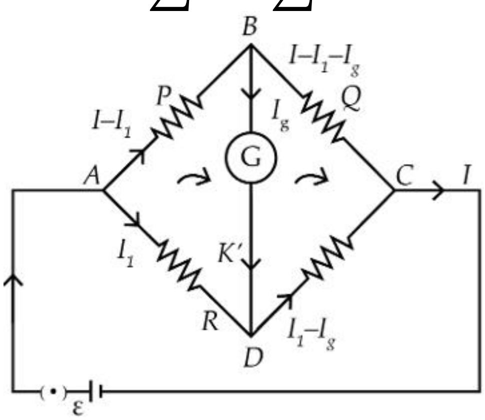
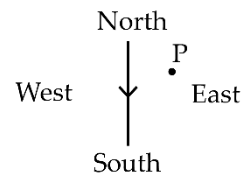
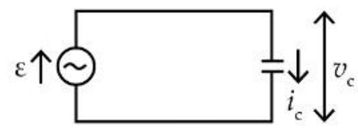
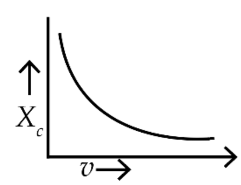
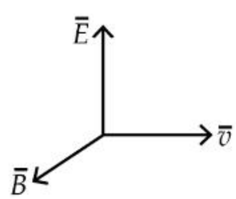
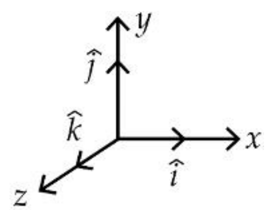
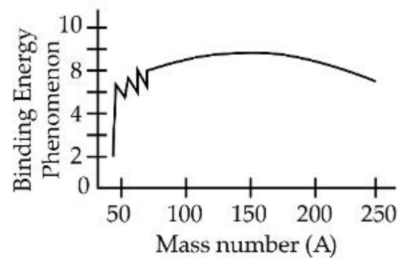
MARKING SCHEME
ALL INDIA SENIOR SCHOOL EXAMINATION, 2027
Sample Question Paper (2026-27)
Subject: Physics (150)

Q.No.	Expected Answer/ Value Points	Distribution of Marks
	Section A	
1.	(d) $\phi_E = \frac{q}{6\varepsilon_0}$ $\phi_E \rightarrow$ electric flux through each face	1
2.	(a) Current in series is same $I_X = I_Y = I_Z$	1
3.	(b) Rotatory motion only	1
4.	(d) At resonance impedance Z = R	1
5.	(b) Induced emf = $1.5 \times 10^{-3} V$	1
6.	(c) Number of turns in the coil	1
7.	(d) γ-ray	1
8.	(d) $L = f_0 + f_e = 45$ cm	1
9.	(b) 6×10^{14} Hz Frequency does not change with medium.	1
10.	(b) Frequency	1
11.	(c) Potential energy and total energy both increases	1
12.	(a)	1
13.	(b) Both (A) and (B) are true but (B) is not correct reason of (A)	1
14.	(b) Both (A) and (B) are true but (R) is not the correct explanation of (A).	1
15.	(c) (A) is true but (B) is false.	1
16.	(d) Both (A) and (B) are false.	1
	Section B	
17.	$R = \rho \frac{l}{A}$ $\frac{R_A}{R_Q} = \frac{\rho \frac{l}{A} \pi a^2}{\rho \frac{l}{\pi (1.5a)^2}} \Rightarrow R_Q = \frac{R_A}{2.25} = \frac{R}{2.25}$ OR Drift Velocity $v_d = \frac{I}{neA} = \frac{1.5}{2.5 \times 10^{28} \times 1.6 \times 10^{-19} \times 1.2 \times 10^{-6}}$ $= 0.3125$ mm/s	2 2
18.	Focal length of lens (i) in air $\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ …(1) In a medium $\frac{1}{f_m} = \left(\frac{\mu}{\mu_m} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ …(2) From 1 and 2 $f_m = \frac{(\mu-1)\mu_m}{(\mu - \mu_m)} f = \frac{(\mu-1)\frac{2}{3}\mu f}{\left(\mu - \frac{2}{3}\mu\right)}$ $\Rightarrow f_m = 2(\mu - 1)f$	2
19.	Here refracting angle $A = 60°$, Also $r = e = 45°$, and $A + \delta = i + e$ Deviation $\delta = i + e - A = 45 + 45 - 60 = 30°$	2
20.	Nuclear density $\rho = \frac{M}{V} = \frac{M}{\frac{1}{3}\pi r^3}$	2

<table>
<tr><th>Q.No.</th><th>Expected Answer/ Value Points</th><th>Distribution of Marks</th></tr>
<tr><td></td><td>Where $r = r_0 A^{\frac{1}{3}}$
$\therefore P = \frac{3M}{4\pi\left(r_0 A^{\frac{1}{3}}\right)^3}$
$$= \frac{3 \times 55.85 \times 1.66054 \times 10^{-27}}{4 \times 3.14 \times \left(1.2 \times 10^{-5} \times 56^{\frac{1}{3}}\right)^3}$$
$= 2.3 \times 10^{17}$ kg/m^3</td><td></td></tr>
<tr><td>21.</td><td>
<table>
<tr><th>n-type</th><th>p-type</th></tr>
<tr><td>(i) Doping with pentavalent impurity (Si or Ge with As, P)</td><td>Doping with trivalent impurity (Si, Ge with Al, In)</td></tr>
<tr><td>(ii) Majority carriers are electrons</td><td>Majority carriers are holes</td></tr>
</table>
</td><td>2</td></tr>
<tr><td></td><td>Section C</td><td></td></tr>
<tr><td>22.</td><td>(i) Algebraic sum of currents meeting at a junction is zero
$$\sum I = 0$$
(ii) In a closed loop algebraic sum of products of currents and resistances in different branches of the loop, equals algebraic sum of emfs in that loop.
$$\sum IR = \sum E$$


In the given circuit diagram of Wheatstone bridge ABCD, current distribution is as shown. In closed loop ABDA $(I - I_1)P + I_g G - I_1 R = 0$ (1)
In closed loop BCDB
$(I - I_1 - I_g)Q - (I_1 + I_g)S - I_g G = 0$ (2)
In balance state of the bridge $I_g = 0$ (3)
Therefore from (1) and (2)
$\frac{I-I_1}{I_1} = \frac{R}{p}$ (4)
$\frac{I-I_1}{I_1} = \frac{S}{Q}$ (5)
From (4) and (5)
$\frac{R}{P} = \frac{S}{Q}$
$\frac{P}{Q} = \frac{R}{S}$ (6)</td><td>3</td></tr>
</table>

Q.No.	Expected Answer/ Value Points	Distribution of Marks
	(6) is condition for balanced wheatstone bridge.	
23.	Force per unit length of either of the parallel wires A and B carrying current $f = \frac{\mu_0 I_1 I_2}{2\pi r}$ Force on length l of wire A. $$F_A = f l_A = \frac{\mu I_1 I_2 l_A}{4\mu r} = \frac{2\times 10^{-7}\times 8.0\times 5.0\times .1}{4.0\times 10^{-2}}$$ $= 2\times 10^{-5} N$ attractive OR At required point P magnetic field due to the current carrying wire  $B = \frac{\mu_0 I}{2\pi r} = \frac{2\times 10^{-7}\times 50}{2.5} = 4\times 10^{-6} T$ vertically outward	3
24.	The alternating EMF of generator  $\varepsilon = \varepsilon_0 \sin \omega t$ ...(1) From the Kirchhof's loop rule, the potential difference across the capacitor $v_C = V_{0c} \sin \omega t$ ...(2) $V_{0c} \rightarrow$ Voltage amplitude across the capacitor. Charge on the capacitor $q = C v_C = C V_{0c} \sin \omega t$ ...(3) Current $i_C = \frac{di}{dt} = C V_{0c} w \cos \omega t$ ...(4) Further from (4) $i_C = \frac{V_{0c}}{\frac{1}{\omega C}} \cos \omega t = \frac{V_{0c}}{X_C} \cos \omega t$ $i_C = I_{0c} \sin\left(\frac{\pi}{2} + \omega t\right)$ ...(5) From (2) and (5) it follows that current leads voltage by $\frac{\pi}{2}$ $I_{0_C} = \frac{V_{0c}}{X_C}$ ...(6) $I_{0c} \rightarrow$ current amplitude $X_C = \frac{1}{\omega C}$ ...(7) $X_C \rightarrow$ capacitive reactance $\omega = 2\pi v$ $X_C \propto \frac{1}{v}$ 	3
25.	In an electromagnetic wave $$\frac{\lvert\bar{E}\rvert}{\lvert\bar{B}\rvert} = \frac{\lvert\bar{E}_0\rvert}{\lvert\bar{B}_0\rvert} = \lvert\bar{v}\rvert = v = c\ (vaccum)$$ $$\lvert\bar{B}\rvert = \frac{\lvert\bar{E}_0\rvert}{C} = \frac{6.3}{3\times 10^8} = 2.1\times 10^{-8} T$$ $\bar{B} = B_0 \hat{k} = 2.1\times 10^{-8} T\hat{k}$  	3
26.	Given $v > v_0$ $v_0 \rightarrow$ threshold frequency $v \rightarrow$ frequency of incident radiation	3

Q.No.	Expected Answer/ Value Points	Distribution of Marks
	(i) Kinetic energy is independent of intensity, therefore the maximum kinetic energy of emitted electrons will remain unaffected. (ii) Higher intensity means more number of electrons will be emitted. Therefore, photelectric current will increase. (iii) de Broglie wavelength $\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2mE_{kmax}}}$ As E_{kmax} remains unchanged, therefore, de Broglie wavelength will remain same. $E_{kmax} \rightarrow$ maximum kinetic energy.	
27.	Binding energy per nucleon $\left(\frac{B.E}{A}\right)$ as a function of mass number A. $\left(\frac{B.E.}{A}\right)$ in M_eV  Binding energy per nucleon of the fused heavier nuclei is more than the binding energy per nucleon of the lighter nuclei. This means that the heavy nuclei are more highly bound than the light nuclei. Hence, heavier nuclei are more stable than lighter nuclei.	3
28.	Electron configuration of C, S_i and G_e respectively $_6C^{12}$ = 2, 4 $_{14}G^{v}$ = 2,8, 4 $_{32}G_e$ = 2, 8, 18, 4 4 bonding electrons in C in second orbit, in S_i in third orbit and in Ge in fourth orbit. Energy required to take electron out from these atoms is least for G_e followed by S_i and highest for C. Hence, number of free electrons for conduction in G_e and S_i are significant and negligibly small for carbon C. Hence, C is insulator, while S_i and G_e are intrinsic semiconductors.	3
	Section D	
29.	(i) (c) Parabolic with increasing speed OR (b) will move on straight path (ii) (b) first decreases to zero then increases (iii) (b) $p_p = \frac{p_x}{2}$ (iv) (d) $\left(v_0 + \frac{q_{E_0} t_0}{m}\right)\hat{j}$	4
30.	(i) (d) Total internal reflection (ii) (b) $\sin^{-1}\left(\frac{\mu_2}{\mu_1}\right)$ (iii) (a) One (iv) (c) Looming OR (c) 45°	4

Q.No.	Expected Answer/ Value Points	Distribution of Marks
	Section E	
31.	(see below)	5

(a) Consider a capacitor of capacitance C_0 charged by a battery of EMF V_0 such that $q_0 = C_0V_0$ ...(1)

$q_0 \rightarrow$ charge on the capacitor, when fully charged. If q be instantaneous charge on the capacitor and V potential difference across its plates then

$$V = \frac{q}{C_0} \quad \text{...(2)}$$

Work done in adding charge dq further to the capacitor

$$dw = Vdq \quad \text{....(3)}$$

Net work done $W = \int dw = \int_0^{q_0} Vdq = \int_0^{q_0} \frac{q}{C_0} dq$

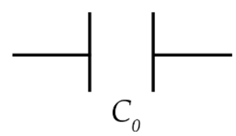
$$W = \frac{1}{2}\frac{q_0^2}{C_0} \quad \text{...(4)}$$

This work done is stored as electrostatic potential energy in the capacitor.

$$\therefore U_0 = \frac{1}{2}\frac{q_0^2}{C_0} \quad \text{...(5)}$$

$$\Rightarrow U_0 = \frac{1}{2}C_0V_0^2 \quad \text{...(6) (Using (1) in (5))}$$

(b) $C_0 = \frac{\epsilon_0 A}{d}$ (1) air capacitor

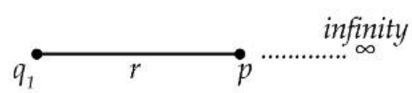


$C = \frac{\epsilon_0 A}{d - t + \frac{t}{k}}$ (2) with dielectric slab

$C = \frac{C_0 A}{d - \frac{3d}{4} + \frac{3d}{4k}} = \frac{4kC_0}{(k+3)}$ (3)

OR

(a) Electrostatic potential energy of a system of charges is the work done in making up the system against or by electrostatic force.



Potential of q_1 at point P

$V = \frac{1}{4\pi\epsilon_0}\frac{q_1}{r}$ ...(1)

Work done in bringing charge q_2 from infinity to point p

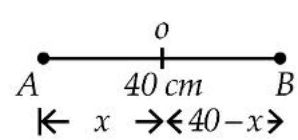
$W = q_2 V$ ...(2)

$W = q_0 \frac{1}{4\pi\epsilon_0}\frac{q_1}{r} = \frac{q_1 q_2}{4\pi\epsilon_0 r}$ ...(3)

This work done in electrostatic potential energy of the system

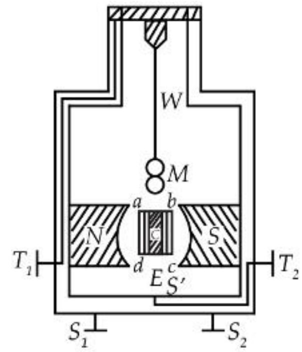
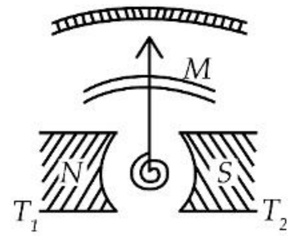
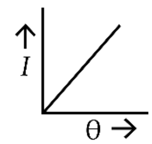
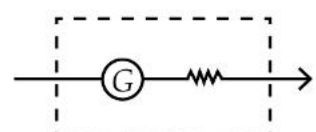
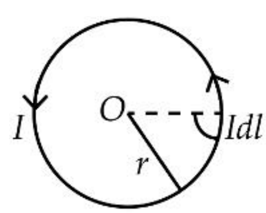
$\therefore U_E = \frac{q_1 q_2}{4\pi\epsilon_0 r}$ ...(4)

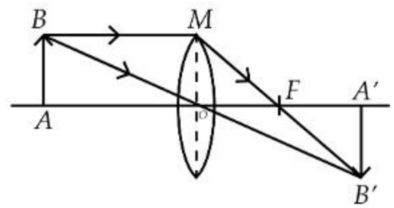
(b) Net potential at point O



$V_0 = V_1 + V_2$ ...(1)

$0 = V_1 + V_2 \qquad V_1 = -V_2$ ...(2)

Q.No.	Expected Answer/ Value Points	Distribution of Marks
	$\frac{1}{4\pi\epsilon_0}\frac{6\times10^{-6}}{X} = -\frac{1}{4\pi\epsilon_0}\left(\frac{-4\times10^{-6}}{40-X}\right) \Rightarrow X = 24cm$	
32.	(a) T_1, T_2 current leads $W \rightarrow$ Phosphor bronze suspension wire $S^1 \rightarrow$ Phosphor bronze spring $N, S \rightarrow$ Concave surfaced poles of field magnet S_1, S_2 Levelling screws $M \rightarrow$ Mirror for measuring deflection in the coil $aecd \rightarrow$ coil of thin insulated copper wire having n turns $C \rightarrow$ soft iron cylinder  Current I is passed through the coil aecd. Being in magnetic field B, it experience deflecting torque $T = nIAB\sin\theta$ ...(1)  $I \propto \theta$ in radial field. This gives linear scale $\sin\theta = 1$ in radial field $\therefore T = nIAB$ ...(2) In equilibrium restoring torque due to W and S^1. $T^1 = k\theta$ ...(3)  In equilibrium $T = T^1$ ...(4) $nIAB = k\theta \Rightarrow I = \left(\frac{k}{nAB}\right)\theta$ ...(5) $I = C'\theta$ ...(6) $C' = \frac{k}{nAB}$ ...(7) $C' \rightarrow$ Galvanometer constant Thus, by measuring θ deflection current I is measured by 16. (b) A galvanometer is converted into voltmeter of desired range by connecting high valve resistance in series of the galvanometer.  Voltmeter of range V $V = I_g(G+R)$ $10 = .01(10+R)$ $\Rightarrow R = 990\Omega$ OR (a) Biot Savart law magnetic field at centre O due to current element Idl of the loop  $dB = \frac{\mu_0 Idl gn\, 90}{4\pi r^2} = \frac{\mu_0 Idl}{4\pi r^2}$ ...(1) As due to all the elements of the loop, magnetic field is outward) in same direction, therefore resultant field at 0.	5

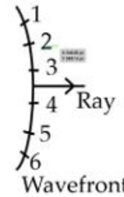
Q.No.	Expected Answer/ Value Points	Distribution of Marks
	$$B_0 = \oint dB = \oint \frac{\mu_0 I dl}{4\pi r^2} = \frac{\mu_0 I}{4\pi r^2}\oint dl$$ $$= \frac{\mu_0 I}{4\pi r^2}.2\pi r = \frac{\mu_0 I}{2r}$$ $B_0 = \frac{\mu_0 I}{2r}$ …(2) Due to n turns loop $B_0 = \frac{\mu_0 nI}{2r}$ (b) Magnetic field at the centre of n turns circular current loop $$B_0 = \frac{\mu_0 nI}{2r} = \frac{4\pi \times 10^{-7} \times 120 \times 30}{2 \times .1}$$ $$= 2.2 \times 10^{-2} T$$	
33.	(a) $AB \rightarrow$ Object $A'B' \rightarrow$ Image $OF \rightarrow$ Focal length of the lens $OA' \rightarrow$ v image distance $OA \rightarrow$ u object distance  Triangle $ABO \sim$ trangle $OA'B$ $\therefore \frac{A'B'}{AB} = \frac{OA'}{OA}$ …(1) Also, $\Delta OMF \sim \Delta FA'B'$ $\therefore \frac{A'B'}{OM} = \frac{FA'}{OF}$ …(2) Or $\frac{A'B'}{AB} = \frac{FA'}{OF}$ …(3) $(\because OM = AB)$ From (1) and (3) $\frac{OA'}{OA} = \frac{FA'}{OF} = \frac{OA'-OF}{OF}$ …(4) $OA = -u, OA' = v, OF = f$ …(5) Using (5) in (4) $\frac{v}{-u} = \frac{v-f}{f}$ $\frac{v}{u} = \frac{f-v}{f}$ …(6) $v_f = i_f - u_v$ $u_v = u_f - v_f$ $\Rightarrow \frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ or $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ …(7) (b) Height of object (needle) $h_1 = 4.5\ cm$ $u = -12\ cm$ $f = 15\ cm$ Position of image $v = 7$ $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ $\frac{1}{v} - \frac{1}{-12} = \frac{1}{15} \Rightarrow \frac{1}{v} = \frac{1}{15} - \frac{1}{12} = \frac{4-5}{60}$ $V = -60\ cm$ Magnification $m = \frac{h_2}{h_1} = \frac{v}{u}$ $$m = \frac{-60\ cm}{-12\ cm} = 5$$	5

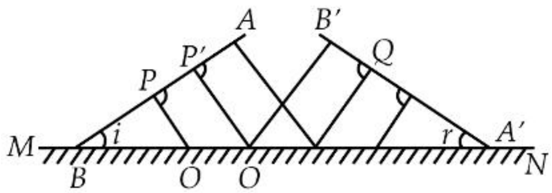
Q.No.	Expected Answer/ Value Points	Distribution of Marks

OR

(a) Wavefront: Locus of points which are in same phase of vibrations. Phase difference between any two points on this surface is zero.

Wavelet: Point on a wavefront which act as now source of light and spread with speed of light.





Points 1, 2, 3, etc. on the wavefront are wavelets

AB → incident wavefront

$A'B'$ → reflected wavefront

MN → reflecting surface (mirror)

Time required from incident wavefront AB to reflected wavefront $A'B'$ is same along all the path.

Now

$t = \frac{PO}{V} + \frac{OQ}{V}$ ...(1) v → speed of light

$= \frac{BO \sin i}{v} + \frac{OA' \sin r}{v}$

$= \frac{(BA' - OA') \sin i}{v} + \frac{OA' \sin r}{v}$

or $t = \frac{BA'}{v} \sin i - \frac{OA'}{v} (\sin i - \sin r)$ ...(2)

For constancy of time from AB to $A'B'$ (2) should be free from OA'

$$\therefore \sin i - \sin r = 0$$

$\Rightarrow i = r$ ...(3)

i → angle of incidence

r → angle of reflection

(b) Radius at time t $r = vt.$ ...(1) v → speed of light

$\therefore r_1 = vt_1$ ...(2)

$r_1 = vt_2$ ...(3)

$$\frac{r_1}{r_2} = \frac{t_1}{t_2} = \frac{4s}{8s} = \frac{1}{2}$$

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