

**Marking Scheme**  
**Strictly Confidential**  
**(For Internal and Restricted use only)**  
**Senior School Certificate Examination, 2025**  
**SUBJECT NAME PHYSICS [PAPER CODE 55/S/2]**

**General Instructions: -**

<b>1</b>	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.
<b>2</b>	<b>“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.”</b>
<b>3</b>	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. <b>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.</b>
<b>4</b>	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.
<b>5</b>	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 deliberation 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.
<b>6</b>	Evaluators will mark( $\surd$ ) wherever answer is correct. For wrong answer CROSS ‘X” be marked. Evaluators will not put right ( $\surd$ ) while evaluating which gives an impression that answer is correct and no marks are awarded. <b>This is most common mistake which evaluators are committing.</b>
<b>7</b>	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.
<b>8</b>	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.
<b>9</b>	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 <b>“Extra Question”</b> .
<b>10</b>	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
<b>11</b>	A full scale of marks <u>0-70</u> (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	<p>Ensure that you do not make the following common types of errors committed by the Examiner in the past:-</p> <ul style="list-style-type: none"> <li>● Leaving answer or part thereof unassessed in an answer book.</li> <li>● Giving more marks for an answer than assigned to it.</li> <li>● Wrong totaling of marks awarded on an answer.</li> <li>● Wrong transfer of marks from the inside pages of the answer book to the title page.</li> <li>● Wrong question wise totaling on the title page.</li> <li>● Wrong totaling of marks of the two columns on the title page.</li> <li>● Wrong grand total.</li> <li>● Marks in words and figures not tallying/not same.</li> <li>● Wrong transfer of marks from the answer book to online award list.</li> <li>● 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.)</li> <li>● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.</li> </ul>
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 “ <b>Guidelines for spot Evaluation</b> ” 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.





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

For plano convex lens

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

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

For concave lens

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

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

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

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

1/2

1/2

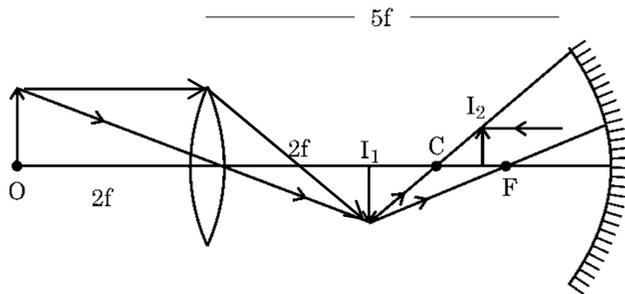
1/2

1/2

OR

(b)

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



1

$$u = -3f$$

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

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

$$v = -\frac{3}{2}f$$

1/2

1/2

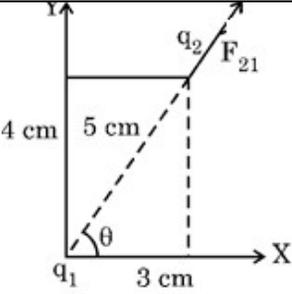
2

20.

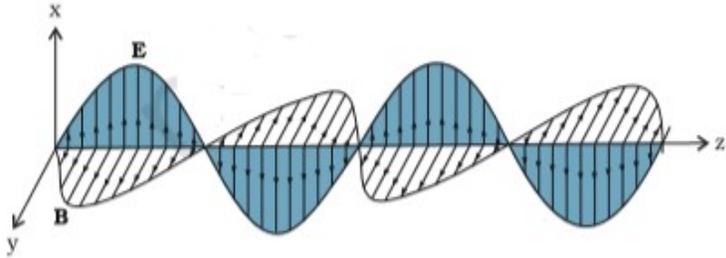
Finding the current supplied by the battery	2
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2

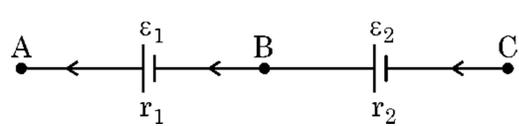
	$\frac{R_{AB}}{R_{BC}} = \frac{R_{AD}}{R_{DC}} = \frac{4}{1}$ <p>The bridge is balanced. Resistance of the circuit between points A and C.</p> $\frac{1}{R} = \frac{1}{(8+2)} + \frac{1}{(4+1)}$ $R = \frac{10}{3} \Omega$ $I = \frac{E}{R+r}$ $I = \frac{5}{\frac{10}{3} + \frac{2}{3}}$ $I = 1.25 \text{ A}$	1/2	
		1/2	
		1/2	
		1/2	2
21.	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">           Calculating the change in the fringe width with change in the distance from the screen. <span style="float: right;">2</span> </div> $\beta = \frac{\lambda D}{d}$ $\beta' = \frac{\lambda D'}{d}$ $\Delta\beta = \beta - \beta' = \frac{\lambda}{d} [D - D']$ $\Delta\beta = \frac{\lambda}{d} [D - (D - 0.1)]$ $\Delta\beta = \frac{600 \times 10^{-9}}{2 \times 10^{-3}} \times 0.1$ $= 3 \times 10^{-5} \text{ m}$	1/2	
		1/2	
		1/2	
		1/2	2
<b>SECTION C</b>			
22.	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">           Finding            (i) magnitude of the force exerted on <math>q_2</math> by <math>q_1</math> <span style="float: right;">2</span>            (ii) angle that the force make with X- axis <span style="float: right;">1</span> </div> (i)		

	 <p> <math display="block"> \vec{F}_{21}  = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2}</math> <math display="block">= \frac{9 \times 10^9 \times 10 \times 10^{-6} \times 20 \times 10^{-6}}{5 \times 5 \times 10^{-4}}</math> <math display="block">= 720 \text{ N}</math> </p> <p>(ii) The angle that the force makes with the <math>x</math>-axis is</p> $\tan \theta = \frac{4}{3}$ $\theta = \tan^{-1}\left(\frac{4}{3}\right)$	<p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p>1</p>	<p>3</p>																
<p>23.</p>	<p>(a)</p> <table border="1" data-bbox="344 911 1260 1031"> <tbody> <tr> <td>i. Finding capacitive reactance and peak value of current</td> <td>1+1</td> </tr> <tr> <td>ii. Finding change in capacitive reactance and current</td> <td><math>\frac{1}{2} + \frac{1}{2}</math></td> </tr> </tbody> </table> <p>(i)</p> $X_c = \frac{1}{2\pi\nu C}$ $= \frac{1}{2\pi \times \frac{125}{\pi} \times 20 \times 10^{-6}}$ $= 200 \Omega$ $I_0 = \frac{V_0}{X_C}$ $= \frac{220 \times 1.414}{200}$ $= 1.6 \text{ A or } 1.1\sqrt{2} \text{ A}$ <p>(ii) <math>X_c</math> becomes half Current becomes double.</p> <p style="text-align: center;">OR</p> <table border="1" data-bbox="305 1675 1276 1843"> <thead> <tr> <th colspan="3">Calculating</th> </tr> </thead> <tbody> <tr> <td>(i) Radius of the circular path</td> <td></td> <td>1</td> </tr> <tr> <td>(ii) Frequency of rotation</td> <td></td> <td>1</td> </tr> <tr> <td>(iii) Energy</td> <td></td> <td>1</td> </tr> </tbody> </table>	i. Finding capacitive reactance and peak value of current	1+1	ii. Finding change in capacitive reactance and current	$\frac{1}{2} + \frac{1}{2}$	Calculating			(i) Radius of the circular path		1	(ii) Frequency of rotation		1	(iii) Energy		1	<p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>	
i. Finding capacitive reactance and peak value of current	1+1																		
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Calculating																			
(i) Radius of the circular path		1																	
(ii) Frequency of rotation		1																	
(iii) Energy		1																	

	<p>(i) <math>r = \frac{mv}{qB}</math></p> $= \frac{9 \times 10^{-31} \times 3.2 \times 10^7}{1.6 \times 10^{-19} \times 4.5 \times 10^{-4}}$ $= 0.4 \text{ m}$	$\frac{1}{2}$	
	<p>(ii) <math>v = \frac{v}{2\pi r}</math></p> $= \frac{3.2 \times 10^7}{2\pi \times 0.4}$ $= \frac{4}{\pi} \times 10^7 \text{ Hz}$	$\frac{1}{2}$	
	<p>(iii) <math>E = \frac{1}{2} mv^2</math></p> $= \frac{1}{2} \times 9 \times 10^{-31} \times 3.2 \times 3.2 \times 10^{14}$ $= 4.608 \times 10^{-16} \text{ J}$	$\frac{1}{2}$	
		$\frac{1}{2}$	3

24.	<ul style="list-style-type: none"> <li>• Depicting the variation of electric and magnetic fields of an electromagnetic wave along z-axis 1</li> <li>• Finding <ul style="list-style-type: none"> <li>a) The wavelength of the wave 1</li> <li>b) The amplitude of the associated magnetic field 1</li> </ul> </li> </ul>		
	<p>a)</p> 	1	
	$\lambda = \frac{c}{v}$ $= \frac{3 \times 10^8}{1.5 \times 10^{10}} = 2 \times 10^{-2} = 0.02 \text{ m}$	$\frac{1}{2}$	
	<p>b) <math>B_0 = \frac{E_0}{c}</math></p>	$\frac{1}{2}$	

	$= \frac{36}{3 \times 10^8}$ $= 1.2 \times 10^{-7} \text{ T}$	1/2	3
25.	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <ul style="list-style-type: none"> <li>• Defining binding energy <span style="float: right;">1</span></li> <li>• Calculating energy released <span style="float: right;">2</span></li> </ul> </div> <p>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.</p> <p>Binding Energy of X, <math>B.E_X = 240 \times 7.6</math>  <math>= 1824 \text{ MeV}</math></p> <p>Binding Energy of Y,  <math>B.E_Y = 120 \times 8.5 = 1020 \text{ MeV}</math></p> <p>Energy released <math>E = 2(B.E_Y) - (B.E_X)</math>  <math>= (2 \times 1020) - 1824</math>  <math>= 216 \text{ MeV}</math></p>	1 1/2 1/2 1/2 1/2	3
26.	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <ul style="list-style-type: none"> <li>• Example of fission reaction. <span style="float: right;">1</span></li> <li>• Calculating the energy released by the fission of 1 kg of <math>^{235}\text{U}</math> in kWh <span style="float: right;">2</span></li> </ul> </div> <ul style="list-style-type: none"> <li>• Example of fission reaction.  <math display="block">{}_0^1\text{n} + {}_{92}^{235}\text{U} \rightarrow {}_{56}^{144}\text{Ba} + {}_{36}^{89}\text{Kr} + 3{}_0^1\text{n}</math> <p>Or any other appropriate example of fission reaction.</p> </li> <li>• No. of atoms in 1 kg of <math>^{235}\text{U} = \frac{6.023 \times 10^{23}}{235} \times 1000</math></li> </ul> <p>Total energy released by the fission of 1 kg of <math>^{235}\text{U}</math></p> $= \frac{6.023 \times 10^{26}}{235} \times 200 \text{ MeV}$ $= \frac{6.023 \times 10^{26}}{235} \times 200 \times 1.6 \times 10^{-13} \text{ J}$ $= \frac{6.023 \times 10^{26} \times 200 \times 1.6 \times 10^{-13}}{235 \times 3.6 \times 10^6} \text{ kWh}$ $= 2.27 \times 10^7 \text{ kWh}$	1 1/2 1/2 1/2 1/2	3

27.	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <ul style="list-style-type: none"> <li>• Defining emf of a cell. <span style="float: right;">½</span></li> <li>• Finding equivalent internal resistance of two cells connected in series. <span style="float: right;">2 ½</span></li> </ul> </div> <ul style="list-style-type: none"> <li>• Emf of a cell is defined as the potential difference between the two electrodes of the cell when no current is drawn from it.</li> <li>•</li> </ul> <div style="text-align: center; margin: 10px 0;">  </div> $V_A - V_B = \varepsilon_1 - Ir_1$ $V_B - V_C = \varepsilon_2 - Ir_2$ $V_A - V_C = \varepsilon_1 + \varepsilon_2 - I(r_1 + r_2)$ $\therefore V_{AC} = \varepsilon_{eq} - Ir_{eq}$ $\therefore r_{eq} = r_1 + r_2$	½ ½ ½ ½ ½	3
28.	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Calculating</p> <ul style="list-style-type: none"> <li>(i) Magnetic moment <math>\vec{m}</math> of the loop. <span style="float: right;">1 ½</span></li> <li>(ii) Torque <math>\vec{\tau}</math> acting on the loop. <span style="float: right;">1 ½</span></li> </ul> </div> <p>(i) <math>\vec{m} = IA\hat{n} = I\pi r^2\hat{n}</math>  <math>= 1.0 \times \frac{22}{7} \times 7 \times 7 \times 10^{-4} [0.6\hat{i} + 0.8\hat{j}]</math>  <math>= 154 \times 10^{-4} [0.6\hat{i} + 0.8\hat{j}]</math>  <math>= (92.4\hat{i} + 123.2\hat{j}) \times 10^{-4} \text{ A m}^2</math></p> <p>(ii) <math>\vec{\tau} = \vec{m} \times \vec{B}</math>  <math>= [(92.4\hat{i} + 123.2\hat{j}) \times 10^{-4}] \times [0.5\hat{i} + 0.4\hat{k}]</math>  <math>= [(49.28\hat{i} - 36.96\hat{j} - 61.6\hat{k}) \times 10^{-4} \text{ N m}]</math></p>	½ ½ ½ ½ ½ ½	3
<b>SECTION D</b>			
29.	<p>(i) (a) (C) Majority charge carrier in n type semiconductors are holes. OR (b) (D) The drift current and the diffusion current cancel each other.</p> <p>(ii) (B) Phosphorus</p> <p>(iii) (A) 0.72 eV</p> <p>(iv) (C) Increases and the depletion layer width also increases.</p>	1  1 1 1	4
30.	<p>(i) (a) (D) 2.59 cm</p>	1	

	<p>OR</p> <p>(b) (C) 9.47 cm</p> <p>(ii) (B) 10</p> <p>(iii) (A) Real inverted and magnified.</p> <p>iv) (B) The object is at a distance more than <math>f_0</math> and less than <math>2 f_0</math> from the objective</p>	1	
	<b>SECTION E</b>		
31.	<p>(a)</p> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• Deducing expression for refractive index of glass prism in terms of angle of minimum deviation and angle of prism <span style="float: right;">4</span></li> <li>• Writing condition for n for refraction to place on opposite face of prism</li> </ul> </div> <div style="text-align: center; margin: 10px 0;"> </div> <p> <math>A + \delta = i + e</math>  and <math>A = r_1 + r_2</math> </p> <p>at angle of minimum deviation , <math>\delta = D_m</math></p> <p><math>i = e, r_1 = r_2 = r</math></p> <p><math>A + D_m = 2i</math></p> <p><math>i = \frac{A + D_m}{2}</math></p> <p><math>A = 2r \Rightarrow r = \frac{A}{2}</math></p> <p>From Snell's law</p> <p><math>n = \frac{\sin i}{\sin r}</math></p>	1	
		$\frac{1}{2}$	

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

For refraction to take place on opposite face

$$r_2 < i_c$$

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

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

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

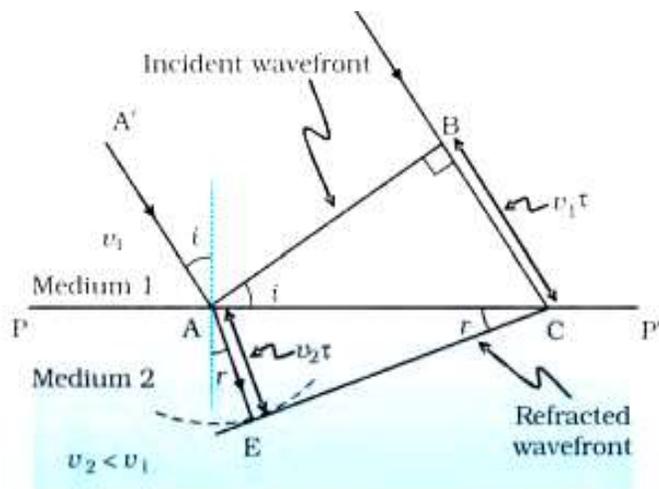
OR

(b)

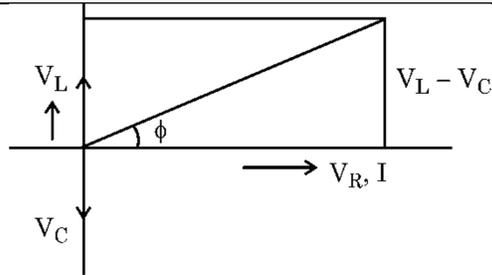
- |  |     |
|--|-----|
| • Stating Huygen's principle   | 1   |
| • Drawing diagram  | 1 ½ |
| • Discussing the case of refraction of plane wave of light from rarer to a denser medium | ½   |
| • Deriving Snell's law   | 2   |

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.







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

$$Z = \frac{\mathcal{E}}{I}$$

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

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

$$(III) \quad \text{Phase angle } \tan \phi = \frac{V_L - V_C}{V_R}$$

(ii)  $P = E_V I_V \cos \phi$  where  $P$  = true power and  $E_V I_V$  is the apparent power.  $\phi$  is phase difference between current and voltage.

Power factor is defined as the ratio of true power to the apparent power.

$$\text{Power factor} = \frac{\text{True Power } (P)}{\text{Apparent power } (E_V I_V)} = \cos \phi$$

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

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

OR

- (b)
- |   |   |
|---|---|
| (i) Proving that the voltage is ahead of current in phase by $\pi/2$ 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

$$v = v_m \sin \omega t$$

1/2

1/2

1/2

1/2

1/2

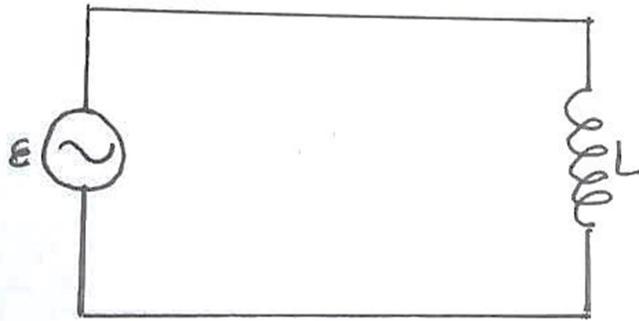
1/2

1

1/2

1/2

1/2



Using Kirchoff's loop rule

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

$$\frac{di}{dt} = \frac{v}{L} = \frac{v_m}{L} \sin \omega t$$

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

Integrating

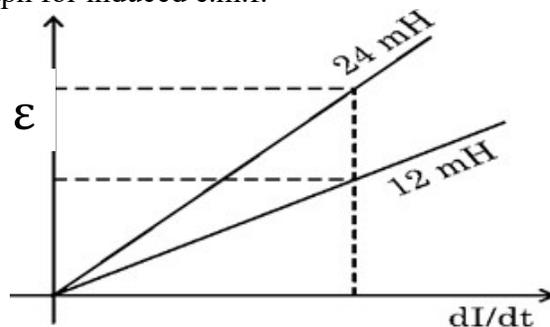
$$i = \frac{v_m}{\omega L} \cos \omega t$$

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

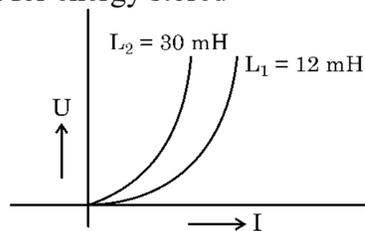
This show that current lags behind the voltage by  $\frac{\pi}{2}$  rad.

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

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



(II) Graph for energy stored



1

½

½

½

1

1

5

33.

- (a) (i) Calculating the new value for the capacitor with justification
- |                           |                             |
|---------------------------|-----------------------------|
| (I) Charge                | $\frac{1}{2} + \frac{1}{2}$ |
| (II) Potential Difference | $\frac{1}{2} + \frac{1}{2}$ |
| (III) Energy stored       | $\frac{1}{2} + \frac{1}{2}$ |
- (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

$$q_A = cV \quad q_B = 0$$

$$V_{common} = \frac{q_A + q_B}{c_A + c_B} = \frac{cV}{2c}$$

$$= \frac{V}{2}$$

$$q'_A = cV_{common} = \frac{cV}{2} = \frac{q_A}{2}$$

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

(II) Potential difference will become half.

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

$$= \frac{cV + 0}{2c} = \frac{V}{2}$$

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

(III) Energy stored will become one fourth

$$U_A = \frac{1}{2} CV^2$$

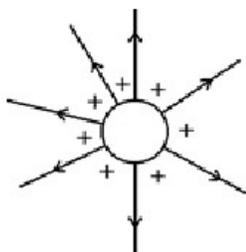
$$U'_A = \frac{1}{2} CV_{common}^2$$

$$= \frac{1}{2} C \left( \frac{V}{2} \right)^2$$

$$= \frac{U_A}{4}$$

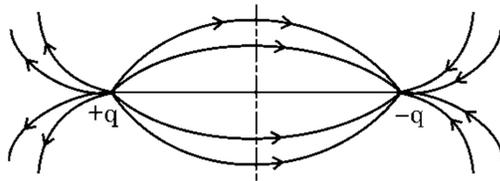
 $\frac{1}{2}$  $\frac{1}{2}$ 

(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

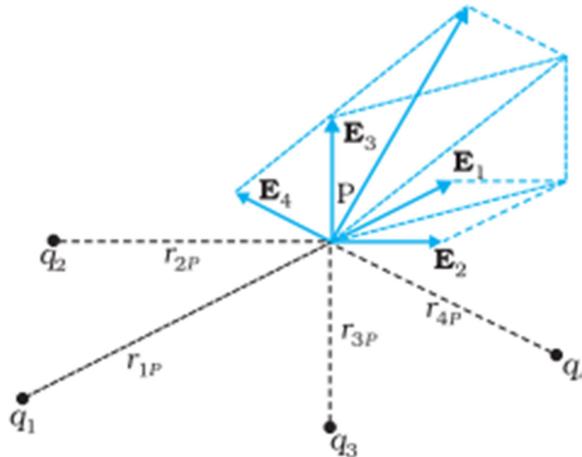
$$(i) \vec{F}_{21} = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r_{21}^2} \hat{r}_{21}$$

Alternative:  $\vec{F}_{12} = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r_{12}^2} \hat{r}_{12}$

OR  $\vec{F} = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2} \hat{r}$

1

For determining electric field due to a system of point charges



1/2

$$\vec{E}_1 = \frac{1}{4\pi\epsilon_0} \frac{q_1}{r_{1p}^2} \hat{r}_{1p}$$

$$\vec{E}_2 = \frac{1}{4\pi\epsilon_0} \frac{q_2}{r_{2p}^2} \hat{r}_{2p}$$

1/2

and so on

By superposition principle

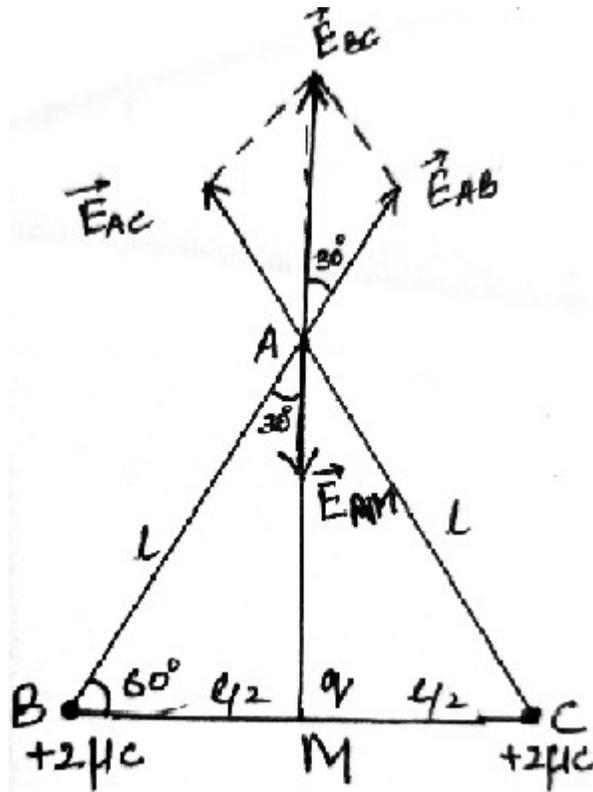
$$\vec{E} = \vec{E}_1 + \vec{E}_2 + \dots + \vec{E}_n$$

1/2

$$\vec{E} = \frac{1}{4\pi\epsilon_0} \sum_{i=1}^n \frac{q_i}{r_{ip}^2} \hat{r}_{ip}$$

1/2

(ii)



1/2

From the figure

$$|\vec{E}_{AB}| = \frac{1}{4\pi\epsilon_0} \cdot \frac{q}{r^2}$$

$$= \frac{1}{4\pi\epsilon_0} \cdot \frac{2 \times 10^{-6}}{l^2}$$

$$|\vec{E}_{AC}| = \frac{1}{4\pi\epsilon_0} \cdot \frac{2 \times 10^{-6}}{l^2}$$

1/2

$$\therefore |\vec{E}_{AB}| = |\vec{E}_{AC}|$$

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

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

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

$$|\vec{E}_{BC}| = \frac{1}{4\pi\epsilon_0} \cdot \frac{2 \times 10^{-6}}{l^2} \cdot \frac{\sqrt{3}}{2}$$

$$|\vec{E}_{AM}| = \frac{1}{4\pi\epsilon_0} \cdot \frac{q}{\left(\frac{l\sqrt{3}}{2}\right)^2}$$

1/2

	<p>∴ Net electric field at A is zero.</p> <p>∴ <math>E_{AM} = -E_{BC}</math></p> $\frac{1}{4\pi\epsilon_0} \cdot \frac{q}{\left(\frac{l\sqrt{3}}{2}\right)^2} = -\frac{2}{4\pi\epsilon_0} \cdot \frac{2 \times 10^{-6}}{l^2} \frac{\sqrt{3}}{2}$ $q = \frac{-3\sqrt{3}}{2} \times 10^{-6} \text{C} \text{ or } \frac{-3\sqrt{3}}{2} \mu\text{C}$	$\frac{1}{2}$	5
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