IB Chemistry
Energetics Study Guide
Topics 5/15

Textbook CH 5 p. 165-188 CH 8. P. 325-330 CH 19 p. 801-826

1. Know all vocabulary words.
2. List all the ways you have learned to calculate the enthalpy of a reaction.
4. State the First law of thermodynamics
5. Describe endothermic and exothermic reactions in terms of heat flow into or out of a system. Be able to correctly assign positive and negative values to ΔH.
6. Know what happens to the enthalpy value for a reversible reaction.
7. Be able to draw enthalpy diagrams.
8. Describe the function of a calorimeter.
9. Do calorimeter problems using $\Delta H = mc\Delta T$.
10. Do calorimeter problems using the idea that the heat absorbed by the water in a calorimeter is lost by the system. ΔH (water) =- ΔH(system)
11. State Hess's Law.
12. Solve Hess's law problems $\Delta H1 = \Delta H2 + \Delta H3$
13. Draw enthalpy cycles for Hess's law problems
14. Use bond enthalpies to determine ΔH for reactions. $\Delta H^\circ = \Sigma$ BE $_{\text{bonds broken}} - \Sigma$ BE $_{\text{bonds formed}}$
15. Use appendix C to obtain values for ΔH_f° , S°, ΔG°
16. Know that the enthalpy values for elements in their standard form is 0.
17. Calculate the ΔH_{rxn}° using the following equation
    $\Delta H^\circ_{rxn} = \Sigma \Delta H_f^\circ$ products $- \Sigma \Delta H_f^\circ$ reactants
18. Explain what a Born_Haber Cycle is and give 2 uses for them.
19. Define the following and be able to use the appropriate table for finding values for each.
    a. Ionization energy
    b. Electron affinity
    c. Enthalpy of Atomization
    d. Lattice Energy
20. Be able to construct a Born-Haber Cycle for any given ionic compound.
21. Be able to read a Born-Haber Cycle and determine values for any variable involved in the following equation:
    $\Delta H_{at}^\circ + \Delta H_{IE}^\circ + \Delta H_{EA}^\circ + \Delta H_{latt}^\circ = \Delta H_f^\circ$
22. Use ionic radii to compare lattice energies for ionic compounds.
23. Use size of charges to compare lattice energies for ionic compounds.
24. Compare theoretical vs. experimental lattice energies to determine the degree of ionic character of a compound.
25. Explain what a spontaneous process is. Give examples.
14. Define entropy.
15. Know that entropy increases with
    a. Increasing temperature
    b. Increasing volume
    c. Increased number of molecules
    d. Increased freedom of molecules
    e. Dissolution

f. Increased number of gas molecules
g. Increased number of moles of gas
h. Increased complexity of molecules

28. Use the following equation as well as the standard entropy values given in appendix C to determine the entropy change of a reaction .

$$\Delta S^\circ = \Sigma S^\circ_{\text{products}} - \Sigma S^\circ_{\text{reactants}}$$

29. Explain the significance of the sign of ΔS and use it to determine if a reaction is spontaneous.
30. Define Gibb's Free Energy.
31. Predict whether a process will be spontaneous by using the sign of ΔG°.
32. At constant temperature and pressure, explain what happens when G is negative, zero, and positive.
33. Calculate ΔG for a reaction by using the following equation
    $\Delta G^\circ = \Delta H^\circ + T\Delta S^\circ$
34. Calculate ΔG for a reaction using the equation

$$\Delta G^\circ = \Sigma \Delta G^\circ_f \text{ products} - \Sigma \Delta G^\circ_f \text{ reactants}$$

and by using values of the standard free energy change of formation ΔG°_f

35. Predict the effect of a change in temperature on the spontaneity of a reaction .
36. Predict the sign of ΔG *given different scenarios of* ΔS, ΔT, *and* ΔH.