

Thermochemistry

Heat of Reaction Lab

Name:
Partner:

Introduction

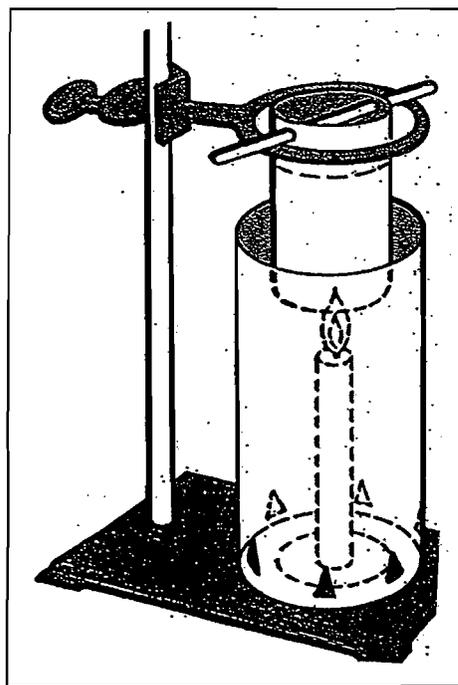
The amount of heat required or released during a chemical reaction is referred to as the **heat of reaction**, ΔH_{rxn} . Like other enthalpy changes, heat of reaction is a “molar” quantity that is expressed in kJ/mol. When the chemical reaction is a combustion reaction, this quantity is referred to as the **heat of combustion**.

Hydrocarbons are molecules containing hydrogen and carbon that are burned to release chemical energy. Some notable examples include natural gas, propane, and gasoline. In the following experiment, you will determine the heat of combustion for paraffin, the hydrocarbon used to make candle wax:



Procedure

1. Light a candle. Drip wax into the center of a can lid. Attach the candle to the lid and extinguish the flame. **Record** the mass of the lid and candle.
2. Set up the apparatus shown to the right. The small can should hang about 2 inches above the wick of the candle.
3. Fill the small can 2/3 full with cold tap water. Add ice so that the temperature is around 10°C. Remove the ice. Then, **record** the temperature.
4. Light the candle with a wooden splint. Stir the water with the thermometer until the temperature reaches about 35°C.
5. Extinguish the flame. Stir the water with the thermometer until the highest temperature is reached. **Record** the temperature.
6. **Record** the mass of the candle and lid.
7. Carefully pour the water into a graduated cylinder. **Record** the mass of water below. (Since the density of water is 1 g/ml, 1 ml = 1 g H₂O)



Data

| | |
|-----------------------------------|--|
| Initial mass candle and lid (g) | |
| Initial temperature of water (°C) | |
| Final temperature of water (°C) | |
| Final mass candle and lid (g) | |
| Mass water (g) | |

Strategy

Recall the unit for molar enthalpy changes like heat of combustion:

$$\frac{\text{kJ}}{\text{mol}}$$

The unit is made from a heat value over a mole value. In this case, the numerator is the **heat released** by the wax. The denominator is the **moles** of wax used in the reaction.

Data Analysis

Calculate the following on a separate piece of paper. Be organized. Include units.

1. ΔT for water
2. Heat released by the wax in kJ ($C_w = 4.18 \text{ J}/(\text{g} \times ^\circ\text{C})$)
3. Mass of wax used in the combustion
4. Molar mass of wax (paraffin- $\text{C}_{25}\text{H}_{52}$)
5. Moles of wax
6. Heat of reaction in kJ/mol with appropriate sign

PowerPoint

IMPROPERLY SAVED ITEMS WILL BE DISCARDED WITHOUT BEING SCORED.

period_combustion_lastf (ex. 4_combustion_haydenm)

General Specifications

- Clearly indicate your name and the name(s) of your lab partners.
- Do not exceed 6 slides.
- You have the freedom to structure your lab report (PPT presentation) as you see fit. However, please incorporate all basic lab report elements. In addition, be sure to include:
 - ✓ Definition of molar heat of combustion.
 - ✓ Balanced thermochemical equation for the reaction
 - ✓ Original drawing (i.e. paint, PPT shapes) of reaction coordinate with:
 - Labeled reactants and products
 - Labeled heat of reaction with numeric value and unit indicated
 - Labeled activation energy
 - Endothermic or exothermic?
 - ✓ Answer to the following question with work shown using Equation Editor:
 - Using your lab data, calculate the heat released when 10.0 grams of wax combusts.
- Reflect (qualitatively and quantitatively) on your results assuming that the actual molar heat of combustion for paraffin is 14,800 kJ/mol.