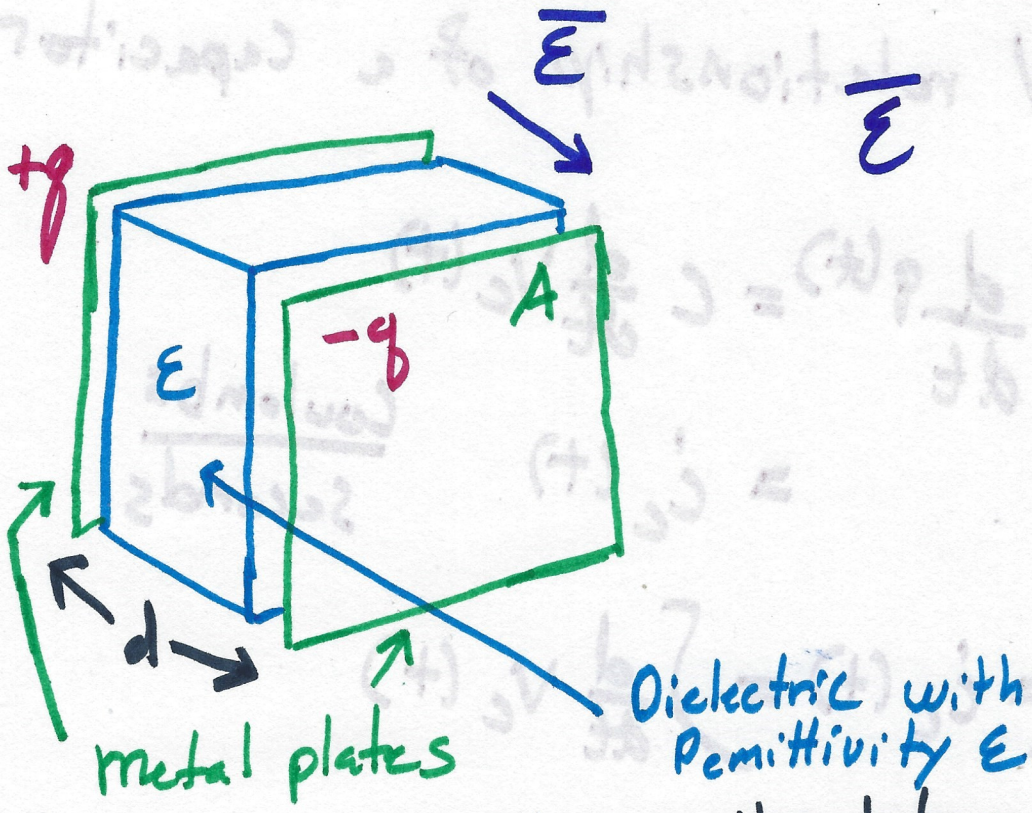

d = distance between the plates

$$\bar{\mathcal{E}} = \frac{q(t)}{\varepsilon A}, \qquad \bar{\mathcal{E}} = \frac{V_c(t)}{d}$$

$$\rightarrow \frac{V_c(t)}{d} = \frac{q(t)}{\varepsilon A} \rightarrow q(t) = \frac{\varepsilon A}{d} V_c(t)$$

$$\rightarrow \frac{\varepsilon A}{d} = C$$

$$\rightarrow q(t) = C V_c(t)$$

I-V relationship of a capacitor

$$\frac{d}{dt} q(t) = C \frac{d}{dt} V_c(t)$$

$$= i_c(t) \qquad \frac{\text{Coulombs}}{\text{seconds}}$$

$$\int \frac{1}{C} i_c(t) = \int \frac{d}{dt} V_c(t)$$

$$\frac{1}{C} \int i_c(t)\,dt = V_c(t) - V_c(t_0)$$

~~$V_c(t) = V_c(t_0)$~~

$$V_c(t) = V_c(t_0) + \frac{1}{C} \int_{t_0}^{t} i_c(x)\,dx$$