BK BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
SENIOR SECONDARY |CO-ED DAY CUM BOYS' RESIDENTIAL SCHOOL

B K BIRLA CENTRE FOR EDUCATION (Sarala Birla Group of Schools)

INDIAN PUBLIC SCHOOLS' CONFERENCE

PRE BOARD -3 EXAMINATION 2024-25

PHYSICS (042)

Class: XII　　　　Duration: 3 Hrs
Date: 19/01/2025　　　　Max. Marks: 70

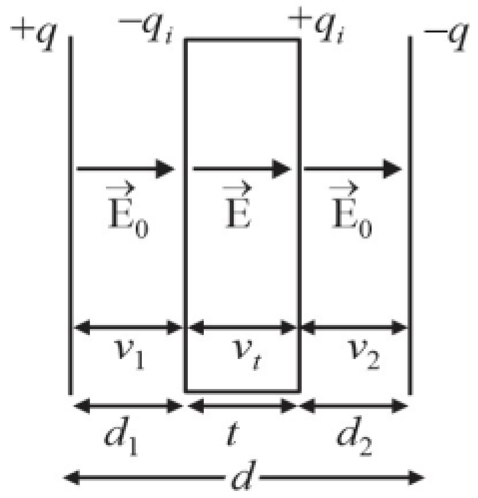
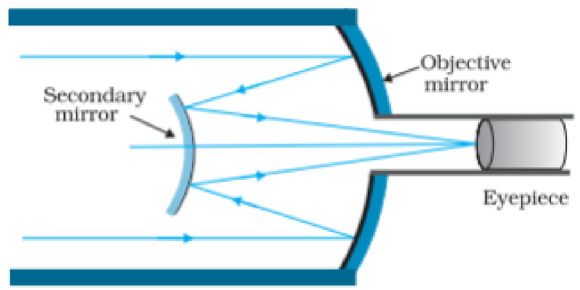
MARKING KEY

[SECTION – A]　　　　**(16x1=16 marks)**

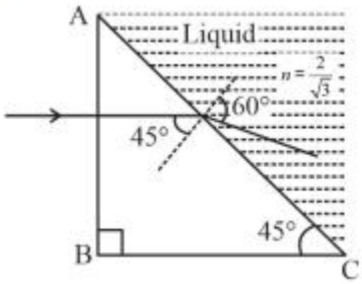
Q.N.	ANSWER	MARKS
1	c	1
2	c	1
3	c	1
4	b	1
5	c	1
6	b	1
7	a	1
8	b	1
9	c	1
10	d	1
11	c	1
12	b	1
13	a	1
14	a	1
15	a	1
16	c	1

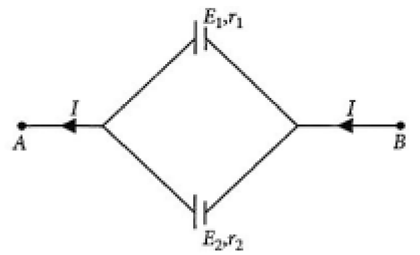
SECTION – B -5x2		
17	λ=h/√2mqV λp=h/√2mqV $λ_α$=h/√2x4mx2qV on dividing Ans = 2√2	½ ½ ½ 1/2
18	$$\frac{1}{-25} = (n-1)(\frac{1}{\infty} - \frac{1}{10})$$ $$(n-1) = \frac{10}{25} = \frac{2}{5}$$ $$\frac{1}{f} = (n-1)(\frac{1}{R_1} - \frac{1}{R_2}) \qquad (n) = \frac{2}{5} + 1 = \frac{7}{5}$$ OR $$\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$$ $$\frac{1.5}{v} - \frac{1}{-100} = \frac{1.5-1}{10}$$ V=37.5cm	½ ½ ½ ½ ½ 1 1/2

19	Torque on the loop is directly proportional to the area of the loop. Therefore, the counter-torque required to hold coil in a position such that the axis of the loop is perpendicular to the magnetic field will be less for square loop n for the circular loop. e counter torque required is MB sin 90 n I A B 0.0250 Nm.	1 1/2 1/2
20	. Nuclear fission : Binding energy per nucleon is smaller for heavier nuclei than the middle ones i.e. heavier nuclei are less stable. When a heavier nucleus splits into the lighter nuclei, the B.E./nucleon changes (increases) from about 7.6 MeV to 8.4 MeV. Greater binding energy of the product nuclei results in the liberation of energy. This is what happens in nuclear fission which is the basis of the atom bomb. Nuclear fusion : The binding energy per nucleon is small for light nuclei, i.e., they are less stable. So when two light nuclei combine to form a heavier nucleus, the higher binding energy per nucleon of the latter results in the release of energy.	1 1
21	R=ℓL/A For same 'R' and 'A' , L∞ℓ The manganin has greater resistivity, therefore manganin wire has greater length.	½ 1 1/2
	SECTION - C 7x3	
22	For correct biasing (reverse bias). For justification. For correct VI graph.	1 1 1

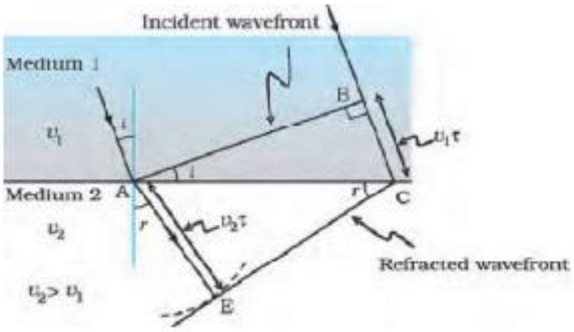
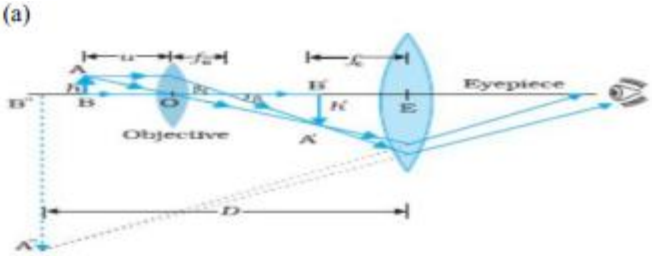
23	 	½
	$V = V_1 + V_t + V_2$ $V = E_0 d_1 + Et + E_0 d_2$	½
	$V = E_0[d_1 + d_2] + \frac{E_0}{K}t$ $V = \frac{q}{A\varepsilon_0}\left[d - t + \frac{t}{K}\right]$	½
	$C = \frac{\varepsilon_0 A}{d - t + \frac{t}{K}}$	½
	For a metallic slab K is infinitely large, therefore $C = \frac{\varepsilon_0 A}{d-t}$	½
	In case of metallic K=∞,therefore capacitance is greater in case of metallic slab	1/2
24	 	2
	(ii) 1 • It has mirror objective, which is free from chromatic and spherical aberrations. • It can gather more light as objectives can be made larger, hence images can be brighter. Any other two equivalent examples can be accepted.	1

25	For correct explanation of depletion layer and potential barrier with diagram for name of device correct circuit.	1.5 ½ 1
26	It keeps the magnetic field line normal to the area vector of the coil (ii) The cylindrical soft iron core, when placed inside the coil of a galvanometer, makes the magnetic field stronger and radial in the space between it and pole pieces, such that whatever the position of the rotation of the coil maybe, the magnetic field is always parallel to its plane. Current sensitivity is defined as the deflection produced by the galvanometer when unit current is passed through its coil. C.S. = φ/I = NBA/k radian/ampere It can only detect current but cannot measure currents in the (mA/A) range.	½ 1 1 1/2
27	(I) Since the light ray enters perpendicular to the face AB, the angle of incidence on face AC will be 45° , So, Sin C = 1/n , $Sin\ 45° = 1/n$, n = √2 (II) In fig.2, the face AC of the prism is surrounded by a liquid so $n = \frac{ng}{n_l} = \frac{\sqrt{2}}{\left(\frac{2}{\sqrt{3}}\right)} = \frac{\sqrt{3}}{\sqrt{2}}$ Since the angle of incidence on the surface AC is 45°, which is less than the critical angle for the pair of media (glass and the liquid), the ray neither undergoes grazing along surface AC, nor does it suffer total internal reflection **1M**	½ ½ ½ 1/2

	Instead it passes through the surface AC and undergoes refraction into the liquid. For refracting interface AC, $n_1 \sin i = n_2 \sin r$ $n_1 . sin45^{\circ} = \left(\frac{2}{\sqrt{3}}\right) sin\, r$ $sin\, r = \frac{\sqrt{3}}{2} \therefore\ r = 60^{\circ}.$  1	
28	Definition SI unit Derivation OR Theorem Derivation	½ ½ 2 1 2
29	I (b) Magnetic field II (c) If v is parallel to B III (d) + Y axis IV (d) Both (a) and (b) OR IV (d)A helix with non-uniform pitch	1 1 1 1
30	I(D) II(C) III (A) IV(B) 0R IV (A)	4x1

31	I (a)Correct Statement (b)  Let $V(A)$ and $V(B)$ be the potentials at A and B, respectively. $V = V(A) - V(B) = \varepsilon_1 - I_1 r_1 = \varepsilon_2 - I_2 r_2$ **[1]** $I = I_1 + I_2 = \frac{\varepsilon_1 - V}{r_1} + \frac{\varepsilon_2 - V}{r_2} = \frac{\varepsilon_{eq} - V}{req_1}$ **[1]** $\varepsilon_{eq} = \frac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2}$ **[2]** $r_{eq} = \frac{r_1 r_2}{r_1 + r_2}$ C) Potential difference between A and B is : V = $\varepsilon_{eq} - I r_{eq}$ **[1]** OR	1 1 1 1 1
31	OR Correct explanation with graph (b).$I = \frac{\varepsilon}{R_0 + r}$ $Where\ R_0\ is\ resistance\ at\ room\ temperature\ 20^0$ $\Rightarrow R_0 = \frac{\varepsilon}{I}$ -1 OR $R_0 = \frac{100}{10}$ -1 = $R_0 = 9\Omega$	1+1 1

	Now Final temperature is 320^0C So, $R = R_0\,(1 + \alpha\Delta T)$ $= 9\,((1 + 3.7 \times 10^{-4} \times 300)$ $=$ 10 Ohm Power Consumed by cell $(P) = i^2r$ $= (\frac{\varepsilon}{R+r})^2 \times r \quad Watt$ $= (\frac{100}{11})^2 =$ 82.64 W	 1 1
32	Principle Labelled Diagram Working a) On increasing turns, L and hence inductive reactance increases; so current decreases. Glow of bulb decreases. b) On inserting iron rod, L and hence inductive reactance increases; so current decreases. Glow of bulb decreases OR Principle Derivation Derivation Any two energy losses Correct explanation	1 1 1 1 1 OR 1 1 1 1 1

33	(a) Each point of the wavefront is the source of secondary disturbance and the wavelets emanating from these points spread out in all directions with the speed of the wave. These wavelets emanating from the wavefront are usually referred to as secondary wavelets and if we draw a common tangent to all these spheres, we obtain the new position of the wavefront at a later time.	1
	(b)  $\sin i = BC/AC = v_1 t / AC$ $\sin r = AE/AC = v_2 t / AC$ $\sin i/\sin r = v_1/v_2$ since, $n_1 = c/v_1$ and $n_2 = c/v_2$ thus $n_1 \sin i = n_2 \sin r$ (Snell's law)	3
	c) λ_1 be the wavelength in medium1 λ_2 be the wavelength in medium 2 λ_1 and λ_2 are respectively proportional to BC and AE. $\lambda_1 / \lambda_2 = BC/AE = v_1/v_2$ $\Rightarrow v_1/\lambda_1 = v_2/\lambda_2$ $\Rightarrow \nu_1 = \nu_2$ **[1]**	1
	OR (a)  	2

	Ans. Here $f_0 = 2.0\,\text{cm}$, $f_e = 6.25\,\text{cm}$, $u_0 = ?$ (i) *When the final image is obtained at the least distance of distinct vision :* $v_e = -25\,\text{cm}$ As $\frac{1}{v_e} - \frac{1}{u_e} = \frac{1}{f_e}$ $\therefore \frac{1}{u_e} = \frac{1}{v_e} - \frac{1}{f_e} = \frac{1}{-25} - \frac{1}{6.25}$ $= \frac{-1-4}{25} = \frac{-5}{25} = -\frac{1}{5}$ or $u_e = -5\,\text{cm}$ Now distance between objective and eyepiece $= 15\,\text{cm}$ $\therefore$ Distance of the image from objective is $v_0 = 15 - 5 = 10\,\text{cm}$ $\therefore \frac{1}{u_0} = \frac{1}{v_0} - \frac{1}{f_0} = \frac{1}{10} - \frac{1}{2} = \frac{1-5}{10} = -\frac{2}{5}$ or $u_0 = -\frac{5}{2} = -2.5\,\text{cm}$ $\therefore$ Distance of object from objective = **2.5 cm**	1.5

1.5

Magnifying power,

$$m = m_0 \times m_e = \frac{v_0}{u_0}\left(1+\frac{D}{f_e}\right) = \frac{10}{2.5}\left(1+\frac{25}{6.25}\right) = \mathbf{20.}$$

(*ii*) *When the final image is formed at infinity* :

Here $v_e = \infty$, $\quad f_e = 6.25\,\text{cm}$

As $\quad \frac{1}{v_e} - \frac{1}{u_e} = \frac{1}{f_e} \quad \therefore \quad \frac{1}{\infty} - \frac{1}{u_e} = \frac{1}{f_e}$

or $\quad u_e = -f_e = -6.25\,\text{cm}$

Distance between objective and eyepiece = 15 cm

∴ Distance of the objective from the image formed by itself,

$$v_0 = 15 - 6.25 = 8.75\ \text{cm}$$

Also $\quad f_0 = +2.0\,\text{cm}$

$$\therefore \quad \frac{1}{u_0} = \frac{1}{v_0} - \frac{1}{f_0} = \frac{1}{8.75} - \frac{1}{2} = \frac{2-8.75}{17.5} = \frac{-6.75}{17.5}$$

or $\quad u_0 = -\frac{17.5}{6.75} = -2.59\,\text{cm}$

∴ The distance of the object from objective = **2.59 cm**

Magnifying power,

$$m = m_0 \times m_e = \frac{v_0}{u_0} \times \frac{25}{6.25} = \frac{27}{8} \times 4 = \mathbf{13.46 = 13.5.}$$