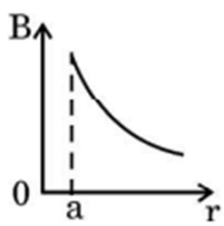
Marking Scheme Strictly Confidential (For Internal and Restricted use only) Senior School Certificate Examination, 2023 SUBJECT NAME PHYSICS (PAPER CODE 55/3/2)	
General Instructions: -	
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. Its' leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc may invite action under various rules of the Board and IPC."**
3	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class-X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4	The Marking scheme carries only suggested value points for the answers These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after delibration and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark(√) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.
9	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note **"Extra Question"**.
10	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11	A full scale of marks _0-70(example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer

	deserves it.
12	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).This is in view of the reduced syllabus and number of questions in question paper.
13	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totaling of marks awarded on an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totaling on the title page. ● Wrong totaling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
14	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0)Marks.
15	Any un assessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
16	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
17	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.
18	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

MARKING SCHEME: PHYSICS(042)

Code: 55/3/2

Q.No.	VALUE POINTS/EXPECTED ANSWERS	Marks	Total Marks
	SECTION A		
1.	(a) $\frac{V_o}{\sqrt{2}}$	1	1
2.	(b) $\frac{9}{5}$	1	1
3.	(c) $5 \times 10^9\ m^{-3}$	1	1
4.	(d) $1.0 \times 10^{-7}\ Cm^{-1}$	1	1
5.	(d) Infinite	1	1
6.	(b) 0.51 eV	1	1
7.	(a) Increase	1	1
8.	(b) $m^2V^{-1}s^{-1}$	1	1
9.	(b) inductor decreases and the capacitor increases.	1	1
10.	(c) $\tau\ \alpha$ I	1	1
11.	(c) I $\alpha\ \ A^2$	1	1
12.	(c) H.R. Hertz	1	1
13.	(c) $\frac{2}{3}E$	1	1
14.	(b) twice	1	1
15.	(c) 	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
17.	(c) Assertion (A) is true, but Reason (R) is false.	1	1
18.	(d) Assertion (A) is false & Reason(R) is also false.	1	1
	SECTION B		
19.	Effect on width of depletion layer with justification in case of (i) Forward Bias ½+ ½ (ii) Reverse Bias ½+ ½		

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(i) Forward Bias- Decreases
The direction of the applied voltage (V) is opposite to the built-in potential V_o

(ii) Reverse Bias- Increases
The direction of the applied voltage (V) is same as the built-in potential V_o

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½

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½</td>
<td>2</td>
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Explanation of property	1
Difference between half wave and full wave rectifier.	1

pn-junction conducts in forward bias.

Alternatively:-pn-junction is a uni-directional device.

The half-wave rectifier gives output only for half of the input cycle .The full-wave rectifier gives output for both the halves of the input cycles.

Alternatively:-If output waveform of both the rectifiers shown diagrammatically, then full credit to be given.

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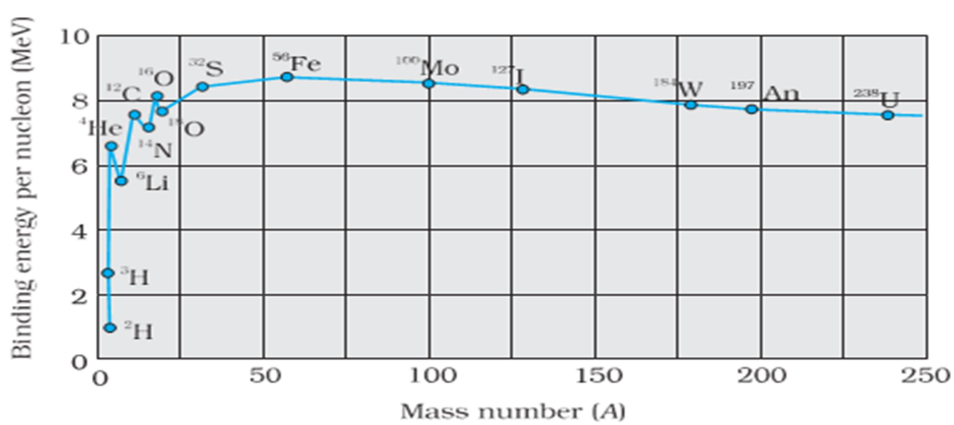
(a)

Graph of binding energy per nucleon as a function of mass number A	1
Explanation	1



Explanation:-Nuclear forces are short range & show saturation, while the electrostatic force are neither short range nor show any saturation. Hence for heavier nuclei (A>170) the electrostatic force of repulsion becomes predominant, decreasing the binding energy per nucleon.
Alternatively:-As the size of the nucleus increases, the nucleus becomes unstable.

Note: No deduction of marks if values of elements are not shown in the graph.

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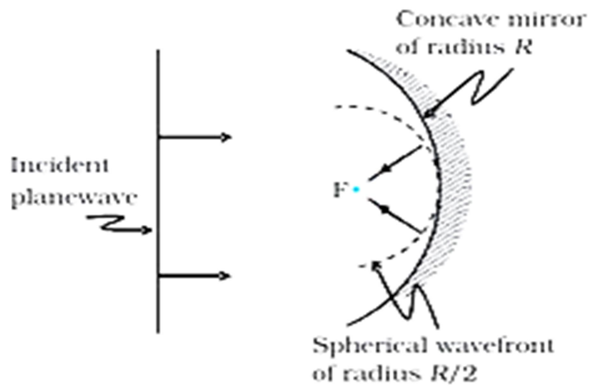
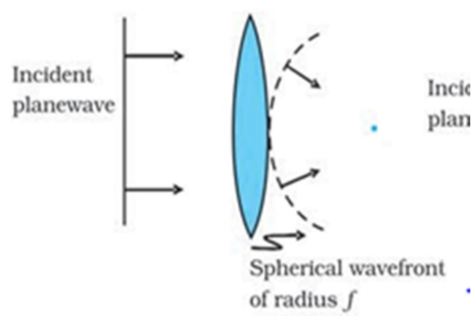
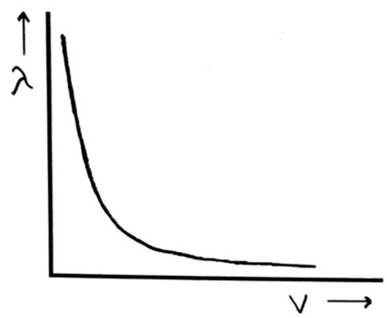
	OR (b) Expression for radius of the n^{th} orbit in a hydrogen atom 2 $\frac{mv^2}{r_n} = \frac{kq^2}{r_n^2} = \frac{e^2}{4\pi \in_o r_n^2}$ -----(1) $mvr_n = \frac{nh}{2\pi}$ -----(2) Using equation (1) &(2) $r_n = \frac{n^2 h^2 4\pi\varepsilon_o}{m(2\pi)^2 e^2}$ = $0.53 \times 10^{-10} n^2$ m	½ ½ 1	2
22.	Definition of Displacement Current 1 Difference 1 Displacement current: It is the current that arises due to the rate of change of electric field/flux. **Alternatively:-** $I_d = \varepsilon_0 \left(\frac{d\phi_E}{dt}\right)$ **Alternatively:** The term with units of current to explain the continuity of current in a region. **Difference:** Displacement current is due to change in electric flux. Conduction current is due to flow of electrons. **Alternatively:** $I_d = \varepsilon_0 \left(\frac{d\phi_E}{dt}\right)$ $I_c = \frac{dq}{dt}$	1 1	2

23.	Proving that the circular loop will experience larger torque. 2 Let the length of the wire be l. For square loop; $l = 4a \Rightarrow a = \frac{l}{4}$ Area of square loop = $a^2 = \frac{l^2}{16}$ ---(i) For Circular loop; $l = 2\pi r \Rightarrow r = \frac{l}{2\pi}$ Area of circular loop(A_c) = $\pi r^2 = \frac{l^2}{4\pi}$ ----(ii) Torque acting on the loop $(\tau) \alpha A$ $\because A_c > A_s \quad \therefore \tau_c > \tau_s$	½ ½ ½ ½	2
24.	(a) Statement of Huygen's Principle 1 Explanation 1 Statement: Each point of the wavefront is the source of secondary disturbance in all directions. Common tangent to all the secondary wavelets gives new position of the wavefront. Explanation: Light energy cannot travel in backward direction. **Alternatively:** It was an adhoc assumption . **Alternatively:** For back wave: $I = \frac{1}{2}(1+\cos\theta)$ at θ=180° ; contribution is zero. **Alternatively:** Amplitude of secondary wavelets is maximum in forward direction and zero in backward in direction. **Note:** If any other relevant explanation given, give full credit.	½ ½ 1	

	OR		
	(b)		
	(i) Diagram for concave mirror 1 (ii) Diagram for convex lens 1		
	(i) 	1	
	(ii) 	1	2
25.	Calculation of critical angle 2		
	From Snell 's law:-		
	$\mu_A \sin i_c = \mu_B \text{Sin}\, 90°$	½	
	$2 \times \sin i_c = \sqrt{2} \times 1$	½	
	$\sin i_c = \frac{1}{\sqrt{2}}$	½	
	$i_c = 45°$	½	

	Alternatively: $\sin i_c = \frac{1}{{}^{B}\mu_A}$ $\sin i_c = \frac{1}{\sqrt{2}}$ $i_c = 45^o$	1 ½ ½	2
	SECTION C		
26.	(a) Graph 1 (b) Calculation of energy & de-Broglie Wavelength 1+ 1 (a)  (b) Energy acquired = qV_o $= 1.6\times10^{-19}\times$ 400 = 6.4 × 10^{-17} J = 400 eV $\lambda = \frac{h}{\sqrt{2mK}}$ $\lambda = \frac{6.63\times10^{-34}}{\sqrt{2\times9.1\times10^{-31}\times6.4\times10^{-17}}}$ $\lambda = 0.61\times10^{-10}\,m$=0.6145A0	1 ½ ½ ½ ½	3
27.	(a) (i) Expression for current 1 (ii) Reactance of the capacitor 1 Graph of i versus ωt 1		

(i) $V_m \operatorname{Sin} \omega t = \frac{q}{C}$

$$I = \frac{dq}{dt} = \frac{d}{dt}(CV_m \sin \omega t)$$ ½

$$I = \omega C V_m \cos \omega t$$ ½

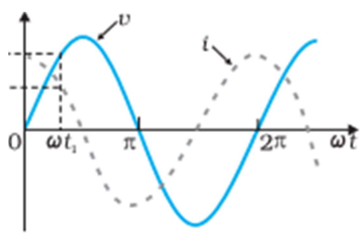
Alternatively:-

$$I = \frac{V_m}{1/\omega C} \cos \omega t = I_m \sin(\omega t + \pi/2)$$

(ii) $I = \frac{V_m}{1/\omega C} \sin(\omega t + \pi/2) = I_m \sin(\omega t + \pi/2)$

Comparing with $I_m = \frac{V_m}{1/\omega C}$

Reactance of the capacitor; $X_c = \frac{1}{\omega C}$ 1



1

OR

(b)

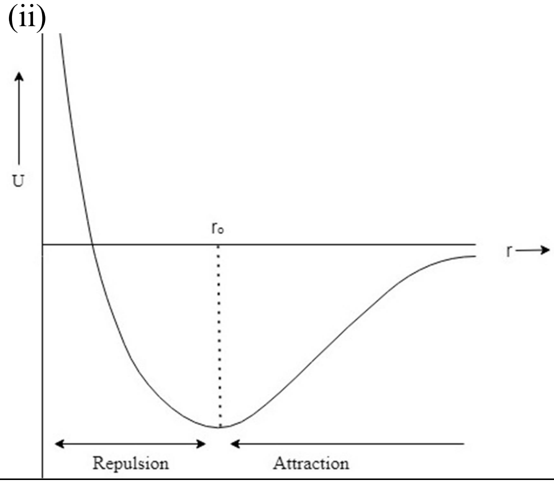
Expression for average power consumed	2
Power Factor for	
(i) Purely Inductive circuit	½
(ii) Purely Resistive Circuit	½

Instantaneous Power;

$$P = VI = (V_m \sin \omega t) \times i_m \sin(\omega t + \phi)$$ ½

$$P = \frac{V_m i_m}{2}[\cos \phi - \cos(2\omega t + \phi)] \quad ----(1)$$ ½

The average power over a cycle is given by the average of the two terms in the R.H.S of equation (1). It is only the second term which is time dependent .Its average is zero (the positive half of the cosine cancels the negative half). Therefore, ½

	$P_{avg} = \frac{V_m I_m}{2}\cos\phi = \frac{V_m}{\sqrt{2}}\frac{I_m}{\sqrt{2}}\cos\phi$ $P_{avg} = V_{rms} I_{rms} \cos\phi$ **Alternatively:-** If the expression is deduced using integration, then full credit to be given. (i) Power factor for purely inductive circuit, $\phi = \frac{\pi}{2} \Rightarrow \cos\phi = 0$ (ii) Power factor for purely resistive circuit; $\phi = 0 \Rightarrow \cos\phi = 1$	½ ½ ½	3
28.	(a) (i) Prove that nuclear density is constant — 1 (ii) Graph between potential energy & separation — 1 Two Inferences — ½ + ½ (i) $\rho = \frac{mass}{volume}$ $= \frac{\text{mass number} \times \text{mass of nucleon}}{volume\ of\ nucleus}$ $\rho = \frac{A \times m}{\frac{4}{3}\pi\left(R_0 A^{1/3}\right)^3} = \frac{3m}{4\pi R_o^3}$ Hence, density is independent of mass number. (ii) 	½ ½ 1	

Inferences

-The force is attractive for distances larger than r_o. ½

- The force is repulsive for distance less than r_o. ½

Alternatively:-

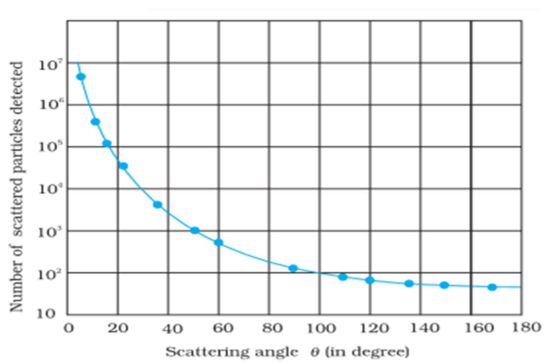
Any other relevant inference drawn from the graph should be given full credit.

OR

(b)

(i) Graph to show the variation of the number of scattered particles as a function of scattering angle.	1
(ii) Two conclusions	½ + ½
Discovery of nucleus	1

(i)



1

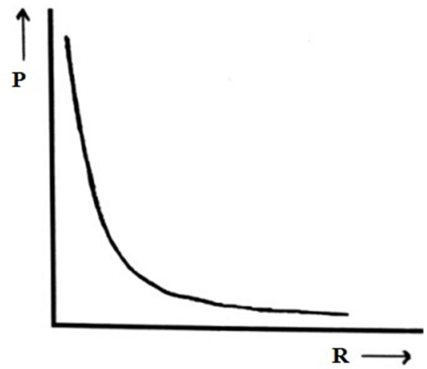
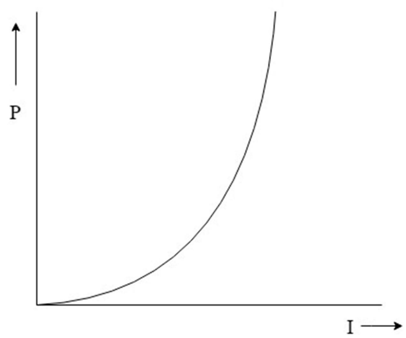
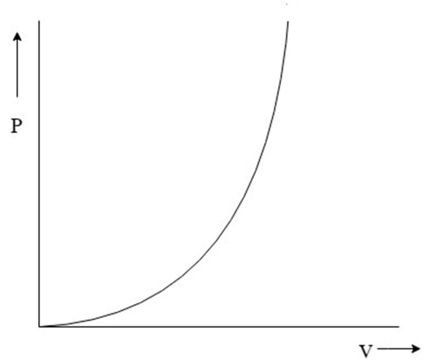
(ii)- The entire positive charge and most of the mass of the atom are concentrated in a small space. ½

-Many of the α-particles pass through the foil. It means that they do not suffer any collisions. ½

To deflect the α-particle backwards, a large repulsive force is required, which is provided only if the greater part of the mass of the atom & its positive charge were concentrated tightly at its centre. This lead to the discovery of the nucleus in the atom. 1

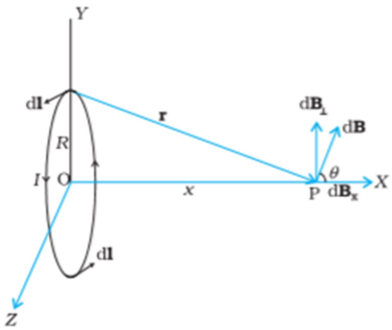
3

29.	Induced Emf 2 Induced Current 1		
	$\phi_B = \vec{B} \bullet \vec{A} = BA\cos 0^o$ $= (5t^2 + 2t + 10) \times (25 \times 10^{-2} \times 20 \times 10^{-2})$ $\lvert\varepsilon\rvert = \left\lvert -\frac{d\phi_B}{dt} \right\rvert$	½	
	$= 5 \times 10^{-2} \times (10t + 2)$	½	
	At t = 5 sec; $\varepsilon = (5 \times 10^{-2}) \times (52)$	½	
	$\varepsilon = 2.6$ V	½	
	$I = \frac{\varepsilon}{R}$	½	
	$= \frac{2.6}{4}$ $I = 0.65$ A	½	3
30.	Graph showing variation of power consumed by the resistor as a function of: (a) R, keeping V constant 1 (b) I, keeping R constant 1 (c) V, keeping R constant 1		

	(a) $P = \frac{V^2}{R}$; keeping V constant  	1	
	(b) $P = I^2 R$; keeping R constant  	1	
	(c) $P = \frac{V^2}{R}$; keeping R constant  	1	3

	SECTION D		
31.	(a) (i) For a moving coil galvanometer Principle 1 Working 1 Reason it cannot be used as such 1 (ii) Reason for radial field 1 How radial field is achieved 1 (i) Principle – When a rectangular loop carrying current I is placed in a uniform magnetic field, it experiences a torque. Working:- When a current flows through the coil of a galvanometer, a torque acts on it. $\tau = NiAB\sin\theta$ For radial magnetic field; $\sin\theta = 1$ The spring provides a counter or restoring toqrue $k\phi$. $k\phi = NiAB$ **In equilibrium;** $\phi = \left(\frac{NAB}{k}\right)i$ Galvanometer cannot be used as such to measure current because: -It has large resistance and hence will change the value of current in the circuit. -It is a sensitive device. (Any one of the above) (ii) The magnetic field is made radial in a moving coil galvanometer so that the magnetic dipole moment $(\vec{m})$ is always perpendicular to the magnetic field $(\vec{B})$ Hence, $\sin\theta = 1$ always **Alternatively:** The magnetic field is made radial in a moving coil galvanometer to make the scale linear. It is achieved by using curved magnetic poles. **Alternatively:-**By using soft iron cylindrical core. **OR** (b) (i) Derivation of expression for magnetic field on the axis of a current carrying loop. 3 (ii) Two differences between diamagnetic and paramagnetic substance. 1+1	1 1 1 1 1	

(i)



½

$$dB = \frac{\mu_0}{4\pi}\frac{I|d\mathbf{l}\times\mathbf{r}|}{r^3}$$

½

$$= \frac{\mu_o idl\sin 90^o}{4\pi\left(x^2+R^2\right)}$$

½

$dB_\perp$ cancels out.

Net B = $\int dB_x = \int dB\cos\theta$

½

$$= \frac{\mu_o}{4\pi}\int\frac{idl}{\left(x^2+R^2\right)}\times\frac{R}{\left(x^2+R^2\right)^{1/2}}$$

$$= \frac{\mu_o iR}{4\pi\left(x^2+R^2\right)^{3/2}}\int dl$$

$$= \frac{\mu_o iR}{4\pi\left(x^2+R^2\right)^{3/2}}\ (2\pi R)$$

½

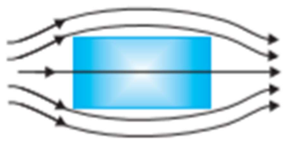
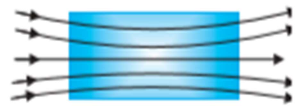
$$\mathbf{B} = B_x\hat{\mathbf{i}} = \frac{\mu_0 I R^2}{2\left(x^2+R^2\right)^{3/2}}\hat{\mathbf{i}}$$

½

(ii) Differences

Diamagnetic Materials	Paramagnetic Materials
(i) Susceptibility is between -1 and 0.	(i) Susceptibility is a small positive number.(slightly greater than zero.)
(ii) Relative permeability is between 0 and 1.	(ii) Relative permeability is slightly greater than 1.
(iii) $\mu < \mu_o$	(iii) $\mu > \mu_o$
(iv) Tendency to move from stronger to weaker part of external magnetism.	(iv) Tendency to move from region of weak to strong magnetic field.

1+1

(v) is repelled by a magnet.	(v) is weakly attracted by a magnet.
(vi) Field inside the material is reduced.	(vi) Field inside is slightly enhanced.
(vii) 	(vii) 

Any two of the above mentioned differences.

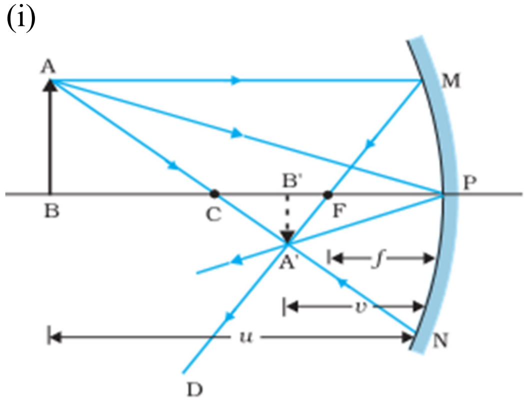
5

32.

(a)

(i) Ray diagram showing formation of real image in a concave mirror.	1
Obtaining the relation between u,v and R	2
(ii) Position of image formed	1
Height of image formed	1

(i)



1

From Fig. the two right-angled triangles A′B′F and MPF are similar. (For paraxial rays, MP can be considered to be a straight line perpendicular to CP.) Therefore,

$$\frac{B'A'}{PM} = \frac{B'F}{FP}$$

$$\text{or } \frac{B'A'}{BA} = \frac{B'F}{FP} \quad (\because PM = AB)$$

-----(i)

½

Since ∠ APB = ∠ A′PB′, the right angled triangles A′B′P and ABP are also similar. Therefore,

$$\frac{B'A'}{BA} = \frac{B'P}{BP}$$ -----(ii) ½

Comparing equations (i) and (ii)

$$\frac{B'F}{FP} = \frac{B'P - FP}{FP} = \frac{B'P}{BP}$$ -----(iii) ½

B′ P = – v, FP = – f, BP = – u;

Using these in Eq.(iii) we get $\frac{1}{v} + \frac{1}{u} = \frac{1}{f} = \frac{2}{R}$ ½

Alternatively:- If the result derived by any other method, full credit to be given.

(ii) For lens: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ ½

$u = -5m; \quad f = +1m$

$$\frac{1}{v} - \frac{1}{-5} = \frac{1}{(+1)}$$

$\Rightarrow v = \frac{5}{4}m = 1.25m$ ½

$m = \frac{I}{O} = \frac{v}{u} = \frac{\left(+5/4\right)}{(-5)}$ ½

I = (- 0.25) × (1.8)

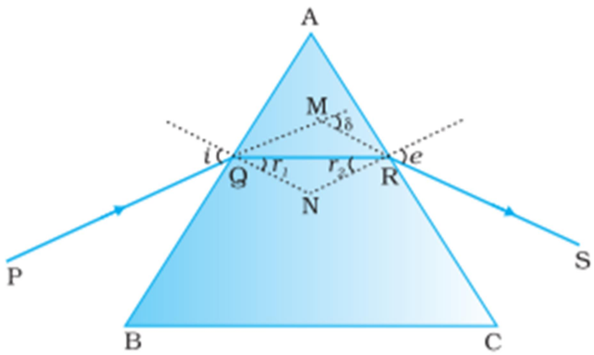
I = - 0.45 m ½

OR

(b)

(i) Ray diagram showing refraction of a ray of light through a rectangular glass prism.	1
Obtaining the relation between $\mu, A \,\&\, \delta_m$	2
(ii) Finding Refractive Index of material of the lens.	2

(i)



1

In the quadrilateral AQNR, two of the angles (at the vertices Q and R) are right angles. Therefore, the sum of the other angles of the quadrilateral is 180º.

$\angle A + \angle QNR = 180^o$

From the triangle QNR, $r_1 + r_2 + \angle QNR = 180^o$

Comparing these two equations, we get

$r_1 + r_2 = A$ -------(i) ½

The total deviation δ is the sum of deviations at the two faces,

$\delta = (i - r_1) + (e - r_2)$ that is, $\delta = i + e - A$ -------(ii) ½

When $\delta = \delta_m$; $i = e$ & $r_1 = r_2$

From (i); $2r = A$ or $r = A/2$ ½

From (ii); $\delta_m = 2i - A$ or $i = \frac{A+\delta_m}{2}$

$$\mu = \frac{\sin i}{\sin r} = \frac{\sin(\frac{A+\delta_m}{2})}{\sin A/2}$$ ½

(ii) Given; P = - 5D

f (in cm) $= \frac{100}{(-5)} =$ - 20 cm ½

Using Lens Maker's formula ; $\frac{1}{f} = (\mu - 1)[\frac{1}{R_1} - \frac{1}{R_2}]$ ½

$$\frac{1}{(-20)} = (\mu - 1)[\frac{1}{(-20)} - \frac{1}{(+20)}]$$

$$\frac{1}{(-20)} = (\mu - 1)[-\frac{1}{10}]; \quad \mu - 1 = \frac{1}{2}$$ ½

$$\Rightarrow \mu = \frac{3}{2} = 1.5$$ ½

5

33.

(a)

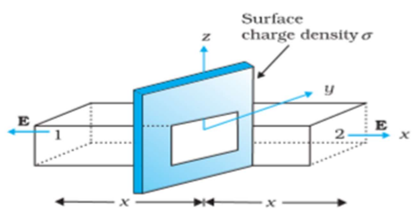
(i) Definition & SI Unit of Electric Flux	½+ ½
(ii) Deriving the expression for electric field due to a uniformly charged infinite plane sheet.	2
(iii) Net charge enclosed by the cube	2

(i) $\phi = \vec{E}.\vec{A}$ ½

Alternatively: Electric flux is the number of electric field lines passing through an area normally.

S.I. unit of electric flux Nm^2/C or V-m. ½

(ii)



½

From Gauss's law:- $\phi = \oint \vec{E} \cdot \overrightarrow{dA} = \frac{q}{\varepsilon_o}$ ½

$2EA = \frac{\sigma A}{\varepsilon_o}$ ½

$E = \frac{\sigma}{2\varepsilon_o}$ ½

Alternatively: If the shape of the Gaussian surface is taken cylindrical, full credit to be given.

(iii)

$\phi_L = Eds\cos 180^o = -Eds$ ½

$= -BL^2$

$\phi_R = Eds\cos 0^0 = Eds$ ½

$= (AL + B)L^2 = AL^3 + BL^2$

Net flux $= \phi_L + \phi_R$

$= (AL^3 + BL^2) - BL^2$

Net flux = $AL^3 = \frac{q}{\epsilon_o}$ ½

=> $q = AL^3 \epsilon_o$ ½

OR

(b)

(i) Definitions & S.I. Unit of electric potential	½ + ½
(ii) Derivation of expression of Equivalent capacitance	2
(iii) Calculation of Electrostatic Potential Energy	2

(i) Electrical Potential – Electrostatic potential at any point in a region with electrostatic field is the work done in bringing a unit positive charge (without acceleration) from infinity to that point. ½

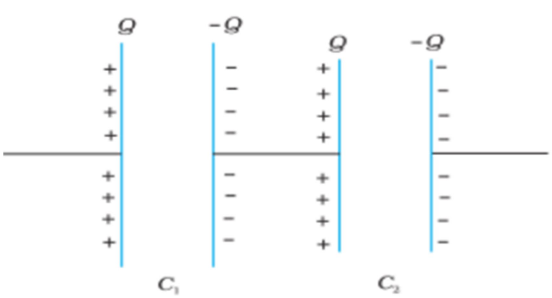
Alternatively:-

$$V = \frac{Work\ Done}{q}$$

$$V = -\int \vec{E} \cdot \vec{dl}$$

S.I. unit of electrostatic potential is volt. ½

Alternatively:-
S.I. unit is J/C.



½

$$V = V_1 + V_2 = \frac{Q}{C_1} + \frac{Q}{C_2}$$ ½

$$\frac{Q}{Ceq.} = Q\left(\frac{1}{C_1} + \frac{1}{C_2}\right)$$ ½

$$\frac{1}{Ceq.} = \frac{1}{C_1} + \frac{1}{C_2}$$ ½

(iii)

Potential energy of the system = $K\left[\frac{Q(-q)}{4a} + \frac{Qq}{3a} - \frac{q^2}{5a}\right]$ ½

Potential energy of the system = 0

$$\Rightarrow K\left[\frac{-Qq}{4a}+\frac{Qq}{3a}-\frac{q^2}{5a}\right]=0$$ ½

$$\Rightarrow \frac{-Q}{4}+\frac{Q}{3}-\frac{q}{5}=0$$

$$\Rightarrow +\frac{Q}{12}-\frac{q}{5}=0$$ 1

$$\Rightarrow Q=+\ \frac{12q}{5}$$ 5

SECTION E

34.

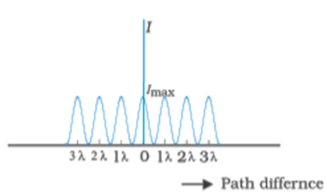
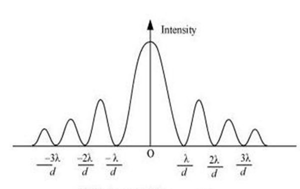
(a) Effect on width of central maximum	1
(b) Condition for first minimum	1
(c) Differences between interference and diffraction patterns	2
OR	
Reason	2

(a) $\beta_o \ \alpha \ \lambda$

β_o will increase with increase in wavelength. 1

(b) When path difference $a\theta = \lambda$ or at an angle ; $\theta \approx \lambda / a$ 1

(c) Differences 1+1

Interference Pattern	Diffraction Pattern
(i) All the maxima are equally spaced. (ii)The dark fringe is having zero intensity. (iii) All the maxima are of the same intensity. (iv)  **Alternatively:-** -It is obtained by the superposition of	(i) Width of Central bright maxima is twice the width of the other maxima. (ii) The dark fringe is not completely dark. (iii) There is a sharp decrease in the intensity of maxima after the central bright maxima. (iv)  It is obtained by the superposition

two waves originating from two sources/slits.	of waves from points on a single slit.

Any two of the above differences.

OR

(c) The opening (slit) is 3m; which is of the order of the wavelength of sound waves whereas it is very large compare to the wavelength of light.
Hence, sound can bend around the obstacle while light cannot. 2

4

35.

(a) Time taken by the electron to strike the edge.	1
(b) Shape of path followed by the electron and it's reason	½+ ½
(c) Potential Difference applied	2
OR	
(c) Magnitude and Direction of magnetic field	1+1

(a) Electron strikes the edge after travelling 3 cm horizontally (along x-axis).

$S_x = v_x \times t$ ½

$3 \times 10^{-2} = (3 \times 10^{7}) \times t$

$t = 10^{-9}$ s ½

(b) Shape of the path is parabola. ½

Reason: Force/acceleration is in a fixed direction perpendicular to the initial velocity. ½

(c) Along y-direction

$S_y = u_y t + \frac{1}{2} a_y t^2$

$-0.5 \times 10^{-2} = 0 + \frac{1}{2} a_y (10^{-9})^2$

$a_y = -10^{16}$ m/s^2 ½

Magnitude of acceleration $(a_y) = \frac{eE}{m} = \frac{e}{m}\left(\frac{V}{l}\right)$ ½

$V = \frac{10^{16} \times 9.1 \times 10^{-31} \times 1 \times 10^{-2}}{1.6 \times 10^{-19}}$ ½

$V = 568.75$ V ½

OR

(c) $|qE| = |qvB|$; $B = \frac{E}{v} = (\frac{ma_y}{e})(\frac{1}{v})$ ½

Along y-direction

	$S_y = u_y t + \frac{1}{2} a_y t^2$ $-0.5 \times 10^{-2} = 0 + \frac{1}{2} a_y (10^{-9})^2$ $a_y = -10^{16}\ m/s^2$ $B = \left(\frac{9.1 \times 10^{-31} \times 10^{16}}{1.6 \times 10^{-19}}\right) \times \left(\frac{1}{3 \times 10^7}\right)$ $B = 1.9 \times 10^{-3} T$ Direction of magnetic field will be out of the plane of the paper.	½ 1	4