_2 = 3$ to $n_1 = 2$ | **I** | 410.2 |
| **B.** | $n_2 = 4$ to $n_1 = 2$ | **II** | 434.1 |
| **C.** | $n_2 = 5$ to $n_1 = 2$ | **III** | 656.3 |
| **D.** | $N_2 = 6$ to $n_1 = 2$ | **IV** | 486.1 |

Choose the correct answer from the options given below.

(1) A – III, B-IV, C-II, D-I
(2) A-IV, B-III, C-I, D-II
(3) A-I, B-II, C-III, D-IV
(4) A-II, B-I, C-IV, D-III

**Solution:**

**(1) A-III, B-IV, C-II, D-I**

$$\frac{1}{\lambda} = R\left(\frac{1}{p^2} - \frac{1}{n^2}\right)$$

$$\frac{1}{\lambda} = 10^7\left(\frac{1}{2^2} - \frac{1}{3^2}\right)$$

$$= 10^7\left(\frac{1}{4} - \frac{1}{9}\right)$$

$$\frac{1}{\lambda} = 10^7\left(\frac{5}{36}\right)$$

$\therefore$ $\lambda = \frac{36}{5} \times 10^{-7}$

$\lambda = 7.2 \times 10^{-7}$ m

$\lambda = 720 \times 10^{-9}$ m

$\therefore$ $\lambda = 720$ nm

Which is approx. by seeing option 656.3

$\therefore$ $A \rightarrow III$

8. **A bob is whirled in a horizontal plane by means of a string with an initial speed of ω rpm. The tension in the string is T. If speed becomes 2ω while keeping the same radius, the tension in the string becomes :**

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

(3) $\sqrt{2}T$ (4) T

**Solution:**

**(1) 4T**

**Tension provides necessary centripetal force**

**$T = F_{cp}$**

**$T =$** $m\omega^2 r$

$\therefore$ $\frac{T_2}{T_1} = \left(\frac{\omega^2}{\omega_1}\right)$

$$\frac{T_2}{T_1} = \left(\frac{2\omega}{\omega}\right)^2$$

$$\frac{T_2}{T_1} = 4$$

$T_2 = 4T_1$

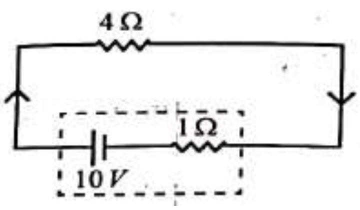
9. **An unpolarised light beam strikes a glass surface at Brewster's angle. Then**

(1) the refracted light will be completely polarised.
(2) both the reflected and refracted light will be completely polarised.
(3) the reflected light will be completely polarised but the refracted light will be partially polarised.
(4) the reflected light will be partially polarised.

**Solution:**

(3) The reflected light will be completely polarised but the refracted light will be partially polarised

**10. The terminal voltage of the battery, whose emf is 10V and internal resistance 1Ω, when connected through an external resistance of 4 Ω as shown in the figure is:**




(1) 6 V (2) 8 V
(3) 10 V (4) 4 V

**Solution:**

**(2) 8 volt**

$V = E - Ir$

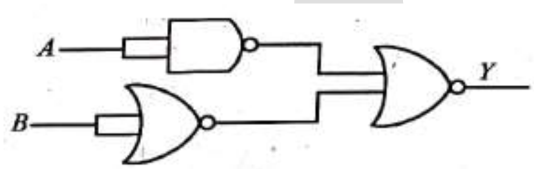
$= 10 - \left(\frac{10}{4+1}\right).1$

$= 10 - \left(\frac{10}{5}\right)$

$= 10 - 2$

$V = 8$ volt

**11. The output (Y) of the given logic gate is similar to the output of an/a**



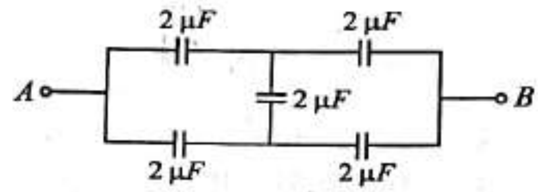

(1) NOR gate (2) OR gate
(3) AND gate (4) NAND gate

**Solution:**

**(3) AND gate**

$\therefore \quad Y = \overline{\overline{A}+\overline{B}} = A \cdot B$ (AND gate)

**12. In the following circuit, the equivalent capacitance between terminal A and terminal B is:**




(1) 1 μF (2) 0.5 μF
(3) 4 μF (4) 2 μF

**Solution:**

**(4) 2 μF**

It's a wheatstone Bridge By property of bridge

$C_{eq} = 2\mu F$

**13.** $^{290}_{82}X \xrightarrow{\alpha} Y \xrightarrow{e^+} Z \xrightarrow{\beta^-} P \xrightarrow{e^-} Q$

**In the nuclear emission stated above, the mass number and atomic number of the product Q respectively, are:**

(1) 286, 80 (2) 288, 82
(3) 286, 81 (4) 280, 81

**Solution:**

**(3) 286, 81**

$^{290}_{82}X \xrightarrow{\alpha} y \xrightarrow{e^+} Z \xrightarrow{B^-} P \xrightarrow{e^-} Q$

$\alpha : {}^{A}_{Z}X \rightarrow {}^{A-4}_{Z-2}Y$

$e^+ : {}^{A}_{Z}X \rightarrow {}^{A}_{Z-1}Y$

$\beta^- : {}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y$

$e^- : {}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y$

$\therefore \quad {}^{290}_{82}X \xrightarrow{\alpha} {}^{286}_{80}Y \xrightarrow{e^+} {}^{286}_{79}Z \xrightarrow{\beta^-} {}^{286}_{80}P \xrightarrow{e^-} {}^{286}_{81}Q$

**14. The quantities which have the same dimensions as those of solid angle are**

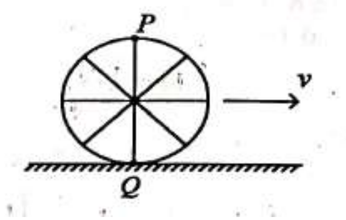
(1) stress and angle
(2) strain and arc
(3) angular speed and stress
(4) strain and angle

**Solution:**

**(4) Strain and angle**

Solid Angle, strain and angle have same dimension i.e. dimensionless.

**15. A wheel of a bullock cart is rolling on a level road as shown in the figure below. If its linear speed is v in the direction shown, which one of the following options is correct (P and Q are any- highest and lowest points on the wheel, respectively)?**




(1) Point P moves faster than point Q.

(2) Both the points P and Q move with equal speed.

(3) Point P has zero speed

(4) Point P moves slower than point Q.

**Solution:**

**(1) Point P moves faster than point Q.**

In Rolling Motion, Topmost point have maximum velocity & Lowest point has minimum velocity (zero)

**16. A wire of length '$\ell$' and resistance 100Ω is divided into 10 equal parts. The first 5 parts are connected in series while the next 5 parts are connected in parallel. The two combinations are again connected in series. The resistance of this final combination is:**

(1) 52Ω (2) 55Ω

(3) 60Ω (4) 26Ω

**Solution:**

**(1) 52Ω**

Resistance of each part R = 10Ω

5 parts are connected in series $R_5 = 5R = 5(10) = 50\Omega$

5 Parts are connected in parallel $R_5 = \frac{R}{5} = \frac{10}{5}$ 2Ω

Now, they are connected in series.

$\therefore$ Req = 50 + 2 = 52Ω

**17. A thin flat circular disc of radius 4.5 cm is placed gently over the surface of water. If surface tension of water is 0.07 $Nm^{-1}$, then the excess force required to take it away from the surface is :**

(1) 198 N (2) 1.98 mN

(3) 99 N (4) 19.8 mN

**Solution:**

**(4) 19.8 mN**

Force due to surface Tension

$F = T \times L = T \times (2\pi R)$

$F = 0.07 \times 2\pi \times 4.5 \times 10^{-2}$

$F = 14\pi \times 4.5 \times 10^{-4}$

F = 19.8 mN

**18. The maximum elongation of a steel wire of 1m length if the elastic limit of steel and its Young's modulus, respectively, are $8 \times 10^8$ N $m^{-2}$ and $2 \times 10^{11}$ N $m^{-2}$, is:**

(1) 0.4 mm (2) 40 mm

(3) 8 mm (4) 4 mm

**Solution:**

**(4) 4mm**

Data : L = 1m

$$\text{Stress} = \frac{F}{A} = 8\times10^{8}\frac{N}{m^2}$$

$$y = 2\times10'' \frac{N}{m^2}$$

To find: $\ell$ = ?

**Solution :**

$$y = \frac{\text{stress}}{\text{strain}} = \frac{F/A}{\ell/L}$$

$$\ell = \left(\frac{F}{A}\right).\frac{L}{y}$$

$= \dfrac{8\times10^{8}\times1}{2\times10^{11}}$

$\ell = 4 \times 10^{-3}$ m

$\ell = 4$ mm

**19. A tightly wound 100 turns coil of radius 10 cm carries a current of 7 A. The magnitude of the magnetic field at the centre of the coil is (Take permeability of free space as $4\pi \times 10^{-7}$ SI units):**

(1) 4.4 T (2) 4.4 mT
(3) 44 T (4) 44 mT

**Solution:**

**(2) 4.4mT**

Data : N = 100
I = 7A
To find : B = ?

**Solution :**

$B = \dfrac{\mu_0 IN}{2r}$

$= \dfrac{4\pi\times10^{-7}\times7\times100}{2\times10^{-1}}$

$= 2 \times 3.142 \times 7 \times 10^{-4}$

$= 43.98 \times 10^{-4}$

$= 4.4 \times 10^{-3}$ T

$\therefore$ B = 4.4 mT

**20. In a vernier calipers, (N +1) divisions of vernier scale coincide with N divisions of main scale. If 1 MSD represents 0.1 mm, the vernier constant (in cm) is :**

(1) $\dfrac{1}{100(N+1)}$ (2) 100N
(3) 10(N + 1) (4) $\dfrac{1}{10N}$

**Solution:**

**(1)** $\dfrac{1}{100(N+1)}$

(N + 1)V.S.D = (N)M.S.D.

1 V.S.D = $\dfrac{N}{N+1}$ M.S.D. -(1)

L.C. = 1 M.S.D. – 1 V.S.D.

= 1 M.S.D. – $\dfrac{N}{N+1}$ M.S.D.

$= \dfrac{(N+1)M.S.D.(N)M.S.D.}{N+1}$

$= \dfrac{1M.S.D.}{N+1}$

L.C. $= \dfrac{(0.1)\times10^{-1}}{N+1} = \dfrac{1}{100(N+1)}$

Correct Ans : $\dfrac{1}{100(N+1)}$

**21. A logic circuit provides the output ‘Y as per the following truth table :**

| A | B | Y |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

**The expression for the output Y is:**

(1) $\overline{A.B}+\overline{A}$ (2) $\overline{B}$
(3) B (4) $A.B+\overline{A}$

**Solution:**

**(2)** $\overline{B}$

By using option elimination method

- $y = \overline{B}$
- $y \neq B$
- $A \cdot B + \overline{A} \neq$ (A = 0, B = 1)
- $A\cdot\overline{B}+\overline{A} \neq$ (A = 0, B = 1)

**22. If c is the velocity of light in free space, the correct statements about photon among the following are:**
**A. The energy of a photon is E = hv**

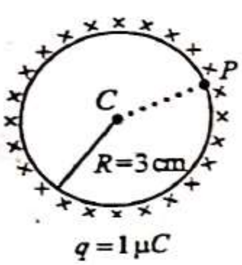
**B. The velocity of a photon is c.**

**C. The momentum of a photon, $p = \frac{h\nu}{C}$**

**D. In a photon-electron collision, both total energy and total momentum are conserved.**
**E. Photon possesses positive charge.**
**Choose the correct answer from the options given below:**
(1) A, B, C and D only
(2) A, C and D only
(3) A, B, D and E only
(4) A and B only

**Solution:**
**(1) A, B, C and D only**
Photon does not have +ve or –ve charge
∴ E option is incorrect
∴ Correct ans : A, B, C and D only

**23. A thin spherical shell is charged by some source. The potential difference between the two points C and P (in V) shown in the figure is:**
**(Take $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9$ SI units)**



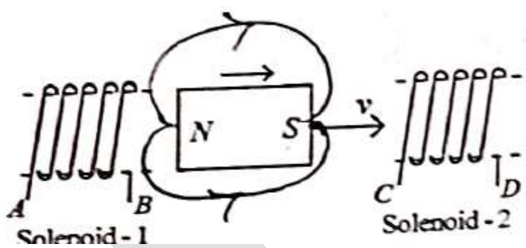

(1) $1 \times 10^5$ (2) $0.5 \times 10^5$
(3) zero (4) $3 \times 10^5$

**Solution:**
**(3) Zero**

$$V_{inside} = V_{surface} = \frac{1}{4\pi\epsilon_0 K}.\frac{q}{R}$$

Hence potential at center and surface are same.
∴ Pot. Difference between point C & P = Zero

**24.**

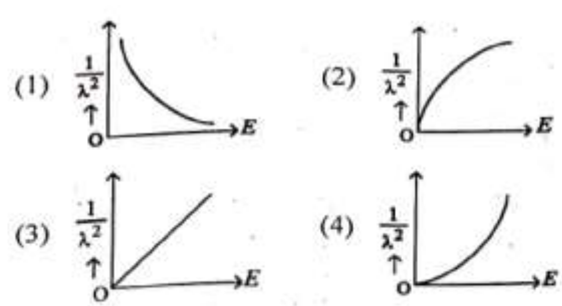



**In the above diagram, a strong bar magnet is moving towards solenoid-2 from solenoid-1. The direction of induced current in solenoid-1 and that in solenoid-2, respectively, are through the directions:**
(1) BA and CD (2) AB and CD
(3) BA and DC (4) AB and DC

**Solution:**
**(4) AB and DC**
According to Len's law
- S-pole generate in solenoid-1
  Direction of current is AB
- S-Pole generate in solenoid-2
  Direction of current is DC

∴ Current ans : AB and DC

**25. The graph which shows the variation of $\left(\frac{1}{\lambda^2}\right)$ and its kinetic energy, E is (where λ is de Broglie wavelength of a free particle) :**



**Solution:**

**(3)**

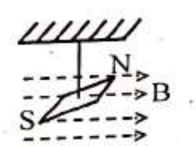
$$\lambda = \frac{h}{p} = \frac{h}{\sqrt{2m(KE)}}$$

$$\lambda \propto \frac{1}{\sqrt{(KE)}}$$

$$\lambda^2 \propto \frac{1}{KE}$$

$\therefore \quad \frac{1}{\lambda^2} \propto \text{K.E.}$ (Directly proportional)

**26. In a uniform magnetic field of 0.049 T, a magnetic needle performs 20 complete oscillations in 5 seconds as shown. The moment of inertia of the needle is 9.8 × $10^{-6}$ kg $m^2$. If the magnitude of magnetic moment of the needle is x × $10^{-5}$ $Am^2$; then the value of 'x' is:**




(1) $128\,\pi^2$ (2) $50\,\pi^2$

(3) $1280\,\pi^2$ (4) $5\,\pi^2$

**Solution:**

**(3) $1280\,\pi^2$**

$$T = \frac{\text{Total time}}{\text{No.\& oscillation}} = \frac{5}{20} = \frac{1}{4}$$

$$T = 2\pi\sqrt{\frac{I}{M.B.}}$$

$$\therefore \quad T^2 = 4\pi^2 \cdot \frac{I}{M.B}$$

$$M = 4\pi^2 \cdot \frac{I}{T^2.B}$$

$$M = \frac{4\pi^2 \times 9.8 \times 10^{-6}}{\left(\frac{1}{4}\right)^2 \times 49 \times 10^{-3}}$$

$$x \times 10^{-5} = \frac{4\pi^2 \times 9.8 \times 16 \times 10^{-4}}{49}$$

$$x \times 10^{-5} = \frac{4\pi^2 \times 9.8 \times 16 \times 10^{-4}}{49}$$

$x \times 10^{-5} = 1280^2 \times 10^{-5}$

$x = 1280\,\pi^2$

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

| | **List-I (Material)** | | **List-II (Susceptibility ($\chi$))** |
|---|---|---|---|
| **A.** | Diamagnetic | **I** | $\chi = 0$ |
| **B.** | Ferromagnetic | **II** | $0 > \chi \geq -1$ |
| **C.** | Paramagnetic | **III** | $\chi >> 1$ |
| **D.** | Non-magnetic | **IV** | $0 < \chi < \varepsilon$ (a small positive number) |

**Choose the correct answer from the options given below**

(1) A-II, B-I, C-III, D-IV

(2) A-III, B-II, C-I, D-IV

(3) A-IV, B-III, C-II, D-I

(4) A-II, B-III, C-IV, D-I

**Solution:**

**(4) A-II, B-III, C-IV, D-I**

**28. If x = 5 sin $\left(\pi t + \frac{\pi}{3}\right)$ m represents the motion of a particle executing simple harmonic motion, the amplitude and time period of motion, respectively, are:**

(1) 5 m, 2 s (2) 5 cm, 1 s

(3) 5 m, 1 s (4) 5 cm, 2 s

**Solution:**

**(1) 5m, 2s**

$x = 5 \sin\left(\pi t + \frac{\pi}{3}\right) m$

General Equation of S.H.M.

$X = A \sin(wt + \phi)$

$\therefore \quad A = 5$

$\omega = \pi$

$$\frac{2\pi}{T} = \pi$$

T = 2 see

**29.** Given below are two statements:

**Statement I**: Atoms are electrically neutral as they contain equal number of positive and negative charges.

**Statement II**: Atoms of each element are stable and emit their characteristic spectrum.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both Statement I and Statement II are incorrect.

(2) Statement I is correct but Statement II is incorrect.

(3) Statement I is incorrect but Statement II is correct.

(4) Both Statement I and Statement II are correct

**Solution:**

**(2)** Statement I is correct but Statement II is incorrect

**30. If the monochromatic source in Young's double slit experiment is replaced by white light, then**

(1) there will be a central dark fringe surrounded by a few coloured fringes.

(2) there will be a central bright white fringe surrounded by a few coloured fringes.

(3) all bright fringes will be of equal width

(4) interference pattern will disappear

**Solution:**

**(2) there will be a central bright white fringe surrounded by a few coloured fringes.**

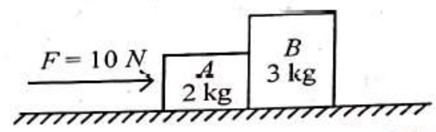
Central fringe for all the colour are formed at central point so it becomes white after mixing up.

As fringe of other colours fall at different places we see fringes of all colour on the central bright fringe

**Correct ans :**

Only the central fringe is white and all other fringes are observed coloured.

**31. A horizontal force 10 N is applied to a block A as shown in figure. The mass of blocks A and B are 2 kg and 3 kg, respectively. The blocks slide over a frictionless surface. The force exerted by block A on block B is:**

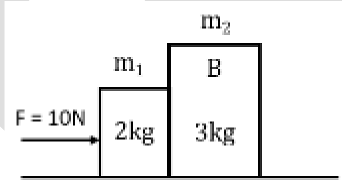



(1) 4 N (2) 6 N

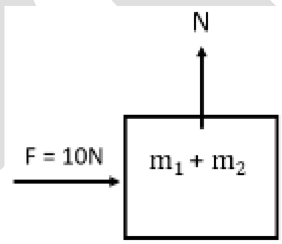
(3) 10 N (4) Zero

**Solution:**

**(2) 6N**



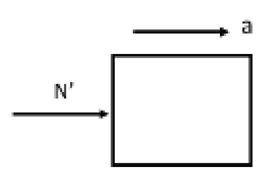

FBD




$F = (m_1 + m_2)a$

$10 = (2 + 3)a$

$a = \frac{10}{5} = 2\frac{m}{s^2}$




$\therefore$ $N' - m_2 a$

$= 3 \times 2$

$N' = 6N$

32. **Two bodies A and B of same mass undergo completely inelastic one dimensional collision. The body A moves with velocity $v_1$ while body B is at rest before collision. The velocity of the system after collision is $v_2$. The ratio $v_1 : v_2$ is:**

(1) 2 : 1 (2) 4 : 1
(3) 1 : 4 (4) 1 : 2

**Solution:**

**(1)** $\frac{v_1}{v_2} = \frac{2}{1}$

$m_1 = m_2 = m$

applying L.C.M.

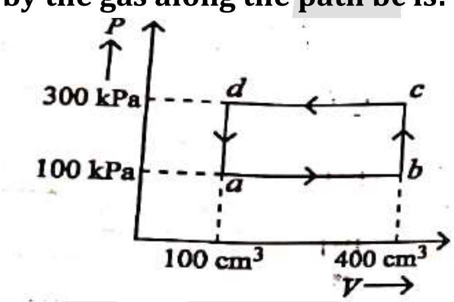
$P_i = P_f$

$(m_1 v_1 + 0) = (m_1 + m_2)v_2$

$mv_1 = 2mv_2$

$\frac{v_1}{v_2} = \frac{2}{1}$

33. **A thermodynamic system is taken through the cycle abcda. The work done by the gas along the path bc is:**




(1) 30 J (2) – 90 J
(3) – 60 J (4) zero

**Solution:**

**(4) Zero**

Along path bc

V = constant

∴ W = 0

34. **The mass of a planet is $\frac{1}{10}^{\text{th}}$ that of the earth and its diameter is half that of the earth. The acceleration due to gravity on that planet is:**

(1) $9.8 \text{ m s}^{-2}$ (2) $4.9 \text{ m s}^{-2}$
(3) $3.92 \text{ m s}^{-2}$ (4) $19.6 \text{ m s}^{-2}$

**Solution:**

**(3) $3.92 \text{ m s}^{-2}$**

Data : $M_p = \frac{M_E}{10}$

$d_p = \frac{d_E}{2}$

i.e. $R_p = \frac{R_E}{2}$

To find : $g_P = ?$

**Solution :**

W.K.T.

$G = \frac{GM}{R^2}$

$g \propto \frac{M}{R^2}$

$\frac{g_p}{g_e} = \frac{M_P}{M_E} \times \left(\frac{R_E}{R_P}\right)^2$

$= \frac{\frac{M_E}{10}}{M_E}\left(\frac{R_E}{R_E/2}\right)^2$

$\frac{9_g}{9.8} = \frac{1}{10}(4)$

$g_p = \frac{4 \times 9.8}{10}$

$g_p = \frac{39.2}{10}$

$G_p = 3.92 \ \frac{m}{s^2}$

**35. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.**

**Assertion A:** The potential (V) at any axial point, at 2 m distance(r) from the centre of the dipole of dipole moment vector $\vec{P}$ of magnitude, $4 \times 10^{-6}$ C m, is $\pm 9 \times 10^3$ V.

(Take $\frac{1}{4\pi \epsilon_0} = 9 \times 10^9$ SI units)

**Reason R:** $V = \pm \frac{2P}{4\pi \epsilon_0 r^2}$, where r is the distance of any axial point, situated at 2 m from the centre of the dipole.

**In the light of the above statements, choose the correct answer from the options given below:**

(1) Both A and R are true and R is NOT the correct explanation of A.

(2) A is true but R is false.

(3) A is false but R is true.

(4) Both A and R are true and R is the correct explanation of A.

**Solution:**

**(2) A is true but R is False**

Potential at any axial point is

$$V = \frac{KP}{r^2} = \frac{9 \times 10^9 \times 4 \times 10^{-6}}{2^2}$$

$V = 9 \times 10^3$ volt

$\therefore$ Assertion is true.
But Reason is False.

**36. A small telescope has an objective of focal length 140 cm and an eye piece of focal length 5.0 cm. The magnifying power of telescope for viewing a distant object is:**

(1) 28 (2) 17
(3) 32 (4) 34

**Solution:**

**()** = 28

Magnifying power of telescope

$$(\text{M.P.}) = \frac{f_o}{f_e} = \frac{140}{5} = 28$$

**37. The minimum energy required to launch a satellite of mass m from the surface of earth of mass M and radius R in a circular orbit at an altitude of 2R from the surface of the earth is:**

(1) $\frac{2GmM}{3R}$ (2) $\frac{GmM}{2R}$
(3) $\frac{GmM}{3R}$ (4) $\frac{5GmM}{6R}$

**Solution:**

**(4)** $\Delta E = \frac{5GMm}{6R}$

P.E. at surface = $-\frac{GMm}{R}$

P.E. at surface = $-\frac{GMm}{R+h} = -\frac{GMm}{R+2R} = -\frac{GMm}{3R}$

Total Energy at surface

$$E_i = -\frac{GMm}{R}$$

Total energy at altitude (orbit)

$$E_f = \frac{1}{2}mv_0^2 - \frac{GMm}{3R} \quad \left(V_0 = \sqrt{\frac{GM}{R+h}}\right)$$

$$E_f = \frac{1}{2}\frac{GMm}{3R} - \frac{GMm}{3R}$$

$$E_f = \frac{GMm}{3R}\left(\frac{1}{2} - 1\right)$$

$$E_f = -\frac{GMm}{6R}$$

Now, Minimum required energy

$\Delta E = E_f - E_i$

$$= -\frac{GMm}{6R} - \left(-\frac{GMm}{R}\right)$$

$$= -\frac{GMm}{6R} + \frac{GMm}{R}$$

$$\Delta E = \frac{5GMm}{6R}$$

**38. Two heaters A and B have power rating of 1 kW and 2 kW, respectively. Those two are first connected in series and then in parallel to a fixed power source. The ratio of power outputs for these two cases is:**

(1) 2 : 9 (2) 1 : 2

(3) 2 : 3 (4) 1 : 1

**Solution:**

**(1) 2 : 9**

Case 1 : Heaters connected in series

$$P_1 = \frac{Po_1 \cdot Po_2}{Po_1 + Po_2}$$

$$P_1 = \frac{1\times 2}{1+2}$$

$$P_1 = \frac{2}{3} KW$$

Case 2 : Heaters connected in Parallel

$$P_2 = Po_1 + Po_2$$

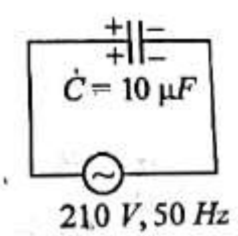
$P_2$ = 1  2

$P_2$ = 3KW

Now,

$$\frac{P_1}{P_2} = \frac{2/3}{3} = \frac{2}{g}$$

**39. A 10 μF capacitor is connected to a 210 V, 50 Hz source as shown in figure. The peak current in the circuit is nearly (π= 3.14):**




(1) 0.93 A (2) 1.20 A

(3) 0.35 A (4) 0.58 A

**Solution:**

**(1) 0.93 A**

Peak current $i_o = \frac{V_o}{X_c}$

$$x_c = \frac{1}{2\pi fc}$$

$$\therefore \quad i_0 = \frac{V_0}{\frac{1}{2\pi fc}} = V_0 \times 2\pi fc$$

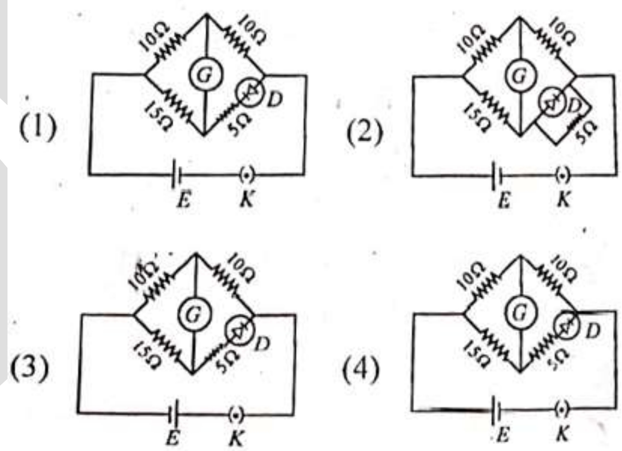
$$i_0 = \sqrt{2}\ V_{rms} \times 2\pi fc$$

$$i = \sqrt{2} \times 210 \times 2 \times \frac{22}{7} \times 50 \times 10 \times 10^{-6}$$

$$i_0 = \sqrt{2} \times 3 \times 22 \times 10^{-3}$$

$i_0$ = 0.93 A

**40. Choose the correct circuit which can achieve the bridge balance.**




**Solution:**

(4)

**41. If the plates of a parallel plate capacitor connected to a battery are moved close to each other, then**

A. the charge stored in it, increases.

B. the energy stored in it, decreases.

C. its capacitance increases.

D. the ratio of charge to its potential remains the same.

E. the product of charge and voltage increases.

**Choose the most appropriate answer from the options given below:**

(1) A, C and E only

(2) B, D and E only

(3) A, B and C only

(4) A, B and E only

**Solution:**

**(1) A, C and E only**

Battery is connected

$\therefore$ V = const.

(c) $C = \frac{\epsilon_0 AK}{d}$

$d\downarrow \Rightarrow c\uparrow$

(b) $E = \frac{1}{2}CV^2$

$C\uparrow \Rightarrow E\uparrow$

(A) Q = CV

$C\uparrow \Rightarrow Q\uparrow$

(D) $Q.V \Rightarrow \uparrow$

**42. A parallel plate capacitor is charged by connecting it to a battery through a resistor. If I is the current in the circuit, then in the gap between the plates :**

(1) displacement current of magnitude equal to I flows in the same direction as I

(2) displacement current of magnitude equal to I flows in a direction opposite to that of I

(3) displacement current of magnitude greater than I flows but can be in any direction

(4) there is no current

**Solution:**

**(1)** Displacement current ($I_D$) is equal to conduction Current (I) and Flows in same direction as I.

Correct SOLUTION: displacement current of magnitude equal to I flows in the same direction as I.

**43. The property which is not of an electromagnetic wave travelling in free space is that :**

(1) the energy density in electric field is equal to energy density in magnetic field.

(2) they travel with a speed equal to $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$

(3) they originate from charges moving with uniform speed

(4) they are transverse in nature

**Solution:**

**(3) they originate from charges moving with uniform speed**

1. EM waves originates from varying Electric or Magnetic Field.
2. EM waves Travels with speed C= $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$ Moto
3. EM waves are Transverse in nature.
4. Energy density in electric field is equal to energy density in magnetic field.

EM waves do not originate from charge moving with uniform Speed.

EM waves originates from accelerated charge Particle.

Correct SOLUTION:

They originate from Charges moving with uniform speed.

**44. If the mass of the bob in a simple pendulum is increased to thrice its original mass and its length is made half its original length, then the new time period of oscillation is $\frac{x}{2}$ times its original time period. Then the value of x is:**

(1) $\sqrt{2}$ (2) $2\sqrt{3}$

(3) 4 (4) $\sqrt{3}$

**Solution:**

**(1)** $\sqrt{2}$

Time period of simple pendulum

$$T = 2\pi\sqrt{\frac{\ell}{g}}$$

$$\frac{T_2}{T_1} = \sqrt{\frac{\ell_2}{\ell_1}} = \sqrt{\frac{\ell/2}{\ell}}$$

$$\frac{T_2}{T_1} = \frac{1}{\sqrt{2}}$$

$$\frac{\frac{x}{2}\cdot T_1}{T_1} = \frac{1}{\sqrt{2}}$$

$$\frac{x}{2} = \frac{1}{\sqrt{2}}$$

$\therefore$ x = $\sqrt{2}$

**45. A force defined by F = $\alpha t^2 + \beta t$ acts on a particle at a given time t. The factor which is dimensionless, if $\alpha$ and $\beta$ are constants, is:**

(1) $\alpha t/\beta$ (2) $\alpha\beta t$

(3) $\alpha\beta/t$ (4) $\beta t/\alpha$

**Solution:**

**(1)** $\frac{\alpha.t}{\beta}$

F = $\propto t^2 + \beta t$

[F] = [$\propto t^2$] = [$\beta t$]

Now,

[F] = [$\propto$] [$t^2$]

$$\frac{[M'L'T^{-2}]}{[T^2]} = [\propto]$$

[$\propto$] = [$M'\,L'\,T^{-4}$]

[F] = [B] [t]

$$\frac{[M'L'T^{-2}]}{[T']} = [\beta]$$

[$\beta$] = [$M'\,L'\,T^{-3}$]

Now,

$$\left[\frac{\propto.t}{\beta}\right] = \frac{[M'L'T^{-4}][T']}{[M'L'T^{-3}]}$$

= [$M^\circ\ L^\circ\ T^\circ$]

$$\frac{\propto.t}{\beta}$$

**46. A sheet is placed on a horizontal surface in front of a strong magnetic pole. A force is needed to :**

**A**. hold the sheet there if it is magnetic.

**B**. hold the sheet there if it is non-magnetic.

**C.** move the sheet away from the pole with uniform velocity if it is conducting.

**D.** move the sheet away from the pole with uniform velocity if it is both, non-conducting and non-polar.

**Choose the correct statement(s) from the options given below**

(1) A and C only

(2) A, C and D only

(3) C only

(4) B and D only

**Solution:**

**(1) (A) and (c) only.**

Force is needed to:

(A) Hold the sheet there if it is magnetic

(c) move the sheet Away from the pole with uniform velocity to if it is conducting.
Correct SOLUTION: (A) and (c) only.

**47. A metallic bar of Young's modulus, 0.5 × $10^{11}$ N $m^{-2}$ and coefficient of linear thermal expansion $10^{-5}$ $^oC^{-1}$, length 1 m and area of cross-section $10^{-3}$ $m^2$ is heated from 0°C to 100$^o$C without expansion or bending. The compressive force developed in it is:**

(1) $50 \times 10^3$ N (2) $100 \times 10^3$ N

(3) $2 \times 10^3$ N (4) $5 \times 10^3$ N

**Solution:**

Compressive Force

$F = Y.A. \propto \Delta\theta$

$= 0.5 \times 10^{11} \times 10^{-3} \times 10^{5} \times 100$

$= 0.5 \times 10^{5}$

$F = 50 \times 10^{3}$ N

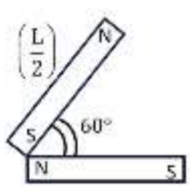
**48. An iron bar of length L has magnetic moment M. It is bent at the middle of its length such that the two arms make an angle 60° with each other. The magnetic moment of this new magnet is:**

(1) $\frac{M}{2}$  (2) 2M

(3) $\frac{M}{\sqrt{3}}$  (4) M

**Solution:**

**(1)** $\frac{M}{2}$

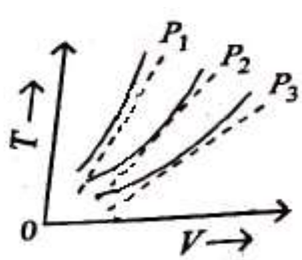



$M = m \times L$

$M' = m \times \frac{L}{2} = \frac{mL}{2} = \frac{M}{2}$

$\therefore \quad M' = \frac{M}{2}$

**49. The following graph represents the T-V curves of an ideal gas (where T is the temperature and V the volume), at three pressures $P_1$, $P_2$ and $P_3$ compared with those of Charles's law represented as dotted lines.**




**Then the correct relation is:**

(1) $P_1 > P_3 > P_2$  (2) $P_2 > P_1 > P_3$

(3) $P_1 > P_2 > P_3$  (4) $P_3 > P_2 > P_1$

**Solution:**

(3) $P_1 > P_2 > P_3$

Ideal gas Equation

$PV = nRT$

$\therefore \quad \left(\frac{P}{nR}\right)V = T$

Comparey = m ×

$m = \text{slope} = \left(\frac{P}{nR}\right)$

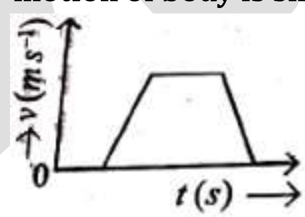
from graph

$\theta_1 > \theta_2 > \theta_3$

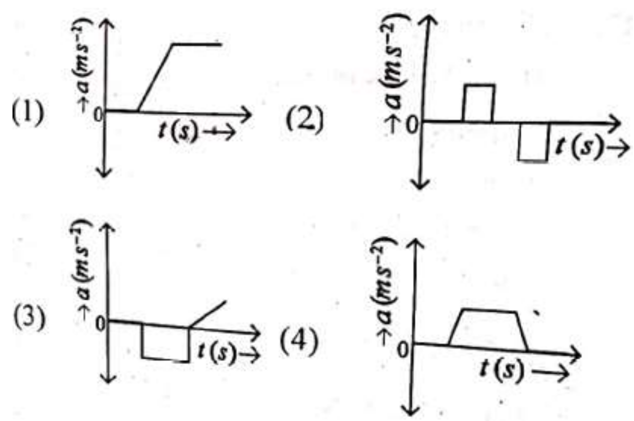
Slope 1 > Slope 1 > Slope 3

$\therefore \quad P_1 > P_2 > P_3$

**50. The velocity (v) – time (t) plot of the motion of body is shown below:**

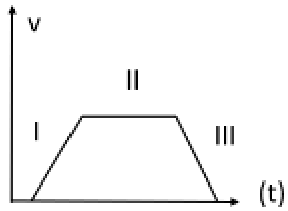



**The acceleration (a) – time (t) graph that best suits this motion is t**



**Solution:**

**(2)**




For Path I:

Velocity increasing with constant with constant Rate. (uniformly Accelerated motion)

$\therefore$ $acc^n$ = +ve const

For Path II:

Velocity is constant. (uniform motion)

Hence $acc^n = 0$

For Path III:

velocity is decreasing with constant Rate. (uniformly (Retarded motion)

$\therefore$ $acc^n$ = –ve const.