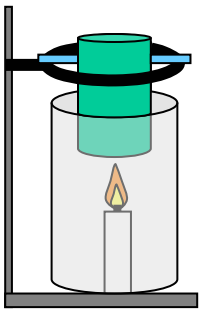
Determining the Heat of Combustion

Prelab: Read pg. 150 – 151. Do PE1 on page 152 (calculate your answer in joules but not calories).

Procedure:

1. Get: small can, large can, a glass stirring rods, thermometer, graduated cylinder, candle, match.
2. Weigh the candle (with base) to the nearest 0.01 g. Record your value below.
3. Note: do not light the candle until you are instructed to do so (see step 7).
4. Set up a retort stand with a ring clamp. Insert a glass rod through the holes in the small metal can. Suspend the can in the center of the ring clamp. Position the candle so that, when lit, the flame will almost, but not quite, touch the bottom of the can (mark the position of the ring clamp by placing a strip of tape just below where the clamp is attached to the stand). Position the large metal can so that it surrounds the candle and the smaller metal can (as in the diagram). Note that the holes in the large can should at the base of the candle to allow air into the can.



5. Using a graduated cylinder, measure exactly 200 mL of cold water (from the beaker at the front of the room) into your small metal can. The metal can, with water, will act as your calorimeter.
6. Gently stir the water with the thermometer. Record the initial temperature of the water (when the temperature reading is fairly constant). Your initial reading should be between 0°C – 10°C.
7. Move the ring clamp up and remove the large can so that you have access to the candle. Light the candle, then quickly replace the large can and lower the ring clamp to its correct 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 and base as before. Record the final mass.
10. Return all equipment, remove the tape from your retort stand, and clean off your lab bench.
11. Calculate the total mass of candle wax that was burned and the change in temperature (ΔT).

Data:

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

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

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

Questions and Calculations: For all calculations 1) show your work, 2) use J or kJ not cal or kcal

1. Give the term (i.e. name) and the units associated with each variable in the equation $q = cm\Delta T$.
2. What mass of water was used in this lab (note: the density of water is 1 g/mL)?
3. Using the class averages, calculate the amount of heat absorbed by the water.
4. Calculate the amount of heat liberated per gram of candle wax.
5. If wax has the formula $C_{25}H_{52}$, how much heat per mole of wax is produced via combustion (if you have forgotten how to convert between g and mol, see pages 97-98 in your textbook).
6. Define calorimeter and calorimetry.
7. We have assumed that the specific heat of the "calorimeter" is 4.18 J/g°C. Suggest a reason why this assumption is not entirely accurate. What other sources of error are there in this lab?