

SNC1D/1P The Characteristics of Electricity/Electrical Applications

Teacher Demo/Student Activity: Charging by Contact

Topics	Timing
static electricity	preparation: 3 min
transfer of charge	demonstration: 5 min
induction	activity: 10 min

Specific Expectations

SNC1D

A1.1 formulate scientific questions about observed relationships, ideas, problems, and/or issues, make predictions, and/or formulate hypotheses to focus inquiries or research

A1.8 analyse and interpret qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis, identifying possible sources of error, bias, or uncertainty

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions

A1.11 communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)

E2.1 use appropriate terminology related to electricity, including, but not limited to: *ammeter, amperes, battery, current, fuse, kilowatt hours, load, ohms, potential difference, resistance, switch, voltmeter, and volts* [C]

E2.2 conduct investigations into the transfer of static electric charges by friction, contact, and induction, and produce labelled diagrams to explain the results [PR, AI, C]

E3.2 explain the characteristics of conductors and insulators and how materials allow static charge to build up or be discharged

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E2.1 use appropriate terminology related to static and current electricity, including, but not limited to: *ammeter, ampere, battery, conductivity, current, energy consumption, fuse, kilowatt hours, load, ohm, potential difference, resistance, switch, voltmeter, and volts* [C]

E3.1 compare conductors and insulators, and explain how materials allow static charge to build up or be discharged

E3.2 explain the law of electric charges with reference to common electrostatic phenomena (e.g., charging by contact or by induction)

Introduction

In this demo, a polyethylene strip is charged by rubbing with wool. The charged strip is then used to charge a neutral object, a pith ball, by contact. This demo can be done as a student activity.

Materials

polyethylene strip
wool
pith ball electroscope

Safety Considerations

- None

Procedure

1. Charge the polyethylene strip by rubbing it with wool.
2. **Predict**
Ask students to predict what will happen when the polyethylene strip is placed near the neutral pith ball electroscope.
3. **Explain**
Ask students to justify their predictions based on their understanding of static electricity.
4. **Observe**
Slowly move the polyethylene strip toward the pith ball until the pith ball begins to move toward the strip (when they are about 5 cm apart). Move the strip toward and away from the pith ball a few times without allowing them to touch.
5. Allow strip to come in contact with the pith ball for a moment, then move the strip away again. Move the strip towards and away from the pith ball a few more times.
6. **Explain**
Ask the students to review their predictions and see if they match what they have observed. Challenge them to suggest a model of static electricity to explain why the pith ball is initially attracted to the strip and then repelled after coming in contact with the strip.

Disposal

Store the equipment for future use.

What happens?

In Step 4, prior to contact, the pith ball is attracted to the strip. In Step 5, after contact, the pith ball is repelled.

How does it work?

Rubbing polyethylene with wool transfers electrons from the wool to the polyethylene strip, leaving the strip negatively charged. Initially, in Step 4, the excess electrons in the polyethylene strip repel some of the electrons on the surface of the neutral pith ball. This results in a slight excess of positive charge on one side of the ball, causing the ball to move towards the strip. This is an example of charging an object temporarily by induction. This movement of electrons is only temporary: the electrons return to their normal position when the charged object is moved away.

When the pith ball comes in contact with the negatively charged strip, in Step 5, some of the electrons in the strip transfer to the neutral pith ball, making it negatively charged. This demonstrates charging by contact. The pith ball is then repelled by the strip because both objects have a negative charge.

Teaching Suggestions/Hints

1. Discuss why, in solids, the moving particles are the negatively charged electrons rather than any positively charged particles. Relate this to the model of the atom.
2. Draw a series of steps showing the electron transfer. (See the STAO BLMs in Additional Resources.)

Next Steps

Repeat the demo using a positively charged strip produced by rubbing an acetate strip with silk. Before performing the demo, ask students to predict if something different will happen when using different pairs of materials. The positively charged acetate strip initially attracts some of the electrons on the surface of the neutral pith ball. This results in a slight excess of negative charge on one side of the ball, causing the ball to move towards the strip. This movement of electrons is only temporary as the electrons return to their normal position when the charged strip is moved away. When the pith ball comes in contact with the positively charged strip, some of the electrons in the pith ball transfer to the strip, making the pith ball positively charged. Once the pith ball becomes positively charged from contacting the acetate strip, it is repelled from the strip, because like charges repel.

Additional Resources

1. STAO Virtual Library Black Line Masters (BLM): charging a neutral pith ball by contact with either a negative rod or a positive rod - <http://stao.ca/VLresources/2008/PithBall.pdf>
2. A video of this demonstration - <http://www.youtube.com/watch?v=aeiqw81kGio>