Lab #6: Calorimetry and Molar Heat of Combustion

Objectives:

1. Using the First Law of Thermodynamics, Conservation of Energy, determine the Heat of Combustion of Wax.
2. Understand various limitations of a calorimetry experiment.

Materials:

Graduated Cylinder	Tea Light Wax Candle ($C_{25}H_{52}$)	Thermometer	Aluminum Foil
Soda can	Distilled Water	Electronic Balance	2 Rings
Ring Stand	Clay Triangle	Butane Lighter	

Procedure:

1. Get approximately 50 mL of distilled water in a soda can; determine its temperature and its mass.
2. Determine the mass of the candle before it is lit. (If the candle is new, you may want to burn it for a few minutes so the wick can sustain the flame. Then, determine its mass.)
3. Wrap some aluminum foil around the candle. Be sure to leave sufficient space for oxygen intake when the candle is lit.
4. Set up the apparatus. You may want to use aluminum foil to enclose the setup. Light the candle and quickly place it inside this enclosure beneath the beaker. Let the candle burn for about 30 minutes or till around 70°C. Observe the temperature of the water continuously. Record the temperature of the water and extinguish the candle.
5. Measure the mass of the aluminum holder and the candle after it is cooled down.

Observations:

Mass of Water used	
Initial Water Temperature	
Mass of Aluminum Tea Light Holder and Candle (Before)	
Final Water Temperature	
Mass of Aluminum Tea Light Holder and Candle (After)	

Analysis

1. Using the Law of Conservation of Energy, determine the molar enthalpy of combustion of wax, $C_{25}H_{52}$. Show all the steps involved and list all values used.
2. Write the chemical equation for the combustion reaction of wax.
3. Using the direct method of Hess's Law, find the theoretical ΔH_{comb} of $C_{25}H_{52}$ given that the ΔH_f of wax is −10,514 kJ/mol.
4. From the values used in the last question, draw a detail potential energy diagram for the combustion of $C_{25}H_{52(s)}$. Label all pertinent information and discuss the combustion of $C_{25}H_{52}$ in terms of an endothermic or exothermic process.

Evaluation:

1. Using the theoretical and experimental values from the analysis section, calculate the % error of the experiment?
2. Evaluate the effectiveness of this experimental design. What are three other possible sources of error besides heat lost to the surrounding? (Do a quick research on wax on the Internet.)

Conclusion:

1. Summarize what you have learned from this lab.