CHAPTER 14 LEARNING OBJECTIVES

Learning Objectives (sections 14.1-14.7)

You should be able to:

1. Use a table of concentration versus time data to calculate an average rate of reaction over a period of time.
2. From the coefficients of a balanced reaction, express the rate of reaction in terms of the change in concentration of a reactant or product with time.
3. Determine instantaneous rates from a graph of reactant or product concentration as a function of time.
4. From initial rate data, determine the order of reaction with respect to each reactant, the overall order of reaction, the rate law, the rate constant, the units of the rate constant, and the initial rate for any other set of initial concentrations.
5. Use integrated first- and second-order rate laws to find the value of one variable, given values of the other variables.
6. Explain the concept of reaction half-life and describe the relationship between half-life and rate constant for first-order and second-order reactions.
7. From plots of concentration versus time, ln concentration versus time, and 1/concentration versus time, determine the order of reaction.
8. From a plot of concentration versus time, estimate the half-life of a first- or second-order reaction.
9. Use the collision model of chemical reactions to explain how reactions occur at the molecular level.
10. Explain the concept of activation energy and how it relates to the variation of reaction rate with temperature.
11. Solve the Arrhenius equation for any variable given the others, and determine the activation energy from the slope of the Arrhenius plot (ln k versus 1/T).
12. Given a reaction mechanism, identify the reaction intermediates and catalysts, determine the overall reaction, and determine the molecularity of each step.
13. Derive a rate law for a reaction that has a rate-determining step, given the elementary steps and their relative speeds; or conversely, choose a plausible mechanism for a reaction given the rate law.
14. Describe the effect of a catalyst on the energy requirements for a reaction and explain the differences between homogeneous and heterogeneous catalysts.
15. 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.
16. Explain how enzymes act as biological catalysts using the lock and key model.
17. Explain the mechanism by which the nerve agent Sarin inactivates the enzyme acetylcholinesterase.
18. Understand and explain the boldface terms in the Summary and Key Terms section of Chapter 14 (pages 563-564).