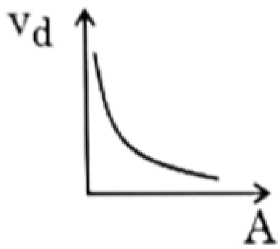
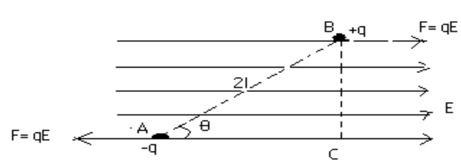
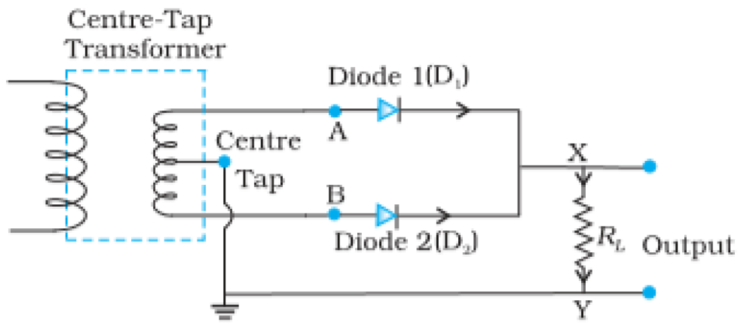
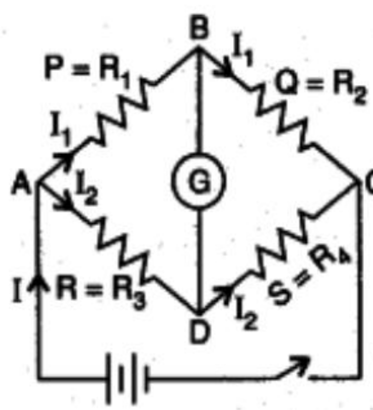
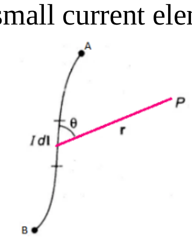
COMMON PRE-BOARD EXAMINATION
PHYSICS-Code No. 042
Class-XII-(2025-26)
ANSWER KEY
SET 1

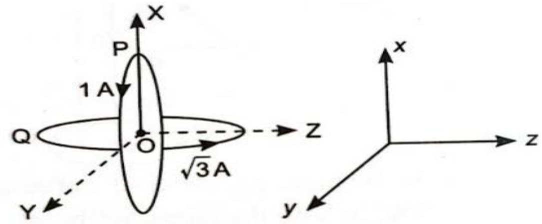
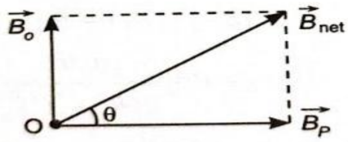
Q.NO.	ANSWERS	MARKS
1	(B) $\frac{Q}{\varepsilon_0}$	1
2	(A) 	1
3	(D) Capacitive and inductive respectively	1
4	(C) $\varepsilon_0 \frac{d\phi_E}{dt}$	1
5	(C) 4f	1
6	(B) maximum in the forward direction and zero in the backward direction.	1
7	(A) 13.6 eV, -27.2eV $KE = -(\text{Total Energy})$ $KE = -(-13.6\text{ eV})$ $KE = +13.6\text{ eV}$ $PE = 2 \times (\text{Total Energy})$ $PE = 2 \times (-13.6\text{ eV})$ $PE = -27.2\text{ eV}$	1
8	(A) Only P Only substance P will be attracted when taken near a magnet, as it has positive susceptibility. Substance Q is diamagnetic and will actually be repelled (though very weakly).	1
9	(A) 0.02 Wb	1
10	(D) $\frac{1}{200}$ s $T = \frac{2\pi}{\omega}$. $T = \frac{2\pi}{100\pi} = \frac{1}{50}$ s. $t = \frac{T}{4} = \frac{1/50}{4} = \frac{1}{200}$ s	1

11	(D) 1 The nuclear density of all atomic nuclei is approximately constant and is independent of the mass number of the nucleus.	1
12	(D)zero **Here v** × **B** = (4**î** + 3**k̂**) × (4**î** + 3**k̂**) The two vectors **v** and **B** are parallel, then their cross product is **zero**: **v** × **B** = **0** Therefore: **F** = q(**v** × **B**) = q × **0** = **0**	1
13	(D) Both Assertion and Reason are false.	1
14	(A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.	1
15	(A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.	1
16	(B) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion	1
	SECTION-B	
17	(a)The part of the electromagnetic spectrum next to the lowest frequency end of visible light is infrared radiation. (b) X-rays are produced by bombarding a metal target with high-energy electron Use of infrared radiation- Remote Controls, Infrared cameras, relieves muscle tension and pain associated with conditions like arthritis. (any one point) Use of X-rays - Diagnosing injuries, Airport screening: X-ray scanners are used to examine baggage and cargo at ports of entry to identify prohibited or restricted items. (Any one point)	½ ½ ½ ½
18	EMF = 6V Internal resistance = slope of the graph $r = \frac{E-V}{I}$ r = 6 – 4/1 = 2 Ω	½ ½ ½ + ½
19	It is a pair of equal and opposite charges separated by a small distance.  Torque = τ = F X perpendicular distance = qE x BC = q E x 2ℓ sinΘ = PE sinΘ	½ ½ 1

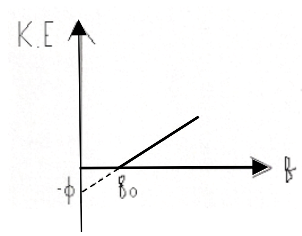
20(I)	Since the magnetic susceptibility $\chi = -2.6 \times 10^{-5}$ is **negative**, this is a **diamagnetic material**. Weak repulsion from magnetic field Relative permeability less than 1. It develops a magnetic moment in the opposite direction to the applied field (Any two properties)	1 ½ + ½
	OR	
20(II)	(A)The magnetic force acting on a charged particle is given by: **F** = q (**v** × **B**) **(B)** The force is **maximum** when **sin θ = 1**, which occurs when **θ = 90°** **Condition**: The charged particle moves **perpendicular to the magnetic field** (**v ⊥ B**) **(i)Maximum force**: Fmax = qvB The force is **minimum** (zero) when **sin θ = 0**, which occurs when **θ = 0°** or **θ = 180°** **Condition**: The charged particle moves **parallel or anti-parallel to the magnetic field** (**v ∥ B**) **(ii)Minimum force**: $F_{min} = 0$	½ ½ ½ ½
21(I)	$\frac{hC}{\lambda} = \varphi_o + eV_o$ $\varphi_o = (\frac{6.6\times10^{-34}\times3\times10^{8}}{2270\times10^{-10}\times1.6\times10^{-19}}$ - 1.3)eV = 4.2 eV (also accept the answer in joules) The value of energy of red light is less than the work function. So no photo emission.	½ ½ ½ ½
	OR	
21(II)	$\lambda_1 = \frac{12.3}{\sqrt{V}}$ $\lambda_2 = \frac{12.3}{\sqrt{3V}}$ ie $\lambda_2 = \frac{\lambda 1}{\sqrt{3}}$	1 1
	SECTION-C	
22	Labelled circuit diagram 1½ mark Explanation 1½ mark	

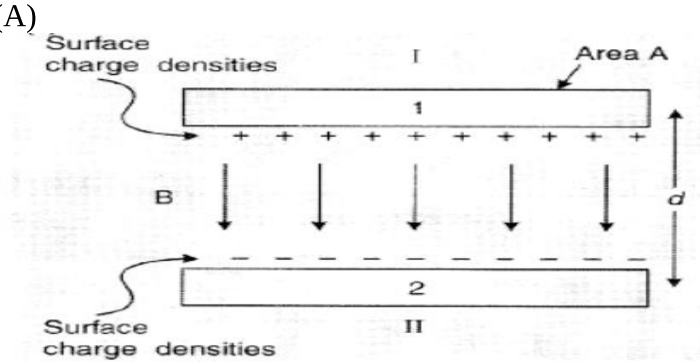
	 Explanation During positive half of the AC input, diode D1 gets forward biased and conducts and diode D2 gets reverse biased. During negative half of the AC input, diode D2 gets forward biased and conducts; and diode D1 gets reverse biased. So, output is obtained during both positive and negative half of the cycle in the same direction.	1 ½ ½ ½ ½
23	(A)  Applying kirchhoff's loop rule to closed loop ADBA $-I_1R_1 + 0 + I_2R_2 = 0\ (I_g = 0)$ ...(i) For loop CBDC, $-I_2R_4 + 0 + I_1R_3 = 0$ ...(ii) ⇒ from equation (i) $\frac{I_1}{I_2} = \frac{R_1}{R_2}$ From equation (ii) $\frac{I_1}{I_2} = \frac{R_4}{R_3}$ $\therefore \frac{R_1}{R_2} = \frac{R_4}{R_3}$	½ ½ ½ ½ ½

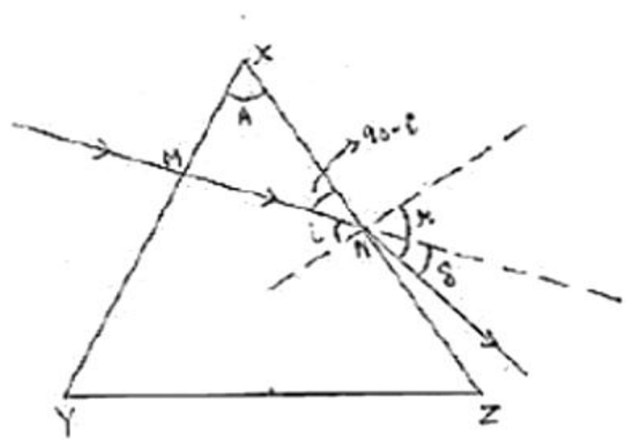
	(B) Meterbridge	½
24	Number of atoms= $\therefore N = \frac{6.023 \times 10^{23} \times 3}{63} = 2.868 \times 10^{22}$ atoms It has 29 protons and (63− 29) 34 neutrons $\Delta m' = 29 \times 1.007825 + 34 \times 1.008665 - 62.9296 = 0.591935$ u Mass defect of all atoms, $\Delta m = 0.591935 \times 2.868 \times 10^{22}$ $= 1.69766958 \times 10^{22}$ u But 1 u = 931.5 MeV/c^2 $\therefore \Delta m = 1.69766958 \times 10^{22} \times 931.5$ MeV/c^2 Hence, the binding energy of the nuclei of the coin is given as: $E_b = \Delta mc^2$ $= 1.69766958 \times 10^{22} \times 931.5$ MeV $= 1.581 \times 10^{25}$ MeV $= 2.5296 \times 10^{12}$ J	½ ½ 1 ½ ½
25	(A) $m = -\frac{v}{u}$ $-2 = -\frac{v}{u}$ $v = 2u$ $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$ $\frac{1}{-10} = \frac{1}{2u} + \frac{1}{u}$ $u = -15\,\text{cm}$ $v = -30\,\text{cm}$ (B) Yes, same image is formed with reduced intensity, because reflecting area get reduced and laws of reflection still hold good for remaining part of the mirror.	½ ½ ½ ½ 1
26	(A) Two sources are said to be coherent if the phase difference between them does not change with time. No, as the phase between them does not remain constant with time. (B) $4\beta_2 = 5\beta_1$ $4 \times \frac{\lambda D}{d} = 5 \times \frac{\lambda_{known} D}{d}$ $\Rightarrow \lambda = \frac{5}{4} \times \lambda_{known}$ $= \frac{5}{4} \times 520$ $= 650$ nm	½ ½ 1 ½ ½
27(I)	(A)Biot-Savart's law states that the magnetic field **dB** produced at a point by a small current element is:  • **Directly proportional** to the current (I) and the length of the current element (dl) • **Directly proportional** to the sine of the angle (θ) between the current element and the line joining the current element to the point	1

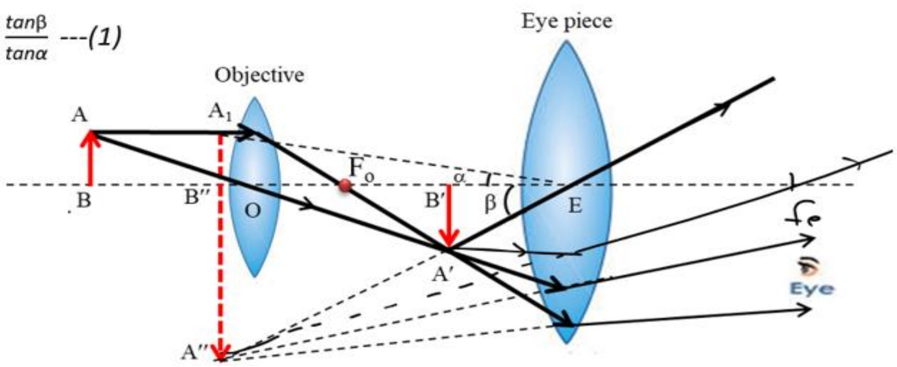
	• **Inversely proportional** to the square of the distance (r^2) between the current element and the point $\mathbf{dB} = (\mu_0/4\pi) \times (I\ \mathbf{dl} \times \mathbf{r})/r^3$ (B)   **At centre *O*** Magnetic field due to coil, $P = \vec{B}_P = \frac{\mu_o I}{2R}\hat{k}$ $\vec{B}_P = \frac{4\pi \times 10^{-7} \times 1}{2R}\hat{k}$ Magnetic field due to coil, $Q = \vec{B}_Q = \frac{4\pi \times 10^{-7} \times \sqrt{3}}{2R}\hat{i}$ $\therefore \quad \vec{B}_{net} = \vec{B}_P + \vec{B}_Q = \frac{4\pi \times 10^{-7}}{2R}\left[\hat{k} + \sqrt{3}\,\hat{i}\right]$ $\therefore \quad \lvert\vec{B}_{net}\rvert = \frac{4\pi \times 10^{-7}}{2R}\sqrt{1+3}$ $= \frac{4\pi \times 10^{-7}}{R}\,\mathbf{T}$	½ ½ ½ ½
	OR	
27(II)	(A) Gauss's law for magnetism states that the net magnetic flux through any closed surface is always zero. $\oint \mathbf{B} \cdot d\mathbf{A} = 0$ Significance- No Magnetic Monopoles. Magnetic Field Lines are Closed Loops. (Any significance) (B) The net magnetic moment of the combination of the two halves of the bar magnet is zero. (When the two halves are placed together, their magnetic moments will interact. Since the magnetic moments of the two halves are equal in magnitude but opposite in direction (one is upward and the other is downward), they will cancel each other out.)	1 1 1

28	Power factor of A $= \frac{R}{\sqrt{[R^2+[X_L]^2}} = \frac{R}{\sqrt{[R^2+[3R]^2}} = \frac{R}{R\sqrt{10}} = \frac{1}{\sqrt{10}}$	1

	Power factor of B = $\frac{R}{\sqrt{R^2+[X_c-X_L]^2}} = \frac{R}{\sqrt{R^2+[R-3R]^2}} = \frac{1}{\sqrt{5}}$ Ratio = $\frac{\sqrt{10}}{\sqrt{5}} = \sqrt{2}$	1 1
	SECTION-D	
29	(I) (B) $E = \frac{V_B}{d} = \frac{0\cdot4}{4\times10^{-7}}$ = 1.0 x 10^6 V/m (II) (C) Potential difference across R = $\frac{V}{I} = \frac{3-0\cdot4}{20\times10^{-3}} = 130\Omega$ (III) (D) Immobile positive and negative ions. (IV) (B) When $V=V_0$	1 1 1 1
30	(I) Energy of ordinary light is less than the work function of the Metal Zinc. Energy of ordinary light is greater than the work function of sodium. (II) Increases (III) 	1 1 1 1
	SECTION-E	

31	An equipotential surface is a surface where the electric potential is the same at every point. Two important properties are that the electric field is always perpendicular to the surface, and no work is done by the electric field when a charge moves along the surface. (i) Magnitude of electric field, $E = \frac{dV}{dr} = \frac{10V}{1 \times 10^{-2} m} = 10^{3} Vm^{-1}$ The direction fo electric field is form Y to Z. (ii) As surface A is an equipotential surface, the potential difference between X and Y is zero. Work done = q x ΔV = q x 0 = 0	Total-5 1 1 ½ + ½ ½ 1 ½
	OR	
31 (II)	(A)  Electric field between the plates of capacitor $E = \frac{\sigma}{\varepsilon_0} = \frac{Q}{A\varepsilon_0}$ $\therefore \quad V = Ed = \frac{Qd}{A\varepsilon_0}$ Capacitance, $C = \frac{Q}{V} = \frac{\varepsilon_0 A}{d}$ Energy is stored as electrostatic potential energy in the electric field that builds up between the plates of a parallel plate capacitor as it is being charged.	Diag ½ ½ ½ ½ +½ 1

	(B)	
	When the two charged spherical conductors are connected by a conducting wire they acquire the same potential. *i.e.* $\frac{Kq_1}{R_1} = \frac{Kq_2}{R_2} \Rightarrow \frac{q_1}{q_2} = \frac{R_1}{R_2}$	½
	Hence, ratio of surface charge densities, $\frac{\sigma_1}{\sigma_2} = \frac{q_1 / 4\pi R_1^2}{q_2 / 4\pi R_2^2}$	½
	$\frac{\sigma_1}{\sigma_2} = \frac{q_1 R_2^2}{q_2 R_1^2}$ $\frac{\sigma_1}{\sigma_2} = \frac{R_1}{R_2} \times \frac{R_2^2}{R_1^2} = \frac{R_2}{R_1}$	½
32	(A) (i) 	Diag-1
	At the face XZ :- $\mu \sin i = 1 \times \sin r$ ----- (1) $r = i + \delta$ [from diagram] ----- (2)	1
	In ΔXMN ; $A + (90 - i) + 90 = 180$ $\Rightarrow A = i$ ----- (3)	½
	Putting eq. (3) & (2) in eq. (1) $\mu \sin A = \sin(A + \delta)$ $\mu = \frac{\sin(A+\delta)}{\sin A}$	½
	(B)	

	(ii) (1) $\mu = \dfrac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\frac{A}{2}}$ $\sqrt{2} = \dfrac{\sin\left(\frac{60+\delta_m}{2}\right)}{\sin 30^\circ}$ $\Rightarrow \sin\left(\frac{60+\delta_m}{2}\right) = \frac{1}{\sqrt{2}} = \sin 45^\circ$ $\frac{60+\delta_m}{2} = 45^\circ \Rightarrow \delta_m = 30^\circ$ (2) $i = \frac{A+\delta_m}{2}$ $\Rightarrow i = \frac{60+30}{2}$ $i = 45^\circ$	½ ½ ½ ½
	OR	
32	(A) $m = \frac{\beta}{\alpha} \approx \frac{\tan\beta}{\tan\alpha}$ ---(1)  in △ A''B''E, $\tan\beta = \frac{A''B''}{B''E}$ and in △ $A_1B''E$ $\tan\alpha = \frac{A_1B''}{B''E} = \frac{AB}{B''E}$ $m = \frac{A''B''}{B''E} \times \frac{B''E}{AB} = \frac{A''B''}{AB} = \frac{A''B''}{A'B'} \times \frac{A'B'}{AB}$ $m = m_e \times m_o$ $m_e = \left(1+\frac{d}{f_e}\right)$ and $m_o = \frac{A'B'}{AB} = \frac{V_o}{-u_o}$ $m = \frac{V_o}{-u_o}\left(1+\frac{d}{f_e}\right)$ (B) m = fo/fe M = 100/5 = 20.	Diag-1 ½ +½ ½ + ½ ½ ½ ½ ½

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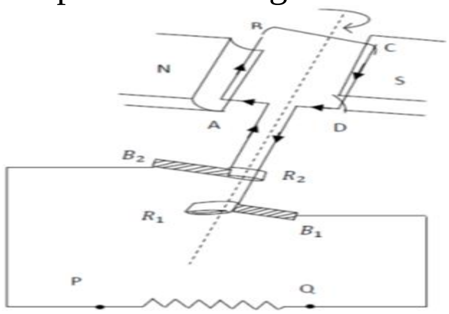
<td>33</td>
<td>(A) Principle: electromagnetic induction

<u>Working</u>:
In the fig. the frame ABCD is rotating with an angular velocity ω. Due to the change in flux an emf is induced and let the direction of current is clockwise. After completing half of the rotation, the direction of current changes with the help of slip rings. This will continue and will get alternating current
Initially the coil area A coincides with the magnetic field B and it is then rotated with an angular velocity ‘ω’ and makes an angle θ in ‘t’ sec
$\omega = \theta/t$ or $\theta = \omega t$
Magnetic flux at that instant = $\phi = BA \cos \omega t$
Induced emf at that instant = $e = \frac{-d\phi N}{dt} = \frac{-dBA\cos\omega tN}{dt}$
$e = BAN\omega \sin \omega t$
when $\omega t = 90$, $\sin \omega t = 1$ and $e = e_o$ = max. emf
$e_o = BAN\omega$
ie $e = e_o \sin \omega t$
(B)
$e \frac{-\Delta BA}{\Delta t} = 3.2 \times 10^{-5}$ V
$P = I^2R$, $I = e/R$
$I = 2 \times 10^{-5}$ A, $P = 6.4 \times 10^{-10}$ W</td>
<td>½
½
1
½
½
½
½
½
½</td>
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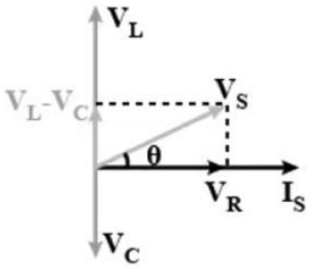
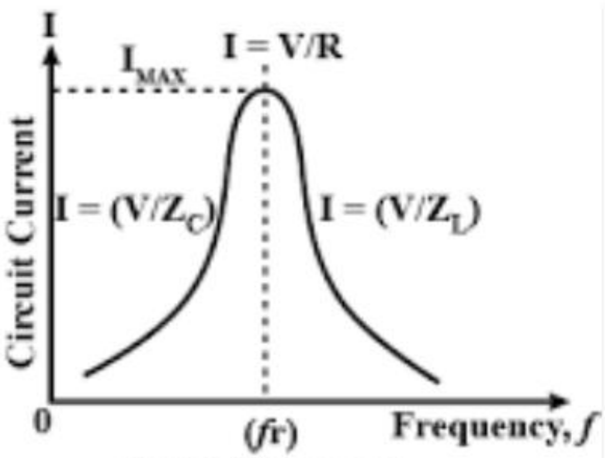
33	 **Phasor Diagram**	½
	$Eo = I_o X_L + I_o Xc + I_o R$	
	$E_o^2 = [V_R]^2 + [V_c - V_L]^2$	½
	$E_o^2 = [I_oR]^2 + [I_o X_c - I_o X_L]^2 = I_o^2 R^2 + I_o^2\{X_c - X_L\}^2$	½
	$E_o^2 = I_o^2[R^2 + \{X_c - X_L\}^2]$ or $Io = \frac{Eo}{\sqrt{R^2 + [Xc - XL]^2}}$	½
	Ie $\sqrt{R^2 + \{X_c - X_L\}^2} = Z$	½
	(B)	
	 (C) Series Resonance	1
	(C)	
	Impedance Z = Z = $\sqrt{R^2 + [Xc - XL]^2}$ = 20 ohm	½
	Current in circuit, Irms = $\frac{Vrms}{R}$ 200/ 20 = 10 A	½
	Power factor cosϕ = $\frac{R}{Z} = \frac{R}{R} = 1$	
	Av. power P = Irms Erms x cosϕ = 200 X 10 = 2000 W	½