Chem 308-01: General Chemistry II

Spring 208, TT 11:00 am – 12:20 pm, Rogers 100
Instructor: Professor Deborah C. Bebout
Office: Rogers 225
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Office Hours: Wednesday 2:30 – 3:30 pm in Rogers 225, Friday 12:30 – 2:30 pm in Chemistry Conference Room
Blackboard course ID: Chem308-01-S08

COURSE CATALOG DESCRIPTION: (3 credits; Prerequisite Chem 103) A continuation of the study of the principles of chemistry begun in Chemistry 103. Topics include thermodynamics, nuclear chemistry, chemical kinetics, descriptive inorganic chemistry, and acid-base chemistry. Recommended for students expecting to major in the life sciences, geology, and physics.

Chem 305, 308 and 335 are interchangeable for the purposes of meeting biology, chemistry, geology, neuroscience and physics major degree requirements, chemistry and biochemistry minor degree requirements, as well as admission requirements for medical school. There is, however, no coordination between these courses or between the two sections of Chem 308. Students enrolled in Chem 308 Section 01 should plan to consult Professor Bebout regarding all issues related to this course.

At William and Mary, the course sequence Gen Chem I, Orgo I, Orgo II, Gen Chem II is normal for those planning to take two years of college chemistry since Orgo I is only taught in the spring and summer. However, Chem 308 does not have a organic chemistry as a prerequisite and may be taken immediately after Gen Chem I for those only planning to take two semesters of college chemistry.

Course Objectives:

1. Study the content, principles and methods of chemistry;
2. Develop an appreciation for the relevance of chemistry in our daily lives;
3. Improve analytical and problem solving skills.

Texts and other resources:

Required Text:
Zumdahl & Zumdahl, Chemistry, Seventh Edition, Houghton Mifflin, 2006 ISBN 978-0-618-52844-8
Earlier editions of the book have comparable content but different tpage, chapter, figure, problem, etc. numbering. Students choosing to use an earlier version of the text are responsible for any correlation between texts that may be necessary. There are copies of the 7th edition end-of-chapter problems posted as Blackboard course documents.

Recommended Optional Texts:
Zumdahl & Kelter, Study Guide for text above ISBN 978-0-618-52849-3
Hummel, Zumdahl & Zumdahl, Student Solutions Guide for text above ISBN 978-0-618-52850-9

Course related Electronic Resources:
1. Zumdahl, 7th Ed., Chemistry, CD-ROM (packaged with text).
2. CHEM 308-01 Blackboard site: Course documents such as solutions to homework problems and study problems
3. http://www.webassign.net to submit answers to homework assignments

Student Course Responsibilities & Course Policies:

Time commitment: Excelling in college level course work typically requires on average three to four hours per credit per week. Since this is a three credit course, in addition to almost three hours spent in class each week you should expect to spend six to nine hours on average reading the textbook, doing homework and otherwise preparing for this class on a weekly basis.

Attendance: Class attendance is expected for all scheduled meetings and required on scheduled exam dates. Students are responsible for everything that is covered during class including demonstrations and other visual aids. Students missing class for any reason are expected to get notes from a peer in the class and check Blackboard for any important announcements that they might have missed.

Classroom Behavior: Students attending lecture are expected to be attentive and refrain from activities that would distract other students in the class. Please refrain from eating, cell phone and laptop use during class.

Preparation for class: A brief review of relevant textbook sections before class is recommended.

Homework Assignments: There will be eleven WebAssign homework assignments, each worth 10 pts. Your overall homework score will be based on the ten highest scores. Points earned on the eleventh homework will count as extra credit. Answers to homework assignments must be submitted via WebAssign before 5 pm every Sunday except March 2nd (first Sunday of spring break) and weeks with mid-terms scheduled on Thursday. **Answer keys for homework will be posted as Blackboard course documents at 5 pm the Sunday they are due, so there will be NO CREDIT FOR LATE HOMEWORK**. Each student must purchase a WebAssign login access code for this class at the Bookstore or on line at www.. Each homework assignment will consist of ~10 problems posted at least one week in advance. Five attempts to submit the correct answer will be permitted on each problem part. Assignments are set up so they can be started, saved and resumed later numerous times. One or two bonus points will be awarded to each student earning more than five or more than eight points, respectively, on individual homework assignments.

How to Log into WebAssign (Student roster uploaded December 29, 2008):
1) Go to WebAssign.net
2) Click on "Log In" and enter the following
Username = your W&M e-mail name without the @wm.edu. For example, dcbebo
Institution = wm
Password = your 9-digit student number, if you have never used WebAssign before (you might want to change your password once you have logged in). If you have had a WebAssign account previously, your old password will still apply.
3) Log in and enter your access code for this class. You should now see your assignments.

Study Problems: Answers for all odd-numbered end-of-chapter problems can be found in the back of Zumdahl and complete solutions for these problems are available in the student study guide. Several studies problems will posted for each lecture.

Review Sessions: Review sessions will be held at 9 pm in Rogers 100 on Tuesday before mid-terms (February 12th, March 18th and April 8th) and on Monday May 5th at 9 pm in Rogers 100 for the final. Review session attendance is optional but encouraged.

Grading Policies

Grading: Your grade will be calculated as follows:

100 pts	Homework: Top ten scores on homework assignments. Maximum 10 each (bonus points accumulate separately).
200 pts	First mid-term
200 pts	Second mid-term
200 pts	Third mid-term
300 pts	Final (50% material after 3rd mid-term + 50% cumulative = 62.5% material after 3rd mid-term + 37.5% earlier material)

Mid-Terms: All mid-terms will be closed-book, closed-note, independent exercises. **NO MAKE-UP MID-TERM EXAMS WILL BE GIVEN.** For excused absences, the remaining exams will be weighted more heavily to account for the missed exam. If you know that you will have a conflict with a scheduled exam due to a College function such as varsity sports, choir, etc., please notify me **in advance** of your absence. Documentation for severe illness must be obtained from the Health Center or other medical professional. Documentation for deaths in the family and other extraordinary circumstances must be obtained from the Dean of Students. Unexcused absences for scheduled mid-terms, including early departures or late returns from weekends/spring break, fraternity/sorority functions, family reunions, etc. will result in a grade of zero for the missed exam.

Second Chance Mid-Terms: Students will be given the opportunity to regain **UP TO 20%** of the points missed on exams by returning hand-written corrections no later than 11 am the Thursday following the mid-term. The original graded exam must be returned with additional sheets of paper attached on which ***detailed explanations*** of the correct answers to each incorrect problem are provided in the same order as the exam problems. Late submissions will not be accepted. Second Chance Mid-Terms are open-source exercises.

Final Exam: The final exam for this section of Chem 308 is scheduled for Wednesday, May 7th from 1:30-4:30 pm, the last spring exam period. Since I do not teach the MWF section of this course, plan on taking the exam at the scheduled time unless you meet the limited criteria for rescheduling a final (three consecutive examination periods on consecutive days or a conflict between scheduled examinations). The Office of the Dean of Students handles deferral requests from students unable to take their examinations at the time scheduled on account of documented illness or other extenuating circumstances (such as a death or other family emergency, conflict with a religious holiday, or participation in activities by a student representing the College). Final examinations that are deferred will be scheduled for the beginning of the Fall 2008 semester.

Class Climate, Culture and the Honor System
The College of William and May has an Honor System detailing the academic responsibilities of all students. Students may work with other students on the homework but are required to submit their own answers. Exams will be closed book and closed note. Please let me know if you have documented disabilities that require specific accommodation to minimize their impact on your performance in this class.

Anticipated Course Calendar:

Date	Topic & Readings	Recommended Study & Required Homework Problems[a]
Jan 17	Review; Start chapter 14	**1**.34, **4**.17, **6**.85, **8**.93, **12**.29, **13**.51
Jan 20	WebAssign HW #1 due @ 5 pm (Key posted Jan 27)	**1**.32, **2**.56, **3**.58, **3**.86, **4**.74, **6**.36, **6**.62, **12**.86, **13**.34,60 & Intro to WebAssign
Jan 22	14.1-14.3	**14**.29, 33, 39, 43, 45
Jan 24	14.4-14.7	**14**.47, 51, 61, 85, 91
Jan 27	WebAssign HW #2 due @ 5 pm	**14**.28, 32, 38, 50, 54, 64, 68, 72, 78, 80
Jan 29	14.8-14.11	**14**.97, 107, 115, 121, 133
Jan 31	15.1-15.3	**15**.
Feb 3	WebAssign HW #3 due @ 5 pm	**14**.84, 96, 104, 114, 120; 15.TBA
Feb 5	15.4-15.5	**15**.
Feb 7	15.6-15.9	**15**.
Feb 10	WebAssign HW #4 due @ 5 pm	**15**.
Feb 12	16.1-16.3	**16**.
Feb 14	**Mid-term 1: Chapters 14 & 15**	
Feb 17	*Test week, no homework due*	
Feb 19	16.4-16.6	**16**.
Feb 21	16.7-16.9; Enzyme kinetics **Midterm I corrections due**	**16**.
Feb 24	WebAssign HW #5 due @ 5 pm	
Feb 26	Enzyme kinetics	Study problems posted on Blackboard
Feb 28	17.1-17.3	**17**.
Mar 4	*Spring break*	
Mar 6	*Spring break*	
Mar 9	WebAssign HW #6 due @ 5 pm	
Mar 11	17.4-17.5	**17**.
Mar 13	17.6-17.7 & biochemical redox reactions	**17**.
Mar 16	WebAssign HW #7 due @ 5 pm	
Mar 18	9.1-9.2	**9**.
Mar 20	**Mid-term II: Chapter 16& 17, Enzyme kinetics**	
Mar 21	*Last day to withdraw from a course with grade of W*	
Mar 23	*Test week, no homework due*	
Mar 25	9.3-9.4	**9**.
Mar 27	19.1, 19.2, 19.4 **Mid-term II corrections due**	**19**.
Mar 30	WebAssign HW #8 due @ 5 pm	**9**.
Apr 1	20.1-20.2	**20**.
Apr 3	20.3-20.5	**20**.
Apr 6	WebAssign HW #9 due @ 5 pm	**20**.
Apr 8	18.1-18.2	**18**.
Apr 10	**Mid-term III: Chapter 9, 19, 20**	
Apr 13	*Test week, no homework due*	
Apr 15	18.3-6	**18**.
Apr 17	Metal spectroscopy **Mid-term III corrections due**	Study problems posted on Blackboard
Apr 20	WebAssign HW #10 due @ 5 pm	
Apr 22	21.1-3	**21**.
Apr 24	21.4-7	**21**.
Apr 27	WebAssign HW #11 due @ 5 pm	
May 7	**Final 1:30 – 4:30 pm** 62.5% Chapters 18, 21 & Metal spectroscopy 37.5% Chapters 9, 14-17, 19 &20 & Enzyme kinetics	

[a] For all odd numbered textbook problems, answers are provided in the back of the textbook and complete solutions are provided in the student solution guide.

Overview of Critical General Chemistry I and Math Knowledge

Symbols & Abbreviations

∴ Therefore

Rxn = reaction	E = Energy	T = Temperature	K = equilibrium constant	eq = equation
Soln = solution	H = Enthalpy	t = time	k = rate constant	

Arrows: $\longrightarrow$ used if reaction goes to completion; $\rightleftharpoons$ used for equilibria; $\leftrightarrow$ used for resonance

[A] = Molar concentration of A (moles A/liter solut)

$^{A}_{Z}X$ = Atomic symbol where A = Mass Number = # protons + # neutrons, Z = Atomic number = # protons, X = element symbol

Significant Figures

Rounding: Carry all the digits available through calculations to avoid round off error. If ≥ 5, round up; if < 5 round down.
Addition & Subtraction: Modify the result to have the same number of *decimal places* as the number with the *fewest decimal places*.
Multiplication & Division: Modify the result to have the same number of *significant figures* as the number with the *fewest sig. figs.*
Combined calculations: Apply above rules in the same order as their respective operations in performing calculation.
Logarithms: Number of decimal places in the log is equal to the number of significant figures in the original number.
Approximations: $100 - x \cong 100$ when $x << 100$

Nomenclature

General: Cations first by element name(oxidation state) then simple anions Xide; Compounds are **neutral**
Number prefixes: 1-10 = mono-, di-, tri-, tetra-, penta-, hexa-, hepta-, octa-, nona-, deca-
Oxyanions: if only two XO_n = Xite, XO_{n+1} = Xate; if four XO = hypoXite; XO_2 = Xite; XO_3 = Xate; XO_4 = perXate

Important types of solution reactions

Acid-base reactions: involve a transfer of H^+ ions
Precipitation reactions: formation of a solid occurs
Oxidation-reduction reactions: involve electron transfer [organic: reduction (oxidation) gain H (O) OR lose O (H), not both!]

Bonding

Ionic bond: electrons are transferred to form ions
Covalent bond: equal sharing of electrons
Polar covalent bond: unequal electron sharing
Electronegativity: Relative ability of atom to attract shared e^-; polarity of bond depends on relative electronegativity of bonded atoms
VESPR Model: Valence shell Electron Pair Repulsion model = minimization of electron pair repulsion dictates geometry

Thermodynamics

First law of thermodynamics: Energy is conserved.
State functions: Functions which are path independent and only depend on endpoints (eg. energy, enthalpy)
Standard state: 1 M concentrations, 1 atm, 25 °C
Exothermic: Energy as heat flows out of system; opposite of endothermic

$$\Delta H^\circ_{rxn} = \Sigma n_p \Delta H^\circ_f(\text{products}) - \Sigma n_r \Delta H^\circ_f(\text{reactants})$$ (elements omitted since $\Delta H^\circ_f(\text{element}) = 0$)

Kinetics

Differential Rate Law: $\text{Rate} = -\frac{\Delta[A]}{\Delta t} = k[A]^n$ where A = reactant; k = rate constant; n = order of rxn (NOT coefficient in balanced eq)

Integrated Rate Law: For a reaction of type aA → products for which Rate = $k[A]^n$

n = 0: $[A] = -kt + [A]_0$ n = 1: $\ln[A] = -kt + \ln[A]_0$ n = 2: $[A]^{-1} = kt + [A]_0^{-1}$

These equations have the form y = mx + b, the value of k can be determined from the slope of the plot of appropriate [A] vs t plot

Arrhenius equation: $k = Ae^{-E_a/RT}$

Equilibria

K = Equilibrium Constant = [product]/[reactants] = $[C]^c[D]^d/[A]^a[B]^b$ for the reaction $aA + bB \rightleftharpoons cC + dD$

Q = Equilibrium Quotient ; If Q > K, rxn will shift toward reactants, if Q < K rxn will shift toward products

Le Châtelier's Principle: when a stress is placed on a system at equilibrium, the system shifts in the direction that relieves the stress

Dynamic State: At equilibrium, reactants and products are interconverted continually; Forward rate = Reverse rate