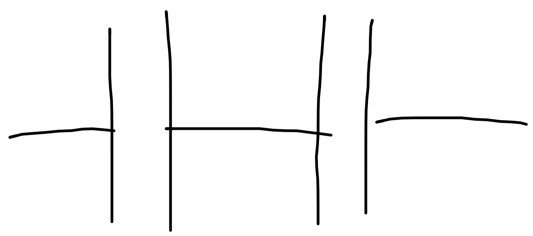
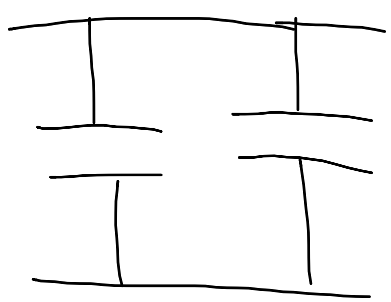
Capacitors

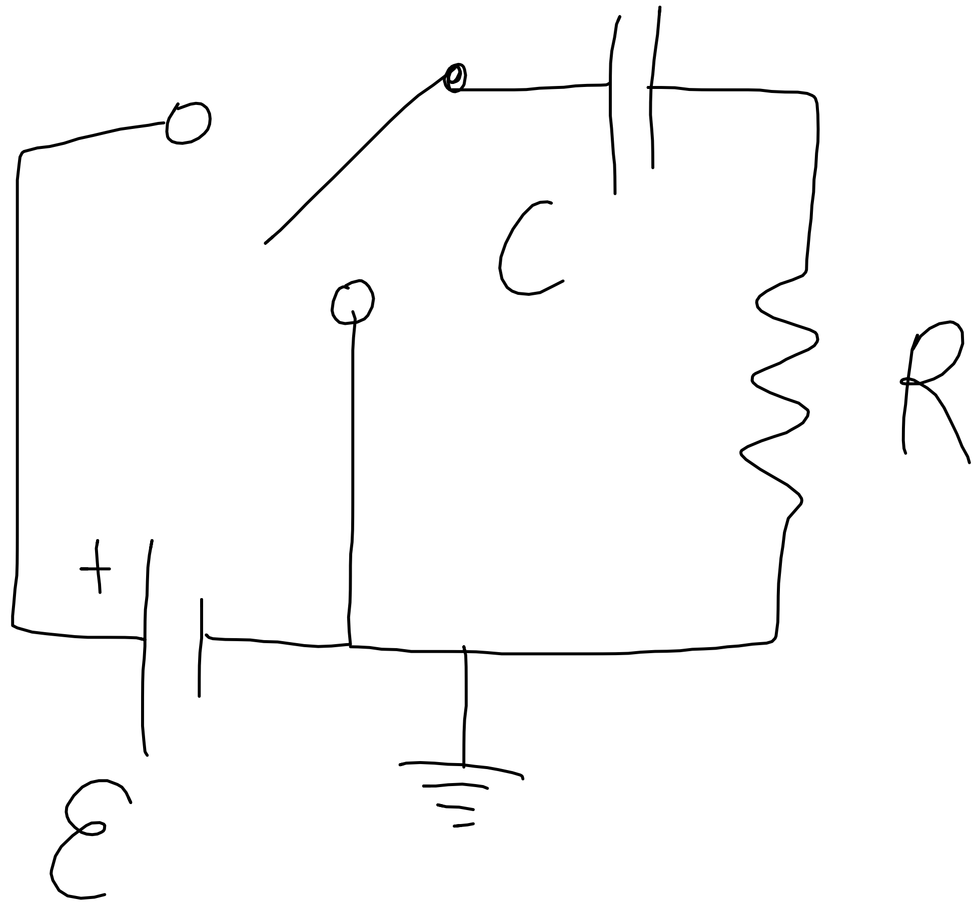


in series, $\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2}$

or $C_{eq} = \frac{C_1 C_2}{C_1 + C_2}$



$C_{eq} = C_1 + C_2$



Recall

$$I = \frac{dQ}{dt}$$

First, charge...

$$\mathcal{E} - \frac{Q(t)}{C} - I(t)R = 0$$

$$\frac{dQ}{dt} = \frac{\mathcal{E}}{R} - \frac{Q(t)}{RC}$$

$$\frac{dQ}{dt} = -\left[\frac{Q(t) - C\mathcal{E}}{RC}\right]$$

$$\int_0^Q \frac{dQ}{Q - C\mathcal{E}} = -\int_0^t \frac{dt}{RC}$$

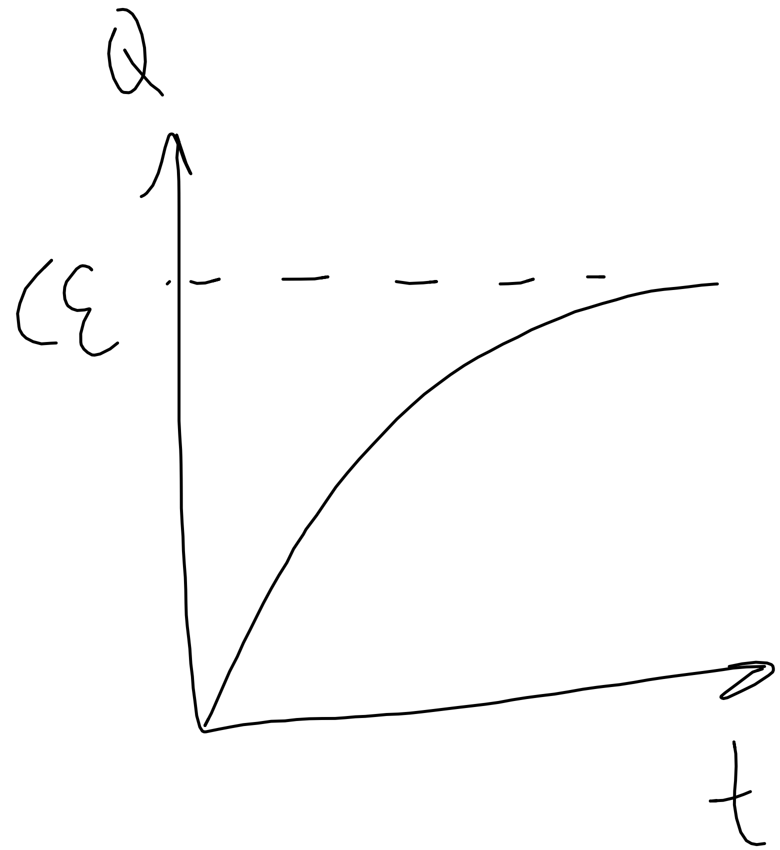
$$\ln(Q - C\mathcal{E})\Big|_0^{C\mathcal{E}} = -\frac{t}{RC}\Big|_0^t$$

$$\ln(Q - C\mathcal{E}) - \ln(-C\mathcal{E}) = -t/RC$$

$$\ln\left(\frac{Q - C\mathcal{E}}{-C\mathcal{E}}\right) = -t/RC$$

$$\frac{Q - C\mathcal{E}}{-C\mathcal{E}} = e^{-t/RC}$$

$$Q = C\mathcal{E}\left[1 - e^{-t/RC}\right]$$



$$I = \frac{dQ}{dt} = \frac{\varepsilon}{R} e^{-t/RC}$$

Discharge:

$RC = \text{time}$

$$V_c = \varepsilon e^{-t/RC}$$

$$I = \frac{\varepsilon}{R} e^{-t/RC}$$