CLASS XII PHYSICS CHAPTER 1. ELECTROSTATICS

ANSWER KEY

ANSWER TO VERY SHORT ANSWER TYPE QUESTIONS

1. **CHOOSE THE CORRECT OPTION ANSWERS:**

i) (c) Electric flux Φ is independent of size.

ii) (b) E = -dv/dr

iii) (a)Decreases K times

iv) (a)-Q/4

SHORT ANSWER TYPE QUESTIONS FOR 1 & 2 MARKS

2. W = **$-pE(\cos\Theta_2 - \cos\Theta_1)$** = **$-pE(\cos 90° - \cos 0°)$** = pE

3.$\mathcal{E} = \mathcal{E}_o\mathcal{E}_r$

4. Yes **$F_{12} = -F_{21}$**

5. F is proportional to $1/d^2$; hence $F'/F = d^2/d'^2$; $F/3/F = d^2/d'^2$.
$d^2/d'^2 = 1/3$; therefore $d'^2 = 3\,d^2$; $d' = \sqrt{3}\,d$.

6.No. dV/dr = -E =0; or dV = 0; or V = constant

7. Let at P, V = 0; therefore, $V(q_1)$ at P = $(1/4\pi\varepsilon_o)\,4 \times 10^{-6}/x$
$V(q_2)$ at P = $(1/4\pi\varepsilon_o)\,-2 \times 10^{-6}/(1-x)$
Therefore, At P = 0, $(4/x) - (2/1-x) = 0$; $x = 2/3$.

8. $\tau = pE\sin\theta = 4 \times 10^{-9} \times 5 \times 10^4 \times \sin 30° = 10$ Nm.

9. $\phi = q/\varepsilon_o = \int E.\,ds = 5 \times 10^{-6}/8.85 \times 10^{-12} = 5.65 \times 10^5\ Nm^2C^{-1}$

LONG ANSWER TYPE QUESTIONS FOR 3 & 5 MARKS

10. $\tau = pE\sin\theta$
$dW = \tau d\theta = \tau = pE\sin\theta d\theta$; $\int dW = \int pE\sin\theta d\theta =$ **$-pE(\cos\Theta_2 - \cos\Theta_1)$**

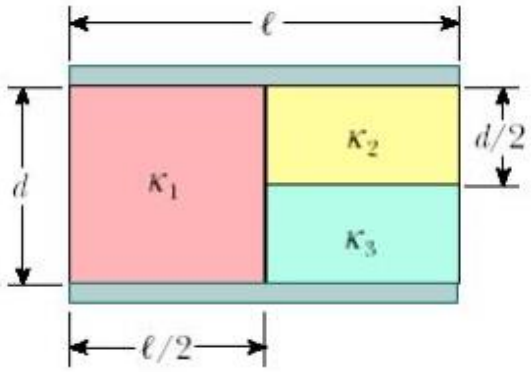
11. Refer to the summary given with the assignment.

12. $U = 1/2\,CV^2$; Since $C = \varepsilon_o A/d$; Therefore, $U = (1/2)\,\varepsilon_o A/d(Ed)^2$
Therefore, energy per unit volume = $U/Ad = (1/2)\,\varepsilon_o E^2$

13. 1 µF

14. Take the help of the following:

(b) A parallel-plate capacitor is constructed by filling the space between two square plates with blocks of three dielectric materials, as in the figure below. You may assume that $\ell >> d$. Find an expression for the capacitance of the device in terms of the plate area A and d, κ_1, κ_2, and κ_3.



The capacitor can be regarded as being consisted of three capacitors, $C_1 = \frac{\kappa_1 \varepsilon_0 A/2}{d}, C_2 = \frac{\kappa_2 \varepsilon_0 A/2}{d/2}$ and $C_3 = \frac{\kappa_3 \varepsilon_0 A/2}{d/2}$, with C_2 and C_3 connected in series, and the combination connected in parallel with C_1. Thus, the equivalent capacitance is

$$C = C_1 + \left(\frac{1}{C_2} + \frac{1}{C_3}\right)^{-1} = C_1 + \frac{C_2 C_3}{C_2 + C_3} = \frac{\kappa_1 \varepsilon_0 A/2}{d} + \frac{\varepsilon_0 A}{d}\left(\frac{\kappa_2 \kappa_3}{\kappa_2 + \kappa_3}\right)$$

$$= \frac{\varepsilon_0 A}{d}\left(\frac{\kappa_1}{2} + \frac{\kappa_2 \kappa_3}{\kappa_2 + \kappa_3}\right)$$
