Thermochemistry background: Definitions from 5.3, 5.4

1. Thermochemistry – The study of the energy changes in chemical reactions.
2. System – That part of the universe we wish to study.
3. Surroundings – That part of the universe other than the system being studied.
4. Boundary – That which divides a system from its surroundings.
5. State of system – The set of specific values of the physical properties of a system (composition, state, concentration, temperature, pressure, volume).
6. Change of state – Transformation of matter from one physical state to another. In thermochemistry, any change in a variable used to define the state of a particular system.
7. **Endothermic** – A change in which a system's internal energy increases (thus energy is absorbed)
8. **Exothermic** – A change in which a system's internal energy decreases (thus energy is released)
9. Heat of reaction (q) – The heat exchanged between a system and its surroundings when the entire change in energy involves heat. Exothermic is –. Endothermic is +.
10. **Enthalpy** (H) – The heat content of a system (the total energy of a system).
11. Enthalpy change (ΔH) – The difference in enthalpy between the initial state and the final state. (ΔH = H products - H reactants). Equal to q when all the change in energy is heat energy.
12. **Law of conservation of energy** – Energy is neither created nor destroyed, only transferred and transformed.
13. State function – A function or variable whose value depends only on the initial and final states of the system and not on the path taken by the system to get from the initial to the final state (e.g. P, V, T). Solubility (g/ml at a particular temperature) is not a state function.
14. **Calorimeter** – An apparatus used in the determination of the heat of a reaction.
15. **Calorimetry** – The science of measuring the quantities of heat involved in chemical or physical changes.
16. Heat of combustion – The heat evolved in the combustion of a substance.

Relating terms to candle lab (heat of combustion)

1. Thermochemistry – The purpose of lab 3.1 (to consider changes in energy as chemicals react)
2. System – Will vary depending on your perspective. It could be thought of as everything inside the large can (the candle and the surrounding air).
3. Surroundings – Will vary depending on your perspective. It could be thought of as everything except the candle and surrounding air. The water is the most important part of the surroundings since it is used to determine the energy change of the candle.
4. Boundary – Again this will vary. We could view it as the space in which the candle sits: surrounded at the top by the small can of water, and on the sides by the larger can. In our example, the boundary is not perfect since oxygen will rush in and CO_2 will leave the system.
5. State of system –composition (wax and some air), state (candle is solid), concentration (density of candle), temperature (room temperature), pressure (1 atm.), volume.
6. Change of state – both the candle and the water changed state (e.g. mass of candle and temperature of water)
7. Endothermic – The increase in water temperature showed that energy was absorbed (endothermic).
8. Exothermic – The release of heat by the candle made this an exothermic change.
9. Heat of reaction – $q=cm\Delta T \cong 4.2\ Jg^{-1}°C^{-1} \times 200\ g \times 27°C$
10. Enthalpy – Total energy including KE, PE. Can not be determined experimentally since it is impossible to know all energies (for example, we do not know the speed of the candle due to the rotation of the earth).
11. Enthalpy change – For the water $\Delta H = q$, for the candle $\Delta H = -q$.
12. Law of conservation of energy – Loss of energy from the candle was equal to gain in energy by the water.
13. State function – For example, the initial mass of the candle.
14. Calorimeter – The apparatus used in the experiment was a basic calorimeter.
15. Calorimetry – As above.
16. Heat of combustion – This was measured. The heat of combustion is the same as the heat of reaction in this case.