

# Physics 142, October 7, 2008

■ Exam 1 over - hooray  
Will try to have graded / hand back in 1 wk

■ P142 presentations

You have until Thursday Morning  
at 10 AM or so to  
Petition me to add a topic  
to the list

Last  
Time

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

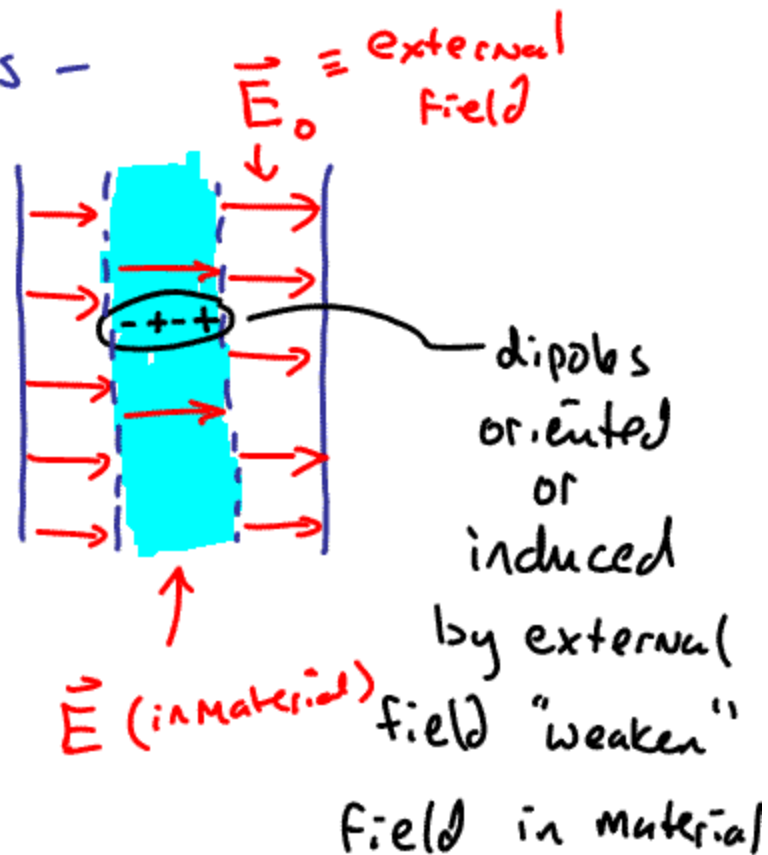
$K \equiv$  Dielectric constant

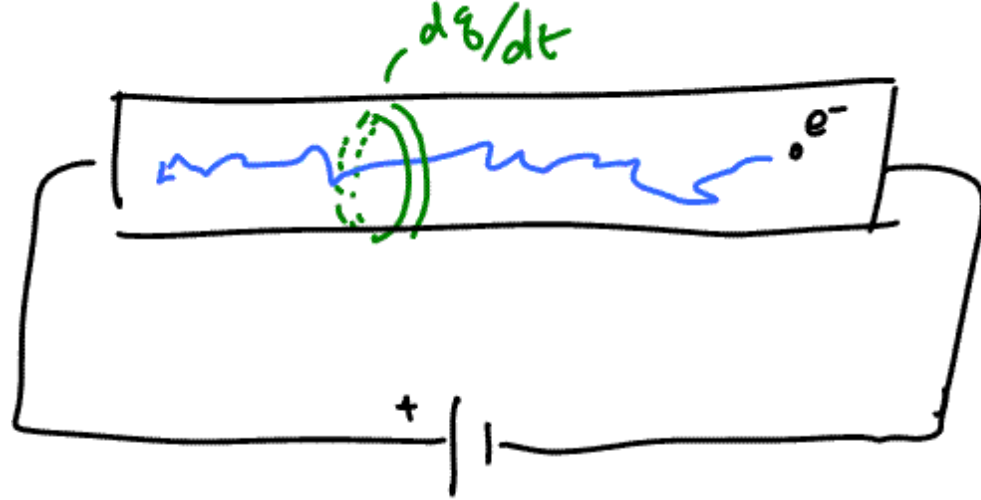
$$K > 1$$

$K$  material dependent

$$\frac{1}{K} \equiv \epsilon \equiv \text{permittivity}$$

(Linear)  
Dielectrics -





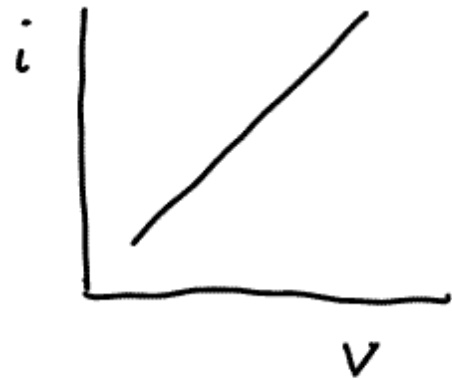
♥  
 "Resistance"  
 impedes electrons  
 looking for love!

$i \equiv$  current in units of  $C/s$

$$i \equiv \frac{dq}{dt}$$

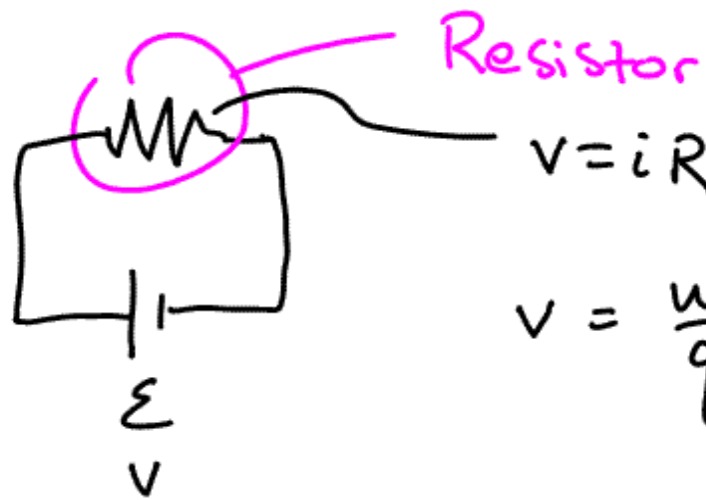
$$i \propto V$$

$R \equiv$  RESISTANCE is const of  
 proportionality



$$V = iR$$

ohm's Law



$$V = iR$$

$$V = \frac{W}{q} \quad \text{across resistor}$$

$$W = qV$$

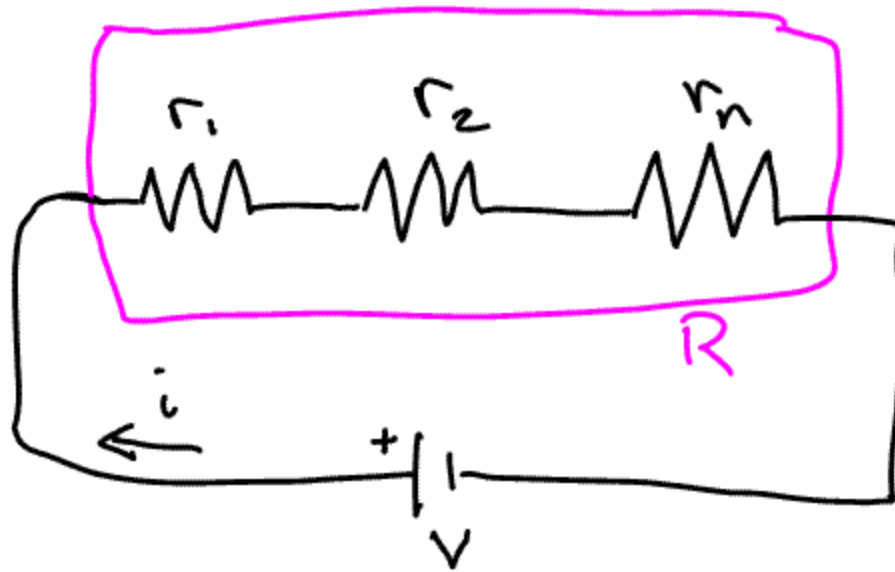
$$\text{Power} \equiv \frac{dW}{dt} = \frac{dq}{dt} V = iV$$

$$P = iV$$

$$P = i(iR) = i^2 R$$

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

$$V = iR$$



Resistors  
in  
series

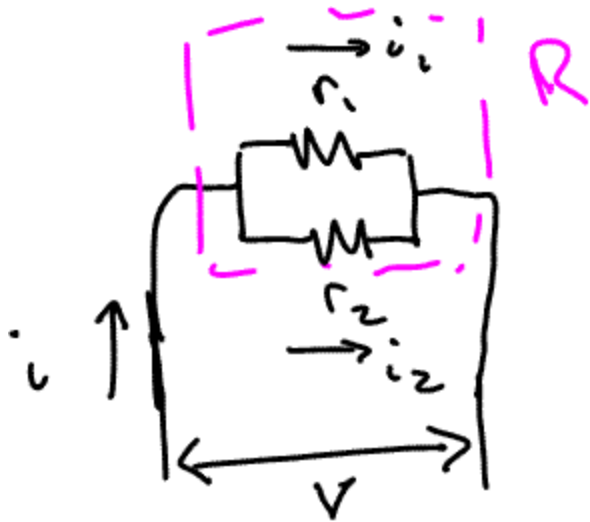
$$V = iR$$

$$V = V_1 + V_2 + \dots + V_n$$

$$iR = ir_1 + ir_2 + \dots + ir_n$$

$$R = r_1 + r_2 + \dots + r_n$$

$$R = \sum_i r_i$$



resistors  
in  
parallel

$$V = i_1 r_1$$

$$V = i_2 r_2$$

$$i = i_1 + i_2$$

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

$$\frac{V}{R} = \frac{V}{r_1} + \frac{V}{r_2}$$

$$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2}$$

# Source of confusion

Resistors

Capacitors

Series

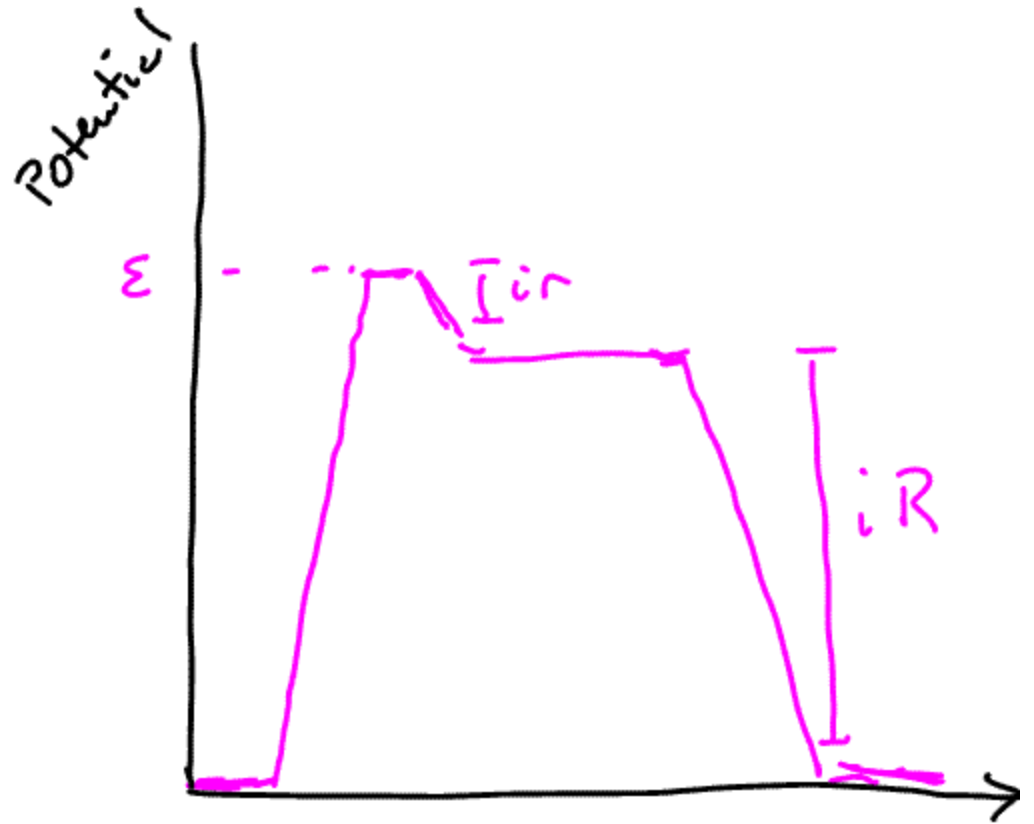
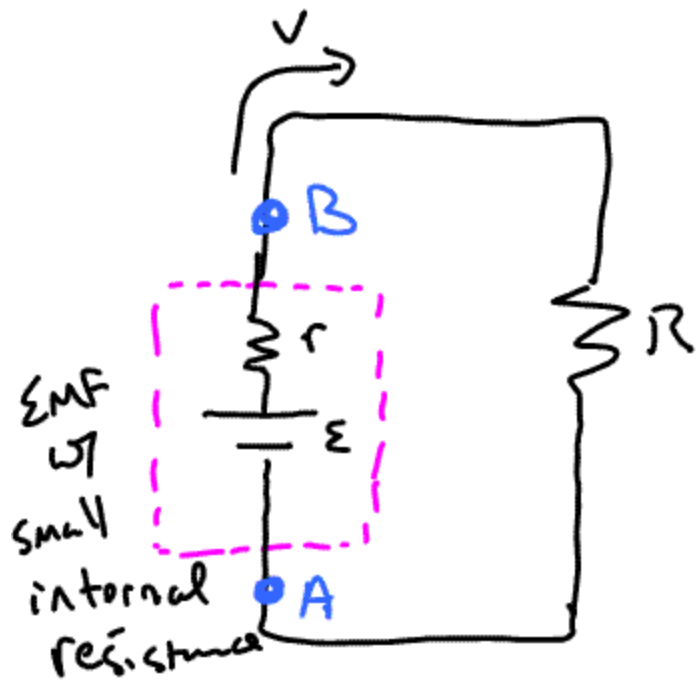
$$R = \sum_i r_i$$

$$\frac{1}{C} = \sum_i \frac{1}{C_i}$$

Parallel

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

$$C = \sum_i C_i$$

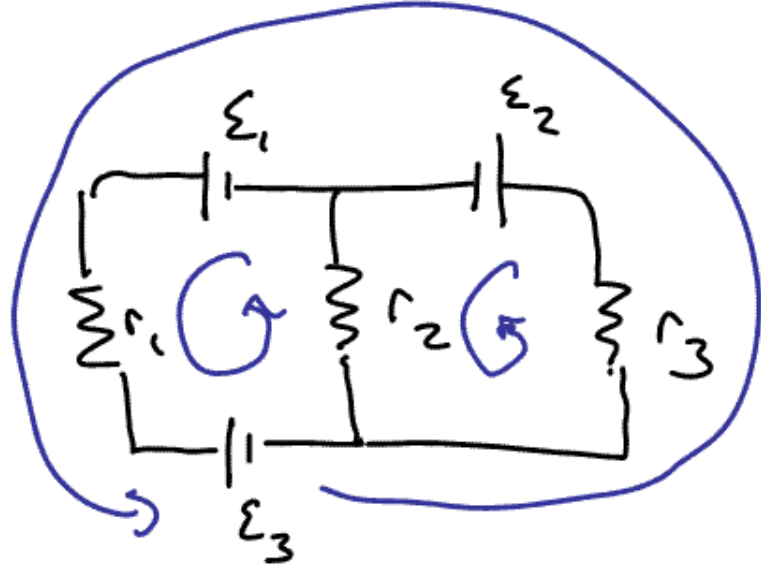


Define  $V_A = 0$



# Kirchoff's rules:

How do you solve this?



①  $\sum V = 0$  around closed loop in circuit

② Sum of  $i$  at branch point = 0

Current is conserved at  
branch points

use these constraints  $\rightarrow$  Negns, N unknowns  $\rightarrow$  solve

Convention [Possibly opposite ECE 210 ?]

Choose currents in each branch  
(arbitrary)

... out of time. Will come back  
to this Thursday