General Chemistry
Chemistry 106 Lecture Section
Dr. Badger

Contents:

Required and Supplementary Materials

REQUIRED:

- Course Text: Gilbert, Thomas R.; Kirss, Rein V.; Foster, Natalie; Chemistry: An Atoms- Focused Approach, First Edition; W.W. Norton & Company, New York, 2017. Available for rental at the Campus Bookstore; Required
- Chem 106 Lab Summer 2017, available for purchase in the bookstore; Required.
- Barbakam Lab Notebook: 100 Carbonless Pages Spiral Bound. Available for purchase at the Campus Bookstore; Required
- Calculator - A scientific calculator with logarithm functions in good operating condition will be of immense assistance on exams, quizzes, problem sets and labs. A cell phone calculator app is not acceptable, especially on exams.

Supplementary materials:

- Chem 106 Web site URL: http://crbadger.uwsp.edu/rbadger/106

Philosophy (contents)

Chemistry 106 is the second semester of a two semester sequence in introductory college chemistry. If you have received a grade of D+ or less in Chemistry 105 or an equivalent course, I recommend that you retake Chemistry 105 as you are not adequately prepared for this course.

In lecture we shall discuss - demonstrate - elucidate - illuminate selected material from the chapters 10-21 of Gilbert. Approximately 500 pages of lecture and laboratory text material during the semester. This necessarily means we will move at a fairly rapid pace and in some cases will not be able to discuss in sufficient detail material that may be of interest or confusing to you. I urge you to ask questions in discussion session, email questions to rbadger@uwsp.edu, email a request for an office appointment, stop by my office, or stop me in the street, if necessary, to obtain satisfactory solutions to problems you may have. I can not guarantee to have all the answers, but I will try to find them, if possible.

Chemistry is viewed by many as black magic. While the magician's goal is to confuse and confound, it will be our goal to explain and understand some of the magic of chemistry. In that regard, you will discover that coming to lecture well prepared (by reading the assigned text thoroughly) and perhaps a little confused (with questions

generated by making a first pass through the chapter assessment exercises) will make the lecture experience more fruitful and enjoyable.

Attendance (contents)

Attendance records will be maintained for lecture, discussion and lab. Extended absences will be reported to the Dean of Students to be sure you are safe and well. Attendance, in itself, will have no direct effect on your grade, but your performance on exams, and problem sets will undoubtedly suffer. The student is responsible for all missed material.

Grading (contents)

Generally, final grades will be based on total points and will be assigned on the following curve:

grade	Percent points possible	Course Exercise	Course point allocations
A	93	Three Hour exams	300 pts.
A-	90-93	Twelve Problem Sets	120 pts.
B+	87-90	12 Lab Reports	120 pts.
B	83-87		
B-	80-83	Final exam (multiple choice)	200 pts
C+	77-80	Total	740 pts.
C	73-77		
C-	70-73		
D+	67-70		
D	60-70		
F	60		

I reserve the right to alter this curve depending on the overall performance of the class. I will under no circumstances raise this curve.

Exams (contents)

Exams are closed book and will be given during class as indicated on the attached schedule. Questions will be taken mainly from the lecture, assigned text, problem sets and laboratory. In addition, the chapter learning guides suggest problems from Brady and Senese that are appropriate practice material for the exams. Solutions to these suggested problems will be discussed at your request and, while they will not be graded, it has become my policy to include one suggested problem from each chapter on exams. Thus, by diligently working the problems, you are assured of being able to successfully answer at least two or three questions correctly on exams. I have made sample exams available via the Chemistry 106 home page. These samples will give you an idea of the depth and type of questions I will ask.

Typically the exams will consist of five types of questions: 1) multiple choice similar to the problem sets; 2) short, fill in the blank questions; 3) three or four short problems, definition or explanation questions; and 4) two of three longer essay or problem questions, for which partial credit will be given.

The final exam will be comprehensive and consist of 50 multiple choice questions similar to those encountered on problem sets and exams.

Materials you may bring: pencils, pens, erasers, and calculators.

Materials I will provide: the exam, a periodic chart, data tables and scratch paper.

Please note the excerpt from UWSP 14 below. Full information on academic misconduct can be found at: http://www.uwsp.edu/dos/Pages/Academic-Misconduct.aspx .I am concerned about academic misconduct during exams and other class activities. I intend to initiate the following measures to protect your intellectual property:

- **Assigned exam seats** On exam day I may project a list of assigned seats and you will be required to sit in your assigned seat or, if and as space allows, a seat that is completely isolated from others.
- **Unique exam** I may create two or more different exams on different colored paper. You must have a different colored exam than your neighbor to the left and right.
- **Video tape** I may video tape the exam to assist in preventing academic misconduct.
- **Your assistance** During the exam please take every precaution to protect your intellectual property - the answers you have placed on your exam. Keep your eyes on your paper or the periodic chart at the front of the class.

(contents)

UWSP 14.03 ACADEMIC MISCONDUCT SUBJECT TO DISCIPLINARY ACTION.

Academic misconduct is an act in which a student:

1. **Seeks to claim credit for the work or efforts of another without authorization or citation;**
2. **Uses unauthorized materials or fabricated data in any academic exercise;**
3. **Forges or falsifies academic documents or records;**
4. **Intentionally impedes or damages the academic work of others;**
5. **Engages in conduct aimed at making false representation of a student's academic performance; or**
6. **Assists other students in any of these acts.**

- **Examples of academic misconduct include, but are not limited to: cheating on an examination; collaborating with others in work to be presented, contrary to the stated rules of the course; submitting a paper or assignment as one's own work when a part or all of the paper or assignment is the work of another; submitting a paper or assignment that contains ideas or research of others without appropriately identifying the sources of those ideas; stealing examinations or course materials; submitting, if contrary to the rules of a course, work previously presented in another course; tampering with the laboratory experiment or computer program of another student; knowingly and intentionally assisting another student in any of the above, including assistance in an arrangement whereby any work, classroom performance, examination or other activity is submitted or performed by a person other than the student under whose name the work is submitted or performed.**
- **The penalty for any academic misconduct is an F for the course grade.**

Lab (contents)

You are expected to attend all scheduled labs. In general, missed labs cannot be made up and will be counted as zeros. The lecture instructor may make allowances for acceptable excused absences.

Other questions pertaining to the experiment of the day, previous week's experiment or relevant chemical concepts in general can be expected. Come prepared!

If, upon studying the experiment to be performed the following lab period, you find you are unsure what is required, please consult with your instructor before lab takes place.

Homework (contents)

The most efficient way to learn new material is to practice applying it. To this end, I will give 12 multiple choice problem sets worth 10 points each which will be submitted via the internet (chem 106 web site). While you are encouraged to discuss these problems with the instructor and classmates you must ultimately provide your own answers. You will be able change your answers for each question up to the due date/time for the problem set.

Schedules (contents)

Chem. 106 - Lecture Schedule - Summer 2017

Problem sets are due on the Prob days by midnight.					
Exams will be held on the Exam days during the lecture period in SCI A111.					
Chapter reading assignments are listed in the schedule.					
May					
Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Reading Assign.**
29	30	31			Chap 10
June					
Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Reading Assign.**
			1 Probset 1	2	Chap 11
5	***6 Probset 2***	7	***8 Probset 3***	9	Chap 12
12 Exam 1	13	14	***15 Probset 4***	16	Chap 13
19	***20 Probset 5***	21	***22 Probset 6***	23	Chap 14
26 Exam 2	27	28	***29 Probset 7***	30	Chap 15
July					
Mon	**Tue**	**Wed**	**Thu**	**Fri**	**Reading Assign.**
3	4	***5 Probset 8***	6	7	Chap 15
10 Exam 3	11	***12 Probset 9***	13	14	***Chap 17 July 16 Probset 10***
17	***18 Probset 11***	19	***20 Probset 12***	21 Final Exam	Chap 21

Chem. 106 - Lab Schedule - Summer 2017

Lab Period	Title
May 30	Check in
June 1	Synthesis of Aspirin
June 6	Analysis of Aspirin
June 8	Molar Mass of a Metal by Gas Evolution
June 13	Lattice Enthalpy, Hydration Enthalpy, and Heats of Solution
June 15	Freezing Point Depression
June 20	Iodine Clock
June 22	Decomposition of Crystal Violet
June 27	Determination of an Equilibrium Constant
June 29	LeChatlier's Principle
July 6	Thermodynamics of KNO_3 Dissolution
July 11	Strong vs Weak Acid Analysis (1)
July 13	Strong vs Weak Acid Analysis (2)
July 18	Buffers
July 20	Electrochemical Cells, Check-Out

Learning Goals (contents)

Chapter 10 Properties of Gases

1. Know what properties are common to all gases.
2. Understand pressure as a force over a specific area.
3. Know the difference between a barometer and a manometer.
4. Be able to use: Boyle's, Charles', Avogadro's, Monton's and the Combined Gas Laws.
5. Know the Ideal Gas Law, and what deviations from it are seen in real gases.
6. Know what STP is.
7. Be able to apply factor label conversions to volumes of gases.
8. Be able to use gas density to calculate molecular weight.
9. Understand Dalton's Law of Partial Pressure.
10. Be able to work with mole fractions and mole percent of gases in mixtures.
11. Be able to define effusion.
12. Understand and apply Graham's Law of Effusion.
13. Have a basic understanding of the kinetic theory and how it relates to the gas laws.

Review questions/problems: 10.1, 10.3, 10.5, 10.7, 10.13, 10.39, 10.45, 10.51, 10.53, 10.57, 10.59, 10.61, 10.65, 10.69, 10.73, 10.81, 10.83, 10.87 10.89, 10.93, 10.99, 10.105, 10.109

Chapter 11 Properties of Solutions

1. Define solute and solvent.
2. See that the tendency of any system to disorder is one major driving force for the formation of solutions.
3. Understand the rule of thumb, "like dissolves like."
4. Determine the difference between an exothermic and endothermic heat of solution, ΔH_{soln}.
5. Be aware that solutions can be formed from all three states of matter as both solute and solvent.
6. Be able to use the Clausius-Claperon equation to calculate vapor pressure of a liquid at any any temperature.
7. Know why a gas is less soluble in aqueous solution with increasing temperature, while most solids are more soluble with increasing temperature.
8. Use Henry's Law, $C_g = k_g P_g$.
9. Define freezing point depression and boiling point elevation (colligative properties).
10. Be able to use colligative properties to determine molecular weight.
11. Be able to define and use the solution concentration units mass percentage, ppm, ppb, mole fraction, molarity and molality.
12. Be able to use the van't Hoff equation.($\Delta T = iK_m$)
13. Use Raoult's Law, $P_{solution} = (X_{solvent})(P_{solvent})$.
14. Explain deviations from Raoult's Law.
15. Define osmosis.
16. Know what component of a solution flows through a semipermeable membrane in an osmotic system.
17. Give examples of colligative properties of solutions.
18. Define the term colloid.
19. Know the difference between solutions, colloids, and suspensions.

End of chapter questions/problems: 11.1, 11.3, 11.7, 11.9, 11.15, 11.19, 11.21, 11.25, 11.29, 11.31, 11.37, 11.39, 11.41, 11.45, 11.47, 11.51, 11.65, 11.73, 11.75

Chapter 12 Thermodynamics

1. Develop an understanding of whether a change occurs spontaneously or not.
2. Understand and be able to use the Three Laws of Thermodynamics.
3. Know the relationship between heat, work, and energy change.
4. Be able to define entropy, ΔS for a process.
5. Be able to define enthalpy, ΔH for a process.
6. Be able to predict the sign of a ΔS at different temperatures, volumes, and states.
7. Know what Gibbs Free Energy is, and how it relates to enthalpy and entropy.
8. Know how to work with standard free energies of reactions.
9. Be aware that change in Gibbs Free Energy in an equilibrium situation is zero.

End of chapter questions/problems: 12.4, 12.5, 12.9, 12.13, 12.15, 12.17, 12.19, 12.23, 12.25, 12.27, 12.31, 12.35, 12.37, 12.39, 12.41, 12.45, 12.49, 12.51, 12.53, 12.55, 12.57, 12.61

Chapter 13 Chemical Kinetics

1. Be able to define the term kinetics.
2. Understand what factors affect reaction rate.
3. Be able to define the term catalyst.
4. Know the differences between transition metal catalysts and enzymes.
5. Understand that all rates are functions of something per unit time.
6. Describe theories of reaction rate.
7. Articulate the main idea behind collision theory, and effective collisions.
8. Be able to determine reaction order given appropriate concentrations and reaction rates or relative reaction rates.
9. Be able to determine the rate constant for first and second order processes given concentration versus time data.
10. Be able to define the half life of a substance.
11. Be able to calculate the half life for first and second order processes.
12. Have a thorough understanding of the Arrhenius Equation.
13. Know how to determine activation energy from an Arrhenius Equation.
14. Be able to determine activation energy from rate constant versus temperature data.
15. Be able to explain what a mechanism is and propose possible mechanisms given the balanced reaction and the rate law for a process..
16. Be able to work with rate laws for elementary processes.
17. Understand the difference between homo- and heterogeneous catalysts.

End of chapter questions/problems: 13.1, 13.3, 13.5, 13.25, 13.35, 13.39, 13.47, 13.51, 13.61, 13.63, 13.65, 13.69, 13.71, 13.79, 13.87, 13.89, 13.99, 13.103, 13.105, 13.111, 13.113, 13.115

Chapter 14 Chemical Equilibrium: General Concepts

1. Know what a dynamic equilibrium is.
2. Know how to determine mass action expressions for a reaction.
3. Be able to convert reaction coefficients to equilibrium constant expression superscripts for equilibrium reactions.
4. Be capable in manipulating equations for chemical equilibria.
5. Know under what conditions K_c can be converted into K_p.
6. Understand the meaning of the magnitude of K.
7. Know the relationship of number of moles of gas to K_c and K_p.
8. Be able to determine conditions for computing K in heterogeneous equilibria.
9. Understand and apply Le Chatelier's Principle.
10. Know what conditions affect or shift a dynamic equilibrium.

11. Know how to calculate K_c from equilibrium concentrations.
12. Be able to establish concentration tables to determine an unknown concentration of reactant or product at equilibrium.
13. Be able to calculate equilibrium concentrations when given a K_c that is very small or very large.

End of chapter questions/problems: 14.1, 14.3, 14.5, 14.15, 14.19, 14.23, 14.25, 14.29, 14.39, 14.43, 14.45, 14.47, 14.53, 14.57, 14.61, 14.63, 14.65, 14.67, 14.71, 14.75, 14.77, 14.81, 14.83, 17.89, 14.91, 14.97, 14.101, 14.103, 14.105, 14.107, 14.111, 14.113, 14.115

Chapter 15 Aqueous Equilibria

1. Be able to identify a Bronsted/Lowry acid and a Bronsted/Lowry base.
2. Be able to identify Lewis acids and bases.
3. Be able to predict and explain relative acidity of binary and oxyacids.
4. Understand what constitutes a conjugate acid - base pair.
5. Understand that the conjugate base of a weak acid may produce a basic solution.
6. Understand the concept of conjugate acids and bases.
7. Know the names and chemical formulas of the common strong acids and bases.
8. Understand what is meant by complete and partial dissociation.
9. Understand periodic trends in acid and base strengths.
10. Be able to define and identify amphiprotic materials.
11. Be able to define and utilize Lewis acid/base concepts.
12. Understand what the term pH represents.
13. Know the relationship between pH and pOH.
14. Understand the mathematical relations between pH, [H+], pOH, and [OH-].
15. Be able to formulate an ICE table and use it to determine an equilibrium constant.
16. Know how to solve equilibrium calculations using an an ICE table with the quadratic equation.
17. Be able to calculate percent ionization from equilibrium concentrations.
18. Be aware that in successive ionizations of a polyprotic acid, the K_{a1} is approximately 10000 times larger than K_{a2} in most cases.
19. Know what constitutes an acidic, basic, or neutral solution.
20. Be able to define strong acid and strong base, and know the difference between them and weak acids or bases.
21. Know the relationship between K_a and pK_a (or K_b and pK_b).

End of chapter questions/problems: 15.3, 15.5, 15.9, 15.11, 15.13, 15.15, 15.17, 15.19, 15.21, 15.23, 15.25, 15.29, 15.31, 15.33, 15.35, 15.39, 15.41, 15.43, 15.45, 15.49, 15.51, 15.53, 15.55, 15.57, 15.59, 15.63, 15.65, 15.67, 15.75, 15.77, 15.79, 15.81, 15.83, 15.85, 15.87, 15.89, 15.91, 15.93, 15.95, 15.97, 15.99, 15.101, 15.103, 15.105, 15.109, 15.111, 15.113, 15.115, 15.117, 15.119, 15.121, 15.123, 15.125, 15.127, 15.131

Chapter 17 - Electrochemistry

1. Know what an electrochemical cell is.
2. Be able to define anode and cathode.
3. Understand that in aqueous electrochemistry, water may also undergo electrolysis.
4. Know that a coulomb is 1 amp multiplied by 1 second.
5. Be able to use conversion factors incorporating coulombs and moles of electrons.
6. Be aware of industrial scale electrolysis for such elements and compounds as: aluminum, magnesium, sodium, copper, and brine.
7. Understand that spontaneous electrochemical cells are essentially batteries.
8. Know how to utilize SRP (Standard Reduction Potential) in determining cell potential for a given reaction.

9. Be capable of predicting spontaneous redox cells.
10. Be able to calculate free energy change for a reaction from its cell potential.
11. Be able to calculate the equilibrium constant for a reaction from its cell potential.
12. Be able to use the Nernst Equation to determine cell potentials.
13. Be able to use the Nernst Equation to calculate ion concentrations from cell potentials.

End of chapter questions/problems: 17.3, 17.11, 17.13, 17.15, 17.17, 17.19, 17.25, 17.27, 17.29, 17.35, 17.37, 17.39, 17.41, 17.43, 17.47, 17.49, 17.51, 17.53, 17.55, 17.65, 17.67, 17.71

Chapter 21 - Nuclear Chemistry

1. Understand the principle of the conservation of mass and energy.
2. Know what the zone of nuclear stability is.
3. Know what alpha, beta, and gamma radiation are composed of.
4. Be able to predict products in a radioactive disintegration series.
5. Be capable of predicting products in nuclear transmutation reactions.
6. Know what a Geiger counter is.
7. Understand the reasons for and causes of radiation sickness.
8. Be able to define background radiation.
9. Know basic, non-lethal, productive applications of radioactivity.
10. Understand the difference between nuclear fusion and nuclear fission.
11. Know how nuclear fission produces electrical energy in a nuclear power plant.
12. Understand the basic safety features of nuclear reactors.

End of chapter questions/problems: 21.1, 21.4, 21.5, 21.7, 21.10, 21.13, 21.19, 21.22, 21.27, 21.37, 21.39, 21.47, 21.53, 21.69, 21.73, 21.79

Last update: Saturday, 27-May-2017 16:55:52 CDT

Copyright © 1998-2018Dr. Robert Badger, 449 Chemistry Biology Building, | University of Wisconsin-Stevens Point