Capacitance

C = capacitance; a measure of an object(s) ability to store charge

$$C = \frac{q}{\Delta V} = \frac{q}{V}$$

$C > 0$

Unts: 1 C/V = 1 farad = 1 F

Two parallel large charged plates

$$|\vec{E}| = \frac{\sigma}{\varepsilon_0}$$

$$\Delta V = Ed$$

$$C = \varepsilon_0 \frac{A}{d}$$

Spherical capacitor

$$C_{\text{sphere}} = 4\pi\varepsilon_0 \frac{ab}{b-a}$$

Two closely spaced charged cylinders

$$C = \frac{2\pi\varepsilon_0 l}{\ln\left(\frac{r_0}{r_i}\right)}$$

Stored Energy

$$U = \frac{1}{2}CV^2$$

$$U = \frac{q^2}{2C}$$

$$U = \frac{1}{2}qV$$

Combinations of Capacitors

$$\Delta V = \frac{q}{C_{\text{eq}}}$$

1. Series connection (single path)

- Charge on each capacitor is the same

$$\Delta V = \Delta V_1 + \Delta V_2 + \Delta V_3 + \ldots$$

$$\frac{1}{C_{\text{eq}}} = \sum_{i=1}^{N} \frac{1}{C_i}$$

2. Parallel connection (multiple paths)

- Voltage on each capacitor is the same

$$q = q_1 + q_2 + q_3 + \ldots$$

$$C_{\text{eq}} = \sum_{i=1}^{N} C_i$$