$$\boxed{V_c = V_+ - V_-}$$

$$dL = Q\,dV_c = Q\,\frac{dQ}{C}$$

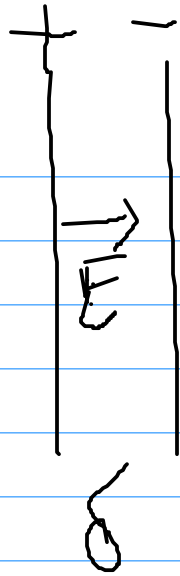
$$C = \frac{Q}{V_c}$$

$$\boxed{V_c = \frac{Q}{C}}$$

$$L\Big|_0^{Q_F} = \int_0^{Q_F} \frac{Q}{C}\,dQ$$

$$= \frac{1}{2}\frac{Q_F^2}{C}$$

$$= \frac{1}{2} V_c \cdot Q$$



$$V_c = V_+ - V_-$$

$$E = \frac{V_c}{\delta} \qquad V_c = E \cdot \delta$$

$$E_c = \frac{C}{2} V_c^2 = \frac{1}{2}\frac{Q^2}{C}$$

$$= \frac{1}{2} C \delta^2 E^2$$

$$C \propto \frac{A}{\delta} = \varepsilon_0 \frac{A}{\delta}$$

$$= \frac{1}{2} \frac{\varepsilon_0 A}{\cancel{\delta}} \delta^{\cancel{2}} E^2 = \frac{1}{2}\varepsilon_0 V E^2$$

$$E_c \propto V \rightarrow E_c = e_E V$$

$$e_E = \frac{1}{2}\varepsilon_0 E^2 \qquad e_E = \frac{E_c}{V}$$

$$I(t) = \frac{\mathcal{E}}{R} e^{-t/\tau}$$

$$P_J(t) = R \cdot I^2(t) = \frac{\mathcal{E}^2}{R} e^{-2t/\tau}$$

$$E_J = \int_0^\infty P(t)\,dt = \frac{\mathcal{E}^2}{R}\left(-\frac{\tau}{2} e^{-2t/\tau}\right)\Bigg|_0^\infty$$

$$= \frac{\mathcal{E}^2}{R}\frac{\tau}{2} = \frac{1}{2}C\mathcal{E}^2$$

$$E_G \to E_J + E_C$$

$$T(t) - T_A = (T_0 - T_A)\, e^{-t/\tau}$$

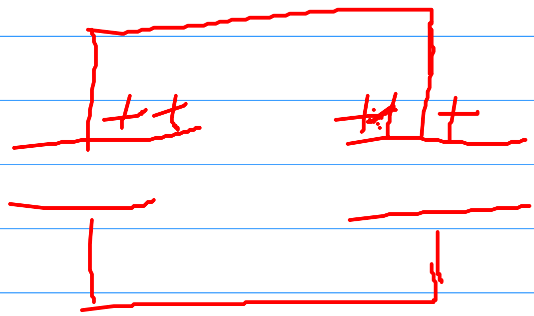
$$\Delta T(t) = \underbrace{\Delta T_0}_{60^0}\, e^{-t/\tau}$$

$t_1 = 20\,min$

$$\Delta T(t_1) = 22^0$$

$$\ln\left(\frac{\Delta T(t_1)}{\Delta T_0}\right) = -\frac{t_1}{\tau}$$

C_1 V_{c_1}



C_2 V_{c_2}

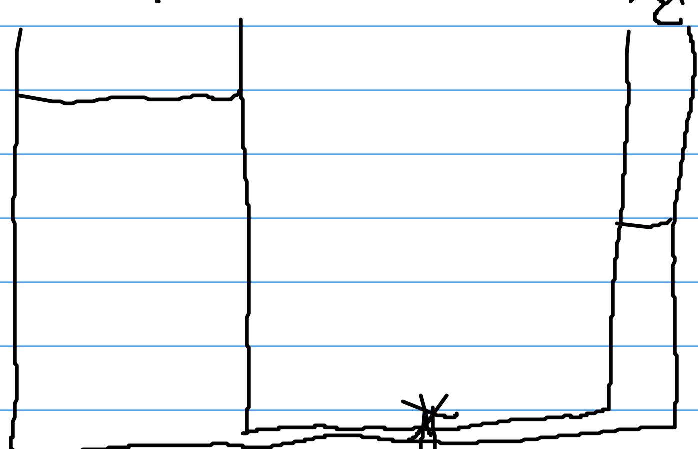
$$C = C_1 + C_2$$

$$Q = Q_1 + Q_2$$

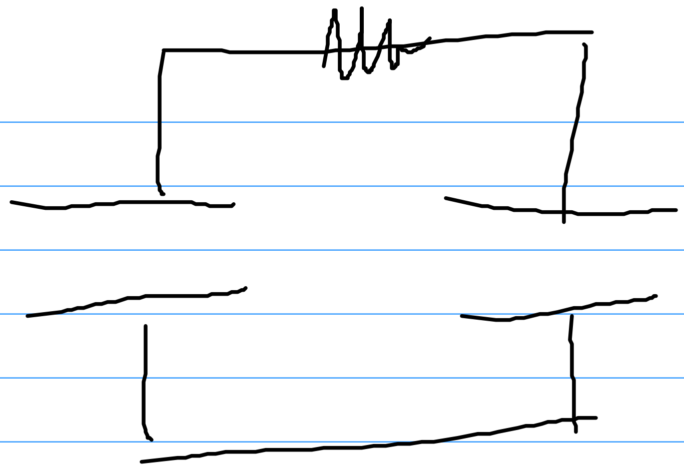
$$V_c = \frac{Q_1 + Q_2}{C_1 + C_2} = \frac{C_1 V_1 + C_2 V_2}{C_1 + C_2}$$

A_1 A_2

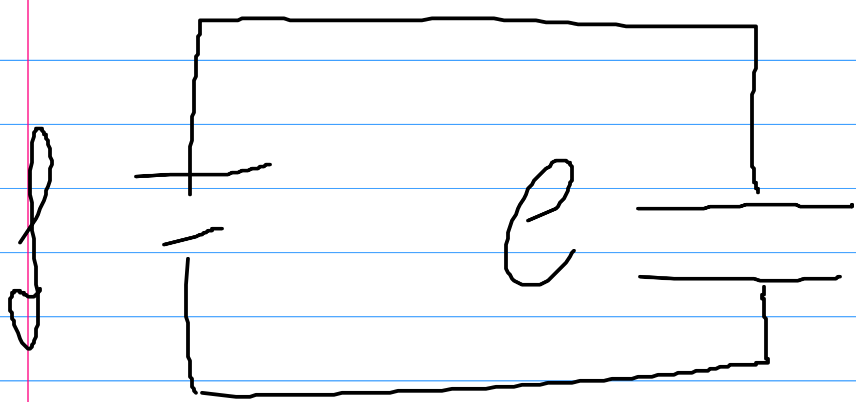
h_1



h_2



$$E_G = fQ$$



$$E_C = \frac{1}{C} f \cdot q$$