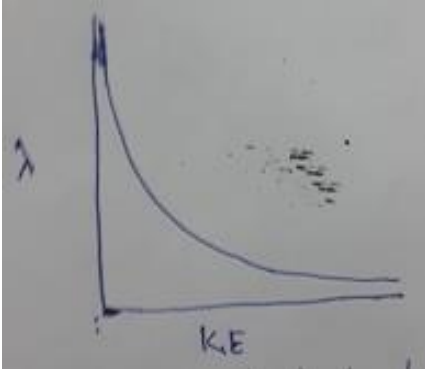
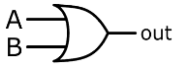
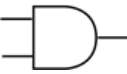
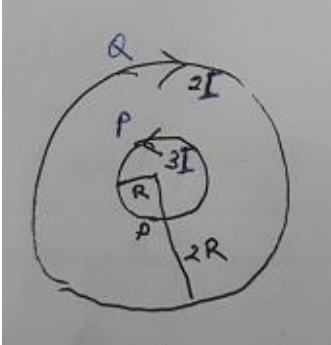


Q. No.	Value Points/Expected answers	Marks	Total Marks
1	$\lambda \propto \frac{1}{\sqrt{KE}}$  <p>(Even if the student draws only the graph, award full 1 mark)</p>	$\frac{1}{2}$ $\frac{1}{2}$	1
2	OR gate  OR AND gate 	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	1 1
3	Any one property of paramagnetic materials. (e.g. (i) It gets (weakly) attracted by a magnet/magnetic field (ii) It moves from weaker towards stronger field. or any other property.) OR No.	1 1	1 1
4	Take any arbitrary closed surface S inside the conductor. Since electric field inside the conductor is zero, electric flux through S is also zero. Hence by Gauss's law there is no net charge enclosed by S (Also accept : Electric field inside the conductor is zero)	1	1
5	Its barrier potential gets reduced.	1	1

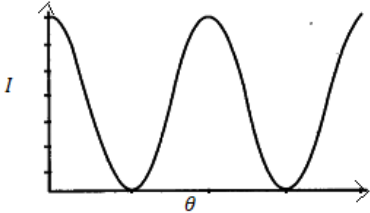
6	<div data-bbox="289 170 792 289" style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> Block Diagram 1 Function of Transmitter ½ Function of Receiver ½ </div> <div data-bbox="191 317 1040 596" style="text-align: center;"> <p style="text-align: center;">(Also accept if the student just writes communication system in the central box)</p> </div> <p data-bbox="191 632 1347 705">Transmitter: A transmitter processes the incoming message signal so as to make it suitable for transmission through a channel and subsequent reception.</p> <p data-bbox="191 705 1317 779">Receiver: A receiver extracts the desired message signals from the received signals at the channel output.</p>	1	2
7	<div data-bbox="277 835 764 961" style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> a) Condition for no deflection - 1 b) Conclusion for greater radius - 1 </div> <p data-bbox="240 1016 1260 1052">(a) No deflection if electron moves parallel or anti parallel to the magnetic field.</p> <p data-bbox="240 1066 383 1142">(b) $r = \frac{mv}{qB}$</p> $\frac{r_1}{r_2} = \frac{B_2}{B_1}$ <p data-bbox="272 1220 532 1255">As $B_1 < B_2$ $r_2 < r_1$</p> <p data-bbox="272 1304 456 1339">[Alternatively</p> $r \propto \frac{1}{B}$ <p data-bbox="261 1430 699 1465">r_2 is smaller because B_2 is greater]</p>	1 ½ ½	2

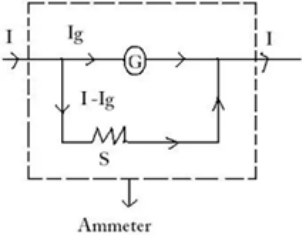
8	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Magnetic field due to P and Q $\frac{1}{2} + \frac{1}{2}$</p> <p>Net magnetic field $\frac{1}{2}$</p> <p>Direction of net field $\frac{1}{2}$</p> </div>  <p> $B_P = \frac{3\mu_0 I}{2R}$ (out of the paper) </p> <p> $B_Q = \frac{\mu_0 2I}{2(2R)}$ (into the paper) </p> <p> Net $B = \frac{3\mu_0 I}{2R} - \frac{\mu_0 I}{2R} = \frac{2\mu_0 I}{2R} = \frac{\mu_0 I}{R}$ (out of the paper) </p> <p>Note : If the student takes the directions of currents opposite to the above direction then the direction of resultant field will be into the paper)</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2} + \frac{1}{2}$</p>	<p>2</p>
9	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Resistance of stretched wire 1</p> <p>Resistance of each piece $\frac{1}{2}$</p> <p>Resistance of parallel combination $\frac{1}{2}$</p> </div> <p> $R = \rho \frac{l}{A}$ </p> <p>When l is doubled, and A is halved</p> <p> $R' = \rho \frac{2l}{\frac{A}{2}} = 4R$ </p> <p>Resistance of each part, $r = \frac{4}{3}R$</p> <p>Resistance of parallel combination, $r_p = \frac{4R}{3 \times 3} = \frac{4}{9}R$</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>	<p>2</p>

10	<div data-bbox="594 184 967 344" style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> Diagram - $\frac{1}{2}$ Expression for torque - 1 Direction of torque - $\frac{1}{2}$ </div> <div data-bbox="256 344 542 533" style="text-align: center;"> </div> <p data-bbox="305 571 691 604">Force on either charge $F = qE$</p> <p data-bbox="305 621 1123 655">Magnitude of torque = Either of force \times \perp distance between them.</p> <p data-bbox="305 667 487 701">$\tau = qE \cdot 2a \sin \theta$</p> <p data-bbox="305 714 451 747">$\tau = pE \sin \theta$</p> <p data-bbox="305 772 418 806">$\rightarrow \rightarrow \rightarrow$</p> <p data-bbox="305 806 418 840">$\tau = p \times E$</p> <p data-bbox="305 886 886 919">Direction is normal to the paper coming out of it.</p>	$\frac{1}{2}$	1 $\frac{1}{2}$ 2
OR			
	<div data-bbox="496 999 1065 1100" style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> Expression for field at an axial point - $1 \frac{1}{2}$ Field at large distance - $\frac{1}{2}$ </div> <div data-bbox="646 1125 1107 1285" style="text-align: center;"> </div> $E_- = \frac{q}{4\pi\epsilon_0 (r+a)^2} \text{ along } (-) \vec{p}$ $E_+ = \frac{q}{4\pi\epsilon_0 (r-a)^2} \text{ along } \vec{p}$ <p data-bbox="191 1444 574 1478">\therefore Total field at P, $E = E_- - E_+$</p> $= \frac{q}{4\pi\epsilon_0} \left[\frac{1}{(r-a)^2} - \frac{1}{(r+a)^2} \right]$ $= \frac{q}{4\pi\epsilon_0} \frac{2pr}{(r^2 - a^2)^2}$ <p data-bbox="191 1717 250 1751">For</p> <p data-bbox="191 1764 250 1797">$r \gg a$</p> $E = \frac{1}{4\pi\epsilon_0} \frac{2p}{r^3}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2

11	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Potential difference across the capacitor $\frac{1}{2} + \frac{1}{2}$</p> <p>Charge on capacitor C_1 1</p> </div> <p>$C_{23} = (6+3)\mu F = 9 \mu F$</p> <p>$C_1 = \frac{q}{V_1} \Rightarrow V_1 = \frac{q}{2\mu F}$</p> <p>$C_{23} = \frac{q}{V_2} \Rightarrow V_2 = \frac{q}{9\mu F}$</p> <p>$V = V_1 + V_2$</p> <p>$\Rightarrow 10 = q\left(\frac{1}{2\mu F} + \frac{1}{9\mu F}\right)$</p> <p>$\Rightarrow q = \frac{10 \times 18}{11} \mu C = 16.4 \mu C$</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>2</p>	
12	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Expression for frequency of side bands - $\frac{1}{2}$</p> <p>Carrier frequency - $\frac{1}{2}$</p> <p>Modulating frequency - $\frac{1}{2}$</p> <p>Band width - $\frac{1}{2}$</p> </div> <p>$f_u = f_c + f_m = 660 \text{ kHz}$</p> <p>$f_l = f_c - f_m = 640 \text{ kHz}$</p> <p>$\therefore 2f_c = 1300 \text{ kHz}$</p> <p>$\therefore f_c = 650 \text{ kHz}$</p> <p>and $2f_m = 20 \text{ kHz}$</p> <p>$f_m = 10 \text{ kHz}$</p> <p>Band width = $f_u - f_l$</p> <p style="padding-left: 40px;">$= 20 \text{ kHz}$</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>2</p>	
OR			

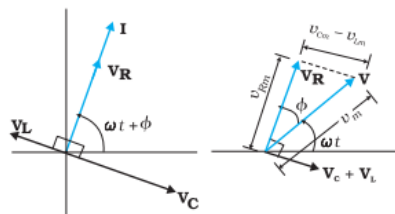
	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> Frequency of two side bands - $\frac{1}{2} + \frac{1}{2}$ Amplitude of side bands – 1 </div> $f_u = f_c + f_m = (10000 + 10) \text{ kHz}$ $= 10010 \text{ kHz}$ $f_l = f_c - f_m = (10000 - 10) \text{ kHz}$ $= 9990 \text{ kHz}$ <p>Amplitude of side bands = $\mu \frac{A_c}{2}$</p> $= 0.3 \times \frac{40}{2} = 6 \text{ V}$	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>	<p>2</p>
<p>13</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> Value of v+ u _____ $\frac{1}{2}$ Value of v - u _____ $\frac{1}{2}$ Calculation of v and u _____ 1 Calculation of f _____ 1 </div> <p>v+u = 90 v-u = 20 v = 55 cm u = 35 cm</p> $f = \frac{55 \times 35}{55 + 35} = 21.4 \text{ cm}$ <p>[or any other correct method used]</p> <p style="text-align: center;">OR</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> Diagram _____ $\frac{1}{2}$ Image distance for convex lens 1 Image distance for concave lens 1 Explanation of the result change _____ $\frac{1}{2}$ </div> <div style="text-align: center;"> </div>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p>	<p>3</p>

	<p>For Image formed by convex lens:</p> $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ $\frac{1}{20} = \frac{1}{v} + \frac{1}{30}$ $v = \frac{20 \times 30}{30 - 20} = 60 \text{cm}$ <p>u for concave lens = + 30cm</p> $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ $\frac{1}{-15} = \frac{1}{v} - \frac{1}{30}$ $v = \frac{15 \times 30}{15 - 30} = -30 \text{cm}$ <p>No, the result will not change from principle of reversibility</p>	1 1 ½	3						
14	<table border="1" data-bbox="245 1150 1057 1276"> <tbody> <tr> <td>(a) Reason to use polaroid</td> <td>1</td> </tr> <tr> <td>(b) Explanation</td> <td>1</td> </tr> <tr> <td>(c) Graph</td> <td>1</td> </tr> </tbody> </table> <p>(a) Polaroid sunglasses are preferred over colored sun glasses, because they can reduce intensity of light</p> <p>(b) Light in which vibrations of electric field vector are restricted to one plane containing direction of propagation.</p> <p>(c)</p>  <p>(Award ½ mark for part (c) if the student just writes malus law but does not draw the graph)</p>	(a) Reason to use polaroid	1	(b) Explanation	1	(c) Graph	1	1 1 1	3
(a) Reason to use polaroid	1								
(b) Explanation	1								
(c) Graph	1								

15	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> Principle - 1 Working & expression for deflection – 1 Current Sensitivity – 1 </div> <p>Principle - A current carrying coil can experience a torque in a magnetic field. 1</p> <p>Working - When current is passed through the coil torque produced is $\tau = NIAB \sin \theta = NIAB$ ($\theta=90^\circ$) $\frac{1}{2}$</p> <p>Restoring torque $\tau' = k\phi$ At equilibrium $\tau = \tau'$ $NIAB = k\phi$ $\frac{1}{2}$ $\Phi = \left(\frac{NAB}{K}\right)I$ Current sensitivity = $\frac{\phi}{I} = \frac{NAB}{k}$ [Alternatively: It is deflection per unit current] 1</p>		3
OR			
	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> Conversion of galvanometer into ammeter - 1 Expression for shunt resistance - 1 Effective resistance of ammeter – 1 </div> <p>A galvanometer is converted into an ammeter when a suitable shunt resistance is connected in parallel with the galvanometer coil. $\frac{1}{2}$</p> <p>[Alternatively</p> <div style="text-align: center; margin: 10px 0;">  </div> <p>]</p> <p>$G I_g = (I - I_g)S$ $\frac{1}{2}$</p> <p>$S = \left(\frac{I_g}{I - I_g}\right)G$ $\frac{1}{2}$</p> <p>$R_{\text{eff}} = \frac{GS}{G + S}$ 1</p>		3

16

Phasor diagram	$\frac{1}{2}$
Expression for impedance	1
Expression for phase difference	$\frac{1}{2}$
Conditions for maximum and minimum currents	$\frac{1}{2} + \frac{1}{2}$



$$V_m^2 = V_{Rm}^2 + (V_{Cm} - V_{Lm})^2$$

$$V_m^2 = (i_m R)^2 + (i_m X_C - i_m X_L)^2$$

$$= i_m^2 [R^2 + (X_C - X_L)^2]$$

$$i_m = \frac{V_m}{\sqrt{R^2 + (X_C - X_L)^2}}$$

$$Z = \frac{V_m}{i_m} = \sqrt{R^2 + (X_C - X_L)^2}$$

$$\tan \phi = \frac{(X_C - X_L)}{R}$$

For (i_m) Max Z should be minimum ($Z=R$) or $X_C - X_L = 0$ & $\phi = 0$

For (i_m) min $\phi \rightarrow 90^\circ$ ($\bar{u} |X_C - X_L| \gg R$)
(or $Z \rightarrow \infty$)

(Note: Award the last 1 mark even if the student correctly writes only the condition for I_{\max})

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

3

17	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>(a) Effect of slit width on size and intensity of central band ½+½</p> <p>(b) Effect of wavelength on width of central band 1</p> <p>(c) Relation between diffraction and interference 1</p> </div> <p>(a) When width is doubled, then $\frac{\lambda}{a}$ reduces to half hence size of the central maximum will get halved and intensity of central maximum will become 4 times. ½+½</p> <p>(b) For red light width will be maximum because $\beta = \frac{2\lambda D}{a}$</p> <p>Wave length of blue is small as compared to red so width will be less when red is replaced by blue.</p> <p>(c) Interference pattern is observed by superposing two waves originating from the two narrow slits. The diffraction pattern is a superposition of a continuous family of waves originating from each point on a single slit. 1</p> <p>[Alternatively, the intensity of interference fringes in a doubled slit arrangement is modulated by the diffraction pattern of each slit] 3</p>		
18	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Expression for total Q. - 1</p> <p>Formula for common potential - 2</p> </div> <p>$Q = q_1 + q_2$</p> <p>$= 4\pi\sigma(r^2 + R^2)$</p> <p><i>Potential at common centre</i></p> <p>$V = \frac{1}{4\pi\epsilon_0} \left[\frac{q_1}{r} + \frac{q_2}{R} \right]$</p> <p>$= \frac{1}{4\pi\epsilon_0} \times \left[\frac{4\pi r^2 \sigma}{r} + \frac{4\pi R^2 \sigma}{R} \right]$</p> <p>$= \frac{(r+R)\sigma}{\epsilon_0}$</p> <p>$= \frac{Q(r+R)}{4\pi \epsilon_0 (r^2 + R^2)}$</p>	<p>1</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p>	3

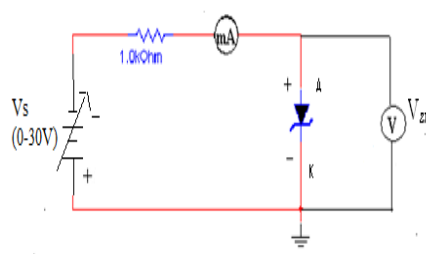
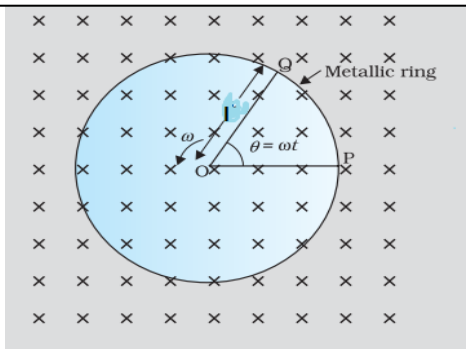
OR

Expressions for potential of shells A,B,C – 1+1+1/2

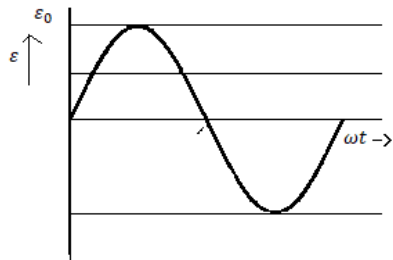
Relation b/w a,b,c ½

(a)	$V_A = \frac{kQ_A}{a} + \frac{kQ_B}{b} + \frac{kQ_C}{c}$ $V_A = \frac{1}{4\pi\epsilon_0} \left[\frac{4\pi a^2 \sigma}{a} - \frac{4\pi b^2 \sigma}{b} + \frac{4\pi c^2 \sigma}{c} \right]$ $= \frac{\sigma}{\epsilon_0} [a - b + c]$ $V_B = \frac{kQ_A}{b} + \frac{kQ_B}{b} + \frac{kQ_C}{c}$ $V_B = \frac{1}{4\pi\epsilon_0} \left[\frac{4\pi a^2 \sigma}{b} - \frac{4\pi b^2 \sigma}{b} + \frac{4\pi c^2 \sigma}{c} \right]$ $V_B = \frac{\sigma}{\epsilon_0} \left[\frac{a^2 - b^2}{b} + c \right]$ $V_C = \frac{kQ_A}{c} + \frac{kQ_B}{c} + \frac{kQ_C}{c}$ $V_C = \frac{1}{4\pi\epsilon_0} \left[\frac{4\pi a^2 \sigma}{c} - \frac{4\pi b^2 \sigma}{c} + \frac{4\pi c^2 \sigma}{c} \right]$ $= \frac{\sigma}{\epsilon_0} \left[\frac{a^2 - b^2 + c^2}{c} \right]$ $V_A = V_C$ $a - b + c = \frac{a^2 - b^2}{c} + c$ $c = a + b$	½	
(b)		½	3

19	<p>Einstein's photoelectric equation , Quantum Picture 1+½</p> <p>Three features that cannot be explained by wave theory ½+½+½</p> <hr/> <p>Photon energy is used to overcome work function and remaining energy becomes kinetic energy of emitted photo electron. ½</p> <p>$(KE)_{max}=h\nu-\phi_0$ [or any other equivalent form] 1</p> <p>(i) Existence of threshold frequency ½</p> <p>(ii) Stopping potential is independent of intensity for a particular frequency of incident radiation ½</p> <p>(iii) Effect of frequency of incident radiation on stopping potential. ½</p>		3
20	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>(a) Defining Isotopes and example ½ + ½</p> <p style="padding-left: 40px;">Defining Isobars and example ½ + ½</p> <p>(b) Reason & example ½ + ½</p> </div> <p>(a) Isotopes have same atomic number & isobars have same mass number ½ + ½</p> <p>Examples of Isotopes $^{12}_6C$, $^{14}_6C$ ½ + ½ Examples Isobars 3_2He , 3_1H</p> <p>(a) Mass of a nucleus is less than its constituents because in the bound state. some mass is converted into binding energy which is energy equivalent of mass defect e.g. mass of $^{16}_8O$ nucleus is less than the sum of masses of 8 protons and 8 neutrons ½</p>		3
OR			

<p>24</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>(a) Identification of diode 1 (b) For circuit diagram 1 (c) For explaining the use of device 1</p> </div> <p>(a) The diode used is Zener diode</p> <div style="text-align: center;">  </div> <p>(c) The Zener diode used can be used as a voltage regulator because, In its breakdown region. The Zener voltage remains constant even when the current through the Zener diode changes. [Award this one mark even if the student just writes" the Zener diode can be used as voltage regulator"] [This one mark can also be awarded if student draws the circuit diagram of a Zener diode as a voltage regulator]</p>	<p>1</p> <p>1</p> <p>1</p>	<p>3</p>
<p>25</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>(a)(i) Expression induced emf & current 1+1 (ii) For force and its direction 1 ½ (iii) Expression for power 1 (b) Effect on the force 1/2</p> </div> <div style="text-align: center;">  </div> <p>(a) (i)</p> $\mathcal{E} = Blv$ $\mathcal{E} = Bl \frac{v}{2}$ $(\mathcal{E} = Bl \left(\frac{l\omega}{2} \right))$ $\mathcal{E} = \frac{bl^2\omega}{2}$ <p style="text-align: center;">[Student may use any method to arrive at this result]</p> $I = \frac{\mathcal{E}}{R} = \frac{bl^2\omega}{2R}$	<p>1</p> <p>1</p>	

(b)	<p>(ii) $\vec{F} = I(\vec{l} \times \vec{b})$ $F = \frac{bl^3\omega B}{2R}$ Direction of force is perpendicular to both \vec{l} and \vec{B}</p> <p>iii) $\text{Power} = i^2 R = \left(\frac{bl^2\omega}{2R}\right)^2 R$ $= \frac{b^2 l^4 \omega^2}{4R}$</p> <p>Since induced current will reduce, it will be a little easier to remove the coil</p> <p>[Even if student writes induced current decreases award ½ mark.]</p>	½ ½ ½ ½ ½ ½	5								
OR											
	<table border="1" data-bbox="261 810 1218 1066"> <tbody> <tr> <td>(a) Expression for induced emf and current</td> <td>1 ½ +1</td> </tr> <tr> <td> Their peak values</td> <td>½ + ½</td> </tr> <tr> <td> Graph</td> <td>1</td> </tr> <tr> <td>(b) Nature of rod</td> <td>½</td> </tr> </tbody> </table> <p>(a)</p> $\phi = N\vec{B} \cdot \vec{A}$ $\phi = NBA \cos \omega t$ $\varepsilon = \frac{-d\phi}{dt}$ $\varepsilon = NBA\omega \sin \omega t$ <p>here $\varepsilon_0 = NBA\omega$</p> $i = \frac{\varepsilon}{R} = \frac{NBA\omega}{R} \sin \omega t$ $i_0 = \frac{NBA\omega}{R}$	(a) Expression for induced emf and current	1 ½ +1	Their peak values	½ + ½	Graph	1	(b) Nature of rod	½	½ ½ ½ ½ ½ ½	
(a) Expression for induced emf and current	1 ½ +1										
Their peak values	½ + ½										
Graph	1										
(b) Nature of rod	½										



(b) Bar is magnetic

Reason: Lenz's law/(Induced emf/current opposes its cause)

1

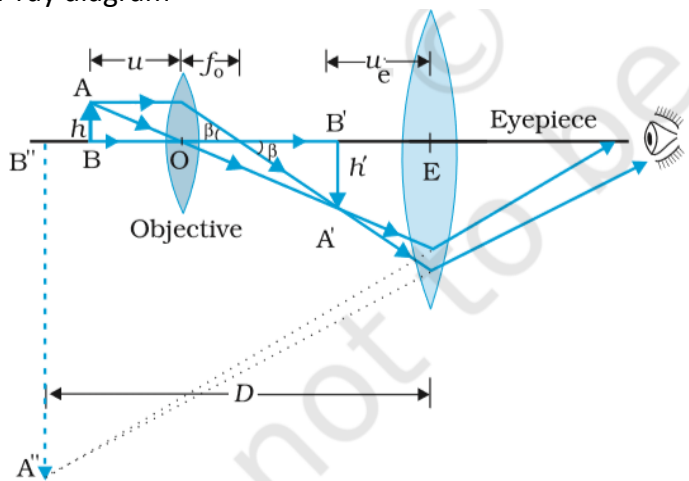
5

½

26

- | | | |
|-----|-------------------------------------|---|
| (a) | Ray diagram | 1 |
| (b) | Reason for short 'f' and aperture | 1 |
| (c) | (i) Calculation of Magnifying power | 2 |
| | (ii) Length of microscope | 1 |

For ray diagram



(a)

1

(b)

The magnifying power of compound microscope

$$m = m_0 \times m_e = \frac{L}{f_0} \times \left(1 + \frac{D}{f_e}\right)$$

½

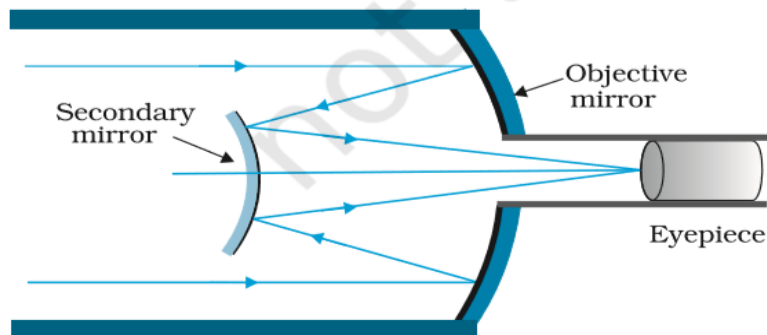
To have high magnifying power and high resolution, the focal length of the objective and its aperture should be short.

½

(c)	<p>Focal length of eyepiece is comparatively greater than the objective so that image formed by objective lens may form within the focal length of eyepiece and the final magnified image may be formed.</p> $u_0 = -6cm$ <p>for objective lens</p> $\frac{1}{f_0} = \frac{1}{v_0} - \frac{1}{u_0}$ $\frac{1}{v_0} = \frac{1}{f_0} + \frac{1}{u_0} = \frac{1}{4} + \frac{1}{-6}$ $v_0 = 12cm$ <p>Since for eyepiece $v_e = -D = -25cm$</p> $\frac{1}{u_e} = \frac{1}{v_e} - \frac{1}{f_e} = \frac{1}{-25} - \frac{1}{10}$ $u_e = -7.14cm$ <p>(i) Magnifying power of compound microscope</p> $m = \frac{v_o}{u_o} \left(1 + \frac{D}{f_e} \right)$ $m = \frac{12}{6} \left(1 + \frac{25}{10} \right) = 7$ <p>(ii) Length of Microscope</p> $L = v_0 + u_e = 12 + 7.14$ $L = 19.14cm$	<p>½</p> <p>½</p> <p>1</p> <p>1</p>	<p>5</p>
OR			

- | | |
|---------------------------------|-----|
| (a) Ray diagram and explanation | 2+1 |
| (b) Calculation of Sun's size | 2 |

(a)



2

It consists for large concave (primary) parabolic mirror having in its central part a hole. There is a small convex (secondary) mirror near the focus of concave mirror. Eye pieces if placed near the hole of the concave mirror.

1

The parallel rays from distance object are reflected by the large concave mirror . These rays fall on the convex mirror which reflects these rays outside the hole. The final magnified image in formed.

(b) For eyepiece.

$$\frac{1}{v_e} - \frac{1}{u_e} = \frac{1}{f_e}$$

$$\text{or } \frac{1}{u_e} = \frac{1}{v_e} - \frac{1}{f_e} = \frac{1}{40} - \frac{1}{10}$$

$$u_e = \frac{40}{3} \text{ cm}$$

 $\frac{1}{2}$

Magnification produced by eye pieces is

$$m_e = \frac{v_e}{|u_e|} = \frac{40}{40/3} = 3$$

Diameter of the image formed by the objective is

 $\frac{1}{2}$

$$d = 6/3 = 2 \text{ cm}$$

If D be the diameter of the SUN then the angle subtended by it on the objective will be

 $\frac{1}{2}$

$$\alpha = \frac{D}{1.5 \times 10^{11}} \text{ rad}$$

Angle subtended by the image at the objective

= angle subtended by the SUN

$$\therefore \alpha = \frac{\text{size of image}}{f_o} = \frac{2}{200} = \frac{1}{100} \text{ rad.}$$

$$\therefore \frac{D}{1.5 \times 10^{11}} = \frac{1}{100}$$

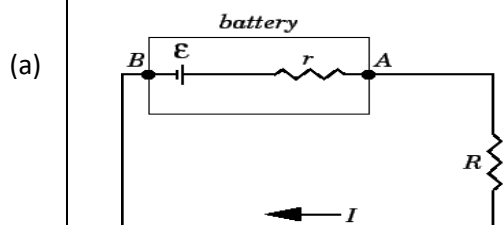
or

$$D = 1.5 \times 10^9 \text{ m}$$

½

5

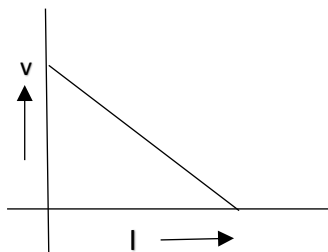
27	a) Relation between E, V, r	1
	Graph V (v/s) I	1
	Significance of graph	1
	b) Current in voltmeter	1
	Potential difference across voltmeter	½
	Percentage Error	½



$E - IR - rI = 0$
 $E - V - Ir = 0$
 $E = V + Ir$

½
½

[Award 1 mark even if student writes the relation directly]

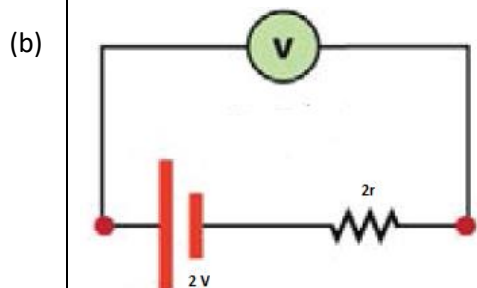


1

Significance of Graph – It shows that the p.d. across the cell increases with a decrease in the current drawn from it.

(To find emf and internal resistance of cell.)

1



$V = E - Ir$
 $998 \times I = 2 - 2I$

$$1000 \times I = 2$$

$$I = \frac{2}{1000} = .002 \text{ A}$$

$$V = .002 \times 998$$

$$V = 1.996 \text{ V}$$

$$\% \text{ error} = \frac{.004}{2} \times 100 = 20\%$$

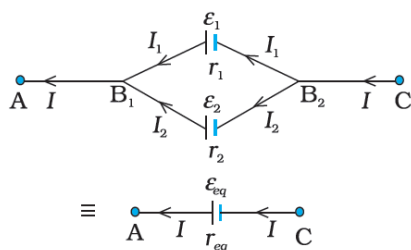
 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$

5

OR

a) Expression of current in terms of E and V	1
Expression of voltage in terms of emf and internal resistance	1
Expression for Eeq and req	$\frac{1}{2} + \frac{1}{2}$
b) Value of current & value of internal resistance	1+1

(a)

 $\frac{1}{2}$

$$I = I_1 + I_2$$

Potential difference across $B_1 B_2$

$$V = E_1 - I_1 r_1 \quad \Rightarrow \quad I_1 = \frac{E_1 - V}{r_1}$$

$$V = E_2 - I_2 r_2 \quad \Rightarrow \quad I_2 = \frac{E_2 - V}{r_2}$$

$$I = I_1 + I_2$$

$$= \frac{E_1 - V}{r_1} + \frac{E_2 - V}{r_2}$$

$$= \left(\frac{E_1}{r_1} + \frac{E_2}{r_2} \right) - V \left(\frac{1}{r_1} + \frac{1}{r_2} \right)$$

$$V = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2} - \frac{I(r_1 r_2)}{r_1 + r_2}$$

Compare with

$$V = E_{eq} - I r_{eq}$$

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

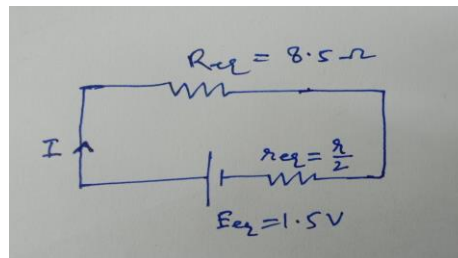
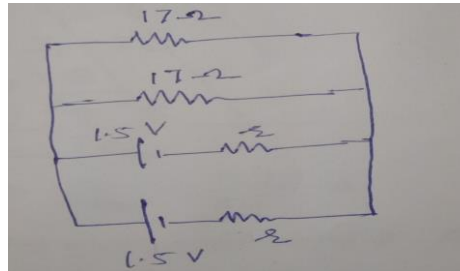
$$E_{eq} = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2}$$

$$r_{eq} = \frac{r_1 r_2}{r_1 + r_2}$$

½

½

(b)



Equivalent circuit

$$I = \frac{V}{R_{eq}} = \frac{1.4}{8.5} \text{ A}$$

And

$$V = E_{eq} - I r_{eq}$$

$$\Rightarrow 1.4 = 1.5 - \frac{1.4}{8.5} \times \frac{r}{2}$$

$$\Rightarrow r = 1.21 \Omega$$

1

1

5