Lab 16.1a
Determining Specific Heats

I. PURPOSE
To learn the process for determining specific heats of unknown substances.

II. MATERIALS
1. Electronic balance
2. Calorimeter cup
3. 250 ml beaker
4. Bunsen burner
5. Iron ring
6. Wire gauze
7. Crucible tongs
8. Thermometer
9. Metal sample

III. PROCEDURES
1. Record the mass of each sample.
2. Fill the calorimeter cup will 100 mL of water.
3. Fill a 250 ml beaker 3/4 full of tap water. Place the samples in the beaker on the platform provided.
4. Bring the water bath to a boil using your Bunsen burner. Allow the samples to come to equilibrium by allowing them to sit for approximately 5 minutes.
5. Record the initial temperatures of the boiling water “T_i, Sample (°C)” and cool water “T_i, Calorimeter (°C)”.
6. Remove a sample from the boiling water, using the tongs. Shake it gently to remove water, and quickly put it into the calorimeter. Allow the system to come to equilibrium. While it sits, gently agitate the water with the thermometer for a minute. Record the final temperature “T_f, Calorimeter (°C)” of the system.
7. Repeat steps 1-6 for a total of three different samples.

IV. PRE-LAB QUESTIONS
1. Explain the difference between heat and temperature.
2. Explain the unit used for specific heat.
3. Using a table of specific heats, determine if specific heat exhibits any periodic trends.
4. The platform mentioned in Step 3 is a screen to keep the sample off the bottom of the beaker. Why is this platform necessary?

V. DATA & CALCULATIONS
A. DATA

<table>
<thead>
<tr>
<th>Sample</th>
<th>Mass (g)</th>
<th>T_i, Sample (°C)</th>
<th>T_i, Calorimeter (°C)</th>
<th>T_f, Calorimeter (°C)</th>
<th>ΔT Calorimeter (°C)</th>
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</thead>
<tbody>
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B. CALCULATIONS
1. Using $Q = m \cdot c_p \cdot \Delta T$ calculate the heat in Joules gained by the water and the specific heat of each metal sample (m = mass of water, $c_p =$ specific heat of water, $\Delta T =$ change in temperature of water).
2. Using accepted values provided by the instructor, calculate the percent error for each metal sample.

VI. QUESTIONS & DISCUSSION OF ERROR
A. QUESTIONS
1. How would the data differ if metal samples with twice the mass were used?
2. When the final temperature is achieved, what is occurring at the molecular level between the metal sample and the water?
3. What considerations should be made if a substance other than water were to be used in the calorimeter?
4. Explain why thermal insulators are chosen based on their specific heat.

B. DISCUSSION OF ERROR

VII. CONCLUSION

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