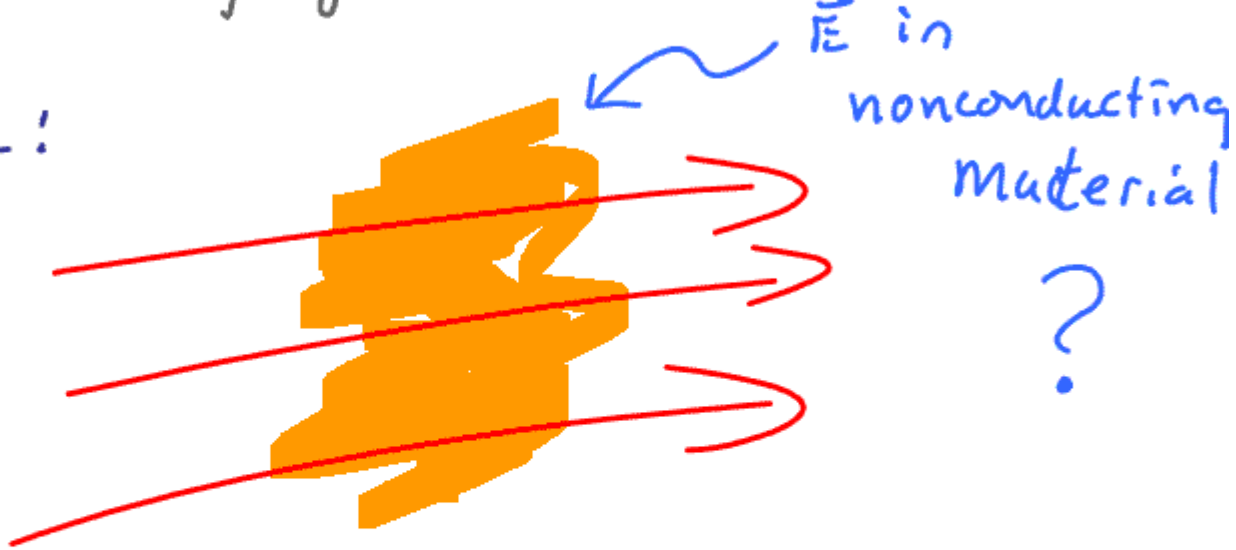
# Physics 114 - March 2, 2006

Trouble-shooting guide

Last time!

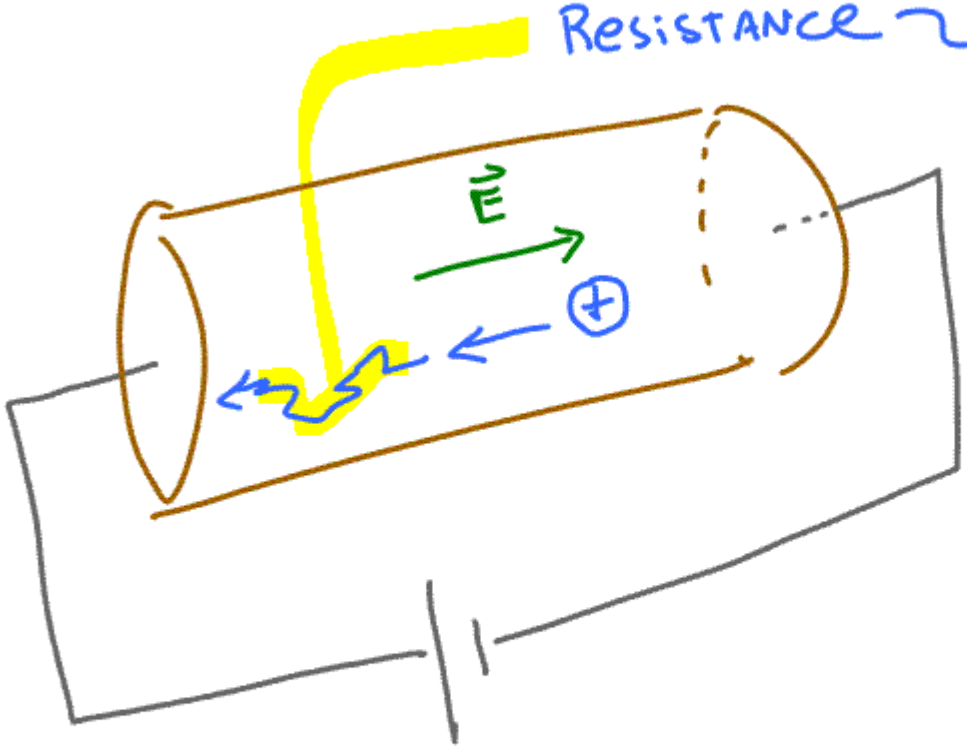



$$E = \frac{E_0}{\{K\}}$$ ≡ dielectric CONSTANT

or can use $\epsilon \equiv$ Permittivity

rather than $\epsilon_0$ $\quad \epsilon \equiv K\epsilon_0$

# $K, \epsilon$ are Material dependent





Charges flow $i = \frac{dq}{dt}$ in Amperes

1 Ampere = $\frac{1 \text{ coul}}{1 \text{ second}}$

André Marie Ampère
(1775 - 1836)

French { mathematician
chemist
physicist

the inspiration for
Elvis' Collar

$V = IR$

Ohm's Law

Georg Ohm

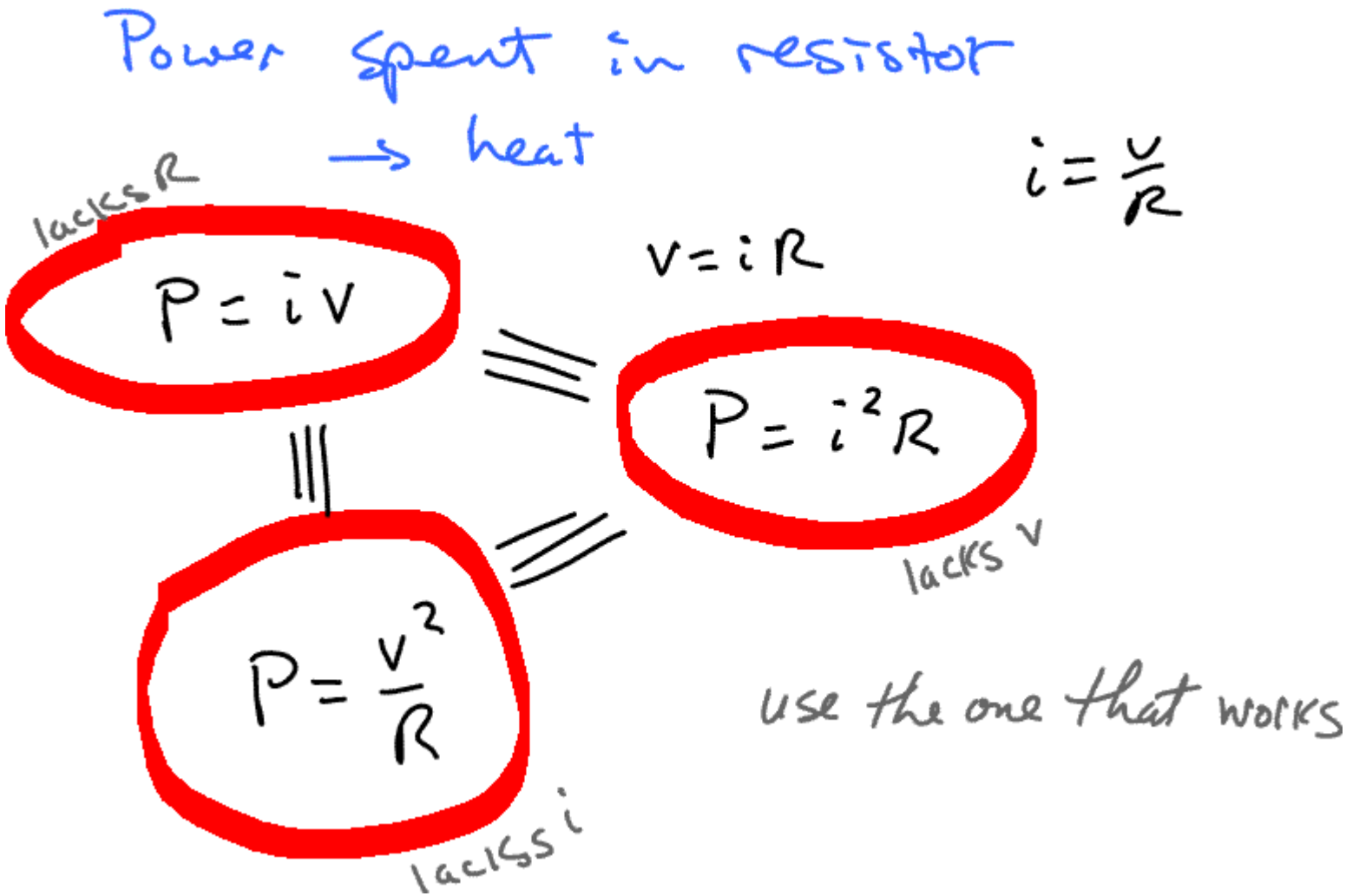
1789-1854

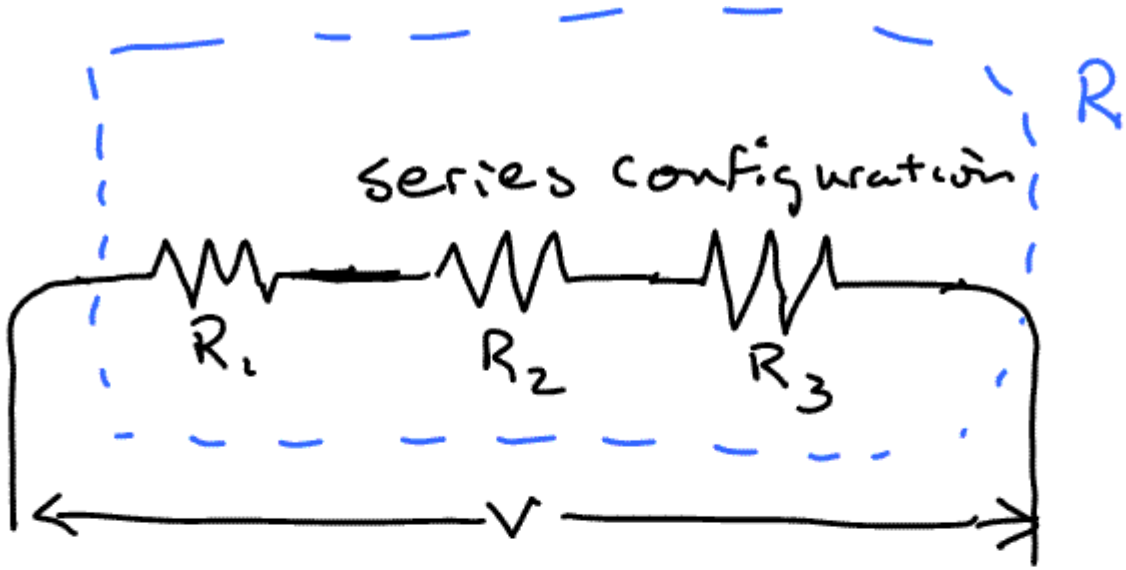
German

Resistance measured in Ohms

$1 \text{ Ohm} = 1 \frac{\text{volt}}{\text{Ampere}}$

$\Omega$


Power spent in resistor
→ heat
$i = \frac{V}{R}$
$V = iR$
lacks R
$P = iV$
$P = i^2R$
lacks V
$P = \frac{V^2}{R}$
lacks i
use the one that works



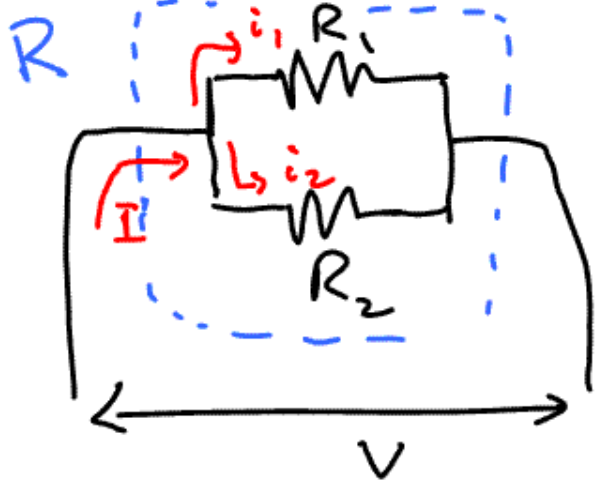

$$V = V_1 + V_2 + V_3 = iR_1 + iR_2 + iR_3 = i(R_1 + R_2 + R_3)$$

$$= iR$$

$$R = R_1 + R_2 + R_3 = \sum_i R_i$$

Resistors in Series

$$R = \sum_i R_i$$



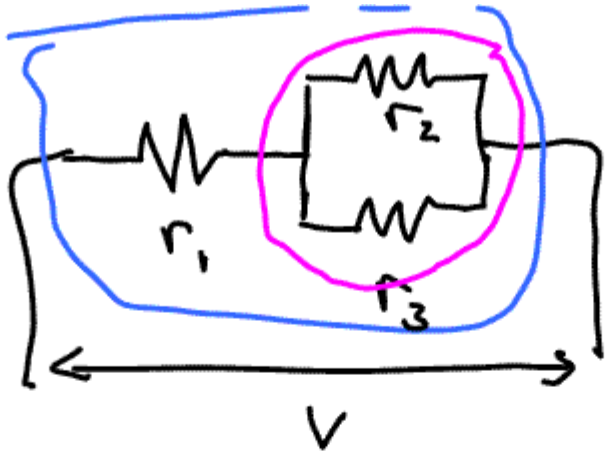

Resistors in Parallel

$V = IR \qquad V = i_1 R_1 \qquad V = i_2 R_2$

$I = i_1 + i_2$

$\frac{V}{R} = \frac{V}{R_1} + \frac{V}{R_2} \qquad \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$

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




$\Delta V$ relative to pt A

=

V

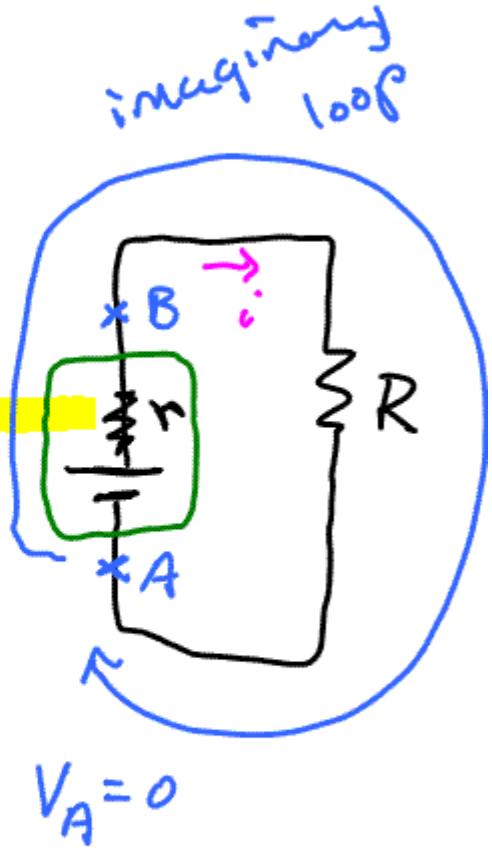
$\mathcal{E}$

ir

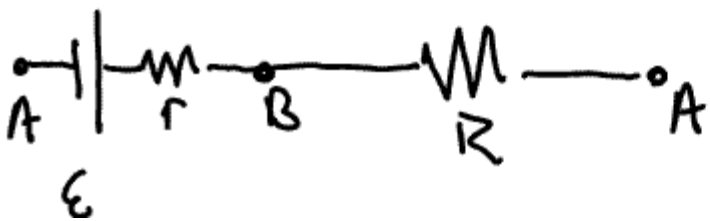
iR

loop distance

internal Resistance



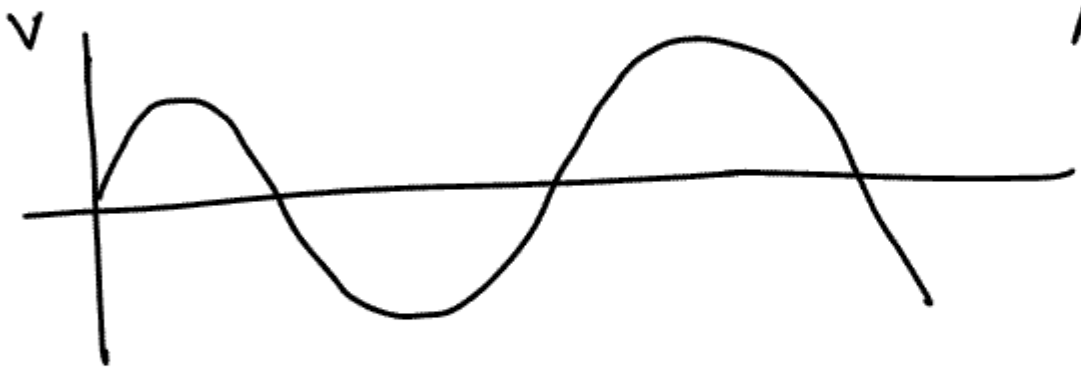

$V_A = 0$



Battery → V constant

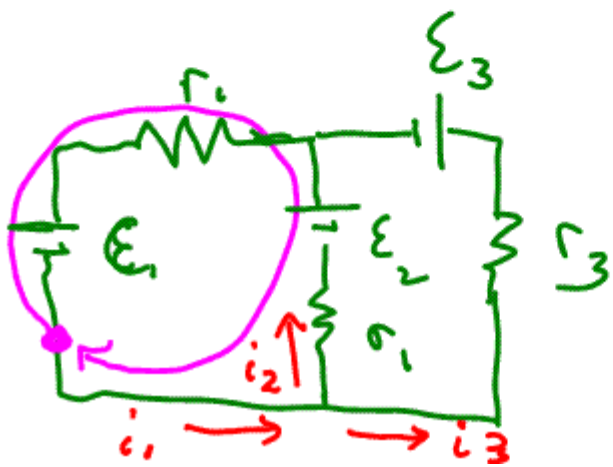
one direction

Direct Current DC




Alternating current

AC




$i_1 = i_2 + i_3$

# Kirchoff's Rules:

1. $\sum V = 0$ around closed loop in Circuit

2. $\sum i = 0$ at any junction

Current is conserved at any branch point

use rules and independent loops and conventions

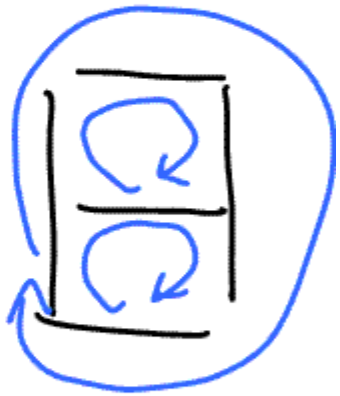
To get N eqns

↳ solve for N unknowns

Solve a problem → conventions

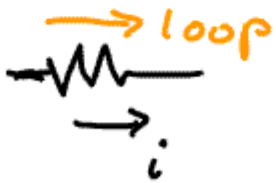
Choose currents in each branch of circuit
(arbitrary)

Imaginary loops about circuit

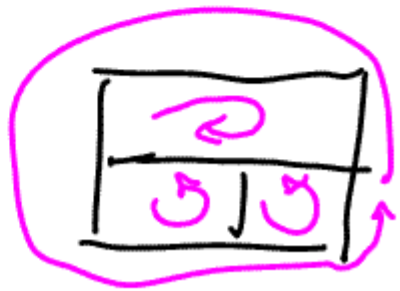


Sum $\Delta V$ as go around
each independent
imaginary loop

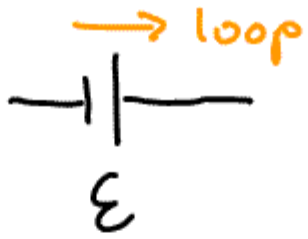
$\Delta V$ − if



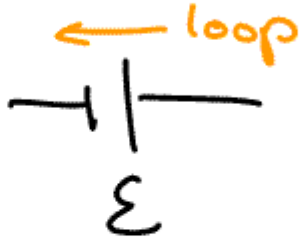

$\Delta V$ + if

$\mathcal{E}$ + if



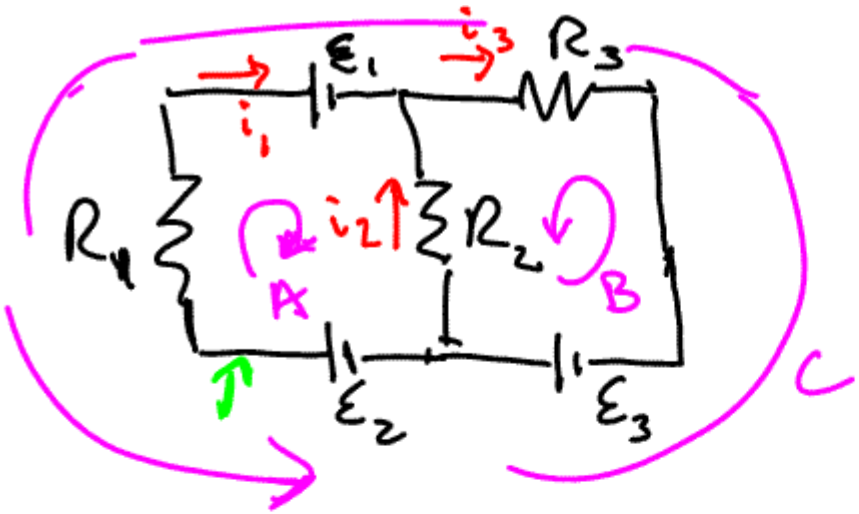

$\mathcal{E}$ − if




Each indep loop $\Sigma V = 0$

$\rightarrow$ N eqns

Solve N unk




$$i_1 + i_2 = i_3$$

$\Sigma V = 0$ around each loop

A $\quad \Sigma V = -i_1 R - \mathcal{E}_1 + i_2 R_2 + \mathcal{E}_2 = 0$

B $\quad \Sigma V = -\mathcal{E}_3 + i_3 R_3 + i_2 R_2 = 0$

gives 3 eqns → can solve for up to 3 unknowns