CHEM 1412 — General Chemistry — Spring, 2012
Syllabus

Faculty Information

Section 020 - TR 8:00-9:15, CAV 200
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Office Hours: M-F 10 am - 11 am
or by appointment

Required Supplies

- **Textbook** [**Required** – **Choose One**]:
  1. Steven S. Zumdahl, Susan A. Zumdahl, *Chemistry: An Atoms First Approach* (1st edition, 2012) bundled with OWL/eBook printed access card.
  2. OWL with Zumdahl & Zumdahl eBook (24 months) Printed Access Card (or can be purchased online at http://www.cengage.com/owl)

  Note: OWL (Online Web-based Learning) online homework is required.
  If you purchase a textbook off-campus, make sure it is bundled with OWL).
- **Lab Manual [Required]:** David Carter, Kevin A. Boudreaux, Nick Flynn, and Joe Velasquez, III, *Laboratory Manual for Chemistry 1411* (Fall, 2011) [required]
- **Approved Lab Goggles [Required]**
- **Calculator [Required]:** Scientific calculator capable of performing calculations with log and scientific notation. *Bring your calculator to class and to lab every day.*

Course Description

In this class, you will study the fundamental laws and theories of chemistry, chemical nomenclature, chemical equilibrium, metals and non-metals and their compounds, nuclear chemistry and the quantum theory of structure. **Prerequisites:** Chemistry 1411 is to be completed before Chemistry 1412. Proficiency in algebra required. Only students eligible to take college-level mathematics courses may take Chemistry 1411.

Grading

Exams, 3 @ 100 pts	300 pts
Final	150 pts
Quizzes, classroom participation	150 pts
Mastering Chemistry Homework	200 pts
Laboratory	200 pts
Total	**1000 pts**

Grading Scale			
A	=	90-100%	900-1000 pts
B	=	80-89.9%	800-899 pts
C	=	70-79.9%	700-799 pts
D	=	60-69.9%	600-699 pts
F	=	<60%	0-599 pts

Quizzes

Quizzes will be given *every week*, usually at the end of class on Thursdays. They will be based on material presented since the previous quiz, and will be taken primarily from the problems in the textbook. There will be approximately 12 to 15 quizzes, worth 100 points each; the lowest two quiz grades will be dropped from the total; and the remaining quiz grades will be averaged together and scaled to 150 points.

Computer Homework

OWL (www.cengage.com/owl) is an online homework program which accompanies the Zumdahl

textbook. There will be assignments due every Monday and Thursday at 11:59 pm. These assignments will be averaged to give a 200-point grade.

Exams
Three exams, each worth 100 pts., will be given on **February 14**, **March 22**, and **April 26**. The problems from the textbook, the computer homework, and the quizzes will be a good preparation for these exams. Most of the exams will be over material covered since the last exam, however, since the course builds on material delivered earlier, so the concepts, calculations and techniques from earlier exams may be required. Usually, allowances for make-up exams will only be made in the case of an excused university absence. Communication with your instructor is critical.

Final Exam
The final exam will be a standardized ACS exam which covers the entire 1411/1412 sequence. For this section, the Final Exam will be on **Tuesday, May 8** from **8:00 AM to 10:00 AM**. **Students who must miss the scheduled exam time must notify the instructor by noon of the day of the exam, otherwise no make-up provisions will be made.**

Last Day to Drop
The last day to drop the course with a grade of "W" is Wednesday, April 4, 2012. Ceasing to attend class does not constitute a formal course drop, and failure to drop a course properly will result in a failing grade in the course.

Reserve Material and Blackboard
Most of the slides which are projected on the LCD projector are available on my faculty web page at www.angelo.edu/faculty/kboudrea. (There is also a link to this page from the "Our Faculty" section of the Department of Chemistry and Biochemistry web page at www.angelo.edu/dept/chemistry/.) Homework and exam schedules, suggested problems, and other materials will also be posted here. If you have trouble accessing these files, or you want the printout in some other page format, I can make a copy on a removable drive or blank CD-R.

The printed lecture notes do *not* contain all of the information presented during the class, such as solutions to the example problems. You should take good notes anyway.

The web site for this textbook is wps.prenhall.com/esm_tro_chemistry_1/. This site has a large number of activities, problems, and videos that reinforce many concepts presented in class.

Grades, information, handouts, homework assignments and other course documents will be posted on Blackboard. http://blackboard.angelo.edu (or access Blackboard from RamPort).

Review Sessions
Review sessions will be held weekly on Wednesdays at 5 pm (location to be announced later). These sessions should give you a chance to enhance your understanding of chemistry, and hence, your grade. SI tutoring sessions will also be available for this course.

Attendance
You are expected to attend all class meetings. You are expected to arrive on time and to stay until the end of the lecture. In-classroom activities such as worksheets and quizzes cannot be made up. You will not be automatically dropped if you stop attending class.

Honor Code / Academic Dishonesty
Angelo State University expects its students to maintain complete honesty and integrity in their academic pursuits. Students are responsible for understanding the Academic Honor Code, which is to be found in the Student Handbook (www.angelo.edu/cstudent/). The penalty for ANY sort

of dishonesty, cheating or plagiarism can range from a grade of zero on the assignment to a F in the course and disciplinary action as warranted in accordance with university guidelines. Don't even consider it.

Disabilities
Persons with disabilities which may warrant academic accommodations must contact the Student Life Office, Room 112 University Center, in order to request and to implement academic accommodations.

Studying and Homework
The lectures in this course will follow the general format for the textbook; it is expected that you will read the appropriate sections in the textbook.

In general, for any college-level class, you should be prepared to spend about 2-3 hours of studying for each hour of lecture.

In order to master chemistry, you MUST WORK PROBLEMS. This textbook has a good selection of problems within each chapter and at the end of each chapter. You should make an effort to work all of the problems within the text of the chapter; in addition, I will highlight some selected problems from the end of the chapter that you should try to work. You can expect to see a lot of these (or at least similar ones) on the exams.

Copies of the *Student Solutions Manual* will be on reserve in the library; in this book, all of the problems which have answers in the back of the textbook are worked out in full.

Lab Course
The lab course will give you practical experience in many common laboratory techniques involved in the qualitative analysis of unknown mixtures. Attendance in lab is a mandatory part of this course. The grade you receive in lab will be counted as a 200 pt. score.

Labs will begin meeting during the first week of classes. Bring your calculator!

Proper attire will be required in your laboratory section! (see below)

Laboratory Attire
Beginning on the first day of lab, everyone MUST have **approved goggles**, **long-sleeved shirts which cover the midriff**, **long pants**, and **shoes with closed toes and heels** (no sandals, slides, etc.). (Basically, you should have as little exposed skin as possible.) Anyone not wearing the appropriate attire will not be allowed into lab.

CHEM 1412 Lab Classes

Section	Day	Meeting Time	Instructor	Lab Room	Class Room
04Z	M	02:00 pm-04:50 pm	Ross C. Dawkins	CAV 212	CAV 211
05Z	T	11:00 am-01:50 pm	Ross C. Dawkins	CAV 212	CAV
06Z	T	02:00 pm-04:50 pm	Edith M. Osborne	CAV 212	CAV
07Z	W	02:00 pm-04:50 pm	Ross C. Dawkins	CAV 212	CAV
08Z	R	02:00 pm-04:50 pm	Ross C. Dawkins	CAV 212	CAV

Pre-lab lectures will be given in the class rooms listed above.

Lab Manual and Lab Reports
The lab manual provides a set of procedures and a lab report form for each qualitative analysis procedure. There will be 7 qualitative analysis reports handed in (Groups I-V, General, Salt), and

4 problem sets, worth 100 pts. each. There will also be a titration curve lab, worth 100 pts.

For the qualitative analysis reports, 5 pts will be taken off for the first incorrect identification, 10 pts for the second, 15 pts for the third, and so on. For the General unknown, 5 pts will be taken off for each incorrect identification. For the salt unknown, the cation is worth 50 pts, and the anion is worth 50 pts.

The problem sets will be averaged together to give one 100 point grade, which will then be averaged together with the 7 analyses, to give one 200 pt. grade for the lab portion of this course. *No labs will be dropped from the total.*

Cleaning Up After Lab

Make sure that your lab area is clean and that all glassware and hardware has been cleaned and returned to the appropriate drawers before leaving the lab.

Lab Schedule

Week Of	Lab	Deadlines	Problem Sets
1/17	*1*	Check in, begin Group I	
1/23	*2*	Group I unknown due	Problem Set I Due
1/30	*3*		
2/6	*4*	Group II unknown due	Problem Set II Due
2/13	*5*		
2/20	*6*	Group III unknown due	Problem Set III Due
2/27	*7*	Group IV unknown due	
3/5	*8*	Group V unknown due	Problem Set IV Due
3/12	*9*	**Spring Break**	
3/19			
3/26	*10*		
4/02	*11*	Titration curve lab	
4/09	*12*	General unknown due	
4/16	*13*		
4/23	*14*	Salt unknown due, check out	

Schedule of Topics for 1412 – Spring 2012

Week	Topics {[] = optional topics}
1/16	**Chapter 8: Liquids and Solids.** Solids, liquids and gases. Polar vs. nonpolar covalent bonds and molecules. Intermolecular forces. Properties of liquids. Phase changes. Vapor pressure. The Clausius-Clayperon equation. Boiling points. Heating-cooling curves. Phase diagrams. The solid state.
1/23	**Chapter 11: Properties of Solutions.** Types of solutions. Intermolecular forces. Thermodynamics of solution formation. Factors affecting solubility. Units of concentration. Conversions of concentration units. Colligative properties: vapor pressure lowering.
1/30	Colligative properties: boiling point elevation, freezing point depression, and osmosis. Colloids. **Chapter 12: Chemical Kinetics.** Rates of reactions. Rate laws. The method of initial rates.
2/6	Integrated rate law, half-life of first-order reactions. Integrated rate law, half-life of second-order reactions. Collision theory. The Arrhenius equation. Reaction mechanisms. Catalysts.

2/13	**Chapter 13: Chemical Equilibrium.** Dynamic equilibrium. Writing equilibrium laws. Manipulating K. K_p vs. K_c. Reaction quotient. Direction of reaction.
2/20	Equilibrium problems and ICE tables. Using the quadratic formula in ICE tables. Simplification of # - x = #. ICE tables. Le Chatelier's Principle. **Chapter 14: Acids and Bases.** Arrhenius, Bronsted-Lowry definitions of acids and bases. The hydronium ion. Conjugate acid-base pairs. Strong acids.
2/27	Strong and weak acids. Autoionization of water. The pH scale. General pH calculations. Weak acid equilibria. pH's of strong acids and weak acids. Polyprotic acids. [Sulfuric acid?] Weak base equilibria. pH's of strong bases and weak bases.
3/5	Relationship between K_a and K_b. Predicting pH of salt solutions. Calculating pH's of salt solutions. Calculating pH's of divalent anion salt solutions. Factors affecting acid strength. Lewis acids and bases.
3/12	**Spring Break.**
3/19	**Chapter 15: Acid-Base Equilibria.** Buffers. ICE tables vs. the Henderson-Hasselbalch equation. Buffers. Buffer capacity. Titrations curves. Strong-strong titration example. Strong-weak titration example.
3/26	Titration curve examples. **Chapter 16: Solubility and Complex Ion Equilibria.** Slightly soluble compounds. Solubility equilibria. The common-ion effect.
4/2	Precipitation. Qualitative analysis. Complex ions. **Chapter 17: Spontaneity, Entropy, and Free Energy.** Spontaneous vs. nonspontaneous processes. The First Law of thermodynamics. Entropy. Entropy changes. Predicting entropies. The Second Law of thermodynamics and spontaneity. Calculating entropy changes.
4/9	Free energy. Free energy changes. The Gibbs equation. Free energy of formation. The meaning of free energy. Free energy changes under nonstandard conditions. Relationship of free energy to equilibrium constant. **Chapter 18: Electrochemistry.** Redox reactions. Balancing redox reactions. Galvanic cells. Parts of a galvanic cell.
4/16	Galvanic cells. Cell potentials. Free energy and cell potential. The Nernst equation. Batteries.
4/23	Corrosion. Electrolytic cells. Faraday's Law of electrolysis. Applications of electrolysis. **Chapter 19: The Nucleus: A Chemist's View.** Writing and balancing nuclear reactions. Types of radiation. Nuclear stability and decay rates.
4/30	The kinetics of radioactive decay. Energy changes in nuclear reactions. Fusion and fission. Nuclear transmutation and the transuranic elements. Radioactivity and health. Nuclear energy.
5/8	**Final Exam.**

Student Learning Outcomes
After completion of this course students will be able to:

- Demonstrate technical and analytical skills in the area of general chemistry.
  - Students will be able to use the periodic table to determine basic atomic information and to predict trends in atomic properties.
  - Students will be able to interconvert between chemical names and formulas to the extent that they can work problems given only one of those pieces of information.
  - Students will be able to classify common types of chemical reactions and predict the outcomes of reactions.
- Analyze complex chemical problems and draw logical conclusions.
  - Students will be able to use an understanding of atomic structure at the basic and atomic levels to analyze the structure and reactivity of substances and chemical species.
  - Students will be able to use an understanding of how energy interacts with matter to predict stable chemical species, and perform thermodynamic calculations describing chemical reactions.
- Employ mathematics in the analysis of chemical problems.
  - The mole concept, chemical formulas and balanced chemical equations will be used to do chemical calculations that relate macroscopic measurements to numbers of atoms, ions or molecules.
  - Students will be able to do calculations involving solution concentration and know how to prepare solutions of given concentrations.
  - Students will be able to quantitatively predict gas properties using gas law calculations.
- Understand and apply scientific reasoning in the chemical sciences.
  - Students will be able to use an understanding of ions and molecules at the atomic level to predict the behavior of reactions in aqueous solutions.
  - Students will be able to use the basic ideas of quantum mechanics to describe how molecular bonds form and to predict molecular shape and polarity. Molecular structure and polarity will be used to predict the forces between molecules and relate those forces to the states of matter and phase changes.

Evaluation of Student Learning Outcomes
Student learning outcomes will be evaluated by test questions or by the grading of in-classroom activities, as described by your instructor.

Texas Higher Education Coordinating Board Natural Sciences Objectives
The objective of the study of a natural sciences component of a core curriculum is to enable the student to understand, construct, and evaluate relationships in the natural sciences, and to enable the student to understand the basis for building and testing theories.

Exemplary Educational Objectives

1. To understand and apply method and appropriate technology to the study of natural sciences.
2. To recognize scientific and quantitative methods and the differences between these approaches and other methods of inquiry and to communicate findings, analyses, and interpretation both orally and in writing.
3. To identify and recognize the differences among competing scientific theories.
4. To demonstrate knowledge of the major issues and problems facing modern science, including issues that touch upon ethics, values, and public policies.
5. To demonstrate knowledge of the interdependence of science and technology and their influence on, and contribution to, modern culture.