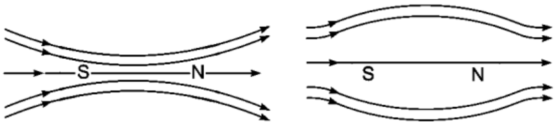
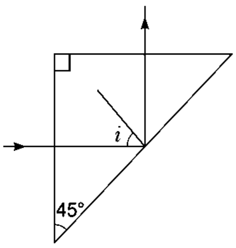
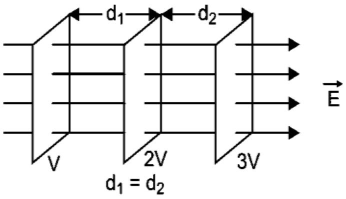
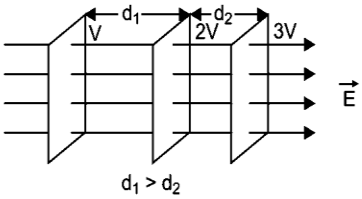
COMMON PRE-BOARD EXAMINATION

PHYSICS -Code No. 042

Class-XII-(2025-26)

SET- 1

ANSWER KEY

	SECTION–A	
1	(A) 20cm	1
2	(D) 5 x10^9 m^{-3}	1
3	(B) An accelerating charge	1
4	(C) k/2	1
5	(C) become double	1
6	(B) decreases	1
7	(A) move faster than its actual speed	1
8	(A) $K_{air} < K_{rubber} < K_{copper}$	1
9	(D) 9 : 4	1
10	(B) 2√2	1
11	(A) 0.04 A	1
12	(C) KE decreases, PE increases	1
13	(A)Both A and R are true and R is the correct explanation of A.	1
14	(D)Both A and R are false.	1
15	(B) Both A and R are true and R is not the correct explanation of A.	1
16	(C)A is true but R is false.	1
	SECTION–B	
17	Diamagnetic Any one example.  	2
18	The critical angle depends on refractive index n as $\sin i_c = \frac{1}{n}$ For total internal reflection, $\angle i \geq \angle i_c$ (critical angle) $\Rightarrow \quad 45° \geq \angle i_c \quad \Rightarrow \quad \angle i_c \leq 45°$ $\Rightarrow \quad \sin i_c \leq \sin 45° \Rightarrow \quad \sin i_c \leq \frac{1}{\sqrt{2}}$ $\Rightarrow \quad \frac{1}{\sin i_c} \geq \sqrt{2} \quad \Rightarrow \quad n \geq \sqrt{2}$ Hence, the minimum value of refractive index must be $\sqrt{2}$.  	2
19(I)	For constant electric field $\vec{E}$  For increasing electric field  	2

<table>
<tr><td>19(II)</td><td>

OR

	Non-Polar (O_2)	Polar (H_2O)
(a) Absence of electric field		
Individual	No dipole moment exists	Dipole moment exists
Specimen	No dipole moment exists	Dipole are randomly oriented. Net P = 0
(b) Presence of electric field		
Individual	Dipole moment exists (molecules become polarised)	Torque acts on the molecules to align them parallel to $\vec{E}$
Specimen	Dipole moment exists	Net dipole moment exists parallel to $\vec{E}$

</td><td>2</td></tr>
<tr><td>20</td><td>

The nearest distance of approach of an α -particle,

$x = \frac{2Ze^2}{4\pi\varepsilon_0} \times \frac{1}{\left(\frac{mv^2}{2}\right)}$

Now energy of α-particle $= \frac{1}{2}mv^2$ = 2.5 MeV

$= 2.5 \times 10^6 \times 1.6 \times 10^{-19} J$

$= 2.5 \times 1.6 \times 10^{-13} J$

Substituting values we get,

$x = \frac{2\times79\times1.6\times1.6\times10^{-38}\times9\times10^9}{2.5\times1.6\times10^{-13}}$

$= 9.101 \times 10^{-14} m$

</td><td>2</td></tr>
<tr><td>21(I)</td><td>

Let l be the length of the wire. When the wire is bent in the form of one turn circular coil,
$l_1 = 2\pi r1 \quad r_1 = l/2\pi$,N= 1

$$\therefore \quad B_1 = \frac{\mu_0 NI}{2r} = \frac{\mu\times1\times I}{2\times(l/2\pi)} = \frac{\mu_0\pi I}{l}$$

When the wire is bent in form of two-turn coil

$$l = 2\times 2\pi r_2 \text{ or } r_2 = \frac{1}{4\pi}, N = 2$$

$$\therefore \quad B_2 = \frac{\mu_0\times2\times I}{2\times(1/4\pi)} = \frac{4\mu_0\pi I}{l}$$

$$\therefore \quad \frac{B_2}{B_1} = 4:1$$

OR

</td><td>2</td></tr>
<tr><td>21(II)</td><td>

$$I_g = \frac{V}{R+G}$$

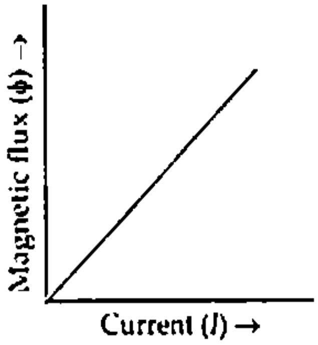
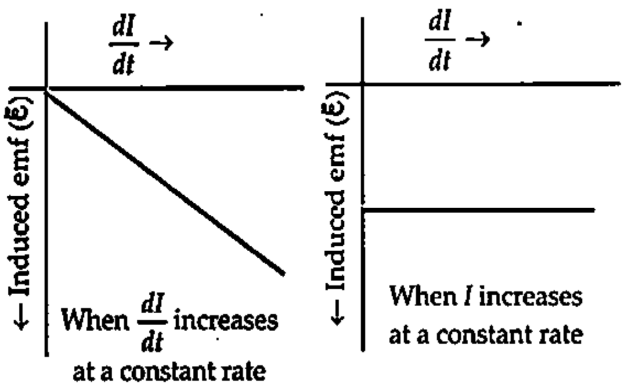
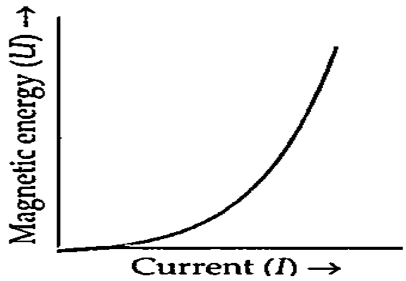
In first case, $I_g = \frac{V}{880+G}$

In second case, $I_g = \frac{V/2}{420+G} = \frac{V}{2(420+G)}$

$$\therefore \frac{V}{880+G} = \frac{V}{2(420+G)}$$

or $880 + G = 840 + 2G$ or $G = 40\Omega$.

</td><td>2</td></tr>
</table>

	SECTION–C	
22	i. As $\phi \propto$ I, so the graph of ϕ versus I is a straight line as shown in the figure.  ii. As $\varepsilon = -L\frac{dI}{dt}$, the graph of ε versus $\frac{dI}{dt}$ is a straight line with ε on the -ve side.  iii. Magnetic energy stored, $U = \frac{1}{2}LI^2$ $\Rightarrow U \propto I^2$ So the graph of U versus I is a parabola as shown in  	3
23	(i)As the dielectric slab is introduced between the plates of the capacitor, its capacitance will increase. Hence, the potential drop across the capacitor will decrease ($V=\frac{Q}{C}$). As a result, the potential drop across the bulb will increase (since both are connected in series). So, its brightness will increase. (ii)As the resistance (R) is increased, the potential drop across the resistor will increase. As a result, the potential drop across the bulb will decrease (since both are connected in series). So, its brightness will decrease.	3

24	(i) Microwave is used in satellite communications. So λ_1 is the wavelength of microwave. (ii) Ultraviolet rays are used to kill germs in water purifier So λ_2 is the wavelength of UV rays. (iii) X-rays are used to detect leakage of oil in underground pipelines .So λ_3 is the wavelength of X-rays. (i) Mirowave is used in rader. UV is used in LASIK eye surgery.) X-rays is used to detect a fracture in bones.	3
25	Ratio 1:1 The fission of ${}^{56}_{26}Fe$ can be given as: ${}^{56}_{26}Fe \longrightarrow 2\,{}^{28}_{13}Al$ It is given that: Atomic mass of $m({}^{56}_{26}Fe) = 55.93494$ u Atomic mass of $m({}^{28}_{13}Al) = 27.98191$ u The Q-value of this nuclear reaction is given as: $Q = \left[m({}^{56}_{26}Fe) - 2m({}^{28}_{13}Al)\right]c^2$ $= [55.93494 - 2 \times 27.98191]c^2$ $= (-0.02888\ c^2)$ u But $1u = 931.5\ MeV/c^2$ $\therefore Q = -0.02888 \times 931.5 = -26.902$ MeV Not possible.	3
26(I)	Here, $R = 100\Omega, L = \frac{4}{\pi^2}H, E_v = 200V,$ $v = 50Hz C = ? I_v = ?$ When current is in phase with the voltage, $X_C = X_L$, i.e., $\frac{1}{\omega C} = \omega L, C = \frac{1}{\omega^2 L}$ $C = \frac{1}{4\pi^2 v^2 L} = \frac{1}{4\pi^2(50)^2 \times 4/\pi^2}$ $= \frac{1}{16 \times 2500}$ $= 0.25 \times 10^{-4}F = 25 \times 10^{-6}F = 25\mu F$ $I_v = \frac{E_v}{Z} = \frac{E_v}{R} = \frac{200}{100} = 2A$ $P = I_{rms}^2 R = (2\text{ A})^2(100\ \Omega) = 4 \times 100 = 400$ W **OR**	3
26(II)	Showing diagrammatically two different arrangements used for winding the primary and secondary coils in a transformer.	3

Here, $n_p = 2000, n_s = 50,$
$E_p = 120V, R_s = 0.6\Omega$
$E_s = ?, I_s = ?, I_p = ?, P_p = ?, P_s = ?$

(i) As $\frac{E_s}{E_p} = \frac{n_s}{n_p}$

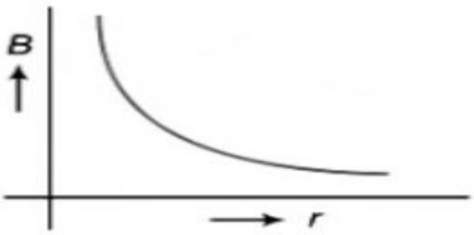
$\therefore E_s = E_p . \frac{n_s}{n_p} = 120 \times \frac{50}{2000} = 3V$

(ii) As $I_s = \frac{E_s}{R}$ $\therefore I_s = \frac{3}{0.6} = 5A$ (iii) As $\frac{I_p}{I_s} = \frac{E_s}{E_p}$

$\therefore I_p = \frac{E_s}{E_p} \times I_s = \frac{3}{120} \times 5 = 0.125A$

(iv) Power in primary,
$P_p = E_p \times I_p = 120 \times 0.125 = 15W$
Power in secondary, $P_s = E_s \times I_s = 3 \times 5 = 15W$

27 | 3



Student 2

Both the fields are perpendicular to each other

$$\therefore \quad B_{net} = \sqrt{B_P^2 + B_Q^2}$$

$$= \sqrt{\left(\frac{\mu_0 \times 3}{2(5\times10^{-2})}\right)^2 + \left(\frac{\mu_0 \times 4}{2(5\times10^{-2})}\right)^2}$$

$$= \frac{\mu_0}{2\times5\times10^{-2}}\sqrt{3^2+4^2}$$

$$= \frac{4\pi\times10^{-7}}{2\times5\times10^{-2}}\times5$$

$$= 2\pi \times 10^{-5} \text{ Tesla}$$

Also, $\tan\theta = \frac{B_P}{B_Q} = \frac{3}{4}$

$\Rightarrow \quad \theta = \tan^{-1}\frac{3}{4}$

28 | 3

(i) According to Einstein, packets of energy called photons, which are absorbed completely by electrons. This absorbed energy is used to reject the electron and also provide kinetic energy to the emitted electron.

(ii) $$\frac{1}{2}mV_{max}^2 = hv - \phi_0$$

$$V_{max}^2 = \left(\frac{2h}{m}\right)v - \left(\frac{2\phi_0}{m}\right)$$

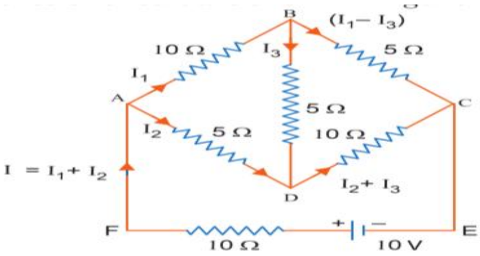
Hence, $\text{Slope} = \frac{2h}{m} = \frac{l}{n}$

$$h = \frac{ml}{2n}$$

$$\text{Intercept} = \frac{2\phi_0}{m} = l$$

Hence, $\phi_0 = \frac{ml}{2}$

	SECTION–D	
29		
	(I) (C) the actual transfer of electrons	1
	(II) (B) Option (ii)	1
	(III) (A) 1.97×10^{-8} N	1
	(IV) (C) both electric and magnetic effects	1
30		
	(I) $\beta = n\lambda D/d$ a. As d increases, β decreases so spacing between fringes also decreases. b. As λ decreases, β also decreases so spacing between fringes also decreases.	2
	(II)(i) Spherical wavefront (ii) Plane wavefront.	1
	(III)Angular separation is $\theta = \beta/D = D\lambda d/D = \lambda/d$ Since θ is independent of D, angular separation would remain same.	1
	SECTION–E	
31(I)	A labelled ray diagram to show the image formation in an astronomical telescope. Obtaining an expression for (i) the angular magnifying power (ii) length of the tube of an astronomical telescope in its 'normal adjustment' position. $M = -\frac{1}{f_o} \cdot \frac{D}{f_e}$ $30 = \frac{1}{1.25} \cdot \frac{25}{5}$ $L = \frac{1.25 \times 30 \times 5}{25 \times 100}$ $L = \frac{25 \times 30}{100}$ $L = \frac{30}{4}$ $L = 7.5$ cm This is a required separation between the objective and the eyepiece. **OR**	3+ 2
31(II)	Obtaining relation between focal length, radius of curvature and refractive index of a convex surface, using proper diagram. The convex lens will behave as a converging lens If f and -f be the focal length of coverging and diverging lenses respectively, then Power of combination, $P = P_1 + P_2 = \frac{1}{f} - \frac{1}{f} = 0$ ∴ Focal length of combination $F = \frac{1}{P} = \frac{1}{0} = \infty$	2+ 1+ 2
32(I)	Full wave rectifier. A neat labelled diagram and explanation of the construction of the device X. 120 Hz **OR**	1+ 3+ 1
32(II)	Diffusion and drift. Formation of a pn junction diode with suitable diagram. Definition of the term 'barrier potential'. V – I characteristics of a p–n junction diode.	1+ 2+ 1+ 1

33(I)	Establishing a relation between electric current and drift velocity. **i** As $v_d \propto V$, when V is halved the drift velocity is halved. **ii** As $v_d \propto \frac{1}{l}$, when l is doubled the drift velocity is halved. **iii** As v_d is independent of D, when D is halved drift velocity remains unchanged. **OR**	2+ 3
33(II)	Definition of the term 'Mobility' of charge carries in a conductor. m^2/Vs. $\mu = e\tau/m$  Current in branch $AB = I_1 = \frac{4}{17}$ A, Current in branch $BC = I_1 - I_3 = \frac{6}{17}$ A Current in branch $AD = I_2 = \frac{6}{17}$ A Current in branch $DC = I_2 + I_3 = \frac{4}{17}$ A Current in branch $BD = I_3 = -\frac{2}{17}$ A *i.e.*, Current in branch$= BD = \frac{2}{17}$ A and its direction is from D to B. Current drawn from cell, $I = I_1 + I_2 = \frac{10}{17}$ A	3+ 2