## Marking Scheme Strictly Confidential (For Internal and Restricted use only) Senior School Certificate Examination, 2024

## **SUBJECT PHYSICS (CODE 55/3/1)**

## **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. <b>However, while evaluating, answers which are</b>
	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.
	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
3	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.
	that there is no significant variation in the marking of marviadar evaluators.
6	Evaluators will mark( $\sqrt{\ }$ ) 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.
	energia. This may be followed suredy.
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.

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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 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.
	or questions in question pupor
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.)
1.4	Half or a part of answer marked correct and the rest as wrong, but no marks awarded.    Will
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 ymagagad moution, mon comprise area of moules to the title maga, on totaling amon detected by
15	Any unassessed 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 Every in any about decreased the annulus with the swidelines siven in the "Cwidelines for Cwed
16	The Examiners should acquaint themselves with the guidelines given in the "Guidelines for Spot
	<b>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.

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MARKING SCHEME: PHYSICS (042)			
Q.NO.	CODE :55/3/1 VALUE POINTS/ EXPECTED ANSWERS	MARKS	TOTAL MARKS
	SECTION-A		
1.	(B) Spherical surface	1	1
2.	(B) $1.6 \times 10^{-18} \mathrm{J}$	1	1
3.	(C) –(0.24 nT) $\hat{k}$	1	1
4.	(D) remain stationary	1	1
5.	(B) 0.3 MB	1	1
6.	(C) 15.0 V	1	1
7.	(B) 1 is decreased and A is increased	1	1
8.	(B) Gamma rays	1	1
9.	(B) 2	1	1
10.	$(\mathbf{C}) \qquad \qquad \downarrow^{\mathbf{K_m}}$	1	1
11.	(B) decreased by 87.5%	1	1
12.	(B) 0.05 eV	1	1
13.	(D) Assertion (A) is false and Reason (R) is also false.	1	1
14.	(C) Assertion (A) is true but Reason (R) is false.	1	1
15.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion(A).	1	1
16.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion(A).	1	1
	SECTION- B		
17.	(a) Meaning of relaxation time Derivation of R  Average time between two successive collisions of electron in presence of electric field Drift velocity of an electron $ v_d = \frac{eE}{m}\tau \qquad(i) $ Current flowing through a conductor of length $l$ and area of cross section A $ I = neAv_d \qquad(ii) $	1/2	
	$I = \frac{ne^2 AE\tau}{m} = \frac{ne^2 A\tau V}{ml}$ $R = \frac{V}{I} = \frac{ml}{ne^2 \tau A}$ OR  (b) Circuit diagram of Wheatstone bridge	1/2	2

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	By applying Kirchoff's loop rule to closed loops ADBA and CBDC	1/2	
	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	1/2	
	$\frac{I_1}{I_2} = \frac{R_2}{R_1}$ From eq (ii)-	1/2	
	$\frac{I_1}{I_2} = \frac{R_4}{R_3}$		
	Hence, $\frac{R_2}{R_1} = \frac{R_4}{R_3}$	1/2	2
18.	Finding the focal length of objective lens 2  Magnifying power = 24 , Distance between lenses =150 cm $\frac{f_o}{f_e}$ = 24 $f_o + f_e = 150  \mathrm{cm}$ $f_e = 6  \mathrm{cm}$ $f_o = 144  \mathrm{cm}$	1/ <sub>2</sub> 1/ <sub>2</sub> 1/ <sub>2</sub> 1/ <sub>2</sub> 1/ <sub>2</sub>	2
19.	(a) Explanation of magnification 1 (b) Explanation 1		
	<ul> <li>(a) Yes, it offers magnification.</li> <li>We can keep the small object much closer to the eye than 25 cm and hence have it subtend a large angle.</li> <li>(b) Yes,</li> <li>Rays converging to a point behind a plane or convex mirror are reflected to a point in front of the mirror on a screen</li> </ul>	1/ <sub>2</sub> 1/ <sub>2</sub> 1/ <sub>2</sub> 1/ <sub>2</sub> 1/ <sub>2</sub>	2
20.	Calculation of number of photons per second 2		
	Total Energy gained per second from photon= IA $E = N hv$	1/2	
L	I .		

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		T	1
	$IA = N \times \frac{hc}{\lambda}$		
	$N = \frac{[IA]\lambda}{hc}$		
	$N = \frac{[0.1 \times 10^{-9} \times 0.4 \times 10^{-4}] \times 500 \times 10^{-9}}{6.6 \times 10^{-34} \times 3 \times 10^{8}}$	1	
	$N = 1.01 \times 10^4$	1/2	2
21.		/2	
	Calculation of concentration of holes & electrons 2		
	$n_e n_{_h} = n_i^2$	1/2	
	$n_h \approx 5 \times 10^{22} / m^3$		
	$n_e = \frac{n_i^2}{n_h}$		
	"	1/2	
	$n_e = \frac{(1.5 \times 10^{16})^2}{5 \times 10^{22}}$	/2	
	$n_e = 4.5 \times 10^9 / m^3$	1/2	_
	$n_h > n_e$ , it is a p- type crystal	1/2	2
22.	SECTION- C		
22.	Determination of current in branches AB, AC, BC 1+1+1		
	$\begin{array}{c c}  & & & & & & & & & & & & & & & & & & &$		
	For closed loop ADCA,		
	$10-4(I_1-I_2)+2(I_2+I_3-I_1)-I_1=0$		
	$7I_1 - 6I_2 - 2I_3 = 10$ (i)	1/2	
	For closed loop ABCA,		
	$\begin{vmatrix} 10-4I_2-2(I_2+I_3)-I_1=0 \\ I_1+6I_2+2I_3=10 &(ii) \end{vmatrix}$	1/2	
	For closed loop BCDED,	/2	
	$5 - 2(I_2 + I_3) - 2(I_2 + I_3 - I_1) = 0$	1,	
	$2I_1 - 4I_2 - 4I_3 = -5$ (iii)	1/2	
	Current in branch AB = $I_2 = \frac{5}{8}A$	1/	
	Current in branch AC = $I_1 = 2.5A$	1/ <sub>2</sub> 1/ <sub>2</sub>	
	Current in branch BC = $I_1 = 2.5A$	1/2	3
	<u> </u>	1	I

23.			
23.	Reason for exerting force on straight parallel conductors ½ Derivation for force per unit length 2 Explanation of nature of Force ½		
	One conductor experiences a force due to magnetic field of the other conductor	1/2	
	a L d L b TEba TEBA TEBA	1/2	
	Magnetic field produced by conductor 'a' at all points along the length of conductor 'b' $B_a = \frac{\mu_0 I_a}{2\pi d}$ Force on conductor 'b' due to this magnetic field	1/2	
	$F_{ba} = I_b L B_a$ $F_{ba} = \frac{\mu_0 I_a I_b L}{2\pi d}$	1/2	
	$f_{ba} = \frac{F_{ba}}{L} = \frac{\mu_0 I_a I_b}{2\pi d}$ directed away from a $f_{ab} = \frac{F_{ab}}{L} = \frac{\mu_0 I_a I_b}{2\pi d}$ directed away from b	1/2	
	Repulsive, the forces acting on them are away from each other.	1/2	3
24.	(a) Identifying the element X  (b) Writing the formula for reactance  (c) Showing variation of reactance with frequency  (d) Explanation of behavior of element with  (i) an ac circuit  (ii) a dc circuit  (2)  (2)  (4)  (b) Writing the element X  (1/2		
	(a) Capacitor	1/2	
	(b) $X_c = \frac{1}{\omega c}$	1/2	

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(c)  Frequency (v)  Frequency (v)	1	
(d) (i) For ac X <sub>c</sub> is finite and therefore allows the ac to pass.	1/2	3
(a) Finding the wavelength and frequency (b) Finding the amplitude of magnetic field (c) Writing expression for magnetic field  1/2	72	3
(a) $k = \frac{2\pi}{\lambda}$ $\lambda = \frac{2\pi}{K} = \frac{4\pi}{3} \text{ m} = 4.18 \text{ m}$	1/2	
$\omega = 2\pi \upsilon$ $v = \frac{\omega}{2\pi} = \frac{4.5 \times 10^8}{2\pi} \text{ Hz}$	1/2	
$v = 7.16 \times 10^{-1} \text{ Hz}$ (b) $B_0 = \frac{E_0}{C}$	1/2	
$B_0 = \frac{6.3}{3 \times 10^8} = 2.1 \times 10^{-8} \mathrm{T}$	1/2	
(c) $\vec{B} = 2.1 \times 10^{-8} [(\cos 1.5 \text{ rad/m}) \text{ y} + (4.5 \times 10^8 \text{ rad/s}) \text{ t}] \hat{\mathbf{k}} \text{ T}$	1/2	3
Statements of Bohr's first and second Postulates Derivation of expression for radius of n <sup>th</sup> orbit  Bohr's first postulate		
<ul> <li>the emission of radiant energy.</li> <li>Bohr's second postulate Electron revolves around the nucleus only in those orbits for</li> </ul>	1/2	
Electrostatic force between revolving electron and nucleus provides requisite centripetal force $\frac{mv_n^2}{r_n} = \frac{1}{4\pi\varepsilon_0} \frac{e^2}{r_n^2}$	1/2	
	(d) (i) For ac $X_c$ is finite and therefore allows the ac to pass.  (ii) For de $X_c$ is infinite and therefore does not allow the dc to pass.  (a) Finding the wavelength and frequency (b) Finding the amplitude of magnetic field (c) Writing expression for magnetic field (d) $\frac{1}{2}$ (a) $k = \frac{2\pi}{\lambda}$ $\lambda = \frac{2\pi}{K} = \frac{4\pi}{3} \text{ m} = 4.18 \text{ m}$ $\omega = 2\pi \upsilon$ $v = \frac{\omega}{2\pi} = \frac{4.5 \times 10^8}{2\pi} \text{ Hz}$ $v = \frac{9}{4\pi} \times 10^8 \text{ Hz}$ $v = 7.16 \times 10^{-1} \text{ Hz}$ (b) $B_0 = \frac{E_0}{c}$ $B_0 = \frac{6.3}{3 \times 10^8} = 2.1 \times 10^{-8} \text{ (cos } 1.5 \text{ rad/m}) \text{ y} + (4.5 \times 10^8 \text{ rad/s}) \text{ t}] \hat{k} \text{ T}$ Statements of Bohr's first and second Postulates Derivation of expression for radius of nth orbit 2  • Bohr's first postulate An electron in an atom revolves in certain stable orbits without the emission of radiant energy. • Bohr's second postulate Electron revolves around the nucleus only in those orbits for which the angular momentum is integral multiple of $\frac{h}{2\pi}$ .  Electrostatic force between revolving electron and nucleus provides requisite centripetal force	(d) (i) For ac $X_c$ is finite and therefore allows the ac to pass.  (ii) For de $X_c$ is infinite and therefore does not allow the dc to pass.  (a) Finding the wavelength and frequency 1+1 (b) Finding the amplitude of magnetic field ½ (c) Writing expression for magnetic field ½  (a) $k = \frac{2\pi}{\lambda}$ $\lambda = \frac{2\pi}{K} = \frac{4\pi}{3} \text{m} = 4.18 \text{m}$ $\omega = 2\pi \nu$ $\nu = \frac{\omega}{2\pi} = \frac{4.5 \times 10^8}{2\pi} \text{Hz}$ $\nu = \frac{9}{4\pi} \times 10^8 \text{Hz}$ $\nu = 7.16 \times 10^{-1} \text{Hz}$ (b) $B_0 = \frac{E_0}{c}$ $B_0 = \frac{6.3}{3 \times 10^8} = 2.1 \times 10^{-8} \text{T}$ (c) $\vec{B} = 2.1 \times 10^{-8} \text{f}(\cos 1.5 \text{ rad/m}) \text{y} + (4.5 \times 10^8 \text{ rad/s}) \text{t}) \hat{k} \text{T}$ Statements of Bohr's first and second Postulates  An electron in an atom revolves in certain stable orbits without the emission of radiant energy.  • Bohr's first postulate  An electron revolves around the nucleus only in those orbits for which the angular momentum is integral multiple of $\frac{h}{2\pi}$ .  Electrostatic force between revolving electron and nucleus provides requisite centripetal force

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		1	
	$v_n = \frac{e}{\sqrt{4\pi\varepsilon_0 mr_n}} \qquad(i)$	1/2	
	$mv_n r_n = \frac{nh}{2\pi}$	1/2	
	using equations (i) and (ii)		
	$r_n = \left(\frac{n^2}{m}\right) \left(\frac{h}{2\pi}\right)^2 \frac{4\pi\varepsilon_0}{e^2}$	1/2	3
	" $(m)(2\pi)$ $e^2$	,-	
27.	(a) Definition of atomic mass unit (u) 1 (b) Calculation of energy required 2		
	(c) carestanted of the gy required		
	(a) atomic mass unit (u) is defined as $1/12^{th}$ of the mass of the carbon ( $^{12}C$ ) atom.	1	
	(b) $m(_{1}H^{2}) \rightarrow m(_{1}H^{1}) + m(_{0}n^{1})$		
	$Q = (m_R - m_P) \times 931.5  MeV$	1/2	
	$= (2.014102 - 1.007825 - 1.008665) \times 931.5 \text{MeV}$	1/2	
	$= -0.002388 \times 931.5 \text{MeV}$	1/2	
	=-2.224  MeV		
	Hence energy required is 2.224 MeV	1/2	3
28.			
	(a) Drawing the circuit diagram for V-I characteristics 1		
	Salient features of V-I characteristics in		
	(i) Forward biasing 1		
	(ii) Reverse biasing 1		
	Voltmeter(V)		
	p n	1	
	Milliammeter Microammeter (mA) (μA)		
	Switch		
	イー (a) - 体 (b)		
	[any one circuit diagram]		
	- · · · · · · · · · · · · · · · · · · ·		
	Salient features  (i) Forward bigging. A from thread old yelloop on out in yelloop diede	1	
	(i) <b>Forward biasing</b> - After threshold voltage or cut in voltage diode current increases significantly (exponentially), even for a small increase	1	
	in the diode bias voltage.		
	(ii) <b>Reverse biasing-</b> Current is very small (~μA) and almost remains	1	
	constant and it increases rapidly after breakdown voltage.		
	OR		

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	Differ (i) an (ii) a	ry band diagrams rence between insulator semiconductor metal	1+1+1		
	(i)	Electron energies $E_V$	Empty conduction band $E_g > 3 \; \mathrm{eV}$ Valence band	1	
	(ii)	Electron energies $ \downarrow^{E^g} $	$E_C$ EV	1	
	(iii)	Electron energies $E_{\rm V}$	Overlapping conduction band $(E_g \approx 0)$ Valence band	1	3
		SECTIO	N- D		
29.	(iii) (A) V= V (iv) (a) (C) E	$E_1 > E_2 > E_1$		1 1 1	4
30.	(i) (D) 6 (ii) (C) 3 (iii) (a) (C) 6 <b>OR</b> (b) sin <sup>-1</sup> (0 (iv) (D) 10		ANI E	1 1 1	4
31.	(ii) Fir	aining expression for the ading the electric potential i) at the surface i) at the centre	capacitance 3		
			tween the plates of capacitor, there oses the original charge density		

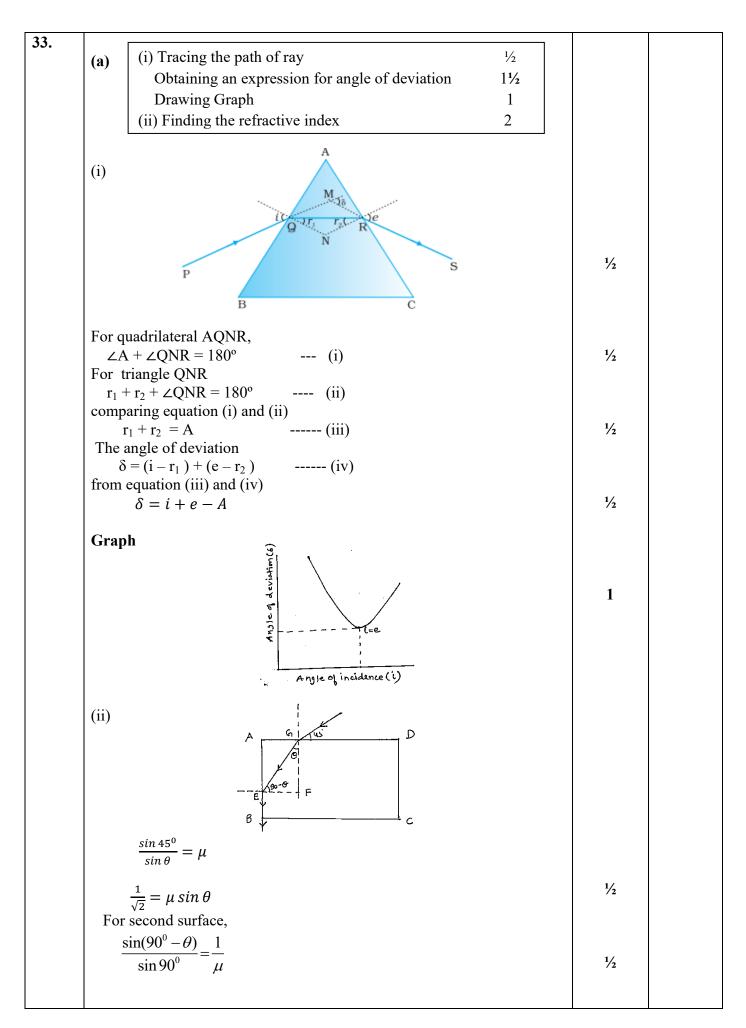
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Electric field with dielectric medium is	1/2	
1		
$E = \frac{(\sigma - \sigma_P)}{\sigma_P}$	1/2	
$E = \frac{(\sigma - \sigma_P)}{\varepsilon_0}$ $V = E \times d = \frac{(\sigma - \sigma_P)}{\varepsilon_0} d$		
$V=E\times d=\frac{1}{\varepsilon_0}d$	1/2	
$(\sigma - \sigma_P) = \frac{\sigma}{\kappa}$	1/2	
N.	/2	
$V = \frac{\sigma d}{\varepsilon_0 K} = \frac{Qd}{A\varepsilon_0 K}$	1/2	
$arepsilon_0 K \qquad \mathrm{A} arepsilon_0 K$	, , ,	
$Q = Q = K \varepsilon_0 A$	1/2	
$C = \frac{Q}{V} = \frac{K \varepsilon_0 A}{d}$		
(ii) Electric potential due to a point charge		
$V = \frac{1}{4\pi\epsilon_0} \frac{q}{r}$	1/2	
(i) At the surface		
$V = \frac{1}{4\pi\epsilon_0} \frac{q}{r} = \frac{9 \times 10^9 \times 6 \times 10^{-6}}{0.2}$	1/	
$4\pi\varepsilon_0 r$ 0.2	1/2	
$V = 2.7 \times 10^5 \text{ V}$	1/2	
$V = 2.7 \times 10^{\circ} \text{ V}$	/2	
(ii) Since electric field inside the hollow sphere is zero, hence V is same		
as that of the surface and remains constant throughout the volume.	1/2	
$V = 2.7 \times 10^5 \text{ V}$	, , ,	
$V = 2.7 \times 10^{-7}$ OR		
(b) (i) Expression for electric field at a point lying		
(i) inside		
(ii) outside 2		
(ii) Explanation 2		
( / 1		
(i) <u>Field inside the shell</u>		
Gaussian surface		
Surface charge		
density o		
r		
The Flux through the Gaussian surface is		
The Flux through the Gaussian surface is $= E \times 4\pi R^{2}$	1/2	
$= E \times 4\pi R^2$	1/2	
= $E \times 4\pi R^2$ In this case Gaussian surface encloses no charge.		
= E × $4\pi R^2$ In this case Gaussian surface encloses no charge. Hence $E \times 4\pi R^2 = 0$	1/2	
= $E \times 4\pi R^2$ In this case Gaussian surface encloses no charge.		
$= E \times 4\pi R^{2}$ In this case Gaussian surface encloses no charge. Hence $E \times 4\pi R^{2} = 0$ $E = 0$		
= E × $4\pi R^2$ In this case Gaussian surface encloses no charge. Hence $E \times 4\pi R^2 = 0$		

	(ii) Field outside the shell-		
	Surface charge Gaussian surface density σ		
	R <sub>O</sub> r <sub>P</sub>	1/2	
	Electric flux through Gaussian surface $E \times 4\pi r^2 = \frac{(\sigma  4\pi R^2)}{\varepsilon_0}$	1/2	
	Charge enclosed by the Gaussian surface $E \times 4\pi r^2 = \frac{(\sigma  4\pi R^2)}{\varepsilon_0}$ Using Gauss's law: $\int \vec{E} \cdot \vec{ds} = \frac{Q}{\varepsilon_0}$ $E \times 4\pi r^2 = \frac{(\sigma  4\pi R^2)}{\varepsilon_0}$	1/2	
	$E \times 4\pi r^2 = \frac{(\sigma  4\pi R^2)}{\varepsilon_0}$ $E = \frac{\sigma}{\varepsilon_0} \frac{R^2}{r^2} = \frac{q}{4\pi \varepsilon_0 r^2}$	1/2	
	(ii) For conducting sheet, Electric field due to a conducting sheet $E_c = \frac{\sigma}{\varepsilon_0}$ Surface	1/2	
	z charge density $\sigma$		
	For non-conducting sheet $E_{nc} = \frac{\sigma}{2\varepsilon_0}$	1/2	
	Since surface charge density is same. $2E_{nc} = E_c$	1/ <sub>2</sub> 1/ <sub>2</sub>	5
32.	(a) (i)(1) Meaning of current sensitivity, mentioning factors 2 (2) Finding the required resistance 1½ (ii) Finding the induced current 1½		
	(i) (1). Current sensitivity of galvanometer is defined as the deflection per unit current.  Alternatively, $\frac{\phi}{I} = \frac{NBA}{K}$	1	
	Factors Number of turns in coil, Magnetic field intensity, Area of coil, Torsional Constant (Any two)	1/2+1/2	

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(2) $R = \frac{V}{I} - G$ for (0-V) Range $R_1 = \frac{V}{2I} - G$ for $(0 - \frac{V}{2})$ Range	1/2	
$R_1 = \frac{\vec{V}}{2I} - G$ for $(0 - \frac{\vec{V}}{2})$ Range	1/2	
$\frac{V}{I} = R + G$		
$R_1 = \left(\frac{R+G}{2}\right) - G$		
$R_1 = \frac{R - G}{2}$	1/2	
(ii) $\phi = (2.0t^3 + 5.0t^2 + 6.0t) \text{ mWb}$		
$ \varepsilon  = \frac{d\phi}{dt} = 50 \times 10^{-3} \text{ V}$	1/2	
$\mathrm{I}=rac{ arepsilon }{R}$	1/2	
$I = \frac{\frac{1}{50} \times 10^{-3}}{5} A = 10 \text{ mA}$	1/2	
OR		
(i) Obtaining the expression of emf induced 3		
(ii) Calculation of mutual inductance 2		
Coil Axle		
$\frac{1}{N}$	4	
	1	
Slip rings Alternating emf		
Carbon		
brushes		
(i) The flux at any instant t is		
$\phi = NBA \cos\theta = NBA \cos\omega t$	1/2	
	/2	
From Faraday's law $\boldsymbol{\varepsilon} = -\frac{d\phi_B}{dt}$	1/2	
dt dt	/2	
$=-NBA\frac{d}{dt}\left(\cos\omega t\right)$	1/2	
$\varepsilon = -NBA \omega \sin \omega t$	1/2	
(ii) $M = \frac{\mu_0 \pi r_1^2}{2r_2} = \frac{4\pi \times 10^{-7} \times \pi r_1^2}{2r_2}$	1/2+1/2	
$r_1$ $r_2$ $r_2$ $r_2$ $r_2$	,2.,2	
$=\frac{2\times10\times10^{-7}\times\left(10^{-2}\right)^2}{100\times10^{-7}}$	1/2	
$-\frac{100\times10^{-7}}{}$	/2	
$= 2 \times 10^{-10} \text{ H}$	1/2	_
		5
		1



$\frac{1}{\sqrt{2}}\frac{\cos\theta}{\sin\theta} = 1$		
$\tan \theta = \frac{1}{\sqrt{2}}$	1/	
v =	1/2	
From the triangle GEF		
$\sin \theta = \frac{1}{\sqrt{2}}$		
$\sin \theta = \frac{1}{\sqrt{3}}$ $\mu = \sqrt{\frac{3}{2}}$	1/2	
$\mu = \frac{3}{5}$		
·		
OR		
(b) (i) Expression for resultant intensity 3		
(ii) Ratio of intensities 2		
(i) $y_1 = a \cos \omega t$		
$y_2 = a\cos(\omega t + \phi)$		
According to the principle of superposition		
	1/2	
$y = y_1 + y_2$	/2	
$y = a\cos\omega t + a\cos(\omega t + \phi)$		
$y = a\cos\omega t + a\cos\omega t\cos\phi - a\sin\omega t\sin\phi$	1.0	
$y = a\cos\omega t(1 + \cos\phi) - a\sin\phi\sin\omega t$	1/2	
Let,		
$a(1 + \cos \phi) = A\cos \theta \qquad (i)$		
$a \sin \phi = A \sin \theta$ (ii)	1/2	
Squaring and adding equation (i) and (ii)		
$A^2 = a^2 (1 + \cos\phi)^2 + a^2 \sin^2 \phi$		
$= a^2(1 + \cos^2\phi + 2\cos\phi) + a^2\sin^2\phi$		
	1/2	
$=2a^2(1+\cos\phi)$		
$=4a^2\cos^2\phi/2$	1/2	
$I\alpha A^2$	, 2	
$I = kA^2$		
where k is constant	1/2	
$I = 4ka^2 \cos^2 \phi / 2$	72	
[Award full credit for this part for any other alternative methods]		
(ii) $\phi_1 = \frac{2\pi}{\lambda} \times \frac{\lambda}{6} = \pi/3$	17	
(ii) $\Psi_1 - \frac{1}{\lambda} \wedge \frac{1}{6} - \frac{n}{3}$	1/2	
$I_1 = 4I_0 \cos^2 \phi / 2$		
$=4I_0\cos^2(\pi/6)$	1.	
$I_1 = 3I_0$	1/2	
$\phi_2 = \frac{2\pi}{\lambda} \times \frac{\lambda}{12} = \pi/6$		
γ 2 λ 12 17 5		
$I_2 = 4I_0 \cos^2(\pi/12)$	1/2	
- , , ,		
$I_2 = 4I_0 \cos^2 15^0$		
L 3		
$\frac{I_1}{I_2} = \frac{3}{4\cos^2 15^0}$	1/2	5
-2 1000 10		
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