CHM 2046 Exam 1 Learning Objectives

Mrs. Sanchez has a solutions manual with all problems worked out. You can check your work for the odd exercises using this manual during her office hours.

Chapter 14

1. Explain the rule of thumb: "like dissolves like" by analyzing the solution process in terms of forces overcome in the solute and solvent and forces formed between solute and solvent particles.
2. Define solution density, molarity, mole fraction, weight percent, and molality, and perform calculations using these quantities.
3. Perform calculations using Henry's law.
4. Use Raoult's law to calculate the vapor pressure over a solution containing a nonvolatile solute and a solution containing two volatile liquids.
5. Perform calculations involving freezing point depression and boiling point and determine the molar mass of the solute.
6. Perform calculations involving the osmotic pressure equation, and determine the molar mass of the solute.

Homework: 4,9,10,18,19,22,27,29,44,45,50,51,58,67,71,75,77,79-103 (odd)

Chapter 15

1. Use a table of concentration versus time data to calculate an average rate of reaction over a period of time. *Find the difference between 2 concentrations at 2 different times. The average rate is the change in concentration divided by the change in time.*
2. From the coefficients of a balanced chemical equation, express the relative rates of consumption of reactants and formation of products. Practice with HW 66-68

For the reaction $3A + 2B \rightarrow 2C + D$, the rate of disappearance of A was 0.60 M/s. What is the rate of disappearance of B? What is the rate of formation of C? What is the rate of formation of D?

3. From a table of initial concentrations of reactants and initial rates, determine the order of reaction with respect to each reactant, the overall order of reaction the rate law, the rate constant, and the initial rate for any other set of initial concentrations. Practice with HW 27-30 and 76-81.

For the reaction $2A + B + C \rightarrow D + 2E$, determine the rate equation using the following data:

Run	*[A] (M)*	*[B] (M)*	*[C] (M)*	*Rate (M/s)*
1	*1.00*	*1.00*	*1.00*	*4.99*
2	*3.00*	*1.00*	*1.00*	*44.97*
3	*2.00*	*2.00*	*1.00*	*40.11*
4	*1.00*	*3.00*	*2.00*	*14.99*

(b) Calculate rate constant (and units) (c) Determine rate when [A] = [B] = [C] =2.00M

4. Be able to use a rate law to determine the effects of changing concentration on rates. Practice with HW 70-74 *A sample question is c in the above example.*

5. Use integrated first- and second-order rate laws to find the value of one variable, given values of the other variables. Practice with HW 84-95

A reaction is first-order in A.
(a) Calculate k if 30.0% A remains after 10.0 min.
(b) Calculate the half life of the reaction.
(c) If the initial concentration is $3.00x10^{-2}$M, what is the concentration after 1.00 hour?

6. From plots of log concentrations versus time and I/concentration versus time, determine the order of reaction. Practice with HW 82, 83 and Kinetics lab.
7. Use the expression for half-life of a first- or second-order reaction to determine $t_{1/2}$ from k, or vice versa. Practice with HW 90-95 *A sample question is given above.*
8. From a plot of concentration versus time, estimate the half-life of a first-order reaction.
9. Given a reaction mechanism and an experimental rate law, identify the reaction intermediates, determine the molecularity of each elementary reaction, and determine if the mechanism is consistent with the experimental rate law. HW question 52, 57
10. Prepare an Arrhenius plot and determine the activation energy from the slope of the line. Practice with HW 96, 97 and Part II of Kinetics Lab.
11. Solve the Arrhenius equation for any variable given the others. Practice with HW 98-102

At 300. K the rate constant is 0.200 s^{-1} and at 350.K the rate constant is 0.750 s^{-1}.
(a) Determine the activation energy of the reaction.
(b) Determine rate constant at 425 K.

12. Sketch a potential energy profile showing the activation energies for the forward and reverse reactions and showing how they are affected by the addition of a catalyst. HW 42, 45, 59

Sketch a potential energy profile for a reaction with an E_a = 70 kJ/mol and ΔH = -35 kJ/mole. Sketch on your graph the affect of adding an inhibitor to the reaction.

13. Recognize the role of a catalyst during chemical change.
14. Useful internet resources to help your studies:
    a. Chapter 12 Lecture http://web.fccj.org/~ksanchez/2046/lecture.htm
    b. **Strongly recommended** Additional Practice with rates and the Arrhenius equation http://mooni.fccj.org/~ethall/2046/kinetics.htm

Homework: Thinking it through: 1
Review Questions: 27-30, 42, 45, 52, 57, 59
Review Problems: 64, 66-68, 70-103 (start with evens; do odds if time permits and you need more practice in a particular skill)

EQUATIONS LIST FOR EXAM 1 These equations will be provided for students on exam 1. Students should learn when and how to use them, but they need not memorize them.

1st Order Reactions

$$\ln \frac{[A]_t}{[A]_0} = -kt \qquad \ln [A]_t = (-k)t + \ln[A_0] \qquad \frac{[A]_t}{[A]_0} = e^{-kt}$$

$$kt_{1/2} = .693$$

2nd Order Reactions

$$\frac{1}{[A_t]} = kt + \frac{1}{[A_0]}$$

Arrhenius Equation **R= 8.314 J/mol·K**

$$k = p Z e^{-\frac{Ea}{RT}} \qquad \ln k = \left(-\frac{Ea}{R}\right)\left(\frac{1}{T}\right) + \ln A \qquad \ln\left(\frac{k_2}{k_1}\right) = \frac{-E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$