Chemistry 212: Principles of Chemistry II
(2503 – CHM 212 – 202)
Spring 2012

Instructor: Phil Alexander **Phone:** 304-696-4808(Office) 304-638-7239(Cell)
Email: alexand1@marshall.edu **Office:** 403
Class Time: 11-11:50 M, W, F **Room:** 473
Office hours: 8-10 M, W, F and by appointment

Text: Chemistry-The Central Science, 11th edition Brown, LeMay, Bursten, and Murphy.

Required Materials: Clicker; Simple non-programmable calculator. Please use a simple non-programmable calculator for exams and quizzes. Using a calculator to store information for a test is a reason for receiving a zero on that test. Academic dishonesty will not be tolerated.

Purpose of Course: To continue the general study of chemistry emphasizing the problem solving skills necessary to apply the concepts of chemistry to a variety of situations. Several basic topics will be explored this term. These topics are listed at the end of this syllabus.

Course content and grading: Four tests will be given composed of multiple choice and free response (including problems) questions. The tests will make up 2/3 of the final grade. The final exam will count as 1/6 of the grade. Quizzes will be given about once weekly and will represent 1/6 of the final grade. Approximately 1 in 5 quizzes will be dropped. The grading scale will be no higher than **A** $\geq$ 90%, **B** 80 to 89%, **C** 70 to 79%, **D** 60 to 69%, and **F** < 60%.

Attendance: Regular attendance is expected. No makeup tests or quizzes will be given without university excuses. Homework problems will be assigned for each chapter and will be discussed in class, but will not be collected for a grade. Problems similar to those on the homework will be included on the tests and quizzes. Attendance, reading, and working the homework are essential for successful completion of this course. Plan on doing 2 hours out of class work for each hour in class. **Please seek me out if you want or need help.** Should attendance problems arise contact me before you miss if at all possible. Please be on time and do not disrupt class by coming in late. Makeup day is 4/27

Comments on success in this class:

1. **Keep up.** Do reading, problems, etc. promptly.
2. **Ask for help.** Ask questions in class and seek out other students and the instructor for help. Study/homework groups are often helpful.
3. **Read before class to improve understanding.**
4. **Do the homework.**
5. **Form a study group.**
6. **Use muonline to access class resources.**

Important Dates

1/16	MLK Holiday no class	2/29	Midterm
3/5	Freshman midterm grades	3/16	Last day to drop
3/17-25	Spring Break	4/4	Assessment day
4/23-27	Dead week	4/27	All class work completed
4/28	Final Exam 9:50 AM location TBA		

Approximate Schedule

Date	Chapters/ Tests
1/9-13	11, 13
1/16-20	13
1/23-27	14
1/30-2/3	Test 1(11, 13, 14) 15
2/6-10	15
2/13-17	16
2/20-24	Test 2(15, 16) 17
2/27-3/2	17
3/5-9	19
3/12-16	Test 3(17, 19) 19
3/26-30	20
4/2-6	21
4/9-13	24
4/16-20	Test 4(20, 21, 24) 24
4/23-27	25
4/28 Saturday 9:50 AM	Final Exam

Electronic Device Policy: All cell phones and pagers must be turned to vibrate during class. The instructor reserves the right to answer any ringing cell phones during lecture, or to dismiss the offending student. Recording of lectures without the instructor's permission is prohibited. During examinations, all electronic devices except calculators must be inaccessible. Students **MUST BRING A CALCULATOR** to class for all lectures and exams. Calculators that are part of a cell phone or PDA are not acceptable during an exam or quiz.

Academic Dishonesty Policy: Marshall University's academic dishonesty policy (http://www.marshall.edu/academicaffairs/Academic%20Dishonesty%20Policy.pdf) will be enforced.

Policy for Students with Disabilities: Marshall University is committed to equal opportunity in education for all students, including those with physical, learning and psychological disabilities. University policy states that it is the responsibility of students with disabilities to contact the Office of Disabled Student Services (DSS) in Prichard Hall 117, phone 304 696-2271 to provide documentation of their disability. Following this, the DSS Coordinator will send a letter to each of the student's instructors outlining the academic accommodation he/she will need to ensure equality in classroom experiences, outside assignment, testing and grading. The instructor and student will meet to discuss how the accommodation(s) requested will be provided. For more information, please visit http://www.marshall.edu/disabled or contact Disabled Student Services Office at Prichard Hall 11, phone 304-696-2271.

Course Objectives: At the end of each of the following chapters successful students will be able to:

Chapter 11:

1. understand and describe the intermolecular attractive interactions (ion-dipole, dipole-dipole, London dispersion, hydrogen bonding) that exist between molecules or ions, and be able to compare the relative strengths of intermolecular attractions in substances based on their molecular structure, or physical properties.

2. understand the concept of polarizability.
3. understand the concepts of viscosity and surface tension in liquids.
4. know the names of the various phase changes for a pure substance.
5. interpret heating curves and calculate quantities related to temperature and enthalpies of phase changes.
6. define critical pressure, critical temperature, vapor pressure, normal boiling point, normal melting point, critical point, triple point.
7. interpret and sketch phase diagrams; know how water's phase diagram differs from most other substances, and why.
8. know the difference between crystalline and amorphous solids, and explain the differences between primitive cubic, body-centered cubic and face-centered cubic unit cells.
9. classify solids based on their bonding/intermolecular forces and understand how difference in bonding relates to physical properties.

Chapter 13:

1. understand how enthalpy and entropy changes affect solution formation.
2. understand the relationship between intermolecular forces and solubility, including use of the "like dissolves like" rule.
3. describe the effect of temperature on the solubility of solids and gases.
4. describe the relationship between the partial pressure of a gas and its solubility.
5. calculate the concentration of a solution in terms of molarity, molality, mole fraction, percent composition, and parts per million and interconvert between them.
6. describe what a colligative property is and explain the difference between the effects of nonelectrolytes and electrolytes on colligative properties.
7. calculate the vapor pressure of a solvent over a solution.
8. calculate the boiling point elevation and freezing point depression of a solution.
9. calculate the osmotic pressure of a solution.

Chapter 14:

1. understand the factors that affect the rate of chemical reactions.
2. determine the rate of a reaction given time and concentration.
3. relate the rate of formation of products and the rate of disappearance of reactants given the balanced chemical equation for the reaction.
4. understand the form and meaning of a rate law including the ideas of reaction order and rate constant.
5. determine the rate law and rate constant for a reaction from a series of experiments given the measured rates for various concentrations of reactants.
6. use the integrated form of a rate law to determine the concentration of a reactant at a given time.
7. explain how the activation energy affects a rate and be able to use the Arrhenius Equation.
8. predict a rate law for a reaction having a multistep mechanism given the individual steps in the mechanism.
9. explain how a catalyst works.

Chapter 15:

1. understand what is meant by chemical equilibrium and how it relates to reaction rates.
2. write the equilibrium-constant expression for any reaction.
3. relate K_c and K_p.
4. relate the magnitude of an equilibrium constant to the relative amounts of reactants and products present in an equilibrium mixture.

5. manipulate the equilibrium constant to reflect changes in the chemical equation.
6. write the equilibrium-constant expression for a heterogeneous reaction.
7. calculate an equilibrium constant from concentration measurements.
8. predict the direction of a reaction given the equilibrium constant and the concentrations of reactants and products.
9. calculate equilibrium concentrations given the equilibrium constant and all but on equilibrium concentration.
10. calculate equilibrium concentrations given the equilibrium constant and the starting concentrations.
11. understand how changing the concentration, volume, or temperature of a system at equilibrium affects the equilibrium position.

Chapter 16:

1. understand the nature of the hydrated proton, represented as either H^+ (aq) or H_3O^+ (aq).
2. define and identify Arrhenius acids and bases.
3. define and identify Bronsted-Lowry acids and bases, and identify conjugate acid-base pairs.
4. relate the strength of an acid to the strength of its conjugate base.
5. understand how the equilibrium position of a proton transfer reaction relates the strengths of the acids and bases involved.
6. describe the autoionization of water and understand how $[H_3O^+]$ and $[OH^-]$ are related.
7. calculate the pH of a solution given $[H_3O^+]$ and $[OH^-]$.
8. calculate the pH of a strong acid or strong base given its concentration.
9. calculate K_a or K_b for a weak acid or weak base given its concentration and the pH of the solution.
10. calculate the pH of a weak acid or weak base or its percent ionization given its concentration and K_a or K_b.
11. calculate the K_b for a weak base given K_a of its conjugate acid, and similarly calculate K_a from K_b.
12. predict whether an aqueous solution of a salt will be acidic, basic, or neutral.
13. predict the relative strength of a series of acids from their molecular structures.
14. define and identify Lewis acids and bases.

Chapter 17:

1. describe the common-ion effect.
2. explain how a buffer functions.
3. calculate the pH of a buffer solution.
4. calculate the pH of a buffer after the addition of small amounts of a strong acid or a strong base.
5. calculate the pH at any point in an acid-base titration of a strong acid and strong base.
6. calculate the pH at any point in a titration of a weak acid with a strong base or a weak base with a strong acid.
7. understand the differences between the titration curves for a strong acid-strong base titration and those when either the acid or base is weak.
8. calculate K_{sp} from molar solubility and molar solubility from K_{sp}.
9. calculate molar solubility in the presence of a common ion.
10. predict the effect of pH on solubility.
11. predict whether a precipitate will form when solutions are mixed by comparing Q and K_{sp}.
12. calculate the ion concentrations required to begin precipitation.
13. explain the effect of complex-ion formation on solubility.

Chapter 20:

1. identify oxidation, reduction, oxidizing agent, and reducing agent in a chemical equation.
2. complete and balance redox equations using the method of half-reactions.
3. sketch a voltaic cell and identify its cathode, anode, and the directions that electrons and ions move.
4. calculate standard emfs (cell potentials), E^{o}_{cell}, from standard reduction potentials.
5. use reduction potentials to predict whether a redox reaction is spontaneous.
6. relate E^{o}_{cell} to ΔG^{o} and equilibrium constants.
7. calculate emf under nonstandard conditions.
8. describe the reactions in electrolytic cells.
9. relate amounts of products and reactants in redox reactions to electrical charge.

Chapter 21:

1. write balanced nuclear equations.
2. know the difference between fission and fusion.
3. predict nuclear stability in terms of neutron-to-proton ratio.
4. calculate ages of objects or amounts of material from data on nucleon abundances using the half-life of a radioactive material.
5. convert between nuclear activity units.
6. calculate mass and energy changes for nuclear reactions.
7. understand the meaning of radiation dosage terms.
8. understand the biological effects of different kinds of radiation.

Chapter 24:

1. determine the oxidation number and number of d electrons for metal ions in complexes.
2. name coordination compounds given their formula and write their formula given their name.
3. recognize and draw the geometric isomers of a complex.
4. recognize and draw the optical isomers of a complex.
5. use crystal-field theory to explain the colors and to determine the number of unpaired electrons in a complex.

Chapter 25:

1. draw hydrocarbon structures based on their names and name hydrocarbons based on their structures.
2. know the structures of the functional groups: alkene, alkyne, alcohol, carbonyl, ether, aldehyde, ketone, carboxylic acid, amine, and amide.
3. distinguish between addition reactions and substitution reactions.
4. understand what makes a compound chiral and recognize a chiral substance.
5. recognize the amino acids and understand how they form peptides and proteins via amide bond formation.
6. understand the difference between primary, secondary, and tertiary structure of proteins.
7. explain the difference between α helix and β sheet peptide and protein structures.
8. understand the distinction between starch and cellulose structures.
9. classify molecules as saccharides or lipids based on their structures.
10. understand the difference between *cis* and *trans*, and saturated and unsaturated fatty acids.
11. understand the structure of nucleic acids.