Chem 201
Spring 2011

EXAM 1 STUDY GUIDE

The exam will consist of 20 multiple choice questions with approximately 70% "C" questions, 20% "B" questions, and 10% "A" questions. In general, "C" questions are those involving the most basic concepts, particularly ones that you have used before. "C" calculation problems typically involve one major step with 1-2 more minor steps. (Examples of minor steps would be calculating molecular weights or converting [H_3O^+] to pH.) "B" questions involve more difficult concepts, particularly ones that are new. "B" calculation questions typically involve at least two major steps with 1-4 minor steps. "A" questions are those involving the most difficult concepts or those that require a thorough understanding in order to answer correctly. Often "A" questions require bringing together different concepts to solve the problem and 2+ calculation steps.

Note also that concepts listed under the "C" or "B" categories below can be converted to harder questions, depending on how I ask the question.

Background Concepts [Homework Examples; *similar questions in italic that weren't previously assigned*]

- Know the molecular formulas and charges of common ions. [Common Ion handout]
- Calculate molar mass, convert between grams and moles using the molar mass. [Homework 1, *3.14*]
- Calculate concentrations in molarity, convert between liters and moles using molarity. [Homework 1, quiz 2, *3.9,*]
- Calculate concentrations after dilution. [Exp. 2, *3.96*]
- Be able to balance chemical reactions. [Quiz 2]
- Be able to determine net ionic equations. [18.51, Quiz 2]

"C" Questions [Homework Examples; *similar questions in italic that weren't previously assigned*]

- Draw reasonable Lewis structures given the molecular formula (and atom connectivity for non-symmetric molecules.) [Homework 1, quiz 1, *10.5*, *10.7*, *10.19*, *10.21*]
- Calculate formal charges. [quiz 1, *10.15*, *10.13*]
- Know what resonance structures are and how to evaluate them based on formal charge. [Homework 1, quiz 1, *10.11*, *10.26*]
- Be able to predict the correct 3-D shape of molecules using VSEPR theory. [Homework 1, quiz 1, *10.43*,*10.45*,*10.57*]
- Be able to draw and interpret C framework structures of organic compounds. [Homework 1, quiz 1]
- Determine limiting reagents. Calculate amounts of products based on amounts of reagents used. [Homework 1, quiz 2]
- Determine reaction quotient expression for a given reaction. [17.12, 17.18, quiz 2]
- Understand the significance of the magnitude of the equilibrium constant. What does K<1 mean in terms of the balance between reactants and products? What does K>1 mean? What K values will mean there will be mainly reactants at equilibrium? What K values will mean there will be mainly products? What K values will mean there will be a mixture? [Quiz 2]
- Compare Q to K to predict which direction the reaction will go to reach completion. [17.33, 17.35, 17.37, quiz 2]

- What are the Bronsted definitions of an acid, base and acid-base reaction?
- Identify Bronsted acids, bases and conjugate acid-base pairs. [quiz 2, 18.43, 18.45, 18,47, 18.51]
- Be able to predict whether K > 1 or < 1 for an acid base reaction, knowing what acid or base is stronger [18.55, 18.57]
- What do pH and pOH values indicate? Which values indicate an acidic aqueous solution?

Which indicate a basic solution?

- What values of $[H_3O^+]$ and $[OH^-]$ indicate an acidic, basic or neutral solution?
- Convert back and forth between $[H_3O^+]$,$[OH^-]$, pH and pH with correct sig. figs. [18.27, 18.29, Exp. 3]
- Know the strong bases (OH^- salts) and the 6 strong acids (HCl, HBr, HI, HNO_3, $HClO_4$, H_2SO_4).[*18.15, 18.17*]
- Calculate pH of strong acid, strong base solutions. [Homework 3, 18.25, 18.23]
- Write out the acid and base dissociation reactions and the Ka and Kb expressions for Bronsted acids and bases. (What does the magnitude of Ka and Kb indicate?) [18.41, 18.86]

- Understand Beer's Law. Be able to calculate concentrations of unknown solutions from absorbance values knowing the absorbance value of a solution of known concentration. [Exp 2]

"B" Questions [Homework Examples]

- Determine how much strong acid or base need to be used to make a solution of a certain pH. [Homework 3]
- Recognize molecular weak acids (carboxylic acids and inorganic weak acids) and molecular weak bases (NH_3 and amines)
- Calculate pH (or pOH, $[H_3O^+]$,$[OH^-]$) of a weak acid or base solution knowing Ka or Kb and the initial concentration. [18.65,*18.67*, 18.73, 18.90, 18.92]
- Calculate Ka of a non-ionic weak acid or Kb of a non-ionic weak base from pH and initial concentrations. [18.63, 18.71, Exp. 3]

"A" Questions [Homework Examples]

- Be able to recognize ionic acids and bases (other than hydroxides).
- Calculate pH of a solution of a cationic weak acid or anionic weak base knowing Kb or Ka of their neutral conjugates and the initial concentration. [18.98, 18.100]

Concepts listed under the "C" category can be converted to B questions by combining them and/or requiring a better understanding of the concept in order to be solved.

Concepts listed under the "C" or "B" categories can be converted to A questions by combining them and/or asking the question in such a way that the route to the answer is not straightforward and requires a thorough understanding of the concepts.

Information that will be given with exam:
Periodic Table
Ka and Kb values

Equations you need to know:
$[H_3O^+][OH^-] = Kw = 1.008\times10^{-14}$
$pH = -\log[H_3O^+]$
$[H_3O^+] = 10^{-pH}$
$pOH = -\log[OH^-]$
$[OH^-] = 10^{-pOH}$
$pH + pOH = pKw = 13.9965$