Get a Move On…Electron!

Strand Force, Motion, and Energy
Topic Investigating conductors and insulators
Primary SOL 4.3 The student will investigate and understand the characteristics of electricity. Key concepts include
a) conductors and insulators.
Related SOL 4.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
a) distinctions are made among observations, conclusions, inferences, and predictions;
b) objects or events are classified and arranged according to characteristics or properties;
e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources;
f) independent and dependent variables are identified;
g) constants in an experimental situation are identified;
h) hypotheses are developed as cause and effect relationships;
i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs;
k) data are communicated with simple graphs, pictures, written statements, and numbers;
l) models are constructed to clarify explanations, demonstrate relationships, and solve needs.

Background Information

Conductors are materials that allow electric current to flow. Most metals are considered good conductors. Insulators, on the other hand, are materials that do not allow the free flow of electricity. Examples of insulators include rubber, wood, air, and plastic.

Materials

- Copies of the attached Get a Move on…Electron! packet for each student

For each small group, a box that includes:

- Three wires (at least 10 cm in length)
- One bulb holder
- One minibulb
- One D-battery
- Aluminum foil
- Pencil
- Spiral notebook
- Penny
- Dime
- Nickel

- Toothpick
- CD Case
- Paperclip
- Cotton

Vocabulary

circuit, closed circuit, open circuit, insulator, conductor, dry cell, electric current

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

Introduction

1. Ask students if they know what makes the lights go on in the classroom. If students answer that you flip the light switch, ask them why the lights do not go on in a house when the power is out.
2. Hold a discussion about what students know about electricity. Ask them to think about why the light switch makes the difference of whether the lights are on or off in the classroom.
3. Tell students that they will be designing their own circuit today that provides opportunities for the lights to be on or off.

Procedure

1. Model for the students how to make a functioning circuit by using the three wires, the light bulb, the bulb holder, and the dry cell (battery). Discuss that within this closed circuit there are both insulators and conductors. Ask students to identify those items that let electricity flow (conductors) and those that would not let the electricity flow (insulators).
2. Place students into groups of three to four students.
3. Give each group the box of materials and each student the attached Get a Move on…Electron! packet.
4. Have students review the packet and complete the Experiment Design section with their group. When students reach the stop sign, they should stop for the teacher to review their work.
5. Once the design has been reviewed, students will then complete their experiment and record the data on the Get a Move on…Electron! packet.
6. Circulate and observe the experiment process to assist where needed.

Conclusion

1. Ask each individual student to independently complete question the labeled “Elaborate” in the Conclusions section on the Get a Move on…Electron! packet to apply what they have learned.
2. Have students share their experiment design in front of the class.
3. Discuss all student results from their experiments, pointing out any differences and why they might have occurred.

Assessment

- **Questions**
    - What is a conductor and what is an insulator?

    - Why might wires be covered in plastic or rubber?
    - Hold up different items and ask children to state whether they are insulators or conductors.
- **Journal/writing prompts**
    - Write a journal entry to describe the problems that would result from using wire without insulation when building a home.
    - If you were an electrician having to work with dangerous amounts of electricity, what are some precautions you may need to take? Think about insulators and conductors.
- **Other**
    - Have students create a graphic organizer categorizing 10 conductors and 10 insulators.
    - Have students find both insulators and conductors in their classroom or at home and record them in a spreadsheet.

Extensions and Connections

- Have students label a diagram of a light bulb indicating insulators and conductors within the bulb. Discuss the importance of both.
- Have students research the level of conductivity of different metals. Students can record the conductivity on a continuum.

Strategies for Differentiation

- Give pictures of wires, bulbs, bulb holders, and sources for the students to use with their testing design sheet.
- Instead of drawing a diagram of the class experiment, the students can create their explanation about the experiment with pictures.
- Assign roles to the students. Some possible roles are the:
    - Recorder (The one who writes all the information down.)
    - Illustrator (The one who sketches your team's experiment.)
    - Speaker (The one who will share with the class what they did in their experiment.)
    - Reader (The one who reads the sheet and directions to the group.)
- Create an anticipation guide that provides students with a list of reasonable and unreasonable predictions to sort. After finishing the lesson, direct students to check their predictions.
- Create a checklist of steps to follow in the completion of the activity. Groups will check off the steps as they complete sections of the activity.
- Direct students to draw the steps of the activity in story frames.

Get a Move On…Electron!

Names: _____ Date: _____

As you may already know, electricity is the energy created from the movement of electrons. Some electrons are easy to move. Some are not. Today you will be designing an experiment to test what substances allow the movement of electrons. You will be using the wires, bulb holder, bulb, and the dry cell to test the conductivity of several different materials.

Experiment Design

The first step is to classify the items available for testing into categories by substance. For example, both the nickel and the dime are made of metal. Fill in the table below. Some items may be made of more than one material. Insert these items into every appropriate column.

Wood	Metal	Plastic	Rubber	Other
	nickel			
	dime			

Hypothesis

Make an educated guess for your test.

Your Hypothesis: If electrical current is applied to wood, metal, plastic, rubber, and other substances, then electricity will pass through the following materials:

_____ .

Independent Variable

An independent variable is what you are changing in the experiment. What is it that *you* are going to change during testing?

- The material type
- The circuit type
- The bulb

Dependent variable

A dependent variable is what happens because of the independent variable. This is what the scientist measures. What may change because of the independent variable?

- The material type
- The flow of electricity
- The color of the wires

Constants

Constants are the variables that are kept the same during each of the experimental trials. It is important to identify your constants to help keep your experiment fair. Which of the following would be appropriate constants for this experiment?

- Same energy source
- Same wires
- Same bulb
- Type of tested materials
- Flow of electricity

Testing design

In order to test your materials, you should set up your experiment in an efficient way. Sketch your team's designed setup of wires, bulb, bulb holder, and source below.

Raise your hand and wait for the teacher before you go on.

Predictions and Data

Enter each item you will be testing in the first column. Prior to testing, make a prediction whether the material is a conductor or an insulator. Record your prediction in the second column.

In the prediction and test categories enter "C" for items that allow electrons to flow and "I" for items that do not allow electrons to flow. A conductor is a material that allows electrons to flow. An insulator is a material that does not allow electrons to flow easily.

Materials	Prediction	Test

Conclusion

Look closely at your data. Based on the data you collected, is your hypothesis supported or not supported? If you notice a pattern in your data, this is where you would write about it. Below, make a conclusion after analyzing your data.

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Elaborate: Now that you understand what insulators and conductors are, write a brief paragraph explaining why it might be dangerous if you don't know the difference between the two.

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