Lab #9: 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. Using the ΔH_f of wax, evaluate the design of a simple calorimeter.

Materials:

Graduated Cylinder	Tea Light Wax Candle ($C_{25}H_{52}$)	Thermometer	Aluminum Foil
Small Beaker	Distilled Water	Electronic Balance	Tong

Pre-Lab Exercise:
1. Read the procedure thoroughly and using the law of conservation of energy, determine what measurements are needed. Set up the observation table to record all necessary measurements.
2. Rewrite the procedure in a detail manner that reflects your actual measuring methods. (Remember that the wrong measuring techniques or devices used can affect your % errors.)

Procedure:
1. Get approximately 50 mL of distilled water in a beaker; 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. Using a tong, hold the beaker of water on the aluminum foil enclosure. Lit the candle and quickly place it inside this enclosure beneath the beaker. 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:

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.
4. Write the chemical equation for the formation reaction of $C_{25}H_{52}$. Refer to Table 8.4 of page 372 of your textbook; calculate the theoretical ΔH_f of wax using bond energies.

Evaluation:
1. What is the % error for the enthalpy of formation of $C_{25}H_{52}$ using the theoretical ΔH_f based on bond energy and the experimental ΔH_f based on the results found from this experimental design?
2. Evaluate the effectiveness of this experimental design. What are other possible sources of error besides heat lost to the surrounding? Research the Internet for paraffin wax. Is our assumption correct?

Conclusion:
1. Summarize what you have learned from this lab.