Lab 14

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Aim - Apply the laws of thermodynamics and thermodynamic calculations

Theory - Formulas
$Q=mc\Delta T$
$Q_{system}=-Q_{surroundings}$

Where:
c=specific heat capacity
m=mass
T=temperature
Q=energy

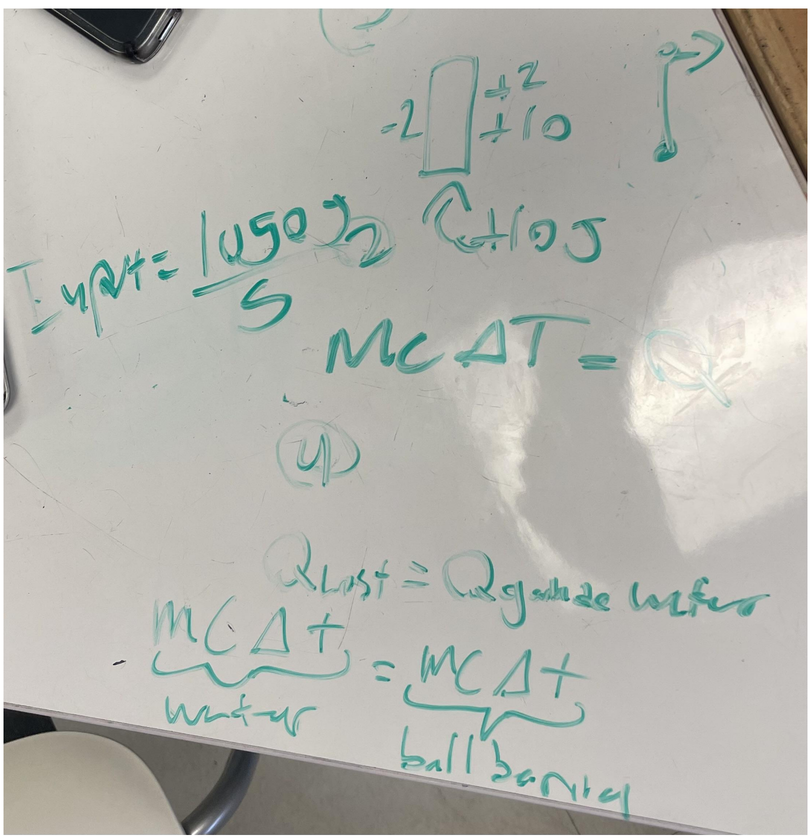
Radiative Cooling

Procedure -
1. Predicted which aluminum cylinder would cool the fastest
2. Heated up the 3 cylinders
3. Felt which one was giving off the most thermal radiation
4. Let cylinders cool at least 30ºC
5. Noted which were the coolest

Prediction - The unpainted aluminum cylinder will cool the fastest of any of the three because it has the most emissivity and a higher thermal conductivity.

Results - Analyze
Our prediction was correct, as the unpainted aluminum cylinder cooled the fastest. This is likely due to the lack of thermal insulation, and the ability of raw aluminum to quickly conduct heat. After they all cooled 30ºC, the unpainted one was significantly cooler than the other 2, while the unpainted one remained the hottest.

Calculations



<u>Efficiency of a Microwave</u>

Procedure -

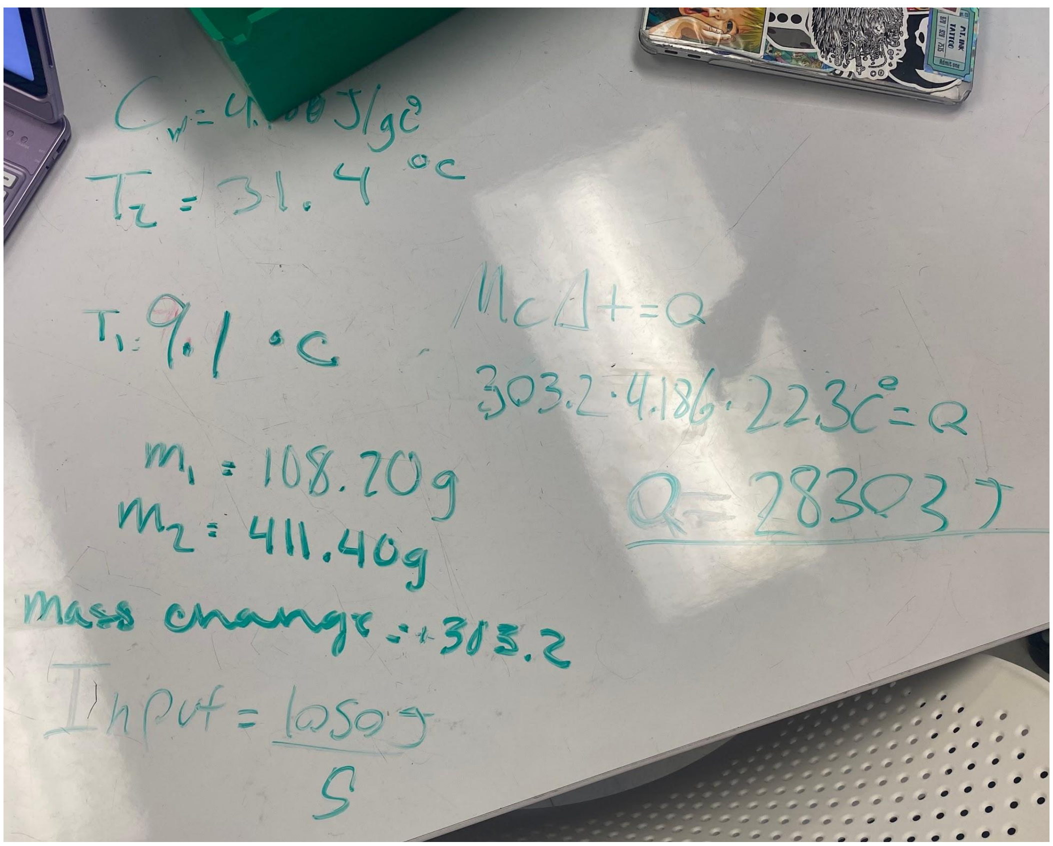
1. Checked the power of the microwave on the label
2. Put water in the microwave + heated it up until it boiled
3. Measured final temperature of the water
4. Used known specific heat of water to calculate energy absorbed
5. Calculated the efficiency of the microwave with this value

Results -

We calculated the change in energy caused by the microwave to be 28,303J and the input energy to be 63,000J

This means that we had an efficiency of 45%

Calculations -



<u>Heat Pump</u>

Procedure -

1. Crank that (like soulja boy) clockwise

2. Feel which side of the metal changed in temperature
3. Cranked the other way (YOOOOOOUUUUUUUU)
4. Felt what side changed in temperature

Results -

When the handle was cranked clockwise, the black side of the metal changed in temperature. When we cranked it counterclockwise, the red side changed. This is likely due to the way the current was flowing, and which side energy was flowing through. This shows that it acts as a heat pump, as it is taking heat from one part of the system and transferring it to another, rather than using energy to heat the whole system.

<u>Determining an Unknown Metal</u>

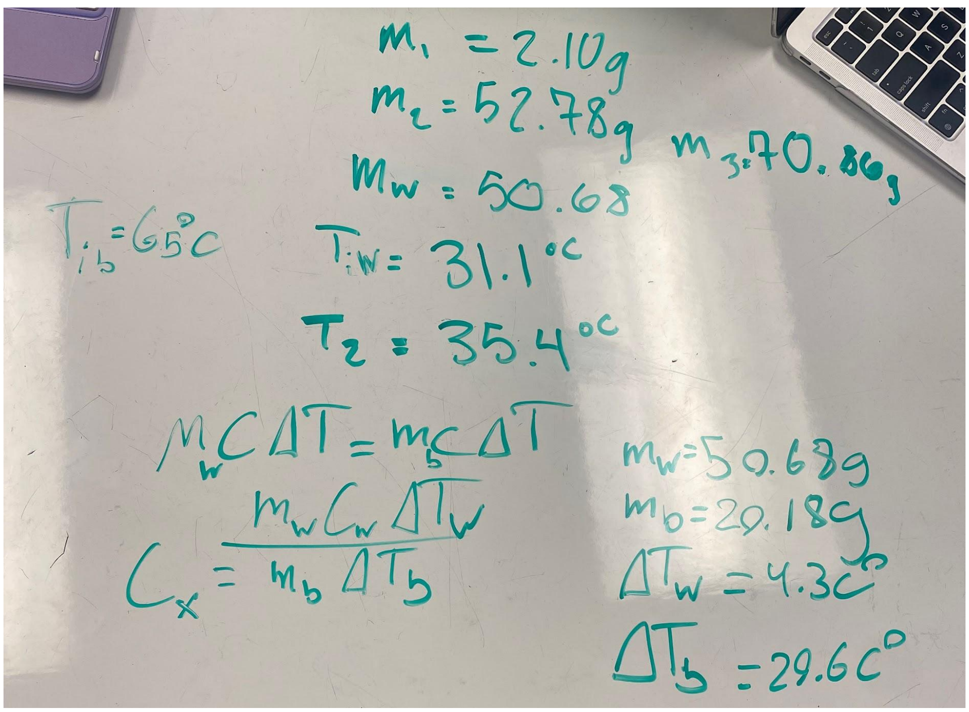
Procedure -

1. Measure mass of cup
2. Measure mass of water
3. Measure Initial temperature of water
4. Add metal beads to water
5. Measure mass of beads
6. Measure temperatures of mixed beads and water

Results -

We calculated a heat capacity of 1.527 J/gC for the unknown material. This value is too high for a metal which could be because we didn't correctly measure the change in temperature of the beads and our value could have been too small.

Calculations-



<u>Bent out of Shape</u>

Procedure - When we put the wire in the water it suddenly changes shape because he temperature change allows the wire to access new stable physical orientations. This wire is made of a polymer that does at higher temperatures it has a lower energy state.