Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Lab: Calorimetry***

In this lab, we’ll use an online simulation of calorimetry, the measurement of heat transfer, to predict the final temperature when a heated sample of known material is placed in water and allowed to equilibrate, and identify an unknown material based on calculating its specific heat.

**Part I: Predicting Final Temperature When Cooling a Known Sample**

1. Consider the following situation. A 50-g block of iron is placed in a beaker of water, which is then brought to a boil using a hot plate. The iron is then placed in 200-g of water which is at room temperature (20°C). If no heat is lost to the surroundings, what should the final temperature of the iron and water be after reaching thermal equilibrium? Show all work below.

*TFinal* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Now let’s test our calculations in a simulation! Go to the following website:

<https://media.pearsoncmg.com/bc/bc_0media_chem/chem_sim/calorimetry/Calor.php>

1. Click the “Experiment” tab, then click the button: “Run Experiment”
2. We’ll be heating a solid, so click the “Solids’ tab and then choose Iron.
3. Set the mass of the iron to be 50 g, and set its temperature to be 100°C.
4. Click “Next”.
5. Choose Water as your liquid. Set its mass to 200 g and temperature to 20°C.
6. Under “Run Experiment” select the box for “Show Graph View”. Then click “START”.
7. What is the final temperature of the iron and water after thermal equilibrium is reached?

*TFinal* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Find the %-error between your answers to #1 and #9. Show all work below.

*%-error* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part II: Identifying an Unknown Sample**

1. Reset the Simulation.
2. Repeat exactly what you did last time, except this time chose “Unknown Metal I” instead of iron. Do **NOT** click the box to show specific heat.
3. What is the final temperature after allowing the system to reach thermal equilibrium?

*TFinal* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Calculate the specific heat of Unknown Metal I. Show all work below:

*cUnknown Metal I* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Identify the unknown metal: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Imagine this experiment had been conducted using real equipment in a laboratory rather than in a simulation. What would you expect to be the most significant source of error or uncertainty in this experiment?
3. Further imagine that this experiment is not only conducted using real equipment, but also a sealed calorimeter vessel is unavailable. Instead a simple Styrofoam cup was used to hold the cool water. What major additional source of error must now be acknowledged?
4. Would the experiment described in #17 most likely result in a calculation of specific heat of the unknown sample that is too high, too low, or would either outcome be equally likely? Explain.