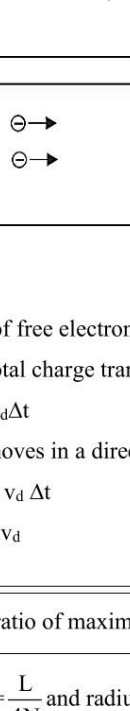
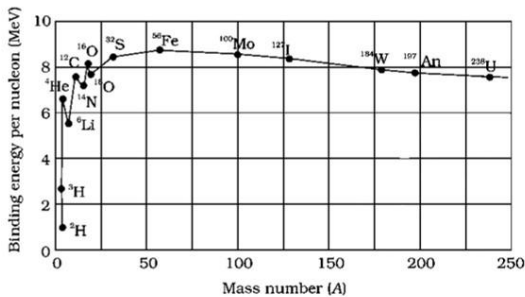
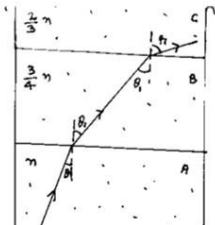
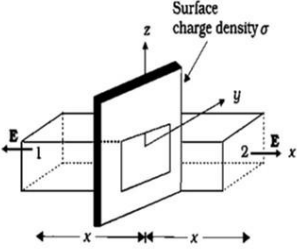


MARKING SCHEME: PHYSICS (042)			
Session: 2025–26			
Code: 55/ 1 /2			
Q. No.	VALUE POINTS/EXPECTED ANSWERS	Marks	Total Marks
SECTION – A			
1.	(B) 16V	1	1
2.	(C) Diffusion and drift currents are equal and opposite.	1	1
3.	(D) 2%	1	1
4.	(C) (i) ,(iii) and (iv) Only	1	1
5.	(D) $\frac{40}{3}$ cm	1	1
6.	(A) 2d	1	1
7.	(B) Ultraviolet rays	1	1
8.	(B) $\frac{r_2}{r_1}$	1	1
9.	(B) $(10\text{nT})\hat{k}$	1	1
10.	(C) Both wavelength of light used and the slits separation	1	1
11.	(C) wavelength is halved and frequency remains unchanged	1	1
12.	(D) 16V	1	1
13.	(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the assertion (A).	1	1
14.	(C) Assertion (A) is true, but Reason (R) is false	1	1
15.	(D) Both assertion (A) and Reason (R) are false	1	1
16.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A)	1	1
SECTION – B			
17.	Finding least distance 2 (a) At the point of coincidence for dark fringes. $d \sin \theta = n\lambda_2 = (n+1)\lambda_1$ $n \times 600 = (n+1) \times 400$ $n = 2$ Position of dark fringe from the central maxima $y = \frac{(n+1)\lambda_1 D}{d}$ $y = \frac{3 \times 400 \times 10^{-9} \times 1.5}{1 \times 10^{-3}}$ $y = 1.8\text{mm}$ Alternatively: $y = \frac{n\lambda_2 D}{d}$ $y = \frac{2 \times 600 \times 10^{-9} \times 1.5}{1 \times 10^{-3}}$ $y = 1.8\text{ mm}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2

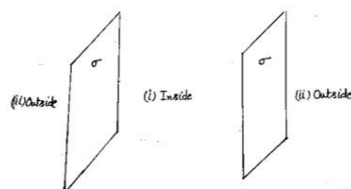
	OR • Finding the least distance 2 (b) At the point of coincidence for bright fringes $\frac{n\lambda_2 D}{d} = \frac{(n+1)\lambda_1 D}{d}$ $n \times 660 = (n+1) \times 440$ $n = 2$ Position of bright fringe from the central maxima $y = \frac{n\lambda_2 D}{d}$ $y = \frac{2 \times 660 \times 10^{-9} \times 1.5}{0.6 \times 10^{-3}}$ $y = 3.3 \text{ mm}$ Alternatively: $y = \frac{(n+1)\lambda_1 D}{d}$ $y = 3.3 \text{ mm}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2
18.	Finding the ratio of $\frac{\lambda_a}{\lambda_p}$ for (a) Same velocity 1 (b) Same kinetic energy 1 de-Broglie wavelength $\lambda = \frac{h}{mv}$ (a) For same velocity $\lambda \propto \frac{1}{m}$ $\frac{\lambda_a}{\lambda_p} = \frac{m_p}{m_a}$ $\therefore$ mass of alpha is four times of mass of proton. Hence $\frac{\lambda_a}{\lambda_p} = \frac{m_p}{4m_p}$ $\frac{\lambda_a}{\lambda_p} = \frac{1}{4}$ (b) For same kinetic energy $\lambda = \frac{h}{\sqrt{2mK}}$ $\lambda \propto \frac{1}{\sqrt{m}}$ $\frac{\lambda_a}{\lambda_p} = \frac{1}{2}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2

19.	• Writing the order of Magnitude of drift velocity $\frac{1}{2}$ • Deducing the relation between current flowing through a conductor and drift velocity. $\frac{1}{2}$ • Magnitude of drift velocity in conductor is of the order of a few mm/s $\frac{1}{2}$  • For n number of free electrons per unit volume in a conductor of cross section area A, the total charge transported across the area in time Δt is $\frac{1}{2}$ $Q = - ne A v_d \Delta t$ As electron moves in a direction opposite to that of electric field $\frac{1}{2}$ $I \Delta t = ne A v_d \Delta t$ $I = ne A v_d$ $\frac{1}{2}$	2
20.	• Finding the ratio of maximum value of torque 2 Side of square $a = \frac{L}{4N}$ and radius of circular coil $r = \frac{L}{2\pi N}$ $\frac{1}{2}$ $\tau = NIBA$ $\frac{\tau_1}{\tau_2} = \frac{NIBA_1}{NIBA_2}$ $\frac{\tau_1}{\tau_2} = \frac{A_1}{A_2}$ $\frac{\tau_1}{\tau_2} = \frac{(L/4N)^2}{\pi(\frac{L}{2\pi N})^2}$ $\frac{\tau_1}{\tau_2} = \frac{\pi}{4}$ $\frac{1}{2}$	2
21.	• Drawing binding energy per nucleon graph as a function of mass number $\frac{1}{2}$ • Explanation of its significance $\frac{1}{2}$	

	 Note: [Give full marks for shape of graph only] • For $A > 170$, it signifies lesser stability	$1\frac{1}{2}$ $\frac{1}{2}$	2
SECTION – C			
22.	Calculating the applied potential difference between the plates. 3 Since $a = \frac{qE}{m} = \frac{qV}{mL}$ $t = \frac{x}{u_x}$ $y = \frac{1}{2} \left(\frac{qV}{mL} \right) \left(\frac{x}{u_x} \right)^2$ $V = \frac{2ymLu_x^2}{ex^2}$ $V = \frac{2 \times 1 \times 10^{-2} \times 9.1 \times 10^{-31} \times 2 \times 10^{-2} (3 \times 10^7)^2}{1.6 \times 10^{-19} \times (3 \times 10^{-2})^2}$ $V = 2275 \text{ Volt}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3
23.	(a) Two Conditions for total internal reflection $\frac{1}{2} + \frac{1}{2}$ (b) Proving that beam does not enter into region C at all for $\sin \theta \geq \frac{2}{3}$ 2 (a) (i) Light must travel from denser medium to rarer medium. (ii) Angle of incidence must be greater than Critical angle. $i > i_c$ (b) 	$\frac{1}{2}$ $\frac{1}{2}$	

	For refraction at AB interface $\frac{\sin \theta}{\sin \theta_1} = \frac{3n/4}{n}$ $\sin \theta = \frac{3}{4} \sin \theta_1 \quad \text{----- (1)}$ For refraction at BC interface $\frac{\sin \theta_1}{\sin r} = \frac{2n/3}{3n/4}$ $\sin \theta_1 = \frac{8}{9} \sin r \quad \text{----- (2)}$ From equations (1) and (2) $\frac{3}{2} \sin \theta = \sin r$ for $\sin \theta = \frac{2}{3}$ $\sin r = 1$ i.e $r = 90^\circ$ Ray grazes the surface Hence for $\sin \theta \geq \frac{2}{3}$ does not enter the region C at all	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 3	
24.	(a) Deducing an expression for electric field at point due to the uniformly charged infinite plane thin sheet. 2 (b) Writing net electric field due to two thin sheets. (i) Inside $\frac{1}{2}$ (ii) Outside $\frac{1}{2}$ (a)  As seen from the figure, only the two faces 1 and 2 will contribute to the flux. Therefore, flux $\vec{E} \cdot \Delta \vec{S}$ through both the surfaces are equal and add up. Therefore, net flux through the Gaussian surface is $2EA$. The charge enclosed by the close surface is σA. $2EA = \frac{\sigma A}{\epsilon_0}$ $\vec{E} = \frac{\sigma}{2\epsilon_0} \hat{n}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	

(b)



(i) $E_{in} = 0$

(ii) $E_{out} = \frac{\sigma}{\epsilon_0}$

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

OR

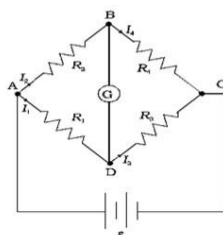
(a) Obtaining the Condition for balanced wheat stone bridge.

2

(b) Finding the net resistance of the given network.

1

(a)

 $\frac{1}{2}$

By using Kirchhoff's loop rule to closed loops ADBA and CBDC. The first loop gives

$$-I_1 R_1 + 0 + I_2 R_2 = 0 \quad \text{----- (1)} \quad \because [V_B = V_D, I_g = 0]$$

 $\frac{1}{2}$

Second loop gives

$$I_4 R_4 + 0 - I_3 R_3 = 0$$

$\because I_g = 0$, hence

$$I_1 = I_3 \text{ and } I_2 = I_4$$

$$I_2 R_4 - I_1 R_3 = 0 \quad \text{----- (2)}$$

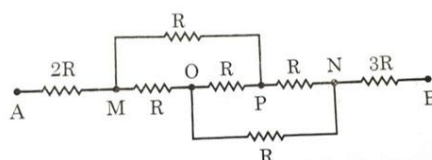
 $\frac{1}{2}$

From equation (1) and (2)

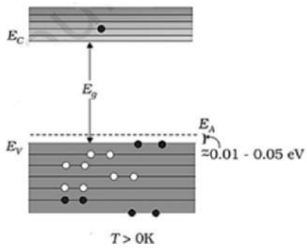
$$\frac{R_2}{R_1} = \frac{R_4}{R_3}$$

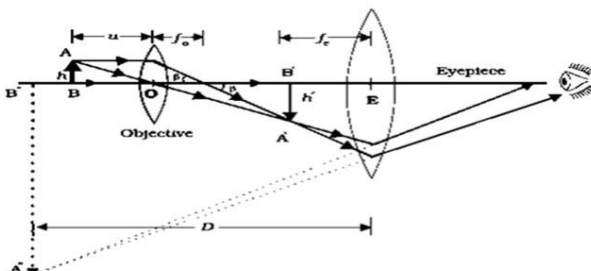
 $\frac{1}{2}$

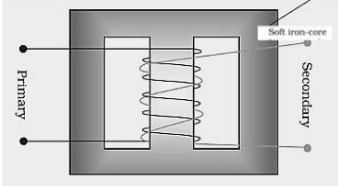
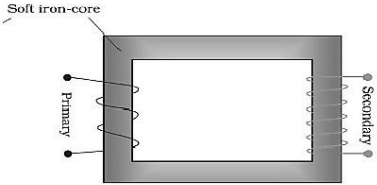
(b)



Due to balanced Wheatstone bridge

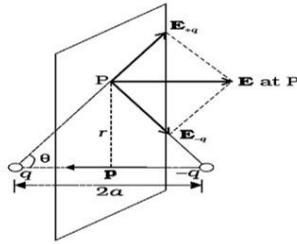
26.	Calculating - Potential difference across each capacitor $1\frac{1}{2}$ - Charge on each capacitor $1\frac{1}{2}$ Initial charge on $12\mu\text{F}$ capacitor is $Q_i = C_i V_i$ $Q_i = 12\mu\text{F} \times 150\text{V}$ $Q_i = 1800\mu\text{C}$ When $6\mu\text{F}$ capacitor is connected with $12\mu\text{F}$ capacitor then common potential of capacitor $V_f = \frac{C_i V_i}{C_1 + C_2}$ $V_f = \frac{1800\mu\text{C}}{(12 + 6)\mu\text{F}}$ $V_f = 100\text{V}$ Final voltage on each capacitor is 100V Charge on $12\mu\text{F}$ capacitor is $Q_1 = C_1 V_f$ $Q_1 = 12\mu\text{F} \times 100\text{V}$ $Q_1 = 1200\mu\text{C}$ Charge of $6\mu\text{F}$ capacitor $Q_2 = C_2 V_f$ $Q_2 = 6\mu\text{F} \times 100\text{V}$ $Q_2 = 600\mu\text{C}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3
27.	(a) Identifying the semiconductor $\frac{1}{2}$ (b) Calculating the electron concentration 1 (c) • Writing change in energy gap $\frac{1}{2}$ • Drawing energy band diagram 1 (a) p type semiconductor (b) $\therefore n_e = \frac{n_i^2}{n_h}$ $n_e = \frac{(3 \times 10^8)^2}{6 \times 10^{10}}$ $n_e = 1.5 \times 10^6 \text{ m}^{-3}$ (c) • Energy gap effectively decreases 	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 1	3

28.	• Drawing labelled ray diagram of compound microscope 1½ • Deriving the expression for magnifying power 1½								
	 Magnification due to the objective lens $m_0 = \frac{h'}{h} = \frac{L}{f_0}$ using $\tan \beta = \left(\frac{h}{f_0}\right) = \left(\frac{h'}{L}\right)$ where L is the length of the tube When final image is formed at least distance of distinct vision, then magnification produced by eye lens $m_e = \left(1 + \frac{D}{f_e}\right)$ Total magnification $m = m_0 \times m_e$ $m = \frac{L}{f_0} \left(1 + \frac{D}{f_e}\right)$ Note: Give full marks for any other alternative method.	1½ ½ ½ ½	3						
SECTION - D									
29	(I) (C) $h\nu_1$ and $h\nu_2$ (II) (A) greater for metal A because it has a smaller work function. (III) (D) the slope of the parallel lines will not change but more electrons will be emitted per second. (IV) (C) $\frac{2}{5}$ OR (A) me	1 1 1 1	4						
30	(I) (B) radial magnetic field (II) (A) increasing number of turns of the coil (III) (D) 0.25 Nm OR (B) 3985 Ω (IV) (C) 0.01 Ω should be connected in parallel with it.	1 1 1 1	4						
SECTION - E									
31	<table border="1" style="width: 100%;"> <tr> <td>(a) Stating Faraday's law</td> <td style="text-align: right;">1</td> </tr> <tr> <td>(b) Deriving of Expression for self-inductance.</td> <td style="text-align: right;">2</td> </tr> <tr> <td>(c) Finding the induced e.m.f</td> <td style="text-align: right;">2</td> </tr> </table>	(a) Stating Faraday's law	1	(b) Deriving of Expression for self-inductance.	2	(c) Finding the induced e.m.f	2		
(a) Stating Faraday's law	1								
(b) Deriving of Expression for self-inductance.	2								
(c) Finding the induced e.m.f	2								

	(a) The magnitude of the induced e.m.f in a circuit is equal to the time rate of change of magnetic flux through the circuit. Alternatively: $\varepsilon = -\frac{d\phi_B}{dt}$ (b) Magnetic field due to current carrying long solenoid of length l area of cross section A having n turns per unit length is $B = \mu_0 nI$ Total magnetic flux linked with the solenoid is $N\phi_B = (nl)(\mu_0 nI)(A)$ $= \mu_0 n^2 Al$ Where nl is total number of turns. Thus $\therefore$ Self inductance of the solenoid $L = \frac{N\phi_B}{I}$ $L = \mu_0 n^2 Al$ Note: Award full marks for any other correct alternative method (c) Induced e.m.f $\varepsilon = \frac{1}{2} Bl^2 \omega$ $= \frac{1}{2} \times 4 \times 10^{-3} \times (50 \times 10^{-2})^2 \times (2\pi \times 1)$ $= 3.14 \text{ mV}$ OR In OSM Award list Q31 has been shown as 31a OR, 31b OR and 31a OR for first option and for choice option 31a, 31bi, and 31b 11 (a) •Drawing labelled diagram of step-up transformer. 1 •Stating the principle 1/2 •Obtaining the ratio of voltages in terms of number of turns and current 2 (b) <u>Finding:</u> (i) Current in Primary coil 1/2 (ii) Output Voltage 1 (a) Fig  Alternatively: 	1 1/2 1/2 1/2 1/2 1 1/2 1 1	
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32.

- (a) Deriving an expression for the electric field $\vec{E}$ due to a dipole on the equatorial plane. 2½
 • Writing the expression for electric field at far off point. ½
 (b) Calculating the force and torque. 2



The magnitude of the electric fields due to the two charges $+q$ and $-q$ are given by

$$E_{+q} = \frac{q}{4\pi\epsilon_0 (r^2 + a^2)}$$

$$E_{-q} = \frac{q}{4\pi\epsilon_0 (r^2 + a^2)}$$

The components normal to the dipole axis cancel away. The components along the dipole axis add up. The Total electric field is opposite to $\vec{p}$.

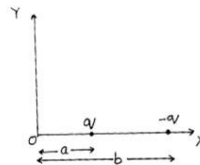
$$\vec{E} = -(E_{+q} + E_{-q}) \cos\theta (\hat{p})$$

$$\vec{E} = -\frac{1}{4\pi\epsilon_0} \frac{2qa}{(r^2 + a^2)^{3/2}} \hat{p}$$

At large distance $r \gg a$

$$\vec{E} = \frac{-2qa}{4\pi\epsilon_0 r^3} \hat{p}$$

(b)



$$\therefore \vec{F} = \vec{F}_{+q} + \vec{F}_{-q}$$

$$\text{Net force} = [+q \cdot 2\hat{i} - q \cdot 2\hat{i}]$$

$$= 0 \text{ N}$$

$$\text{Torque } \vec{\tau} = \vec{p} \times \vec{E}$$

$$\vec{\tau} = p(-\hat{i}) \times 2\hat{i}$$

$$\tau = 0$$

Alternatively:

$$\tau = pE \sin \theta$$

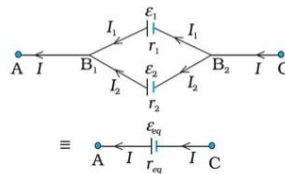
Angle between $\vec{p}$ and $\vec{E}$ is π

$$\tau = 0$$

In OSM Award list Q32 has been shown as 32a OR, 32b OR for first option and for choice option 32a and 32b

- | | |
|---|---|
| (a) Deriving the expression for | 2 |
| • Equivalent e.m.f | 1 |
| • Equivalent internal resistance | 1 |
| (b) Finding the current through resistance $2R$. | 2 |

(a)



Let I_1 and I_2 are the currents leaving from the positive electrodes of the cells ε_1 and ε_2 respectively, Hence $I = I_1 + I_2$

Potential difference across the terminals of cell ε_1 is

$$V = \varepsilon_1 - I_1 r_1$$

Potential difference across the terminals of cell ε_2 is

$$V = \varepsilon_2 - I_2 r_2$$

$$I = I_1 + I_2$$

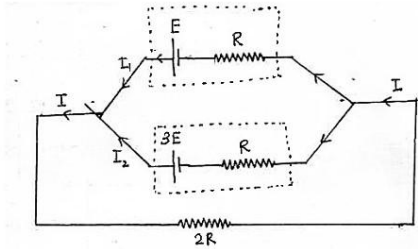
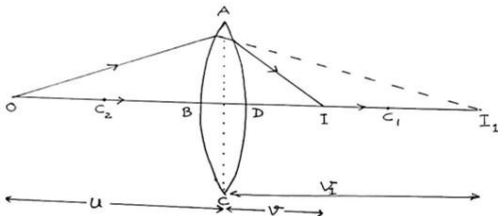
$$I = \frac{\varepsilon_1 - V}{r_1} + \frac{\varepsilon_2 - V}{r_2}$$

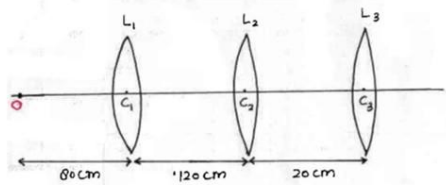
$$I = \left(\frac{\varepsilon_1}{r_1} + \frac{\varepsilon_2}{r_2} \right) - V \left(\frac{1}{r_1} + \frac{1}{r_2} \right)$$

$$V = \frac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2} - I \left(\frac{r_1 r_2}{r_1 + r_2} \right)$$

$$V = \varepsilon_{eq} - I r_{eq}$$

$$\varepsilon_{eq} = \left(\frac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2} \right)$$

	$r_{eq} = \left(\frac{r_1 r_2}{r_1 + r_2} \right)$ (b)  Equivalent emf $E_{eq} = \frac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2}$ $E_{eq} = \frac{E \times R + 3E \times R}{R + R}$ $E_{eq} = \frac{4ER}{2R}$ $E_{eq} = 2E$ Equivalent resistance $r_{eq} = \frac{r_1 r_2}{r_1 + r_2}$ $r_{eq} = \frac{RR}{R + R}$ $r_{eq} = \frac{R}{2}$ $I = \frac{E_{eq}}{2R + \frac{R}{2}}$ $I = \frac{4E}{5R} A$	1	
33	(a) Deriving the expression for lens maker's formula. 3 (b) Finding the distance of the final image from the object. 2 (a) 	1	5

The first refracting surface forms the image of the object O at I_1 For refraction from first interface ABC $\frac{n_1}{OB} + \frac{n_2}{BI_1} = \frac{n_2 - n_1}{BC_1} \quad \text{----- (1)}$ Similarly for refraction from second interface ADC. The image I_1 acts as a virtual object for the second surface ADC $-\frac{n_2}{DI_1} + \frac{n_1}{DI} = \frac{n_2 - n_1}{DC_2} \quad \text{----- (2)}$ For thin lens $BI_1 = DI_1$ By adding equation (1) and (2) $\frac{n_1}{OB} + \frac{n_1}{DI} = (n_2 - n_1) \left[\frac{1}{BC_1} + \frac{1}{DC_2} \right]$ $-\frac{n_1}{u} + \frac{n_1}{v} = (n_2 - n_1) \left[\frac{1}{R_1} - \frac{1}{R_2} \right]$ $\frac{1}{v} - \frac{1}{u} = \left(\frac{n_2}{n_1} - 1 \right) \left[\frac{1}{R_1} - \frac{1}{R_2} \right]$ If object is kept at ∞, image will form at focus hence $\frac{1}{f} = \left(\frac{n_2}{n_1} - 1 \right) \left[\frac{1}{R_1} - \frac{1}{R_2} \right]$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	
(b)  For lens L_1 $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ $\frac{1}{40} = \frac{1}{v_1} + \frac{1}{80}$ $\frac{1}{40} = \frac{1}{v_1} + \frac{1}{80}$ $\frac{1}{v_1} = \frac{1}{80}$ $v_1 = 80 \text{ cm}$ For lens L_2 $u_2 = 120 - 80$ $u_2 = 40 \text{ cm}$ $\frac{1}{40} = \frac{1}{v_2} + \frac{1}{40}$	$\frac{1}{2}$ $\frac{1}{2}$	

$$\frac{1}{v_2} = 0$$

$$v_2 = \infty$$

For lens L_3

$$u_3 = \infty$$

$$\frac{1}{40} = \frac{1}{v_3} + \frac{1}{\infty}$$

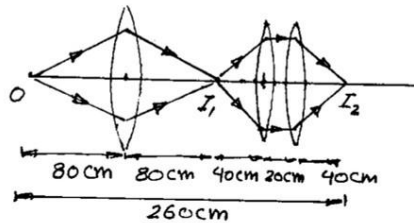
$$v_3 = 40 \text{ cm}$$

Distance between final image and object

$$= 80 + 120 + 20 + 40$$

$$= 260 \text{ cm}$$

Alternatively:

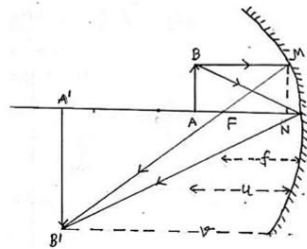


OR

In OSM Award list Q33 has been shown as 33a OR, 33b OR and 33b OR for first option and for choice option 33a, 33b.

(a) •Drawing ray diagram	1
•Deriving of mirror formula	2
(b) Calculating the focal length of mirror	2

(a)



$\triangle BAP$ and $\triangle B'A'P$ are similar then

$$\frac{BA}{B'A'} = \frac{AP}{A'P} \quad \text{-----(1)}$$

$$\therefore BA = MN$$

$\triangle MNF$ and $\triangle B'A'F$ are similar then

$$\frac{MN}{B'A'} = \frac{NF}{A'F}$$

$$\frac{BA}{B'A'} = \frac{NF}{A'F} = \frac{PF}{A'F} \quad (\text{N is very close to P}) \quad \text{-----(2)}$$

From equation (1) and (2) $\frac{AP}{A'P} = \frac{PF}{A'F}$ $\frac{-u}{-v} = \frac{-f}{-v+f}$ $-uv + uf = -vf$ $\frac{-uv}{uvf} + \frac{uf}{uvf} = \frac{-vf}{uvf}$ $\frac{-1}{f} + \frac{1}{v} = \frac{1}{-u}$ $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$ Note: Award two marks if student derives mirror formula by using any other justified method (b) $m = \frac{-v}{u}$ $m = 2$ $\therefore v = -2u \Rightarrow v = -2(-10) = 20 \text{ cm}$ $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ $\frac{1}{20} - \frac{1}{10} = \frac{1}{f}$ $\frac{1-2}{20} = \frac{1}{f}$ $f = -20 \text{ cm}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	5
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