Electricity -

Electricity can travel through some materials better than others

GOOD CONDUCTORS:

POOR CONDUCTORS:

Modern materials designed to conduct only under certain conditions.

The ability of a material to conduct electricity (for electrons to flow through the material) depends on the atomic structure.

29 ← Atomic number of copper =

Cu

63.546 ← Atomic weight ( ) + 35 neutrons

29 protons + 29 electrons

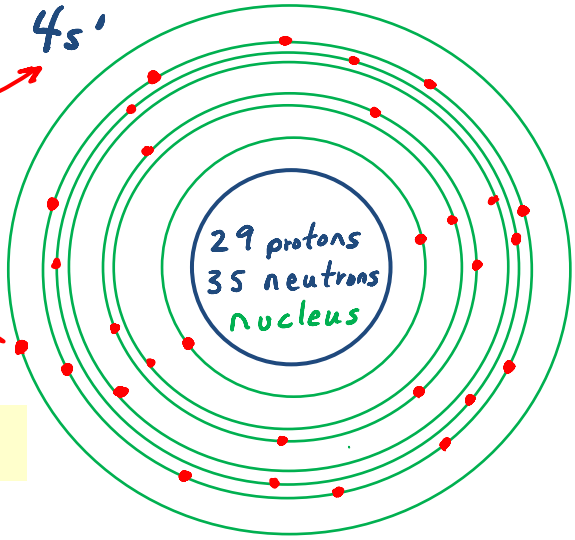
64

protons + avg. # neutrons = atomic wt.

Lightweight electrons whiz about the nucleus
(we think of them as being in shells)

$Cu = 1s^2\ 2s^2 2p^6\ 3s^2 3p^6 3d^{10}\ 4s^1$

electrons in outer shell influence conductivity

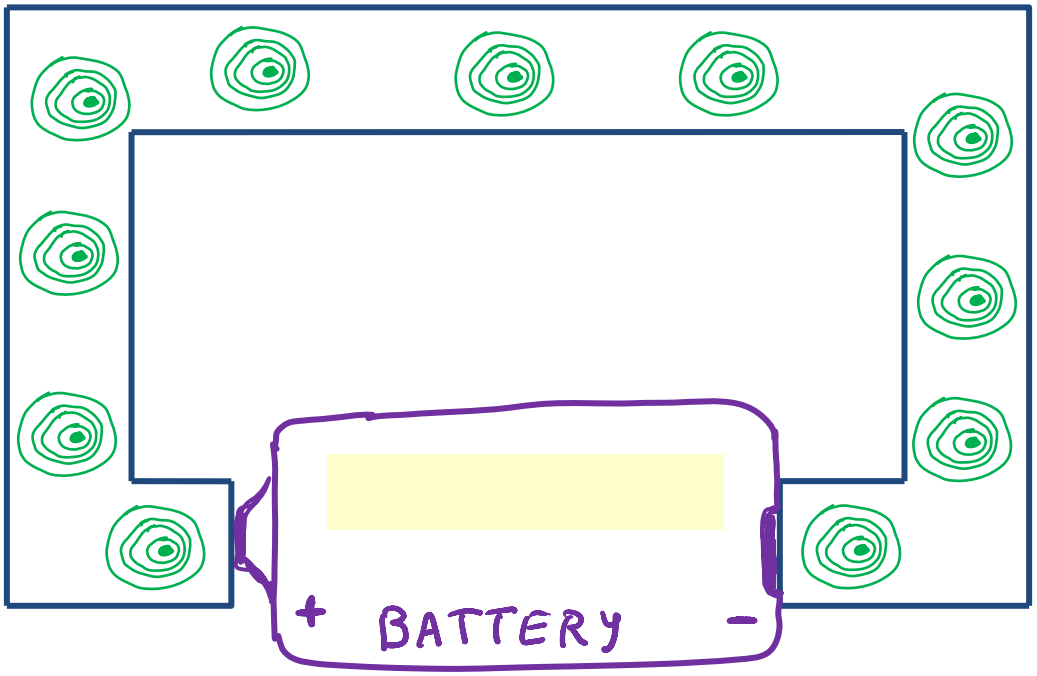


It is EASY for copper to let the $4s^1$ electron go, so copper is a GOOD

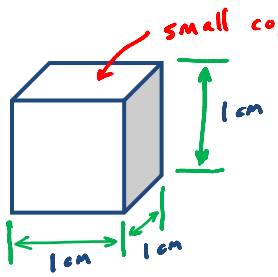
hold onto their electrons more tightly due to their electron configuration.

If you were talking with someone in China on the phone, your voice would cause the diaphram in the microphone to move which would induce electron motion. Would an electron that you just caused to move in the microphone somehow get to China in a fraction of a second? (assuming a telephone line was stretched from here to China)

Flow of electricity through a copper wire:



How many electrons are we talking about?



Atomic wt. of Cu = 63.55 $\frac{g}{mol}$

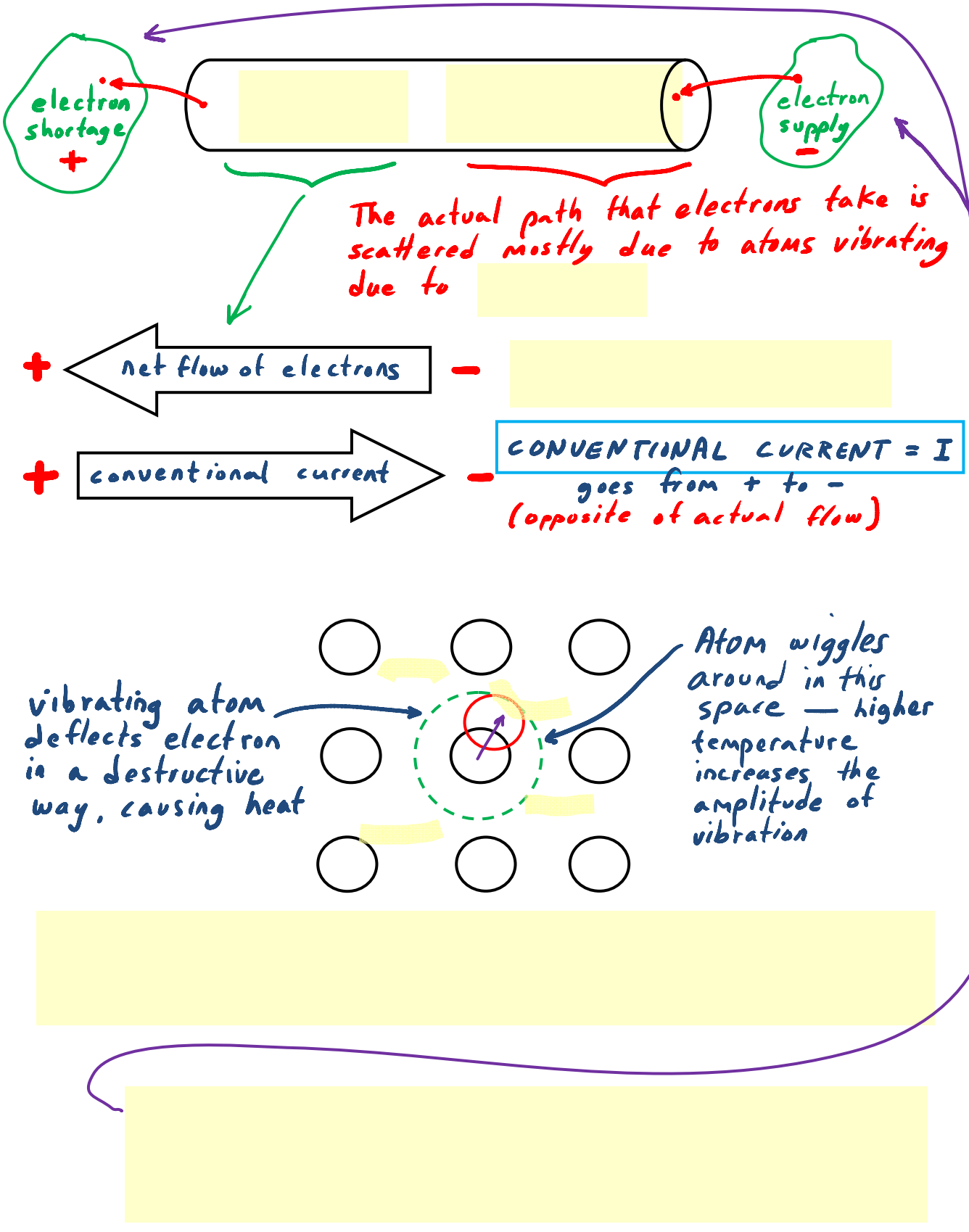
Density of Cu = 8.94 $\frac{g}{cm^3}$

Avogadro's Number = $6.022(10)^{23}$ $\frac{atoms}{mol}$

atoms = # valence electrons for Cu =

valence electrons =

↳ This is more than the number of grains of sand on the entire earth (assuming grains of sand 1mm in diameter, packed at 68% efficiency, 10 cm deep over the earth's 200 million square mile surface)


electron shortage
+
electron supply
−
The actual path that electrons take is scattered mostly due to atoms vibrating due to
+
net flow of electrons
−
+
conventional current
−
CONVENTIONAL CURRENT = I
goes from + to −
(opposite of actual flow)
vibrating atom deflects electron in a destructive way, causing heat
Atom wiggles around in this space — higher temperature increases the amplitude of vibration

DEFINITIONS

Current = I =

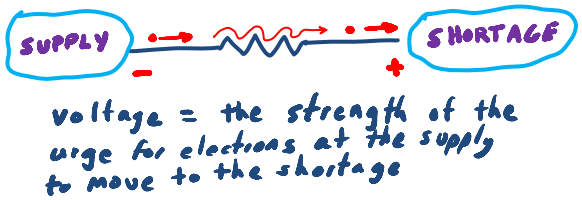
1 Amp = $\frac{6.28(10)^{18} \text{ electrons passing a point}}{\text{per second}}$ = 1 $\frac{\text{coulomb}}{\text{s}}$

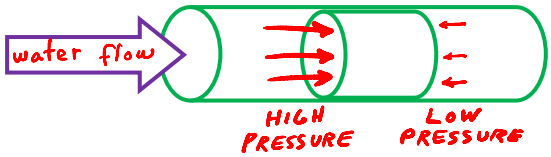
1 C = $6.28(10)^{18}$ electrons

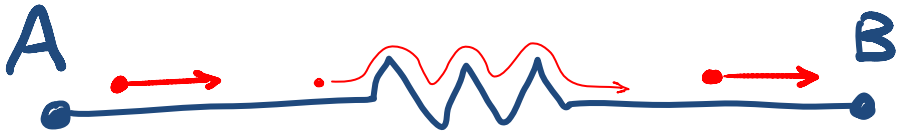
teams of 2

CLASS PROBLEM: A battery powers a flashlight. If the battery supplies a steady current of 1.3 A over 8 minutes, how many electrons leave the negative terminal of the battery during this time period?

Analogy between electric voltage and water pressure







If the voltage between A and B is one volt, then one Joule of work will be done when 6.28 $(10)^{18}$ electrons moves from A to B

Resistance = R

R = ohms or Ω

Ohm's Law

CLASS PROBLEM: A 1.5 volt AA battery is wired to a light bulb that has a resistance of 30 Ω.

(a) Draw the circuit

(b) Find the current

teams of 2