Intro to Statics

Electrostatics

- <u>Electrostatics</u> = electricity at rest
- Electrostatics involves electric charges, the forces between them, and their behavior in materials
- Reminder:
 - Protons (+)
 - Electrons (-)
 - Neutrons (no charge)



- The fundamental rule at the base of all electrical phenomena is that *like charges repel and opposite charges attract*
- An object that has unequal numbers of electrons and protons is **electrically charged or has a net charge**.



Increasing Conducting Ability

Conductors and Insulators



- Materials through which electric charge can flow are called <u>conductors</u>
 - Metals are good conductors because they allow for the free movement of electrons.
 - Conductors CANNOT be easily charged by friction as the extra electrons gained can easily escape.
- In *insulators*, electrons are tightly bound and remain with a particular atom (they are not free to wander about)
 - Rubber and glass are good insulators and poor conductors of electricity.
 - Insulators can be easily charged by friction as the extra electrons gained CANNOT easily escape.

Charging by Friction

- Electrons can be transferred by **friction**.
- Rubbing materials does NOT create electric charges. It just transfers electrons from one material to the other.

• Examples:

- We stroke a cat's fur and hear the crackle of sparks that are produced.
- Comb our hair in front of a mirror in a dark room and see as well as hear the sparks of electricity.
- Scuff our shoes across a rug and feel the tingle as we reach for the doorknob.

Where do charges come from?

When a balloon rubs a piece of wool...



electrons are pulled from the wool to the balloon.

The balloon has more electrons than usual.

The balloon: – charged, The wool: +charged

Charging by Induction

- <u>Induction</u> charging of an object *without* direct contact
 - If a charged object is brought near a conducting surface, even without physical contact, electrons will move in the conducting surface



Attraction of uncharged objects

Similarly, when charged rod is close to paper scrap...



molecules of paper align.

 \Rightarrow attraction between the rod and + charge > repulsion between the rod and - charge.

How does a positively charged rod attract a neutral object?

When a + charged rod is put near neutral object,

is induced on the side of the object near

the rod and ______ is induced on the side away

from the rod. The rod can attract the netural object because

between rod and – induced charge > the

between rod and + induced charge.

Grounding

- When we allow charges to move off (or onto) a conductor by touching it, it is common to say that we are **grounding it**.
 - If a charged conductor is grounded, it will become neutral.



When we touch a metal ball of positive charge...electrons flow from the earth to the metal ball to neutralize the metal ball.

Metal ball becomes neutral.

Why do gasoline tankers usually have metal chains at the back?

When cars run, their tires and bodies are usually charged by ______. For gasoline tankers, if the accumulated charge is large enough, ______ can be produced and ______ will occur if gasoline vapor is ignited. Those metal chains conduct the charge on the bodies of tankers to the and avoid the danger.