

# KINETICS & RATES OF REACTIONS SYLLABUS

## I. MAJOR TOPICS:

- |                          |                                   |
|--------------------------|-----------------------------------|
| A. What is a rate?       | E. Factors that Affect Rate and k |
| B. Determining Rate Laws | F. Collision Theory               |
| C. Integrated Rate Laws  | G. Reaction Mechanisms            |
| D. Activation Energy     | H. Catalysis                      |

## II. OBJECTIVES/GUIDELINES:

1. Understand the difference between calculating an average rate and an instantaneous rate.
2. Be able to look at a balanced reaction and decide or calculate what the relative rate of one reactant would be to another. For example, in the following reaction,  $2A + B \rightarrow C$ , the reagent A would disappear at a rate 2 times as fast as C would appear. Remember to designate a negative sign for the rate of a reactant as it is disappearing.
3. Understand the difference between a rate and a rate constant.
4. Realize that the only way rate laws can be determined is from EXPERIMENTAL data. The orders have nothing to do with the coefficients.
5. Review your homework problems. Be able to determine the rate law expression and k constant from experimental data involving changing concentrations of reactants with initial rates. Be sure to include correct units for k.
6. Have a general idea of what a graph of [A] vs time and rate vs [A] would look like and what info such graphs could offer.
7. Understand the purpose of the integrated rate laws and under what circumstances they are useful. Don't memorize the integrated rate laws. They will be given to you.
8. Be able to compare and contrast the three orders we have discussed. Know what the variables stand for, know how to determine k from a graph for each order, and understand the relationship between each order and its half-life.
9. Be able to use the integrated rate laws and the half-life expressions in calculations. Refer to notes and homework. Don't forget about the zero order notes that were not typed.
10. Be able to explain collision theory and how it affects the rates of reactions and how it applies to the different orders.
11. Be able to define activation energy and be able to draw and label energy diagrams for endothermic and exothermic reactions that incorporate  $E_a$ , the activation energy.
12. Be able to explain how concentration, surface area, nature of reactions, catalysis, and temperature affect the rate of a reaction and the rate constant.
13. Understand how a Maxwell distribution curve can be used to explain the effects of temperature on the rate of a reaction. Realize that a higher temperature increases the # of collisions that would have enough energy to result in product formation. Also, as temperature increases, rate increases exponentially. Why? What are the TWO ways that temp affects rate?
14. What is a reaction mechanism? What are elementary steps?
15. Be able to identify an intermediate in a mechanism.
16. Be able to describe and determine the molecularity of an elementary step.
17. Be able to write a rate law expression for any elementary step. Realize that the orders can be determined from the coefficients. Why can't you do this with overall balanced equation?
18. Be able to comment on the validity of a proposed mechanism. Do the elementary steps add up? Does the rate law of the slowest elementary step make the experimentally determined rate law?
19. Comment on how the rate of the slow step and the rate of the overall reaction are related.
20. Be able to look at a mechanism that has an equilibrium step and determine the rate law.
21. What is a catalyst and how does it reduce activation energy?
22. How does a heterogeneous and homogeneous catalyst work? Be able to site some examples of each. Very briefly, what is an enzyme and how does it work?

**Problem Set #23:** problems 14.4, 14.10, 14.12, 14.15, 14.21, 14.24. In addition to the book problems, also complete the handout, *KINETICS ½ SHEET*. Work all problems on a separate sheet. Do NOT just scribble in the margins of the handout.

**Due Date:** \_\_\_\_\_

**Problem Set #24:** problems 14.30, 14.34, 14.47, 14.50, 14.61, 14.73. In addition to the book problems, also complete the handout *MORE KINETICS ½ SHEET*. Work all problems on a separate sheet. Do NOT just scribble in the margins of the handout.

**Due Date:** \_\_\_\_\_