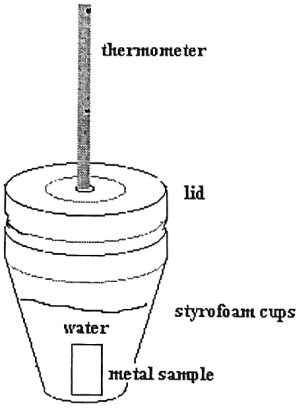
Calorimetry Explorations

Lab One - Determining the Specific Heat of an Unknown Metal

Materials you must use:

Copper mass with hook and string	Styrofoam cup and lid	Thermometer
Graduated cylinder	Balance	Hot plate
Water	Crucible Tongs	Hot water bath



Objective - Using the Law of Conservation of Energy (the First Law of Thermodynamics) and heat equations, determine the specific heat of a metal and identify what metal it is using a table of known specific heat capacities.

What you must provide -

1. Quantitative data table
2. A picture of your experimental setup, and a brief explanation of how your experimental setup allows you to solve the problem.
3. All calculations needed to find the specific heat of the metal.
4. Explain how the measured heat capacity would be affected if droplets of water were still on the metal sample when it was transferred from the boiling water bath to the calorimeter.

Lab Two - Determining the Temperature of a Bunsen Burner Flame

Materials you must use:

Bunsen Burner	Nickel Shot	Thermometer
Water	Crucible Tongs	Balance
Styrofoam Cup and Lid	Matches/Strikers	Graduated Cylinder

Objective - Using the Law of Conservation of Energy (the First Law of Thermodynamics) and heat equations, determine the initial temperature of the Bunsen burner, which is used to heat nickel shot. (use copper wire coil instead?)

What you must provide -

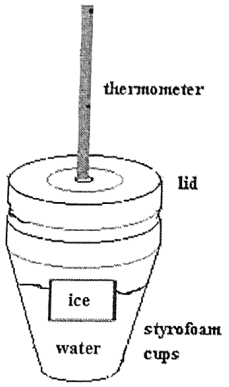
1. Quantitative data table
2. A picture of your experimental setup, and a brief explanation of how your experimental setup allows you to solve the problem.
3. All calculations needed to find the initial temperature of the Bunsen burner flame.
4. Explain how your final flame temperature would be affected if you took too long to move the heated metal shot from the flame to the calorimeter.

(I will demonstrate a direct measurement of the flame temperature for each group so you can have an accepted value with which to find percent error in your result.)

Lab Three - Determination of the Heat of a Phase Change

Materials you must use:

Beaker	Ice cubes	~50-100g Water
Thermometer	Balance	Graduated Cylinder



Objective - Using the Law of Conservation of Energy, determine the heat that was used in the phase change of ice based on the mixing of ice and water to reach thermal equilibrium. Energy gained/lost in this lab includes: heat exchange of water, heat exchange of ice, energy needed for phase change from ice to water.
(add ice cubes to cal.; stir until minimum temp ~2-4°C; remove excess ice; weigh cal.)
Note: assume ice remains 0°C if not all melted.

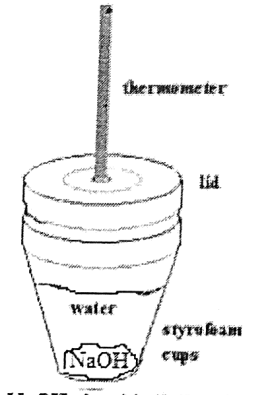
What you must provide -

1. Quantitative data table
2. A picture of your experimental setup, and a brief explanation of how your experimental setup allows you to solve the problem.
3. All calculations needed to find the molar heat of fusion ice in kJ/mol.
4. Percent error based on accepted value of 6.01 KJ/mol
5. What do you think the energy is being used to do in the phase change from ice to water? Explain.

Lab Four - Determination of the Heat of Solution of Sodium Hydroxide

Materials you must use:

Beaker	5.0 g Solid NaOH	100.0 g Water
Thermometer	Balance	Graduated Cylinder



NaOH should all dissolve

Objective - Using the Law of Conservation of Energy, determine the enthalpy of solution in kJ/mol for sodium hydroxide.
What you must provide -

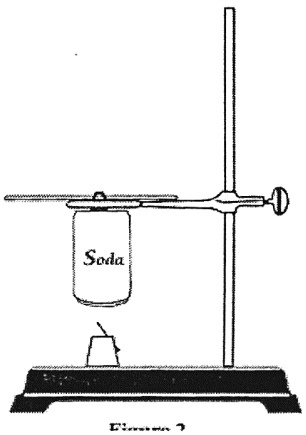
1. Quantitative data table
2. A picture of your experimental setup, and a brief explanation of how your experimental setup allows you to solve the problem.
3. All calculations needed to find the molar heat of solution of NaOH in kJ/mol.
4. Percent error based on accepted value of -44 KJ/mol.
5. Is the solution process of NaOH endothermic or exothermic? Explain.

Lab Five - Determination of the Molar Enthalpy for Candle Wax

Materials you must use:

Candle	Balance	Matches
Pop Can	Iron Ring	Glass Stirring Rod
Ring Stand	Thermometer	Water

Objective - Using the Law of Conservation of Energy (the First Law of Thermodynamics) and heat equations, determine the molar enthalpy (kJ/mol) for a sample of candle wax.



What you must provide -

1. Quantitative data table
2. A picture of your experimental setup, and a brief explanation of how your experimental setup allows you to solve the problem.
3. All calculations needed to find the molar enthalpy of combustion (kJ/mol burned) of a candle.
4. If all of the heat was not transferred from the burning candle to the can of water, how would your calculated value for the molar enthalpy have been affected? Explain.

(accepted value = -42 kJ/g = -14,800 kJ/mol)
Candles are made of paraffin wax with "average formula" $C_{25}H_{52}$

(it is really a mixture of hydrocarbons with C between 20 and 30)