Lab #8: Molar Heat of Combustion

Objectives:

1. Using the First Law of Thermodynamics, Conservation of Energy, determine the Heat of Combustion and the Heat of Formation of Wax.
2. Determine the ΔH_f of wax.

Materials:

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

Procedure:

1. Get approximately 50 mL of distilled water in a aluminium can; determine its temperature and 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 including the aluminum foil enclosure. Light the candle and quickly place it inside this enclosure beneath the aluminium can. Let the candle burn for about 30 minutes. 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. From the enthalpy of combustion of wax calculated above, find the ΔH_f of $C_{25}H_{52}$.
3. 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. The theoretical molar heat of formation of $C_{25}H_{52\,(s)}$ is −10514 kJ/mol. What is the % error of the experiment?
2. Evaluate the effectiveness of this experimental design. List four other possible sources of error besides heat lost to the surrounding? Can these problems be eliminated from a better experimental design? Why or why not?

Conclusion:

1. Summarize what you have learned from this lab.