PHYSICS (042)
CODE: 55/2/1

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Senior Secondary School Examination, 2026 (XII)
SUBJECT NAME : PHYSICS (Q.P. CODE : 042/55-2-1)

General Instructions: -

1	The CBSE has decided to introduce On Screen Marking (OSM) for the evaluation of Class XII answer Book with the 2026 Examination.
2	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.
3	**"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 Newspaper/Website, etc. may invite action under various rules of the Board and IPC."**
4	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-XII, 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.**
5	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.
6	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.
7	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.**
8	If a question has parts, please award marks on the right-hand side for each part in the OSM Portal. Marks awarded for different parts of the question will be totaled up by the OSM System.
9	If a question does not have any parts, marks must be awarded in the left-hand margin in the OSM Portal. This may also be followed strictly.

HOME

HOME

HOME

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 to 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 :- • 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	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for Spot Evaluation**" before starting the actual evaluation.
16	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.
17	**If a candidate attempts both alternatives/options in a question where only one option/ alternative is required to be attempted, the Evaluator shall award marks in both the options. The system will take the higher of two scores and disregard the other response.**
18	**In a question having two options/alternatives, if a candidate has attempted only one, then the evaluator shall mark "NA" (Not attempted) against the option that has not been attempted by the candidate.**

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Important Note

In questions provided with choice, main part of the question has been indicated with "OR" against the question number in OSM whereas in it's optional part "OR" is not indicated.

HOME

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MARKING SCHEME: PHYSICS (042) Session: 2025–26 Code: 55/ 2 /1			
Q. No.	**VALUE POINTS/EXPECTED ANSWERS**	**Marks**	**Total Marks**
	SECTION – A		
1.	(D) $\frac{-q^2}{\pi\varepsilon_0 l}$	1	1
2.	(D) The final potential of the system equals $\frac{1}{4\pi\varepsilon_0}\frac{(q_1+q_2)(r_1+r_2)}{r_1 r_2}$	1	1
3.	(D) Both ϕ_0 and ν	1	1
4.	(B) n	1	1
5.	(A) z -axis	1	1
6.	(B) Al	1	1
7.	(C) 1 mA	1	1
8.	(C) $\text{Wb}s^{-2}$, $\text{Wb}s^{-1}$	1	1
9.	(D) $\frac{1}{\sqrt{3}}$	1	1
10.	(A) The induced current will flow in the anticlockwise direction	1	1
11.	(A) Zero	1	1
12.	(D) $\frac{32}{7}\lambda$	1	1
13.	(B) Both assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A)	1	1
14.	(D) Assertion (A) is false and Reason (R) is also false.	1	1
15.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A)	1	1
16.	(C) Assertion (A) is true but Reason (R) is false	1	1
	SECTION – B		
17.	(a) Writing two differences between intrinsic and extrinsic semiconductors 2 **Intrinsic semiconductors** / **Extrinsic semiconductors** 1. $n_e = n_h$ / 1. $n_e \neq n_h$ (Alternatively $n_e \gg n_h$ or $n_e \ll n_h$ 2. Low conductivity / 2. high conductivity 3. Semiconductor without any impurity atoms added/ Pure semiconductor. / 3. Semiconductor with doping/ Impure Semiconductor. 4. Its conductivity depends only on temperature / 4. Its conductivity depends on temperature and concentration of dopants 5. They are naturally occurring semiconductors / 5. They are manufactured semiconductors. (Any two) or (Any other relevant differences)	1+1	2

HOME

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18.	Finding the ratio λ_a/λ_p (i) For same kinetic energy 1 (ii) For same accelerating potential 1		
	(i) $\lambda = \frac{h}{\sqrt{2mK}}$	$^1/_2$	
	$\frac{\lambda_a}{\lambda_p} = \sqrt{\frac{m_p}{m_a}} = \sqrt{\frac{m}{4m}}$		
	$= \frac{1}{2}$	$^1/_2$	
	(ii) $\lambda = \frac{h}{\sqrt{2mqV}}$	$^1/_2$	
	$\frac{\lambda_a}{\lambda_p} = \sqrt{\frac{m_p q_p}{m_a q_a}} = \sqrt{\frac{m}{4m} \cdot \frac{e}{2e}}$		
	$= \frac{1}{2\sqrt{2}}$	$^1/_2$	2
19.	Calculating the speed of light in the prism. 2		
	Angle of incidence $i = \frac{3}{4}A = 45^o$	$^1/_2$	
	At minimum deviation $r = \frac{A}{2} = 30^o$	$^1/_2$	
	$n = \frac{\sin i}{\sin r} = \frac{\sin 45^o}{\sin 30^o}$		
	$n = \sqrt{2}$	1/2	
	$n = \frac{c}{v}$		
	$v = \frac{3}{\sqrt{2}} \times 10^8$ m/s = 2.12×10^8 m/s	$^1/_2$	2
20.	Finding steady temperature of heating element 2		
	$R_1 = \frac{V}{I_1} = \frac{220}{2.9}\Omega$ at temperature t_1	$^1/_2$	
	$R_2 = \frac{V}{I_2} = \frac{220}{2.5}\Omega$ at temperature t_2	$^1/_2$	
	$R_2 = R_1[1 + \alpha(t_2 - t_1)]$	$^1/_2$	

HOME

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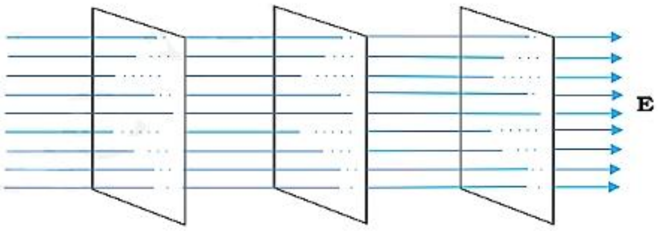
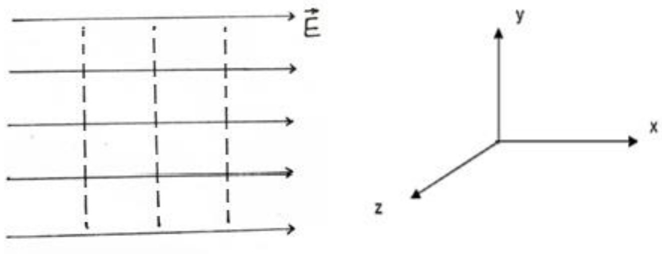
	$t_2 - t_1 = \frac{R_2 - R_1}{R_1.\alpha}$ $t_2 - 27 = \frac{\left(\frac{220}{2.5} - \frac{220}{2.9}\right)}{\left(\frac{220}{2.9} \times 1.7 \times 10^{-4}\right)}$ $t_2 \approx 968^0C$	½	2
21.	**Calculating the length of the image** 2 $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$ $\frac{1}{v_1} = \frac{1}{f} - \frac{1}{u_1}$ $= \frac{1}{(-20)} - \frac{1}{(-25)}$ (For near end of the pencil) $v_1 = -100cm$ $\frac{1}{v_2} = \frac{1}{(-20)} - \frac{1}{(-30)}$ (For far end of the pencil) $v_2 = -60$ cm Length of the image L = $\lvert v_1 \rvert - \lvert v_2 \rvert = 40cm$	½ ½ ½ ½	
	OR		
I	**Calculating the least distance of coincidence of bright fringes** 2 $n_1\lambda_1 = n_2\lambda_2$ $\frac{n_1}{n_2} = \frac{\lambda_2}{\lambda_1}$ $\frac{n_1}{n_2} = \frac{600}{500} = \frac{6}{5}$ $y_6^{max} = n_1 \frac{\lambda_1 D}{d}$ $= \frac{6 \times 500 \times 10^{-9} \times 1.8}{0.3 \times 10^{-3}}$ = 18 mm **Alternatively** : $n\lambda_1 = (n+1)\lambda_2$, we get $n=5$ $y_5^{max} = \frac{n_2\lambda_2 D}{d} = \frac{5 \times 600 \times 10^{-9} \times 1.8}{0.3 \times 10^{-3}} = 18$ mm	½ ½ ½ ½	2

HOME

HOME

HOME

	SECTION – C		
22.	(a) Identifying • Isotopes $\frac{1}{2}$ • Isotones $\frac{1}{2}$ (b) • Writing dependence of size of nucleus on its mass number (A) $\frac{1}{2}$ • Proving that density of nucleus is independent of A $1\frac{1}{2}$		
	(a) • Isotopes: ${}^{12}_{6}C$, ${}^{14}_{6}C$	$\frac{1}{2}$	
	• Isotones: ${}^{198}_{80}Hg$, ${}^{197}_{79}Au$	$\frac{1}{2}$	
	(b) • Size of nucleus α $A^{1/3}$	$\frac{1}{2}$	
	Alternatively: $R = R_0 A^{1/3}$ • Suppose m is the average mass of a nucleon, density of nucleus		
	$\rho = \frac{\text{Mass}}{\text{Volume}}$	$\frac{1}{2}$	
	$\rho = \frac{mA}{\frac{4}{3}\pi\left(R_0 A^{1/3}\right)^3}$	$\frac{1}{2}$	
	$\rho = \frac{3m}{4\pi R_0^3}$ = constant	$\frac{1}{2}$	3
23.	(a) Drawing three equipotential surfaces 1 (b) Finding the electrostatic potential at a point (x, 0, 0) where x>>a 2		
	(a) 	1	
	Alternatively: 		

HOME

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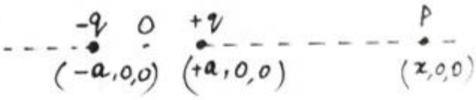
	(b) 		
	Potential at P due to -q charge		
	$V_{-q} = -\frac{1}{4\pi\varepsilon_0}\frac{q}{(x+a)}$	$1/2$	
	Potential at P due to $+q$ charge		
	$V_{+q} = \frac{1}{4\pi\varepsilon_0}\frac{q}{(x-a)}$	$1/2$	
	Net potential at P		
	$V = V_{-q} + V_{+q}$		
	$V = \frac{-1}{4\pi\varepsilon_0}\frac{q}{(x+a)} + \frac{1}{4\pi\varepsilon_0}\frac{q}{(x-a)}$		
	$V = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q(2a)}{(x^2-a^2)}$	$1/2$	
	For $x >> a$		
	$V = \frac{1}{4\pi\varepsilon_0}\frac{q(2a)}{x^2}$	$1/2$	3
24.	Naming the electromagnetic wave and writing their wavelength range (i) Detection of fracture in bones $1/2 + 1/2$ (ii) Physiotherapy $1/2 + 1/2$ (iii) Radar systems $1/2 + 1/2$		
	(i) X-rays	$1/2$	
	Wavelength range: 1 nm to 10^{-3} nm	$1/2$	
	(ii) Infrared waves	$1/2$	
	Wavelength range: 1 mm to 700 nm	$1/2$	
	(iii) Microwaves	$1/2$	
	Wavelength range: 0.1 m to 1 mm	$1/2$	3

HOME

HOME

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HOME

25.

(i)	• Defining mutual inductance of a pair of coils.	1
	• Writing SI unit	$^1/_2$
(ii)	Obtaining an expression for mutual inductance.	$1\frac{1}{2}$

(i) It is the ratio of the magnetic flux linked with a coil to the current flowing in the neighbouring coil. 1

Alternatively:

It is the ratio of magnitude of induced emf in a coil to the rate of change of current in the neighbouring coil.

Note: Award ($^1/_2$) mark if a student writes

$$M = \frac{\phi}{I}$$

OR

$$M = \frac{|\varepsilon|}{di/dt}$$

SI unit: henry(H) Or Tm^2A^{-1} Or WbA^{-1} or VsA^{-1} $^1/_2$

(ii) If current I is setup through the solenoid, the magnetic field inside at its center

$$B = \mu_0 n I$$ $^1/_2$

Flux linked with the circular loop of radius $r(< R)$

$$\phi_B = BA$$

$$\phi_B = (\mu_0 n I)(\pi r^2)$$ $^1/_2$

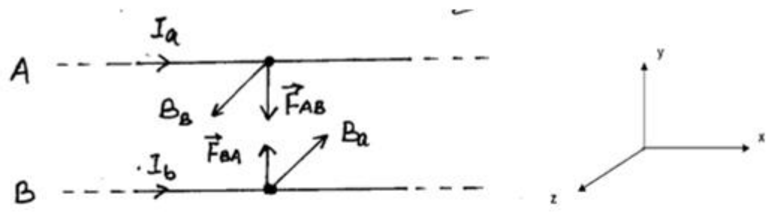
Mutual Inductance

$$M = \frac{\phi_B}{I}$$

$$M = \mu_0 n \pi r^2$$ $^1/_2$

OR

• Deducing the expression for force acting on conductor B and showing the direction of force.	$1\frac{1}{2} + {}^1/_2$
• Writing the expression for force acting on conductor A	$^1/_2$
• Showing that Newton's third law is obeyed	$^1/_2$



1

Note: Deduct ½ mark if direction of force on conductor B is not shown.

HOME

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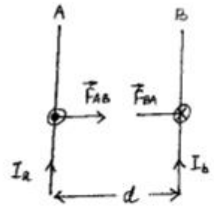
	Magnetic field due to current carrying conductor A at all points along the conductor B $\overrightarrow{B_a} = \frac{\mu_0 I_a}{2\pi d}(-\hat{k})$ Force experienced by a segment of length L of conductor B $\vec{F}_{BA} = I_b \vec{L} \times \vec{B}_a$ $\vec{F}_{BA} = I_b L\left(\frac{\mu_0 I_a}{2\pi d}\right)[\hat{\imath} \times (-\hat{k})]$ $\vec{F}_{BA} = \frac{\mu_0 I_a I_b L}{2\pi d}\hat{j}$ Similarly $\vec{F}_{AB} = \frac{\mu_0 I_a I_b L}{2\pi d}(-\hat{j})$ $\vec{F}_{BA} = -\vec{F}_{AB}$ It follows Newton's third law **Alternatively:**  $B_a = \frac{\mu_0 I_a}{2\pi d}$ Vertically inward $F_{BA} = I_b\ L\ B_a = \frac{\mu_0 I_a I_b}{2\pi d}L$ directed towards A $F_{AB} = I_a L\ B_b$ $F_{AB} = \frac{\mu_0 I_a I_b L}{2\pi d}$ It is equal in magnitude to F_{BA} but directed towards the conductor'B'. Thus $\vec{F}_{BA} = -\vec{F}_{AB}$ Thus, they follow Newton's third law. **Note: Award 1 mark for the diagram, if the directions are not indicated in the diagram but written**	1/2 1/2 1/2 1/2	3
26.	(a) • Stating Bohr's second postulate. 1 • Mentioning its significance 1/2 (b) Proving that the energy levels get closer and closer with increasing principal quantum number $1\frac{1}{2}$ (a) The electron revolves around the nucleus only in those orbits for which angular momentum is some integral multiple of $\frac{h}{2\pi}$ where h is Planck's constant. <u>Alternatively:</u> $L = n\left(\frac{h}{2\pi}\right)$ • It defines stable / stationary orbits <u>Alternatively</u> Angular momentum is quantised	1 1/2	

HOME HOME HOME

HOME

(b) $E_n = \frac{-13.6}{n^2}\text{eV}$ — $1/2$

For any two consecutive energy levels, the energy difference is:
$\Delta E = E_n - E_{n-1}$

$\Delta E = 13.6\left[\frac{1}{(n-1)^2} - \frac{1}{n^2}\right]$ — $1/2$

$\Delta E = 13.6\,\frac{(2n-1)}{n^2(n-1)^2}$

For large value of n

$\Delta E = \frac{27.2}{n^3}\text{eV}$

Thus as n increase, ΔE decrease i.e., energy levels get closer and closer. — $1/2$ — 3

27.

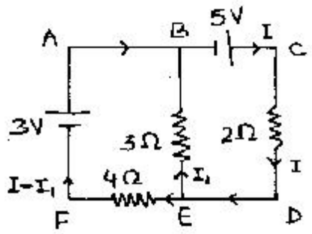
(a) Explaining the statement	1
(b) Finding the current through 3Ω resistor in the circuit	2

(a) Electric current is a scalar quantity because it does not obey law of vector addition.
The current with an arrow is only to signify the direction of conventional current. — 1

Alternatively:
Current do not follow the law of vector addition. The current through an area of cross-section is given by the scalar product of two vectors. $I = \vec{j}\,.\,\Delta\vec{S}$

HOME

(b)



$1/2$

In Loop ABEFA
$3 + 3I_1 - 4(I - I_1) = 0$
$4I - 7I_1 = 3$……………………(1) — $1/2$

In loop BCDEB
$5 - 2I - 3I_1 = 0$
$2I + 3I_1 = 5$…………………..(2) — $1/2$

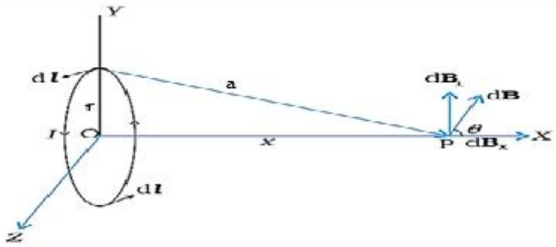
Solving equations (1) and (2), we get

Current through 3Ω resistor is
$I_1 = \frac{7}{13}\text{A}$ — $1/2$

Note: Award full marks if a student solves by another appropriate current distribution in the circuit. — 3

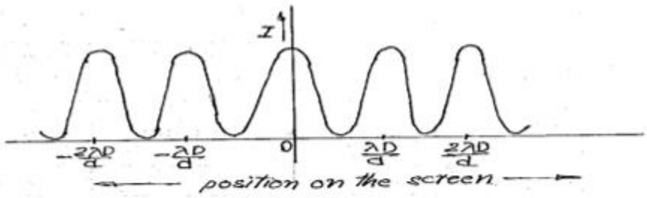
HOME

HOME

28.	Deriving an expression for the magnetic field 3		
		$^1/_2$	
	The magnitude of magnetic filed (dB) due to curent element Idl is $dB = \frac{\mu 0}{4\pi} \frac{I\|\vec{dl}\times\vec{a}\|}{a^3}$ $dB = \frac{\mu 0}{4\pi} \frac{I\,dl}{(r^2+x^2)}$	$^1/_2$	
	The components of the magnetic field perpendicular to the x-axis $(dB_\perp)$ are summed over and get cancelled.	$^1/_2$	
	The components of the magnetic field along the x-axis contribute towards the net magnetic field $B_x = \int dB cos\theta$	$^1/_2$	
	$= \int \frac{\mu_0}{4\pi} \frac{I\,dl}{(x^2+r^2)} \cdot \frac{r}{\sqrt{x^2+r^2}}$ $\vec{B} = B_x\hat{\imath} = \frac{\mu_0 I r^2}{2(x^2+r^2)^{3/2}}\ (\hat{\imath})$	$^1/_2$	
	For N number of turns, net magnetic field $\vec{B}_{net} = \frac{\mu_0 N I r^2}{2(x^2+r^2)^{3/2}}(\hat{i})$	$^1/_2$	3
	SECTION - D		
29.	(i) (C) Boron	1	
	(ii) (D) $4.5 \times 10^9 m^{-3}$	1	
	(iii) Award 1 mark to each student, who has attempted this part.	1	
	(iv) (C) 0.7V OR (A) 0.01 eV	1	4
30.	(i) (A) $\sqrt{D(D-4f)}$	1	
	(ii) (D) Enlarged, reduced	1	
	(iii) (B) 18.75 cm	1	
	(iv) (D) 65cm OR (A) -15 cm	1	4

HOME

HOME

	SECTION - E		
31.	(a) • Defining coherent sources 1 • Necessity for observing stable interference pattern 1 • Drawing graph showing the variation of intensity of light with the position on the screen 1 (b) Finding the intensity of light for path difference (i) $\frac{\lambda}{4}$ 1 (ii) $\frac{\lambda}{3}$ 1		
	(a) • Two sources of light emitting waves of same frequency and constant phase or zero phase difference are said to be coherent.	1	
.	• If the sources are incoherent, interference pattern will change with time. Hence the positions of maxima and minima will also vary rapidly with time and we obtain 'time averaged' intensity distribution. Alternatively: If the two sources are coherent then the phase difference at any point will not change with time and we will have a stable interference pattern.	1	
	• 	1	
	(b) (i) $I = 4I_0 \cos^2\left(\frac{\phi}{2}\right)$ $\Delta p = \frac{\lambda}{4}$ $\phi = \frac{2\pi}{\lambda}.\frac{\lambda}{4}$ $\phi = \frac{\pi}{2}$	$^1/_2$	
	$I = 4I_0 \cos^2 \frac{\pi}{4}$ $= 2I_0$	$^1/_2$	
	(ii) $\Delta p = \frac{\lambda}{3}$ $\phi = \frac{2\pi}{\lambda}.\frac{\lambda}{3}$ $\phi = \frac{2\pi}{3}$	$^1/_2$	

HOME

HOME

HOME

$$I = 4I_0 \cos^2 \frac{\pi}{3}$$

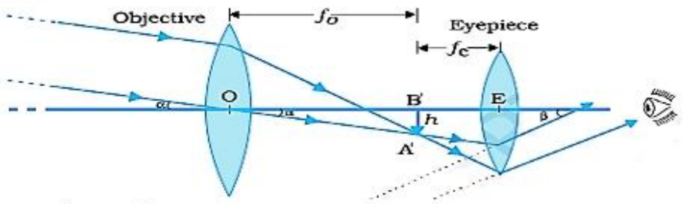
$$= I_0$$ ½

Note: Award (½) mark if the student writes $I = 4I_0 \cos^2\left(\frac{\phi}{2}\right)$

OR

(a) • Drawing labelled ray diagram of refracting telescope	1
• Deriving expression for its magnifying power	2
(b) (i) Giving reason for the larger aperture of objective	1
(ii) Writing two advantages of reflecting telescope	1

(a)



1

• $$m = \frac{\beta}{\alpha} \approx \frac{\tan\beta}{\tan\alpha}$$ 1

$$= \frac{h/f_e}{h/f_o}$$ ½

$$= \frac{f_o}{f_e}$$ ½

(b) (i) With larger aperture even the fainter objects can be observed clearly. 1

Alternatively:

With larger aperture, the light gathering power and its resolution / resolving power increases.

Alternatively:

Large aperture helps in correcting more light from distant object which forms a sharper/ brighter images.

(ii)
- There is no chromatic aberration in a mirror.
- Spherical aberration in case of parabolic reflectors is removed.
- Requires less mechanical support
- Cost effective
- Brighter / sharper image is formed (½+½)

(Any two from above or any other appropriate advantages) 5

HOME

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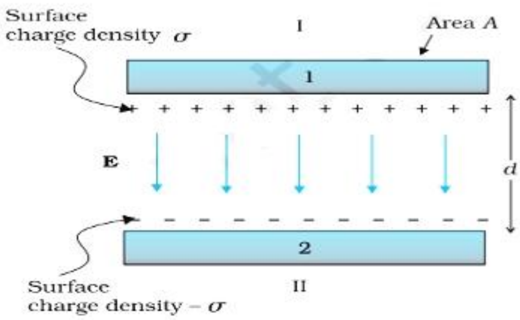
32.	(a) Deriving an expression for capacitance of a parallel plate capacitor 3 (b) Effect of inserting a dielectric slab on (i) Charge on each capacitor 1 (ii) Energy stored in the capacitor 1		**HOME**
	(a) 		
	Electric filed between the plates $E = \frac{\sigma}{\varepsilon_0}$ $E = \frac{q}{A\varepsilon_0}$	1	
	Potential difference $V = Ed$ $= \frac{qd}{A\varepsilon_0}$	1	**HOME**
	Capacitance $C = \frac{q}{V}$ $C = \frac{A\varepsilon_0}{d}$	1	
	(b) (i) In parallel combination the potential difference is same across the capacitors. On insertion of dielectric slab capacitance of each capacitor becomes K (dielectric constant) times.	1	
	Alternatively: $C' = KC$ Hence final charge on each capacitor becomes K times. **Alternatively:** $q' = C'V$ $q' = KCV$ $q' = Kq$ **Alternatively**: $q'_1 = KC_1V = Kq_1$ $q'_2 = KC_2V = Kq_2$		

HOME

HOME

	(ii) Energy stored by capacitor, $U=\frac{1}{2}CV^2$ As the capacitance becomes K times energy stored by each capacitor also increases by factor K **Alternatively:** $U^{'}=KU$ **Alternatively:** $U^{'}_1=\frac{1}{2}KC_1V^2=KU_1$ $U^{'}_2=\frac{1}{2}KC_2V^2=KU_2$ **OR**	1	
	(a) • Explanation for the time independence of average velocity. 1 • Obtaining relation between current and average velocity. 2 (b) (i) Reason for instantaneously establishment of current 1 (ii) Finding the ratio of drift velocities 1		
	(a) • $\vec{v_d}=\frac{-e\vec{E}\tau}{m}$, where τ is the average time between two successive collisions, which is constant. Distance covered by electrons between two successive collisions is almost same. Hence $S=\frac{1}{2}at^2$ where a=constant, s=almost constant So t is constant. **Alternatively** At any instant some of the electrons would have spent time more than τ and some less than τ. Thus averaging over all the times we get a constant time. This way we get average velocity independent of time.	1	
	• Let n is the number of free electrons per unit volume in the conductor of length L and cross -sectional area A . Total charge crossing area A in time Δt is $q=-neA\|\vec{v}_d\|\Delta t$	1	
	Where negative sign indicates direction of flow of electrons is opposite to direction of electric field. By definition, electric current is opposite to flow of electrons. $\therefore I\Delta t=neA\|\vec{v}_d\|\Delta t$ $I=neA\|\vec{v}_d\|$	1	
	(b) (i) Electric field is established throughout the circuit, almost instantly causing at every point a local electron drift. As a result the current is established instantaneously.	1	
	(ii) $v_d=\frac{I}{ne\pi r^2}$	1/2	
	$\frac{v_{d1}}{v_{d2}}=\left(\frac{r_2}{r_1}\right)^2$ $=\frac{4}{9}$	1/2	5

HOME

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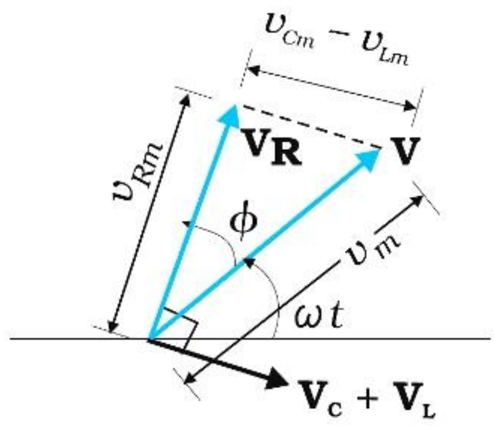
33.	(a) Deriving expression for • Impedance of series LCR circuit and 2 • Phase difference between V&I 1 (b) Giving the condition (i) Minimum impedance 1 (ii) Wattless current in the circuit 1		
	(a) 	½	
	Phase relation for series LCR circuit $\vec{V_L} + \vec{V_R} + \vec{V_C} = \vec{V}$ Applying Pythagorean theorem, we get $v_m^2 = v_{Rm}^2 + \left(v_{Cm} - v_{Lm}\right)^2$ $v_m^2 = \left(i_m R\right)^2 + \left(i_m X_C - i_m X_L\right)^2$	1	
	$I_m = \dfrac{v_m}{\sqrt{R^2 + \left(X_c - X_L\right)^2}} = \dfrac{v_m}{Z}$		
	Where $Z = \sqrt{R^2 + (X_C - X_L)^2}$ is impedance	½	
	$\tan\phi = \dfrac{V_{Cm} - V_{Lm}}{V_{Rm}} = \dfrac{X_C - X_L}{R}$ Or $\phi = \tan^{-1}\left(\dfrac{X_C - X_L}{R}\right)$	1	
	(b) (i) At resonance i.e., $X_C = X_L$	1	
	(ii) When the average power consumed is zero.	1	
	Alternatively: $P_{avg} = V_{rms} I_{rms} \cos\phi$ For $\phi = \pi/2$; $\cos\phi = 0$, $\therefore P_{avg} = 0$		

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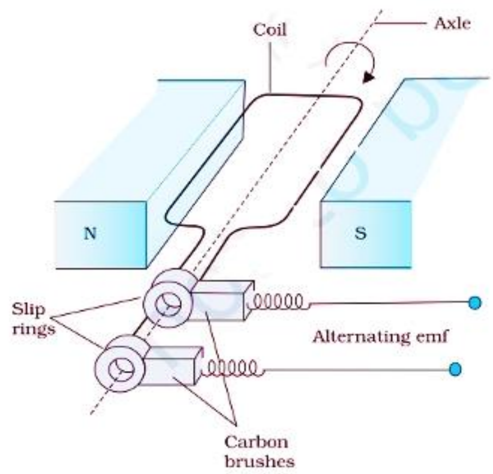
OR

(i)	For ac generator	
	• labelled diagram / construction	1
	• Principle	1
	• Working	1
(ii)	Deducing expression for induced emf	1
(iii)	Giving the times at which emf generated is maximum in terms of T	1

(i)



1

• Principle: It is based on the principle of electromagnetic induction. When the magnetic flux passing through a coil changes continuously, emf is induced. 1

Working: When coil is rotated in magnetic field, magnetic flux linked with it changes and emf is induced in the coil. 1

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(ii) Flux linked with a coil at any instant of time placed in magnetic field rotating with angular speed ω

$\phi_B = BA\cos\omega t$ 1/2

From faraday's law

$\varepsilon = -N\frac{d\phi_B}{dt}$

$\varepsilon = NBA\omega \sin\omega t$ 1/2

(iii) EMF generated is maximum at $\frac{T}{4}$ and $\frac{3T}{4}$ 1

5

HOME