Zapped!

Summary

Six classroom learning stations will give students many opportunities to experiment with static electricity.

Group Size

Individual

Materials

Station 1

- Station Directions (pdf)
  Ten strings 15 inches long (five cotton and five yarn)
  Five balloons, blown up and tied
  Wool cloth

Station 2

- Station Directions (pdf)
- Romeo Proton and Juliet Electron necklaces (pdf)
  Wool socks or nylons (optional)

Station 3

- Station Directions (pdf)
  Ten balloons blown up and tied
  Wool cloth
  Ten pieces of string cut 24 inches long, one tied to each balloon

Additional Resources

Book

- *Hands-on Physical Science Activities*
  , by Marvin N. Tolman; ISBN 0-13-230178-4

Background for Teachers

When you shuffle across a carpet and touch a metal doorknob you may get zapped! You may feel a tiny electric shock as a spark jumps from you to the metal. This sort of electricity is called static electricity. It can make your hair stand on end, attract dust to the television set, or stick a balloon to the wall. It can cause your clothes to stick together as they come out of the dryer. *Static electricity* builds up charges in one place. It is stationary. When it discharges, it becomes *current electricity*.

Intended Learning Outcomes

1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Instructional Procedures

Invitation to Learn

“Romeo, Romeo, where art thou, Romeo?” (Juliet flings left arm out and bends right arm with hand on chest and exclaims. . .

“I’m Juliet Electron and I’m looking for Romeo Proton. Will you (point to students) help me find him?”

When you walked across the carpet on a dry winter day and touched someone . . . Zap!. . . a small electrical shock happened. This is called static electricity, or the story of Romeo Proton and Juliet Electron. Static electricity is a buildup of charges on non-metallic materials. When objects are rubbed, their electrons move from one atom, or material, to another causing an unbalance in charges and creating an electric current. Electrons have a negative charge and the materials that lost the electrons become positively charged by the same amount. Electrons aren't really lost, they just move.

When you walked across carpet you picked up extra Juliet Electrons. When you extended your finger to touch Romeo Proton, the extra electrons on you caused the electrons on neutrally balanced Romeo to move away from your finger. This caused a positive charge on Romeo.

"A-ha!" exclaims Juliet.

Romeo now has a positive charge and all the extra electrons on Juliet are attracted to positively charged Romeo. (opposite charges attract) Your lovebird, Juliet Electron, is not going to stay stationary any longer. An electric current has developed. When she sees Romeo Proton getting closer, she runs to him and gives him a shock! (Juliet, spying Romeo, runs toward him, extends her finger, touches his ear and he pretends to receive a shock.) It's static electricity! (End of play. Thunderous applause!)

Instructional Procedures

Students are given the same opportunity to experiment with static electricity. The room is setup into six stations—two of each as outlined below. Place materials for each station on a table, including a station sign and *Station Directions*. Students rotate from one station to the next approximately every seven minutes until they have participated in each station. They write what they observe at each station and include drawings in a science journal.

Station 1—Snake Charmer

Charge the end of the balloon with the wool cloth by rubbing it for 60 seconds.

With the end of the balloon, pick up the string without touching it.

What did you observe? See how high you can raise the string. Try picking up the yarn with the end of the charged balloon without touching it. Record your observations in a science journal.

Explanation: The charged end of the balloon gains electrons from the wool cloth, thus building up a negative charge. The string is neutral until attracted by induction to the balloon. (OPPOSITES ATTRACT.)

Station 2—Romeo and Juliet

Pick one Romeo and Juliet from your group. Don the appropriate necklaces. Juliet Electron shuffles his/her feet on the carpet and heads for Romeo Proton with an extended finger. Try building up a charge and touching other metallic items in the room.

Write a paragraph about what you observed. Include opposite charges attract, static electricity is stationary, it is a build up of charges until it discharges, then it becomes current electricity. Record your observations in a science journal.

Explanation: Juliet builds up a negative charge from the electrons gained from the carpet. Romeo becomes positively charged by induction. (OPPOSITES ATTRACT)

Station 3—Balloon Games

Hang both balloons by their strings from a student's desk about two inches apart. Tape the string to the desktops. How do they react to each other? Record your observation in a science journal.

Explanation: The balloons are neutral and should not react to each other.

Charge the side of one balloon that faces the other balloon by rubbing it with a wool cloth for one minute. Make a drawing showing how the balloons react to each other. Label the drawing, telling what you did and how they reacted.

Explanation: The charged balloon will attract the other balloon because the wool cloth will have left extra electrons on the balloon, giving it a negative charge. When the negatively charged balloon is

brought near the neutral balloon, it induces a positive charge near the surface of the balloon. The negative charges on the neutral balloon will separate and run away, and the positive charges will be attracted to the charged balloon. (OPPOSITE CHARGES ATTRACT.)

Rub both balloons for one minute with a wool cloth on the sides FACING each other. Draw how they reacted to each other and record what you did to the balloon to cause that reaction.

Explanation: Rubbing creates a gain of electrons on both balloons, causing them to repel. (LIKE CHARGES REPEL.)

Extensions

Floating Halo

Materials

One Christmas tree icicle tied into a small circle (the thin hanging kind)
One 9-inch square of 1/2-inch Styrofoam building insulation
One 8-inch aluminum pie plate with a plastic drinking cup taped to the center (see diagram).

Since Juliet was practicing devilish pranks on Romeo, let's end by seeing how "near to the angels" some of you may become with a halo activity.

Rub the Styrofoam for 60 seconds with the wool cloth.
Holding the pie plate by the plastic cup, set it on the Styrofoam.
Place your finger close enough to the pie plate to receive a shock. Don't touch the pie plate.
Pick up the pie plate by the cup handle, turn it over and hold it away from you.
With the other hand, hold the circular icicle six inches above the pie plate.
Let go of the icicle. It will float after it hits the pie plate. Move the plate around to keep the halo floating.
Explain what you observed.

Family Connections

Build an electroscope using the *Making Electroscope handout*. *Students design an electroscope with their family and conduct the experiment at the bottom of the page. Complete the Electroscopes handout and share with the class. Encourage students to design additional electroscope experiments.*

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