Physics 142 - October 11, 2007

- Exam 1 — Soon ...

Last Time -

- Dielectrics

$$\vec{E} = \frac{\vec{E}_0}{\kappa}$$

κ ≡ dielectric constant > 1

$\frac{1}{\kappa} = \epsilon$ ≡ permittivity

- Current

$$I \text{ or } i = \frac{dq}{dt}$$

+i is direction of + charge flow

- Resistance

$V = IR$ — Ohm's Law

R: Resistance → unit: ohm = Ω

Impedes electrons "Looking" for love

Pass current thru resistor — Energy lost as heat or light

Power dissipated $= P = iV = iiR = i^2R$ Mostly

$P = i^2R$

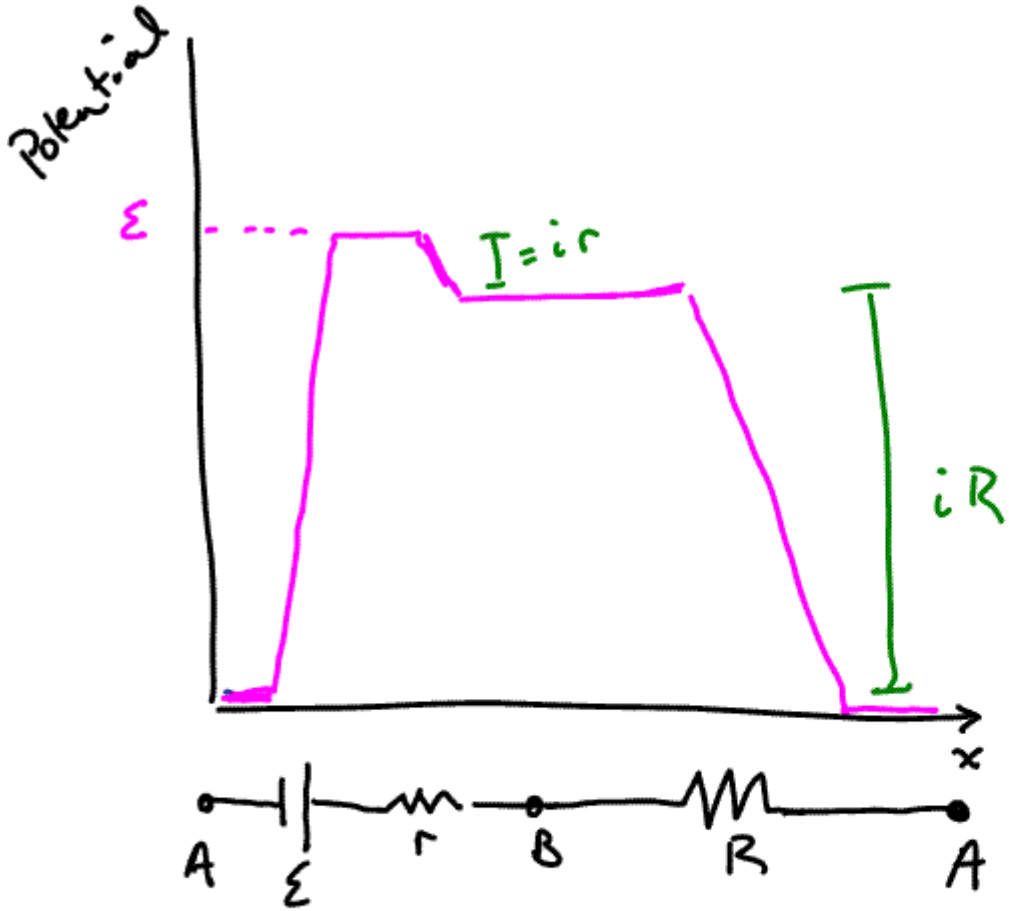
$V = iR$

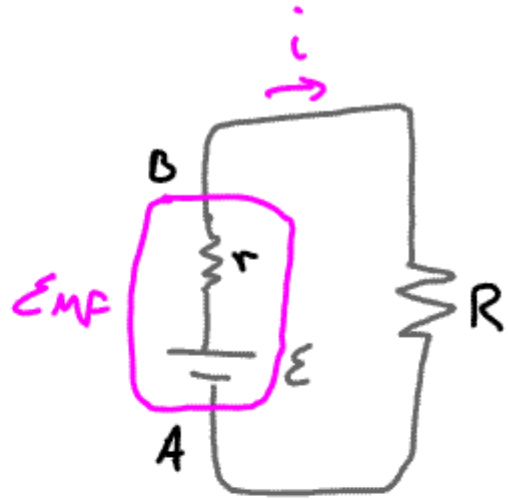
$i = V/R$

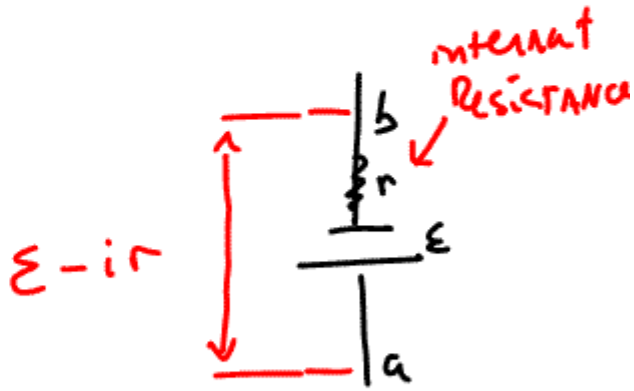
$P = \frac{V^2}{R}$

Possible Source of Confusion

	Resistors:	Capacitors:
Series	$R = \sum_i r_i$	$\frac{1}{C} = \sum_i \frac{1}{C_i}$
Parallel	$\frac{1}{R} = \sum_i \frac{1}{r_i}$	$C = \sum_i C_i$







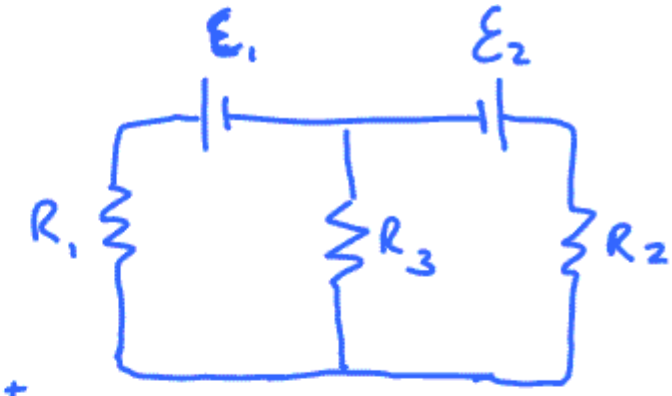
$V_A = 0$

Assuming DC

direct current

for now

Kirchoff's rules



know $\mathcal{E}_1, \mathcal{E}_2$
R_1, R_2, R_3
want currents throughout circuit → how?

Kirchoff's Rules:

1. $\Sigma V = 0$ around closed loop in circuit
2. Current is conserved at any BRANCH point in circuit

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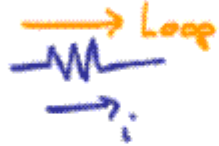
use these rules to create N independent equations to solve for N unknowns

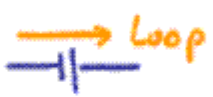
Convention [told this is opposite that of ECE 210]

↳ no matter if consistent

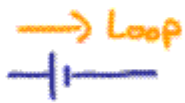
Choose currents in each branch (arbitrary)

Sum ΔV across each circuit component as you go around an imaginary closed loop in the circuit

$\Delta V -$ if 

$\mathcal{E} +$ if 

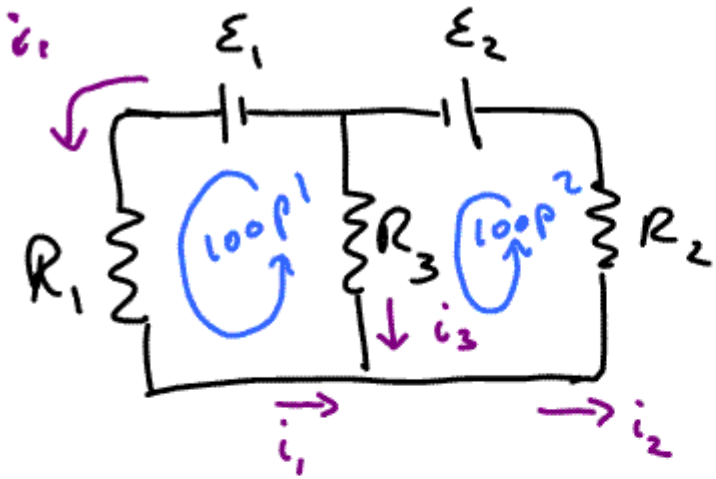
$\Delta V +$ if 

$\mathcal{E} -$ if 

Get N eqns, N unknowns and Solve

Tedious → must be careful and consistent by Conventions and Signs

Use only independent loops



Know $\mathcal{E}_1, \mathcal{E}_2$

R_1, R_2, R_3

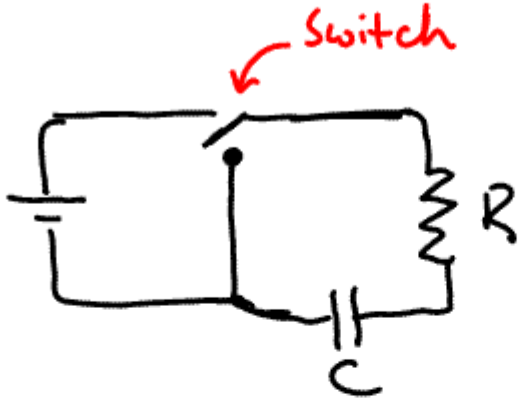
Solve for current thruout circuit

Kirchoff's 2ND rule $i_1 + i_3 = i_2$ (I)

$$\mathcal{E}_1 - i_1 R_1 + i_3 R_3 = 0 \quad \text{(II)}$$

$$-i_3 R_3 - i_2 R_2 - \mathcal{E}_2 = 0 \quad \text{(III)}$$

DC - RC circuits



Switch up

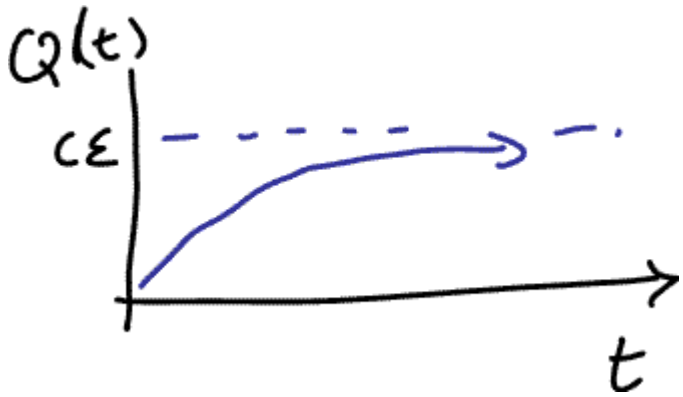
$$\Sigma V = 0$$

$$\mathcal{E} - iR - \frac{q}{C} = 0$$

differential eqn

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

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


Q(t)
cε
t