

Charging by Induction Lab

Teacher's Guide

Topic:

Static Electricity

The following information is provided to the student:

Question:

What type of charge is acquired by an aluminum pie plate when charged by induction with a positively- and a negatively-charged object?

Purpose:

To determine the type of charge an aluminum pie plate acquires charged by induction using a positively- and a negatively-charged object.

A complete lab write-up includes a Title, a Purpose, a Data section, a Conclusion and a Discussion of Results. The Data section should include a diagram which shows with sufficient detail the two methods which were used to charge the aluminum pie plate by induction. The tests used to identify the resulting charges are also represented in the diagram. The Conclusion answers the *question* posed in the Purpose of the lab. The Discussion of Results explains in words the evidence which supports the conclusions.

Materials Required:

Aluminum pie plate; scotch tape; Styrofoam cup; Styrofoam plate; synthetic fur; saran wrap or plastic grocery bag; balloon.

Description of Procedure:

The Styrofoam cup is taped to the inside surface of the aluminum plate; the cup serves as an insulating handle. A Styrofoam plate is rubbed with synthetic fur; its charge is determined by observing its interaction with a negatively charged balloon (which has been rubbed on hair). The Styrofoam plate is placed upside down on the lab table; the aluminum plate is set on top of it so as to maximize the amount of surface contact with the Styrofoam plate. With the aluminum plate resting on top of the Styrofoam or simply held slightly above it, the rim of the aluminum plate is momentarily touched with a finger and then the aluminum is pulled away using the insulating handle. The charge on the aluminum plate is determined by observing its interaction with neutral paper bits and the negatively charged balloon. The process is repeated a couple of times to insure accurate observations. Finally, the same procedure is repeated using an object in place of the Styrofoam plate. Students refer to their Sticky Tape Experiments Lab in order to find an object which becomes charged positively when rubbed with synthetic fur or saran wrap or plastic. This object takes the place of the Styrofoam plate and is used to induce a charge on the aluminum plate.

Alternative Materials and Procedure:

The charge on the aluminum plate can also be determined by observing its interaction with the bottom rectangle tape or the top triangle tape. Refer to the Action-at-a-Distance Lab.

Safety Concern:

The Laboratory

There is always a higher than usual level of risk associated with working in a science lab. Teachers should be aware of this and take the necessary precautions to insure that the working environment is as safe as possible. Student *horseplay* and off-task behaviors should not be tolerated.

Suggestions, Precautions, Notes:

1. Being an insulating material, the charged Styrofoam plate does not likely transmit a significant amount of charge directly to the aluminum plate by virtue of its contact with the aluminum.
2. Students should be reminded to handle the aluminum plate by the insulating handle at all times. If the conducting aluminum is touched, it will lose its charge.
3. Students may experience a mild shock when they touch the aluminum plate. This is a sign of electrons jumping through the air from object to object. You might calm their fears by telling them that the shock isn't harmful. Then add "After all, it happens to me all that time and I haven't suffered any damage yet." (Expect some laughs.)
4. Objects tend to lose their charge over time (especially in humid environments). The Styrofoam plate and the balloon may need to be periodically re-charged.
5. Be aware of students who might be prone to allergic reactions to latex balloons.

Auxiliary Materials:

None

Scoring Rubric:

SE4. Charging by Induction Lab	Score
<input type="checkbox"/> Included, labeled and organized all parts of the lab report. <input type="checkbox"/> Data section includes diagrams for each of the induction charging process; sufficient detail is included in the diagram. The tests used to determine the resulting charge is also included. <input type="checkbox"/> Conclusion answers the <i>question</i> posed in the Purpose; <i>answer</i> is correct. <input type="checkbox"/> Discussion of Results uses the observations from the Data section to explain the supporting evidence for the conclusions.	____/____

Connections to The Physics Classroom Tutorial:

The following reading is a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/Class/estatics/u8l2b.cfm>

Connections to Minds on Physics Internet Modules:

Sublevel 7 of the Static Electricity module is a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/mop/module.cfm>