Synopsis: Conductivity Detectives… Scavenger Hunt

In this activity you will measure the electrical conductivity of a series of materials using a simple conductivity meter. You will use your observations to try to come up with conductivity trends. Understanding conductivity is an essential element of DC circuits and electromagnets.

Standards

4th Grade

1a. Students know how to design and build simple series and parallel circuits by using components such as wires~~, batteries, and bulbs.~~

1c. Students know electric currents~~ produce magnetic fields and know how to build a simple electromagnet.~~

9-12th Grade

5f. *Students know* ~~magnetic materials and~~ electric currents (moving electric charges) ~~are sources of magnetic fields and are subject to forces arising from the magnetic fields of other sources~~.

7c. *Students know* substances can be classified by their properties, including ~~their melting temperature, density, hardness, and thermal and~~ electrical conductivity.

Driving Questions

1. What does it mean to be a conductor? Insulator? Semiconductor?
2. In what materials will current flow?

Learning Objectives

1. Materials can be conductors, semiconductors or insulators (nonconductive).
2. Electrical conductors allow electrons to move freely.
3. With some exceptions, metals tend to be conductors, metalloids/semimetals tend to be semiconductors and nonmetals tend to be insulators.
4. Conductivity is not affected by shape.

Conductivity Detectives... Scavenger Hunt

Work in groups of 2 or 3.

Use the electrical conductance meter to measure the conductivity of each sample. Touch both electrodes to your sample. The LED will give you a measure of the relative conductivity:

Bright and blinking → high conductivity (conductor)
Dim → low conductivity (semi-conductor)
Off → no conductivity (insulator)

Record your findings in your notebook. Find neat things on your own for S-X. Pool your results with two other groups.

	Prediction	Observation		Prediction	Observation
A Copper wire			M Plastic silverware		
B Copper cylinder			N Glass rod		
C Aluminum cylinder			O Germanium chunk		
D Tin strips			P Your arm		
E Graphite rods			Q Your finger		
F Graphite chunk			R A Pen		
G Silicon chunk			S		
H Plastic strips			T		
I Cardboard strips			U		
J Wood strips			V		
K Rubber block			W		
L Amorphous carbon			X		

Possible Alternatives:

You may want to include solutions as well (tap water, pure water, salt water, sugar water would all be interesting).

Quick follow up questions:

1. What trends did you see?
2. What anomalies did you see?
3. Amorphous carbons and graphite are both forms of carbon. What could explain their electrical conductivity differences (if any)?
4. What roll does the shape of a material seem to play in electrical conductivity?
5. What tips would you give a peer attempting this exercise?
6. What tips would you give a student attempting this exercise?

7. Which substance(s) would make the best electrical wire in a light bulb: Plastic, Glass, Silicon, or Graphite? Justify your answer using specific experimental data.
8. Which substance(s) would make the best insulators to coat a wire in a light bulb: Plastic, Glass, Silicon, or Graphite? Justify your answer using specific experimental data.

Practical Application Extension questions:

1.) What materials do you often see in wire? Can you explain why folks use these materials?

Instructor Notes: Conductivity Detectives... Scavenger Hunt

This activity is relatively bullet proof. Trouble shooting the electrical conductance meter is straight forward. You can test your conductance meter before starting by measuring the conductance of a copper wire and your arm. The copper wire should register as "highly conductive" and your arm should register as "non-conductive".

Safety
None of the materials used in this exercise pose significant safety risks.

Materials
- Electrical conductance meter
- Test Samples

Some subset of:

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I Cardboard strips			U		
J Wood strips			V		
K Rubber block			W		
L Amorphous carbon			X		

Feel free to embellish if these materials are not available.

Notes