$$\Delta W = \Delta U = Q\Delta V = CV\Delta V$$

$$E_{\text{stored capacitor}} = \frac{1}{2}CV^2$$

$$E_{\text{stored}} = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{1}{2}\frac{Q^2}{C}$$

$$Q = CV$$

How much energy stored on a 30 μF capacitor with a voltage of 12 V?

$$E = \frac{1}{2}CV^2 = \frac{1}{2}(30\mu F)(12V)^2$$

$$E = \frac{1}{2}(30 \times 10^{-6} F)(12V)^2$$

$$= 2.16 \times 10^{-3} J = 2.16 \text{ mJ}$$

$$E_{energy} = \frac{1}{2} C V^2$$

$$C = \frac{K \varepsilon_0 A}{d} \qquad V = Ed$$

$$\text{Energy} = \frac{1}{2} \frac{K \varepsilon_0 A}{d} E^2 d^2$$

$$= \frac{1}{2} K \varepsilon_0 E^2 A d$$

$$\text{Energy density} = \frac{\text{Energy}}{\text{Vol}} = \frac{1}{2} K \varepsilon_0 E^2$$

Human body is electrical Machine.

Muscles ⇒ Nerves ⇒ electrical

EKG, EEG

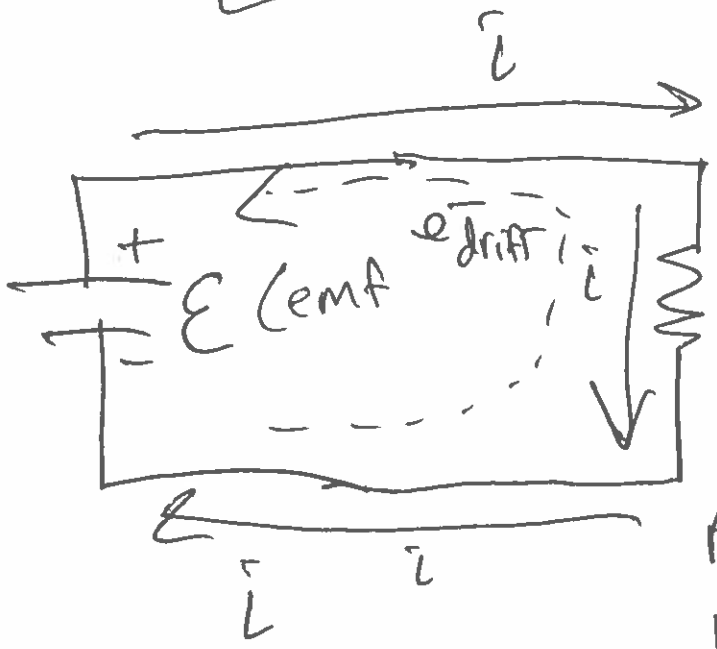
Electromotive Force (EMF)

It is not A force!

EMF is fully electrical potential difference

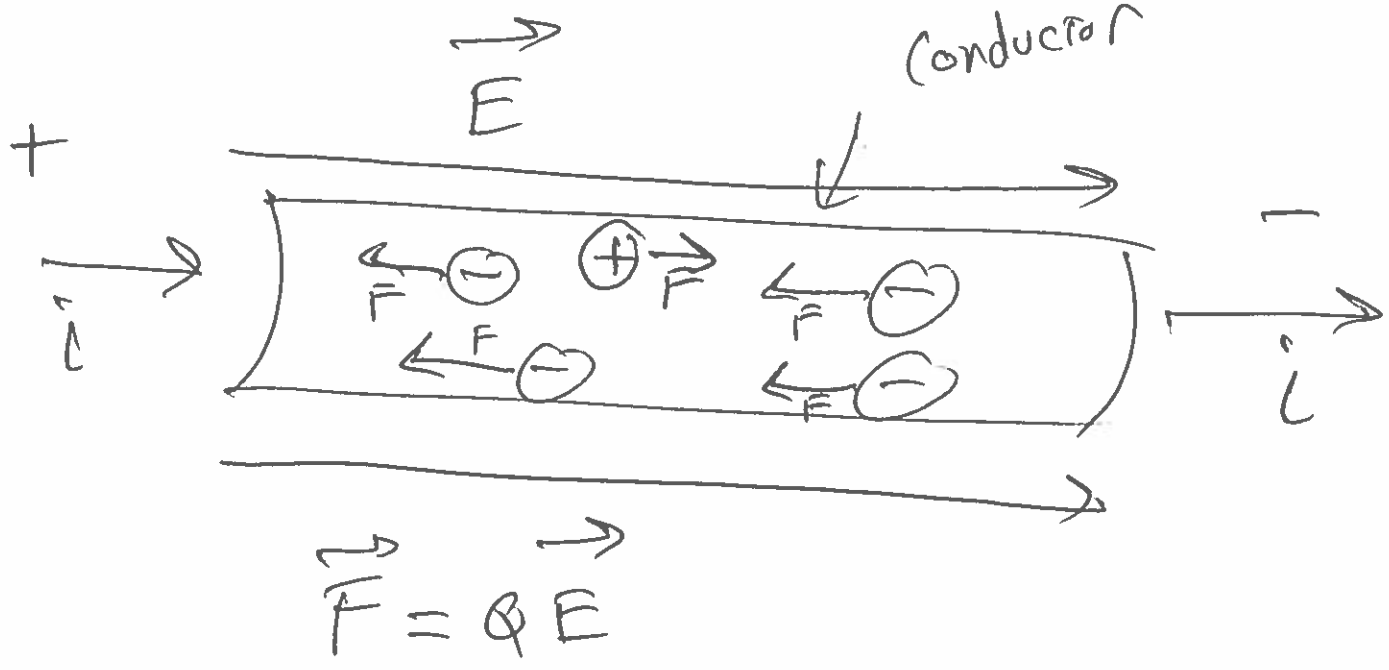
$$EMF \sim \Delta V$$

units ⇒ Volts!



i conventional current

i goes from + high potential to − low potential



$$\vec{F} = q\vec{E}$$

Current is The amount of charge passing a fixed point in a given amount of time

$$I = \frac{Q}{T} = \frac{\Delta Q}{\Delta t} \quad \frac{C}{s}$$

$$1\ A\ (AMP) = 1\ C/s$$

2 Types of current

1) D.C. – Direct current – flows in 1 direction (Batteries)

2) A.C. – Alternating current – flows in 2 directions (Wall Plugs, Generators)

e^- Travel at drift speed which does very with Temperature

$\sim$ cm/s

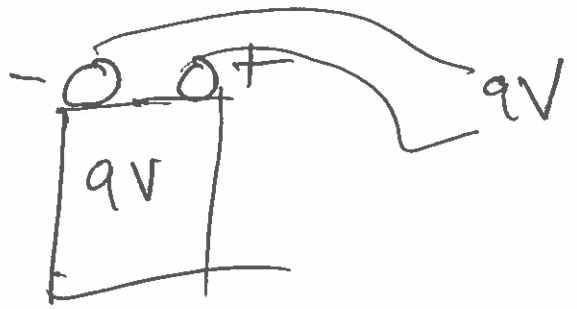
$\vec{E}$ fields Travel speed of light

2.99×10^8 m/s

Voltage or emf is electrical potential energy per charge

$\mathcal{E} \Rightarrow$ Volts $1\ J/C$

Currents Go from + To − potentials.



Tape Deck Draws a current of 0.25A from Batteries Providing +6.0 V emf.

How much charge is used in 1 hour?

$$i = \frac{Q}{t} \qquad Q = it$$

$$Q = (.25A)(1hr)\left(\frac{3600s}{hr}\right) = \boxed{900\ C}$$

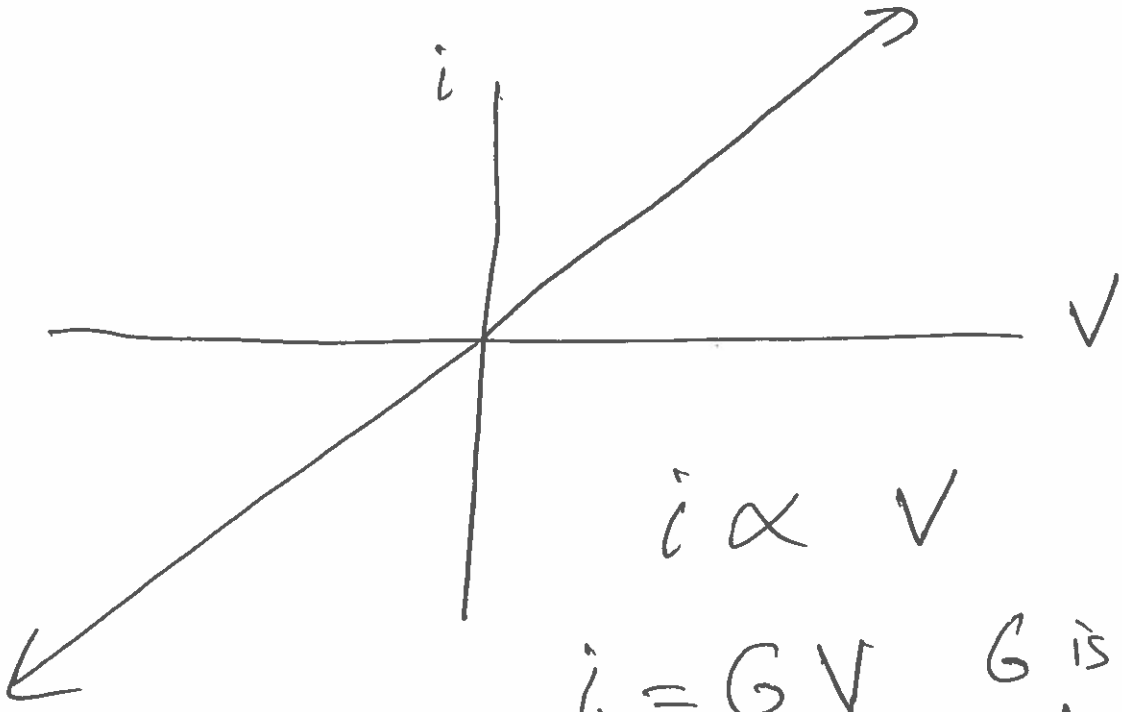
How much energy did battery supply?

$$\text{Energy} = Q\Delta V = (900C)(6V)$$

$$\boxed{\text{Energy} = 5{,}400J}$$

Ohm's Law

Ohm's Law says most materials have a linear relationship between the current created and the potential difference which creates it.



$$i \propto V$$

$$i = GV$$

G is the conductance of a material

Conductance is measure of how easily a current flows in a material.

More common is to use $\frac{1}{G} = R$

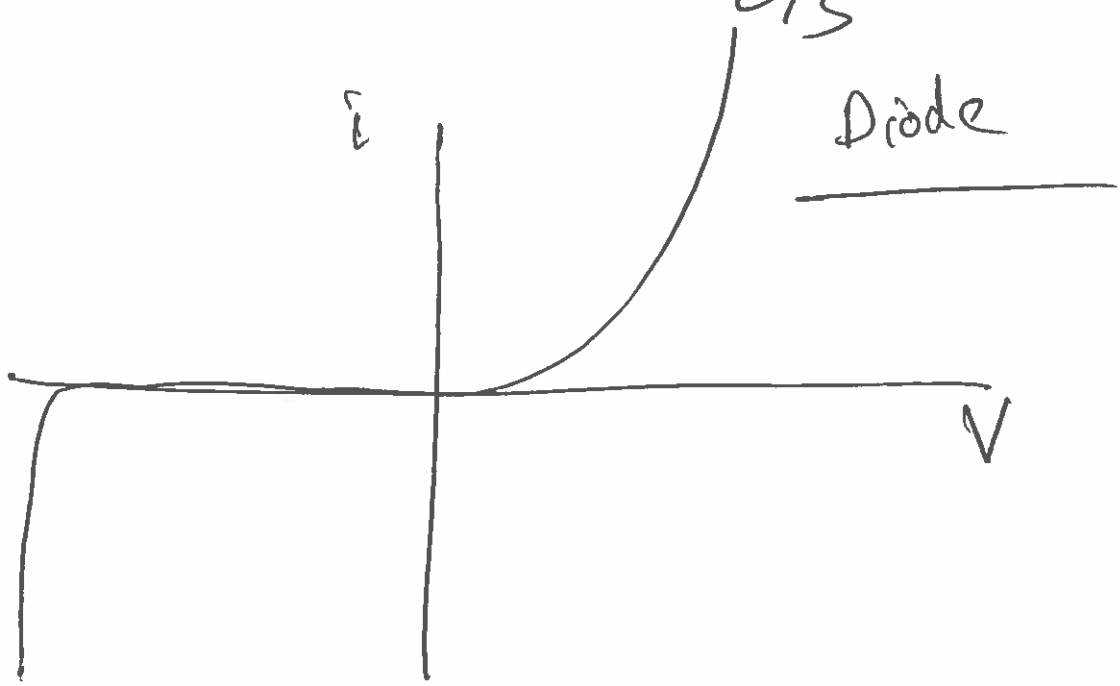
Resistance is the opposition to the flow of current.

Ohm's Law $\Rightarrow$ $i = \frac{1}{R} V$

$$V = iR \quad \text{or} \quad R = \frac{V}{i}$$

Resistance is measured by ohms Ω

$$1\,\Omega = 1\,V/A = 1\,\frac{J/C}{C/s} = 1\,\frac{J s}{C^2}$$



Diode