

Lab 14

Electrostatics

OBJECTIVES

- (1) To investigate charging by friction, charging by contact, and induced charge.
- (2) To discover some of the effects of static electricity.
- (3) To observe the effect of an electric charge in an electric field.

PROCEDURE

Part 1: Induced Charge

- (1) Charge a grey plastic rod and then bring it near, but not touching, the top of the electric pom pom. *Explain what you observed in terms of induced charge.* Now scrape the charged rod across the top of the electric pom pom. Notice that the strings of the electric pom pom repel each other. *Why? Touch the top of the electric pom pom with your fingers. What happens and why?*

Given that the grey rod is negatively charged, use the pom pom to figure out what charge the clear acrylic rod gets when rubbed with wool. *Explain your findings.*

- (2) Suspend a pith ball from a support rod. Bring a charged plastic rod close to, but not touching, the pith ball. *What did you observe?* Now let the pith ball touch the charged rod. *What did you observe? Explain.*
- (3) a) Rub a balloon on your hair or on a piece of clothing. Now touch the balloon to a wall. *Explain what you observed in terms of charging by friction and induced charge. Draw a sketch showing the charges in the balloon and the wall when the balloon is against the wall.*
b) Rub a balloon on your hair again, but this time put the opposite side (i.e. not the side that you rubbed) of the balloon against a neutral wall. *What do you observe? What does this tell you about the balloon?*
- (4) Quickly tear a piece of scotch tape from the roll and tape one end on a support rod. Bring your hand near the hanging end of the tape. This is another example of charging by friction and of induced charge. *Figure out charge on the tape and explain how you did it.*
- (5) Make a prediction: *What will happen to a small neutral stream of water when a negatively charged rod (grey plastic) is brought near? Why?* Rub the rod to charge it and observe its effect on a water stream. (It works best if you hold the rod near the

top of the water stream) *Draw and describe what you see.* Predict what will happen if you use the clear acrylic rod instead (see step 1). *Test out your prediction and report on your findings.*

- (6) Charge a gray plastic (PVC) rod negatively by rubbing it with wool. Place the rod inside **but not touching** the inner surface of the ice pail. With the rod still inside the ice pail, ground the pail by touching your finger across the inner and outer surfaces. Remove your finger and then remove the charged rod. *What is the charge on the inner surface of the ice pail? Explain how this occurred.*

(7) Are We Charged?

a) Place your hand inside but not touching the inner surface of the Faraday's ice pail and observe the reading on the voltmeter. *Are you charged? If so, how do you think it occurred?*

b) Ground yourself by touching the outer surface of the ice pail (which is connected to the ground). Again, place your hand inside but not touching the inner surface of the Faraday's ice pail. The voltmeter should not indicate any charge.

Experiment with different ways of charging yourself: rub your hands together, scuff your feet across the floor, touch the Van de Graff generator, ... *Report on several of the ways that worked and what charge you acquired in each case.*

(8) Electrophorus

a) Charge the square piece of gray (PVC) plastic by rubbing it with wool. Charge the entire square and then do not charge it again. Touch the round metal plate to the square. Then touch the electric pump pom with the metal plate. *Explain what happens and why. Did the plate become charged? Why or why not?*

b) Put the round metal plate back on the charged plastic square and then touch the metal plate with your finger. Now touch the electric pump pom with the plate again. *Explain what happens and why. What charge is the plate? Explain how the plate becomes charged.*

c) Repeat step b numerous times. *How many times can you charge the round metal plate?*

Part 2: Van de Graff Generator

- (9) Turn on the generator while holding a second metal sphere connected to the bottom of it. *What do you observe when the two spheres are brought close together?*

- (10) Place the aluminum pie plates stacked together on top of the Van de Graff generator. Turn on the generator. *Why do the pie plates fly off one at a time?*

- (11) Turn on the generator and bring an electric pom pom near the charged sphere.
Explain what you observed in terms of electric field and induced charge.
- (12) Tape the electric pom pom to the top of the Van de Graff generator. Turn on the generator and *record what you observed.* Turn off the generator and observe the strings of the electric pom pom for a few minutes. Eventually, the electric pom pom would completely discharge. *Why?* Charge the electric pom pom again and then turn off the generator. Bring your hand close to but not touching the generator. *What did you observe?*
- (13) Hold a small piece of animal fur near the Van de Graff generator and then let it go. *Explain the behavior of the fur.* See if you can get to animal fur to bounce back and forth between your hand and the generator – it's pretty cool!