Marking Scheme Strictly Confidential (For Internal and Restricted use only) Senior School Certificate Examination, 2025 SUBJECT NAME PHYSICS [PAPER CODE 55/S/1]	
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/S/1			
Q. No.	**VALUE POINTS/EXPECTED ANSWERS**	**Marks**	**Total Marks**
	SECTION A	1	1
1.	(C) It will oscillate about its original position	1	1
2.	(A) directly proportional to Z.	1	1
3.	(A) 0.8×10^{-15} m	1	1
4.	(A) h	1	1
5.	(B) the resistance of the coil	1	1
6.	(B) Ultraviolet rays	1	1
7.	(C) In parallel a resistance of 12 Ω	1	1
8.	(A) 80 mV	1	1
9.	(B) Remains the same	1	1
10.	(B) 198 V	1	1
11.	(A) Attract each other	1	1
12.	(B) The same flux links both the primary and secondary coils	1	1
13.	(C) Assertion (A) is true, but reason (R) is false	1	1
14.	(D) Both Assertion (A) and Reason (R) are false.	1	1
15.	(B) Both Assertion (A)and Reason (R)are true ,but Reason (R) is not the correct explanation of the Assertion (A).	1	1
16.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).	1	1
SECTION - B			
17.	(a) Finding the threshold frequency for Caesium 1 (b) Finding the wavelength of the incident light 1		
	(a) $\frac{\phi_0}{h} = \nu_0$	½	
	$= \frac{2.14 \times 1.6 \times 10^{-19}}{6.63 \times 10^{-34}}$ $= 5.16 \times 10^{14}$ Hz	½	
	(b) $\frac{hc}{\lambda} = K_{max} + \phi_0$	½	
	$\lambda = \frac{hc}{K_{max} + \phi_0}$ $\lambda = \frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{(2.14 + 0.86) \times 1.6 \times 10^{-19}}$ $\lambda = 4.14 \times 10^{-7}$ m	½	2
18.	(a) Expression for the focal length of combined lens 2		

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

For plano convex lens

$$\frac{1}{f_1} = (\mu_1 - 1)\left(\frac{1}{\infty} - \frac{1}{-R}\right)$$ ½

$$\frac{1}{f_1} = \frac{(\mu_1 - 1)}{R}$$

For concave lens

$$\frac{1}{f_2} = (\mu_2 - 1)\left(\frac{1}{-R} - \frac{1}{R}\right)$$ ½

$$\frac{1}{f_2} = -2\frac{(\mu_2 - 1)}{R}$$

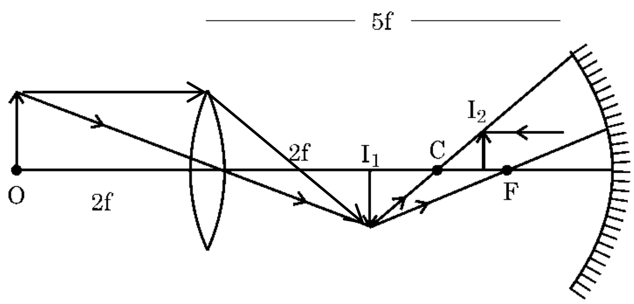
$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$ ½

$$f = \frac{R}{\mu_1 - 2\mu_2 + 1}$$ ½

OR

(b)

- Ray diagram 1
- Calculation of distance of final image from the mirror 1



1

$u = -3f$

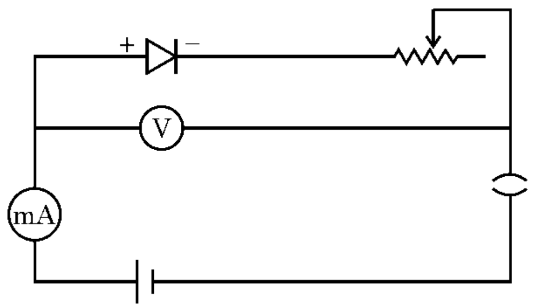
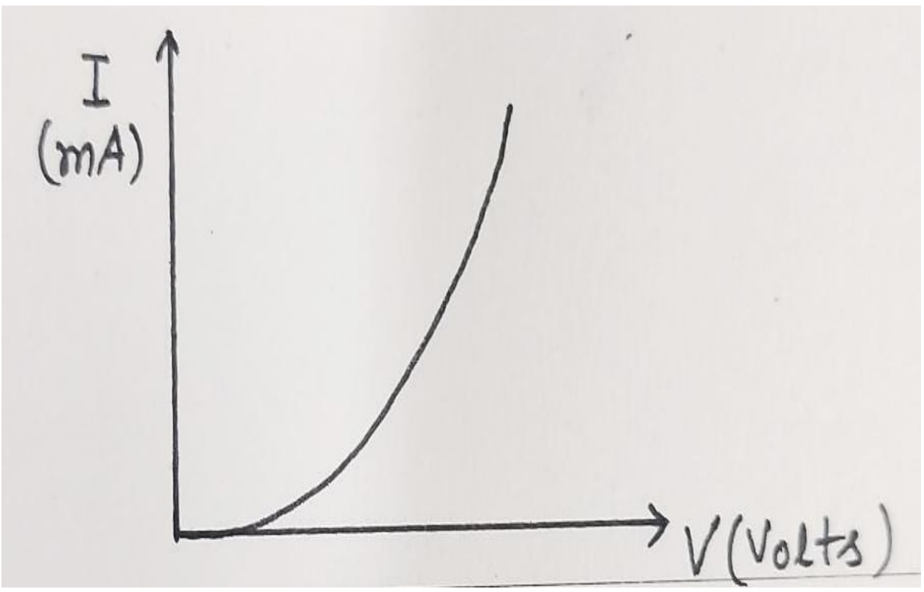
$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$ ½

$$\frac{-1}{f} = -\frac{1}{3f} + \frac{1}{v}$$

$$v = \frac{-3}{2}f$$ ½ 2

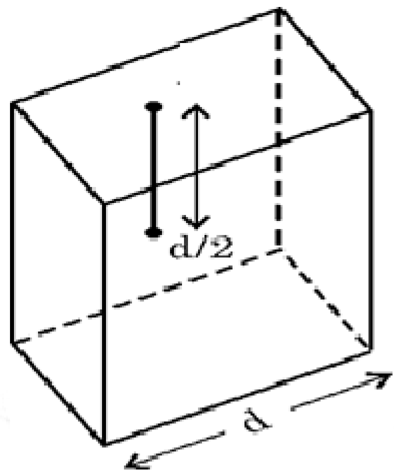
19.

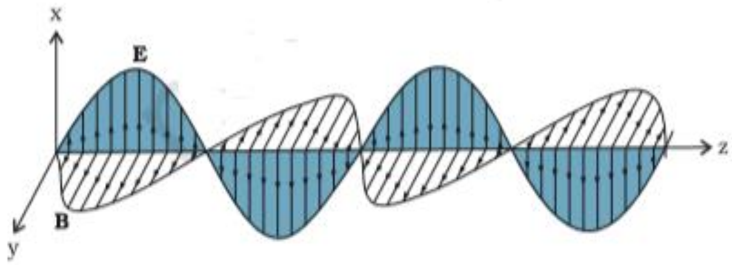
Finding the current supplied by the battery 2

	$\frac{R_{AB}}{R_{BC}} = \frac{R_{AD}}{R_{DC}} = \frac{4}{1}$ The bridge is balanced. Resistance of the circuit between points A and C. $\frac{1}{R} = \frac{1}{(8+2)} + \frac{1}{(4+1)}$ $R = \frac{10}{3}\Omega$ $I = \frac{E}{R+r}$ $I = \frac{5}{\frac{10}{3}+\frac{2}{3}}$ $I = 1.25\,A$	½ ½ ½ ½	2
20.	• Circuit diagram for characteristics of a p-n junction diode 1 • Describing the method to obtain p-n junction diode characteristics ½ • Drawing the shape of characteristics ½ •  • A very small current flows till the applied voltage reaches the barrier potential in the forward bias p-n junction diode. Diode current increases significantly when applied voltage becomes greater than barrier potential. •  	1 ½ ½	2

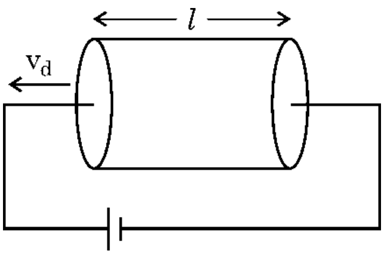
21.	Calculation of the wavelength of light 2		
	$\beta = \frac{D\lambda}{d}$	½	
	$\frac{\beta_1}{\beta_2} = \frac{\lambda_1}{\lambda_2}$	½	
	$\lambda_2 = \frac{\beta_1}{\beta_2} \times \lambda_1$		
	$\lambda_2 = \frac{8.1}{7.2} \times 640$	½	
	$\lambda_2 = 720\,\text{nm}$	½	2

SECTION - C

22.	• Defining electric flux ½ • Stating scalar or vector quantity ½ • Obtaining expression for the electric flux through the square 1 • Effect on electric flux through the square 1		
	Electric flux : The electric flux may be defined as the number of electric lines of force crossing through a surface normal to the surface. $\phi = \oint \vec{E}.d\vec{s}$	½	
	Electric flux is a scalar quantity. Draw a cube of side d such that it completely encloses the charge q.	½	
			
	Total flux through the cube, $\phi_E = \frac{q_{en}}{\varepsilon_0}$	½	
	Flux through one face (square) $= \frac{q_{en}}{6\varepsilon_0}$	½	
	If a charge is now moved to the point of a distance d from the center of square and side of the square is doubled, then electric flux through square remains unchanged because electric flux through a closed surface depends only on the amount of charge contained inside the closed surface and is independent of the size of the Gaussian surface.	1	3

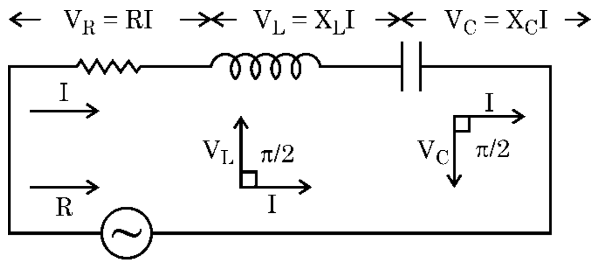
23.	• Depicting the variation of electric and magnetic fields of an electromagnetic wave along z-axis 1 • Finding a) The wavelength of the wave 1 b) The amplitude of the associated magnetic field 1 a)  $\lambda = \frac{c}{v}$ $= \frac{3\times10^{8}}{1.5\times10^{10}} = 2\times10^{-2} = 0.02\,\text{m}$ b) $B_0 = \frac{E_0}{c}$ $= \frac{36}{3\times10^{8}}$ $= 1.2\times10^{-7}$ T	1 ½ ½ ½ ½	3
24.	• Writing three postulates of Bohr's model of hydrogen atom 1½ • Showing that the frequency of revolution of an electron in its nth orbit $\alpha \frac{1}{n_3}$ 1 ½ Bohr's Postulates (i) An electron in an atom could revolve in certain stable orbits without the emission of radiant energy. (ii) Electron revolves around the nucleus only in those orbits for which the angular momentum is some integral multiple of h/2π. (iii) An electron might make a transition from one of its specified non-radiating orbits to another of lower energy. When it does so, a photon is emitted having energy equal to the energy difference between the initial and final states. The frequency of the emitted photon is then given by $h\nu = E_i - E_f$ As frequency of revolution of electron is given by $\nu = \frac{v}{2\pi r}$ ....(1)	½ ½ ½	

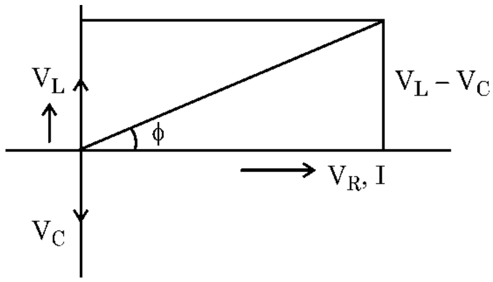
	In Bohr's model the velocity of the electron in the nth orbit is		
	$\upsilon_n = \frac{e^2}{2\varepsilon_0 nh}$		
	$\upsilon_n \ \alpha \ \frac{1}{n}$ ....(2)	½	
	and radius of the electron in the nth orbit is		
	$r_n = \frac{\varepsilon_0 n^2 h^2}{\pi m e^2}$		
	$r_n \ \alpha \ n^2$ ....(3)	½	
	Using (3) and (2) in (1)		
	$v \ \alpha \ \frac{1}{n^3}$	½	3
25.	(a) i. Finding capacitive reactance and Peak value of current 1+1 ii. Finding change in capacitive reactance and current ½ + ½		
	(i)		
	$X_c = \frac{1}{2\pi \nu C}$	½	
	$= \frac{1}{2\pi \times \frac{125}{\pi} \times 20 \times 10^{-6}}$		
	$= 200\ \Omega$	½	
	$I_0 = \frac{V_0}{X_C}$		
	$= \frac{220 \times 1.414}{200}$	½	
	$= 1.6\ \text{A}$ or $1.1\sqrt{2}\ \text{A}$	½	
	(ii) X_c becomes half	½	
	Current becomes double.	½	
	OR		
	Calculating (i) Radius of the circular path 1 (ii) Frequency of rotation 1 (iii) Energy 1		
	(i) $r = \frac{m\upsilon}{qB}$	½	
	$= \frac{9 \times 10^{-31} \times 3.2 \times 10^{7}}{1.6 \times 10^{-19} \times 4.5 \times 10^{-4}}$		
	$= 0.4\ \text{m}$	½	
	(ii) $\upsilon = \frac{\nu}{2\pi r}$	½	

	$= \frac{3.2 \times 10^7}{2\pi \times 0.4}$ $= \frac{4}{\pi} \times 10^7$ Hz (iii) $E = \frac{1}{2} m v^2$ $= \frac{1}{2} \times 9 \times 10^{-31} \times 3.2 \times 3.2 \times 10^{14}$ $= 4.608 \times 10^{-16}$ J	½ ½ ½	3
26.	• Defining binding energy 1 • Calculating energy released 2 Binding energy : Energy released in bringing all the nucleons of a nucleus together to form a nucleus. Alternatively – Energy required to separate the nucleons from the nucleus. Binding Energy of X, $B.E_X = 240 \times 7.6$ $= 1824$ MeV Binding Energy of Y, $B.E_Y = 120 \times 8.5 = 1020$ MeV Energy released $E = 2(B.E_Y) - (B.E_X)$ $= (2 \times 1020) - 1824$ $= 216$ MeV	1 ½ ½ ½ ½	3
27.	• Defining drift velocity 1 • Deriving expression for current flowing through the conductor in terms of drift velocity 2 The drift velocity is defined as average velocity with which free electrons in a conductor get drifted under the influence of electric field applied across the conductor. Let us consider a conductor of length *l* and cross-sectional area A connected across the battery of voltage V.  Let n be the electron density current flowing through the conductor is given by $I = \frac{\text{Total charge}}{\text{time}}$ …. (1)	1 ½	

	i.e. $Q = nAL \times e$ …. (2) $t = \frac{L}{v_d}$ …. (3) Using (2) and (3) in (1) $I = \frac{Q}{t} = \frac{nALe}{L/v_d}$ $I = neAv_d$	 ½ ½ ½	 3
28.	Calculating (a) The magnetic moment $\vec{m}$ of the loop 1 ½ (b) the torque $\vec{\tau}$ acting on the loop 1 ½ (a) $\vec{m} = I\vec{A} = I\,\lvert\vec{A}\rvert\,\hat{n}$ $= 0.25\text{ A} \times (4 \times 5 \times 10^{-4}\text{ m}^2)\,[0.8\hat{i} - 0.6\hat{j}]$ $= 5 \times 10^{-4}\,(0.8\hat{i} - 0.6\hat{j})\text{ A m}^2$ (b) $\vec{t} = \vec{m} \times \vec{B}$ $= 5 \times 10^{-4}(0.8\hat{i} - 0.6\hat{j}) \times (0.2\hat{j} + 0.5\hat{k})\text{ N m}$ $= 5 \times 10^{-4}(0.16\hat{k} - 0.4\hat{j} - 0.3\hat{i})\text{ N m}$ $= 5 \times 10^{-4}(-0.3\hat{i} - 0.4\hat{j} + 0.16\hat{k})\text{ N m}$	 ½ ½ ½ ½ ½ ½	 3
	SECTION - D		
29.	(i) (a) (D) 2.59 cm OR (b) (C) 9.47 cm (ii) (B) 10 (iii) (A) Real inverted and magnified. iv) (B) The object is at a distance more than f_0 and less than 2 f_0 from the objective	1 1 1 1	 4
30.	(i) (a) (C) Majority charge carrier is n type semiconductors are holes. OR (b) (D) The drift current and the diffusion current cancel each other. (ii) (B) Phosphorus (iii) (A) 0.72 eV (iv) (C) Increases and the depletion layer width also increases.	1 1 1 1	 4
	SECTION – E		
31.	(a) (i) Obtaining (I) Impedance of the circuit using phase diagram 2 (II) Expression for the instantaneous current ½ (III) Phase relationship of current to the applied voltage ½ (ii) Defining power factor of ac circuit 1 Stating conditions in which power factor is (I) Maximum ½ (II) Minimum ½ (a) (i) (I) Let resistance R, inductor L and capacitor C be connected in series		

with an alternate e.m.f.





½

$\mathcal{E} = \sqrt{I^2[R^2+(X_L-X_c)^2]}$ ½

$Z = \dfrac{\mathcal{E}}{I}$ ½

$Z = \sqrt{R^2+(X_L-X_C)^2}$ ½

(II) $I_m = \dfrac{V_m}{Z}\sin(\omega t-\phi)$ ½

(III) Phase angle $\tan\phi = \dfrac{V_L - V_C}{V_R}$ ½

(ii) $P = E_V I_V \cos\phi$ where P = true power and $E_V I_V$ is the apparent power. ϕ is phase difference between current and voltage.
Power factor is defined as the ratio of true power to the apparent power. 1

Power factor = $\dfrac{\textit{True Power (P)}}{\textit{Apparent power } (E_V I_V)}$ = cos ϕ

(i) Power factor is maximum when ϕ = 0 purely resistive circuit(It occurs when $\omega = \dfrac{1}{\sqrt{LC}}$ at resonance in an LCR series circuit). ½

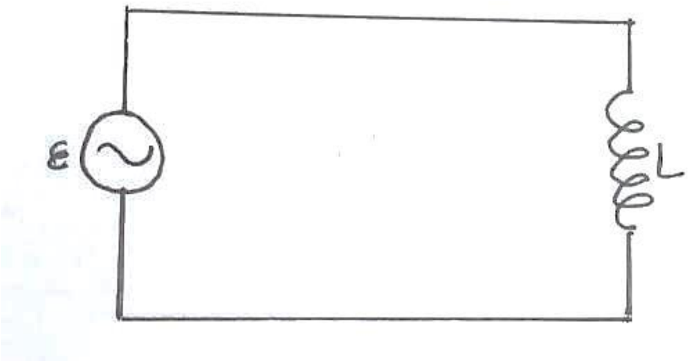
(ii) Power factor is minimum when ϕ = $\dfrac{\pi}{2}$, in pure inductive or capacitive circuit. ½

(b)

(i) Proving that the voltage is ahead of current in phase by π/2 radian in an AC circuit containing an ideal inductor	3
(ii) Drawing graph showing the variations of	
(I) Magnitude of induced emf with rate of change of current	1
(II) Energy stored in inductor with current	1

(i) Let the voltage across the source be

$$\upsilon = \upsilon_m \sin \omega t$$



½

Using Kirchhoff's loop rule

$$\upsilon - L\frac{di}{dt} = 0$$

$$\frac{di}{dt} = \frac{\upsilon}{L} = \frac{\upsilon_m}{L}\sin \omega t$$

$$di = \frac{\upsilon_m}{L}\sin \omega \text{t}\, dt$$ 1

Integrating

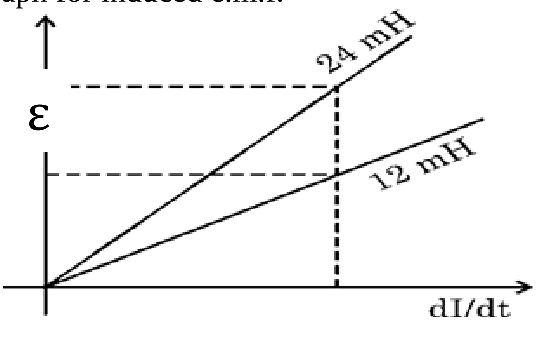
$$i = \frac{\upsilon_m}{\omega L}\cos \omega t$$ ½

$$i = i_m \sin(\omega t - \frac{\pi}{2})$$ ½

This show that current lags behind the voltage by $\frac{\pi}{2}$ rad.

$\therefore$ Voltage is ahead of current in phase by $\frac{\pi}{2}$ rad ½

(ii) (I) Graph for induced e.m.f.



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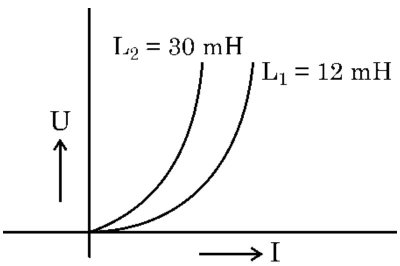
(II) Graph for energy stored



1

5

32.	(a) (i) Calculating the new value for the capacitor with justification (I) Charge ½ + ½ (II) Potential Difference ½ + ½ (III) Energy stored ½ + ½ (ii) Drawing the pattern of electric field lines for (I) Positively charged conducting sphere 1 (II) An electric dipole 1		

(i) (I) Charge will become half

Charge will flow from capacitors A (high potential) to capacitor B (low potential) till they achieve equilibrium.

Alternatively

$$q_A = cv \qquad q_B = 0$$

$$V_{common} = \frac{q_A + q_B}{c_A + c_B} = \frac{cv}{2c} = \frac{v}{2}$$ ½

$$q_A' = cv_{common} = \frac{cv}{2} = \frac{q_A}{2}$$ ½

(II) Potential difference will become half.

$$V_{common} = \frac{q_A + q_B}{c_A + c_B}$$ ½

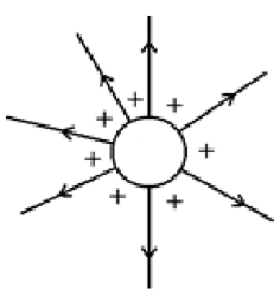
$$= \frac{cv + 0}{2c} = \frac{v}{2}$$ ½

(III) Energy stored will becomes one fourth

$$U_A = \frac{1}{2}CV^2$$ ½

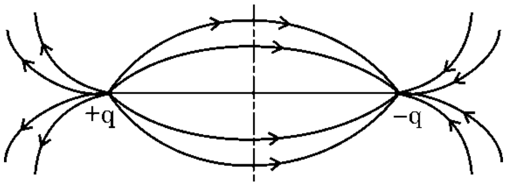
$$U_A' = \frac{1}{2}CV_{common}^2 = \frac{1}{2}C\left(\frac{V}{2}\right)^2 = \frac{U_A}{4}$$ ½

(ii) (I)



1

(II)



1

OR

(b)

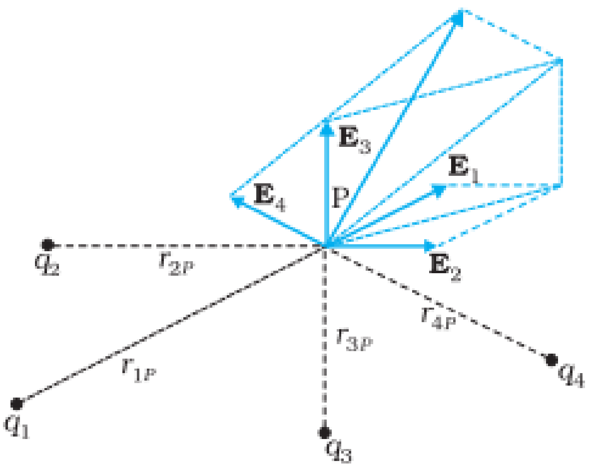
(i) Writing coulomb's law in vector form	1
Determining the electric field due to a system of point charges	2
(ii) Finding sign and magnitude of q	2

(i) $\vec{F}_{21} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r_{21}^2}\hat{r}_{21}$

Alternative: $\vec{F}_{12} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r_{12}^2}\hat{r}_{12}$ 1

OR $\vec{F} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}\hat{r}$

For determining electric field due to a system of point charges



½

$\vec{E}_1 = \frac{1}{4\pi\varepsilon_0}\frac{q_1}{r_{1p}^2}\hat{r}_{1p}$

$\vec{E}_2 = \frac{1}{4\pi\varepsilon_0}\frac{q_2}{r_{2p}^2}\hat{r}_{2p}$ ½

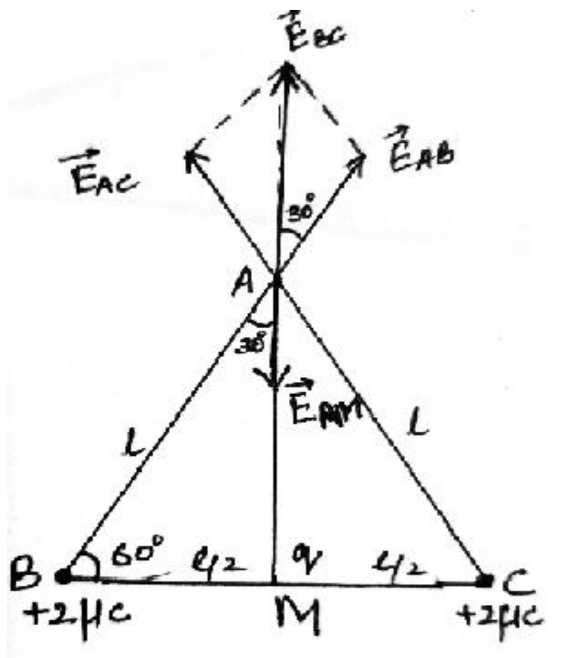
and so on

By superposition principle

$\vec{E} = \vec{E}_1 + \vec{E}_2 + ... + \vec{E}_n$ ½

$\vec{E} = \frac{1}{4\pi\varepsilon_0}\sum_{i=1}^{n}\frac{q_i}{r_{ip}^2}\hat{r}_{ip}$ ½

(ii)



½

From the figure

$$\left|\vec{E}_{AB}\right| = \frac{1}{4\pi\varepsilon_0}\cdot\frac{q}{r^2}$$

$$= \frac{1}{4\pi\varepsilon_0}\cdot\frac{2\times10^{-6}}{l^2}$$

$$\left|\vec{E}_{AC}\right| = \frac{1}{4\pi\varepsilon_0}\cdot\frac{2\times10^{-6}}{l^2}$$

½

$\because \quad \left|\vec{E}_{AB}\right| = \left|\vec{E}_{AC}\right|$

$\therefore$ Resultant of $\vec{E}_{AB}$ & $\vec{E}_{AC}$

$$\vec{E}_{BC} = \vec{E}_{AB} + \vec{E}_{AC}$$

$$\left|\vec{E}_{BC}\right| = 2E_{AB}\cos 30^\circ$$

$$\left|\vec{E}_{BC}\right| = \frac{1}{4\pi\varepsilon_0}\cdot\frac{2\times10^{-6}}{l^2}\frac{\sqrt{3}}{2}$$ ½

$$\left|\vec{E}_{AM}\right| = \frac{1}{4\pi\varepsilon_0}\cdot\frac{q}{\left(\frac{l\sqrt{3}}{2}\right)^2}$$

$\because$ Net electric field at A is zero.

$\therefore \quad E_{AM} = -E_{BC}$

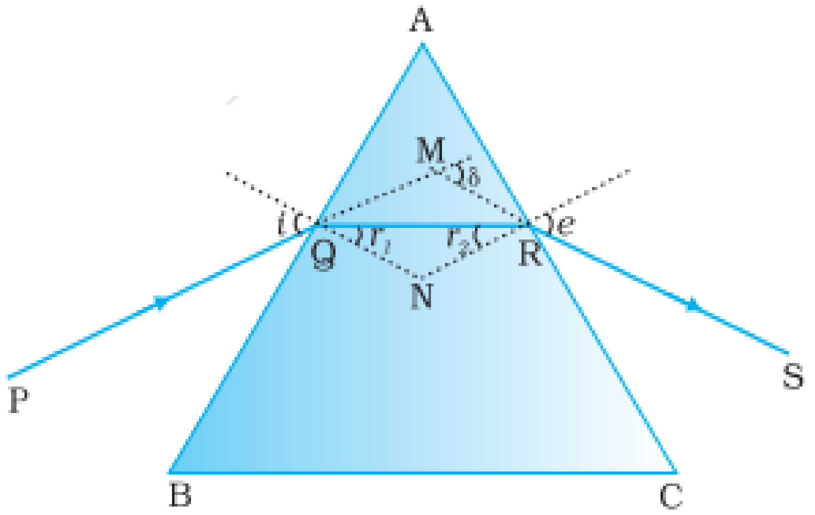
$$\frac{1}{4\pi\varepsilon_0}\cdot\frac{q}{\left(\frac{l\sqrt{3}}{2}\right)^2} = -\frac{2}{4\pi\varepsilon_0}\cdot\frac{2\times10^{-6}}{l^2}\frac{\sqrt{3}}{2}$$

$$q = \frac{-3\sqrt{3}}{2}\times10^{-6}\,\text{C} \; or \; \frac{-3\sqrt{3}}{2}\,\mu\text{C}$$ ½

5

33. (a)

- Deducing expression for refractive index of glass prism in terms of angle of minimum deviation and angle of prism 4
- Writing condition for n for refraction to place on opposite face of prism



1

$A + \delta = i + e$ ½

and $A = r_1 + r_2$ ½

at angle of minimum deviation , $\delta = D_m$

$i = e\ ,\ r_1 = r_2 = r$ ½

$A + D_m = 2i$

$i = \dfrac{A + D_m}{2}$

$A = 2r \Rightarrow r = \dfrac{A}{2}$ ½

From Snell's law

$n = \dfrac{\sin i}{\sin r}$ ½

$$n = \frac{\sin\left(\frac{A + D_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$ ½

For refraction to take place on opposite face

$r_2 < i_c$ ½

$n = \dfrac{1}{\sin i_c}$

$i_c = \sin^{-1}\left(\dfrac{1}{n}\right)$

$r_2 < \sin^{-1}\left(\dfrac{1}{n}\right)$ ½

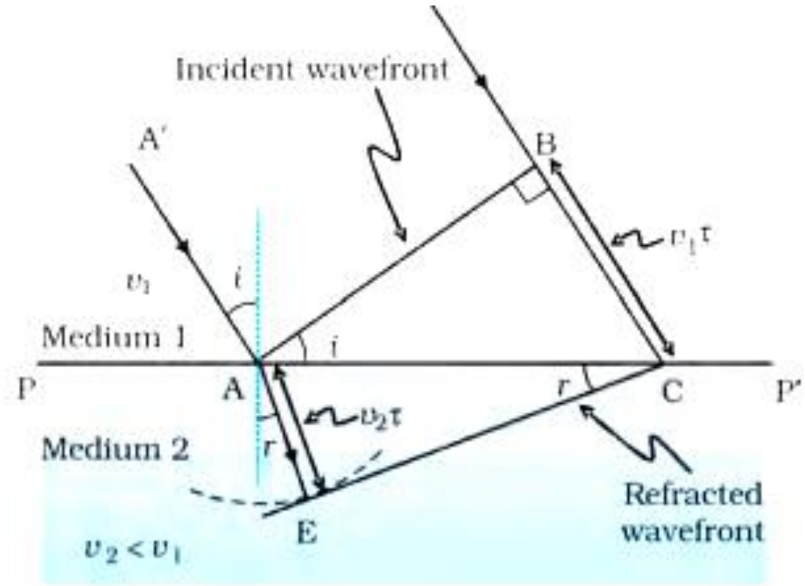
OR

(b)

- Stating Huygen's principle 1
- Drawing diagram 1 ½
- Discussing the case of refraction of plane wave of light from rarer to a denser medium ½
- Deriving Snell's law 2

Huygen's Principle :

Each point of the wavefront is the source of a secondary disturbance and the wavelets emanating from these points spread out in all directions with the speed of the wave. These wavelets emanating from the wavefront are usually referred to as secondary wavelets and if we draw a common tangent to all these spheres, we obtain the new position of the wavefront at a later time. 1



1 ½

Discussion : In time τ distance BC travelled by the incident plane wavefront with the velocity v_1 is $v_1\tau$. To determine the shape of the refracted wave wavefront , draw a sphere of radius $v_2\tau(=AE)$ from point A and draw a tangent from C to E as shown in the diagram. ½

From the above diagram

	$\triangle ABC$ *and* $\triangle AEC$ $\sin i = \frac{BC}{AC} = \frac{v_1\tau}{AC}$ *and* $\sin r = \frac{AE}{AC} = \frac{v_2\tau}{AC}$ $\frac{\sin i}{\sin r} = \frac{v_1}{v_2}$ ....(1) As $n_1 = \frac{c}{v_1}$ *and* $n_2 = \frac{c}{v_2}$ $\therefore \frac{v_1}{v_2} = \frac{n_1}{n_2}$ ....(2) From equations (1) and (2) $n_1 \sin i = n_2 \sin r$	 ½ ½ ½ ½	5