

## SC151 - CHAPTER 10 LEARNING OBJECTIVES

**To satisfy the minimum requirements for this course, you should master the following learning objectives.**

Define and be able to use the terms spontaneous reaction and nonspontaneous reaction.

Describe how entropy is related to randomness/disorder or dispersal of energy, and

- predict whether the sign of  $\Delta S$  is positive, negative, or near zero for a chemical or physical change.
- describe how and why the entropy of a substance changes with temperature or when a phase change occurs.
- calculate  $\Delta S^\circ$  for any reaction from tabulated absolute entropy values,  $S^\circ$ .

State the Second Law of Thermodynamics and explain the role that entropy plays in determining whether a process will be spontaneous.

State the Third Law of Thermodynamics and explain why it's needed to calculate absolute entropies.

Identify the standard state for elements, solids, liquids, gases and solutes in solution.

Calculate the standard free-energy change,  $\Delta G^\circ$ , at 25 °C from standard free energies of formation.

Explain the relationship between the sign of the free-energy change,  $\Delta G$ , and whether a process is spontaneous in the forward direction.

Predict how  $\Delta G$  will change with temperature, given the signs for  $\Delta H$  and  $\Delta S$ .

Use the equation  $\Delta G = \Delta H - T\Delta S$  to calculate the free energy change for a reaction and to determine the temperature at which a nonspontaneous reaction becomes spontaneous.

Describe the relationship between  $\Delta G^\circ$  and  $K$  and be able to

- calculate  $\Delta G^\circ$  from  $K$  and perform the reverse operation.
- explain how  $\Delta G$  differs from  $\Delta G^\circ$  and discuss how  $\Delta G$  changes during the course of a reaction.
- calculate the free-energy  $\Delta G$  for given reaction concentrations.