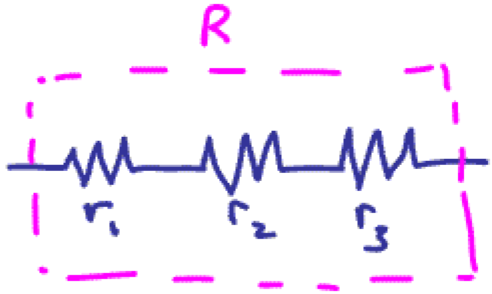
Physics 142 - October 6, 2005

DC circuits, Relativity

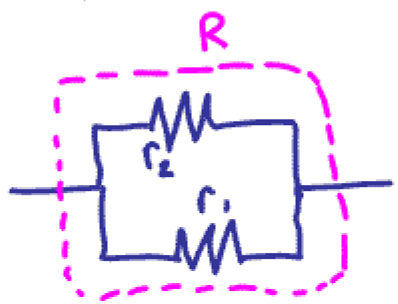
Last Time -

Resistors in Series



$$R = \sum r_i$$

Resistors in Parallel



$$\frac{1}{R} = \sum \frac{1}{r_i}$$

Kirchoff's Rules:

1. $\sum V = 0$ around closed loop in circuit
2. current is conserved at any branch point in circuit

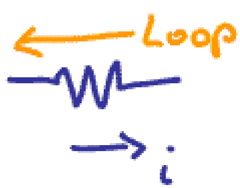
use these rules to create N independant equations
to solve for N unknowns

Convention [told this is opposite that of ECE 210]
↳ no matter if Consistent

Choose currents in each branch (arbitrary)
Sum ΔV across each circuit component as you go
around an imaginary closed loop in the circuit

ΔV − if 

$\mathcal{E}$ + if 

ΔV + if 

$\mathcal{E}$ − if 

Get N eqns, N unknowns and Solve

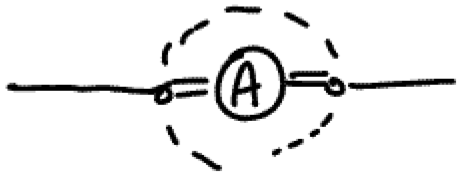
Tedious ⟶ must be careful and consistent
w/ Conventions and Signs

Voltmeter − Meas. pot. difference between 2 pts in a circuit

V has a huge resistance

Always connected in //

Ammeter – Meas. current flow in circuit



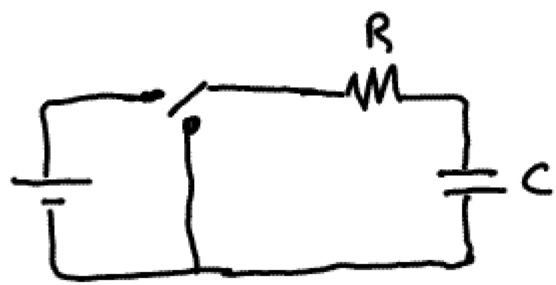
low resistance

All current passes thru

RC circuit (still DC)

Resistor

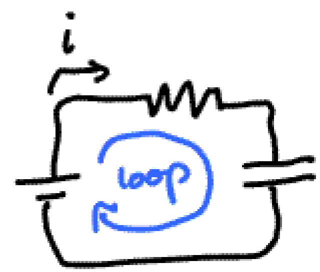
Capacitor



Switch in up position

charging capacitor

$\Sigma V = 0$



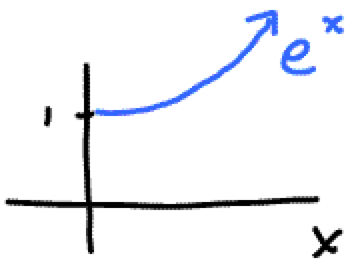
$$\underbrace{\varepsilon - iR}_{V_R} - \underbrace{\frac{q}{C}}_{V_C} = 0$$

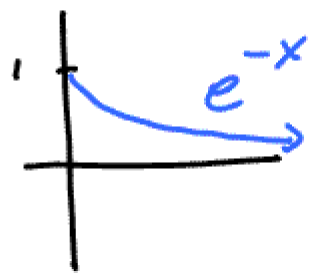
$$q(t), \quad i = \frac{dq}{dt}$$

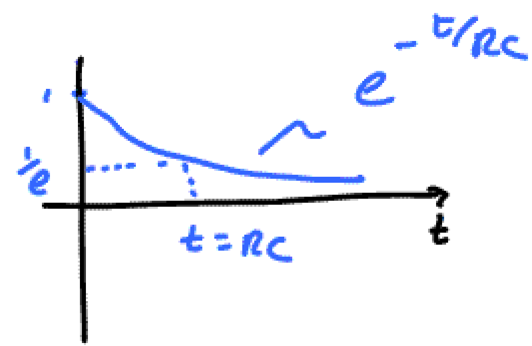
$$\varepsilon = \frac{dq}{dt} R + \frac{q}{C}$$

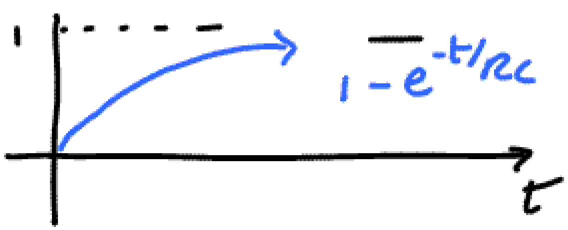
> differential Equations

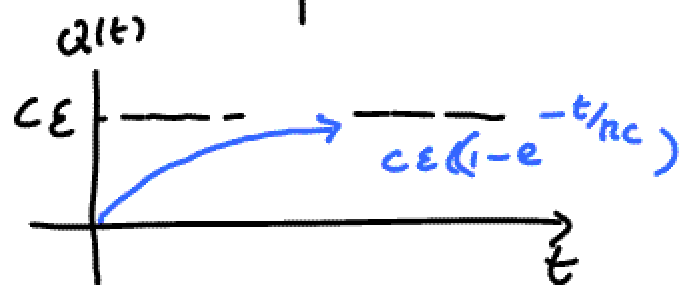
$$q = C\varepsilon\left(1 - e^{-t/RC}\right)$$

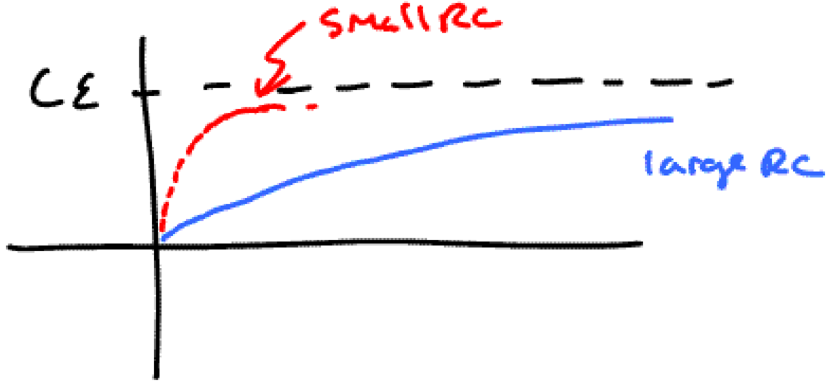








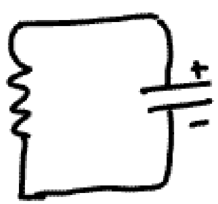




— $t = RC$ get you to w/in $\frac{1}{e}$ of CE

RC ≡ Time Constant of circuit

Throw switch down after C is charged



Same thing as earlier but $\mathcal{E} = 0$

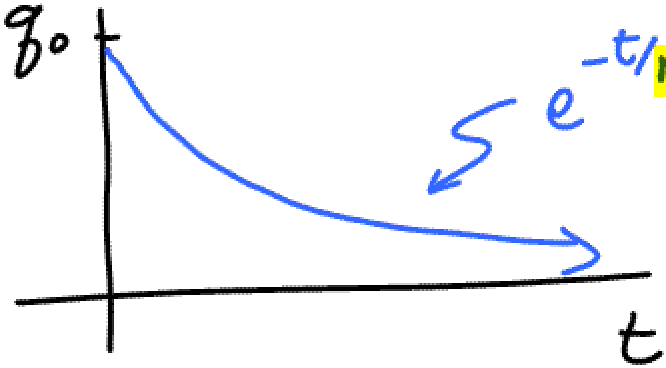
$$\frac{q}{C} = -\frac{dq}{dt} R$$

$$\int_0^t \frac{dt}{RC} = -\int_{q_0}^{q} \frac{dq}{q} \qquad \frac{t}{RC} = -\ln\frac{q}{q_0}$$

$$q_0 e^{-t/RC} = q$$

$C\mathcal{E} = q_0$

if fully charged



$e^{-t/RC}$

TIME CONSTANT

Relativity - see introductory ppt files