

Welcome to the exciting world of Electricity!

- ▶ In this unit we will explore:
 - ▶ static and current electricity
 - ▶ circuits, how to build and design them
 - ▶ the cost/benefit of our own electrical usage and the impact this has on our lives

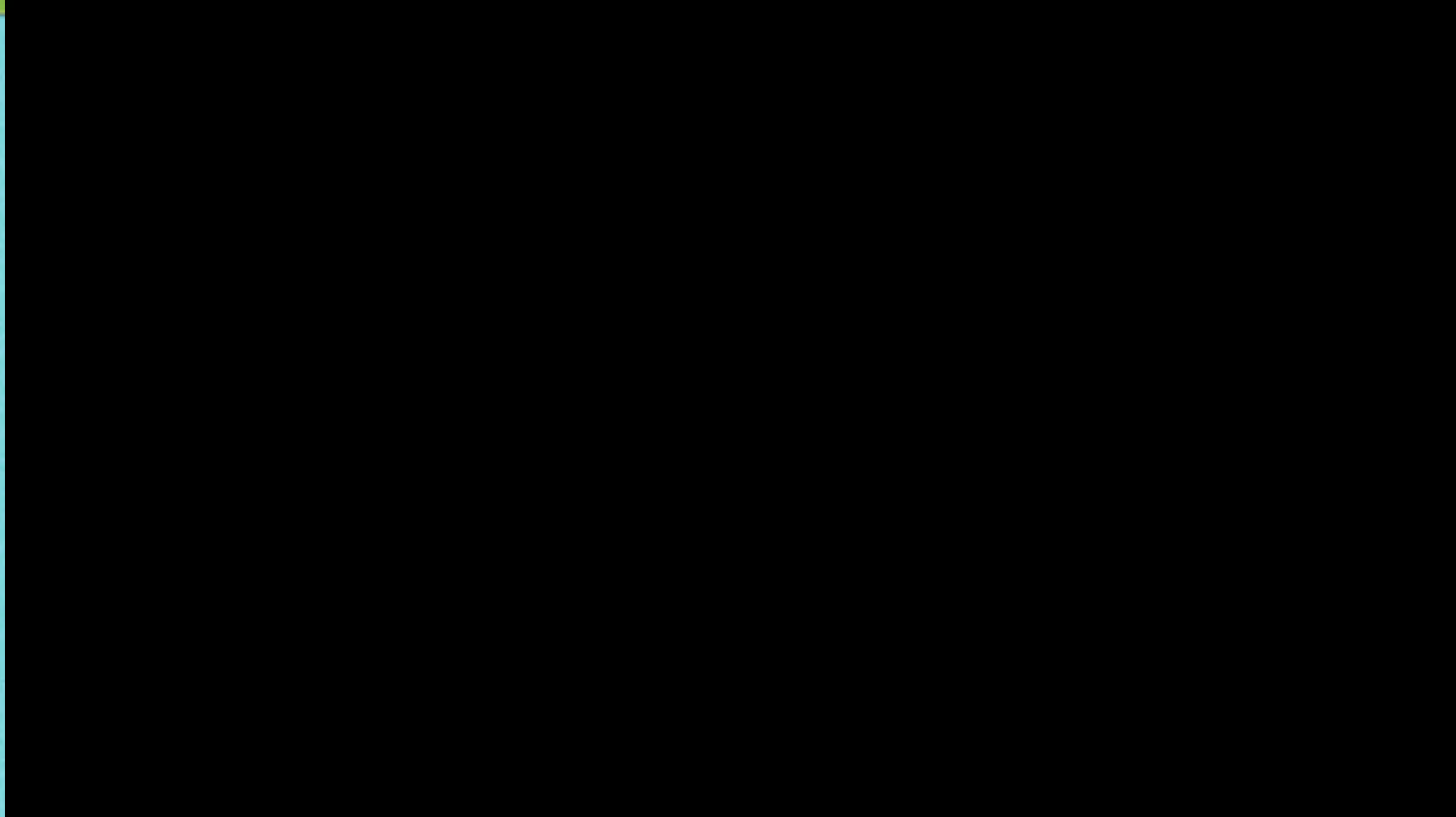
Have you ever?

- ▶ Have you ever been shocked by someone touching you?
- ▶ Have you ever taken your hat off and your hair is sticking straight up?
- ▶ Have you ever seen lightening?
- ▶ Have you ever reached for a doorknob AND ZAP?
- ▶ Have you ever rubbed a balloon on your head, and your hair went BOING?

Then you have experienced Electricity!



Electricity



How is it created?

Where does it come from?

Electricity

- ▶ There are two types of electricity; **static** and **current**
- ▶ Static electricity is the build up of electric charge on the surface of an object
- ▶ Current electricity is electric charge that moves from a source of electrical energy along a controlled path in an electric circuit

ATOMS

- ▶ Everything is made up of atoms
- ▶ Basic unit of matter
- ▶ Atoms cannot be divided further.....

Parts of an Atom

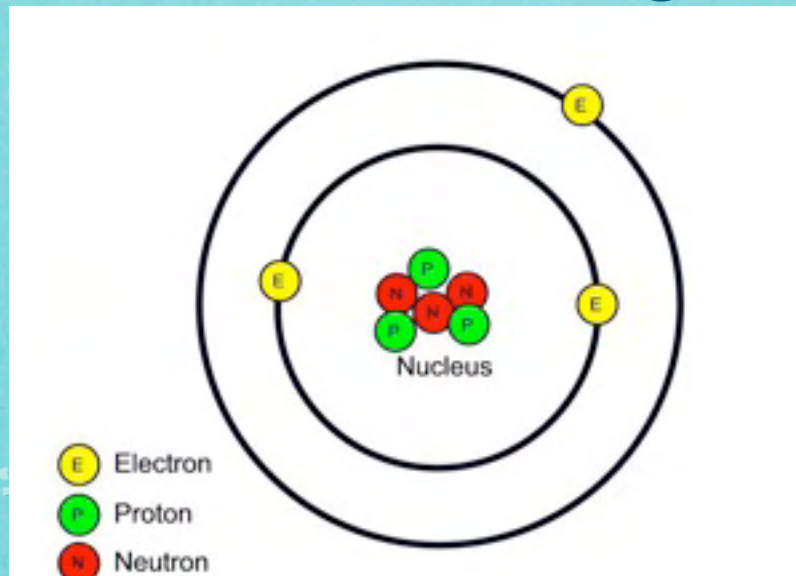
- ▶ In the middle of each atom is a **nucleus**
- ▶ There are two kinds of tiny particles in the nucleus; **protons** and **neutrons**
- ▶ Orbiting around the nucleus are electrons

Electrical Charges

- ▶ Protons → carry a positive charge
- ▶ Neutrons → carry no charge and are said to be neutral
- ▶ Electrons → carry a negative charge
- ▶ Note: one proton's charge is equal in strength to the charge of one electron. Their charges are exactly opposite.

Neutral Objects

- ▶ All objects start out as neutral
- ▶ Atoms
 - # of protons = # of electrons
 - the atom has no overall charge, it is neutral



Electrons

- ▶ Are the only part of the atom that can move, they are light weight and always in motion.
- ▶ The protons and neutrons in the nucleus are heavy weight and DO NOT go anywhere!

Static Electricity

- ▶ Static means “not moving”
- ▶ Static electricity is the build up of electrical charge
- ▶ Electrical Charge: a positive or negative quantity of electricity that builds up on an object
- . Static electricity is the imbalance of positive and negative charges

Charged objects

- ▶ Some electrons are held very loosely to the atom and therefore they can move from one atom to another
- ▶ If an atom loses electrons, it has more positive charges (protons) than negative charges (electrons). Therefore the atom is positively charged.
- ▶ If an atom gains electrons, it has more negative charges (electrons) than positive charges (protons). Therefore the atom is negatively charged.

A victim of Static!



Two atoms are walking down the street one day, and one of them says to the other:

"Hey, wait up a second. I think I lost an electron"

The first atom replied, "Are you sure?"

The second atom exclaimed, "Yes, I'm positive!"

A neutron goes into a bar and asks the bartender, "How much for a beer"?

The bartender replies, "For you, no charge".

Fun with Friction Lab

Let's explore static electricity! Here are your tasks:

- 1) Make a balloon stick to the wall
- 2) Make one balloon attract another balloon
- 3) Make one balloon repel another balloon

Explain how you did it!

Laws of Electric Charges

- ▶ Opposites attract
- ▶ Like objects repel
- ▶ Neutral objects attract charged objects (negatively or positively charged)

Ways of Charging Objects

1. Charge by friction
2. Charge by contact
3. Charge by Induction

Charging by Friction

- ▶ By rubbing two objects together you can transfer electrons from one object to the other

Note:

→ Electrostatic charges are not “caused” by friction

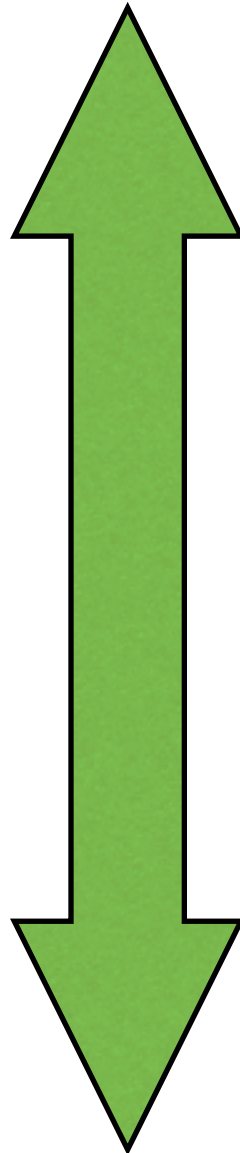
- ▶ When rubbing two objects and transferring electrons, how do you know which object will gain electrons and which one lose electrons?????

Electrostatic Series

- ▶ Determine the kind of electric charge that is produced on each substance when two substances are rubbed together
- ▶ When friction occurs, substances higher on the list **ALWAYS** lose electrons to become positive and substances lower on the list **ALWAYS** gain electrons to become negative

Electrostatic Series

- Dry air
- Rabbit fur
- Glass
- Wool
- Silk
- Aluminum
- Cotton
- Lucite
- Ebonite
- Balloon
- Plastic
- Grocery bags
- Vinyl
- Teflon



**Weak hold on
Electrons**

+++++

**Strong Hold
on Electrons**

Electrostatic Series

- ▶ The relative position of two substances on the electrostatic series tells you how they will act when brought into contact
- ▶ The farther the separation in the table, the greater the effect

Electrostatic Series

- ▶ When rubbing a balloon with a piece of fur, which object becomes negatively charged and which one becomes positively charged?
- ▶ What about a balloon and fur are rubbed together?
- ▶ What about Ebonite and cotton?

Friction Around You

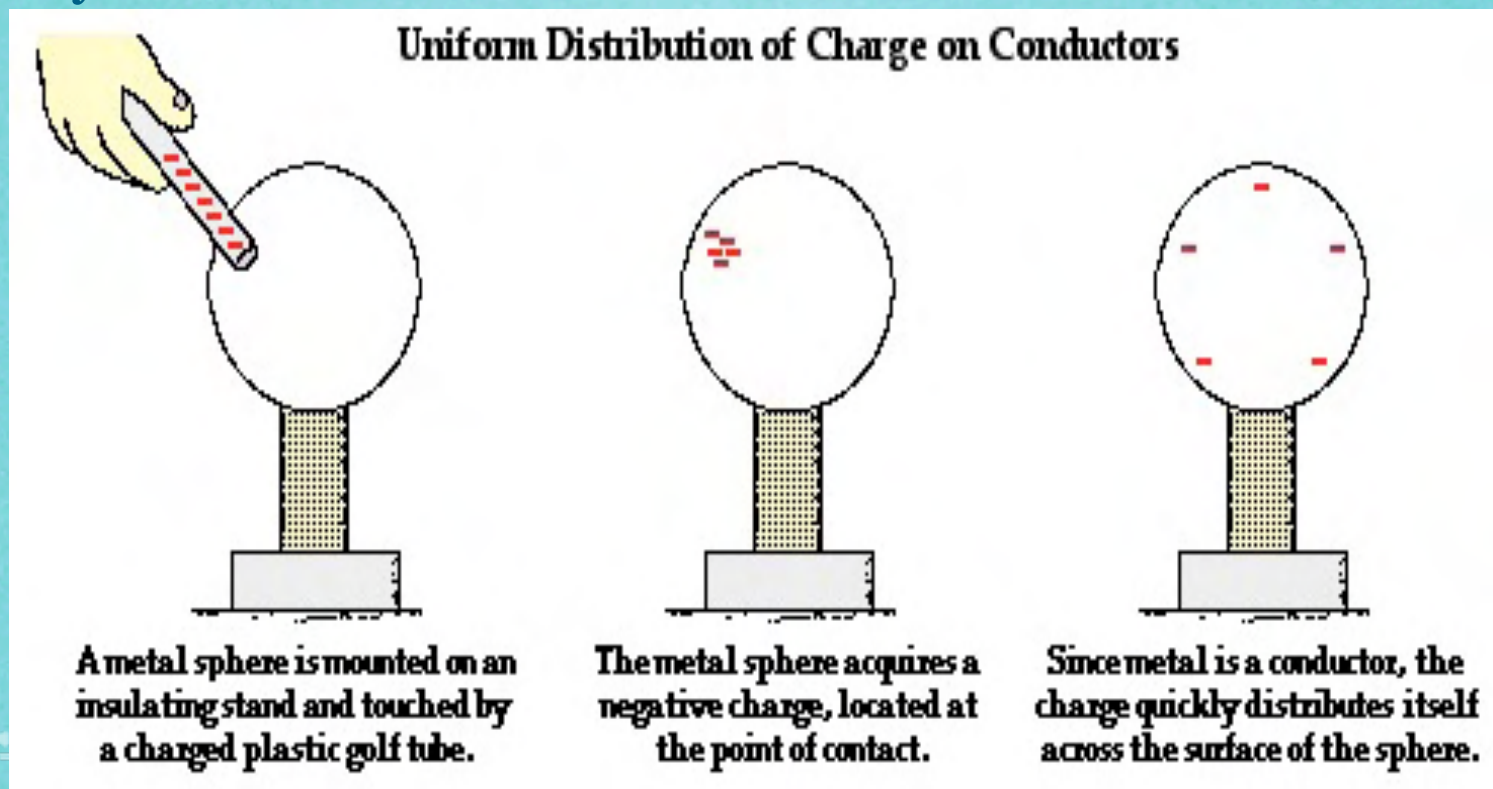
- ▶ Plastic food wrap
- ▶ Static clothes, static hair
- ▶ Dragging your feet across the carpet
- ▶ Gasoline rushing out a hose
- ▶ Air rushing over your car

Homework!

- ▶ Complete p. 3 in your workbook

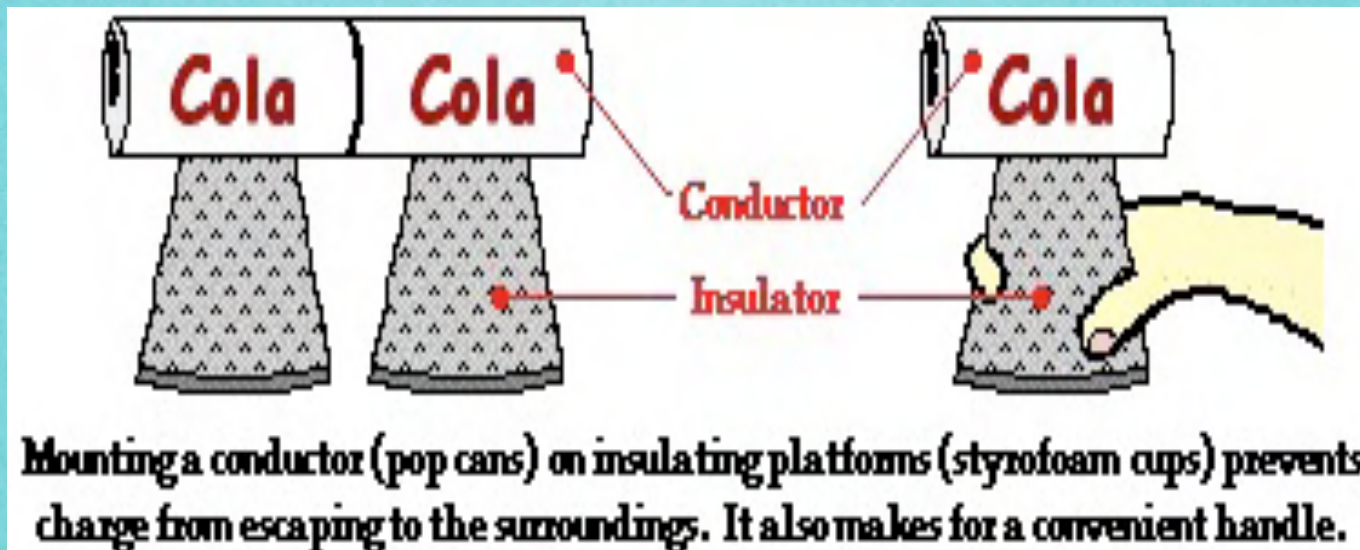
Conductors

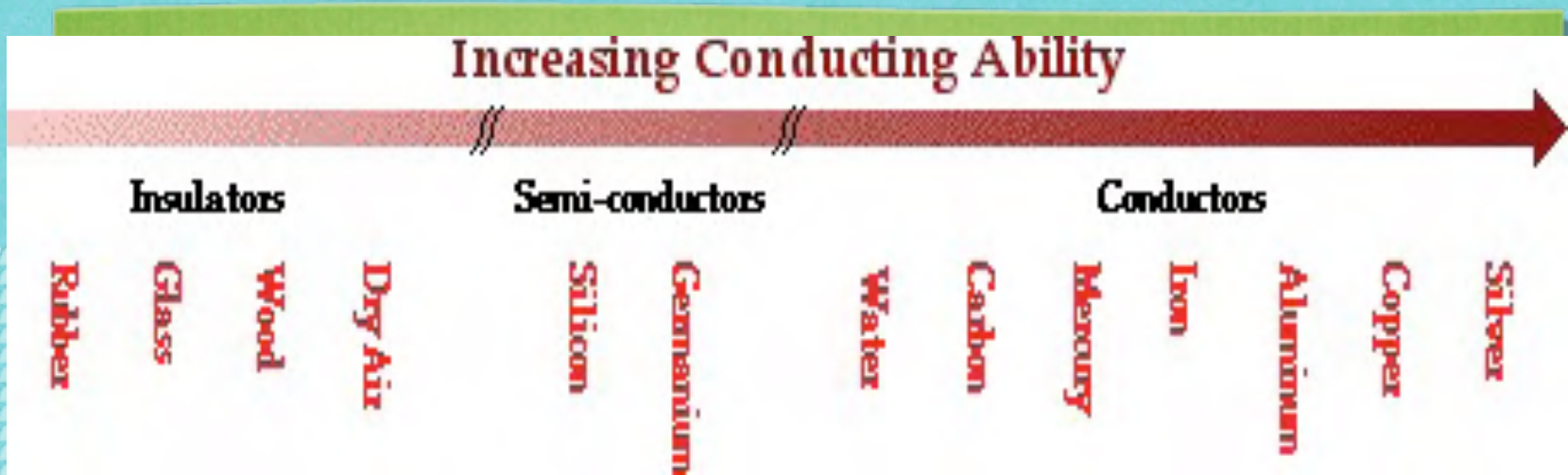
- Conductors: materials which permit electrons to flow freely from atom to atom or molecule to molecule



Insulators

- Insulators: materials that which impede the free flow of electrons from atom to atom and molecule to molecule





Why do bad hair days, electrical shocks, and static clothing most often occur in winter months?

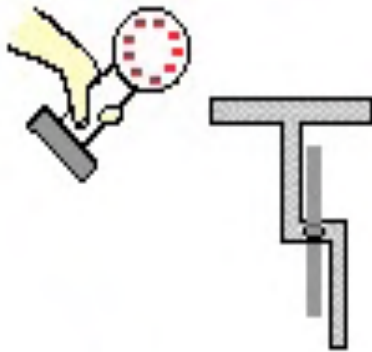
Charging by Contact

- ▶ Involves the contact of a charged object, either positively or negatively charged, to a neutral object
- ▶ **Grounding** - to remove the charge by allowing the electrons to flow to the earth

Charging by Contact

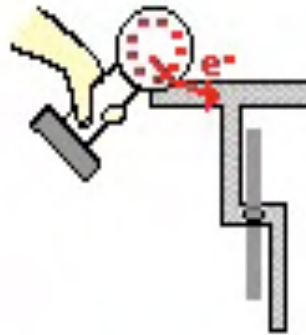
Charging a Neutral Object by Conduction

Diagram i.



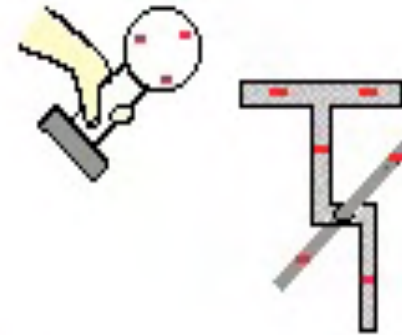
A metal sphere with an excess of - charge is brought near to a neutral electroscope.

Diagram ii.



Upon contact, e^- move from the sphere to the electroscope and spread about uniformly.

Diagram iii.



The metal sphere now has less excess - charge and the electroscope now has a - charge.

Charging by Contact

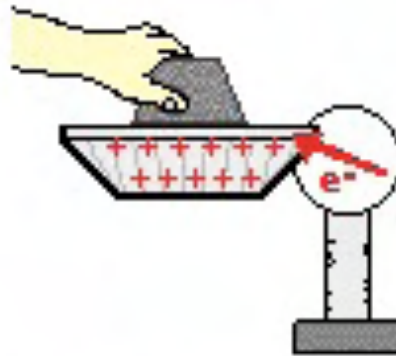
Charging a Neutral Object by Conduction

Diagram i.



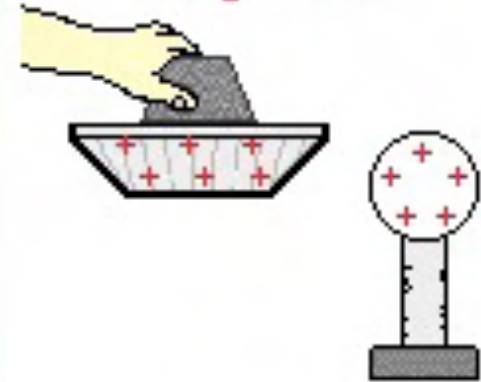
A neutral metal sphere rests upon an insulating platform.

Diagram ii.



When the + aluminum plate is touched to the metal sphere, electrons are drawn off the sphere and onto the aluminum plate.

Diagram iii.



The aluminum plate has less excess + charge and the metal sphere now has an excess of + charge.

Results

- Results in the **SAME CHARGE** on both objects

Charging by Induction

- This involves bringing a charged object CLOSE TO but NOT TOUCHING
- This creates a temporary charge on the object
- The charges move according to the Law of Static Electricity

Results

- The opposite charge is developed