Name _____ Class _____ Date _____

Using Specific Heat to Analyze Metals

In this lab, you will determine the specific heat of steel and aluminum. Then, you will use specific heat to analyze the composition of a metal can.

Problem How can you use specific heat to determine the composition of a metal can?

Materials

- 10 steel bolts
- balance
- 50-cm length of string
- clamp
- ring stand
- boiling water bath (shared with class)
- thermometer
- 500-mL graduated cylinder
- ice water
- foam cup with lid
- aluminum nails
- crushed can

Skills Calculating, Designing Experiments

Procedure

Part A: Determining Specific Heat

1. Measure and record the mass of 10 steel bolts.

DATA TABLE

	Water	Steel Bolts	Aluminum Nails
Mass (g)			
Initial temperature (°C)			
Final temperature (°C)			
Specific heat (J/g • °C)	4.18		

2. Tie the bolts to the string. Use a clamp and ring stand to suspend the bolts in the boiling water bath. **CAUTION:** *Be careful not to splash boiling water.* After a few minutes, record in the data table the water temperature as the initial temperature of the bolts.

3. Use a graduated cylinder to pour 200 mL of ice water (without ice) into the foam cup. Record the mass and temperature of the ice water. (*Hint:* The density of water is 1 g/mL.)

4. Use the clamp to move the bolts into the cup of ice water. Cover the cup and insert the thermometer through the hole in the cover.

5. Gently swirl the water in the cup. Record the highest temperature as the final temperature for both the water and the steel bolts.

6. Calculate and record the specific heat of steel. (*Hint:* Use the equation $Q = m \times c \times \Delta T$ to calculate the energy the water absorbs.)

7. Repeat Steps 2 through 6 with aluminum nails to determine the specific heat of aluminum. Use a mass of aluminum that is close to the mass you used for the steel bolts.

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Part B: Design Your Own Experiment

8. **Designing Experiments** Design an experiment that uses specific heat to identify the metals a can might be made of.
9. In the space below, construct a data table in which to record your observations. After your teacher approves your plan, perform your experiment.

Analyze and Conclude

1. **Comparing and Contrasting** Which metal has a higher specific heat—aluminum or steel?

_____

_____

2. **Drawing Conclusions** Was the specific heat of the can closer to the specific heat of steel or of aluminum? What can you conclude about the material in the can?

_____

_____

3. **Evaluating** Did your observations prove what the can was made of? If not, what other information would you need to be sure?

_____

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4. **Inferring** The can you used is often called a tin can. The specific heat of tin is 0.23 J/g°C. Did your data support the idea that the can was made mostly of tin? Explain your answer.

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