

Pre-Board Examination (2025-26)
Marking Scheme of Physics QP Set - 4

SECTION A

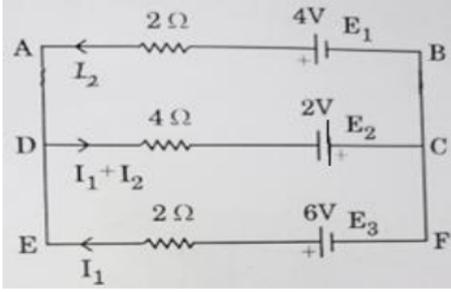
1.	(c) $-7q^2/8\pi\epsilon_0 a$	1
2.	(d) conservation of charge and conservation of energy.	1
3.	(c) capacitive and inductive respectively	1
4.	(a) The wave is propagating along +X-axis.	1
5.	(d) first real and then virtual	1
6.	(b) 0 and $4a^2$	1
7.	(b) -3.02 eV	1
8.	(c) $\sqrt{2}kqq_0 / a^2$	1
9.	(b) resistance of the coil	1
10.	(b) 198 V	1
11.	(a) $5R / 3$	1
12.	(b) m and $M/2$	1
13.	(d) Both Assertion and Reason are false.	1
14.	(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.	1
15.	(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.	1
16.	(c) Assertion is true but Reason is false.	1

SECTION B

17.	(a) $I_d = \epsilon_0 d\Phi / dt$ Displacement current is due to changing electric flux. During charging of capacitor, there is change in electric flux. When fully charged electric field hence electric flux does not change. Hence no displacement current. (1) (b) Infrared waves are also known as heat waves, because water molecules present in most materials readily absorbs infrared waves and their thermal motion increases and heat up. (1)	2
18.	Condition of balanced Wheatstone's bridge: $P / Q = R / S = 4$ (0.5) Calculation of total resistance of circuit = $10/3 + 2/3 = 4 \text{ ohm}$ (0.5) Formula of current $I = \text{Voltage} / \text{Resistance}$ (0.5) Calculation of Current supplied by battery $I = 5 / 4 = 1.25 \text{ A}$ (0.5)	2
19.	Formula: $\Phi = q / \epsilon_0$ (0.5) Correct Answer with Correct Calculations: $\Phi = q / 6\epsilon_0$ (1) Electric Flux will remain unchanged as there is no change in the enclosed charge. (0.5)	2
20.	(1) Correct derivation with diagram: (1.5) Correct Nature: Attraction (0.5) <p style="text-align: center;">Or</p> (2) Paramagnetic (1) Correct Diagram: (1)	2
21.	(1) Correct Explanation of Geiger-Marsden experiment. (1) Correct Graph: (0.5) Correct conclusion: (0.5) <p style="text-align: center;">Or</p> (2)	2

SECTION C

22.	Correct Explanation with Correct Diagram (2) Correct Definition of terms depletion region and potential barrier (1)	3
-----	--	---

<p>23.</p>	 <p>In closed loop ABCD, using Kirchhoff's loop law $4I_1 + 6I_2 = 6$(1) Similarly In closed loop CDFE $6I_1 + 4I_2 = 8$(2) Solving eqn. (1) and (2)</p> $I_2 = \frac{1}{5} \text{ A}$ $I_1 = \frac{6}{5} \text{ A}$ $I_1 + I_2 = \frac{7}{5} \text{ A}$	<p>3</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p>
<p>24.</p>	<p>(a) Correct Definition: (0.5) (b) Correct graph showing the variation of binding energy per nucleon (BE / A) with mass number A. (1.5) Correct Explanation of the release of energy in nuclear fission. (1)</p>	<p>3</p>
<p>25.</p>	<p>Correct Explanation with Correct Diagrams: (2) Correct uses of optical fibre. (0.5+0.5)</p>	<p>3</p>
<p>26.</p>	<p>Correct Statements of Huygen's principle of secondary wavelets. (1) Correct Diagram: (1) Correct verification of Snell's law of refraction: (1)</p>	<p>3</p>
<p>27.</p>	<p>(1)</p> <p>(a) $V = I_g(R + G)$ $V = I_g(9900 + G)$ -----(1) $\frac{V}{2} = I_g(4900 + G)$ -----(2) On Solving above eq (1) and eq (2) $G = 100 \Omega$</p> <p>(b) $2V = I_g(R_1 + G)$ -----(3) From eq (1) and (3) $R_1 = 19900 \Omega$</p> <p style="text-align: center;">Or</p> <p>(2)</p>	<p>3</p> <p>½</p> <p>½</p> <p>1</p> <p>½</p> <p>½</p>

	$\mu_r=200$ $I=1A$ $N=200\text{turn/m}$ (A) $H=nI$ Or, $H=2000/\text{m} \times 1A=2 \times 10^3 A/\text{m}$ (B) $B= \mu_o\mu_rH$ Or, $B=200 \times 4\pi \times 10^{-7} \times 2 \times 10^3 A/\text{m}$ Or, $B= 0.50T$ (C) Magnetisation is given by $M=(\mu_r -1)H=199 \times 10^3 A/\text{m}$ Or, $M = 1.99 \times 10^5 A/\text{m}$	1 1 1	
28.	Correct expression of Flux with graph: Correct expression of induced emf with graph:	(1.5) (1.5)	3
<u>SECTION D</u>			
29.	(i) (a) B_1 only (ii) (c) unidirectional with ripple (iii) (d) holes, electrons (iv) (c) 100 Hz	(1) (1) (1) (1)	4
30.	(i) The light beam B because it requires maximum retarding potential to reduce the photoelectric current to zero. (ii) The light beam C because it requires minimum retarding potential to reduce photoelectric current to zero. (iii) There is no effect on threshold frequency since it is characteristic of the metal. With increase in frequency of incidents beam of light , stopping potential increases because to stop the photoelectrons of higher kinetic energy, larger retarding potential is required.	(0.5 + 0.5) (0.5 + 0.5) (1 + 1)	4
<u>SECTION E</u>			
31.	(1) (a)		5

Electric field at A (\vec{E}_A)

$$\vec{E}_A = \vec{E}_1 + \vec{E}_2$$
$$= \frac{\sigma}{2\epsilon_0}(-\hat{i}) + \frac{3\sigma}{2\epsilon_0}(\hat{i})$$

$$\vec{E}_A = \frac{\sigma}{\epsilon_0}(\hat{i})$$

1/2

1/2

Electric field at B (\vec{E}_B)

$$\vec{E}_B = \vec{E}_1 + \vec{E}_2$$
$$= \frac{\sigma}{2\epsilon_0}\hat{i} + \frac{3\sigma}{2\epsilon_0}\hat{i}$$

$$= \frac{2\sigma}{\epsilon_0}\hat{i}$$

1/2

1/2

Electric field at C (\vec{E}_C)

$$\vec{E}_C = \vec{E}_1 + \vec{E}_2$$
$$= \frac{\sigma}{2\epsilon_0}\hat{i} + \frac{3\sigma}{2\epsilon_0}(-\hat{i})$$
$$= \frac{\sigma}{\epsilon_0}(-\hat{i})$$

1/2

1/2

(b)

$$\vec{\tau} = \vec{p} \times \vec{E}$$
$$= (0.8\hat{i} + 0.6\hat{j}) \times 10^{-29} \times (1 \times 10^7)\hat{k}$$
$$= [0.8(-\hat{j}) + 0.6\hat{i}] \times 10^{-22}$$
$$\tau = \left[\sqrt{(0.8)^2 + (0.6)^2} \right] \times 10^{-22}$$
$$= 10^{-22} \text{ Nm}$$

1/2

$$\tan \alpha = \frac{0.8}{0.6}$$

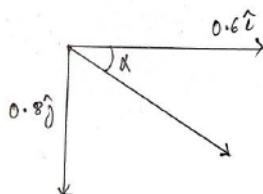
$$\alpha = \tan^{-1}\left(\frac{4}{3}\right)$$

$$\alpha = 53^\circ$$

1/2

1/2

1/2



Or

(2) (a)

	<p>(i) (I) Charge will become half Charge will flow from capacitors A (high potential) to capacitor B (low potential) till they achieve equilibrium. Alternatively</p> $q_A = cv \quad q_B = 0$ $V_{common} = \frac{q_A + q_B}{c_A + c_B} = \frac{cv}{2c}$ $= \frac{v}{2}$ $q'_A = cv_{common} = \frac{cv}{2} = \frac{q_A}{2}$ <p>(II) Potential difference will become half.</p> $V_{common} = \frac{q_A + q_B}{c_A + c_B}$ $= \frac{cv + 0}{2c} = \frac{v}{2}$ <p>(III) Energy stored will becomes one fourth</p> $U_A = \frac{1}{2} CV^2$ $U'_A = \frac{1}{2} CV_{common}^2$ $= \frac{1}{2} C \left(\frac{V}{2} \right)^2$ $= \frac{U_A}{4}$ <p>(b) (i) Correct diagram: (0.5) (ii) Correct diagram: (1.5)</p>	<p>½</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p>	
<p>32.</p>	<p>(1) (a) Two main consideration: Objective should have larger diameter (aperture) and larger focal length. (0.5) Eye-piece should have smaller diameter (aperture) and smaller focal length. (0.5) Correct neat and clean ray diagram: (1) Correct derivation of formula for magnifying power: $M = f_o / f_e$: (1)</p> <p>(b)</p>	<p>(0.5)</p> <p>(0.5)</p> <p>(1)</p> <p>(1)</p>	<p>5</p>

$$i+e = D+A$$

$$\text{at } D = D_m, \quad i = e$$

$$2i = D_m + A$$



$$2 \times 45 = D_m + 60^\circ$$

$$D_m = 30^\circ$$

$$\mu = \frac{\sin\left(\frac{A+D_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

$$\mu = \frac{\sin\left(\frac{60^\circ+30^\circ}{2}\right)}{\sin\left(\frac{60^\circ}{2}\right)}$$

$$= \sqrt{2}$$

1

1

Or

(2) (a) Correct Derivation with Correct Ray Diagram (2)

(b)

$$(ii) \quad \frac{1}{f} = (\mu - 1) \left[\frac{1}{R_1} - \frac{1}{R_2} \right]$$

Focal length of convex lens, $f_1 = 30 \text{ cm}$

$$\frac{1}{30} = (1.5 - 1) \left[\frac{1}{R} - \frac{1}{(-R)} \right]$$

$$R = 30 \text{ cm}$$

focal length of combination, $f = 45 \text{ cm}$

focal length of plane concave lens of liquid.

$$\frac{1}{f_2} = \frac{1}{f} - \frac{1}{f_1}$$

$$\frac{1}{f_2} = \frac{1}{45} - \frac{1}{30}$$

$$f_2 = -90 \text{ cm}$$

Using lens maker's formula

$$\frac{1}{-90} = (\mu_l - 1) \left[\frac{1}{-30} - \frac{1}{\infty} \right]$$

½

½

½

½

½



$$\mu_l = \frac{4}{3}$$

½

33. (1) (a) (i) Correct diagram and correct working principle:

(1 + 0.5)

5

(ii) Correct derivation:

(1)

	(iii) Correct Answer:	(0.5)
	(b) Correct answer with correct calculation: $I_p = 2.5 \text{ A}$	(2)
	Or	
	(2) (a) Correct formula in vector form:	(1)
	Correct derivation of expression of magnetic field:	(2)
	(b) Correct definitions:	(0.5 + 0.5)
	Correct explanation	(1)