

Name: _____ Class: _____ Date: _____

Insulators, Conductors and Resistors. Oh my!

Learner Outcomes:

- Identify electrical conductors and insulators, and compare the resistance of different materials to electric flow (e.g. compare the resistance of copper wire and nickel-chromium wire; investigate the conduction of electricity through different solutions; investigate applications of electrical resistance in polygraph or lie detector tests)
- Measure voltages and amperages in circuits (e.g., determine the resistance in a circuit with a dry cell and a miniature light; determine the resistance of copper, nickel-chromium wire, pencil leads and salt solution.)
 - o Apply Ohm's law to calculate resistance, voltage and current in simple circuits.

Key Terms:

Conductors

Insulators

Resistors

Semi-conductors

Voltage

Current

Background Information: Current electricity is a stream of electrons flowing through a conductor. Different types of materials; conductors, insulators and resistors, influence how easily electricity flows.

Research Question: How do different materials influence the flow of electricity?

Materials:

Battery pack

Paper clip

Plastic spoon

Conducting Wires

Nail

Popsicle Stick

Multi-meter

Copper wire

Distilled water

250 mL beaker

Ni-chrome wire

Salt water

Ruler

Rubber band

Vinegar

This investigation / activity has been adapted from:

Mah K, Martha J, McClelland L, et al. *Science in Action 9*. Toronto, ON: Addison Wesley.

Procedure:

Part A: Conductivity of Solutions

1. Create a closed circuit by connecting a battery, and multi-meter in series. Use the multi-meter to measure and record both the voltage (in V) and conductivity (in mA).
2. Pour 50 mL of distilled water into a 250 mL beaker.
3. Place the one tips of your conductivity tester into the distilled water and place the end of the free wire of your open circuit into the distilled water (be sure the wires do not touch). Measure and record the voltage and conductivity.
4. Repeat steps 2 and 3 using salt water and then again, using vinegar and record your data in your data table.

Part B: Insulators and Conductors

1. Create a closed circuit by connecting a battery and multi-meter in series. Use the multi-meter to measure and record both the voltage and the conductivity in your circuit.
2. Insert a 5 cm length of copper wire into your circuit between the battery and the voltmeter (be sure to have contact throughout the circuit). Measure and record the voltage and the conductivity using the copper wire.
3. Repeat step 2 using a 5 cm length of nickel - chromium wire, a 5 cm length of a straightened paperclip, and a 5cm length of popsicle stick. Record your data on your data table.
4. Repeat step 2 connecting a light bulb in place of any other solid material. Measure and record the voltage and the conductivity in your data table.

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Observations:

Material used	Voltage	Current	Resistance (1/current)	Insulator / conductor?
None				
Distilled water				
Salt water				
Vinegar				
Other?				
Copper wire				
Ni-Chrome wire				
Paperclip				
Popsicle Stick				
Light bulb				

Analysis:

1. Use Ohm's law to calculate the resistance for each of the materials tested.
2. What were the:
 - a. Manipulated variable -
 - b. Responding variables (2) -
 - c. Controlled Variables (2) -

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3. Which was a better indicator of whether a substance was a conductor, insulator or a resistor, the voltage or the current?

4. Was there a difference in conductivity and voltage among the solutions you tested? Explain why.

5. Why was the popsicle stick different from the nickel-chrome and copper wires?

6. What do you think accounted for the difference between the nickel-chrome and copper wires?

7. Is a resistor considered to be a special case of an insulator or of a conductor?

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