Marking Scheme Strictly Confidential (For Internal and Restricted use only) Senior School Certificate Examination, 2025 SUBJECT NAME PHYSICS [PAPER CODE 55(B/S)]	
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 0-70 (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(B/S)			
Q. No.	**VALUE POINTS/EXPECTED ANSWERS**	**Marks**	**Total Marks**
	SECTION A		
1.	(B) The magnitude of electric field is zero at all points in a region where the potential is zero.	1	1
2.	(B) 2.9 W	1	1
3.	(B) $\frac{qBv}{m}$	1	1
4.	(A)18 mH	1	1
5.	(B) A transformer can work for both alternating and direct voltages.	1	1
6.	(B) Changing the material of the coil.	1	1
7.	(B) Frequency	1	1
8.	(B) 0.75 m	1	1
9.	(A) Red light beam has higher number of photons than that in blue light beam.	1	1
10.	(C) 9×10^{10} J	1	1
11.	(A) Arsenic	1	1
12.	(C) Finally, diffusion current and the drift current are equal to each other.	1	1
13.	(D) Both Assertion (A) and Reason (R) are 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.	(C) Assertion (A) is true, but Reason (R) is false.	1	1
16.	(D) Both Assertion (A) and Reason (R) are false.	1	1
	SECTION- B		
17.	Finding the magnitude of the force 1 ½ Finding the direction of force ½		

	$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_1}{r^2}$	½	
	$F = 9 \times 10^9 \times \frac{1.6 \times 10^{-19} \times 1.6 \times 10^{-19}}{4.8 \times 4.8 \times 10^{-22}}$	½	
	$= 10^{-7}$ N Towards nucleus	½ ½	2
18.	Finding energy stored in combination 2 $C_1 = C_2 = 50 \times 10^{-12}$ F $V_1 = 100$ V $V_2 = 0$ Common potential $V = \frac{C_1 V_1 + C_2 V_2}{C_1 + C_2}$ $V = \frac{50 \times 10^{-12} \times 100}{100 \times 10^{-12}} = 50V$ Energy stored $U = \frac{1}{2}(C_1 + C_2)V^2$ $U = \frac{1}{2} \times 100 \times 10^{-12} \times 50 \times 50$ J $U = 1.25 \times 10^{-7}$ J **Alternatively**: $q_1 = C_1 V_1$ $= 50 \times 10^{-12} \times 100$ $= 5 \times 10^{-9}$ C $q_2 = 0$ $q = q_1 + q_2$ $q = 5 \times 10^{-9}$ C $U = \frac{1}{2}\frac{q^2}{(C_1 + C_2)} = \frac{1}{2}\frac{(5 \times 10^{-9})^2}{(100 \times 10^{-12})}$ $U = 1.25 \times 10^{-7}$ J	 ½ ½ ½ ½ ½ ½ ½ ½	2
19.	Finding the electrical conductivity 2 $\sigma = \frac{1}{\rho} = \frac{l}{RA}$ $R = \frac{V}{I} = \frac{6}{4} = 1.5\Omega$	½ ½	

	$\sigma = \dfrac{4}{1.5\times8\times10^{-6}}$	½	
	$= 3.3\times10^{5}\,\Omega^{-1}m^{-1}$	½	2
20.	Finding the ratio of wavelengths 2		
	$\dfrac{1}{\lambda} = R\left[\dfrac{1}{n_1^2} - \dfrac{1}{n_2^2}\right]$	½	
	$\dfrac{1}{\lambda_1} = R\left[\dfrac{1}{(2)^2} - \dfrac{1}{(3)^2}\right] = \dfrac{5}{36}R$	½	
	$\dfrac{1}{\lambda_2} = R\left[\dfrac{1}{(1)^2} - \dfrac{1}{(2)^2}\right] = \dfrac{3}{4}R$	½	
	$\dfrac{\lambda_2}{\lambda_1} = \dfrac{5}{27}$	½	
	OR		
	Finding the ratio of nuclear radii 2		
	$R = R_0 A^{1/3}$	½	
	$\dfrac{R_1}{R_2} = \left(\dfrac{A_1}{A_2}\right)^{\frac{1}{3}}$	½	
	$\dfrac{R_1}{R_2} = \left(\dfrac{125}{27}\right)^{1/3}$	½	
	$\dfrac{R_1}{R_2} = \dfrac{5}{3}$	½	2
21.	Calculation of electron concentration 2		
	$n_e n_h = n_i^2$	½	
	$= \dfrac{2\times1.5\times10^{-2}\times540\times10^{-9}}{0.09\times10^{-2}}$	½	
	$= \dfrac{1.5\times10^{10}\times1.5\times10^{10}}{2.25\times10^{15}}$	½	
	$= 10^{5}\ \text{cm}^{-3}$	½	2

	SECTION- C		
22.	(a) (i) Explanation for steady drift speed of electrons 1½ (ii) Calculating change in drift speed 1½		
	(a) (i) Due to the force exerted by the external electric field, each free electron inside the conductor does accelerate and increases its speed until it collides with a positive ion of the metal. It losses its speed and again starts to accelerate to increase its speed again to suffer a collision again and so on. Therefore electrons acquire on average a drift speed.	1½	
	(ii) $v_d = \frac{eE\tau}{m} = \frac{eV\tau}{ml}$	½	
	$v_d \, \alpha \frac{1}{l}$	½	
	When l becomes $2l$ Drift velocity reduces to half	½	
	OR		
	(b) (i) Definition of internal resistance of a cell ½ Naming two factors affecting internal resistance ½+½ (ii) Derive an expression for internal resistance of a cells 1½		
	(b) (i) The resistance offered by the electrolyte of a cell to the flow of current between its two electrodes is called internal resistance.	½	
	Factors – Nature of electrolyte $r \propto$ concentration of electrolyte $r \propto$ distance b/w two electrodes $r \propto \frac{1}{\text{Area of electrodes}}$ immersed in electrolyte	½	
	$r \, \alpha \frac{1}{\text{Temp.}}$ Any two factors	½	
	(ii) Total resistance in the current = R + nr Total emf = nε $I = \frac{n\varepsilon}{R+nr}$	½	
	$nr = \frac{n\varepsilon}{I} - R$	½	
	$r = \frac{\varepsilon}{I} - \frac{R}{n}$	½	3

23.	(a) Statement of Faraday's law 1 (b) Obtaining expression for instantaneous value of emf 1½ Condition for maximum induced emf ½ (a) The magnitude of the induced emf in a circuit is equal to the time rate of change of magnetic flux through the circuit. (award ½ mark if the student only writes $\varepsilon = -\frac{d\phi_B}{dt}$) (b) ϕ = BA cos θ = BA cos ωt For N turns ϕ = NBA cos ωt $\varepsilon = -\frac{d\phi_B}{dt}$ ε = +NBA ω sin ωt For maximum ε, $\omega t = \frac{\pi}{2}$ ∴ ε_0 = NBAω	1 ½ ½ ½ ½	3
24.	Method to produce EMW 1 Writing two characteristics of EMW ½+½ Giving one use of – (i) radio waves ½ (ii) microwaves ½ EMW are produced by accelerating/ oscillating charges **Characteristics**: 1. Travel with speed of light in free space. 2. Transverse in nature. 3. Exert pressure on the surface they fall. 4. Carry momentum and energy (Or any other two characteristics) **Uses**: (i) Radio waves are used for Radio or T.V. communication. (ii) Microwaves: Radar / Satellite communication (Any other use)	1 ½+½ ½ ½	3
25.	(a) Explaining diffraction of light 1 (b) Finding the width of central maximum 2 (a) When a single narrow slit is illuminated by a monochromatic source. Waves coming from different part of slit superimpose then a broad pattern with a central bright region is seen. On both sides with alternate dark and bright regions, the intensity becoming weakening away from the center. This is called diffraction of light. (b) $\beta_o = \frac{2D\lambda}{a}$ $= \frac{2\times1.5\times10^{-2}\times540\times10^{-9}}{0.09\times10^{-2}}$	1 ½ 1	

<table>
<tr><td></td><td>$= 1.8 \times 10^{-7}$ m</td><td>½</td><td>3</td></tr>
<tr><td>26.</td><td>(a) Differentiating isobars and isotones 1
(b) Showing mass independence of nuclear density 2

(a) Nucleides with same mass number are called isobars.
Nucleides with same neutron number but different atomic numbers are called isotones.
(b) If R is the radius of nucleus, then its volume
$V = \frac{4}{3}\pi R^3$
As $R = R_o A^{\frac{1}{3}}$, $V = \frac{4}{3}\pi R_o^3 A$
Density of nucleus
$\rho = \frac{M}{V} = \frac{A}{\frac{4}{3}\pi R_o^3 A}$
$\rho = \frac{3}{4\pi R_o^3} = \text{constant}$
The nuclear density is independent of A.</td><td>1

½

½

½

½</td><td>3</td></tr>
<tr><td>27.</td><td>(a)Explaining the experimental features of photoelectric emission 1½
(b)Identifying the metal(s) exhibiting photoelectric effect 1½

(a) Einstein’s photoelectric equation
$K_{\max} = h\upsilon - h\upsilon_0$
1. If $\upsilon > \upsilon_0$, $K_{\max}$ of ejected electron increases with frequency of incident radiation.
2. For $\upsilon < \upsilon_0$, $K_{\max}$ is negative which is not possible. So, no photoelectric emission takes place below threshold frequency.
(Give full credit to the student for explaining any other feature)

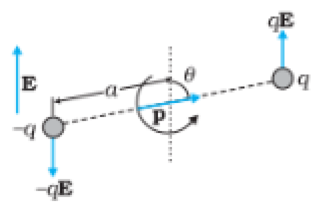
(b) $E = \frac{hc}{\lambda} = = \frac{6.63\times10^{-34}\times3\times10^{8}}{450\times10^{-9}\times1.6\times10^{-19}} eV$
$= 2.76$ eV
$\therefore$ Metal B & C will exhibit photo-electric effect.</td><td>½

½

½

½

½
½</td><td>3</td></tr>
<tr><td>28.</td><td>(a)Differentiating between two types of extrinsic semiconductors 1
(b)Explanation for higher mobility of electrons in conduction band 2
(a)
<table><tr><th>n- type of semiconductor</th><th>p-type of semiconductor</th></tr><tr><td>1. It is formed by doping with group 15 elements.
2. Majority charge carriers are electrons.</td><td>1. It is formed by doping with group 13 elements.
2. Majority charge carriers are holes.</td></tr></table></td><td>1</td><td></td></tr>
</table>

	(b) Electron in conduction band are almost free and get easily accelerated by an E-field. Electrons in V.B. are bound between the atoms of a semiconductor, less accelerated by an E-field. So acquire lesser drift velocity than that of electrons in the C.B. The mobility of electrons in the V.B. is less than the mobility of the electrons in CB. As the motion of an e^- in the VB is equivalent to the motion of a hole in opposite direction, hence the mobility of hole in the V.B. is smaller than mobility of an electrons in CB.	2	3
	SECTION- D		
29.	(i) (D) $\frac{\mu_0 I_1}{2\pi r}$ (ii) (B) $\frac{\mu_0 I_1 I_2}{2\pi r}$, pointing vertically downward. (iii) Give full marks for any choice of answer. (iv) (a) (A) $\frac{I_1 r}{I_1 + I_2}$, I_1 and I_2 flow in the same direction. **OR** (b) (C) zero	1 1 1 1 1	4
30.	(i) (A) decreases, decreases (ii) (B) decrease (iii) (a) (B) quadrupled OR (b) (A) 0.375 mm (iv) (A) same frequency, same intensity and stable phase difference π.	1 1 1 1 1	4
	SECTION- E		
31.	(a) (i) Showing no translatory motion of dipole 1 Deriving the expression of torque 1½ Specifying the direction ½ (b) Finding the work done 1+1 (a) (i) An electric dipole which consists of two charges +q and –q and length $2a$ is placed in an electric field $\vec{E}$ making an angle θ.  Force on +q charge is $\vec{F} = +q\vec{E}$ Force an –q charge is $\vec{F}' = -q\vec{E}$ $\therefore F_{net} = 0$	½ ½	

	Net force on an electric dipole in a uniform E.F. is zero. Hence there will be no translating motion. These two equal and opposite forces on dipole form a couple which exerts a torque. $\tau = qE \times 2a \sin\theta$ $\tau = (q \times 2a) E \sin\theta$ $\tau = p E \sin\theta$ $\vec{\tau} = \vec{p} \times \vec{E}$ τ is $\perp$ to both $\vec{p}$ & $\vec{E}$ and its direction can be given by R.H. screw rule. (ii) $W = U_2 - U_1 = -pE\cos 180° - (-pE\cos 0°)$ $= pE + pE = 2pE$ $W = -pE\cos 90° - (-pE\cos 0°)$ $= 0 + pE = pE$ **OR** (b) (i) Explaining the charging of capacitor — 1 Obtaining the expression of energy stored — 2 (ii) Finding the area of plate — 2 (b) (i) As soon as we switch on the circuit the plate of the capacitor connected with positive terminal of battery loses electrons and gains positive charge. At the same time plate connected with negative terminal gains electrons and acquires negative charge till the potential difference between the capacitor plates is equal to potential difference between the terminals of battery. Work done in charging the capacitor through charge dQ $dW = VdQ$ As, $V = \frac{Q}{C}$ $dW = \frac{Q}{C}dQ$ Total work done $\int dW = \int \frac{Q}{C}dQ$ $W = \frac{Q^2}{2C} = \frac{1}{2}CV^2 \quad (\because Q = CV)$ (ii) Electric field , $E = \frac{\sigma}{\varepsilon_0} = \frac{Q}{A\varepsilon_0}$ $A = \frac{Q}{E\varepsilon_0} = \frac{4.0\times10^{-6}}{1600\times10^3\times8.85\times10^{-12}}\,m^2$ $A = 0.28\,m^2$	½ ½ ½ ½ ½ ½ ½ ½ 1 ½ ½ ½ ½ ½ 1 ½	5

32.

(i) Difference between electric field and magnetic field	1
(ii) Brief explanation of condition for (I),(II) and (III)	2
(iii) Finding the magnitude and direction of magnetic field	2

(i)

Electric field	Magnetic field
1. Produced due to stationary charged particles. 2. Influence electric charges. 3. Electric field lines do not form closed loop.	1. Produced due to moving charges. 2. Influence magnetic materials. 3. Magnetic field lines form closed loop

1

(Any one of the above/ any other correct difference)

(ii) Force on a moving charged particle

$$\vec{F} = q(\vec{v} \times \vec{B})$$ ½

(I) When $\vec{v} \perp \vec{B}$ i.e angle between $\vec{v}$ and $\vec{B}$ is 90º. ½

(II) When angle between $\vec{v}$ and $\vec{B}$ lies between 0º and 180º, except 90º, 0º and 180º i.e. 0º < θ <180º, except θ = 90º. ½

(III) When angle between $\vec{v}$ and $\vec{B}$ is either θ =0º or θ = 180º. ½

(iii) $dB = \frac{\mu_0 Idl}{4\pi r^2}\sin\theta$ ½

$$dB = \frac{4\pi \times 10^{-7} \times 10 \times 0.5 \times 10^{-2} \times \sin 90}{4\pi \times 1^2}$$ 1

$$dB = -5 \times 10^{-9}\,\text{T}$$ ½

OR

(b)

(i) Principle of working	1
Brief description of construction and working	1+1
(ii) Calculation of resistance of voltmeter	2

(i) Current carrying coil placed in a magnetic field experiences a torque. 1

Moving coil galvanometer is made of

1. Coil having many turns free to rotate about a fixed axis.
2. A cylindrical soft iron core.
3. Concave shaped magnetic poles.
4. Spring to provide restoring/ counter torque.
5. Pointer and scale.

1

When current flows through a coil a torque acts on it

$$\tau = \text{NIBA} \quad (1)$$ ½

(due to radial magnetic field $\sin\theta = 1$)

Spring provides a counter torque

$$\tau_r = k\phi \quad (2)$$

	In equilibrium		
	$k\phi = \text{NIBA}$		
	$\phi = \left(\frac{NBA}{k}\right)I$	½	
	(ii) $R = \frac{V}{I_g} - G$	½	
	$R = \frac{10}{10\times10^{-3}} - 100$		
	$R = 900\,\Omega$ in series	½	
	Resistance of voltmeter		
	$R_V = G + R$	½	
	$R_V = 100 + 900 = 1000\,\Omega$	½	5
33.	(a) (i) Finding the value of angle of minimum deviation 2 Stating the effect of medium(water) on angle of minimum deviation 1 (ii) Finding the minimum value of angle of incidence 2		
	(i) $n = \sqrt{2}$, $A = 60^0$		
	$n = \frac{\sin\left(\frac{D_m + A}{2}\right)}{\sin(A/2)}$	½	
	$\sqrt{2} = \frac{\sin\left(\frac{D_m + 60^0}{2}\right)}{\sin(60^0/2)}$	½	
	$\sin\left(\frac{D_m + 60^0}{2}\right) = \frac{1}{\sqrt{2}}$		
	$\sin\left(\frac{D_m}{2} + 30^0\right) = 45^0$	½	
	$D_m = 30^0$	½	
	As $n < \frac{n}{n_w}$, value of D_m decreases in water	1	
	(ii) $\sin i_c = \frac{1}{n}$	½	
	$i_c = \sin^{-1}\left(\frac{1}{n}\right) = \sin\left(\frac{1}{\sqrt{2}}\right)$	½	
	$i_c = 45^0$	½	
	For total internal reflection, angle of incidence > 45°	½	
	OR		
	(b) (i)I. Finding the distance of 5th bright fringe 1½ II. Finding the distance of 3rd dark fringe 1½ (ii) Finding the least distance from the center 2		

	(i) $\lambda_1 = 400 nm$, $\lambda_2 = 500\ nm$ Distance of 5th bright fringe $y_n^{max} = \frac{n\lambda D}{d}$ $y_5^{max} = \frac{5\lambda_2 D}{d}$ $y_5^{max} = \frac{5\times500\times10^{-9}\times1.5}{1.5\times10^{-3}}$ $y_5^{max} = 2.5\times10^{-3} m = 2.5 mm$ $y_n^{min} = \frac{(2n-1)\lambda D}{2d}$ Distance of 3rd dark fringe $y_3^{min} = \frac{5\times400\times10^{-9}\times1.5}{2\times1.5\times10^{-3}}$ $y_3^{min} = 1 mm$ $(ii)\ n\lambda_2 = (n+1)\lambda_1$ $\frac{n+1}{n} = \frac{\lambda_2}{\lambda_1} = \frac{500}{400}$ $n = 4$ Minimum distance $y_4 = \frac{n\lambda_2 D}{d}$ $= \frac{4\times500\times10^{-9}\times1.5}{1.5\times10^{-3}}$ $= 2\ mm$	½ ½ ½ ½ ½ ½ ½ ½ ½ ½	5