Electricity Lessons

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Conductors and Insulators

Grade: 5th

Objective: Students will test a variety of materials to determine if they are conductors or insulators.

Sunshine State Standards:

Benchmark SC.B.1.2.2: The student recognizes various forms of energy (e.g., heat, light, and electricity).

Materials:
Per Group:
1 15- 25 cm wire with ends stripped
D cell
Flashlight bulb
Tape
Materials to be tested (see activity sheet)

Procedures

Part 1:

1. Make a simple circuit to test the conductivity of materials and show students.

Part 2:

1. Distribute materials to each group.
2. Show students how to build a circuit to test the conductivity of materials using a D cell, wire, and light bulb.
3. For the first five objects listed, predict whether or not the object in the circuit will conduct electricity. Place the object in the circuit and record results.
4. Have students pick five additional objects to test, and repeat the above process.
5. Discuss the results and write conclusions in the space provided. Make sure that students note that some objects, like the pencil, are both conductors and insulators, depending on what part of the object is placed in the test circuit.

Part 3:

1. Using Page 1, list the conductors and insulators in the appropriate boxes on Page 2.

2. Discuss common characteristics of the conductors. Record these characteristics in the space provided.
3. Discuss common characteristics of the insulators. Record these characteristics in the space provided.
4. Distribute Page 3. In the appropriate areas of the Venn diagram, write the names of the objects tested. Discuss results.

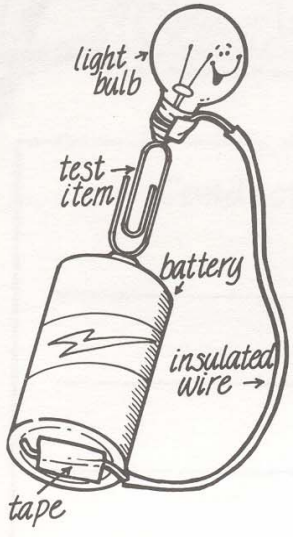
Discussion questions:

1. How are insulators alike?
2. How are conductors alike?
3. What distinguishes a conductor from an insulator?
4. Are there and objects that are both conductors and insulators?
5. What other things do you think might be conductors?
6. What other things do you think might be insulators?
7. Why are many wires coated with plastic or some other material?

Resources:

Electrical Connections, Aims Educational Foundation, 1991, page 40

Conductor or Insulator?



A *conductor* is any item that allows electrons to flow freely through it. The light bulb should light.

An *insulator* is any item that does not allow electrons to flow easily through it. The bulb will not light.

Tape the wire to the bottom of the cell. Wrap the wire around the metal side of the light bulb. Tape it securely in place.

Test each item. Record your findings in the table below.

Item	Prediction	Conductor	Insulator
paper clip			
tape			
pencil			
string			
ruler			

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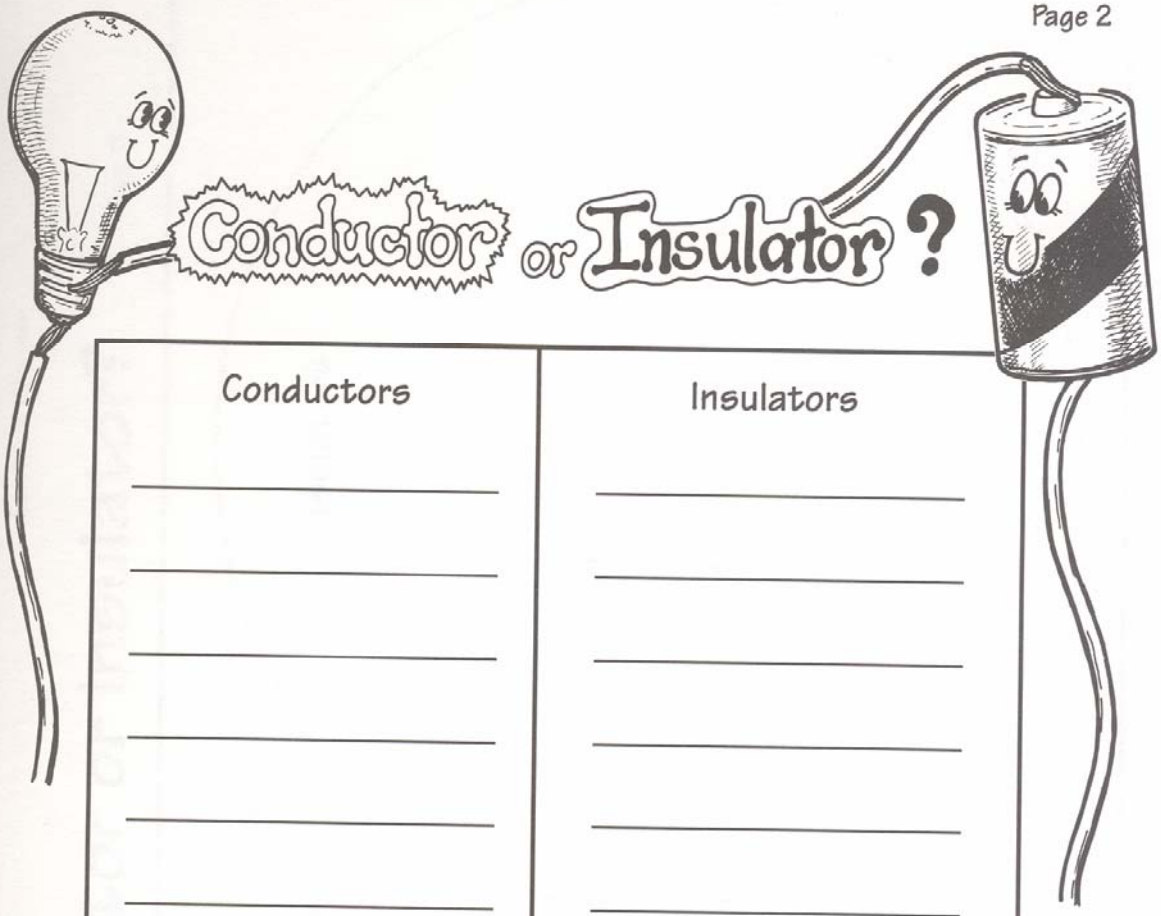

Conductor or Insulator?

Conductors	Insulators
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

How are the conductors alike? _____

_____

How are the insulators alike? _____

_____

Conclusions: _____

_____

_____

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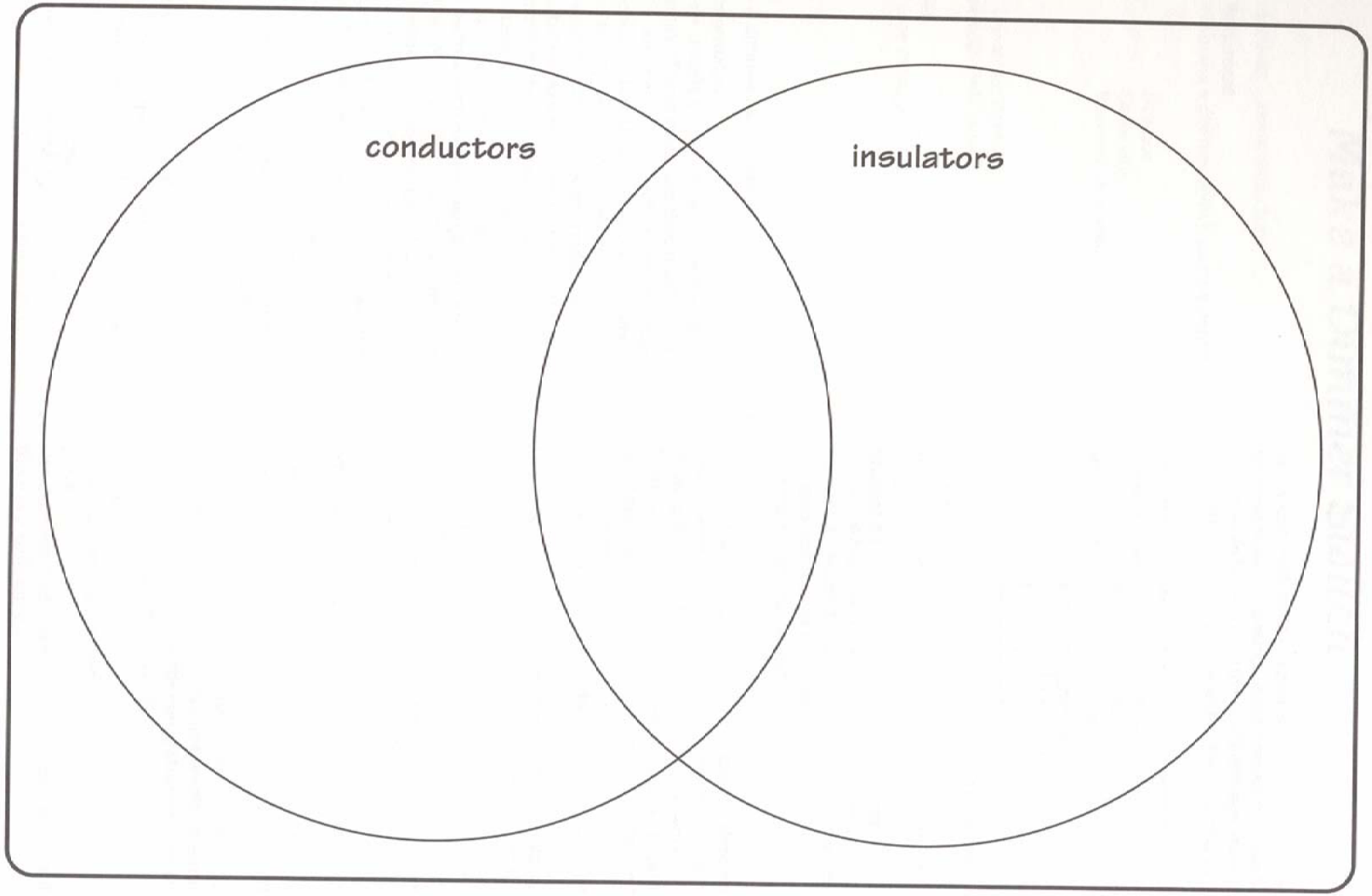
Electrical Engineer _____

Conductor or Insulator?

Page 3



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Swinging cereal

Grade: 1-3

Objective: The students will demonstrate static electricity.

Sunshine State Standards:

Benchmark SC.B.1.2.2: The student recognizes various forms of energy (e.g., heat, light, and electricity).

Materials:

a hard rubber or plastic comb, or a balloon
thread, small pieces of dry cereal (O-shapes, or puffed rice of wheat)

Procedures:

1. Tie a piece of the cereal to one end of a 12 inch piece of thread. Find a place to attach the other end so that the cereal does not hang close to anything else. (You can tape the thread to the edge of a table but check with your parents first.)
2. Wash the comb to remove any oils and dry it well.
3. Charge the comb by running it through long, dry hair several times, or vigorously rub the comb on a wool sweater.
4. Slowly bring the comb near the cereal. It will swing to touch the comb. Hold it still until the cereal jumps away by itself.
5. Now try to touch the comb to the cereal again. It will move away as the comb approaches.
6. This project can also be done by substituting a balloon for the comb.

What Happened: Combing your hair moved electrons from your hair to the comb. The comb had a negative charge. The neutral cereal was attracted to it. When they touched, electrons slowly moved from the comb to the cereal. Now both objects had the same negative charge, and the cereal was repelled.

Resources:

"What is Static Electricity?" Science Made Simple Inc., 7 July 2004. <http://www.sciencemadesimple.com/static.html>

Introduction to Electricity

Grade Level: Kindergarten, 1, 2

Objectives:

1. Using a battery, wires, a socket, and a light bulb, students will be able to construct a simple circuit.
2. Students will draw and label the parts of a simple circuit.

Sunshine State Standards:

Benchmark SC.B.2.1.1:The student recognizes systems of matter and energy.

Materials:

Flashlights (battery powered)
5 small letter e's
1 picture of a light bulb
1 picture of a battery
1.5v battery
plastic coated wires
sockets
light bulbs
trays
overhead projector with blank transparencies and markers
My Circuit Worksheet

Procedure:

Anticipatory Set:

Turn off the lights in the classroom. "What happened? What do we need to do to turn the lights back on? When we turn the switch on, what makes the light come on? What power do the lights use to work? The electricity that makes the lights in the ceiling work is the same kind of electricity that comes from outlets. What are outlets? In the ceiling, you can't see the outlet. (Pick up and turn on a flashlight.) What power does the flashlight use? (If students answer "batteries," explain that batteries are a container for that kind of power.) Does anyone know what kind of power is stored in batteries? The power in batteries is also electricity." (Invite someone to turn the lights back on.)

"Today we are starting a unit on electricity. Electricity is very important in our lives. Electricity makes all kinds of things work. Think about the things in your home that use electricity that comes from outlets. Also, think about the things in your home that use

electricity from batteries. Turn to the person next to you and share three things in your house that use electricity, either with batteries or with outlets."

On the overhead projector, create a "T" chart with the heading, "Electricity." Create two sub-headings: *from outlets* and *from batteries* . "Who would like to share something that uses electricity?" Add items to the chart as students make suggestions. "Tonight, for homework, I would like you to look around your house for things that use electricity. Don't touch or test things at home. The electricity from outlets is very powerful and can hurt you if you play with it. That is why only grown-ups should use outlets. Look around your house, and tomorrow we will talk about what you found and add the items to our list."

"For today's activity, we are going to use batteries to learn what makes electricity work. The energy from batteries is not strong; that is why it is safe for you to use them. Whether electricity comes from batteries or outlets, it works the same way. You are going to have a chance to make a light bulb light up!"

Instructional Input:
Everything in our world is made up of tiny, tiny, tiny bits called "atoms." They are so tiny, you cannot see them unless you have a very powerful microscope. The chair, the desk, the floor, even our bodies, are all made of atoms. Some of the parts of each atom contain even tinier things called electrons. The electrons spin around the center of the atom. Sometimes, if there is power or energy, electrons start to move or jump to other atoms. Moving electrons create electricity. This is the kind of electricity we have in our homes. It is made up of millions and millions of moving electrons. For the electricity to work, the electrons must move in a complete loop. When electricity flows through a loop, it is called a circuit. Let's say that together, "circuit."

"We are going to play a game that I call the *e game* . The e stands for electron, because electron starts with e. Can I have 7 volunteers? Sit in a circle. Who would like to be the light bulb? (Give the student a picture of a light bulb.) Who would like to be the battery? (Give the student a picture of a battery.)" The other 5 students each receive a small letter e. "We are going to pretend that the rest of you are a metal wire, and the electrons are

going to move through you. When the electrons are passing through the light bulb, the light bulb will be lit. (Students pass the electrons [letter e's] around the circle, and then the teacher interrupts the flow by creating a barrier.) Why can't the electrons move now? The loop is broken. The electrons cannot flow through the wire. If the loop is broken, there is no flow of electricity. Now I am going to close the loop. What is going to happen now? Thank you for your help. You can go back to your seats."

Modeling/Checking for Understanding:

"Now, I am going to show you how to make your own circuit using a battery. The battery is in a battery holder. There is also a small light bulb. This is the size of the light bulb in a flashlight. The light bulb is in a holder called a socket. Finally, there are two metal wires. The metal wires are coated with plastic. Electricity move easily through metal, but it cannot pass through plastic. The plastic keeps the electricity inside and safe. On the ends of these wires are alligator clips. (Show students how to open clips.) Why do you think these are called alligator clips? You need to use the same fingers you use for holding a pencil to open the alligator clips. (Demonstrate pincer grasp in the air.) Now I'll attach one end of the alligator clip to one end of the battery. Then I'll attach the other end to the socket. Did the light bulb light up? Why not? We need to have a complete loop. Electricity only flows if it can get all the way around from one end of the battery to the other. So, we need another wire to make a loop and complete the circuit. (Attach the wire.) What happened?"

Guided/Independent Practice:

Divide students into groups of three. Give each group a tray of materials (light bulbs, sockets, wires, batteries). In their groups, students take turns making a circuit.

Checking for Understanding:

Using the overhead projector, draw a picture of the circuit. Label the various parts of the circuit. "What is this part called? (Point to the battery.) What is this called? (Point to the wires.) Who remembers what this is called? (Point to the socket.) Finally, what is this called? (Point to the light bulb.) And, what is this whole diagram or picture called? (circuit)"

Closure:

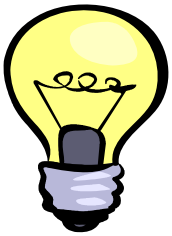
"Today we learned how electricity works, and each of you had a chance to make a circuit. Electricity is an important part of our life and now you know that for electricity to work, it needs a power source, and it needs to flow in a complete loop. Now you can make your own diagram and label the parts, just like I did. (Pass out the worksheets labeled "My Circuit." Students draw a picture of a circuit and label the circuit as demonstrated on the overhead.)

Assessment: Observe how well the students answer the questions, construct their circuits, and diagram their circuits.

Resources:

"Introduction to Electricity." Educator's Reference Desk. 9 July 2004. http://edurf.org/Virtual/Lessons/Science/Physics/PHS0204.html

Name: _____



My Circuit

Draw a picture of your circuit below. Use the words from the Word List to label your picture.

Word List:
socket
light bulb
wires
battery

Electric Gelatin

Grade Level: 1-2

Objectives:
The students will demonstrate what happens when a balloon is rub against objects.

Sunshine State Standards:
Benchmark SC.B.2.1.1:The student recognizes systems of matter and energy.

Materials:
packet of unflavored and flavored gelatin powder
paper plate
balloon
marker
wool sweater
paper towel
salt

Procedures:
1. Pour some gelatin on a plate.

2. Blow up the balloon and tie the opening shut.

3. Use the marker to draw a small "x" on one side of the balloon.

4. Hold the "x" side of the balloon.

5. Hold the balloon about one inch above the gelatin. Don't let the balloon touch the gelatin. What happens?

6. Still holding the "x" side of the balloon, rub the other side on the wool sweater for ten seconds. (If you don't have any wool, rub the balloon on your hair.) Hold the balloon about an inch above the gelatin. What happens?

6. Slowly raise the balloon. Now, what happens?

7. Experiment with flavored gelatin or salt.

8. Rub the balloon with a paper towel. Record if there is any difference.

What Happened:
When you run the balloon on the sweater, you charge the balloon with static electricity. Static electricity is what makes you hair stand up when you take off a sweater, or what makes you socks stick to your other clothes when you take them out of the dryer. When the charged balloon is brought near the gelatin, the gelatin's surface becomes oppositely charged. Things that are oppositely charge attract. That is why the gelatin moves toward the balloon.

Resources:
"Electric Gelatin" PBS Zoom, 9 July 2004. <http://pbskids.org/zoom.html>