



The goal of this experiment is to investigate what happens when a piece of hot metal is added to a sample of water at or near room temperature. NOTE: I expect each student to collect their own, unique set of data for the experiments in this activity.

#### Activity 1. Comparison of the heat exchanged by metals

Start the simulation

([http://www.chem.iastate.edu/group/Greenbowe/sections/projectfolder/flashfiles/thermohem/heat\\_metal.html](http://www.chem.iastate.edu/group/Greenbowe/sections/projectfolder/flashfiles/thermohem/heat_metal.html)). In the upper left corner of the simulation is a list of six metals, four with names and two unknown metals.

For the experiment select two metals to work with according to the table below;

OSU Student Number (last digit)	Metal #1	Metal #2
0 or 1	Silver	Copper
2 or 3	Gold	Iron
4 or 5	Silver	Iron
6 or 7	Copper	Gold
8 or 9	Iron	Copper

#### ACTIVITY #1:

Make a prediction of which of the two metals assigned to you will raise the temperature of water the highest.

You need to make a fair comparison. For example if you use 10 g of metal #1 at 80°C, and 50 mL of water at 25°C, you should use 10 g of metal #2 at 80°C and 50 mL of water at 25°C. The initial temperature of the metal ( $T_i$ ) should be greater than the initial temperature of the water ( $T_i'$ ).

Complete the following:

- 1a. Identify your Metal #1: \_\_\_\_\_ Identify your Metal #2: \_\_\_\_\_
- 1b. Prediction (which metal will raise the temperature of the water the highest?): \_\_\_\_\_
- 1c. Explain how you arrived at your answer.

2. Use the computer simulation to do your experiment. Record your data below. The specific heat of water is  $4.18 \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}}$ . The density of water is 1.00 g/mL.

DATA: (Enter the name of one of your metals, and record the initial mass and temperature for both the metal and for water. Click on the Start button and observe what happens. Record the final temperature for the metal and for water. Repeat this in the second table for the other metal assigned to you.)

Experiment #1			
	Mass	Initial Temperature	Final Temperature
Metal _____ (#1)			
Water			

Experiment #2			
	Mass	Initial Temperature	Final Temperature
Metal _____ (#2)			
Water			

Did your prediction(1c) match your experimental results? Explain.

In the two experiments above, heat was transferred from

\_\_\_\_\_ to \_\_\_\_\_

CALCULATIONS:

- 3a. For each experiment (in Part 2) calculate the heat that was exchanged (absorbed or released) by the water. You may use the formula  $q = mc\Delta T$ . Show all steps and be sure to include units in all steps and in your answer. Be sure to indicate the "sign" (i.e. positive or negative).

Experiment #1

Experiment #2

- 3b. For each experiment (in Part 2) calculate the heat that was exchanged (absorbed or released) by the metal. Show all steps and be sure to include units in all steps and in your answer. Be sure to indicate the "sign" (i.e. positive or negative).

Experiment #1

Experiment #2

- 3c. Compare the values of the heat exchanged by the water and the metal. Within experimental error, was the Law of Conservation of Energy obeyed?

Experiment #1

Experiment #2

ACTIVITY #2:

4a. If you double the mass of Metal #1 in Part 2, keeping everything else the same, predict what will happen to the  $\Delta T$  of the water ?

4b. If you double the mass of water in Part 2, keeping everything else the same, predict what will happen to the  $\Delta T$  of the water?

Do these two experiments using the computer simulation.

DATA:

Experiment #1			
	Mass	Initial Temperature	Final Temperature
Metal _____ (#1)			
Water			

Experiment #2			
	Mass	Initial Temperature	Final Temperature
Metal _____ (#2)			
Water			

Did your predictions (in Part 4) match the results of the computer simulation? Explain.

ACTIVITY #3: Determination of the specific heat of an unknown metal.

5. Select one of the unknown metals (Metal X or Metal Y) to work with according to the table below;

OSU Student Number (last digit)	Unknown Metal
0 - 4	X
5 - 9	Y

Your Metal is, \_\_\_\_\_

Design and carry out an experiment that will help you determine the specific heat of this metal.

Write the experimental procedure you used to determine the specific heat of the unknown metal:

What observations did you collect?: (You may or may not need all of the cells below.)


Using your observations indicate the Evidence you have to support the Claim you will make below.

Claim: The specific heat of metal \_\_\_\_\_ is \_\_\_\_\_.

