$$= (2\times10^{-11})(144-81)$$

$$= (2\times10^{-11})(63)$$

$$= 126\times10^{-11}$$

$$U_{inc} = 1.26\times10^{-9}\ J$$

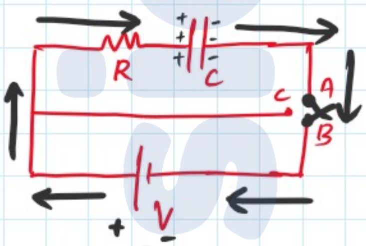
Note :

$$U = \frac{1}{2}QV \quad \because Q = Ne$$

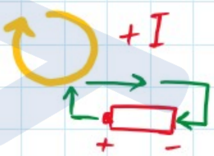
$$U = \frac{1}{2}NeV$$

Charging & Discharging of Capacitor

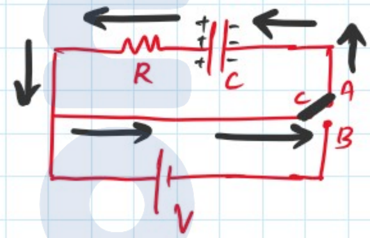
Charging



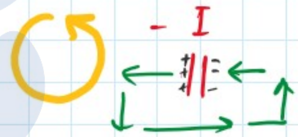
Direction of current $+I$



Discharging



Direction of current $-I$



Time during which 63% of max. charge will be stored

Time Constant $\tau = RC$

Time during which 37% of max. charge will be remaining.

$e = 2.7$

$\ln e = 1$

$\log 10 = 1$

$$\underbrace{q}_{\text{instantaneous charge}} = \underbrace{q_0}_{\text{max. charge}}\left(1 - e^{-\overbrace{t}^{\text{instant}}/\underbrace{RC}_{\text{time const}}}\right)$$

$$\underbrace{q}_{\text{inst. charge}} = \underbrace{q_0}_{\text{max. charge}}\, e^{-\overbrace{t}^{\text{instant}}/\underbrace{RC}_{\text{time const}}}$$

$\because Q = CV$

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

charge: $V = V_0\left(1 - e^{-t/RC}\right)$

disch.: $V = V_0\, e^{-t/RC}$

if $t = RC$

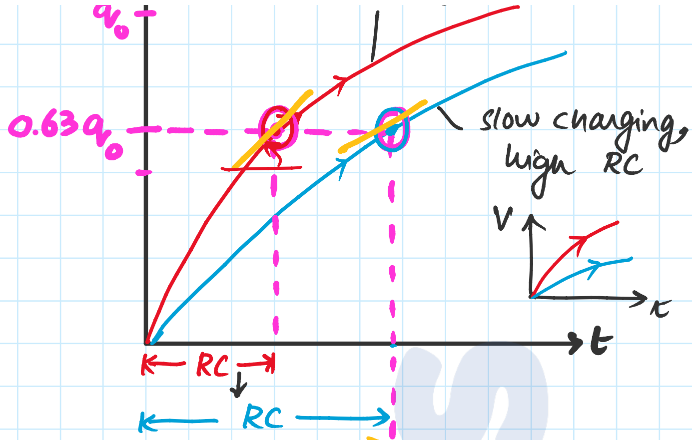
$q = 0.63\, q_0$

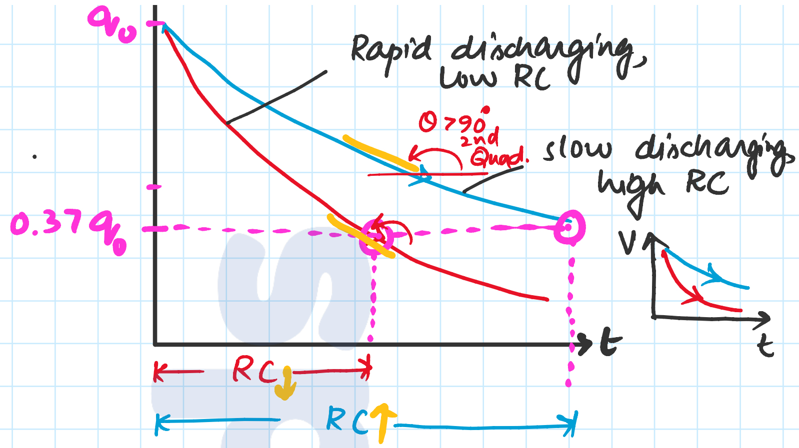
$q = 63\%\, q_0$

if $t = RC$

$q = 0.37\, q_0$

$q = 37\%\, q_0$





Rate of charging $= \dfrac{\Delta Q}{\Delta t} = \text{slope} \uparrow \propto \dfrac{1}{RC \downarrow}$

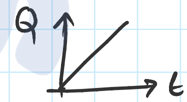
$+I$

overall slope of graph → dec, → +ive

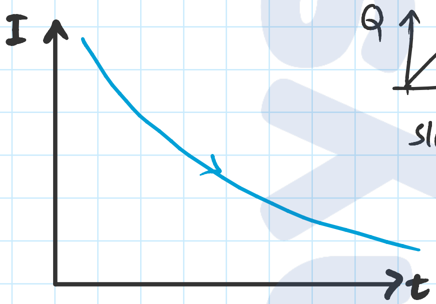
Rate of discharging $= \dfrac{\Delta Q}{\Delta t} = \text{slope} \uparrow \propto \dfrac{1}{RC \downarrow}$

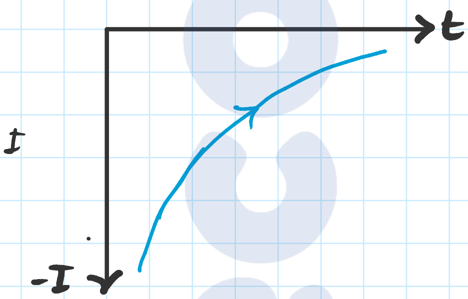
$-I$

overall slope of graph → dec, → -ive



slope $= \dfrac{\Delta Q}{\Delta t} = I$





$I = I_0 e^{-t/RC}$

$I = I_0 e^{-t/RC}$