Electric Current & Resistance

Electric Current - "Flow of Charge" - Quantity of charge that passes a single point in time, not speed

just talk about

- Think of cars on road ↑quantity ↓speed 3a ↑speed quant.

$$I = \frac{\Delta q}{t}$$ I = current t = sec q = Charge Unit $\frac{C}{s}$ or A ampere

Ex. What is the electric current if 240C of charge pass through it in 1 minute

$$I = \frac{\Delta q}{t} = \frac{240C}{60.s} = 4.0\ A$$

Resistance - Opposition to the flow of current

Ex. Charges while traveling in a conductor collide with atoms

$$R = \frac{V}{I}$$ $\frac{\text{Work done}}{\text{Charge}}$ Unit $\frac{V}{A}$ or Ohm Ω

Ex. When a conductor has a potential difference of 110 Volts and a current of 0.50 Amps. What is the resistance

$$R = \frac{V}{I} = \frac{110V}{0.50\ A} = 220\Omega$$

Resistance depends upon several factors:

Length: ↑L → ↑R ↗

Cross Section Area: ↑A → ↓R ↘

↑ Temp → ↑R ↗

Combining these factors you get $R = \frac{\rho L}{A}$

ρ - How much a substance resists carry current

Unit $\Omega \cdot m$ Silver / Copper are of the best conductors

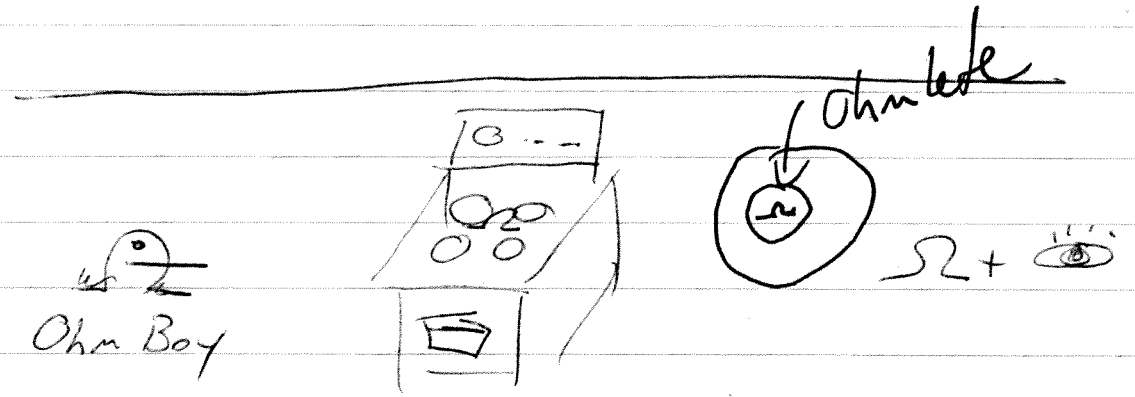
Ex Calculate the resistance at 20°C of an aluminum wire that is 0.200 m long and has a cross-sectional area of $1.00 \times 10^{-3}\ m^2$.

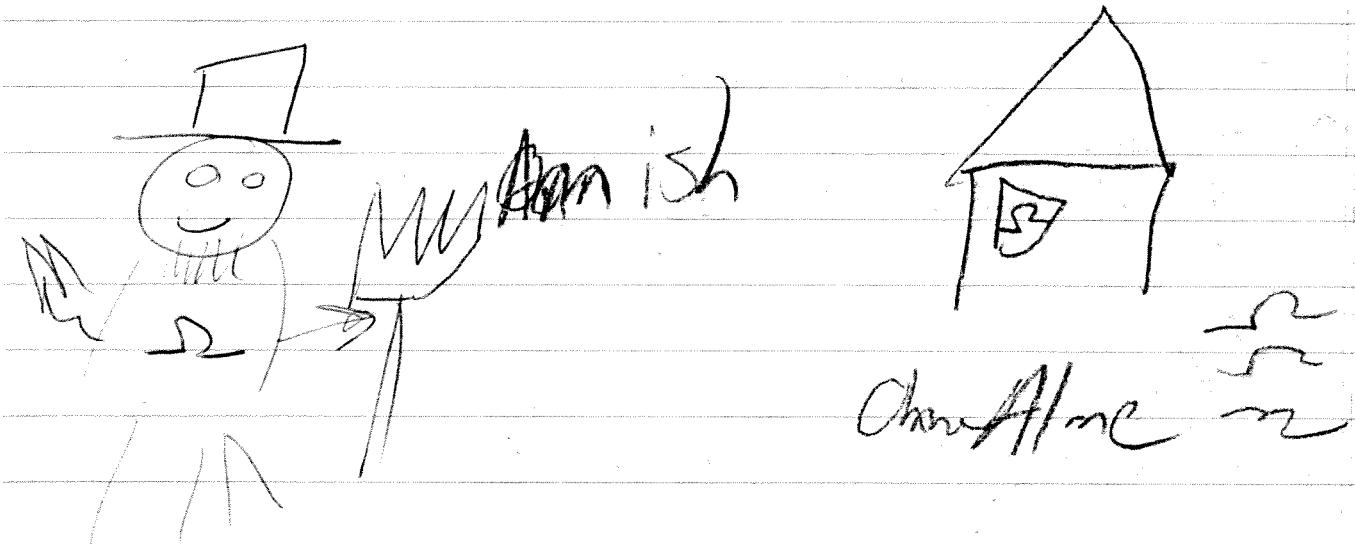
$\rho = 2.82 \times 10^{-8}\ \Omega \cdot m$
$L = 0.200\ m$
$A = 1.00 \times 10^{-3}\ m^2$

$$R = \frac{\rho L}{A} \qquad R = \frac{(2.82 \times 10^{-8}\ \Omega \cdot m)(0.200\ m)}{1.00 \times 10^{-3}\ m^2}$$

$$= 5.64 \times 10^{-6}\ \Omega$$

Super Conductors - lose all resistance when cooled.





Name: Key Date: _____

PHYSICS: Voltage, Work, Intensity, & Excess electrons

Directions: Show all work. Make sure you write out the equation, substitute with units, and leave your final answer in units. GOOD LUCK!!!

1. If 8.0 joules of work is required to transfer 4.0 coulomb of charge between two points, the potential difference between the two points is:

$W = 8.0\,J$
$q = 4.0\,C$
$V = ?$

$V = \frac{W}{q} = \frac{8.0\,J}{4.0\,C} = 2\,V$

2. What force will a proton experience in a uniform electric field whose strength is 2.00×10^5 newtons per coulomb?

$E = 2\times10^5\,N/C$
1 Prot
$1.6\times10^{-19}\,C$

$E = \frac{F}{q}$ $\quad \frac{2\times10^5\,N}{C} = \frac{F}{1.6\times10^{-19}\,C}$ $\quad F = 3.2\times10^{-14}\,N$

3. The number of excess electrons on a sphere that has a charge of -6.4×10^{-17} coulomb is approximately?

$\frac{-6.4\times10^{-17}\,C}{1.6\times10^{-19}\,C} = -400$

4. A point charge experiences a potential difference of 50. volts and work of 10 joules. If the charge has a force of 100 newtons acting upon it, what is the intensity of the electric field?

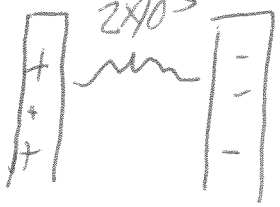
$V = 50\,V$ $\quad W = 10\,J$ $\quad E = ?$ $\quad F = 100\,N$

$E = \frac{F}{q}$ (q used)

$E = \frac{100\,N}{.2\,C} = 500\,N/C$

$V = \frac{W}{q}$ $\quad \frac{50q}{50} = \frac{10\,J}{50}$ $\quad 50\,V = \frac{10\,J}{q}$ $\quad q = .2\,C$

5. If two parallel plates are separates by 2×10^{-3} meters and have a power source of 4×10^3 volts, what is the field intensity?



$V = 4\times10^3\,V$
$d = 2\times10^{-3}\,m$

$V = Ed$
$4\times10^3\,V = E(2\times10^{-3}\,m)$

$E = 2\times10^6\,N/C$

6. If a negatively charged pith ball has a charge of -1.0×10^{-7} coulomb, the number of excess electrons on the pith ball is approximately:

$\frac{-1.0\times10^{-7}\,C}{1.6\times10^{-19}\,C}$ $\quad 6.25\times10^{11}$