I. Circuits

(A) $I = \frac{dQ}{dt}$ (A); flow rate, not speed

(B) $R = \frac{\rho L}{A}$

(C) Ohm's Law: $\Delta V = IR$

(D) $P = I^2 R = IV = \frac{V^2}{R} = \frac{dW}{dt} \Rightarrow \int P\,dt = W$

(E) $C = \frac{Q}{V}$

(F) $U = \frac{1}{2} C \Delta V^2$

II. Resistor Circuits

(A) Series

1. $R_{eq} = \sum R_i$
2. $C_{eq}^{-1} = \sum_i \frac{1}{C_i}$

(B) Parallel

1. $R_{eq}^{-1} = \sum_i \frac{1}{R_i}$
2. $C_{eq} = \sum C_i$

(C) Complex

1. Solve for R_{eq}
2. Then I through battery
3. Use $\Delta V = IR$ for each resistor

(D) Kirchhoff's Law.

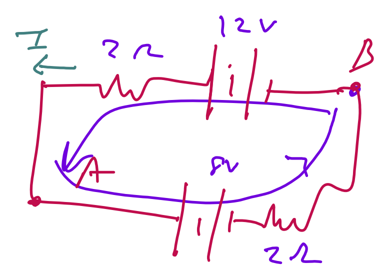
1. $I_{in} = I_{out}$
2. $\Delta V_{loop} = 0$

(a) when ± for |ı|

i. →|ı|→ +

ii. →|ı|→ −

(b) when ± for −ww−



$+12 - 2I - 8V - 2I = 0$

(E) Meters

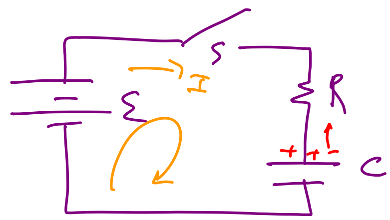
1. Galvanometer
2. Ammeter

(a) connect in series
(b) very small R created by adding small shunt in //.

3. Voltmeter
(a) connect in //
(b) large R created by adding large shunt in series

III RC Circuits

(A) Diff. Eq.



$\Delta V_{loop} = 0$

$$\varepsilon - IR - \frac{q}{C} = 0$$

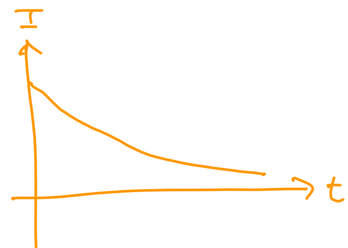
$$\frac{\varepsilon}{R} - \frac{q}{RC} = \frac{dq}{dt}$$

$\Delta V = IR$

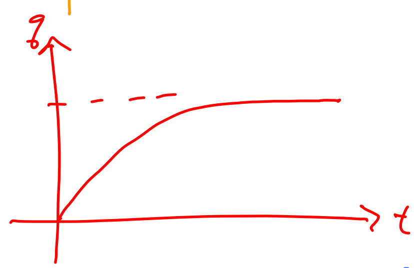
$C = \frac{Q}{\Delta V}$

(B) $I = \frac{\varepsilon}{R} e^{-\frac{t}{\tau}}$

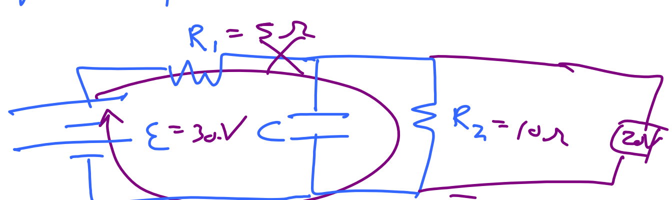
$\tau = RC$



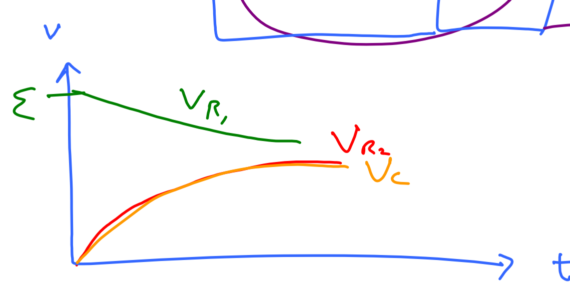
(c) $q = C\varepsilon(1 - e^{-\frac{t}{\tau}})$



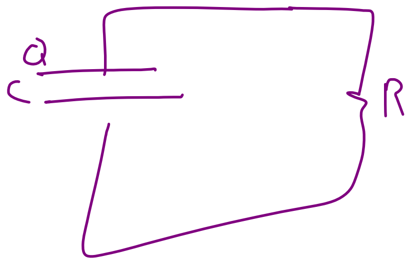
(D) ΔV across R or C for charged, uncharged capacitor

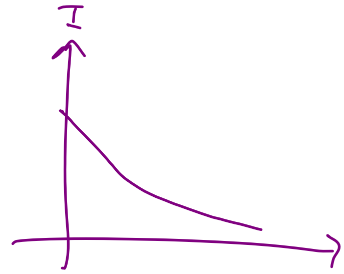


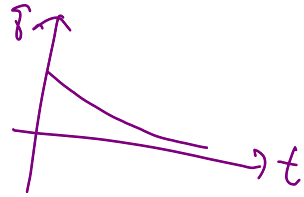
$I_\infty = 2\,A$



(E) Cap @ $t = 0$ & $t = \infty$


Q
C
R


I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