

Lab 3: Electric Charge and Force

Name:

Group Members:

Date:

TA's Name:

Objectives:

- To become familiar with basic electric phenomena.
- To learn the charge model and apply it to conductors and insulators.
- To understand polarization and the attraction between neutral and charged objects.

Materials: Plastic rod, glass rod, piece of wool and silk, scotch tapes, soda can, aluminum foil, Styrofoam board, neon bulb, two aluminum pie pans, alligator clips, and electroscope.

Part 1: Interactions of Charged and Uncharged Objects

In the tutorial you completed an investigation of electrical interactions and you identified types of charges. We are going to continue the investigation.

When performing the following experiments, extend the rubbed objects away from your body so that your body does not influence your observations made with hanging tapes. Also, in humid conditions the electric charge on the pieces of tape can “leak off” causing them to become discharged. You may have to recharge or replace your T- and B-strips from time to time.

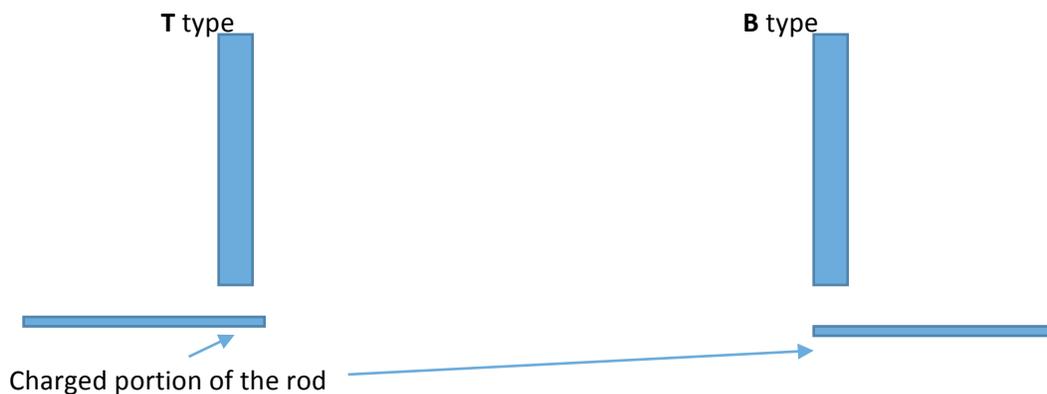
Create T and B tapes approximately 10 cm long. Complete the following investigations and record your observations.

1. Bring a few *charged* objects toward the tapes one at a time and record the observations below.

Material	T type tape Attracted /Repelled/Nothing	B type tape Attracted /Repelled/Nothing
Charged area of plastic rod, rubbed with wool		
Charged area of glass rod rubbed with silk		

2. You learned that like charges repel and unlike charges attract. Use this fact to determine the type of material. Now brainstorm and then explain how you will determine if the material is T type or B type.

3. List only those objects or types of materials that are CLEARLY T-type or B-type. Paste tapes to the edge of the table to do the experiment. Make sure that you keep a good enough distance between the tapes and reach the tapes as follows to minimize the effects on each other.



Record your observations below.

Ex: *X is T type when rubbed with Y*

	Is the charge T or B or none?	Is the charge T or B or none?
Glass rubbed with silk	Glass is	Silk is
Glass rubbed with wool	Glass is	Wool is
Plastic rubbed with silk	Plastic is	Silk is
Plastic rubbed with wool	Plastic is	Wool is

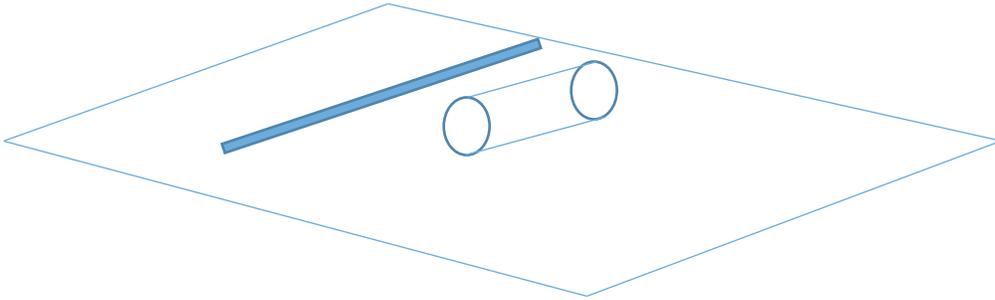
4. Now re-charge the T and B tapes or use new ones. Bring a few *uncharged* objects toward the tapes. And record the observations below.

Material	T type tape Attracted /Repelled/Nothing	B type tape Attracted /Repelled/Nothing
Your finger		
Uncharged area of plastic rod		
Uncharged area of glass rod		
paper		
Aluminum foil		
Any coins		

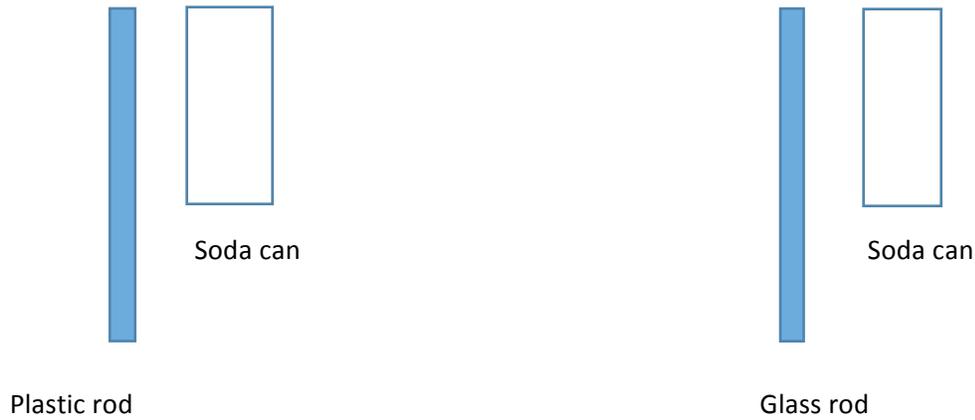
5. How do you explain your observations in #4 based on what you learned in the class or textbook?

6. Charge the plastic rod with wool. Put an empty soda can on the table (horizontal) as shown in the figure below. Bring the charged portion of the rod parallel to the empty soda can. Do not touch the soda can with the rod.

Observe the rolling motion of the soda can. Repeat observation with glass rod charged with silk.



Explain your observations by drawing a model for the relative charge distribution on the *rod* and on the *soda can* for both cases. Name your charges as **T** or **B** based on your identifications in #3.



7. What is the net charge of the soda can in each case? Explain the reason for your answer.
8. Can you have a net electric force on an object with no net charge? Use your observations of the motion of the soda can to support your answer.

Part 2: Charging metals by contact

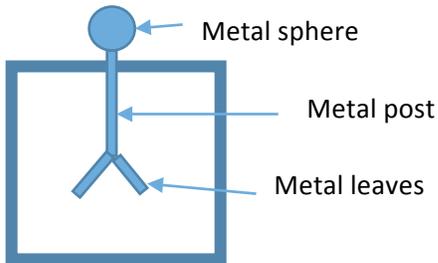
From now on use the following information to identify charges on the plastic rod and glass rod.

Plastic rod rubbed with wool is negatively charged. (plastic negative)

Glass rod rubbed with silk is positively charged. (glass positive)

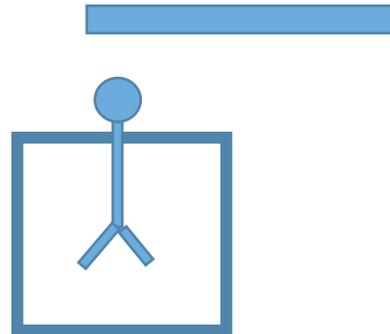
Now go back to #3 and identify T and B in terms of + and –

9. You are provided with an electroscope. A schematic picture of an electroscope is shown below. When the metal leaves have excess charge they repel as shown, when there is no excess charge on leaves they hang vertically down.



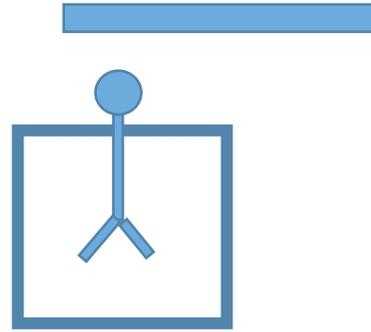
First touch the metal sphere once with your finger. Then bring the charged plastic rod rubbed with wool toward the metal sphere of the electroscope and observe the behavior of the leaves. **Do not touch** the metal sphere with the plastic rod. Record your observations and then explain.

10. Draw + and – charges on the diagram to represent the distribution of charge on the rod and the electroscope when the rod is brought close to the electroscope.

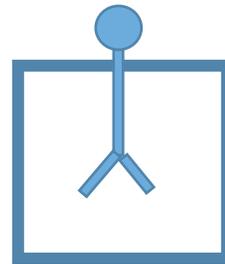


11. What happens to the electroscope when you take the charged rod away? Explain why.

12. Now repeat #9 but instead use the charged glass rod rubbed with silk. Did you have qualitatively the same observation as in #9? Draw the charge distribution and explain why you observe what you observe.



13. Recharge the plastic rod, then touch the metal sphere with the charged portion of the plastic rod and take the rod away. Sketch how the leaves look like after you complete the task. Is the electroscope charged now? Also draw the distribution of charges on the electroscop.



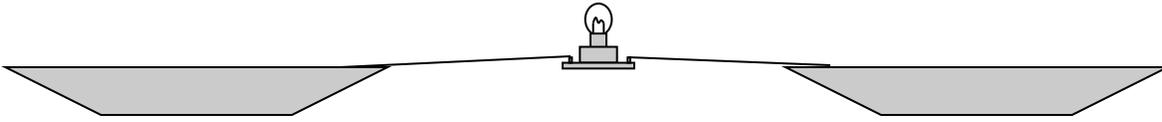
14. One of your class mates says that the angle between the leaves is an indication of the amount of charge present in the electroscope. That is larger angle means more charges etc. Do you agree? If yes why? If not why not?

15. Use the plastic rod to investigate this claim and decide if the angle of the leaves on the electroscope indicates how much charge is on them. Describe your observations and conclusions.

16. Charging of a conductor by touching with a charged material is called charging by contact. Now touch the metal sphere again with your finger. Explain what happens when you touch the metal sphere with the finger.

Part 3: Can Moving Charges Light the Bulb?

The next activity will require two aluminum pie pans, two short wires (with alligator clips), a neon bulb, and a blue Styrofoam board. Assemble these objects as shown in the figure below.



17. In a darkened room, vigorously rub the Styrofoam board with a cloth to charge it. Now wave the foam board in various ways above one of the pie pans while carefully observing the bulb. What did you notice?

18. What, if any, correlation do you detect between the behavior of the bulb and the motion of the board?

19. Using the observations and ideas developed up to now, how do you explain what is happening in this activity?