

## Lab 3: Pre-Lab Questions

1. Water and steam are both 100 °C when water is boiling, but a burn from steam is worse than a burn from the water.

Hypothesize why this is true.

**Steam contain more heat energy than boiling water at 100 °C that is why a burn from steam is worse than a burn from the water**

2. A 10 g ice cube, initially at 0 °C, is melted in 100 g of water that was initially 20 °C. After the ice has melted, the equilibrium temperature is 10.93 °C. Calculate:

a. The total heat lost by the water (the specific heat for water is 4.186 J/g•°C).

$$100 * 4.186 *(20-10.93) = 3796.7 \text{ Joules}$$

b. The heat gained by the ice cube after it melts (the specific heat for ice is 2.093 J/g•°C).

$$10*2.093*(10.93-0) = 228.77 \text{ Joules}$$

c. The heat it took to melt the ice (Hint: it takes 334 J of heat energy to melt 1 g of ice).

$$10 * 334 = 3340 \text{ Joules}$$

3. Inside a calorimeter is 100 g of water at 39.8 °C. A 10 g object at 50 °C is placed inside of a calorimeter. When equilibrium has been reached the new temperature of the water and metal object is 40 °C. What type of metal is the object made from?

$$(-100g * 4.186J/gC* 0.2C) /(10g * -10 C) = 0.836J/gc$$

4.

## Experiment 1 Data Sheet

Table 2: Mass

	Mass (g)
Water	48 g
Unknown Metal Strip	17.8 g

Table 3: Specific Heat Data

Time (minutes)	Temperature (°C)		
	Trial 1	Trial 2	Trial 3
Initial	27	22	22
5 minutes	26	27	23
6 minutes	24	24	23
7 minutes	24	26	25
8 minutes	25	24	25
9 minutes	26	25	24
10 minutes	25	24	23
<b>Average Specific Heat and Identity of the Unknown Metal:</b>	The average specific heat of the material is 0.921 J/g°C And the identity of the metal is Aluminum		

## Show calculations here:

## Specific Heat Calculations

Calculation	Trial 1	Trial 2	Trial 3
Highest Water Temp	27	27	25
$\Delta T_{\text{water}} = T_{\text{highest water}} - T_{i(\text{water})}$	5	5	3
$\Delta T_{\text{metal}} = T_{\text{highest water}} - T_{i(\text{metal})}$	1	5	1
Water Specific Heat	4.186 J/g°C	4.186 J/g°C	4.186 J/g°C
Heat Water Absorbed ( $q_{\text{water}} = m_{\text{water}} \cdot C_{\text{water}} \cdot \Delta T_{\text{water}}$ )	228	227.9	228
Heat Lost by Metal ( $-q_{\text{metal}} = q_{\text{water}}$ )	3796	3796	3796
Metal Specific Heat ( $q_{\text{metal}} = m_{\text{metal}} \cdot C_{\text{metal}} \cdot \Delta T_{\text{metal}}$ )	0.922	0.921	0.921

The average specific heat of the material is =  $(0.922 + 0.921 + 0.921) / 3 = 0.921$

**Substance C- Aluminum**

Table 4: Calorie Testing

	Initial	Final
Mass of Marshmallow	69.9g	30 g
Temperature	94 °C)	85.6 °C)

## Lab 3: Post-Lab Questions

1. Calculate the thermal energy in the burnt marshmallow based on the following information:

$$q = m \times C \times \Delta T$$

$$4.184 \times 39.9 \times 8.4 = 1402.31 \text{ Joules}$$

2. Is there a relationship between the final mass of the marshmallow and an increase in temperature of the water inside of the can? If so, explain your experimental observations.

**Yes, there is a relationship. As the mass of the marshmallow decreases, the temperature of the water is increasing.**

3. What is the purpose of cutting the marshmallows into four quarters? How might the experimental results have changed if the marshmallow was burned in one piece?

**Cutting of the marshmallows allows the marshmallows to be completely burned and faster. The results would have been different if marshmallow was burned whole as the temperature of the water would be increasing way faster than the decrease in mass of the burning marshmallow.**

4. Based on the design of the experiment and on your percent error, would you have designed this experiment differently? Explain why or why not, and if applicable, how you would design it differently.

**I would have designed the experiment differently by cutting the marshmallows into smaller pieces for burning to take place faster and burn more marshmallow.**

5. Does toasting bread change the amount of calories in the bread (i.e., does a slice of toast have more/less calories than a slice of bread)? Explain your answer using the data in Table 4.

**The heat used during toasting of bread decreases the calories which means toast has fewer calories than actual bread.**