**Virtual Calorimetry Activity**

**Heat Transfer between a Metal and Water**

**Purpose:**

The purpose of this activity is to perform a calorimetry experiment and analyze the transfer of heat from one substance to another. The heat transfer will be quantified using Q = CmT.

**Directions:**

The website with the calorimeter simulation is from Iowa State University. Go to the following website: <http://group.chem.iastate.edu/Greenbowe/sections/projectfolder/flashfiles/thermochem/heat_metal.html> For all calculations, show work and circle your final answers!

**Problem 1**

1. Set the following parameters:
   * Metal = iron
   * Mass = 75 g
   * Temperature = 202 oC
   * Water mass = 50 g
   * Water temp = 25.4 oC
2. Record the specific heat of iron and water from the screen –

Iron \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Water \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Click the “Start” button. A temperature v. time graph will open and a digital thermometer will display the temperature. What happens to the temperature of the water when the metal is first immersed? What happens to the temperature at the end of the experiment?
2. Record the final temperature of the water.

Final temperature of water \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What is the final temperature of the iron metal? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Calculate the heat lost by the iron with Q = CmT.
3. Calculate the heat gained by the water with Q = CmT.
4. Compare the values you calculated from #5 and #6. Explain how this demonstrates the law of conservation of energy.
5. How long will heat transfer from the hot metal object to the cooler water? (Hint: look at the graph)
6. Complete the following tables and calculations using the website. Show all work!

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|  | **Problem 2** | **Problem 3** |
| Identity of Metal |  |  |
| Metal Mass |  |  |
| Metal Initial Temperature |  |  |
| Water Mass |  |  |
| Water Initial Temperature |  |  |
| Water Final Temperature |  |  |
| Metal Final Temperature |  |  |
| Heat change of Metal |  |  |
| Heat change of Water |  |  |

1. Challenge Problem: Metal X has a mass of 58.0 g and an initial temperature of 192.00 oC. The metal is immersed in a calorimeter with 65.00 g of water at 22.60 oC. The specific heat of water is 4.18 J/g oC. Run the simulation to find the final temperature. Calculate 1) the amount of heat gained by the water and 2) the specific heat of the metal. Which metal could this be?
2. Mastery Problem: *Do not use the simulation for this problem.*

Metal Y has a specific heat of 0.291 J/gK. If a 45.0 g sample of this metal is placed in 105 g of water in a calorimeter. The initial temperature of the metal is 203 oC and the initial temperature of the water is 29.1 oC. What is the final temperature of the system?

1. Using the data you have collected, describe the direction of heat flow in a closed system.
2. Analyze the direction of heat flow in the calorimeter using the terms *exothermic* and *endothermic*.