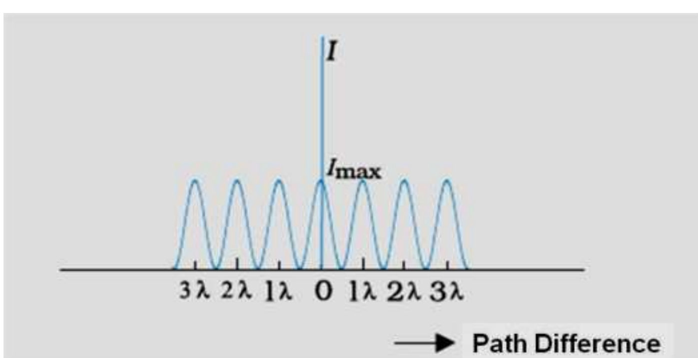
Strictly Confidential (For Internal and Restricted Use only)
Senior School Certificate Examination
Marking Scheme - Physics (Code 55/1, Code 55/2, Code 55/3)

1. The marking scheme provides general guidelines to reduce subjectivity in the marking. The answers given in the marking scheme are suggested answers. The content is thus indicated. If a student has given any other answer, which is different from the one given in the marking scheme, but conveys the meaning correctly, such answers should be given full weightage.
2. In value based questions, any other individual response with suitable justification should also be accepted even if there is no reference to the text.
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 adhered to and religiously followed.
4. If a question has parts, please award in the right hand side for each part. Marks awarded for different part of the question should then be totaled up and written in the left hand margin and circled.
5. If a question does not have any parts, marks are to be awarded in the left hand margin only.
6. If a candidate has attempted an extra question, marks obtained in the question attempted first should be retained and the other answer should be scored out.
7. No marks are to be deducted for the cumulative effect of an error. The student should be penalized only once.
8. Deduct ½ mark for writing wrong units, missing units, in the final answer to numerical problems.
9. Formula can be taken as implied from the calculations even if not explicitly written.
10. In short answer type question, asking for two features / characteristics / properties if a candidate writes three features, characteristics / properties or more, only the correct two should be evaluated.
11. Full marks should be awarded to a candidate if his / her answer in a numerical problem is close to the value given in the scheme.
12. In compliance to the judgement of the Hon'ble Supreme Court of India, Board has decided to provide photocopy of the answer book(s) to the candidates who will apply for it along with the requisite fee. Therefore, it is all the more important that the evaluation is done strictly as per the value points given in the marking scheme so that the Board could be in a position to defend the evaluation at any forum.
13. The Examiner shall also have to certify in the answer book that they have evaluated the answer book strictly in accordance with the value points given in the marking scheme and correct set of question paper.
14. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title paper, correctly totaled and written in figures and words.
15. In the past it has been observed that the following are the common types of errors committed by the Examiners
    - Leaving answer or part thereof unassessed in an answer script.
    - Giving more marks for an answer than assigned to it or deviation from the marking scheme.
    - Wrong transference 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.
    - Wrong transference to marks from the answer book to award list.
    - Answer marked as correct (√) but marks not awarded.
    - Half or part of answer marked correct (√) and the rest as wrong (×) but no marks awarded.
16. 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.

MARKING SCHEME

<table>
<tr><th>Q. No.</th><th>Expected Answer/ Value Points</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td colspan="4">Section A</td></tr>
<tr><td>Q1</td><td>i. Nichrome
ii. $R_{Ni} > R_{Cu}$ (or $Resistivity_{Ni} > Resistivity_{Cu}$)</td><td>½
½</td><td>1</td></tr>
<tr><td>Q2</td><td>Yes</td><td>1</td><td>1</td></tr>
<tr><td>Q3</td><td>i. Decreases
ii. $n_{Violet} > n_{Red}$
(Also accept if the student writes $\lambda_V < \lambda_R$)</td><td>½
½</td><td>1</td></tr>
<tr><td>Q4</td><td>Photoelectric Effect (/Raman Effect/ Compton Effect)</td><td>1</td><td>1</td></tr>
<tr><td>Q5</td><td>A is positive and
B is negative
(Also accept: A is negative and B is positive)</td><td>½
½</td><td>1</td></tr>
<tr><td colspan="4">SECTION B</td></tr>
<tr><td>Q6</td><td>
<table>
<tr><td>Interference pattern</td><td>½</td></tr>
<tr><td>Diffraction pattern</td><td>½</td></tr>
<tr><td>Two Differences</td><td>½ + ½</td></tr>
</table>


</td><td>½</td><td></td></tr>
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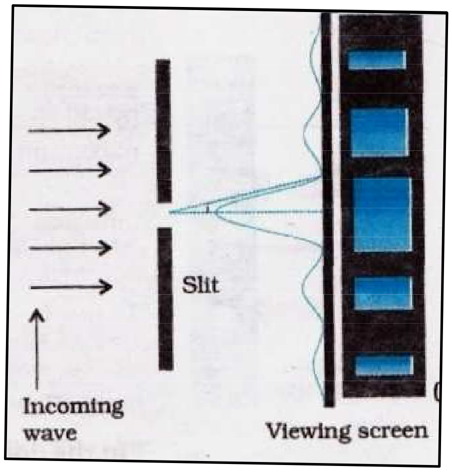


½

Differences

Interference	Diffraction
All maxima have equal intensity	Maxima have different (/rapidly decreasing) intensity
All fringes have equal width.	Different (/changing) width.
Superposition of two wavefronts	Superposition of wavelets from the same wavefront

(Any two)

½ + ½

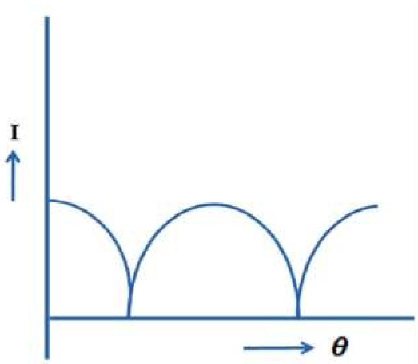
2

OR

Expression for intensity of polarized beam	1
Plot of intensity variation with angle	1

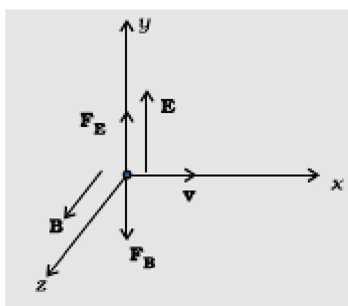
Intensity is $\frac{I_0}{2}\cos^2\theta$ (if I_0 is the intensity of unpolarised light.)
Intensity is $I\cos^2\theta$ (if I is the intensity of polarized light.)
(Award ½ mark if the student writes the expression as $I_0\cos^2\theta$)

1



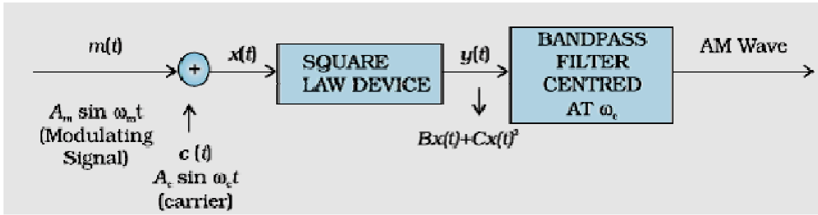
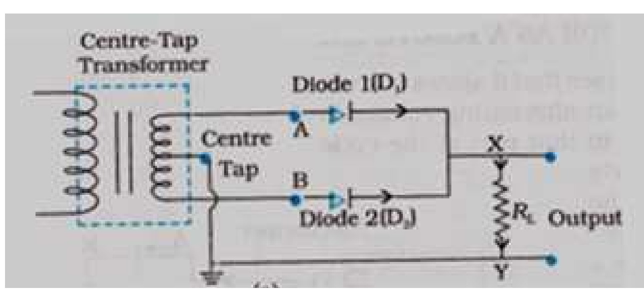
1

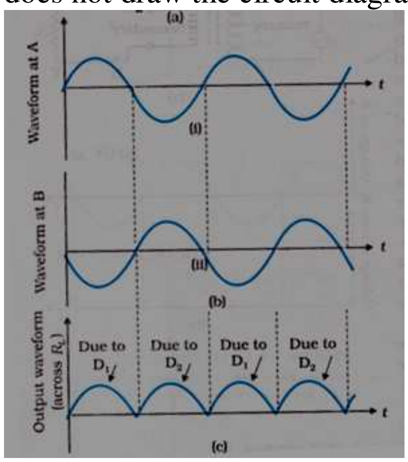
2

Q7	(a) Identification ½ + ½ (b) Uses ½ + ½		
	(a) X – rays Used for medical purposes. (Also accept UV rays and gamma rays and Any one use of the e.m. wave named)	½ ½ ½	
	(b) Microwaves Used in radar systems (Also accept short radio waves and Any one use of the e.m. wave named)	½	**2**
Q8	Condition i. For directions of $\vec{E}, \vec{B}, \vec{v}$ 1 ii. For magnitudes of $\vec{E}, \vec{B}, \vec{v}$ 1		
	(i) The velocity $\vec{v}$, of the charged particles, and the $\vec{E}$ and $\vec{B}$ vectors, should be mutually perpendicular. Also the forces on q, due to $\vec{E}$ and $\vec{B}$, must be oppositely directed. (Also accept if the student draws a diagram to show the directions.)  	½ ½	
	(ii) $qE = qvB$ $or\ v = \frac{E}{B}$	½ ½	
	[Alternatively, The student may write: Force due to electric field = $q\vec{E}$ Force due to magnetic field = $q\ (\vec{v} \times \vec{B})$ The required condition is $q\vec{E} = -q\ (\vec{v} \times \vec{B})$ $\left[or\ \vec{E} = -(\vec{v} \times \vec{B}) = (\vec{B} \times \vec{v})\right]$ (Note: Award 1 mark only if the student just writes: "The forces, on the charged particle, due to the electric and magnetic fields, must be equal and opposite to each other")]	½ ½ ½ ½	**2**

Q9	i. Writing $E_n \propto \frac{1}{n^2}$ ½ ii. Identifying the level to which the electron is emitted. ½ iii. Calculating the wavelengths and identifying the series of atleast one of the three possible lines, that can be emitted. ½ + ½ i. We have $E_n \propto \frac{1}{n^2}$ ii. ∴ The energy levels are $-13.6\text{ eV};\ -3.4\text{ eV}; -1.5\text{ eV}$ ∴ The 12.5 eV electron beam can excite the electron up to n=3 level only. iii. Energy values, of the emitted photons, of the three possible lines are $3 \rightarrow 1 : (-1.5 + 13.6)\text{eV} = 12.1\text{ eV}$ $2 \rightarrow 1 : (-3.4 + 13.6)\text{eV} = 10.2\text{ eV}$ $3 \rightarrow 2 : (-1.5 + 3.4)\text{eV} = 1.9\text{ eV}$ The corresponding wavelengths are: 102 nm, 122 nm and 653 nm $\left(\lambda = \frac{hc}{E}\right)$ (Award this 1 mark if the student draws the energy level diagram and shows (and names the series) the three lines that can be emitted) / (Award these (½ + ½) marks if the student calculates the energies of the three photons that can be emitted and names their series also.)	½ ½ ½ + ½	**2**
Q10	a) Two properties for making permanent magnet ½ + ½ b) Two properties for making an electromagnet ½ + ½		

	a) For making permanent magnet: (i) High retentivity (ii) High coercitivity (iii) High permeability (Any two) b) For making electromagnet: (i) High permeability (ii) Low retentivity (iii) Low coercivity (Any two)	½ + ½ ½ + ½	2
SECTION C			
Q11	a) The factor by which the potential difference changes 1 b) Voltmeter reading 1 Ammeter Reading 1 a) $H = \frac{V^2}{R}$ $\therefore V$ increases by a factor of $\sqrt{9} = 3$ b) Ammeter Reading $I = \frac{V}{R+r}$ $= \frac{12}{4+2} A = 2A$ Voltmeter Reading $V = E - Ir$ $= [12 - (2 \times 2)]\ V = 8V$ (Alternatively, $V = iR = 2 \times 4V = 8V$)	½ ½ ½ ½ ½ ½	3
Q12	a) Achieving amplitude Modulation 1 b) Stating the formulae ½ Calculation of v_c and v_m ½ + ½ Calculation of bandwidth ½ a) Amplitude modulation can be achieved by applying the message signal, and the carrier wave, to a non linear (square law device) followed by a band pass filter.		

	(Alternatively, The student may just draw the block diagram.)  		
	(Alternatively, Amplitude modulation is achieved by superposing a message signal on a carrier wave in a way that causes the amplitude of the carrier wave to change in accordance with the message signal.)	**1**	
	b) Frequencies of side bands are: $(\upsilon_c + \upsilon_m)$ and $(\upsilon_c - \upsilon_m)$	½	
	$\therefore \upsilon_c + \upsilon_m = 660$ kHz and $\upsilon_c - \upsilon_m = 640$ kHz		
	$\therefore \upsilon_c = 650$ kHz	½	
	$\therefore \upsilon_m = 10$ kHz	½	
	Bandwidth = $(660 - 640)$ kHz = 20 kHz	½	**3**
Q13	a) The nature of biasing 1 b) Diagram of full wave rectifier 1 Working 1		
	a) Reverse Biased	**1**	
	b) Diagram of full wave rectifier  	**1**	

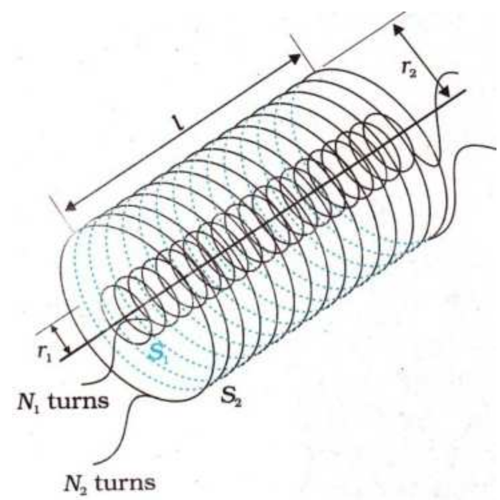
	<u>Working</u>: The diode D_1 is forward biased during one half cycle and current flows through the resistor, but diode D_2 is reverse biased and no current flows through it. During the other half of the signal, D_1 gets reverse biased and no current passes through it, D_2 gets forward biased and current flows through it. In both half cycles current, through the resistor, flows in the same direction. (Note: If the student just draws the following graphs (but does not draw the circuit diagram), award ½ mark only. )	**1**	**3**
Q14	Photon picture plus Einstein's photoelectric equation ½ + 1½ Two features ½ + ½ In the photon picture , energy of the light is assumed to be in the form of photons , each carrying an energy $h\nu$. Einstein assumed that photoelectric emission occurs because of a single collision of a photon with a free electron. The energy of the photon is used to (i) free the electrons from the metal. [For this, a minimum energy, called the work function (=W) is needed]. And (ii) provide kinetic energy to the emitted electrons.	½ ½ ½	

	Hence $$(K.E.)_{max} = h\upsilon - W$$ $$/\left(\frac{1}{2}mv_{max}^2 = h\upsilon - W\right)$$ This is Einstein's photoelectric equation Two features (which cannot be explained by wave theory): i) 'Instantaneous' emission of photoelectrons ii) Existence of a threshold frequency iii) 'Maximum kinetic energy' of the emitted photoelectrons, is independent of the intensity of incident light (Any two)	½ ½ + ½	3
Q15	a. Calculation of wavelength, frequency and speed ½ + ½ + ½ b. Lens Maker's Formula ½ Calculation of R 1 a) $\lambda = \frac{589\text{ nm}}{1.33} = 442.8\text{nm}$ Frequency $\nu = \frac{3\times 10^8\text{ ms}^{-1}}{589\text{ nm}} = 5.09 \times 10^{12}\text{Hz}$ Speed $v = \frac{3\times 10^8}{1.33}\text{m/s} = 2.25 \times 10^8\text{m/s}$ b) $\frac{1}{f} = \left[\frac{\mu_2}{\mu_1} - 1\right]\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$ $\therefore \frac{1}{20} = \left[\frac{1.55}{1} - 1\right]\frac{2}{R}$ $\therefore R = (20 \times 1.10)\text{cm} = 22\text{ cm}$	½ ½ ½ ½ ½ ½	3
Q16	Definition of mutual inductance 1 Derivation of mutual inductance for two long solenoids 2		

(i) Mutual inductance is numerically equal to the induced emf in the secondary coil when the current in the primary coil changes by unity.

<u>Alternatively:</u> Mutual inductance is numerically equal to the magnetic flux linked with one coil/secondary coil when unit current flows through the other coil /primary coil. **1**

(ii)



½

Let a current, i_2, flow in the secondary coil

$$\therefore B_2 = \frac{\mu_0 N_2 i_2}{l}$$ ½

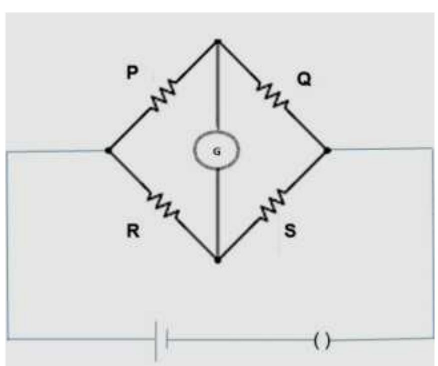
$\therefore$ Flux linked with the primary coil

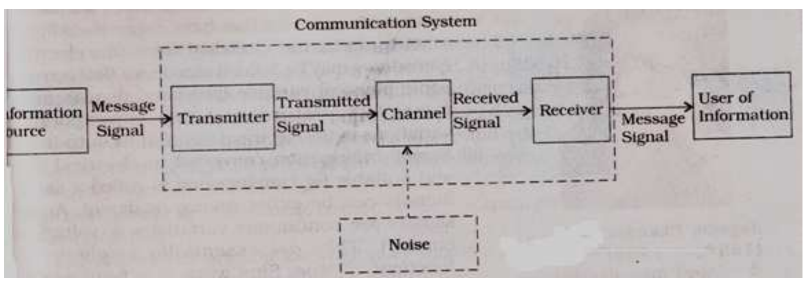
$$= N_1 A_1 B_2 = \frac{\mu_0 N_2 N_1 A_1 i_2}{l} = M_{12} i_2$$ ½

Hence, $M_{12} = \frac{\mu_0 N_2 N_1 A_2}{l} = \mu_0 n_2 n_1 A_1 l \left(n_1 = \frac{N_1}{l}; n_2 = \frac{N_2}{l}\right)$ ½ **3**

OR

Definition of self inductance	1
Expression for energy stored	2

	(i) Self inductance, of a coil, is numerically equal to the emf induced in that coil when the current in it changes at a unit rate. (Alternatively: The self inductance of a coil equals the flux linked with it when a unit current flows through it.) (ii) The work done against back /induced emf is stored as magnetic potential energy. The rate of work done, when a current i is passing through the coil, is $\frac{dW}{dt} = \lvert\varepsilon\rvert i = \left(L\frac{di}{dt}\right)i$ $\therefore W = \int dW = \int_0^I Lidi$ $= \frac{1}{2}Li^2$	1 ½ ½ ½ ½	3
Q17	a) Principle of meter bridge 1 b) Relation between l_1, l_2, and S 2 a) The principle of working of a meter bridge is same as that of a balanced Wheatstone bridge. (Alternatively:  When i_g=0, then $\frac{P}{Q} = \frac{R}{S}$)	1	

	b) $\frac{R}{S} = \frac{l_1}{100-l_1}$ When X is connected in parallel: $$\frac{R}{\left(\frac{XS}{X+S}\right)} = \frac{l_2}{100-l_2}$$ On solving, we get $X = \frac{l_1 S(100-l_2)}{100(l_2-l_1)}$	½ ½ 1	 3
Q18	Diagram of generalized communication system 1½ Function of (a) transmitter (b) channel (c) receiver ½+ ½ + ½  [Also accept the following diagram ] (a) Transmitter: A transmitter processes the incoming message signal so as to make it suitable for transmission through a channel and subsequent reception. (b) Channel: It carries the message signal from a transmitter to a receiver. (c) Receiver: A receiver extracts the desired message signals from the received signals at the channel output.	1 ½ ½ ½ ½	 3

Q19

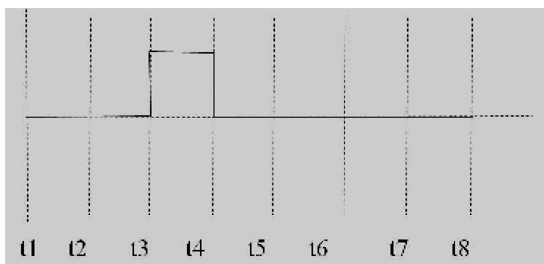
a)	Function of each of the three segments	½ + ½ + ½
b)	Diagram of output wave form	1
	Truth table	½

a) Emitter: Supplies a large number of majority charge carriers. ½

Base: Controls the flow of majority carriers from the emitter to the collector. ½

Collector: It collects the majority carriers from the base / majority of those emitted by the emitter. ½

b)



1

Truth Table

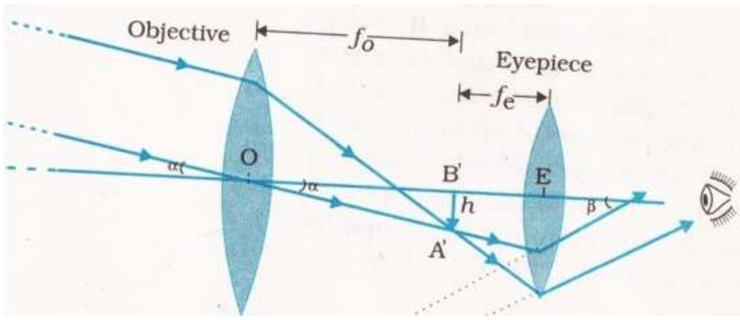
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

½

3

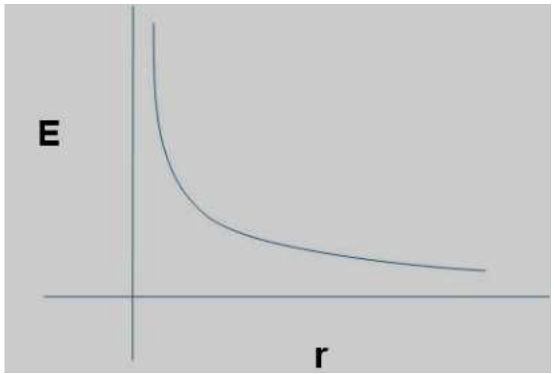
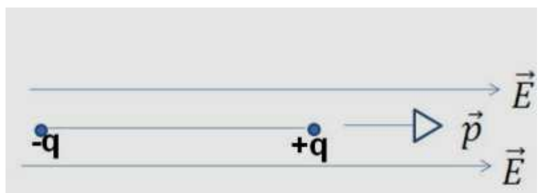
Q20

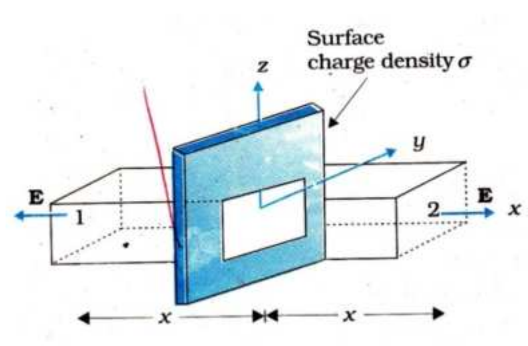
(a)	Ray diagram for astronomical telescope in normal adjustment	1 ½
(b)	Identification of lenses for objective and eyepiece	1
	Reason	½

	(a) Ray diagram of astronomical telescope  (Note: Deduct ½ mark if the 'arrows' are not marked) (b) Objective Lens: Lens L_1 Eyepiece Lens: Lens L_2 <u>Reason:</u> The objective should have large aperture and large focal length while the eyepiece should have small aperture and small focal length.	1 ½ ½ ½ ½	3
Q21	(a) Statement of Biot Savart law — 1 Expression in vector form — ½ (b) Magnitude of magnetic field at centre — 1 Direction of magnetic field — ½ (a) It states that magnetic field strength, $d\vec{\boldsymbol{B}}$, due to a current element, $Id\vec{\boldsymbol{l}}$, at a point, having a position vector **r** relative to the current element, is found to depend (i) directly on the current element, (ii) inversely on the square of the distance $\lvert\mathbf{r}\rvert$, (iii) directly on the sine of angle between the current element and the position vector **r**. In vector notation, $$\overrightarrow{d\boldsymbol{B}} = \frac{\mu_0}{4\pi}\frac{Id\vec{\boldsymbol{l}} \times \vec{\boldsymbol{r}}}{\lvert\vec{\boldsymbol{r}}\rvert^3}$$ **Alternatively**, $$\left(d\vec{\boldsymbol{B}} = \frac{\mu_0}{4\pi}\frac{Id\vec{\boldsymbol{l}} \times \hat{r}}{\lvert\vec{r}\rvert^2}\right)$$	1 ½	

	(b) $B_p = \frac{\mu_0 \times 1}{2R} = \frac{\mu_0}{2R}$ (along z – direction) $B_Q = \frac{\mu_0 \times \sqrt{3}}{2R} = \frac{\mu_0\sqrt{3}}{2R}$ (along x – direction) $\therefore B = \sqrt{{B_p}^2 + {B_Q}^2} = \frac{\mu_0}{R}$ This net magnetic field **B**, is inclined to the field $\mathbf{B_p}$, at an angle Θ, where $\tan\theta = \sqrt{3}$ $\left(/\ \theta = \tan^{-1}\sqrt{3} = 60^0\right)$ (in XZ plane)	½ ½ ½	3
Q22	Formula for energy stored ½ Energy stored before 1 Energy stored after 1 Ratio ½ Energy stored = $\frac{1}{2}\ CV^2\ (= \frac{1}{2}\frac{Q^2}{C})$ Net capacitance with switch S closed = $C + C = 2C$ $\therefore$ Energy stored = $\frac{1}{2} \times 2C \times V^2 = CV^2$ After the switch S is opened, capacitance of each capacitor= KC $\therefore$ Energy stored in capacitor A = $\frac{1}{2}KCV^2$ For capacitor B, Energy stored = $\frac{1}{2}\frac{Q^2}{KC} = \frac{1}{2}\frac{C^2V^2}{KC} = \frac{1}{2}\frac{CV^2}{K}$ $\therefore$ Total Energy stored = $\frac{1}{2}KCV^2 + \frac{1}{2}\frac{CV^2}{K} = \frac{1}{2}CV^2\left(K + \frac{1}{K}\right)$ $= \frac{1}{2}CV^2\left(\frac{K^2+1}{K}\right)$	½ ½ ½ ½ ½	

	$\therefore$ Required ratio = $\dfrac{2CV^2.K}{CV^2(K^2+1)} = \dfrac{2K}{(K^2+1)}$	½	**3**
	SECTION D		
Q23	a) Name of the installation, the cause of disaster ½ + ½ b) Energy release process 1 c) Values shown by Asha and mother 1+1 a) (i) Nuclear Power Plant:/'Set-up' for releasing Nuclear Energy/Energy Plant (Also accept any other such term) (ii)Leakage in the cooling unit/ Some defect in the set up. b) Nuclear Fission/Nuclear Energy Break up (/ Fission) of Uranium nucleus into fragments c) Asha: Helpful, Considerate, Keen to Learn, Modest Mother: Curious, Sensitive, Eager to Learn, Has no airs (Any one such value in each case)	½ ½ **1** **1** **1**	**4**
	SECTION E		
Q24	(a) Derivation of E along the axial line of dipole 2 (b) Graph between E vs r 1 (c) (i) Diagrams for stable and unstable equilibrium of dipole ½ + ½ (ii) Torque on the dipole in the two cases ½ + ½ (a)  Electric field at P due to charge $(+q) = E_1 = \frac{1}{4\pi\varepsilon_0}\frac{q}{(r-a)^2}$ Electric field at P due to charge $(-q) = E_2 = \frac{1}{4\pi\varepsilon_0}\frac{q}{(r+a)^2}$ Net electric Field at P= $E_1 - E_2 = \frac{1}{4\pi\varepsilon_0}\frac{q}{(r-a)^2} - \frac{1}{4\pi\varepsilon_0}\frac{q}{(r+a)^2}$ $= \frac{1}{4\pi\varepsilon_0}\frac{2pr}{(r^2-a^2)^2}$ $(p = q.2a)$ Its direction is parallel to $\vec{p}$.	 ½ ½ ½ ½	

	(b)  (Note: Award ½ mark if the student just writes: For short Dipole = $\frac{1}{4\pi\varepsilon_0}\frac{2p}{r^3}$ without drawing the graph)	1	
	(c)  Stable equilibrium	½	
	 Unstable equilibrium	½	
	(Note: Award ½ mark only if the student does not draw the diagrams but just writes: (i) For stable Equilibrium: $\vec{p}$ is parallel to $\vec{E}$. (ii) For unstable equilibrium: $\vec{p}$ is antiparallel to $\vec{E}$) Torque = 0 for (i) as well as case (ii). (Also accept, $\vec{\tau} = \vec{p} \times \vec{E}$ / $\tau = pE\sin\theta$)	½ + ½	5
	OR a) Using Gauss's theorem to find E due to an infinite plane sheet of charge — 3 b) Expression for the work done to bring charge q from infinity to r — 2		

	a)		
		½	
	$$\oint E.ds = \frac{q}{\varepsilon_0}$$	½	
	The electric field E points outwards normal to the sheet. The field lines are parallel to the Gaussian surface except for surfaces 1 and 2. Hence the net flux = $\oint E.ds = EA + EA$ where A is the area of each of the surface 1 and 2.	1	
	$\therefore \oint E.ds = \frac{q}{\varepsilon_0} = \frac{\sigma A}{\varepsilon_0} = 2EA;$ $E = \frac{\sigma}{2\varepsilon_0}$	1	
	b) $$W = q\int_{\infty}^{r} \vec{E}.d\vec{r}$$	½	
	$$= q\int_{\infty}^{r}(-Edr)$$	½	
	$$= -q\int_{\infty}^{r}\left(\frac{\sigma}{2\epsilon_0}\right)dr$$	½	
	$$= \frac{q\sigma}{2\in}\lvert\infty - r\rvert$$ $$\Rightarrow (\infty)$$	½	
			5

Q25

a) Identification	½
b) Identifying the curves	1
Justification	½
c) Variation of Impedance with frequency	½
Graph	½
d) Expression for current	1½
Phase relation	½

a) The device X is a capacitor ½

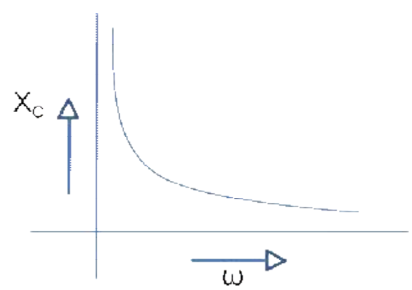
b) Curve B $\longrightarrow$ voltage

Curve C $\longrightarrow$ current ½

Curve A $\longrightarrow$ power ½

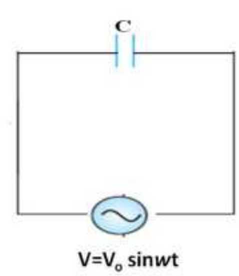
Reason: The current leads the voltage in phase, by $\pi/2$, for a capacitor. ½

c) $X_c = \frac{1}{\omega C}$ $(/ X_c \propto \frac{1}{\omega})$ ½



½

d) $V = V_o \sin \omega t$



$Q = CV = CV_O \sin \omega t$ ½

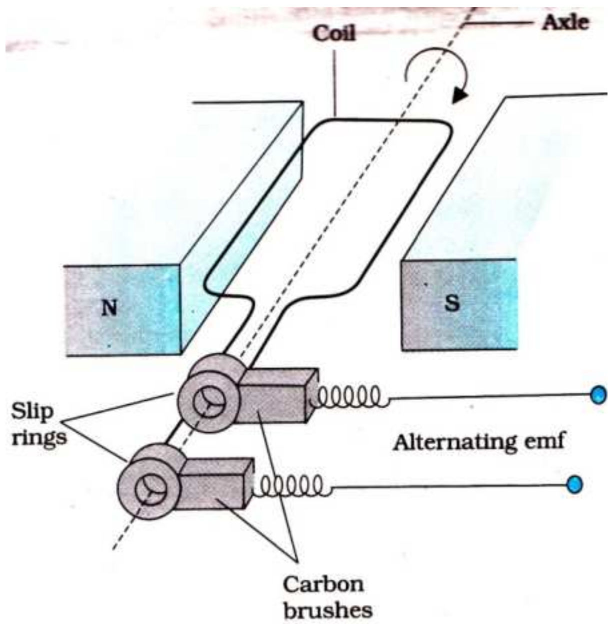
$I = \frac{dq}{dt} = \omega c V_O \cos \omega t$ ½

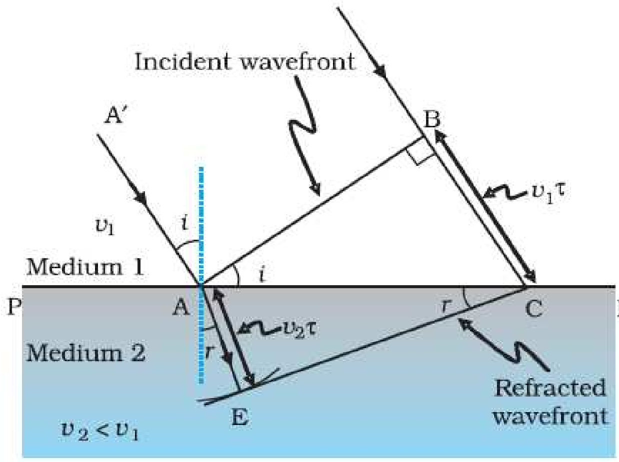
$= I_O \sin(\omega t + \pi/2)$ ½

Current leads the voltage, in phase, by $\pi/2$ ½

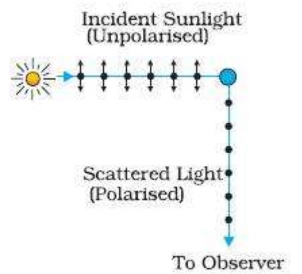
(Note : If the student identifies the device X as an Inductor but writes correct answers to parts (c) and (d) (in terms of an inductor), the student be given full marks for (only) these two parts)

5

	OR		
	a) Labelled diagram of ac generator — 1 Expression for emf — 2 b) Formula for emf — ½ Substitution — ½ Calculation of emf — 1		
	a)  	**1**	
	Let ω be the angular speed of rotation of the coil. We then have		
	$\phi(t) = NBA\cos\omega t$	½	
	$\therefore\ E = -\frac{d\phi}{dt}$		
	$= NBA\omega \sin \omega t$	½	
	$= E_0 \sin \omega t \qquad (E_0 = NBAw)$	**1**	
	b) Induced emf $= BlV$	½	
	$\therefore E = 0.3 \times 10^{-4} \times 10 \times 5$ volt	½	
	$E = 1.5 \times 10^{-3}\text{V}\ (= 1.5\text{mV})$	**1**	5

Q26	a) Definition of wavefront ½ Verifying laws of refraction by Huygen's principle 3 b) Polarisation by scattering ½ Calculation of Brewster's angle 1 a) The wavefront is the common locus of all points which are in phase(/surface of constant phase)	½	
		1	
	Let a plane wavefront be incident on a surface separating two media as shown. Let v_1 and v_2 be the velocities of light in the rarer medium and denser medium respectively. From the diagram		
	$BC = v_1 t$ and $AD = v_2 t$	½	
	$\sin i = \frac{BC}{AC}$ and $\sin r = \frac{AD}{AC}$	½	
	$\therefore \frac{\sin i}{\sin r} = \frac{BC}{AD} = \frac{v_1 t}{v_2 t}$	½	
	$= \frac{v_1}{v_2} = a\ constant$	½	
	This proves Snell's law of refraction.		

b) When unpolarised light gets scattered by molecules, the scattered light has only one of its two components in it.
(Also accept diagrammatic representation



) ½

We have, $\mu = \tan i_B$ ½

$\therefore \tan i_B = 1.5$

$\therefore i_B = \tan^{-1} 1.5$ ½

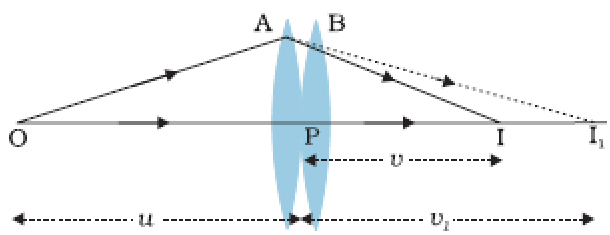
(/56.3°)

5

OR

a)	Ray diagram	1
	Expression for power	2
b)	Formula	½
	Calculation of speed of light	1 ½

a)



1

Two thin lenses, of focal length f_1 and f_2 are kept in contact. Let O be the position of object and let u be the object distance. The distance of the image (which is at I_1), for the first lens is v_1.

This image serves as object for the second lens. ½

	Let the final image be at I. We then have $$\frac{1}{f_1} = \frac{1}{v_1} - \frac{1}{u}$$ $$\frac{1}{f_2} = \frac{1}{v} - \frac{1}{v_1}$$ Adding , we get $$\frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$ $$\therefore \frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$ $$\therefore P = P_1 + P_2$$ b) At minimum deviation $$r = {}^{A}/_{2} = 30^0$$ We are given that $$i = \frac{3}{4}A = 45^0$$ $$\therefore \mu = \frac{\sin 45^0}{\sin 30^0} = \sqrt{2}$$ $\therefore$ Speed of light in the prism $= \frac{c}{\sqrt{2}}$ $(\cong 2.1 \times 10^8\ ms^{-1})$ [Award ½ mark if the student writes the formula: $$\mu = \frac{\sin(A + D_m)/2}{\sin({}^{A}/_{2})}$$ but does not do any calculations.]	½ ½ ½ ½ ½ ½ ½	**5**