

Second-Year HL Chemistry

6. Thermodynamics

Read: Zumdahl² Chapter 16 Sections 1-6; Chapter 17 Section 3 (no calculation detail but the relationship between free energy change and cell potential).

Concepts to be mastered:

To master a concept, you must be able to do three things:

1. define the concept,
 2. explain the concept, and
 3. give an example of the concept.
- disorder, spontaneous, entropy, absolute entropy, entropy of reaction, entropy of formation
 - system, surrounding, universe, change in entropy of system, change in entropy of surrounding, change in entropy of universe (total entropy change)
 - 2nd Law of Thermodynamics, 3rd Law of Thermodynamics, Gibbs Free Energy, Standard Gibbs free energy, Gibbs Free Energy of reaction, Standard Gibbs Free Energy of reaction, Gibbs Free Energy of formation

Skills to be mastered:

To master a skill, you must be able to

4. recognize when the skill is needed,
5. recognize what information is needed to execute the skill,
6. execute the skill, and
7. assess whether the skill has been executed correctly.

Entropy

Zumdahl²

- State and recognize factors that increase disorder in a system **16.20,**
- Recognize that increase in disorder can result from mixing of different types of particles, change of state (increased distance between particles), increased movement of particles, or increased number of particles **16.29-34**
- Predict whether the entropy for a given reaction or process would be positive or negative **16.21**
- From a reaction equation, be able to recognize a single factor which affects the value of ΔS , and predict its sign, e.g., formation of a gas **16.29-34.**

Spontaneity of a reaction

- Compute the standard entropy of reaction (ΔS^θ) from absolute entropies or entropies of reaction **16.33, 34, 41-43.**
- Compute change in standard Gibbs Free Energy of reaction (ΔG^θ) from Gibbs Free Energy of formations **16.49, 50**
- Compute the standard Gibbs Free Energy (ΔG^θ) of reaction from standard entropy of reaction, temperature and standard enthalpy change of reaction **16.41-44**
- Determine the spontaneity for a chemical reaction and explain the temperature **16.15, 16,**

dependence of the spontaneity

- Predict whether a reaction will be spontaneous, by using standard electrode potential values
- Predict the direction of electron flow in an external circuit and the reaction taking place in a cell
- Relate positive E^\ominus values for spontaneous reactions to negative ΔG^\ominus values
- Explain the relationship between the maximization of entropy and the attaining of equilibrium for systems where forces are **not** involved

Additional problems: **16.17**, 18, 22-28, 37-40, 45-48.