

Conductors and Insulators

Goals:

- Observe more electrostatic phenomena
- Learn properties of conductors and insulators
- Construct the concepts of induction and polarization

Equipment:

On student bench: Laptop, pole (1), wooden dowel (1), aluminum pie pan (1), foam cup (1), plastic cup (1), electrophorus (1), foam board (1), Scotch tape (1), rubber rod (1), electroscope (1), empty pop cans (1, watch your fingers!), threads, fur, and wool,

On the cart: Van de Graff generator, 2 aluminum spheres with plastic handles, Wimhurst Machine, and aluminum foil

Part I. Experimental Designs

Activity 1-Charge on tape 1: Remove two pieces (about 15~20 cm long) of regular Scotch tape from a roll of tape and stick them onto the top of the seat of your lab chair. Press them so that they make good contact with the surface. 1) Predict what will happen and describe your reasoning, if you quickly pull the strips of tape off the chair and bring them near each other (try not to let the tape strips touch your hands). 2) Then perform it and record actual result. Discuss any discrepancies between your prediction and the experimental result. 3) Design and conduct an additional experiment to determine what type of charge (positive or negative) is on each tape

Activity 2-Charge on tape 2: Stick a new 15~20 cm strip of Scotch tape with a handle onto the top of the seat of your lab chair. Label the handle of this strip with a “b” for bottom strip. Now place a second new strip with handle on top of the first strip. Label the handle of this strip with a “t” for the top strip. Press the strips so they make good contact with the surface and with each other. 1) Predict what will happen and describe your reasoning, if you quickly pull the bottom strip off the chair, pull the two strips apart, and bring the two strips of the tape near each other (try not to let the tape strips touch your hands). 2) Then perform it and record the actual result. Discuss any discrepancies between your prediction and the experimental result. 3) Design and conduct an additional experiment to determine what type of charge (positive or negative) is on each tape.

Activity 3-Charge on Van de Graff generator: Design and perform an experiment to determine what type of charge is on the Van de Graff generator.

Part II: Conductors and insulators

Note that in the following lab activities your group may use the charged strips of tape as an indicator to determine types of the charge on other objects. Please be aware that in humid conditions the electric charge on the strips of tape can “leak off” causing them to become discharged. Your group may have to prepare new pairs of tape strips from time to time.

OBSERVATION **Activity 4:** Using the contemporary *charged particle model* developed in Lab 1, predict what would happen when an aluminum pie pan is brought near a positively charged tape and then a negatively charged tape. Write down your prediction, explain your reasoning, perform the experiment, and record your actual result. Drawings are encouraged. Discuss any discrepancies between your prediction and the actual result.

Activity 5: Using the contemporary *charged particle model* developed in Lab 1, predict what would happen when a foam board is brought near the positive tape and then the negative tape. Write down your prediction, explain your reasoning, perform the experiment, and record your actual result. Drawings are encouraged. Discuss any discrepancies between your prediction and the actual result.

Activity 6: Open *ALPan&FoamBoard* QuickTime movie (can be downloaded from www.csuchico.edu/~xzou/labs.html) in the folder of **Lab2** under **4BLabs** on the desktop of your computer. Carefully observe and record the experiment.

CONCEPTUAL EXPLANATION **Discussion 1:** Discuss in your group the phenomena in Activities 4-6. 1) Try to identify any patterns of the observed phenomena and write them down. 2) Come up with some alternative ideas/hypotheses to account for them.

TESTING **Activity 7:** Design and perform an experiment to test each hypothesis (the experiment you design should be different from the ones you have observed. Use the steps given in the box below as a guide to record your experiment.)

Model: Clearly state the model that you will apply
Plan: Design a related experiment or describe a phenomenon
Prediction: Write down your prediction as follows: *If ... (the model is right...), then (I predict such evidence or result should be observed...)*
Experiment and result: Sketch your experiment setup, conduct the experiment, and record observed phenomena or evidence.
Conclusion: Discuss any significant discrepancies between your prediction and the result, and