Exploring Static Charges

Section 10.1

Demonstration

1a. Place the ebonite rod in the paper punch dots... What happens?

Nothing

b. Charge the ebonite rod with fur. Now what happens?

The paper dots stick to the rod

2a. Blow up the balloon. Charge it, and bring the charged spot near the paper dots. What happens?

The dots stick to the balloon

b. Try a spot that you didn't charge. What happens now?

The dots don't stick

c. Stick the balloon to the wall, by its charged s
What happens after time passes?

wait and see...

Static Electricity

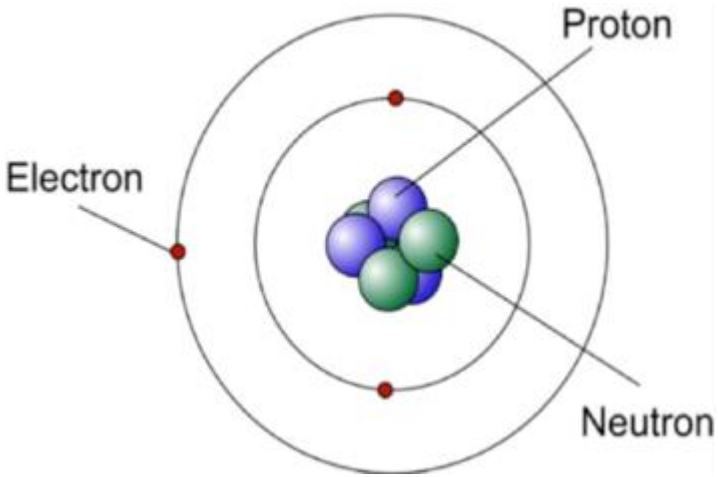
"**Stationary**", or "not moving"

A form of energy that results from the interaction of charged particles, such as **electrons** or **protons**.

static electricity

A charge that builds up on the surface of an object, instead of moving away quickly

Charging by Friction



5a. Which particles are **difficult** to add or remove from an atom? Why?

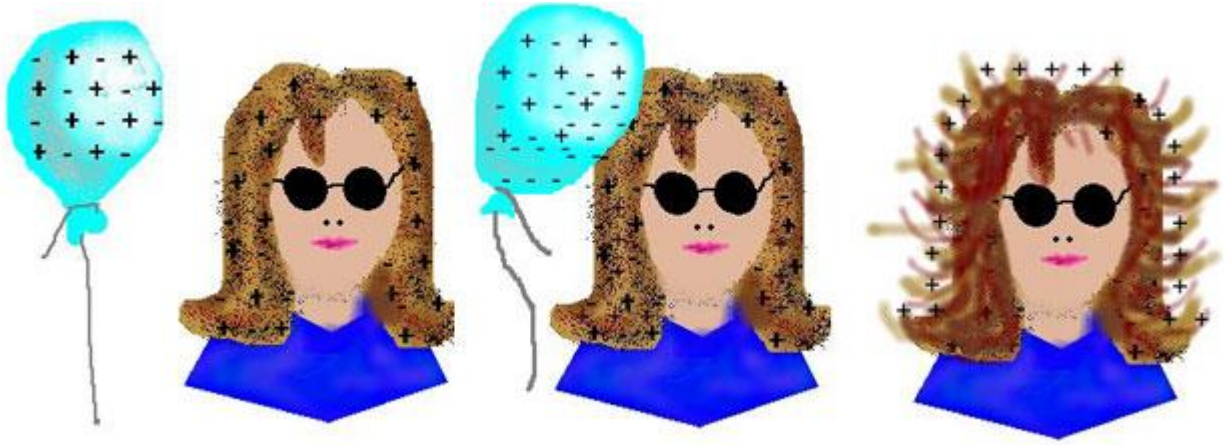
protons and neutrons. They are in the nucleus

5b. Which particles are **easy** to add or remove from an atom? Why?

electrons. They are located outside the nucleus

Charging by **friction** occurs when two objects are **rubbed** against each other.

6. When an object becomes charged by **friction**, the electrons from one object are transferred to the other.



Balloon and hair are neutral.

Electrons are transferred from hair to balloon.

Hair is positively charged.

7. What charge does an object have, if:
   a. It has an equal number of protons and electrons

      neutral

   b. It has more electrons than protons

      negative

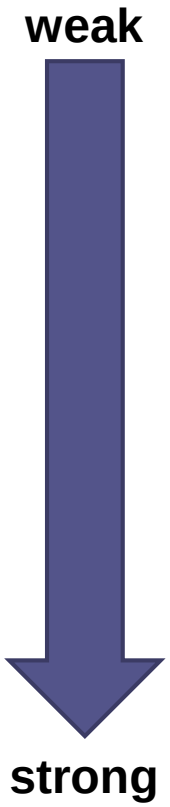
   c. It has less electrons than protons

      positive

Electrostatic Series

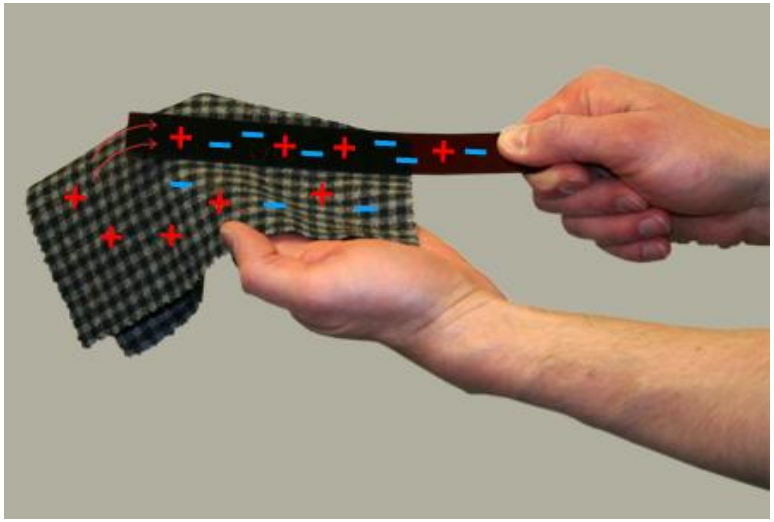
- An electrostatic series is a list of materials that have been arranged in order of their **ability to hold on to electrons**.

Glass
Human Hair
Nylon, Wool
Fur
Silk
Cotton
Lucite(a clear plastic)
Rubber Balloon
Polyester
Foam
Grocery Bag (low density polyethelene)
Ebonite (a hard form of rubber)

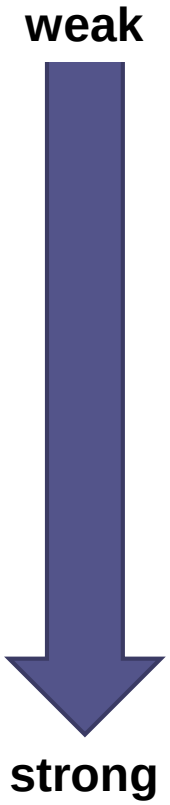


8. What type of experiment could you perform to arrange these objects in order?

Rub objects against each other, and see which charge (positive or negative) the objects have afterwards.



Glass
Human Hair
Nylon, Wool
Fur
Silk
Cotton
Lucite(a clear plastic)
Rubber Balloon
Polyester
Foam
Grocery Bag (low density polyethelene)
Ebonite (a hard form of rubber)



Practice using the series:

9. When you comb your hair with plastic comb, which object - the hair or the comb - holds on to its electrons more tightly?

   plastic comb

   What is the resulting charge on this object?

10. If leather is rubbed with polyester, the polyester becomes negatively charged. Would you place leather **above** or **below** polyester in an electrostatic series?

    Above

11. In the winter, removing a wool hat can give you hair a static charge. Use the series to predict the charge on your hair.

    Positive

Insulators and Conductors

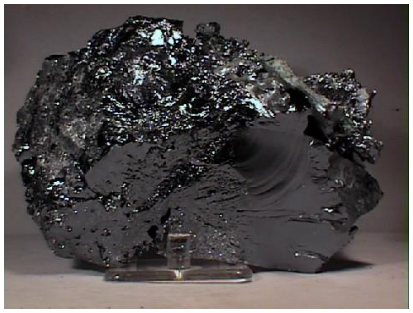
- **Conductor** – A material in which electrons **<u>can</u>** move easily from one atom to another.

Metals, like copper

- **Insulator** – A material in which electrons **<u>cannot</u>** move easily from one atom to another.

Non-metals, like wood

- **Semi-conductor** – A material in which electrons can move **<u>fairly easily</u>** between atoms.



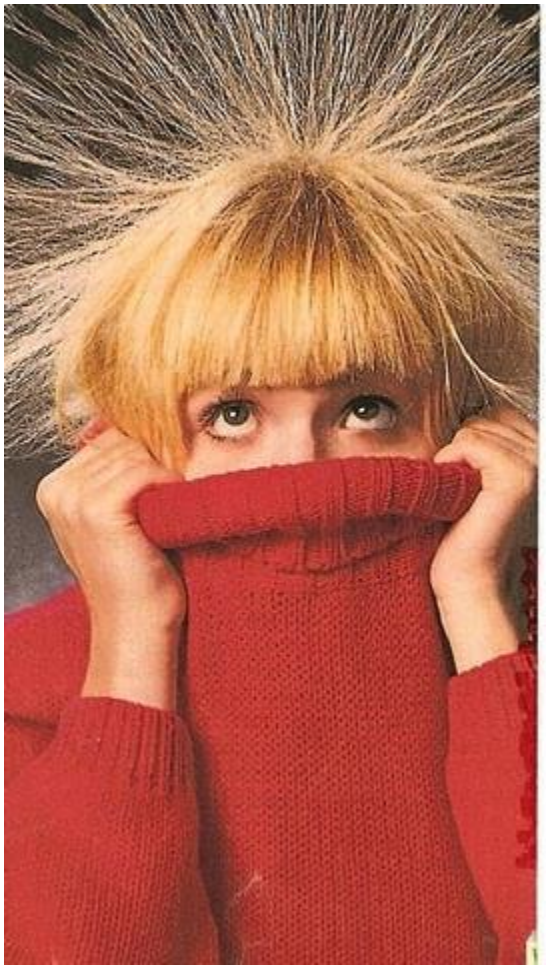
Metalloids, like silicon

What about air?

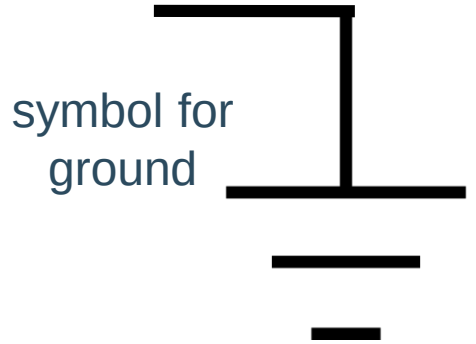
- **Dry air** is a good insulator, and a poor conductor.

- **Humid air** is a fairly good conductor.

This is why static charge builds up more in the winter-time, when it is not humid!

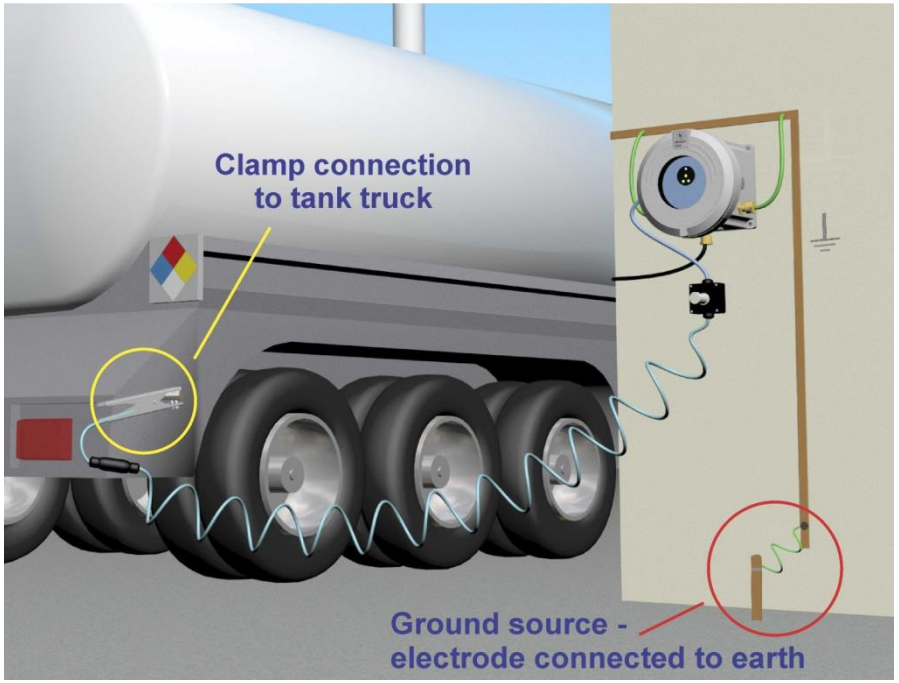


Electrical Grounding



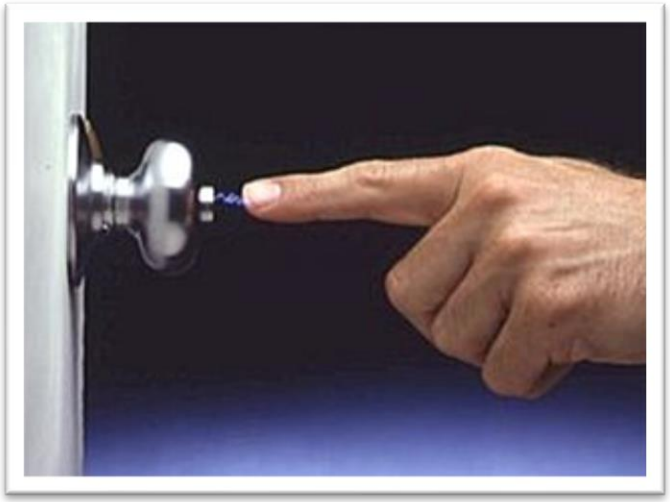
- **Ground**: An object that can supply a very **large** number of **electrons** to, or can remove a very large number of **electrons** from a charged object.

- By supplying or removing electrons, it makes the charged object **neutral.**



Electric discharge

- When two objects with very large amounts of opposite static charge are brought close together, the electrons from the negative object can actually "jump" through the air towards the positive object.



Check back on the balloon

- Is it still stuck to the wall?
  - If **no**, why not? What happened to the charge?
  - If **yes**, do you think the balloon can stay there forever?

Homework

- Read 10.1
- Worksheet
- p. 410 #2, 4, 6, 7, 8