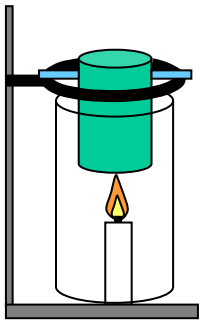
Lab: Determining the Molar Heat of Combustion for Paraffin

Procedure:

1. Note: do not light the candle until you are instructed to do so in step 7.
2. Get a can, glass rod, thermometer, graduated cylinder, candle, paper, piece of tape, & matches.
3. Weigh the candle to the nearest 0.01 g. Record your value below.
4. Set up a retort stand with a ring clamp. Using a pen, punch a hole through either side of the can (near the top). Insert a glass rod through the holes in the can and suspend the can in the center of the ring (as illustrated to the right). Move the clamp so that, if the candle were lit, the flame would almost but not quite touch the bottom of the can. With the paper & tape, create a cylinder that will fit around the bottom of the can and the candle – you may need to cut or fold the paper.



5. Using a graduated cylinder, add 200 mL of cold water to the can (use water from the beaker at the front of the room). The water and can will act as a calorimeter.
6. Gently stir the water with the thermometer. Wait for the temperature to stop falling, then record the initial temperature of the water. Ideally, your initial reading should be between 0-10°C.
7. Light the candle. The flame should almost, but not quite, touch the bottom of the can. Replace the paper cylinder once the candle is in position.
8. Stir the water gently until the temperature reaches 35°C. Carefully blow out the candle (do not spill any wax). Continue to stir. Record the highest temperature reached as the final temperature.
9. Weigh the candle as before. Record the final mass of the candle below.
10. Return all equipment and wipe off your lab bench with a damp paper towel.
11. Calculate the total mass of candle wax that was burned and the change in temperature (ΔT). Give these values to your teacher.

Data:

Initial mass of candle _____ Final mass of candle _____ Mass burned _____

Initial temperature of water _____ Final temperature of water _____ ΔT _____

Class averages: Mass of candle wax burned _____ Change in temperature (ΔT) _____

Questions and Calculations: Show your work for all calculations.

1. What mass of water was used in this lab (note: the density of water is 1 g/mL)?
2. Using class averages, calculate the heat absorbed by the water (assume c = 4.18 J/g°C).
3. Assume that the heat absorbed by the water is equal to the heat given off by the candle. Calculate the amount of heat released per gram of wax (i.e. the specific heat of combustion).
4. Paraffin wax has the formula $C_{25}H_{52}$. Calculate the amount of heat released per mole of wax (i.e. calculate the molar heat of combustion for paraffin).
5. Write the thermochemical equation that represents the combustion of paraffin wax.
6. In question three, 4.18 J/g°C was used as the specific heat capacity of the calorimeter. Suggest a reason why this is not entirely accurate. What other sources of error are there in this lab?