Answer key

1- quantisation, conservation, additivity (any two -1)

2. $N C^{-1}$ or $V m^{-1}$ (1)

3-(i) From -ve charge to +ve charge (1)

(ii) Diagram (½)

$\vec{E} = \vec{E}_+ + \vec{E}_-$ ½

$E_+ =$ ..... ½

$E_- =$ ..... ½

substitution (½)

Final result (½)

4-(i) Statement or $\phi = Q/\varepsilon_0$ or $\oint \vec{E}\cdot\vec{ds} = \frac{Q}{\varepsilon_0}$ (1)

(ii) Diagram (1)

$$\oint \vec{E}\cdot\vec{ds} = \oint E\,ds = E\oint ds = E\,4\pi r^2 - 1$$

Applying is Gauss's law

$$E\,4\pi r^2 = Q/\varepsilon_0 \quad -\tfrac{1}{2}$$

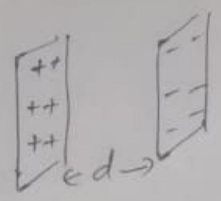
$$E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2} - \tfrac{1}{2}$$

5 Definition -(1)

6 (i) Definition -(1)

(ii) $E = \frac{dV}{dl}$ or $E = \frac{V}{l}$

7. Electric field inside a cavity is zero. (1)

8. 

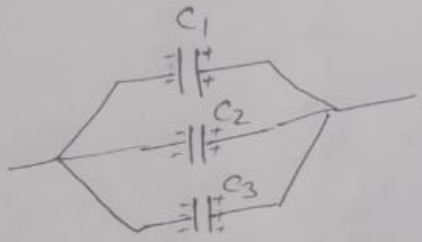
$-\frac{1}{2}$ $C = Q/V$ $-\frac{1}{2}$

$V = Ed$ $-\frac{1}{2}$

$E = \frac{\sigma}{\varepsilon_0} = \frac{Q}{A\varepsilon_0}$ $-\frac{1}{2}$

$\therefore C = \frac{Q}{Q/A\varepsilon_0 d}$ $-\frac{1}{2}$

$= \frac{\varepsilon_0 A}{d}$ $-\frac{1}{2}$

9. 

$-$ 1

$-\frac{1}{2}$

$Q = Q_1 + Q_2 + Q_3$

$Q_1 = C_1V$, $Q_2 = C_2V$, $Q_3 = C_3V$ $-\frac{1}{2}$

$\therefore CV = C_1V + C_2V + C_3V$ $-\frac{1}{2}$

$C = C_1 + C_2 + C_3$ $-\frac{1}{2}$

10 flux, $\phi = Q/\varepsilon_0$ $-$ 1

$= \frac{2\times10^{-6}}{8.85\times10^{-12}}$ $-\frac{1}{2}$

$= 2.25\times10^{5}$ N m^2/C $-\frac{1}{2}$

11- (i) 2 & 4 are ||^{l}, $C = C_1 + C_2 = 2+4 = 6\,\mu F$ — (1/2)

6 μF series with 3 μF, $\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$, $C = 2\,\mu F$. — (1)

Total Charge, $Q = CV = 2\times12\times10^{-6} = 24\times10^{-6}$ — (1/2)

Voltage across 2 μF, $V_1 = \frac{Q}{C_1} = \frac{24\times10^{-6}}{6\times10^{-6}} =$ ~~4×10~~ 4V — (1)