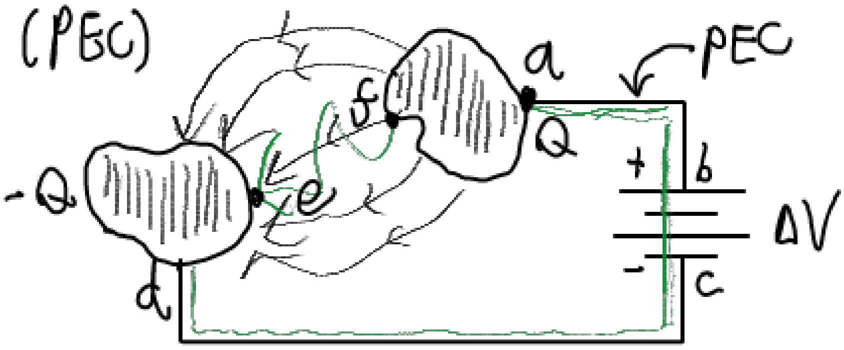
Capacitance
Capacitors
Combination < parallel / series
Energy

Perfect Electric Conducting Material. (PEC)



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

$a \to b \to c \to d \to e \to f \to a$

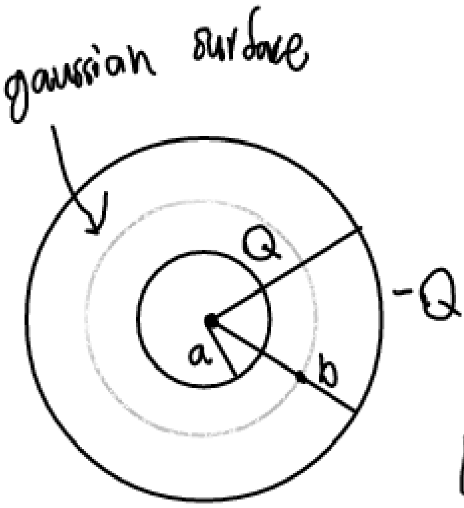
since perfect conducting wire

$$\oint \vec{E} \cdot d\vec{l} = 0 = \cancel{\int_a^b} + \int_b^c + \cancel{\int_c^d} + \cancel{\int_d^e} + \int_e^f + \cancel{\int_f^a}$$

green path

$$= 0 - \Delta V + 0 + 0 + \Delta V + 0$$

$$= 0$$



$$C = \frac{Q}{V}$$

$$\vec{E} = E_r$$

$$\frac{Q}{\varepsilon_0} = \int_{\text{surface}} \vec{E} \cdot d\vec{A} = E_r \int_{\text{area}} = E_r\, 4\pi r^2$$

$$\therefore E_r = \frac{Q}{4\pi r^2 \varepsilon_0}$$

$$|\Delta V| = \int_{r=a}^{b} \vec{E} \cdot d\vec{r}$$

$$= \int_{r=a}^{b} \frac{Q}{4\pi\epsilon_0 r^2}$$

$$= \frac{Q}{4\pi\epsilon_0}\left(\frac{1}{a} - \frac{1}{b}\right)$$

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

$$C = 4\pi\epsilon_0 \frac{1}{\frac{1}{a} + \frac{1}{b}}$$

$$\boxed{C = 4\pi\epsilon_0 \frac{ab}{b-a}}$$

$$C = \frac{Q}{V} = \frac{Q}{QA}$$ where A = constant

$$V(Q) = aQ\cancel{+b}$$