AP CHEMISTRY CHAPTER 17 OUTLINE

SPONTANEITY, ENTROPY, AND FREE ENERGY

17.1: SPONTANEOUS PROCESSES AND ENTROPY

First Law of Thermodynamics

Spontaneous processes

Kinetics vs. Thermodynamics

Consider the following processes

1. A ball rolls down a hill, but never rolls up
2. Iron when exposed to air and moisture rusts, but doesn’t “unrust”
3. A gas fills a container uniformly, it doesn’t collect at one end
4. Heat always flows from the hot object to the less hot one
5. Wood burns to form carbon dioxide and water, but carbon dioxide and water do not come together when heated to form wood

WHY????

Entropy (S)

17.2: ENTROPY AND THE SECOND LAW OF THERMODYNAMICS

The second law of thermodynamics

17.3: THE EFFECT OF TEMPERATURE ON SPONTANEITY

H2O(l) → H2O(g)

Two important characteristics for entropy

1. The sign of ΔSsurr depends on the direction of the heat flow
2. The magnitude of ΔSsurr depends on the temperature

Exothermic and Endothermic: How do they fit?

Summary of ΔSsys, ΔSsurr, and ΔSuniv

17.4: FREE ENERGY

Equation for determining free energy

ΔH and ΔS

17.5: ENTROPY CHANGES IN CHEMICAL REACTIONS

N2(g) + 3H2(g) → 2NH3(g)

The Third Law of Thermodynamics

Using Appendix 4: Standard enthalpy values versus changes in enthalpy and free energy

17.6: FREE ENERGY AND CHEMICAL REACTIONS

Standard free energy change (ΔGo)

Standard free energy of formation

17.7: THE DEPENDENCE OF FREE ENERGY ON PRESSURE

The equation showing dependence comes from our knowledge of entropy under conditions of volume and pressure

The meaning of ΔG for a chemical reaction

17.8: FREE ENERGY AND EQUILIBRIUM

17.9: FREE ENERGY AND WORK