Riverside Community College

Physics 4-C

LABORATORY REPORT 9

Materials have what!!!!!

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Professor

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1 Introduction

This lab's goal will be to experimentally find what the heat capacity of Aluminum and Brass

2 Methodology

2.1 Setup

1. We will use a 15.6 gram Styrofoam calorimeter,container that will hold water.
2. A Vernier wireless thermometer.
3. Six 50 gram Brass pieces attached to a string, held in ice water to make the metal 0 °c .
4. Six 20 gram Aluminum pieces attached to a string as well held in the same ice water configuration.
5. Towel to help the lab equipment stay dry

2.2 Procedure

The procedure stays the same for both the Brass and Aluminum pieces, with the water changed when the different metal was used.

1. We started off by measuring the mass of water.[1]
2. We then measured and logged the initial temperature of the water, as well as noting that our ice water configuration has our metal's initial temperature to be 0 °c.
3. We then placed the piece of water into our Calorimeter and waited for the temperature to reach an equilibrium and logged temperature.
4. Repeat 5 more times adding the same piece of metal each time.

[1]Taking the Mass of the Calorimeter and water and subtracting that by the Mass of the Calorimeter.

3 Data

Tabulating and graphing our values:

Mass Brass (g)	T°C	$\frac{T_w - T}{T}$
50	21.1	0.0189
100	20.8	0.0336
150	20.4	0.0521
200	20.1	0.0696
250	19.85	0.0781
300	19.5	0.1025

Mass Aluminum (g)	T°C	$\frac{T_w - T}{T}$
20	24.3	0.0164
40	23.9	0.0334
60	23.55	0.0488
80	23.2	0.0646
100	22.9	0.0786
120	22.6	0.0929

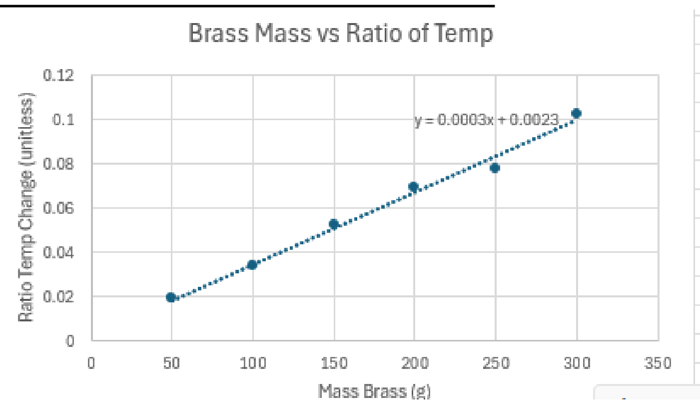

Figure 1: Brass Mass in grams vs Ratio Temperature

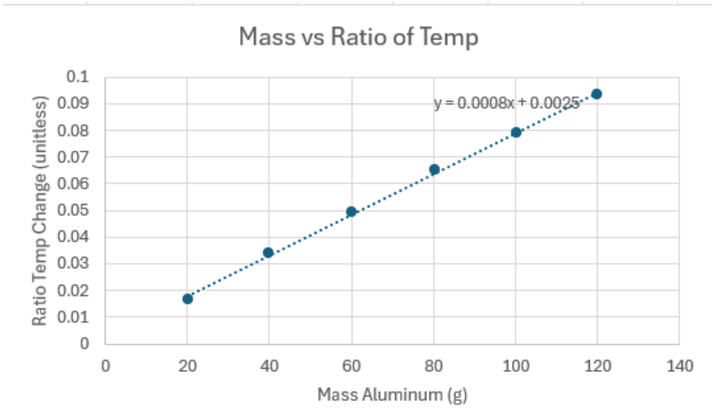

Figure 2: Aluminum Mass in grams vs Ratio Temperature

4 Analysis

4.1 Calculations

1. We started off assuming our Calorimeter was a perfect insulator, in other words no heat going in and no heat going out.

2. From this we can Say $Qnet = 0$ or $Q_w + Q_m = 0$.

3. Rearranging to $Q_m = -Q_w$

4. Plugging in the specific heat capacity equation where $Q = m \times c \times \Delta T$, $m_m c_m \times (T - T_m) = -m_w c_w \times (T - T_w)$. Where the T subscripts are initial temperatures for their respected metal.

5. moving around the equation, $m_w c_w \times (T_w - T) = c_m \times (T - T_m) m_m$

6. Taking a Ratio of Temperatures $\frac{T_w - T}{T - T_m} = (\frac{c_m}{c_w m_w}) \times m_m$, where we can graph the Mass of the metal vs the ratio of temperature to get a linear graph where $(\frac{c_m}{c_w m_w})$ is the slope[2]

7. Graphing and using the least square regression line on excel we find the slope $= \frac{c_m}{m_w}$, isolating the heat capacity of metal $c_m = slope \times m_w$

[2]The heat capacity of water is 1 $\frac{cal}{g°c}$

5 Result

We experimentally found our specific heat capacity of Brass to be 12.67 Joules per kg°Celsius, repeating the process of the lab we experimentally found the specific heat capacity for aluminum to be 4.50 Joules per kg°Celsius.

6 Conclusion

With this experiment we experimentally found the Heat capacity of Aluminum and Brass by leveraging quantity of heat transfer relationship to the change of temperature.

One thing to note with our data is that we assumed that the calorimeter was a perfect insulator but our Styrofoam device had imperfections with age.

7 References

[1] Dr. Russel's Lecture 5/13/24, Riverside Community College.

Special thanks to the pieces of Aluminum and Brass who aided me in this Lab.