

Copper or Carbon? That Is the Question

Problem

Materials scientists work to find the best materials for different products. In this lab, you will look for an answer to the following problem: How do the properties of copper and graphite determine their uses? You will compare the properties of a copper wire and a pencil lead. Pencil lead is made mostly of graphite, a form of the nonmetal element carbon.

Skills Focus

observing, classifying, controlling variables, drawing conclusions

Materials

1.5-V dry cell battery

250-mL beaker

stopwatch

3 lengths of insulated wire

thin copper wire with no insulation, about 5–6 cm long

2 graphite samples (lead from a mechanical pencil), each about 5–6 cm long

hot plate

water

flashlight bulb and socket

Procedure



Review the safety guidelines in Appendix A of your textbook.

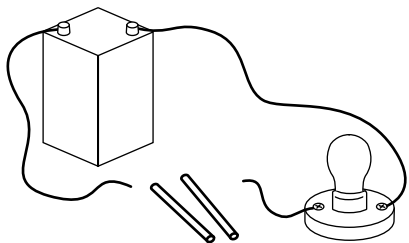
1. Fill a 250-mL beaker about three-fourths full with water. Heat it slowly on a hot plate. Let the water continue to heat as you complete Part 1 and Part 2 of the investigation.

Part 1 Physical Properties

2. Compare the shininess and color of your copper and graphite samples. Record your observations on a separate sheet of paper.
3. Bend the copper wire as far as possible. Next, bend one of the graphite samples as far as possible. Record the results of each test on a separate sheet of paper.

Part 2 Electrical Conductivity

4. Place a bulb into a lamp socket. Use a piece of insulated wire to connect one pole of a dry cell battery to the socket, as shown in the diagram on the next page.

Elements and the Periodic Table ▪ *Consumer Lab*

5. Attach the end of a second piece of insulated wire to the other pole of the dry cell battery. Leave the other end of this wire free.
6. Attach the end of a third piece of insulated wire to the other pole of the lamp socket. Leave the other end of this wire free.
7. Touch the free ends of the insulated wire to the ends of the copper wire. Record your observations of the bulb on a separate sheet of paper.
8. Repeat Step 7 using a graphite sample instead of the copper wire.

Part 3 Heat Conductivity

9. Turn off the hot plate.
10. Hold one end of a graphite sample between the fingertips of one hand. Hold one end of the copper wire between the fingertips of the other hand. **CAUTION:** *Be careful not to touch the beaker.*
11. Dip both the graphite and copper wire into the hot water at the same time. Allow only about 1 cm of each piece to reach under the water's surface. From your fingertips to the water, the lengths of both the graphite sample and the copper wire should be approximately equal.
12. Time how long it takes to feel the heat in the fingertips of each hand. Record your observations on a separate sheet of paper.

Analyze and Conclude

Write your answers on a separate sheet of paper.

1. **Observing** Compare the physical properties of copper and graphite that you observed.
2. **Classifying** Based on the observations you made in this lab, explain why copper is classified as a metal.
3. **Controlling Variables** What parameter was controlled in Step 11 of the procedure? Explain why it was important to control this parameter.
4. **Drawing Conclusions** Which of the two materials, graphite or copper, would work better to cover the handle of a frying pan? Explain your choice.
5. **Communicating** Write a paragraph explaining why copper is better than graphite for electrical wiring. Include supporting evidence from your observations in this lab.

More to Explore

Research other uses of copper in the home and in industry. For each use, list the physical properties that make the material a good choice.