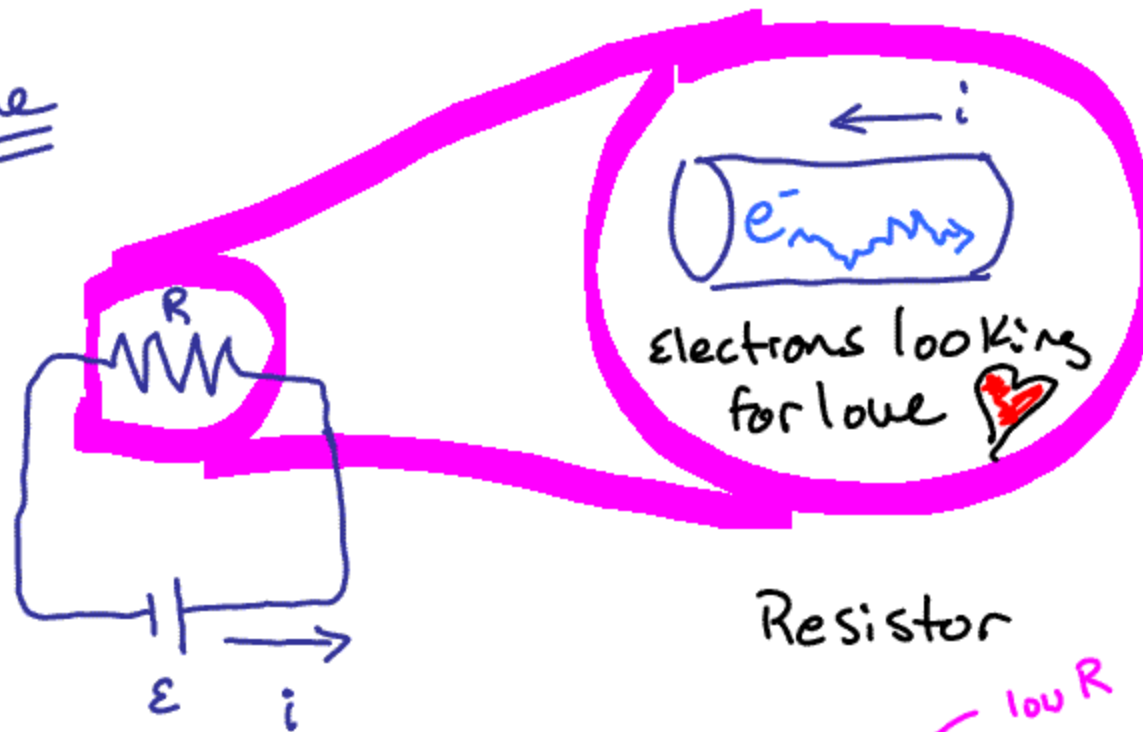


Physics 114 - February 23, 2010

LAST TIME



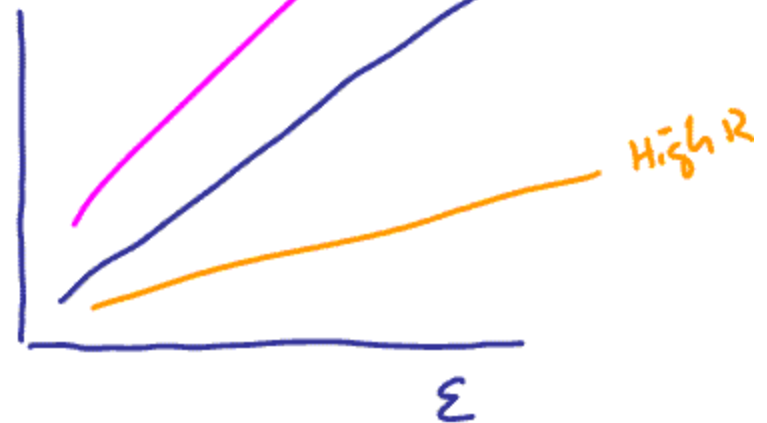
Resistor

RESISTANCE

$$\mathcal{E} = iR$$

$$\begin{pmatrix} \mathcal{E} \\ v \end{pmatrix} = \begin{pmatrix} i \\ I \end{pmatrix} \begin{pmatrix} R \\ r \end{pmatrix}$$

R in
ohms, Ω



Current, i or I , Amperes $\equiv A \equiv \frac{\text{Coul}}{\text{sec}}$

$$I = dq/dt$$

$$V = iR$$

$$P = iV = i^2 R = V^2/R$$



Resistors in Series

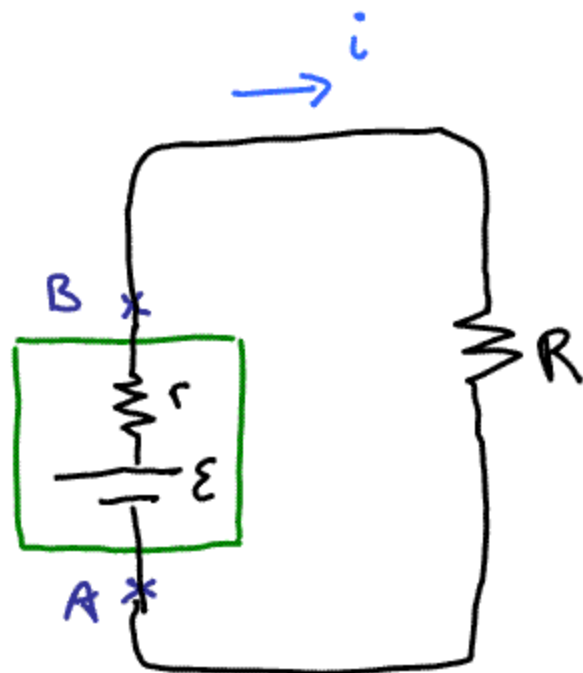
$$R = \sum_i r_i$$



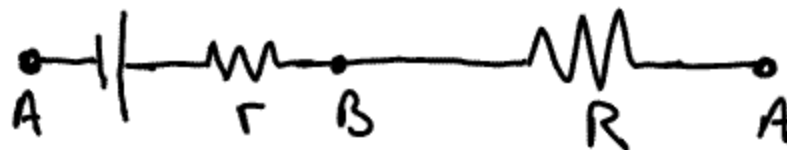
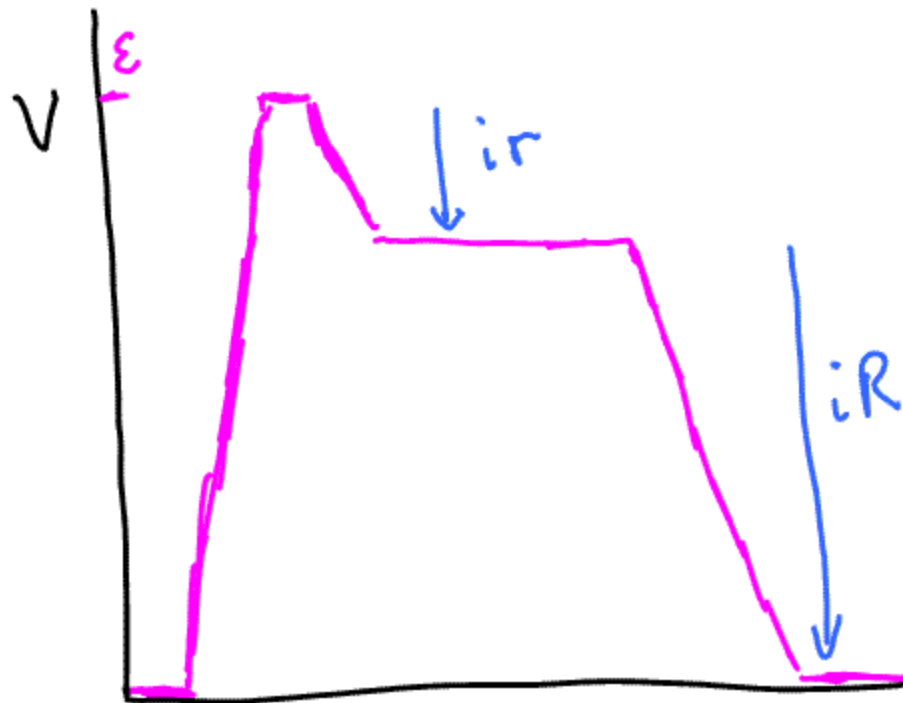
Resistors in parallel

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

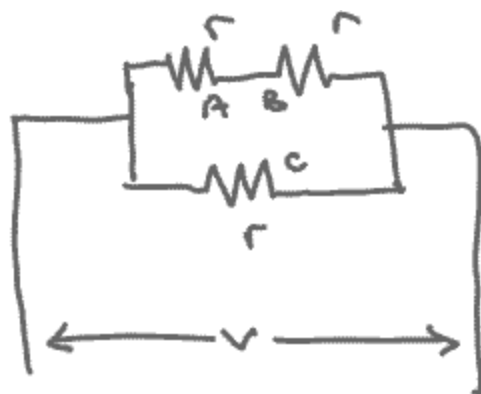
EXAMINE How the potential changes as you move around a closed loop in the circuit.



Assume $r < R$



$$V_A \equiv 0$$



3 lightbulbs Arranged
as shown

order the brightness of the
Bulbs

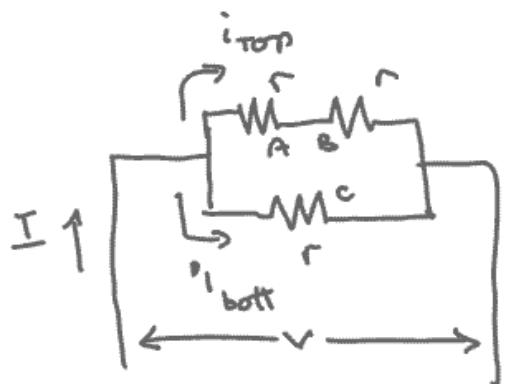
Total R in Top branch is $2r \rightarrow V = iR \rightarrow i = \frac{V}{2r}$

Total R in lower branch is $r \rightarrow V = iR \rightarrow i = \frac{V}{r}$

Power $\equiv$ brightness for bulb $= Vi$

i is the same for A and B $< i$ in C

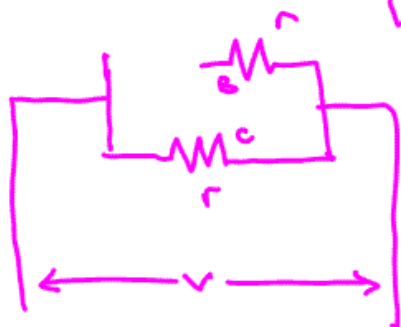
Brightness $C > A = B$



3 lightbulbs Arranged
as shown

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

Becomes



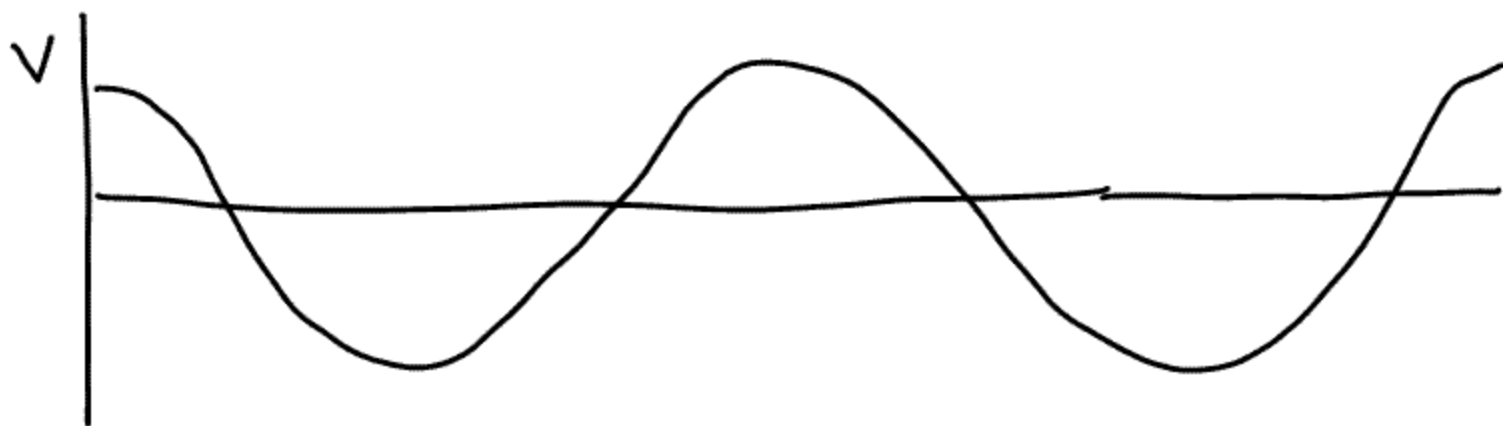
Means that
part of circuit is
broken

V across bulb C is unchanged $\rightarrow$ i through bottom branch
is unchanged
 $\rightarrow$ Brightness of C is unchanged

Current No longer flows thru top branch
Total R in circuit changes, total I changes $\rightarrow I = i_{top} + i_{bottom} \rightarrow I = i_{bottom}$

DC = Direct current

• $\mathcal{E}$ fixed + unchanging



Alternating current AC

AC circuits contain time variation that makes things a bit different. We are doing DC. AC is what to get out of wall. Hire an electrician to wire your home.

Kirchoff's Rules

① $\sum V = 0$ around closed loop

② $\sum i = 0$ at junctions

Apply to independent loops and junctions.

Derive N independent eqns
can solve for N indep. unknowns.

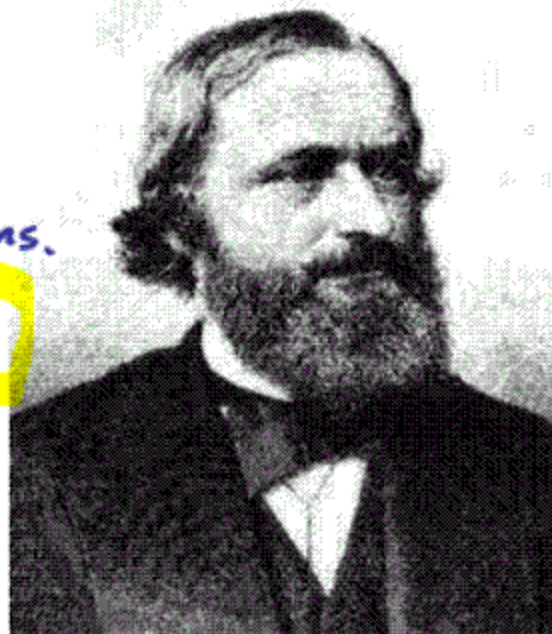
guts + Conventions + Consistency

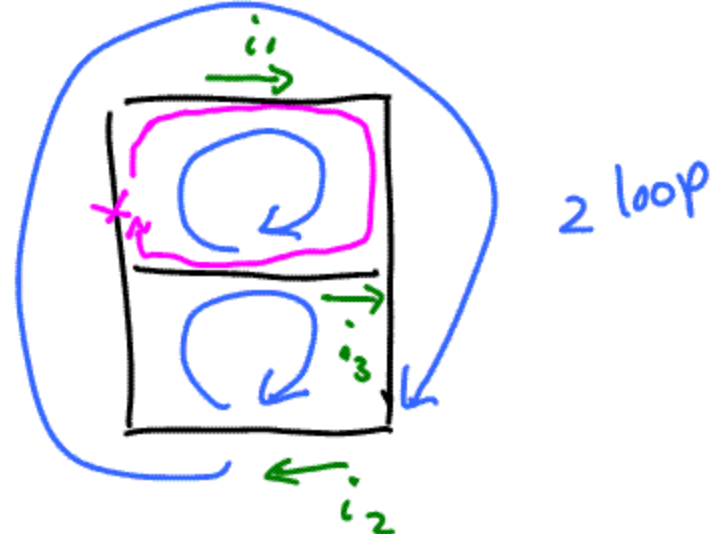
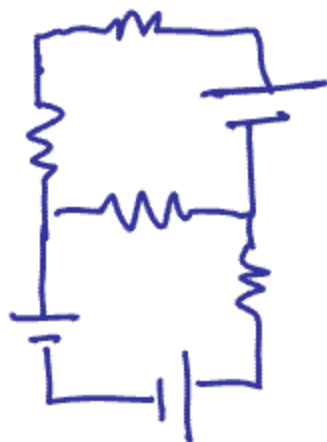
determined Kirchoff's
Laws at age 21

played for ZZ Top
in the early days

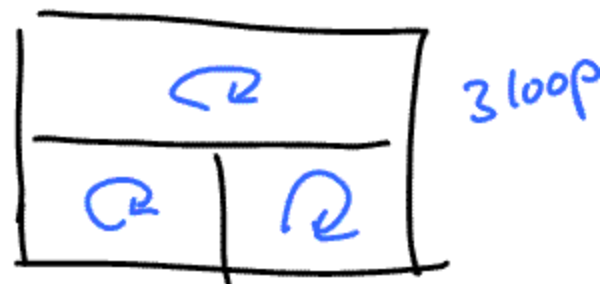


Gustav Robert Kirchoff
Germany (1824-1887)





Sum ΔV as you
go around each
loop



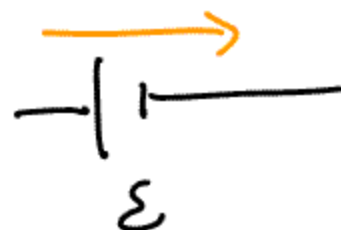
ΔV is - if 

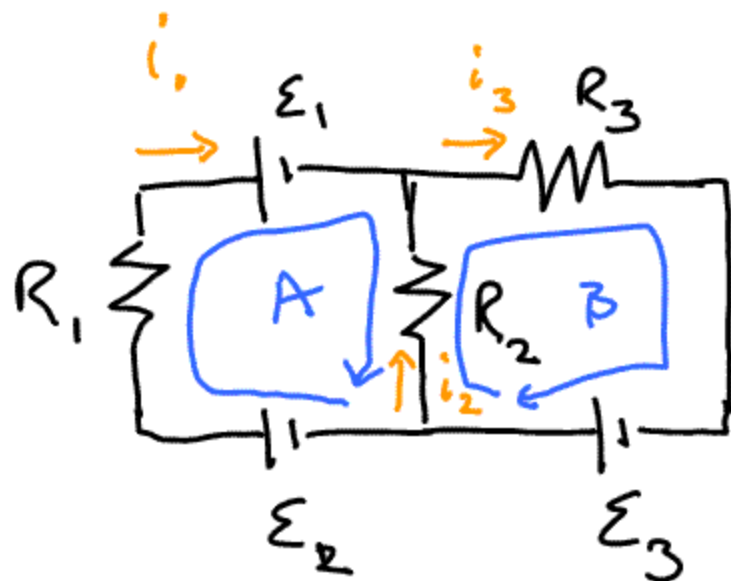
ΔV is + if 

Σ is + if



Σ is - if





$$i_1 + i_2 - i_3 = 0$$

$$i_1 + i_2 = i_3$$

$\sum v = 0$ around each loop

A

$$\mathcal{E}_2 - i_1 R_1 - \mathcal{E}_1 + i_2 R_2 = 0$$

B

$$-i_2 R_2 - i_3 R_3 + \mathcal{E}_3 = 0$$