

Chem 112, General Chemistry 2
Course Syllabus, Spring 2012

Instructor: Dr. Bettie Obi Johnson (lecture / sec 004 lab), Mr. Bob Bundy (sec 104 lab)

Office: Bradley 224

Office hours: MW 1:30 – 3 pm, TTh 11 – 1 pm, or by appointment

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Lecture: MW 11:00 – 12:15 pm (Bradley 121)

Lab: T 2:30 – 5:30 pm (sec 004) (Bradley 208), Th 11:00 – 2:00 pm (sec 104)

I. Course Description

General Chemistry II is a four-credit hour laboratory science course that is a continuation of CHEM 111 with special emphasis on chemical equilibrium. The course will cover properties of solutions, kinetics, chemical equilibrium, acids and bases, thermodynamics, electrochemistry, and an introduction to organic chemistry. In the laboratory, experiments will deal with the major principles discussed in class and will also include inorganic qualitative analysis. This course is primarily intended for students majoring in chemistry, biology, engineering, and pre-professional fields. The course pre-requisites are a “C” or better in Math 111 or Math 115 and Chem 111.

II. Goals and Learning Outcomes

The overall goal of Chem 112 is to provide students with the knowledge and skills necessary to understand and solve chemistry related problems. Upon completion of this course, the student should specifically be able to:

1. Express solution concentration in molarity, molality, and normality.
2. Relate colligative properties of solution to concentration.
3. Determine the rate law for a reaction using the method of initial rates.
4. Use an integrated rate law to determine concentration as a function of time.
5. Identify an appropriate reaction mechanism based on kinetic data.
6. Use equilibrium constant expressions to determine equilibrium solution concentration.
7. Use LeChatelier’s principle to evaluate the impact of changes on a chemical equilibrium.
8. Describe acids and bases and interconvert between $[H_3O^+]$, $[OH^-]$, and pH for a system.
9. Understand the relationship between structure and strengths of acids and bases.
10. Calculate the pH of buffer systems and describe how to prepare a given buffer.
11. Predict whether a given reaction will occur spontaneously using ΔH , ΔS , and ΔG .
12. Write balanced electrochemical reactions and determine the energetics of redox reactions.
13. Name organic compounds, identify functional groups, and relate structure to properties.
14. Apply the theoretical ideas covered in lecture to practical situations in the laboratory.
15. Perform data collection and analysis in the laboratory and document experimental findings in a laboratory report.

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III. Textbooks, Readings, and Other Materials

1. Zumdahl, Steven & Susan, Chemistry: An Atoms First Approach, 1st Ed., 2012 OWL E-Book and Online Homework (24-month instant access code), Cengage Publishing, ISBN 0-8400-6336-9
2. Freeman, D. D. and Reger, D. L. *General Chemistry Laboratory Experience, Chemistry 111 & 112*, University of South Carolina, ISBN 0-7380-0823-0
3. Basic Scientific calculator, available at the USCL bookstore
4. Safety Goggles, available at the USCL bookstore

IV. Overall Structure of the Course

A typical **lecture session** will consist of:

- Announcements and Updates
- Weekly Quiz
- PowerPoint Guided Lecture
- Interactive problem-solving and discussion

A typical **lab session** will consist of:

- Pre-Lab Discussion
- Student run experiments

Course lecture notes, worksheets, and lab handouts are provided in Blackboard for students to download and print prior to class and lab. There will be **three tests**, each covering three or four chapters of material. The tests include some definition, short answer, and problem-solving questions. The **comprehensive final exam** is over *all of the material covered in the course*. There are 50 multiple-choice questions on the final exam, based on questions from the three tests and any material covered after the last test.

V. Course Requirements

Students are required to attend class regularly, complete online and written homework assignments, take the tests and finals exam as scheduled, and complete laboratory experiments as scheduled. *The laboratory is an essential and required component of this course and a failing grade for the lab will automatically result in failure of the course.*

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In addition to the above, students are required to **download and print lecture notes from Blackboard** before class and **check their email and Blackboard regularly** for announcements, grades, and other relevant information.

The homework assignments will be done via an online web-learning program called "OWL". The access code for OWL can be purchased from the bookstore or the Cengage website. Be sure you DO NOT open your access code until you are certain you will remain in the class. The bookstore will not allow you to return an opened access code. You should familiarize yourself with this program through the online video at www.cengage.com/owl/videos/gettingstarted/. Your classroom work and homework grade in this course will constitute 16% of your overall grade in the course, so it is imperative that you complete these assignments. If you are having trouble with an OWL problem, you can send me an email from the OWL program and I will respond as soon as possible. Using OWL will help you gain the practice necessary to master the concepts and skills needed in chemistry. Through the online tutorials, videos, and interactive learning exercises, your learning experience will be enhanced.

Students are encouraged to ask questions and participate in lectures, as this provides a more stimulating experience for everyone and helps me to better understand how you are digesting the material. In order to keep up with the material, **a typical student will need to spend 2 – 4 hours per week outside of class** reading, studying, and working problems. Treat your college coursework as your primary job, giving it the time and attention necessary for you to succeed.

Advice from Former Students:

- *"Pay attention and ask questions in class."*
- *"Review and study your notes right after lecture every day."*
- *"Make a note of what you don't understand and go see the professor for help."*
- *"Seek adequate amounts of outside help. It is nearly impossible to learn all you need from the lectures only."*
- *"Do your OWL homework and learn while doing it. It helps even if you don't like it!"*
- *"Set aside plenty of time for your OWL homework - don't wait until the last minute."*
- *"Take advantage of all extra credit opportunities."*
- *"Keep a record of all important equations to study before the test."*
- *"Flash cards are helpful."*
- *"It is important to retain everything you learn. You can't just take the test and forget it."*

VI. Course Policies

The examinations must be taken as scheduled on this syllabus and as announced in class.

Exceptions will only be made in the case of a true emergency or extenuating circumstance, at the discretion of the instructor. Documentation must be provided for true emergencies and the

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instructor notified within 24 hours of the exam. Makeup exams will be given at the end of the semester.

Attendance is mandatory in this course. Arriving more than 15 minutes late or leaving more than 15 minutes early will count as an absence for the day. Excused and unexcused absences of more than 10% of the scheduled 28 lectures (i.e. > 3 lectures) or 15 labs (i.e. > 2 labs) is excessive and will result in a grade reduction of one letter grade at the end of the semester. Thus, if a student misses more than 3 lectures or 2 labs, their semester grade will drop one letter and the grade will continue to drop one letter for each additional absence. The last day to withdraw from the course with a grade of "W" is February 27, 2012. If you withdraw after this date you will receive a grade of "WF". If you stop attending without officially withdrawing, you will receive a grade of "F".

Students are expected to participate in class discussions, to be attentive and non-disruptive in class. There will be no text messaging, sending or receiving calls, or use of the cell phone as a calculator. Students found using their cell phones during an exam will receive a "0" for that exam. Students engaging in inappropriate or disruptive behaviors such as sleeping, text-messaging, excessive chatting, insulting or offensive remarks, physical aggression, or repeated tardiness will be asked to leave the classroom.

Students are required to prepare for and actively participate in laboratory sessions each week. Although you will work in groups of 2- 4 students, each student needs to take an active role in the experiments. Students who do not actively participate in the experiments will be warned and/or have points deducted from their grade for that experiment. Assigned lab reports must be submitted on time. Each student must submit an independent lab report for each experiment; group work is encouraged but must be reported as such.

Students will practice safety in the lab at all times. A safety orientation will be given and students will be required to complete a safety quiz before performing experiments in the lab. Students must bring their safety glasses each week and wear them in the lab. Students must also wear closed-toed shoes when performing experiments. Students wearing sandals or flip-flops will NOT be permitted to perform the experiment and will receive a grade of "0" for that lab. There is no eating, drinking, or smoking in the laboratory.

Students who have disabilities requiring special arrangements for class participation or test administration should notify the instructor of the need for such arrangements in advance.

You are expected to practice the highest possible standards of academic integrity. Any deviation from this expectation will result in a minimum academic penalty of your failing the assignment, and will result in additional disciplinary measures including referring you to the Office of Academic Integrity. Violations of the University's Honor Code include, but are not limited to improper citation of sources, using another student's work, and any other form of

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academic misrepresentation. For more information, see the Carolina Community Student Handbook at <http://www.sa.sc.edu/carolinacommunity/>.

Remember that the first tenet of the Carolinian Creed is, "I will practice personal and academic integrity."

VII. Assessment and Grading

The tests and final exam will be graded on a scale from 0 to 100, reflecting percent of possible points earned. The laboratory average will be computed as the mathematical average of all laboratory experiment grades, as described below. The final course average will be computed with the following weights assigned to each grade.

Test #1	16%
Test #2	16%
Test #3	16%
Comprehensive Final Exam	16%
Classroom Work and Homework	16%
Laboratory Average*	20%
Total	100%

*Laboratory Average: Exp # 13 (40%), Exp #14 (20%), Exps #15, 16, 18, 19, 20 (40%)

Final grades will be assigned as follows:

90 - 100%	A	70 - 76%	C
87 - 89%	B+	67 - 69%	D+
80 - 86%	B	60 - 66%	D
77 - 79%	C+	59% and below	F

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VIII. Chem 112 Spring 2012 Course Outline / Course Schedule

Day	DATE	CHAPTER	TOPIC	ASSIGNMENT DUE
1	M, 1/9	11	Course Overview, Properties of Solutions	
L 1	T, 1/10 Th, 1/12	Exp #1	Lab Safety Orientation	
2	W, 1/11	11 (cont'd)	Properties of Solutions (cont'd)	1/13 DROP ADD DATE
3	M, 1/16		NO CLASS – MLK HOLIDAY	
L 2	T, 1/17 Th, 1/19	Exp #14	Molar Mass by Freezing Point Depression (handout) *Report*	Safety Certificate
4	W, 1/18	11 (cont'd)	Properties of Solutions (cont'd)	
	M, 1/23	12	Chemical Kinetics	OWL Chapter 11
L 3	T, 1/24 Th, 1/26	Exp #20	Determination of the Rate Law for a Reaction by the Initial Rate Method	Rough Draft – Exp #14 Lab Report
5	W, 1/25	12 (cont'd)	Chemical Kinetics (cont'd)	
6	M, 1/30	13	Chemical Equilibrium	OWL Chapter 12
L 4	T, 1/31 Th, 2/2	Exp #13	Qualitative Inorganic Analysis –Cations Groups 1 and 2 (Unknown #1)	Final Draft – Exp #14 Lab Report
7	W, 2/1	13 (cont'd)	Chemical Equilibrium (cont'd)	
8	M, 2/6	13 (cont'd)	Chemical Equilibrium (cont'd) / Review	
L 5	T, 2/7 Th, 2/9	Exp #13 (cont'd)	Qualitative Inorganic Analysis –Cations Groups 3 and 4 (Unknown #2)	
9	W, 2/8	Test #1	Test #1: Chapters 11, 12, 13	OWL Chapter 13
10	M, 2/13	14	Acids and Bases	
L 6	T, 2/14 Th, 2/16	Exp #13 (cont'd)	Qualitative Inorganic Analysis – Cations Groups 1, 2, 3, and 4 (General Unknown)	
11	W, 2/15	14 (cont'd)	Acids and Bases (cont'd)	
12	M, 2/20	14 (cont'd)	Acids and Bases (cont'd)	
L 7	T, 2/21 Th, 2/23	Exp #13 (cont'd)	Qualitative Inorganic Analysis – Anions (Anion #1 and #2)	
13	W, 2/22	15	Acid-Base Equilibria	OWL Chapter 14
14	M, 2/27	15 (cont'd)	Acid-Base Equilibria (cont'd)	DROP DATE

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<u>Day</u>	<u>DATE</u>	<u>CHAPTER</u>	<u>TOPIC</u>	<u>ASSIGNMENT DUE</u>
L 8	T, 2/28 Th, 3/1	Exp #13 (cont'd)	Qualitative Inorganic Analysis – Cations and Anions (Ionic Compound)	
15	W, 2/29	16	Solubility & Complex Ion Equilibria	OWL Chapter 15
	3/5 – 3/9		USCL SPRING BREAK – NO CLASSES	
16	M, 3/12	16 (cont'd)	Solubility & Complex Ion Equilibria (cont'd)	
L 9	T, 3/13 Th, 3/15	Exp #13 (cont'd)	Qualitative Inorganic Analysis – Cations and Anions (Ionic Compound) *Report*	
17	W, 3/14	16 (cont'd)	Solubility & Complex Ion (cont'd) / Review	
18	M, 3/19	Test #2	Test #2: Chapters 14, 15, 16	OWL Chapter 16
L 10	T, 3/20 Th, 3/22	Exp #15	Diprotic Acids – Identifying an Unknown by Titration	Rough Draft – Exp #13 Lab Report
19	W, 3/21	17	Spontaneity, Entropy, Free Energy	
20	M, 3/26	17 (cont'd)	Spontaneity, Entropy, Free Energy (cont'd)	
L 11	T, 3/27 Th, 3/29	Exp #16	The Acid Ionization Constant (K_a) of Acetic Acid ($HC_2H_3O_2$)	Final Draft – Exp #13 Lab Report
21	W, 3/28	17 (cont'd)	Spontaneity, Entropy, Free Energy (cont'd)	
22	M, 4/2	18	Electrochemistry	OWL Chapter 17
L 12	T, 4/5 Th, 4/7	Exp #18	Identification of Metals by Measuring Potentials of Micro-Voltaic Cells	
23	W, 4/6	18 (cont'd)	Electrochemistry (cont'd)	
24	M, 4/9	22	Organic Chemistry	OWL Chapter 18
L 13	T, 4/10 Th, 4/12	Exp #19	The Solvay Process – Preparation of Sodium Bicarbonate	
25	W, 4/11	22 (cont'd)	Organic Chemistry (cont'd) / Review	
26	M, 4/16	Test #3	Test #3 – Chapters 17, 18, 22	OWL Chapter 22
L 14	4/17, 4/19		No Labs	
27	W, 4/18		Review for Final Exam	
28	M, 4/23		Review for Final Exam	
	W, 4/25	Final Exam	11am – 1:30 pm Comprehensive Final Exam	

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LABORATORY REPORT FORMAT

Note: Lab reports will be submitted through SafeAssign in BlackBoard. No hard copies will be accepted.

- **TITLE, NAME, DATE (5 points)**

These should be included on a single page in front of the report. The title should be centered on the page with your name below it, followed by partner names and the lab date.

- **ABSTRACT (15 points)**

In one paragraph, briefly state the purpose of the experiment, the experimental plan used, a summary of your findings, and major conclusions. Write the abstract LAST to be sure that it accurately reflects the content of your report.

- **INTRODUCTION (20 points)**

In two or three paragraphs, write a clear statement of the problem and the reason for studying it. Discuss appropriate background information, the significance of the project, and pertinent theoretical information (i.e. equations). Cite pertinent references with a superscripted number at the end of the sentence. Your references should include the lab manual and at least two other outside primary reference sources.

- **EXPERIMENTAL METHODS (20 points)**

In two or three paragraphs, identify the materials (chemicals and equipment) used in your experiment and note any hazards and precautionary handling procedures involved. Describe the experimental procedures and steps taken and note any relevant changes or problems with the procedure.

- **RESULTS AND DISCUSSION (25 points)**

In three or four paragraphs, summarize and interpret your results. Point out features and limitations of the work. Relate your results to the original purpose of the experiment. State the logical implications of your results and suggest further study or applications of this work. Be sure to include proper headings for any figures or tables used (i.e. "Figure 1. Calibration Curve for Absorbance Measurements").

- **REFERENCES (15 POINTS)**

List all numbered references in the order they were cited in your report. Use the American Chemical Society (ACS) style guidelines:

<http://pubs.acs.org/userimages/ContentEditor/1246030496632/chapter14.pdf>.

Books

1. Beall, H.; Trimbur, J. *A Short Guide to Writing about Chemistry*, 2nd ed.; Longman: New York, 2001; pp 17-32.

Journal Articles

2. Labaree, D.C.; Reynolds, T.Y.; Hochberg, R.B. Estradiol-16 β -carboxylic Acid Esters as Locally Active Estrogens. *J. Med. Chem.* **2001**, *44*, 1802-1814.

Webpages

3. ThermoDex Home Page. <http://thermodex.lib.utexas.edu> (accessed July 2001)

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IX. University of South Carolina Lancaster General Education Goals

General education is the set of fundamental skills (reading, writing, reasoning, and oral communication), the knowledge, and the capacity for thought needed to pursue further learning, to succeed in chosen fields, and to assume the responsibilities of informed and enlightened citizenship.

From a broad commitment to equity, USC Lancaster:

- seeks to make education accessible, affordable, and convenient
- encourages teaching innovation and adaptation
- encourages participatory student learning
- provides a supportive educational climate that actively and positively
- addresses intellectual and cultural diversity, and
- responds affirmatively to the needs of its students

USC Lancaster works to help its pre-baccalaureate students attain skills and attributes in the areas of communication, critical thinking, cultural literacy, and personal development. Students in the two-year occupational programs focus on those areas most appropriate to their professional education program.

Communication Skills

USC Lancaster helps its students read effectively and attain a basic familiarity with the basic texts of Western and other cultures. In the area of writing skills, USC Lancaster students work to develop the ability to write effectively for both academic and professional audiences. In addition, USC Lancaster helps its students learn to listen critically and speak effectively before a group.

Critical Thinking

USC Lancaster helps its students acquire analytical reasoning abilities and exercise informed value judgments. USC Lancaster students also work to develop mathematical and/ or computational skills.

Cultural Literacy

USC Lancaster strives to give its students an understanding of the history and culture of Western civilization as well as provide some exposure to other cultures. USC Lancaster also recognizes the centrality of science and technology to modern culture; therefore, USC Lancaster students also are offered opportunities to increase their understanding and familiarity in these crucial subject areas.

Student Development

USC Lancaster supports the intellectual, personal, physical, and social development of students, in recognition of the critical interdependency of all these areas. By providing opportunities for productive interaction with students, faculty, and staff, USC Lancaster helps students develop a spirit of curiosity, integrity, and confidence in planning and pursuing academic, career, and personal goals.