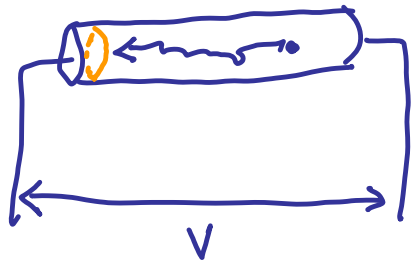
Physics 142 - October 9, 2014

- Hope to have EXAM graded + Back to you NEXT week
- Will send email about "projects" soon

Last Time

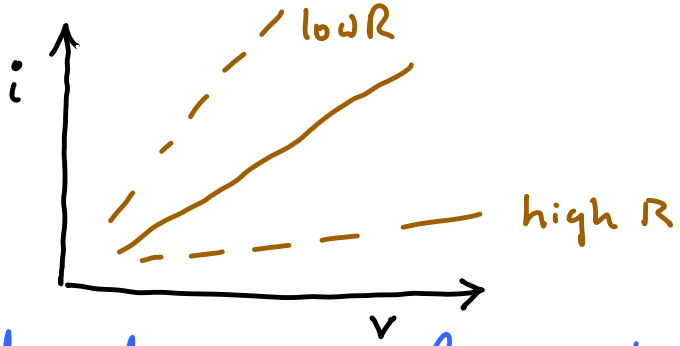


$i = \frac{dq}{dt}$

i in Amperes

electrons impeded as they look for ♥

$V = iR$



R in Ohms, R depends on material + geometry

André Marie Ampère
(1775 - 1836)

French { mathematician
chemist
physicist

$V = IR$ Ohm's Law

Georg Ohm

1789-1854
German

Resistance Measured in Ohms

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

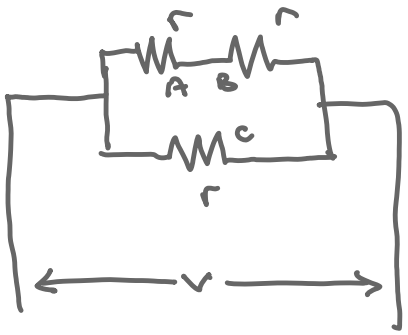
Ω

Energy lost to resistance
↳ heat

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

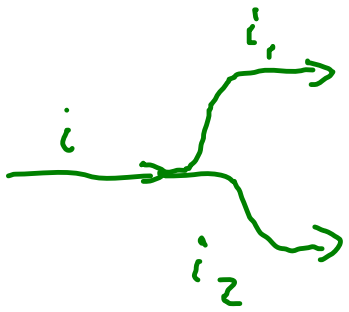
"Resistive heating"

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



3 lightbulbs arranged as shown

order the brightness of the Bulbs

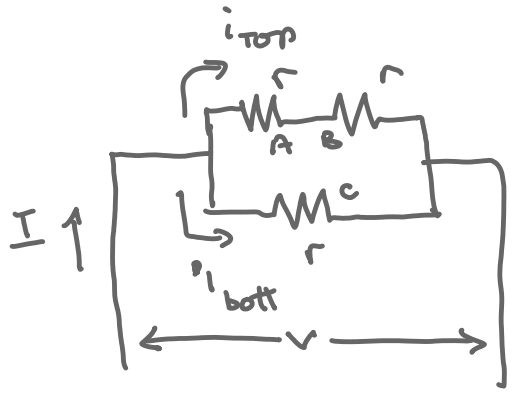


$P = i^2 r$

$\frac{V^2}{4r}$

Top $V = i(2r)$ $i_t = \frac{V}{2r}$ $P = \frac{V^2}{4r^2} r$

Bot $V = i r$ $i_b = \frac{V}{r}$ $P = \frac{V^2}{r}$

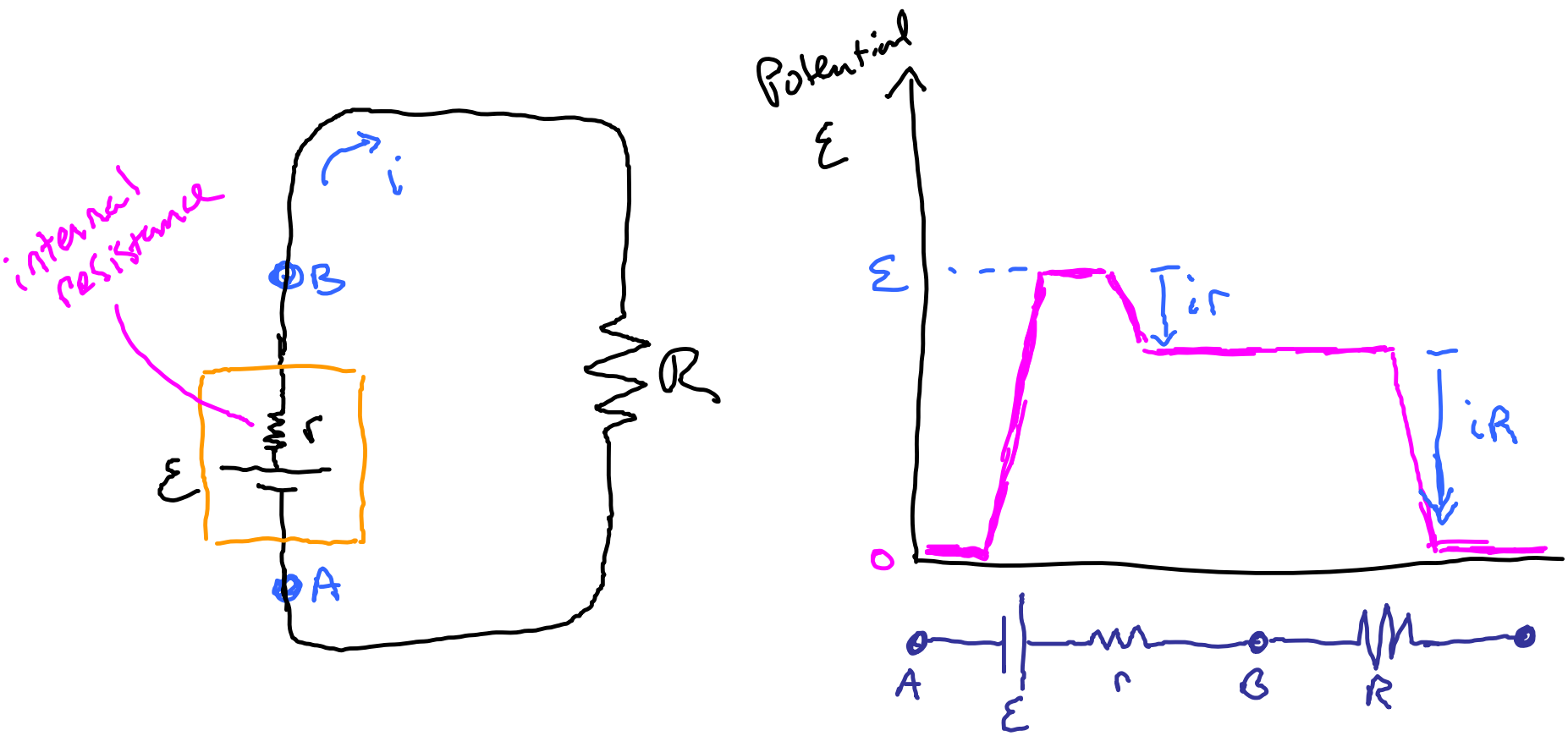


3 lightbulbs Arranged as shown

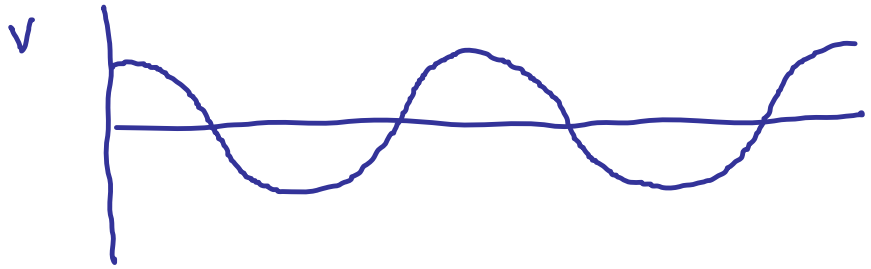
What happens to the brightness of C if bulb A is unscrewed

STAYS The SAME

V unchanged across C


internal resistance
i
B
R
r
ε
A
Potential
ε
ε
ir
iR
0
A
ε
r
B
R

Direct current or DC



Alternating current

AC

Kirchoff's Rules

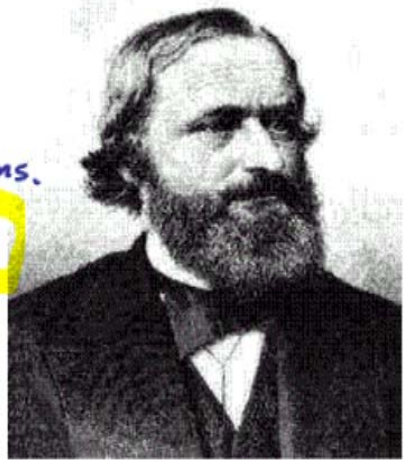
① $\Sigma V = 0$ around closed loop

② $\Sigma i = 0$ at junctions

Gustav Robert Kirchoff
Germany (1824-1887)

Apply to independent loops and junctions.
Derive N independent eqns
can solve for N indep. unknowns.

guts + Conventions + Consistency



determined Kirchoff's Laws at age 21

played for ZZ Top in the early days

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 

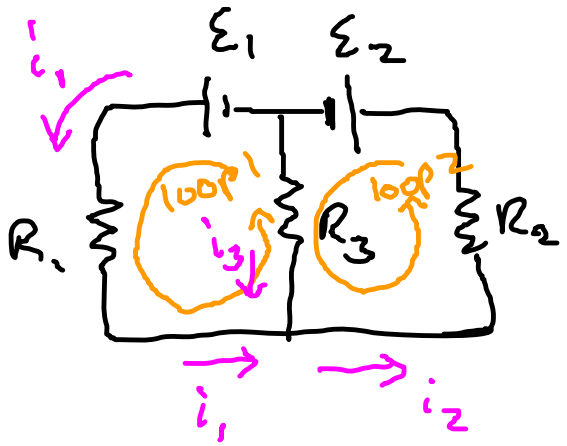
$\mathcal{E} -$ if 

Get N eqns, N unknowns and Solve

Tedious → MUST be careful and Consistent

↳ Conventions and Signs

Use only independent loops



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

R_1, R_2, R_3

Solve for current throughout circuit

Current conservation

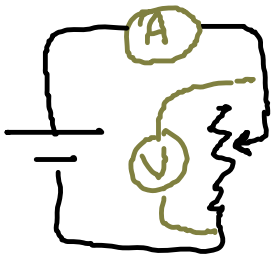
1 indep. equation $\quad i_1 + i_3 = i_2$ (I)

$\Sigma V = 0$

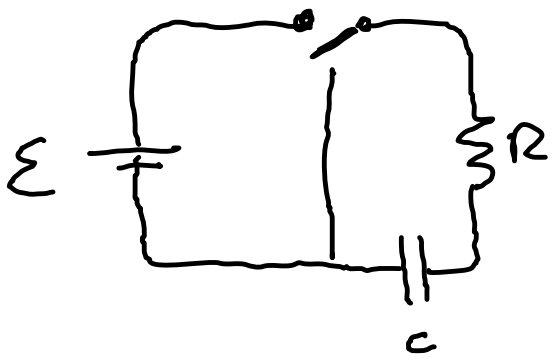
loop 1 $\quad \mathcal{E}_1 - i_1 R_1 + i_3 R_3 = 0$ (II)

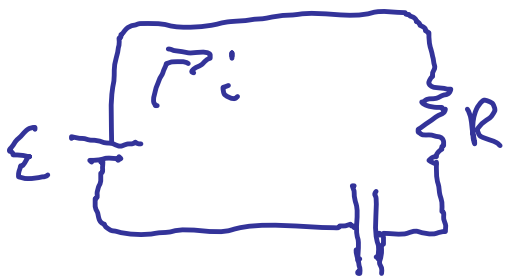
loop 2 $\quad -\mathcal{E}_2 - i_3 R_3 - i_2 R_2 = 0$ (III)

Direct Current



RC circuit





$$\sum \Delta V = 0$$

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

differential Equation

$$\mathcal{E} - \frac{dq}{dt}R - \frac{q}{C} = 0$$

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