Capacitance

property of holding charge ← Capacitance → device used to store electrical energy/charge.

* $\boxed{C = \frac{Q}{V}}$ → scaler

$1\mu f = 10^{-6}$ F
$1 nf = 10^{-9} f$
$1 pF = 10^{-12}$ F.

* For sphere :-

$V = \frac{KQ}{R} \Rightarrow \frac{R}{K} = \frac{Q}{V} = C$ → depends upon — (i) geometry.
(ii) Medium.

doesn't depend upon — charge, voltage

* Force on a capacitor :-

$$F = \frac{Q^2}{2A\varepsilon_0}$$

* Energy stored in the capacitor →

$$\boxed{E = \frac{1}{2}CV^2}$$

* Capacitance in presence of di-electrics

$$C = \frac{\varepsilon_0 A}{d - t + \frac{t}{K}}$$

* for multiple dielectrics

$$C = \frac{\varepsilon_0 A}{d - \Sigma t + \Sigma t/K}$$

Type of capacitors :

(i) spherical capacitor →

$$C = \frac{ab}{K(b-a)}$$

(ii) Cylindrical capacitor →

$r > R \longrightarrow E = \frac{2K\lambda}{r}$ | $r < R \rightarrow E = 0$

(iii) Potential due to infinite wire →

$$V_A - V_B = 2K\lambda \ln\left(\frac{b}{a}\right)$$

$$\therefore C = \frac{Q}{V} = \frac{2\pi\varepsilon_0 l}{\ln(b/a)}$$

⇒ Common Potential

* $V = \frac{C_1V_1 + C_2V_2}{C_1 + C_2}$

Heat Loss ⇒ $H = \frac{1}{2}\frac{C_1C_2}{C_1+C_2}(V_1 - V_2)^2$