

## Electrostatics 2 : Notes/W.S.-30

### Conductors and Insulators

Materials may be classified as conductors or insulators. **Conductors** are materials in which electrons can move easily (such as metals).

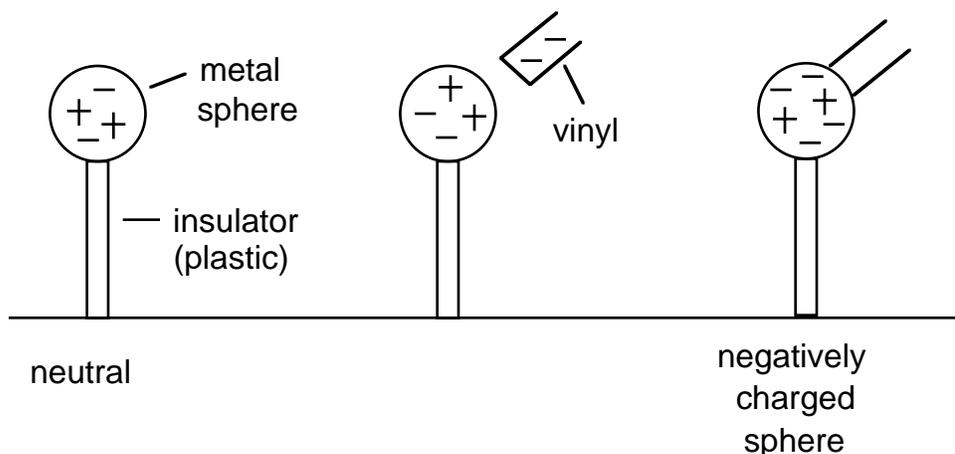
**Insulators** are materials through which electrons cannot move easily (such as plastics or styrofoam).

When one object (an insulator) is rubbed with another different object (another insulator), both objects will become charged. This is called **charging by friction**. The object which has the greater attraction for electrons will become negatively charged. The other object will become positively charged.

If ebonite (hardened rubber), a balloon, vinyl, or styrofoam, are rubbed by wool or fur, they will become negatively charged. The wool, or fur, will become positively charged.

### Charged Metal Sphere

If a charged vinyl rod touches a neutral insulated metal ball, the metal ball will become negatively charged.

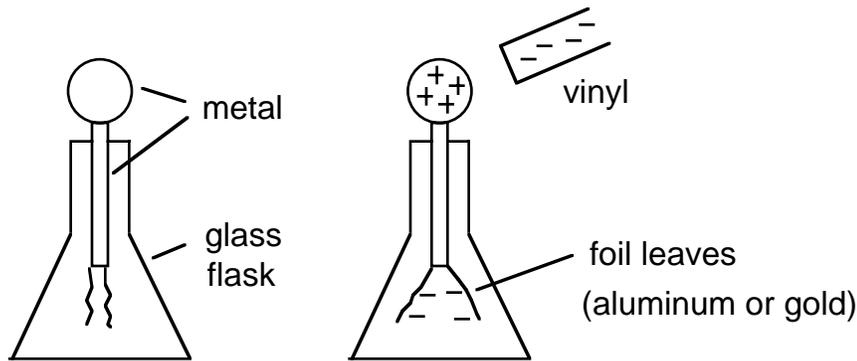


The negatively charged sphere has an excess of electrons. The metal sphere can be charged positive by touching it with a charged glass rod or a charged acetate plastic strip.

## Electroscope

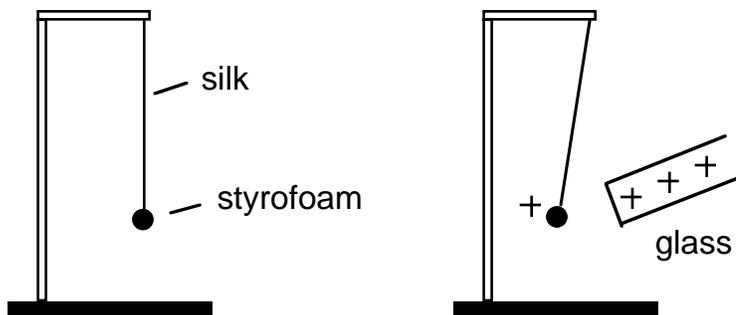
If an object is charged, we can detect the charge using an electroscope. When a charged object approaches the electroscope, the foil leaves will separate. The charged object doesn't have to touch the metal knob.

An electroscope is shown below. In this example, the leaves repel each other because electrons in the knob are repelled downward into them by the negatively charged vinyl strip.



Electroscope

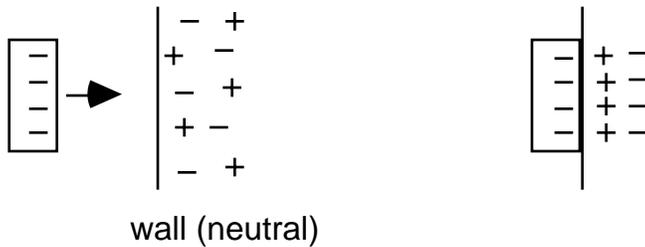
Another type of electroscope is shown below.



A graphite (conductor) coated styrofoam ball can be charged positive when touched by a charged glass rod. The ball is then repelled by the rod.

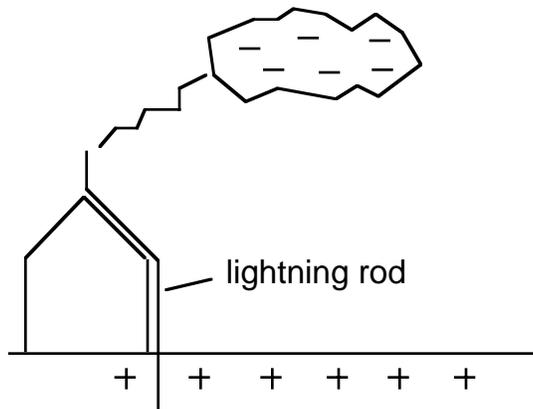
**A charged object will attract a neutral object**

If a piece of styrofoam is rubbed with fur, it will be charged negative and it will stick to a wall which is neutral. Positive parts of molecules in the wall will be oriented towards the styrofoam.



## Lightning

An important example of static electricity is the phenomenon of lightning. When it rains, drops of water rub against each other. Some drops become negative, others become positive. In this way it is possible for a cloud to become negatively charged and the ground positively charged. But when the charge builds up too much, lightning occurs. Lightning is a big spark. Electrons flow through the air from the cloud to the Earth. High buildings or trees were most often hit until the invention of the **lightning rod**. The lightning rod is a metal rod placed on top of buildings to conduct electrons to the positive ground.



Problems:

- 1) Define; conductor, insulator, charging by friction.
- 2) What device would you use to detect a charge?
- 3) How would you charge a neutral insulated metal sphere positive?
- 4) Explain how a charged object is attracted to a neutral object.

5) How would you protect a building from lightning?

Answers: 1) conductor; It is a substance through which electrons move easily., insulator; It is a substance through which electrons do not move easily, 2) an electroscope, 3) Touch it with a positively charged glass rod., 4) Charges on the charged object attract the opposite charges in the molecules of the neutral object., 5) Install a lightning rod.