Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lab: Calculating Specific Heat of an Unknown Metal**

The purpose of this lab is to identify an unknown metal by finding the specific heat capacity of an unknown metal.

Hypothesis: Based on observations, the unknown metal will be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which has a specific heat capacity of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Materials: hot plate, beaker, 2 thermometers, Styrofoam calorimeter with lid, metal tongs, scale, water, unknown metal, 400mL beaker.

Procedure:

1. Turn hotplate on a setting between medium and high heat setting. Fill beaker about half full with water from the faucet (the exact amount of this water does not matter, its only purpose is to help in finding the initial temperature of the metal). Place the beaker on the hot plate and place one thermometer in the beaker.

2. While water is coming to a boil mass the unknown metal on a scale and record. Gently place the metal into the beaker using the metal tongs.

3. Measure out 400 mL of room temperature water and pour it into the Styrofoam cup calorimeter. Record the exact volume of water as the mass of water (remember 1mL=1g for water)

4. Use the 2nd thermometer to measure the temperature of the water in the calorimeter. Record this as the initial temperature of water.

5. Once the water has begun to boil record the temperature of the boiling water as the initial temperature of the metal. The metal in the boiling water will have the same temperature as the boiling water.

6. Very quickly transfer the hot metal to the calorimeter using the metal tongs. Quickly put the lid on the calorimeter and place the 2nd thermometer through the lid to measure the temperature change.

7. The temperature of the water should rise after the metal is added. The highest temperature reached is both the final temperature for the metal and the water.

8. Repeat the process 2 more times. The mass of the metal should be the same for each trial.

9. Turn off hotplate and dry off the metal and the inside of the calorimeter.

10. Calculate the specific heat capacity of the metal using the equation q = mcΔT. q= heat energy in joules, m=mass in grams, c= specific heat capacity in joules per grams degrees Celsius, ΔT= change in temperature in degrees Celsius.

11. Use the chart on the lab table to identify the metal after averaging the specific heat capacities for each trial.

Data:

Trial 1:

|  |  |
| --- | --- |
| Metal | Water |
| Mass, m= | Mass, m= |
| Specific heat, c= x | Specific heat, c= |
| Initial temperature, Ti= | Initial temperature, Ti= |
| Final temperature, Tf= | Final temperature, Tf= |

Trial 2:

|  |  |
| --- | --- |
| Metal | Water |
| Mass, m= | Mass, m= |
| Specific heat, c= x | Specific heat, c= |
| Initial temperature, Ti= | Initial temperature, Ti= |
| Final temperature, Tf= | Final temperature, Tf= |

Trial 3:

|  |  |
| --- | --- |
| Metal | Water |
| Mass, m= | Mass, m= |
| Specific heat, c= x | Specific heat, c= |
| Initial temperature, Ti= | Initial temperature, Ti= |
| Final temperature, Tf= | Final temperature, Tf= |

Calculations: Use q=mcΔT for water then set the negative q equal to the mcΔT for the metal and solve for the specific heat capacity (c) of the metal. You could also use the formula mcΔT=-mcΔT

Trial 1

Trial 2

Trial 3

Average the specific heat capacities from the three trials here:

The identity of the unknown based on this specific heat capacity is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Conclusion: Write a 5-sentence conclusion. Discuss whether the results supported or rejected the hypothesis. Discuss heat flow during the experiment. Discuss ways in which this experiment could be improved to be more efficient.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| **Element/Compound** | **Specific Heat Capacity** |
|  |  |
| **lithium** | **3.56** |
| **sodium** | **1.23** |
| **magnesium** | **1.020** |
| **aluminum** | **0.900** |
| **potassium** | **0.75** |
| **sulfur** | **0.73** |
| **calcium** | **0.650** |
| **steel** | **0.460** |
| **nickel** | **0.440** |
| **zinc** | **0.39** |
| **copper** | **0.385** |
| **silver** | **0.240** |
| **tin** | **0.21** |
| **lead** | **0.160** |
| **mercury** | **0.14** |
| **gold** | **0.129** |