**L153. Investigations in Electrostatics**

**Part A**

Investigation I

1. Suspend a Styrofoam cup by taping a piece of thread to it. Then rub the outside of the cup vigorously with the fur. Rub another cup with fur and bring it near the suspended cup. What do you observe?
2. Tear a 10-15 cm strip of sticky tape from a roll and stick it down firmly to the table top, leaving a short overhang to pick it up again. Strip it off the table top, being careful to hold only the end with your fingertips. Without touching the tape anywhere else, hang the strip of tape vertically over the table’s edge such that the non-sticky side faces outward. If your tape touches your hand – or anything else – you'll need to start the procedure over. Repeat the above procedure with another strip of tape and then bring this strip of tape near the first strip (the non-sticky sides should face each other). What do you observe when the strips are far apart?

…when brought close together?

To reactivate the sticky tape, repeat the procedure above. Tape can be reused. Reactivate the tape strip whenever something inadvertently comes in contact with it.

1. Formulate principles from your previous observations. Base them on your observations rather than on previous knowledge. Remember that words like negative and positive are not allowed at this point. In order to illustrate this process, here's an example of a principle you may have formulated based on your observations above:

***Principle A***: Similar objects rubbed in the same manner repel.

Now write a principle having to do with the strength of the forces that you observed. Name it Principle B. Name successive principles with a continuation of the lettering sequence. This will make it easy to refer to them.

Investigation II

1. Rub Saran wrap vigorously against the sheet of Plexiglas. After rubbing, let the plastic wrap lie on top of the Plexiglas, and then turn the Plexiglas square over. What happens?
2. Again rub the Plexiglas square with the Saran wrap. Now bring the Saran wrap near a tape strip prepared as in step 2 of Investigation I. What happens?

Bring the rubbed surface of the Plexiglas near the tape strip. What happens?

1. Take one of the tape strips and stick it back down to the table. Mentally label this tape strip B. Tape another strip directly on top of the one already on the table. Mentally label the top piece with a T. Now unstick both strips from the table at the same time without unsticking the strips from each other. Run them over your lips or a piece of metal.  (In making this unusual request to 'kiss' the tape, we're using our own knowledge of electrostatic effects in order to produce a particular, unseen result. You may accept it for now, or you may ignore it. The experiment will probably work even if you don't kiss the tape.) Pull the two tape strips apart quickly. Then bring the pieces of tape toward each other, non-sticky sides facing. What do you observe as you bring the strips closer together?
2. Hang both the B and T tape strips vertically over the table’s edge such that the non-sticky sides face outward. We’ll refer to these as the ***test strips***. Prepare another pair of top and bottom strips by repeating the procedure in step 3. What do you observe as you bring the new top piece near each of the original B and T test strips?

…as you bring the new bottom piece near the test strips?

We're going to introduce some new words in order to make it easy to talk about what you did by rubbing the cups and Plexiglas and by sticking and unsticking the tape. One word is ***charge*** (used as a verb).  When you charge an object by rubbing, unsticking, or other actions to be determined, you alter it in such a way that it exhibits effects that we'll group together under the term, ***electrostatic effects***. Right now, these are just words. They don't explain the underlying mechanisms that cause the effects. We will also say that an object is ***charged*** when it exhibits such effects as a result of rubbing, unsticking, etc. Finally, we'll use the term charge (as a noun) to mean whatever an object has that causes it to exhibit electrostatic effects.

1. With the above definitions in mind, here's a question to answer by experiment: Is the tape charged as it comes off the roll? Design a method for deciding and then try it. Describe your method and your findings.

Does the off-the-roll tape have the same charge as the B or the T strip? Note that answering this question is a deduction based on a prior principle or a generalization of observations. Therefore, use the principle or generalization in explaining how you come to your conclusion about the charge of the off-the-roll tape.

1. Rub the exterior of a Styrofoam cup with fur. Bring the rubbed cup close to the B test strip. What do you observe?

Predict what would happen if the cup were brought near the T test strip. Then try it and describe your observations.

1. Which of the observations in Investigation II can be explained with the principles formulated in Investigation I?

What new principles can you write? Remember to continue the lettering sequence started for principles that you’ve already started.