SC151 - CHAPTER 15 LEARNING OBJECTIVES

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

Explain the concept of reaction rates and be able to
- use a table of concentration versus time data to calculate an average rate of reaction over a period of time.
- use the coefficients of a balanced reaction to express the rate of reaction in terms of the change in concentration of a reactant or product with time.
- determine instantaneous rates from a graph of reactant or product concentration as a function of time.

Determine the differential rate law from initial rate data and be able to determine: the order of reaction with respect to each reactant, the overall order of reaction, the rate constant with units, and the initial rate for any other set of initial concentrations.

Recognize the integrated rate laws and be able to
- use integrated first- and second-order rate laws to find the value of one variable, given values of the other variables.
- explain the concept of reaction half-life and describe the relationship between half-life and rate constant for zeroth, first, and second-order reactions.
- determine the order of the reaction from plots of concentration versus time, ln concentration versus time, and 1/concentration versus time.
- recognize and explain the use of pseudo-order rate laws for reactions involving more than one reactant.

Describe the relationship between kinetics (rates of reactions) and equilibrium.

Relate a reaction mechanism to its rate law and
- given a reaction mechanism, identify the reaction intermediates and catalysts, write the overall reaction, and determine the molecularity of each step.
- derive a rate law for a reaction that has a rate-determining step, given the elementary steps and their relative speeds.
- choose a plausible mechanism for a reaction given the rate law.

Use the Collision Theory of Chemical Kinetics to explain how reactions occur at the molecular level, and
- explain the concept of activation energy and how it relates to the variation of reaction rate with temperature.
- solve the Arrhenius equation and determine the activation energy from the slope of the Arrhenius plot (ln k versus 1/T).

Define a catalyst and be able to
- describe the effect of a catalyst on the energy requirements for a reaction.
- sketch a potential energy profile showing the activation energies for the forward and reverse reactions and show how they are affected by the addition of a catalyst.
- explain how enzymes act as biological catalysts and how they interact with specific substrate molecules
- explain the mechanism by which sarin inhibits acetylcholinesterase (NavApp: Chemical Warfare)

Explain what effect the presence of a catalyst has on the position of equilibrium in a chemical system.