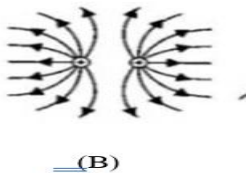
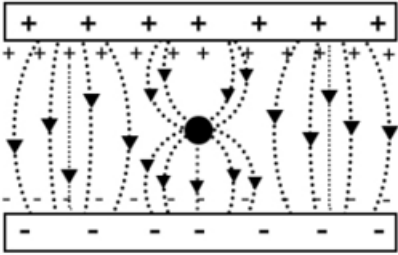


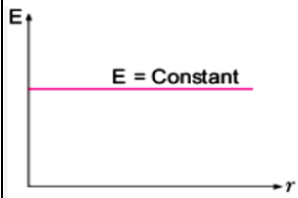
INDIAN SCHOOL AL WADI AL KABIR  
 MARKING SCHEME - UNIT TEST-1-2026-27  
 CLASS 12-PHYSICS  
 SET-2

SL.NO	SECTION A	
1.	(D) 6 m	1
2.	(C) $S_1$ is true, $S_2$ is also true and $S_1$ is the cause of $S_2$ .	1
3.		1
4.	(A) $\frac{1}{x^2}$	1
5.	<p>[D]</p> 	1
6.	(A) 6 V/m along -x-axis.	1
7.	b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.	1
8.	c) If Assertion is true but Reason is false.	1
	SECTION B	
9.	<p>F has dimensional formula <math>MLT^{-2}</math>.</p> <p><math>K \frac{q_1 q_2}{r^2}</math> has dimensional formula</p> $[K] \left[ \frac{AT \cdot AT}{L^2} \right] = [K] \left[ \frac{A^2 T^2}{L^2} \right]$ <p>Equating the dimensions,</p> $[MLT^{-2}] = [K] \left[ \frac{A^2 T^2}{L^2} \right]$ <p><math>\therefore K = ML^3 T^{-4} A^{-2}</math></p>	<p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>

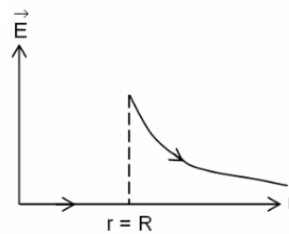
The SI unit of the electrostatic force constant is  $\text{Nm}^2/\text{C}^2$

OR

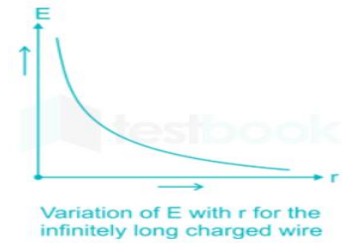
(i)



(ii)



(iii)



$\frac{1}{2}$

1

$\frac{1}{2}$

10.

$$Q = 2 \mu\text{F} \times 200 \text{ V} = 400 \mu\text{C}$$

$$C_{\text{eq}} = C_1 + C_2 = 2 \mu\text{F} + C_2$$

The potential difference across both capacitors becomes  $V_{\text{final}} = 40 \text{ V}$ . Using the relationship  $Q = C_{\text{eq}} \times V_{\text{final}}$ :

$$400 \mu\text{C} = (2 \mu\text{F} + C_2) \times 40 \text{ V}$$

$$\frac{400 \mu\text{C}}{40 \text{ V}} = 2 \mu\text{F} + C_2$$

$$10 \mu\text{F} = 2 \mu\text{F} + C_2$$

$$C_2 = 8 \mu\text{F}$$

$\frac{1}{2}$

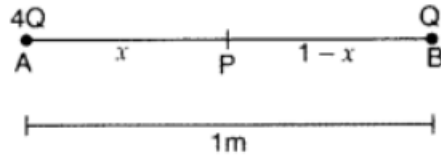
$\frac{1}{2}$

$\frac{1}{2}$

$\frac{1}{2}$

## SECTION C

11.

(i) Given :  $r = 1\text{m}$ ,  $q_1 = 4Q$ ,  $q_2 = Q$ 

$$E_{PA} = E_{PB}$$

$$\frac{K(4Q)}{x^2} = \frac{KQ}{(1-x)^2} \Rightarrow \frac{4}{x^2} = \frac{1}{(1-x)^2}$$

$$\Rightarrow \frac{2}{x} = \frac{1}{1-x} \Rightarrow 2 - 2x = x$$

$$\Rightarrow 3x = 2 \quad \therefore x = \frac{2}{3}\text{m}$$

(ii) Electrostatic potential energy of the system is

$$U = K \frac{q_1 q_2}{r} = \frac{9 \times 10^9 \times 4Q \times Q}{1}$$

$$= 36 \times 10^9 \times (2 \times 10^{-7})^2 = 1.44 \times 10^{-3} \text{ J}$$

OR

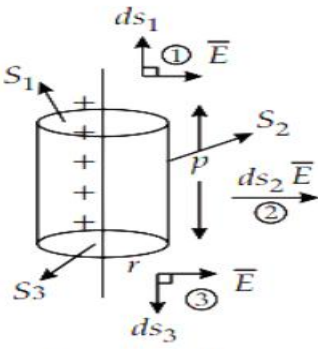
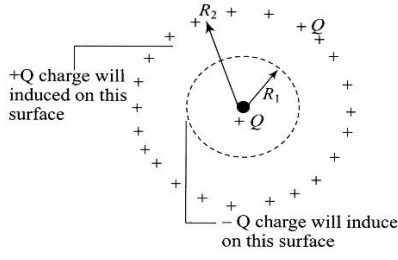
$$C_1 = \frac{\epsilon_0 A}{d}$$

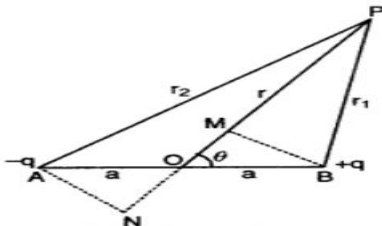
$$\frac{1}{C_2} = \frac{1}{K_1 \frac{\epsilon_0 A}{d/2}} + \frac{1}{K_2 \frac{\epsilon_0 A}{d/2}} = \frac{d}{2 \cdot K_1 \epsilon_0 A} + \frac{d}{2 \cdot K_2 \epsilon_0 A}$$

$$\frac{1}{C_2} = \frac{d}{2 \epsilon_0 A} \left[ \frac{1}{K_1} + \frac{1}{K_2} \right] \Rightarrow C_2 = \frac{2 \cdot \epsilon_0 A}{d} \left[ \frac{K_1 K_2}{K_1 + K_2} \right]$$

$$C_2 = 2C_1 \left[ \frac{K_1 K_2}{K_1 + K_2} \right]$$

$$C_2 = C_1 \left[ \frac{2 K_1 K_2}{K_1 + K_2} \right]$$

<p>12.</p>	<p>Statement of Gauss's law</p> <p>Derivation</p>  $\phi = \oint \vec{E} \cdot d\vec{s} = \frac{q_{\text{enclosed}}}{\epsilon_0}$ $\Rightarrow \int_{S_1} E \cdot ds_1 \cos 90 + \int_{S_2} E \cdot ds_2 \cos 0$ $+ \int_{S_3} E \cdot ds_3 \cos 90 = \frac{\lambda l}{\epsilon_0} \quad (\because q = \lambda l)$ $\Rightarrow 0 + E \cdot \int_{S_2} ds_2 + 0 = \frac{\lambda l}{\epsilon_0}$ $\Rightarrow E \cdot 2\pi r l = \frac{\lambda l}{\epsilon_0} \Rightarrow \boxed{E = \frac{\lambda}{2\pi \epsilon_0 r}}$	<p>1</p> <p>½ - DIAG RAM</p> <p>1/2</p> <p>½</p> <p>½</p>
<p>13.</p>	<p>a) Definition - Electric field lines are <b>imaginary lines or curves</b> drawn in a region of space to provide a visual representation of an electric field's strength and direction. They represent the path a positive test charge would follow.</p> <p>A charge Q is placed at the centre of the spherical cavity. So, the charge induced at the inner surface of the sphere will be +Q.</p> <p>b)</p>  <p>The surface charge density on the inner surface <math>\sigma_1 = \frac{\text{Charge}}{\text{Area}} = \frac{-Q}{4\pi R_1^2}</math></p> <p>Surface charge density on the outer surface <math>\sigma_2 = \frac{+Q}{4\pi R_2^2}</math></p> <p>Hence, (i) <math>\frac{-Q}{4\pi R_1^2}</math> (ii) <math>\frac{+Q}{4\pi R_2^2}</math></p>	<p>1</p> <p>1</p> <p>1</p>

SECTION D		
14.	<p>(i) (d) Explanation: In polar molecules the centre of positive and negative charges is separated even when there is no external field. Such molecules have a permanent dipole moment. Ionic molecule like HCl is an example of polar molecule.</p> <p>(ii) (c) Explanation: As <math>F' = F/K</math>, Therefore the maximum force decreases by K times.</p> <p>(iii) (b)</p> <p>(iv) (b) Explanation: A polar molecule is one in which the centre of gravity for positive and negative charges are separated.</p> <p style="text-align: center;">OR</p> <p>(a) comb polarizes the piece of paper</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
SECTION E		
15.	<p><b>Potential at P due to + q charge</b></p> $V_+ = \frac{1}{4\pi\epsilon_0} \frac{q}{r_1}$ <p><b>Potential at P due to - q charge</b></p> $V_- = \frac{1}{4\pi\epsilon_0} \left( \frac{-q}{r_2} \right)$ <p><b>∴ Net potential at P due to the dipole</b></p> $V = V_+ + V_-$ <p>or <math>V = \frac{q}{4\pi\epsilon_0} \left[ \frac{1}{r_1} - \frac{1}{r_2} \right]</math> .....(i)</p> $V = \frac{q}{4\pi\epsilon_0} \left[ \frac{1}{r - a \cos\theta} - \frac{1}{r + a \cos\theta} \right]$ $= \frac{q}{4\pi\epsilon_0} \left[ \frac{r + a \cos\theta - r + a \cos\theta}{r^2 - a^2 \cos^2\theta} \right]$ <p>or <math>V = \frac{q}{4\pi\epsilon_0} \left[ \frac{2a \cos\theta}{r^2 - a^2 \cos^2\theta} \right]</math> .....(ii)</p> <p>For a short dipole, <math>r \gg a</math>,</p> $\therefore V = \frac{q}{4\pi\epsilon_0} \frac{2a \cos\theta}{r^2}$ <p>or <math>V = \frac{1}{4\pi\epsilon_0} \frac{p \cos\theta}{r^2}</math> .....(iii) [ <math>\because p = q 2 a</math> ]</p> <p><b>(i) At axial line, <math>\theta = 0^\circ</math></b></p> $V = \frac{p \cos 0^\circ}{r^2} = \frac{p}{r^2}$ <p>i.e. <math>V \propto \frac{1}{r^2}</math></p>	 <p>½ - diagram</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p> <p>1/2</p>

