Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Senior School Certificate Examination, 2025
SUBJECT NAME PHYSICS (PAPER CODE 55/5/3)

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 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

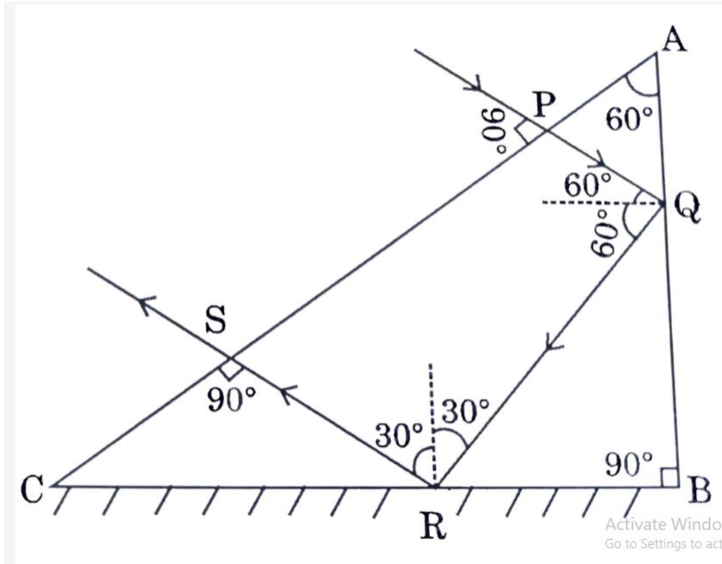
	per day in other subjects (Details are given in Spot Guidelines).This is in view of the reduced syllabus and number of questions in question paper.
13	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in 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: 55/5/3			
Q.No.	**VALUE POINTS/EXPECTED ANSWERS**	**Marks**	**Total Marks**
	SECTION A		
1	(A) 540 nm	**1**	**1**
2	(D) $\frac{X}{4}$	**1**	**1**
3	(B) $\frac{\sqrt{2}Q^2}{\pi\varepsilon_0 l}$	**1**	**1**
4	(B) becomes greater than C	**1**	**1**
5	(D) $\frac{4R}{3}$	**1**	**1**
6	(B) 5 cm	**1**	**1**
7	(C) 0.196 Am^2	**1**	**1**
8	(A) Infrared Rays	**1**	**1**
9	(B) $\left[M^0L^2T^{-2}\right]$	**1**	**1**
10	(A) X- rays	**1**	**1**
11	(C) $\frac{1}{4}$	**1**	**1**
12	(B) 0 and $4a^2$	**1**	**1**
13	(C) Assertion (A) is true, but Reason (R) is false	**1**	**1**
14	(A) Both assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the assertion (A).	**1**	**1**
15	(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is the not the correct explanation of the Assertion (A)	**1**	**1**
16	(D) Both Assertion (A) and reason (R) are false	**1**	**1**
	SECTION - B		
17	Finding effective resistance 2 $R_{BCD} = 2+4 = 6\Omega$ $R_{BD} = \frac{3\times 6}{6+3}$ $= 2\Omega$ $R_{BDE} = 2+8$ $= 10\Omega$	 ½ ½	

	$R_{BE} = \frac{40\times10}{40+10}$ $= 8\Omega$ $R_{AF} = 7+8+5$ $= 20\Omega$	½ ½	2
18	Finding magnetic field 2 Using Biot – Savart's law $\vec{B} = \frac{\mu_0}{4\pi}\frac{I\vec{dl}\times\vec{r}}{r^3}$ $= \frac{(10^{-7})[5(10^{-2})\hat{i}\times(3\hat{i}+4\hat{j})]}{5^3}$ $= 1.6\times10^{-10}\,\hat{k}\,T$	½ 1 ½	2
19	Defining distance of closest approach 1 Calculating distance of closest approach 1 It is the distance from nucleus at which α particles stops momentarily and then begins to retrace its path. **Alternatively** It is the distance from nucleus at which entire intial kinetic energy of the α particle gets converted into electrostatic potential energy. $r_0 = \frac{1}{4\pi\varepsilon_0}\frac{ze^2}{K.E}$ $= \frac{9\times10^9\times79\times(1.6\times10^{-19})^2}{3.95\times10^6\times1.6\times10^{-19}}$ $= 28.8\times10^{-15}\,m$	1 ½ ½	2
20	(a) Finding nature and position of the image 1 + 1 For refraction at convex surface $\frac{n_1}{-u}+\frac{n_2}{v}=\frac{n_2-n_1}{R}$ $\frac{n}{v} = \frac{[n-1-3]}{R}$ $v = \frac{nR}{n-4}$ For all values of n < 4, the value of v is negative and greater than R Therefore the nature of image is virtual and is formed in front of convex surface.	½ ½ 1	

	OR		
	(b) Calculating intensity for the path difference $\lambda / 3$ 2		
	$\phi = \frac{2\pi}{\lambda} \times \Delta x$	½	
	$= \frac{2\pi}{\lambda} \times \frac{\lambda}{3}$		
	$= \frac{2\pi}{3}$	½	
	$I' = 4I \ Cos^2 \ \phi/2$ $\quad$ *Given* $4I = I_0$	½	
	$= I_0 \ Cos^2 \ 2\pi/6$		
	$= \frac{I_0}{4}$	½	
	Note: If a student attempt by using $I = I_1 + I_2 + 2\sqrt{I_1 I_2} Cos\phi$,award full credit for correct answer.		2
21	Finding the cut-off potential 2		
	$eV = h(\upsilon - \upsilon_0)$	½	
	$V = \frac{6.63 \times 10^{-34} \times (6.8 - 3.6) \times 10^{14}}{1.6 \times 10^{-19}}$	1	
	$= 1.33\,V$	½	2
	SECTION - C		
22	(a) Explanation 1 (b) Calculation of ratio of total energy to initial energy 2		
	(a) When a conductor holds a large amount of charge its potential is also high. If electric field becomes high enough, the atoms or molecules of surrounding medium gets ionized. A breakdown occurs in medium and charge on conductor get neutralized or leaks away.	1	
	(b) The common potential after the connection of two capacitors		
	Given $V_1 = V$, $V_2 = 0$		
	$C_1 = C_2 = C$		
	$= \frac{CV}{2C}$	½	
	$= \frac{V}{2}$		
	$U_i = \frac{1}{2} CV^2$	½	

	$U_f = \frac{1}{2}C'V'^2$ $= \frac{1}{2}\times 2C\times\left(\frac{V}{2}\right)^2$ $= \frac{1}{4}CV^2$ $\frac{U_f}{U_i} = \frac{1}{2}$	½ ½	3
23	(a) Explanation 1 (b) Finding distance from central maxima where Intensity is zero 2 (a) Wavelength of light is very small as compared to size of obstacles so diffraction of light is not seen easily. But sound waves have large wavelength, so they get diffracted easily by obstacles. (b) Position of first minima $x = \frac{\lambda D}{a}$ $= \frac{750\times10^{-9}\times1}{1.5\times10^{-3}}$ $= 0.5\ mm$	1 ½ 1 ½	3
24	(a) Calculating (i) Potential energy 1 (ii) Work done in turning the magnet by 180° 1 ½ (b) Identification of minimum potential energy alignment ½ (a) (i) $U = -MB\cos\theta$ $= -5\times0.4\times1$ $= -2\ J$ (ii) $W = MB(\cos\theta_2 - \cos\theta_1)$ $= -5\times0.4(-1-1)$ $= 4\ J$ (b) Potential energy is minimum in case (i)	½ ½ ½ ½ ½ ½	3
25	(a) Tracing path of the ray 2 ½ (b) Finding angle of deviation on ½ (a) $\sin i_c = \frac{1}{\sqrt{2}}$	½	

	$i_c = 45^0$ 	2	
	(Deduct ½ mark for not showing arrow for the ray) (b) The angle of deviation is 180° from diagram	½	3
26	(a) Finding charge densities on A and B 3 For ball A $q_1 = 2\sigma\times 4\pi R^2$ $= 8\pi R^2\sigma$ For ball B $q_2 = 3\sigma\times 4\pi(2R)^2$ $= 48\pi R^2\sigma$	½	
	Total charge (Q) $= q_1 + q_2$ $= 56\pi R^2\sigma$	½	
	When balls A and B are connected by a wire, their potentials will be equal Let q be the charge on ball A and (Q – q) be the charge on the ball B after connecting wire. $\frac{Kq}{R} = \frac{K(Q-q)}{2R}$	½	
	$2q = Q - q$ $q = \frac{Q}{3}$ $= \frac{56\pi R^2\sigma}{3}$	½	

$$Q - \frac{Q}{3} = \frac{112\pi R^2\sigma}{3}$$

$$\sigma_A = \frac{\frac{56\pi R^2\sigma}{3}}{4\pi R^2}$$ ½

$$= \frac{14}{3}\sigma$$

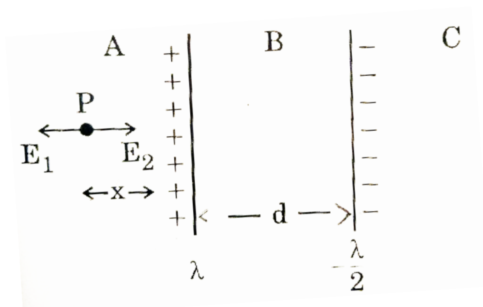
$$\sigma_B = \frac{\frac{112\pi R^2\sigma}{3}}{4\pi(2R)^2}$$ ½

$$= \frac{7}{3}\sigma$$

OR

(b)

Location of point at which net electric field is zero	2½
Identification of Region	½



½

Electric field due to wire 1 and wire 2 at point P

$$E_1 = \frac{\lambda}{2\pi\varepsilon_0 x}$$ ½

$$E_2 = \frac{\lambda/2}{2\pi\varepsilon_0 (x+d)}$$ ½

At P, Net electric field is zero ½

$E_1 = E_2$

$$\frac{\lambda}{2\pi\varepsilon_0 x} = \frac{\lambda}{2\times 2\pi\varepsilon_0(x+d)}$$

$x = -2d$ ½

Negative sign indicates that point lies in the region C. ½

At a distance 2d from wire 1 electric field is zero.

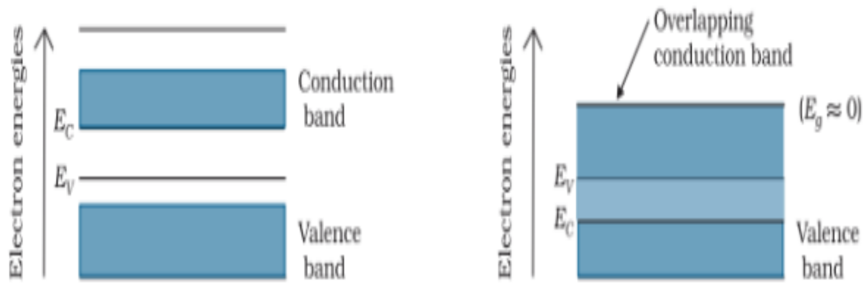
3

(**Note** : Award full credit if a student finds the position by taking point in region C directly)

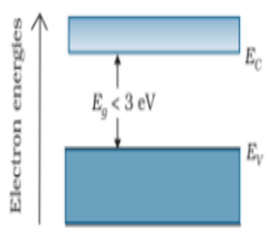
<table>
<tr><td>27</td><td>

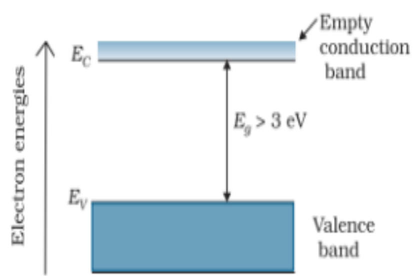
a)	Drawing energy band diagrams	½ + ½ + ½
	Formation of electron hole pair	½
b)	Explanation	1

a)



CONDUCTORS





SEMICONDUCTORS INSULATORS

At room temperature, thermal energy is sufficient for electrons to make them free from the bonds and create a vacancy called hole. Hence electron hole pair is formed.

(b) The valence electron in carbon and silicon lie in the second and third orbit respectively. So, the energy required to take out an electron will be less for silicon as compared to carbon. Hence number of free electrons for conduction in silicon are significant but negligibly small for carbon.
</td><td>½

½ + ½

½

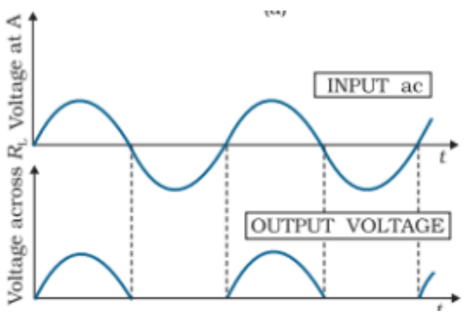
1</td><td>3</td></tr>
<tr><td>28</td><td>

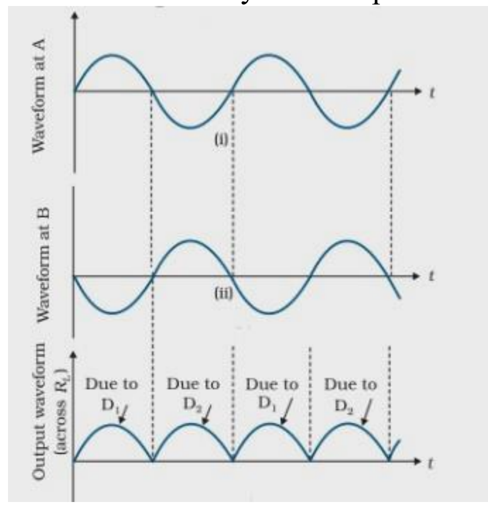
Difference between half wave and full wave rectification	1
Working of full wave rectifier	2

</td><td></td><td></td></tr>
</table>

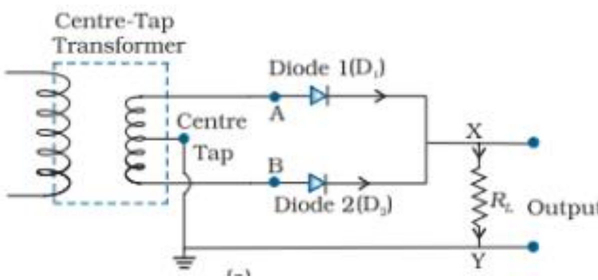
<table>
<tr><td></td><td>In half wave rectification there is output in one half of input cycle, whereas in full wave rectification, output is obtained for both half cycles of input (positive and negative)

Alternatively





Half wave Rectification   Full wave Rectification

Working of full wave rectifier:


Suppose the input voltage to A with respect to the centre-tap at any instant is positive. At that instant, voltage at B being out of phase will be negative. So, diode D_1 gets forward biased and conducts (while D_2 being reverse biased is not conducting). Hence, during this positive half cycle we get an output current (and output voltage across the load resistor R_L). In the course of ac cycle when the voltage at A becomes negative with respect to centre tap, the voltage at B would be positive. In this part of the cycle diode D_1 would not conduct but diode D_2 would, giving an output current and output voltage (across R_L) during the negative half cycle of the input ac.</td><td>1

1

1</td><td>3</td></tr>
<tr><td colspan="4">SECTION D</td></tr>
<tr><td>29</td><td>(i) (a) (A) ($R_2 - 2R_1$)
(b) (B) 1.8×10^{-4} Nm
(ii) Award 1 mark for this question to all students .
(iii) (A) 0.25 Ω
(iv) (B) $\frac{NBA}{K}$</td><td>1

1
1
1</td><td>4</td></tr>
<tr><td>30</td><td>(i) (C) cut– off potential versus frequency of incident light
(ii) (a) (C) $K_B > K_Y > K_R$
(b) (A) Caesium
(iii) (D) Remains the same</td><td>1
1

1</td><td></td></tr>
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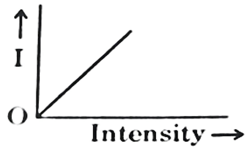
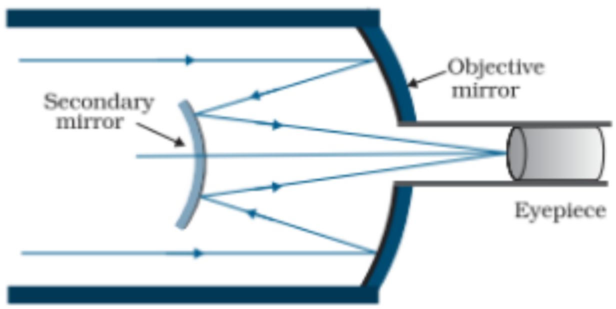
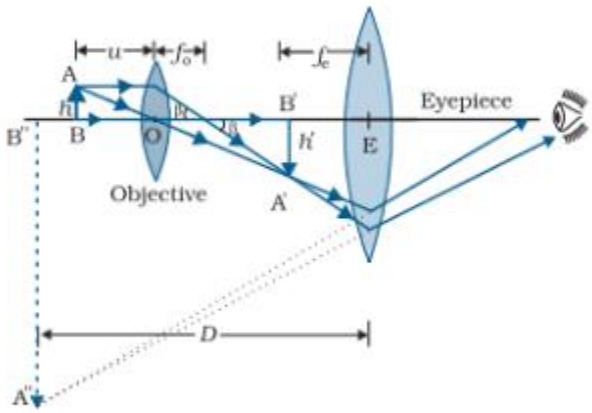
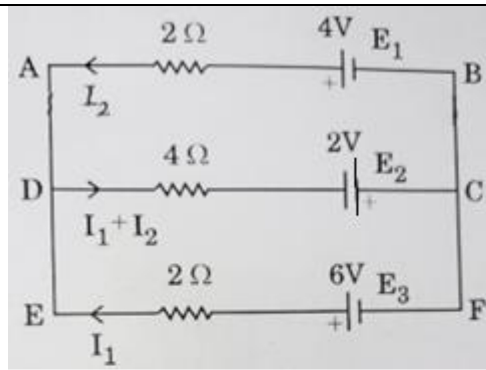
	(iv) (C)  	1	4

SECTION E

31	(a) Drawing ray diagram of reflecting telescope — 1 Explanation of formation of image — 1 Advantages — ½ + ½ (b) Finding focal lengths of the two lenses — 2		
	(i)  	1	
	The parallel rays from a distant object are reflected by a large concave mirror. These rays are then reflected by a convex mirror placed just before the focus of concave mirror and are converged to a point outside the hole. The final image is viewed through eye piece.	1	
	Advantages (any two) 1) No chromatic aberration. 2) Less spherical aberration 3) Less mechanical support required 4) Brighter Image 5) High resolving power. 6) High magnifying power	½ + ½	
	(i) For image at infinity $\|f_0\| + \|f_e\| = L$	½	
	According to question $f_0 = 50 \times f_e$	½	
	$f_e + 50fe = 102$		
	$f_e = 2$ cm	½	
	$f_0 = 100$ cm	½	
	OR		

	(b) (i) Two advantages of a compound microscope over simple microscope ½ + ½ Drawing ray diagram and Explanation 1 + 1 (ii) Obtaining power of combined lens 2 (i) Advantages (any two) 1) Larger magnification 2) Brighter image Any other valid advantage  (deduct ½ mark for not showing arrow for ray diagram) The lens nearest the object, called the objective, forms a real, inverted, magnified image of the object. This serves as the object for the second lens, the eye piece, functions like a simple microscope and produces final image which is enlarged and virtual. (ii) Power of plano concave lens $= P_1 = \frac{-(n_1-1)}{R}$ Power of convex lens $= P_2 = (n_2-1)\left(\frac{2}{R}\right)$ $P = P_1 + P_2$ $= \frac{(2n_2 - n_1 - 1)}{R}$	½ + ½ 1 1 ½ ½ ½ ½	 5
32	(a) (i) Finding current through batteries E_1, E_2 and E_3 3 (ii) Finding effective resistance 2		

i) 

½

In closed loop ABCD, using Kirchhoff's loop law

$4I_1 + 6I_2 = 6$ …………………………..(1) ½

Similarly In closed loop CDFE

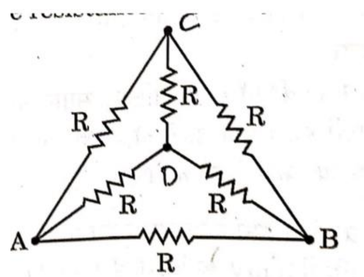
$6I_1 + 4I_2 = 8$ …………………………..(2) ½

Solving eqn. (1) and (2)

$I_2 = \frac{1}{5}A$ ½

$I_1 = \frac{6}{5}A$ ½

$I_1 + I_2 = \frac{7}{5}A$ ½

ii) 

Resistances R_{AC}, R_{CB} , R_{AD} , and R_{DB} form a balanced Wheatstone bridge

Hence current through R_{CD} is zero and will not contribute to equivalent resistance. ½

The equivalent resistance of bridge is R, is in parallel with R_{AB}

Series combinations of R_{AC} & R_{CB} and R_{AD} & R_{DB} is in parallel with R_{AB} ½

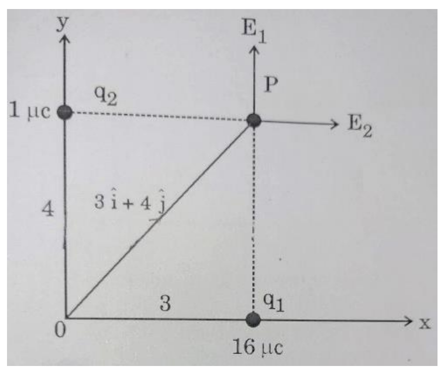
$$\frac{1}{R_{eq}} = \frac{1}{R} + \frac{1}{R}$$

½

$$R_{eq} = \frac{R}{2}$$

Given R = 10Ω, Therefore R_{eq} = 5Ω ½

OR

	(b)	(i) Calculating (I) ratio of electric fields at points A & B 1 ½ (II) drift velocity of free electrons at point B 1 ½ (ii) Finding net electric field at point $\vec{r}$ 2		
		(i) (I) $\vec{j} = \sigma\vec{E}$ $\frac{j_A}{j_B} = \frac{E_A}{E_B}$ $= \frac{I/A_A}{I/A_B}$ $= \frac{A_B}{A_A}$ $= \frac{2}{1}$ (II) $v_d = \frac{I}{neA}$ $= \frac{1}{8.5\times10^{28}\times1.6\times10^{-19}\times2\times10^{-7}}$ $= 3.6\times10^{-4}\ m/s$ (ii) $\vec{E} = \frac{Kq}{r^2}\hat{r}$ $\vec{E}_1 = \frac{9\times10^9\times16\times10^{-6}}{(4)^2}\hat{j}$ $= 9\times10^3\ \hat{j}$ $\vec{E}_2 = \frac{9\times10^9\times1\times10^{-6}}{(3)^2}\ \hat{i}$ $= 10^3\ \hat{i}$ $\vec{E}_{net} = (\hat{i}+9\hat{j})\ 10^3\ N/C$  **NOTE**: Award full credit of this part if a student finds magnitude and direction separately.	½ ½ ½ ½ ½ ½ ½ ½ ½ ½	5
33	(a)	i) Defining self – inductance 1 Deriving expression for energy 1 ii) Drawing graphs showing the variation of (I) Magnitude of emf induced with rate of change of current 1½ (II) Energy stored with current 1½		
		Self Inductance is magnetic flux linked with a coil when the current through the coil is unity. **Alternatively**	**1**	

Self Inductance is the induced emf induced in the coil when rate of change of current through the coil is unity.

To maintain growth of current, power has to be supplied from external source.

$$P = |e||I|$$ ½

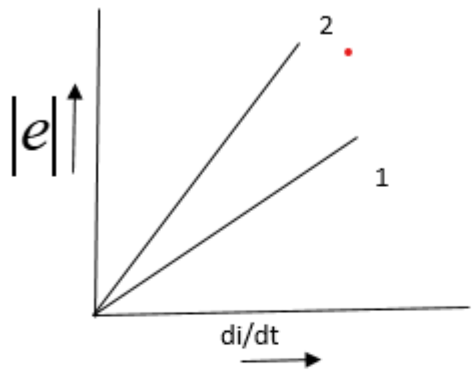
$$= \frac{dW}{dt} = LI\frac{dI}{dt}$$

$$dW = LIdI$$

$$W = \int LIdI$$

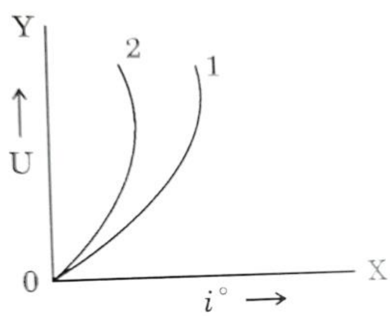
$$= \frac{1}{2}LI^2$$ ½

(I) $E = -L\frac{dI}{dt}$ ½



1

(II) $U = \frac{1}{2}LI^2$ Parabolic graph obtained. ½



1

(1 indicates 10mH) & (2 indicates 20mH)

OR

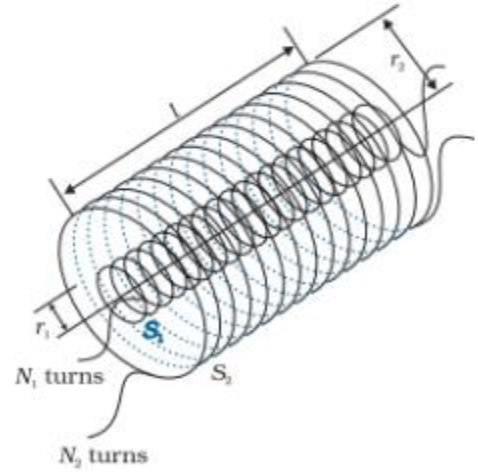
(a)

(i)	Defining mutual inductance	1
	Deducing expression for mutual inductance	2
(ii)	Finding flux linked with the inductor	2

(ii) Mutual inductance is defined as the induced emf in primary coil when the current in secondary coil changes at the unit rate. 1

Alternatively

Mutual inductance is defined as the magnetic flux linked with the primary coil when the current in secondary coil is unity.



½

Consider two long co-axial solenoids each of length l. Radius of inner solenoid S_1 is r_1 and number of turns per unit length is n_1.

The corresponding quantities for outer solenoid S_2 are r_2 and n_2 respectively. Let N_1 and N_2 be the total number of turns of coils S_1 and S_2 respectively.

When a current I_2 is set up through S_2, it sets up magnetic flux through S_1.

$$N_1\phi_1 = M_{12}I_2$$ ½

$$= (n_1 l)\times(\pi r_1^2)\times(\mu_0 n_2 I_2)$$

$$= \mu_0 n_1 n_2 \pi r_1^2 l I_2$$ ½

$$M_{12} = \mu_0 n_1 n_2 \pi r_1^2 l = M_{21}$$ ½

(ii)

$$|e| = L\frac{dI}{dt}$$ ½

$$L = \frac{e}{dI/dt}$$

$$= \frac{5\times10^{-3}}{2/40}$$

$$= 0.1\text{H}$$ ½

$$\phi = LI$$ ½

$$= 0.1\times\frac{2}{40}\times10$$

$$= 0.05\ Wb$$ ½ 5