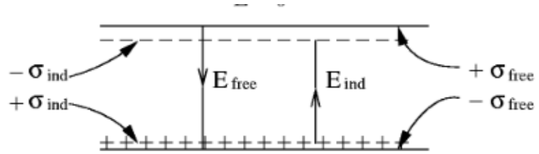
Capacitor

Dielectric of perallel plate capacitor



$$\vec{E}_{induced} = \frac{\sigma_{induced}}{\varepsilon}$$

$$\vec{E}_{net} = \vec{E}_{free} + \vec{E}_{induced}$$

Dielectric constant

$$\kappa = \frac{\vec{E}_{free}}{\vec{E}}$$

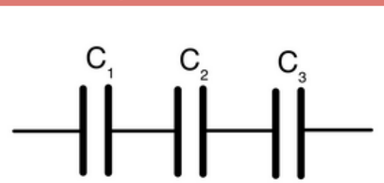
Gauss's law for dielectrics

$$\oint_S \vec{E} \cdot \vec{dA} = \frac{\sum Q_{enclosed,\ free}}{\kappa\varepsilon}$$

Dielectric

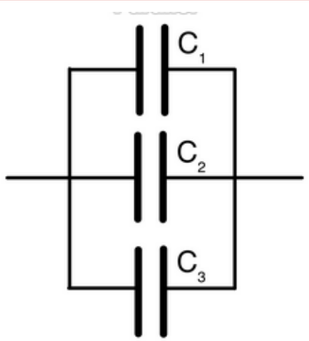
Circuits

Capacitors in Series



$$C_{total}^{-1} = (\sum C^{-1})^{-1}$$

Capacitors in Parallel



$$C_{total} = \sum C$$

Capacitance

Capacitor

A capacitor is a device for storing charge. Capacitors consist of two conductors separated by an insulator (dielectric).

Capacitance

Ratio of charge on either plate to the p.d. between the plates is called nthe capacitance, C of the capacitor.

$$C = \frac{Q}{V} \quad \Rightarrow Q = CV$$

Parallel plate capacitors

$$C = \frac{Q}{V} = \frac{\varepsilon A}{d}$$

$$E = \frac{V}{d} = \frac{\frac{Q}{A}}{\varepsilon} = \frac{\sigma}{\epsilon}$$

Spherical capacitors

$$C = 4\pi\varepsilon r$$

Energy of charged capacitor

$$U = \int_{all\ space} \frac{1}{2}\varepsilon_0 E^2 dV = \frac{1}{2}\varepsilon_0 \frac{\sigma}{\varepsilon_0} Ah = \frac{1}{2}QV = \frac{1}{2}CV^2$$