Name: _____ Date: _____ Class: _____

Specific Heat Capacity Handout

Objectives

- Calculate the specific heat capacity of a liquid.
- Determine the amount of energy required to heat a liquid to a particular temperature.

Data Collection

Mass of the iron:	
Initial temperature of the iron (in boiling water):	
Final temperature of the iron:	
Mass of hot chocolate liquid:	
Initial temperature of hot chocolate liquid:	
Final temperature of the hot chocolate liquid:	

Hot Chocolate Calculations

1. Find the specific heat (SH) of the hot chocolate using the equation: $Q = mc\Delta T$.
   a. Find ΔT for the hot chocolate.

   b. Plug in known variables for the hot chocolate (HC).

2. Since you have two unknowns, you cannot solve for the specific heat just yet. Put the known variables for iron into the equation: $Q = mc\Delta T$.
   a. First, find ΔT for the iron.

   b. Plug in known variables for the iron (SH iron = 0.45 J/g °C).

3. We can assume that the heat lost by the iron equals the heat gained by the hot chocolate, so Q (heat energy) should be the same for the iron and the hot chocolate.
   a. Substitute Q for the iron into the Q for the hot chocolate equation.

   b. Solve for the specific heat of hot chocolate.

4. To heat the hot chocolate to the optimal temperature of 57 °C, how much energy is needed?

Analysis Questions

1. Water has a specific heat of 4.18 J/g °C. How does this compare to the specific heat of the hot chocolate? If the two values are different, provide a possible explanation as to why.

2. According to the *The American Association of Cereal Chemists* handbook, "Dairy-Based Ingredients" by Ramesh Chandan, skim milk has a specific heat of 3.97 J/g °C, whole milk has a specific heat of 3.89 J/g °C, and cream has a specific heat of 3.35 J/g °C.
   a. Why do you think that the specific heat for milk is different than cream?

   b. If you used whole milk instead of water to make the hot chocolate, how would that impact the cooling rate of the hot chocolate?

   c. If you wanted your hot chocolate to cool faster after it is made, which type of liquid would you use in the mixture? Explain your answer.

3. Copper has a specific heat of 0.38 J/g °C. If you used the same mass of copper instead of iron in the experiment, how would this affect the hot chocolate?