

Bill Nye the Science Guy
Static Electricity



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National Science Education Standards

Static Electricity

Standards/Benchmarks



Science as Inquiry

Abilities necessary to do scientific inquiry

- Identify questions that can be answered through scientific investigations.
- Design and conduct a scientific investigation.
- Develop descriptions, explanations, predictions, and models using evidence.
- Communicate scientific procedures and explanations.

Understandings about scientific inquiry

- Different kinds of questions suggest different kinds of scientific investigations. Some investigations involve observing and describing objects, organisms, or events; some involve collecting specimens; some involve experiments; some involve seeking more information; some involve discovery of new objects and phenomena; and some involve making models.
- Current scientific knowledge and understanding guide scientific investigations. Different scientific domains employ different methods, core theories, and standards to advance scientific knowledge and understanding.

Physical Science

Properties and changes of properties in matter

- A substance has characteristic properties, such as density, a boiling point, and solubility, all of which are independent of the amount of the sample. A mixture of substances often can be separated into the original substances using one or more of the characteristic properties.

Transfer of energy

- Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.
- Heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature.
- Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from that object—emitted by or scattered from it—must enter the eye.
- Electrical circuits provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced.
- In most chemical and nuclear reactions, energy is transferred into or out of a system. Heat, light, mechanical motion, or electricity might all be involved in such transfers.



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Episode Guide

Static Electricity

Nifty Questions in This Episode



What is static electricity?

What are electrons?

Can lightning strike backwards?

How many lightning bolts hit the ground all over the Earth?

What is a lightning rod?

Where are you safest during a lightning storm?

Awesome Answers

Static electricity consists of charged electron particles that won't flow.

Electrons are tiny, charged particles and are parts of an atom.

Yes, lightning can strike backwards, from the ground to a cloud.

Fifty to a hundred lightning bolts hit the ground all over Earth every second.

A lightning rod guides lightning to the ground.

During a lightning storm, you are safest in an automobile.

Experiments shown on the video:

ROCK, ROLL, AND BEND

Objective: To demonstrate static electricity at work.

- Roll up a 15-centimeter-square piece of paper and tape it together.
- Rub a comb through your hair and place the comb next to the paper roll; the paper will roll with the comb.
- Comb your hair and place the comb near a fine stream of running water; the water will bend.

STATIC BALLOONS

Objective: To illustrate the attraction of static electricity.

- Rub two blown-up balloons on your hair. Touch one to a wall and leave it clinging.
- Place some sugar on a dish and try to pick up the sugar with the other balloon.
- Pick up some scraps of paper with the balloon, etc. (You may have to rub the balloons again.)



More interesting stuff to do:

YOU GOTTA HAVE SPARK!

Objective: To store an electric charge, and release that charge in the form of an energy spark.

- Coat the inside and outside of a 1-quart jar or glass juice bottle with a thick coat of rubber cement, shellac, or polyurethane (clear liquid plastic paint). Leave the top 3 centimeters of the jar uncoated.
- When the jar is dry, line it inside and outside with aluminum foil, leaving the top 3 centimeters of the jar unlined.
- Cut a thick piece of cardboard to fit the jar or bottle opening.
- Cut a hole in the middle of this cardboard to fit a one-hole rubber stopper.
- Place a 10-centimeter piece of hollow glass tubing (or a thick drinking straw) through the hole in the rubber stopper (leave 3 centimeters sticking up).
- Place the stopper, with the glass tubing in place, into the hole in the cardboard.
- Place the cardboard over the mouth of the jar and tape it into place around the edges with masking tape.
- Slide a bare copper wire (or beaded metal pull chain) about 20 centimeters long through the glass tubing until 6 centimeters of wire or chain rests on the bottom of the jar.
- Using the end of the wire or chain that is sticking out of the jar, crumple it into a ball-shaped mass by twisting the top of the internal copper wire (or pull chain) big enough (1 to 2 centimeters in diameter) to allow a spark to jump when the wire is touched.
- Place the jar on pieces of bare copper wire.
- Rub a comb or metal object (with a handle) 50 strokes on a piece of wool.
- See how close you can get to the top of the copper wire ball before a spark occurs.
- Try the above experiment with your bare fingers or hand to see if a mild spark can be produced.
- For a better charge, connect the top of the internal wire to a mild, hand-cranked static generator; disconnect the hand generator.
- With a metal object held by a piece of wood at the middle, touch first the outside of the jar's aluminum, then the top of the internal wire. Sparks should fly as you approach the top wire.

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Student Recording Sheet

Name

Date

Title of Experiment _____

Question: (What are you testing?) _____

Procedure: (Describe the experiment) _____

Materials: (List what you used) _____

Observations: (Record what happened) _____

Results: (Make your own data table)

--

Conclusions: (Use your observations and results to describe what you learned)

Glossary

Static Electricity

Fold and cut to use as flashcards.

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ELECTRICITY

Electricity

Electricity is the flow of electrons.

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STATIC ELECTRICITY

Static Electricity

When electricity is contained in or produced by stationary charges, it is called static electricity.

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ELECTRONS

Electrons

Electrons are tiny negatively charged particles that are parts of atoms.

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DISCHARGE

Discharge

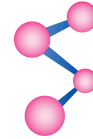
Discharge refers to the process by which electrons leave an electrically charged object.

Name _____

Date _____

Quiz

Static Electricity



True or False? Circle T or F

1. We can see lightning because electricity makes air glow. T or F
2. Electricity is the flow of protons. T or F
3. Oppositely charged objects repel each other. T or F
4. Electrons can move through the human body. T or F
5. Sparks are the result of electrically charged particles jumping from one surface to another. T or F
6. Static in radios and televisions is caused by electrons moving through electric wires. T or F
7. A ground wire lets electrons get to the ground. T or F

Multiple Choice: Circle the letter of the best answer

8. Which of the following is a true statement describing how a van de Graaf generator works?
 - A. Negative charges are deposited on the belt, which deposits positive charges on the metal ball.
 - B. Positive charges are deposited on the belt, which deposits negative charges on the metal ball.
 - C. Negative charges are deposited on the belt, which deposits negative charges on the metal ball.
 - D. Positive charges are deposited on the belt, which deposits positive charges on the metal ball.
9. Which of the following is true regarding “static cling” in clothes?
 - A. “Static cling” is caused by electron buildup on clothes.
 - B. Electrons create a negative static electric charge on clothes.
 - C. Water can absorb the electric charge of “static cling.”
 - D. All of the above.
10. Which of the following is not involved in the production of thunder?
 - A. Lightning strikes.
 - B. Sound is produced as the electrical buildup is discharged.
 - C. The air is heated to very high temperatures.
 - D. Sound is produced as hot air collides with cool air.



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Answer Key

Static Electricity

1. **T**

4. **T**

7. **T**

9. **D**

2. **F**

5. **T**

8. **C**

10. **B**

3. **F**

6. **F**

STATIC ELECTRICITY



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