PHYSICS IN MOTION
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Unit 5B
Static Electricity
Questions to Consider TEACHER

Main Ideas, Key Points, Questions:

After watching the video segment, write down key points, main ideas, and big questions.

Objective(s):

- *Define conductors and insulators and what makes them different.*
- *Understand charging by friction, electrical conduction, and induction.*

Notes:

During the video segment, use words, phrases, or drawings to take notes.

Summary:

After watching the video segment, write at least three sentences explaining what you learned. You may ask yourself: "If I was going to explain this to someone else, what would I say?"

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Answer the following.

1. **What is an insulator? Give two examples of insulating materials.**

An insulator is a material that resists the flow of electric charge by holding protons and electrons tightly in place. Examples of strongly insulating materials are wood, rubber, and glass.

2. **What is a conductor? Give three examples of conducting materials.**

A conductor is a material that gives very little resistance to the flow of electric charge. Most metals are conductors, including copper, silver, aluminum, and gold.

3. **What is the difference between charging an object by conduction and charging by induction?**

Charging by conduction requires contact between objects so that charge can flow directly from one object to the other. Charging by induction relies on electric fields acting at a distance and occurs without physical contact between the object inducing and the object receiving charge.

4. **What does it mean when an object is "grounded"? What happens to excess charge on a grounded object?**

An object is grounded when it is electrically connected to an unlimited charge "sink," usually the earth, so that any excess charge is removed into the ground, leaving an electrically neutral object.

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5. **After rubbing a balloon with a towel, the balloon will be attracted to certain surfaces, such as walls, even though they have no net charge. What causes this attraction to occur?**

Since walls are normally built of insulating material, charges in a wall are not very mobile. However, these charges will still respond to external electric fields by being pulled toward or pushed away from the charge(s) creating the field. Rubbing a balloon with a towel causes it to become negatively charged. The electric field from this negative charge polarizes the wall, causing separation between positive and negative charges. Even though the wall is made of insulating material, positive charges move slightly closer to the balloon than negative charges. Therefore, the wall attracts the balloon more than it repels, and the balloon is drawn toward the wall.

6. **An uncharged metal sphere hangs by an insulating thread. When a positively charged rod is brought close to the sphere, the sphere moves toward the rod. However, when the two objects touch, the sphere immediately moves away from the rod. Why?**

When the rod is brought near, the uncharged metal sphere becomes polarized. The negative charges on the surface of the sphere are drawn toward the positively charged rod, causing the two objects to attract each other. When the rod and sphere touch, the negatively charged electrons on the surface of the sphere flow to the rod. The number of electrons that moves is not enough to completely remove the net positive charge of the rod but is enough to give the sphere a net positive charge. Therefore, the rod and the sphere repel each other because they both have a net positive charge.

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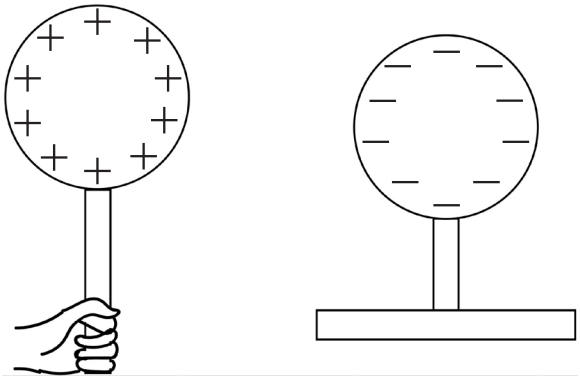
7. **While holding a wooden dowel attached to a positively charged metal sphere, perform each of the following actions. Draw the resulting electrical charge distributions in the associated diagrams.**

   Note: Student diagrams should show charges on the surfaces of the spheres.

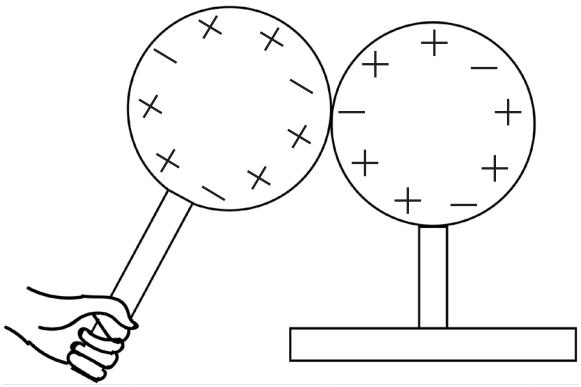
   a. **Bring the sphere close to an insulated, uncharged metal sphere.**



overall positive charge on the hand-held sphere;

overall neutral charge on the tabletop sphere

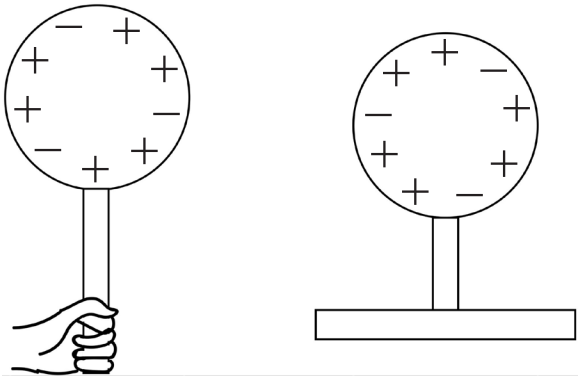
   b. **Touch the spheres together.**



positive and negative charges distributed

evenly over the joined sphere surfaces

   c. **Pull the sphere away, out of contact.**



both positive and negative charges on both spheres