

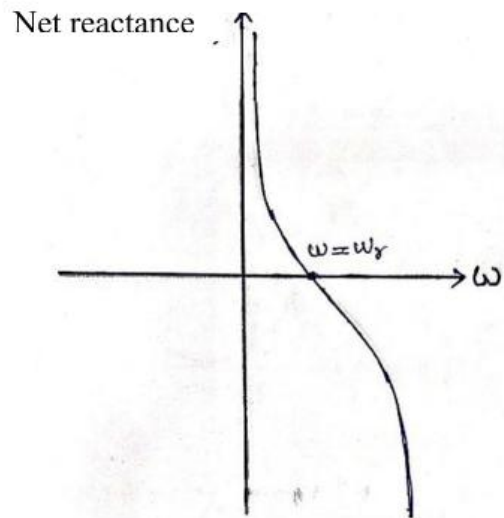
| MARKING SCHEME: PHYSICS (042)<br>Session: 2025–26 |                                                                                                                 |           |                    |
|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------|--------------------|
| Code: 55/5 /2                                     |                                                                                                                 |           |                    |
| SECTION A                                         |                                                                                                                 |           |                    |
| Q. No.                                            | VALUE POINTS/EXPECTED ANSWERS                                                                                   | Mark<br>s | Total<br>Mark<br>s |
| 1                                                 | (C) $\frac{h}{\pi}$                                                                                             | 1         | 1                  |
| 2                                                 | (A) $1.66 \times 10^{-32} \text{ kg ms}^{-1}$                                                                   | 1         | 1                  |
| 3                                                 | (A) 6.0 fm( <b>Note. Award full marks for Attempt</b> )                                                         | 1         | 1                  |
| 4                                                 | (C) $\frac{V_0}{\sqrt{2}}, 0$                                                                                   | 1         | 1                  |
| 5                                                 | (A) high resistance in reverse bias and low resistance in forward bias                                          | 1         | 1                  |
| 6                                                 | (C) $\frac{1}{4\pi\epsilon_0} \frac{Q}{d^2} (\hat{i} - \hat{j})$                                                | 1         | 1                  |
| 7                                                 | (C) describes parabolic path                                                                                    | 1         | 1                  |
| 8                                                 | (B) $\frac{2KB^2}{E^2}$                                                                                         | 1         | 1                  |
| 9                                                 | (D) $8 \times 10^{-3} \text{ Wb}$                                                                               | 1         | 1                  |
| 10                                                | (D) ac is less dangerous                                                                                        | 1         | 1                  |
| 11                                                | (A) $7.5 \times 10^2 \text{ m}^{-1}$                                                                            | 1         | 1                  |
| 12                                                | (D) $\frac{1}{n^2}$                                                                                             | 1         | 1                  |
| 13                                                | (C) Assertion(A) is true, but reason(R) is false.                                                               | 1         | 1                  |
| 14                                                | (B) Both Assertion(A) and reason (R) is true but reason (R) is not the correct explanation of the assertion(A). | 1         | 1                  |
| 15                                                | (D) Both Assertion(A) and reason (R) are false.                                                                 | 1         | 1                  |
| 16                                                | (A) Both Assertion(A) and reason (R) are true, reason (R) is the correct explanation of the assertion(A).       | 1         | 1                  |

|    | SECTION B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                             |   |  |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|---|--|
| 17 | <div> <div>Calculating:</div> <div> Majority carrier concentration <span>1/2</span><br/> Minority carrier concentration <span>1 1/2</span> </div> </div> <div> Majority carrier concentration = Doping concentration<br/> ∴ Majority carrier concentration (n<sub>e</sub>)=5 x10<sup>22</sup> atoms per m<sup>3</sup><br/> <math display="block">n_i^2 = n_e n_h</math> <math display="block">n_h = \frac{n_i^2}{n_e}</math> <math display="block">n_h = \frac{(1.5 \times 10^{16})^2}{5 \times 10^{22}}</math> <math display="block">= 4.5 \times 10^9 \text{ atoms per m}^3</math> Minority carrier concentration = 4.5 x 10<sup>9</sup> atoms per m<sup>3</sup> </div> | <div>1/2</div> <div>1/2</div> <div>1/2</div> <div>1/2</div> | 2 |  |
| 18 | <div> <div>Proving that the resultant intensities at:</div> <div> Maxima is 4I <span>1</span><br/> Minima is zero <span>1</span> </div> </div> <div> <math display="block">I_1 = I_2 = I</math> <math display="block">I_{\max} = (\sqrt{I_1} + \sqrt{I_2})^2</math> <math display="block">I_{\max} = (2\sqrt{I})^2 = 4I</math> <math display="block">I_{\min} = (\sqrt{I_1} - \sqrt{I_2})^2</math> <math display="block">I_{\min} = 0</math> </div> <div>Note: Award full marks for any other correct alternative method.</div>                                                                                                                                           | <div>1/2</div> <div>1/2</div> <div>1/2</div> <div>1/2</div> | 2 |  |

|    |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |      |
|----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|
| 19 | (a) | <div> <div>Calculating</div> <div> <div>(i) Resistance <span>½</span></div> <div>(ii) heat produced in 10 min. <span>1 ½</span></div> </div> </div> <div> <div>(i) <math>R = \frac{V^2}{P}</math><br/> <math>= \frac{(220)^2}{2.2 \times 10^3} = 22\Omega</math> <span>½</span></div> <div>(ii) <math>H = I^2 R t</math><br/> <math>I = \frac{V_{\text{applied}}}{R} = \frac{110}{22} = 5A</math> <span>½</span><br/> <math>= 5 \times 5 \times 22 \times 600</math> <span>½</span><br/> <math>= 3.3 \times 10^5 J</math> <span>½</span></div> <div>OR</div> </div> |  | HOME |
|    | (b) | <div>Calculating the resistivity of the wire. <span>2</span></div> <div> <math>\rho = \frac{RA}{l}</math><br/> <math>R = \frac{V}{I} = \frac{2}{4} = \frac{1}{2}\Omega</math> <span>½</span><br/> <math>\rho = \frac{1 \times 10^{-6}}{2 \times 1}</math> <span>½</span><br/> <math>= 5 \times 10^{-7} \Omega m</math> <span>½</span> </div>                                                                                                                                                                                                                        |  | HOME |
|    |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  | 2    |

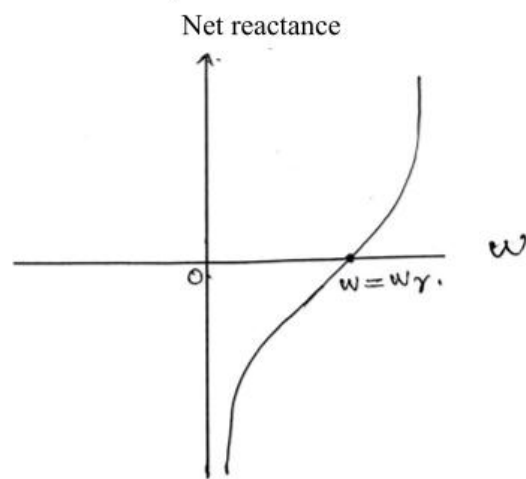
|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                             |   |      |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|---|------|
| 20        | <div> <div>Finding the emf induced in the loop</div> <div>2</div> </div> $e = BA\omega \sin \omega t$ $e = 0.2 \times 100 \times 10^{-4} \times 2\pi \times \sin 2\pi t$ $e = 4\pi \times 10^{-3} \sin 2\pi t \text{ V}$ $= 12.56 \times 10^{-3} \sin 2\pi t \text{ V}$ <p><b>Note: Award full marks if <math>\sin 2\pi t</math> is not mentioned in the final answer.</b></p>                                                                                                                                                                                                                                                                                                              | <div>1/2</div> <div>1</div> <div>1/2</div>                  | 2 | HOME |
| 21        | <div> <div>Finding the<br/>Position<br/>Nature of image formed</div> <div>1 1/2<br/>1/2</div> </div> $\frac{n_2 - n_1}{R} = \frac{n_2}{v} - \frac{n_1}{u}$ $\frac{1.5 - 1.0}{24} = \frac{1.5}{v} - \frac{1.0}{-6}$ <p>After solving</p> $v = \frac{-72}{7} \approx -10.28 \text{ cm}$ <p>Nature: Virtual</p>                                                                                                                                                                                                                                                                                                                                                                                | <div>1/2</div> <div>1/2</div> <div>1/2</div> <div>1/2</div> | 2 | HOME |
| SECTION C |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                             |   |      |
| 22        | <div> <div> (a) Differentiating inductive reactance, capacitive reactance and impedance.<br/> (b) Plotting graph between net reactance with frequency. </div> <div>1 1/2<br/>1 1/2</div> </div> <p>(a) Inductive reactance-It is the opposition to flow of ac current by an inductor.<br/>Alternatively,<br/><math>X_L = \omega L</math><br/>Capacitive reactance- It is the opposition to flow of ac current by a capacitor.<br/>Alternatively,<br/><math>X_C = \frac{1}{\omega C}</math><br/>Impedance- Effective opposition offered by combination of inductor, capacitor and resistor to the flow of ac current.<br/>Alternatively,<br/><math>Z = \sqrt{R^2 + (X_L - X_C)^2}</math></p> | <div>1/2</div> <div>1/2</div> <div>1/2</div>                |   |      |

(b)



1 ½

Alternatively,



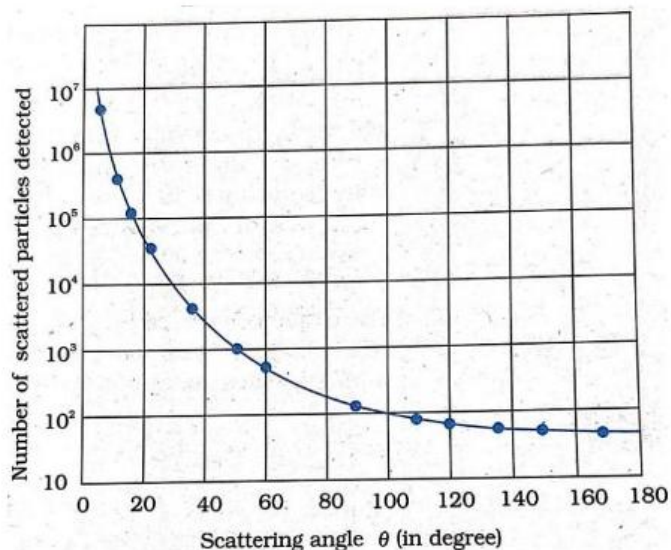
|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                       |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| 23 | <p>(a) Calculating the capacitance of X &amp; Y. <span style="float: right;">1½</span><br/>         (b) Calculating the potential difference across plates of X &amp; Y <span style="float: right;">1½</span></p> <hr/> <p>(a) <math>C_X = C</math>, <math>C_Y = KC = 4C</math></p> $\frac{1}{C_{eq}} = \frac{1}{C_X} + \frac{1}{C_Y}$ $C_{eq} = \frac{C_X C_Y}{C_X + C_Y}$ $4 = \frac{C \cdot 4C}{C + 4C}$ $C = 5\mu F$ $C_X = 5\mu F$ $C_Y = 20\mu F$ <p>(b) Total charge <math>Q = C_{eq} V</math><br/> <math>= 4 \times 10^{-6} \times 6</math><br/> <math>= 24 \times 10^{-6} C</math></p> $V_X = \frac{Q}{C_X} = \frac{24 \times 10^{-6}}{5 \times 10^{-6}}$ $= 4.8V$ $V_Y = \frac{Q}{C_Y} = \frac{24 \times 10^{-6}}{20 \times 10^{-6}}$ $= 1.2V$ <p>Alternatively,</p> $V_Y = V - V_X$ $= 6 - 4.8V$ $= 1.2V$                                                                                                | <p>½</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p> <p>3</p> |
| 24 | <p>(a)</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>(i) Writing two features of nuclear force. <span style="float: right;">2</span><br/>         (ii) Explaining how mass converted into energy. (or vice versa) in a nuclear reaction <span style="float: right;">1</span></p> </div> <p>(i) Features of Nuclear force:</p> <ol style="list-style-type: none"> <li>1. charge independent</li> <li>2. strongest force.</li> <li>3. short-range force /saturated force</li> <li>4. does not follow inverse square law.</li> </ol> <p><b>Note: Award full marks for any two valid points.</b></p> <p>(ii) The total mass of the nuclei on the left-hand side need not be same as that on right hand side of nuclear reaction Since Binding energy contributes to mass, the difference in these binding energies appear as energy released or absorbed. in a nuclear reaction.</p> | <p>1+1</p> <p>1</p>                                   |

OR

(b)

- |                                                                                  |   |
|----------------------------------------------------------------------------------|---|
| (i) Drawing the graph between scattered particles & scattering angle.            | 1 |
| Writing two important conclusions.                                               | 1 |
| (ii) Explaining invalidity for Bohr Quantisation postulate for planetary motion. | 1 |

(i)



Important conclusions:

1. Most of the space in the atom is empty.
2. Most part of mass of atom and its positive charge were tightly concentrated at its centre.

**Note: No marks to be deducted for scale on the axis**

(ii)

According to Bohr Quantisation postulate

$$L = mvr$$

$$= nh/2\pi$$

Since mass of planets is very large as compared to mass of atomic particles, angular momentum (L) will be very large.

Therefore, Principal quantum no.(n) will be very large.

For large quantum no. the difference in successive energy levels will be negligible. Hence quantization fails.

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                            |   |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|---|
| 25 | <div> <div>Calculating</div> <div> a) Energy of a photon in the incident light. 1<br/> b) Maximum kinetic energy emitted. 1<br/> c) Stopping potential. 1 </div> </div> <p>(a) <math>E = h\nu</math><br/> <math display="block">= \frac{6.626 \times 10^{-34} \times 6.4 \times 10^{14}}{1.6 \times 10^{-19}}</math> <math display="block">= 2.64 \text{ eV or } 42.24 \times 10^{-20} \text{ J}</math> <p>(b) <math>K_{\max} = E - \phi_0</math><br/> <math display="block">= 2.64 - 1.96 = 0.68 \text{ eV or } (10.88 \times 10^{-20} \text{ J})</math> <p>(c) <math>eV_0 = K_{\max}</math><br/> <math display="block">V_0 = K_{\max}/e</math> <math display="block">= 0.68 \text{ V}</math></p> </p></p>                                                                                                                                                                                                                                                                                                                     | <div>1/2</div> <div>1/2</div> <div>1/2</div> <div>1/2</div> <div>1/2</div> | 3 |
| 26 | <div> <div>Writing the expression for magnetic field in vector form. 1</div> <div>Calculating magnetic field <math>\vec{B}</math> at a given point. 2</div> </div> <p><b>Magnetic field due to a current element (dl) at a distance r,</b></p> $d\vec{B} = \frac{\mu_0}{4\pi} \frac{I(\vec{dl} \times \vec{r})}{r^3}$ $dB = \frac{\mu_0 i dl \sin\theta}{4\pi r^2}$ $r = \sqrt{2} \text{ m}$ $dB = 10^{-7} \times \frac{10 \times 10^{-2} \sin 45^\circ}{2}$ $dB = 3.53 \times 10^{-9} \text{ T}$ <p><b>Direction :</b> along +ve Z-axis</p> <p><b>Alternatively</b></p> $\vec{r} = (\hat{i} + \hat{j}) \text{ m}, r = \sqrt{2} \text{ m}$ $I\vec{dl} = 10 \times 10^{-2} \hat{i} \text{ Am}$ $\vec{dB} = \frac{\mu_0 I(\vec{dl} \times \vec{r})}{4\pi r^3}$ $= \frac{4\pi \times 10^{-7}}{4\pi} \times \frac{10[(10^{-2})\hat{i} \times (\hat{i} + \hat{j})]}{(\sqrt{2})^3}$ $= \frac{10^{-7}}{2\sqrt{2}} (0.1)(0 + \hat{k})$ $= \frac{5}{\sqrt{2}} \times 10^{-9} \hat{k}$ $\vec{dB} = 3.53 \times 10^{-9} \hat{k} \text{ T}$ | <div>1</div> <div>1/2</div> <div>1/2</div> <div>1/2</div> <div>1/2</div>   | 3 |

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27

Differentiating between conduction and displacement current. 1  
 Explaining total current as the sum of conduction and displacement current. 2

| Conduction Current                                                            | Displacement current                                                                                                  |
|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Current in conductor due to the flow of charges carrier $I_c = \frac{dQ}{dt}$ | Current due to time varying electric field and hence electric flux in a region. $I_D = \epsilon_0 \frac{d\phi_e}{dt}$ |

**Note: Award full marks if the student writes formula only.**

Maxwell corrected Ampere circuital law, that the source of magnetic field is not just conduction current due to flow of charges but also time rate of change of Electric field.

Therefore,

$$I = I_c + I_D$$

$$I = \frac{dQ}{dt} + \epsilon_0 \frac{d\phi_e}{dt}$$

Outside the capacitor plates, only conduction current flows,

$$I_D = 0, I = I_c$$

While inside the capacitor,

$$I_D = I, I_c = 0$$

$\frac{1}{2} + \frac{1}{2}$

1

$\frac{1}{2}$

$\frac{1}{2}$

3HOME

28

Defining the de-Broglie wave. 1  
 Showing the wavelength of electromagnetic radiation equal to de-Broglie wavelength of a photon. 2

Waves associated with moving matter is called de Broglie wave

Alternatively,

$$\lambda = \frac{h}{p} = \frac{h}{mv}$$

For a photon, de-Broglie wavelength will be:

$$\lambda_p = \frac{h}{p} \dots\dots\dots(i)$$

$$\text{For a photon, } p = \frac{hv}{c}$$

$$\frac{h}{p} = \frac{c}{v} = \lambda_{rad} \dots\dots\dots(ii)$$

$$\therefore \lambda_{rad} = \lambda_p$$

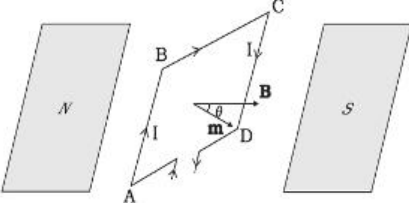
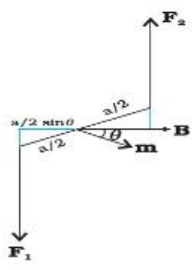
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$\frac{1}{2}$

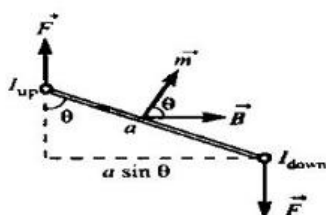
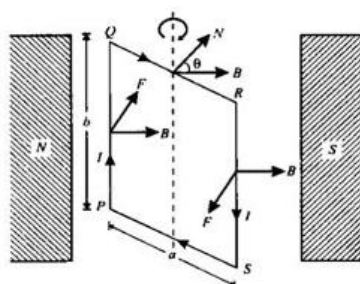
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1

3

| SECTION D |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                        | HOME |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------|
| 29        | (i) (A) wave nature of light.<br>(ii) (a). (C) 480nm<br><b>OR</b><br>(b) (A) 1.2mm<br>(iii) (B) $7.2 \times 10^{-7}$ m<br>(iv) (D) be compressed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1<br>1<br>1<br>1                       | 4    |
| 30        | (i) (D) $(-2 \times 10^4 \text{ V/m}) \ k$<br>(ii) (B) $(3.5 \times 10^{15} \text{ m/s}^2) \ k$<br>(iii) (a) (C) $1.67 \times 10^{-9}$ s<br><b>OR</b><br>(b). (B) 4.9mm<br>(iv) (B) b                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1<br>1<br>1<br>1                       | 4    |
| SECTION E |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                        |      |
| 31        | (a) <div style="border: 1px solid black; padding: 5px; margin: 10px 0;">             (i). Showing the torque acting on the loop. <math>\vec{\tau} = \vec{m} \times \vec{B}</math> 3<br/>             (ii)(I) Calculating magnetic dipole moment of the coil. 1<br/>             (II) Calculating the magnitude of counter torque. 1           </div> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>(a)</p> </div> <div style="text-align: center;">  <p>(b)</p> </div> </div> <p>According to Right Hand Screw Rule,<br/>           Force on BC &amp; DA are equal and opposite in direction with same line of action ,hence they cancel out each other.</p> <p>Force on arm AB &amp; CD, are also equal and opposite in direction but there is a difference in line of action so, a torque will act on it.<br/> <math>F_1 = F_2 = I b B</math></p> <p> <math>\tau = \text{Force} \times \text{perpendicular distance}</math><br/> <math>\tau = F_1 (a/2) \sin\theta + F_2 (a/2) \sin\theta</math><br/> <math>= (I b B) a \sin\theta</math><br/> <math>\tau = I A B \sin\theta</math><br/> <math>\vec{m} = I \vec{A}</math><br/> <math>\tau = m B \sin\theta</math><br/> <math>\vec{\tau} = \vec{m} \times \vec{B}</math> </p> | 1/2<br>1/2<br>1/2<br>1/2<br>1/2<br>1/2 | HOME |

Alternatively,



According to Fleming's left hand rule, the magnitude of force on sides PS and QR are equal and opposite to each other, so they cancel each other.

The side PQ experiences a normal inward force equal to  $IbB$  while the side RS experiences an equal normal outward force. These two forces form a couple which exerts a torque given by:

$$\begin{aligned}\tau &= \text{Force} \times \text{perpendicular distance} \\ &= IbB \times a \sin\theta \\ &= IA B \sin\theta\end{aligned}$$

But  $IA = m$ , the magnetic moment of the loop

$$\tau = mB \sin\theta$$

$$\vec{\tau} = \vec{m} \times \vec{B}$$

(ii) (I)

$$m = NIA$$

$$= 100 \times 5 \times \pi \left( \frac{10 \times 10^{-2}}{\sqrt{\pi}} \right)^2 = 5 \text{ Am}^2$$

(II)

$$\begin{aligned}\tau &= mB \sin\theta \\ &= 5 \times 2 \times \sin 30^\circ \\ &= 5 \text{ Nm}\end{aligned}$$

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$\frac{1}{2}$

$\frac{1}{2}$

$\frac{1}{2}$

$\frac{1}{2}$

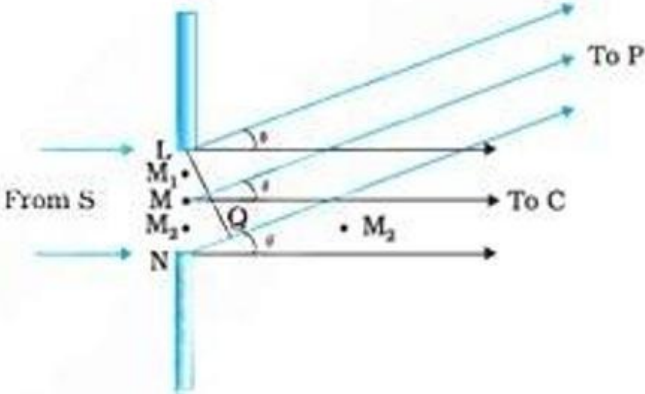
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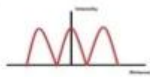
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1

5

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                           |                         |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-------------------------|
| 32 | <p>(a)</p> <p>(i)</p> <p>(I). Explaining the formation of maxima and minima in the diffraction pattern. 2</p> <p>(II) Explaining the reason for weakening of maxima with increasing number(n) 1</p> <p>(ii) Writing two points of difference between interference and diffraction pattern 2</p><br><p>(i)</p> <p>(I)</p>  <p><b>Path difference</b> between the waves originating from points L and N superimposed at P on the screen is</p> $NQ = a \sin \theta$ <p>Secondary minima</p> $a \sin \theta = n\lambda \quad n = \pm 1, \pm 2, \dots$ <p>Secondary maxima</p> $a \sin \theta = (2n + 1) \lambda / 2 \quad n = \pm 1, \pm 2, \dots$ <p><b>Alternatively,</b></p> <p>The light coming from the slit superimposes at the center of screen forms central maxima with maximum intensity. For secondary maxima on screen light coming from a part (one-third, one-fifth, one-seventh...) of whole slit contribute for giving intensity on screen.</p> <p>For Secondary minimas, contribution from two halves of whole slit cancel each other, so the intensity falls to zero.</p> <p>II.</p> <p>As n increases, maxima goes on becoming weaker, since the light coming from a fraction of the slit (one-third, one-fifth, one-seventh, ..) contributes to the intensity at a point.</p> | <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1</p> | <p>HOME</p> <p>HOME</p> |
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(ii)

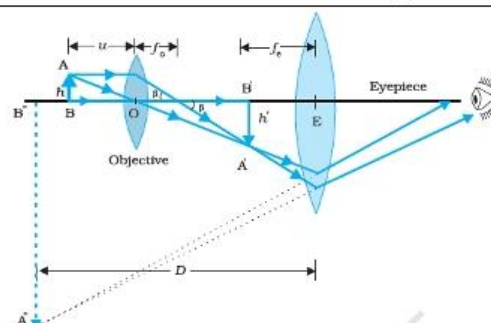
| Interference                                                                      | Diffraction                                                                       |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Bright and dark bands are of equal width                                          | The width maxima is twice the width secondary maxima or minima                    |
| Intensity of all bright fringes is same                                           | Intensity of bright fringe decreases with distance from central maxima.           |
| There is a good contrast between bright and dark fringes                          | There is a poor contrast between bright and dark fringes.                         |
| Intensity distribution curve:                                                     | Intensity distribution curve:                                                     |
|  |  |

**Note: Award full marks for any two correct differences.****OR**

(b)

|                                                                       |     |
|-----------------------------------------------------------------------|-----|
| (i) Construction/labelling using ray diagram.                         | 1+1 |
| Working of a compound microscope with help of ray diagram             | 1   |
| (ii)                                                                  |     |
| (I). Explaining the formation of real image if the screen is removed. | 1   |
| (II) Explaining the circumstances for formation of real image.        | 1   |

(i)



**Construction:** It consists of two convex lenses, objective lens with small aperture placed near the object and the eye piece with large aperture placed near the eye. Both lenses have small focal length. These lenses are placed coaxially in a narrow tube with rack and pinion arrangement

**Working:** The lens near to the object called objective forms a real, inverted & magnified image of the object. This serves as the object for eye piece which produces the final image, enlarged & virtual.

(ii)

**I Yes**

Real image is formed by actual intersection of rays.

**II Yes**

If the object is virtual.

**Note: 1. If students do not write construction award full marks for well-labelled diagram representing objective lens, eye piece, along with image position at near point or normal adjustment.**

**2. Deduct ½ mark if arrows are not drawn.**

(½)x4

1

1

1

½

½

½

½

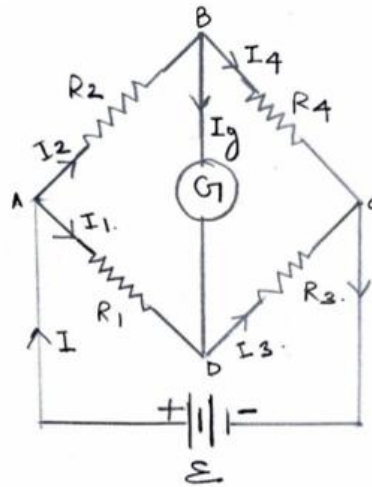
5

33

(a).

- |                                                             |     |
|-------------------------------------------------------------|-----|
| (i) Deriving the condition for balanced wheat stone bridge. | 2 ½ |
| (ii) Determining the current in 3Ω branch.                  | 2 ½ |

(i)



½

Applying Kirchhoff's rule to closed loop ADBA.

For balanced condition  $I_g = 0$ .

$$-I_1 R_1 + 0 + I_2 R_2 = 0 \dots\dots\dots (i)$$

½

Applying Kirchhoff's rule to closed loop CBDC

using  $I_3 = I_1$ ,  $I_4 = I_2$ 

$$I_2 R_4 + 0 - I_1 R_3 = 0 \dots\dots\dots (ii)$$

½

From eq.(i).

$$\frac{I_1}{I_2} = \frac{R_2}{R_1}$$

and from eq.(ii)

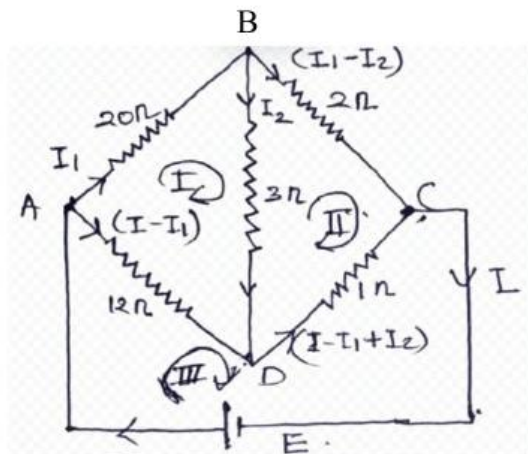
$$\frac{I_1}{I_2} = \frac{R_4}{R_3}$$

hence  $\frac{R_2}{R_1} = \frac{R_4}{R_3}$

½

½

(ii)



Applying Kirchhoff's rule to loop I (ABDA)

$$-20 I_1 - 3 I_2 + 12 (I - I_1) = 0 \dots\dots\dots(i)$$

Applying Kirchhoff's rule to loop II (BCDB)

$$-2 (I_1 - I_2) + 1 (I - I_1 + I_2) + 3 I_2 = 0 \dots\dots\dots(ii)$$

Applying Kirchhoff's rule loop III (EADCE)

$$-12 (I - I_1) - 1 (I - I_1 + I_2) = -6 \dots\dots\dots(iii)$$

After solving eq. (i), (ii) and (iii)

$$I_2 = 12/821 \text{ A}$$

**Note: Award full marks if student takes another appropriate current distribution in the circuit.**

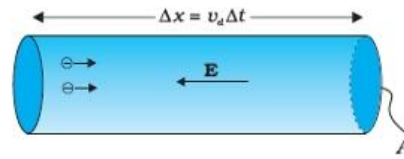
 $\frac{1}{2}$  $\frac{1}{2}$  $\frac{1}{2}$  $\frac{1}{2}$  $\frac{1}{2}$

OR

(b)

- |                                                                    |   |
|--------------------------------------------------------------------|---|
| (i). Showing the conductivity of material. $\sigma = ne^2\tau / m$ | 3 |
| (ii). Determining the temperature coefficient of resistivity.      | 2 |

(i)



The amount of charge crossing the area in time  $\Delta t$  is

$$Q = Ne$$

$$Q = (nAl)e$$

$$I = \frac{Q}{\Delta t}$$

$$I = \frac{nAle}{\Delta t}$$

$$I = nAe |\vec{v}_d| \dots\dots\dots(i)$$

1

Substituting the value of  $|\vec{v}_d|$  in eq.(i)

$$\frac{I}{A} = ne \left( \frac{e |\vec{E}| \tau}{m} \right)$$

 $\frac{1}{2}$ 

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$$|\vec{J}| = \frac{ne^2 \tau |\vec{E}|}{m} \dots\dots\dots(ii)$$

 $\frac{1}{2}$ 

where  $\vec{J}$  is current density and parallel to  $\vec{E}$ , and

$$\vec{J} = \sigma \vec{E} \dots\dots\dots(iii)$$

 $\frac{1}{2}$ 

From eq.(ii) and (iii)

$$\sigma = ne^2\tau/m$$

 $\frac{1}{2}$ 

$$(ii) \alpha = \frac{(R_2 - R_1)}{[R_1 (T_2 - T_1)]}$$

 $\frac{1}{2}$ 

$$\alpha = \frac{(1.38 - 1.05)}{[1.05 \times (100 - 20)]}$$

 $\frac{1}{2}$ 

$$\alpha = \frac{0.33}{(1.05 \times 80)} \\ = 0.0039 \text{ } ^\circ\text{C}^{-1}$$

 $\frac{1}{2}$  $\frac{1}{2}$ 

5

Alternatively

$$R_1 = R_0(1 + \alpha \Delta T_1) \dots\dots\dots (i)$$

$$R_2 = R_0(1 + \alpha \Delta T_2) \dots\dots\dots (ii)$$

$$R_1/R_2 = \frac{(1 + \alpha \Delta T_1)}{(1 + \alpha \Delta T_2)}$$

$$\frac{1.05}{1.38} = \frac{1 + 20\alpha}{1 + 100\alpha}$$

On solving

$$\alpha = \frac{11}{2580} ^\circ\text{C}^{-1} = 0.0042 ^\circ\text{C}^{-1}$$

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