Substances vary widely in their abilities to resist temperature change when absorbing or releasing heat. Water, for example, can absorb a relatively large amount of energy without significant temperature change. Iron, on the other hand, cannot. The temperature of a mass of iron will increase substantially more than the same mass of water if both masses absorb the same amount of heat.

The amount of energy required to raise one gram of water one degree Celsius is known as its specific heat capacity. You are familiar with the specific heat capacity of water (1.00 cal/g°C). Specific heat capacities are usually reported in J/g°C. Since 1 calorie = 4.184 joules, the specific heat capacity of water can also be designated as 4.184 J/g°C. Specific heat capacities of some common substances are shown in the table below.

<table>
<thead>
<tr>
<th>Substance</th>
<th>C_s</th>
</tr>
</thead>
<tbody>
<tr>
<td>liquid water</td>
<td>4.184 J/g°C</td>
</tr>
<tr>
<td>ethanol (ethyl alcohol)</td>
<td>2.438 J/g°C</td>
</tr>
<tr>
<td>table salt (NaCl)</td>
<td>0.865 J/g°C</td>
</tr>
<tr>
<td>aluminum (solid)</td>
<td>0.89 J/g°C</td>
</tr>
<tr>
<td>copper (solid)</td>
<td>0.387 J/g°C</td>
</tr>
<tr>
<td>iron (solid)</td>
<td>0.449 J/g°C</td>
</tr>
<tr>
<td>silver (solid)</td>
<td>0.235 J/g°C</td>
</tr>
<tr>
<td>mercury (liquid)</td>
<td>0.139 J/g°C</td>
</tr>
</tbody>
</table>

Specific heat capacities can be used to help identify unknown substances, as you will see in an example below. They also are considered in the design of items where resistance to temperature change upon heating is important.

The formula \( q = m \cdot C_s \cdot \Delta T \) where \( q \) is the heat transferred, \( m \) is the mass of the sample, \( C_s \) is the specific heat capacity, and \( \Delta T \) is the change in temperature is useful for solving problems involving specific heat capacity.

1. How many joules is one calorie?  
   Ans. ______________________

2. How much energy is required to raise the temperature of 50.0 grams of water 10.0 °C? (Express your answer in joules!)  
   Ans. ______________________

3. If the same amount of energy (the correct answer to #2) were absorbed by 50.0 grams of ethanol, how much would the temperature of the ethanol increase?  
   Ans. ______________________

3. If the same amount of energy (the correct answer to #2) were absorbed by 50.0 grams of iron, how much would the temperature increase?  
   Ans. ______________________

4. Which substances require little heat to increase significantly in temperature, substances with high heat capacities, or substances with low heat capacities?  
   Ans. ______________________

5a. An experiment reveals that 125.0 grams of an unknown metal increases in temperature from 22.0 °C to 43.6 °C upon absorbing 640 joules. What is the specific heat capacity of the metal?  
   Ans. ______________________
b. What is the metal? (Use the table above, and remember some error is associated with every experiment)

Ans. ________________

Ans. ________________

6. A 250 g sample of mercury releases 0.555 kJ. If the initial temperature of the mercury was 24 °C, what is the final temperature of the mercury?

Ans. __________________

7 a. A 1.0 kg chunk of iron cools from 95 °C to 25 °C. How much energy does the iron release into the surroundings?

Ans. __________________

b. Is the process in 7a exothermic or endothermic for the iron? (assume the iron is the system, and the environment the surroundings)

Ans. __________________

9. A 12.45 g piece of metal at 99.4 °C is placed into 100.0 g of water at 22.0 °C. If the final temperature of the water is 29.5 °C, what is the heat capacity of the metal?

Ans. __________________

10. A 50.0 g piece of metal at 90.0 °C is placed into 100.0 g of water at 23.1 °C. The temperature of the water increases a total of 4.5 °C. What is the heat capacity of the metal?

Ans. __________________

\Summary Questions:

1. What is specific heat capacity?

2. What equation is convenient for solving problems involving specific heat capacity and energy flow?

3. Would the handle of a cooking utensil best be made of a substance with a high or low heat capacity? Explain.

<table>
<thead>
<tr>
<th>IRO</th>
<th>many</th>
</tr>
</thead>
<tbody>
<tr>
<td>42.1</td>
<td>17.1</td>
</tr>
<tr>
<td>.60</td>
<td>30.5</td>
</tr>
<tr>
<td>20.8</td>
<td>93.1</td>
</tr>
</tbody>
</table>

°C °C °C °C J J J/g°C J/g°C J/g°C J/g°C

I have had all my questions on this assignment answered through self-study or asking. I understand the concepts, and am ready to receive credit.

Signature _________________________________