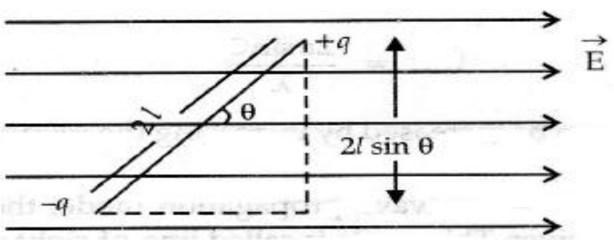
INDIAN SCHOOL AL WADI AL KABIR

UNIT TEST 2025-2026

CLASS XII PHYSICS -SET 2

MARKING SCHEME

SL.NO	ANSWER KEY-SECTION A	
1.	(B) ZERO	1
2.	(D) the electrostatic energy stored in the capacitor increases. As, Q reamains constant after disconnecting the battery , $C=\frac{\epsilon_0 A}{d}$ decreases, as d increases, As Q is constant $C_i V_i = C_f V_f$ $C_f < C_i$ So $V_f > V_i$ so voltage increases As $U=\frac{1}{2}QV, U \propto V$, So $U_f > U_i$ as $V_f > V_i$	1
3.	(C)A plane infinite sheet of charge	
4.	(D) There is no such requirement. The total flux through the container is zero no matter what.	
5.	(C) The electric field in I is the same everywhere but the electric field in II becomes stronger as we move from left to right.	
6.	(C) The total charge on the capacitor increases.	
7.	c) If Assertion is true but Reason is false.	
8.	a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.	
	SECTION B	
9.	Definition of electric flux $$\text{Electric flux} = \oint_S \vec{E} \cdot \vec{dS}$$ According to *Gauss's law*, $\phi = \oint_S \vec{E}.\vec{dS} = \frac{q_1}{\varepsilon_0}$ ...where [q_1 is the total charge enclosed by the surface S $\phi = \frac{2q-q}{\varepsilon_0} = \frac{q}{\varepsilon_0}$ $\therefore$ Electric flux, $\phi = \frac{q}{\varepsilon_0}$ OR	1 1

	Let an electric dipole be placed in uniform electric field vector E  Force on each charge $= q\vec{E}$ Perpendicular distance between two forces $= 2\vec{l}\sin\theta$ $\therefore$ Torque $= q\vec{E}\times 2\vec{l}\sin\theta$ $= (q\times 2\vec{l})\vec{E}\sin\theta$ $= pE\sin\theta$ $= \vec{P}\times\vec{E}$	1/2 1/2 1/2 1/2
10.	Let x be the distance from q_1 to the point of zero potential: $V = \Sigma(kq/r) = 0$ $0 = k[(2x10^{-6}/x) - (5x10^{-6}/(1 - x))]$ $18000/x = 45000/(1 - x)$ $x = 0.29$ m	 1/2 ½ + 1/2 1/2
	SECTION C	
11.	Since, 2 μF and 3 μF capacitors are in parallel. So, their effective capacitance is C′ = 2 + 3 = 5 μF Now 12 μF, 20 μF and C′ are in series. Therefore, their effective capacitance is $\frac{1}{C} = \frac{1}{12} + \frac{1}{20} + \frac{1}{5}$ $= \frac{5+3+12}{60} = \frac{20}{60}$ Hence, $C = \frac{60}{20} = 3\ \mu F$ Now $V_{AB} = \frac{q}{C}$	½ ½ ½ ½ ½

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∴ $1500 = \frac{q}{3}$

or $q = 4500\ \mu C$

Hence, potential difference across 2 μF capacitor

$V_2 = \frac{q}{C'} = \frac{4500}{5} = 900\ V$

OR

The capacitance of the capacitor in the presence of dielectric is

$C = \frac{\varepsilon_r \varepsilon_0 A}{d} = \frac{5\times 8.85\times 10^{-12}\times 6}{6\times 10^{-3}}$

$= 44.25\times 10^{-9} F = 44.25 nF$

The stored charge is

$Q = CV = 44.25\times 10^{-9}\times 10$

$= 442.5\times 10^{-9} C = 442.5 nC$

The stored energy is

$U = \frac{1}{2}\ CV^2 = \frac{1}{2}\times 44.25\ \ C\times 10^{-9}\times 100$

$= 2.21\times 10^{-6}\ \ J = 2.21\mu\ \ J$

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½

½ + ½

½

½

½

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Statement of Gauss's law

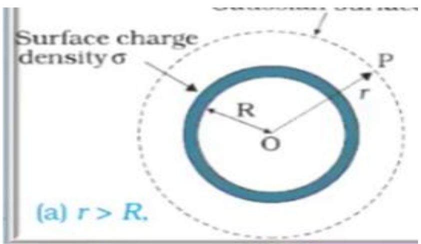
Derivation

The charge enclosed is $\sigma = \frac{Q}{A}$

$Q = \sigma \times 4\pi R^2$.

By Gauss's law $E \times 4\pi r^2 = \frac{\sigma}{\varepsilon_0} 4\pi R^2$

÷ and × with 4π Or. $E = \frac{\sigma R^2}{\varepsilon_0 r^2} = \frac{q}{4\pi\varepsilon_0 r^2}$



Where $q = 4\pi R^2 \sigma$ is the total charge on the spherical shell.

Vectorially, $\mathbf{E} = \frac{q}{4\pi\varepsilon_0 r^2}\hat{\mathbf{r}}$

- Inside the surface E =0

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½ - DIAGRAM

1/2

½

½

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13.	• Definition of equipotential surface-Any surface over which the potential is constant is called an equipotential surface. In other words, the potential difference between any two points on an equipotential surface is zero. Diagram of equipotential surfaces a) for a single negative charge b) for a dipole.	1 1 1
	SECTION D	
14.	(I) (d) can pass through a continuous charge distribution as well as any system of discrete charges. This is because a Gaussian surface can be chosen to enclose any charge distribution, whether continuous or discrete. (ii) (a) Any closed surface. (iii) (a)zero (iv) (d) directly proportional to *E* OR (b) Superposition principle	1 1 1 1
	SECTION E	
15.	(a) expression for the capacitance of a parallel plate capacitor with a dielectric slab filling the space. Steps Expression $C_0 = \frac{A\varepsilon_0}{d}$ Expression $Cm = \frac{A\varepsilon_0\,\varepsilon_r}{d}$ (b) Energy Ui = $\frac{1}{2}CV^2$ When equal capacitor is connected V' = V/2 C' = 2C Uf = $\frac{1}{2}2C \times \left(\frac{V}{2}\right)^2 = \frac{1}{2}\frac{1}{2}Cv^2$ Uf/Ui = 1: 2	½ - diagram 1 + ½ ½ ½ ½ 1/2 ½ ½
	OR	½ - diagram

. (a) ½

Consider a point P situated at a distance r from mid-point of an electric dipole along its axial line. 1

Electric potential at P due to +ve charge at B, $V_B = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q}{(r-a)}$ ½

½

and electric potential at P due to - ve charge at A, $V_A = \frac{1}{4\pi\varepsilon_0} \cdot \frac{(-q)}{(r+a)}$

∴ Net electric potential at point P, ½ ½

$$V = V_B + V_A = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q}{(r-a)} - \frac{1}{4\pi\varepsilon_0} \cdot \frac{q}{(r+a)}$$ ½ ½

$$= \frac{q}{4\pi\varepsilon_0}\left[\frac{1}{(r-a)} - \frac{1}{(r+a)}\right] = \frac{q}{4\pi\varepsilon_0} \cdot \frac{2a}{(r^2-a^2)}$$

$$= \frac{p}{4\pi\varepsilon_0(r^2-a^2)}$$

If $r >> a$, then we have $V = \frac{p}{4\pi\varepsilon_0 r^2}$.

- The work done W in moving a charge Q from one point to another in an electric field is given by:

$W = Q \cdot (V_f - V_i)$

- Here, V_f is the final potential and V_i is the initial potential.

- Since the potential is constant along the circular arc, we have:

$V_f = V_i$

- Thus, the work done becomes:

$W = Q \cdot (V - V) = Q \cdot 0 = 0$