Conductores

$E = 0$ dentro del conductor (Franklin, Priestley)

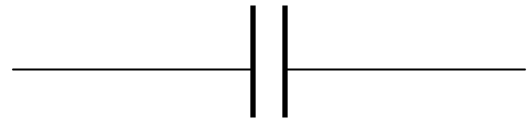
$V = \text{Const.}$ (equipotencial)

$$\vec{E} = \frac{\sigma}{\varepsilon_0}\hat{n} \qquad\qquad \sigma = \varepsilon_0 E_n$$

Energía electrostática de N conductores:

$$W = \frac{1}{2}\sum_{i=1}^{N} Q_i V_i$$

Condensadores

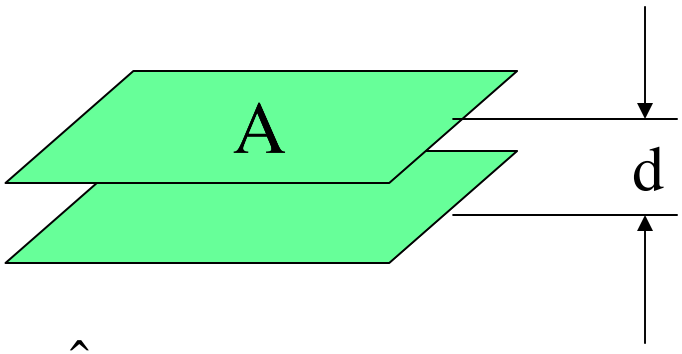
Símbolo: 

Dos conductores, con cargas Q y –Q

Diferencia de potencial = V $\quad Q = CV \quad \therefore \quad C = \dfrac{Q}{V}$

$$[C] = [\text{Faradio}] = \left[\dfrac{\text{Coulomb}}{V}\right]$$

Encontrar la capacidad de un condensador plano.



Distancia = d

Area = A

$$\vec{E} = \frac{\sigma\hat{n}}{\varepsilon_0} = C^{te.} \qquad V = Ed \qquad Q = \sigma A$$

$$\therefore \quad C = \frac{Q}{V} = \frac{\sigma A}{Ed} \qquad \therefore \quad C = \frac{\varepsilon_0 A}{d}$$

Encontrar la capacidad de un condensador esférico

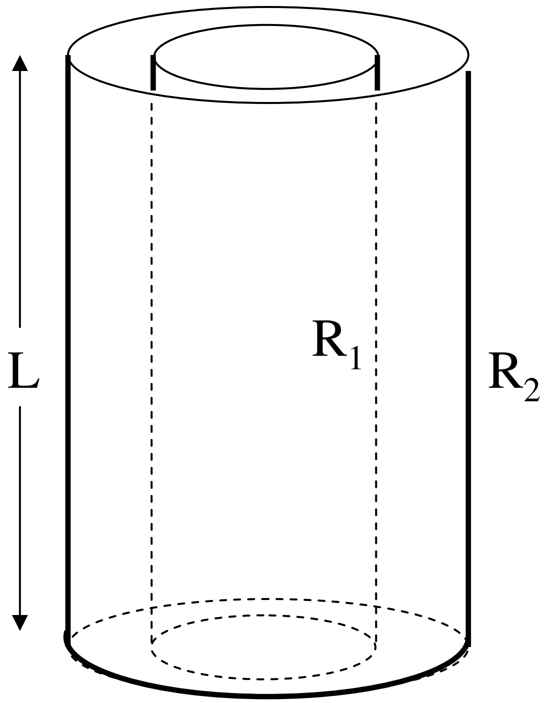
$$\vec{E} = \frac{Q}{4\pi\varepsilon_0 r^2}\hat{r}$$

$$V_2 - V_1 = \frac{-Q}{4\pi\varepsilon_0}\int_{R_1}^{R_2}\frac{dr}{r^2} = \frac{+Q}{4\pi\varepsilon_0}\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = \frac{Q}{4\pi\varepsilon_0}\frac{(R_2 - R_1)}{R_2 R_1}$$

$$C = \frac{Q}{V_2 - V_1} = 4\pi\varepsilon_0 \frac{R_1 R_2}{(R_2 - R_1)}$$

$$\text{Si } R_2 \to \infty, \qquad C \to 4\pi\varepsilon_0 R_1$$

Encontrar la capacidad de un condensador cilíndrico



$$V_1 - V_2 = \int_{R_1}^{R_2} E_r dr = \int_{R_1}^{R_2} \frac{Qdr}{2\pi\varepsilon_0 Lr}$$

$$V_1 - V_2 = \frac{Q}{2\pi\varepsilon_0 L} \int_{R_1}^{R_2} \frac{dr}{r}$$

$$V_1 - V_2 = \frac{Q}{2\pi\varepsilon_0 L} \ln\left(\frac{R_2}{R_1}\right)$$

$$C = \frac{Q}{V_1 - V_2} = \frac{2\pi\varepsilon_0 L}{\ln\left(\frac{R_2}{R_1}\right)}$$

Energía acumulada en un **condensador**

$$W = \frac{1}{2}\sum_{i=1}^{N} Q_i V_i \qquad \text{para N conductores}$$

$$N = 2 \qquad W = \frac{1}{2}\left(Q_1 V_1 + Q_2 V_2\right)$$

$$Q_1 = Q \qquad Q_2 = -Q \qquad W = \frac{1}{2}\left(QV_1 - QV_2\right)$$

$$W = \frac{1}{2}Q\left(V_1 - V_2\right) \qquad W = \frac{1}{2}QV = \frac{Q^2}{2C} = \frac{CV^2}{2}$$

Asociación de condensadores: En serie y en paralelo.

En serie: $Q_1 = Q_2 = Q$

$$Q = C_1 V_1 = C_2 V_2 \qquad V_1 = \frac{Q}{C_1} \qquad V_2 = \frac{Q}{C_2}$$

$$V_1 + V_2 = V = \frac{Q}{C_1} + \frac{Q}{C_2} \qquad \therefore \qquad V = Q\left(\frac{1}{C_1} + \frac{1}{C_2}\right)$$

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} \qquad C = \frac{C_1 C_2}{C_1 + C_2}$$

En paralelo: $V_1 = V_2 = V$

$$Q_1 + Q_2 = Q = (C_1 + C_2)V \qquad \therefore \qquad C = C_1 + C_2$$

Un condensador de placas planas, cargado con Q:

Se alejan las placas: $d_1 \rightarrow d_2$ $d_2 > d_1$ Q = Const.

$$W_1 = \frac{Q^2}{2C_1} \qquad W_2 = \frac{Q^2}{2C_2}$$

$$C_1 = \frac{\varepsilon_0 A}{d_1} \qquad C_2 = \frac{\varepsilon_0 A}{d_2} \qquad W_1 = \frac{Q^2 d_1}{2\varepsilon_0 A} \qquad W_2 = \frac{Q^2 d_2}{2\varepsilon_0 A}$$

$$\frac{W_2}{W_1} = \frac{d_2}{d_1} > 1 \qquad W_2 - W_1 = \frac{Q^2 (d_2 - d_1)}{2\varepsilon_0 A} > 0$$