

Chemistry 109 (3 credit hours)
Honors General Chemistry Lecture, Part I; Fall 2016

Instructor: Professor Jon Zubieta 2-012 SciTech
Phone: X 2547, e-mail: jazubiet@syr.edu
Jeremy Scher, Teaching Assistant, CST 0-010
Phone: X 3697, email: jascher@syr.edu

Class Hours: MWF 9:30-10:25, 1-019 CST

Office Hours: F 11:00 a.m. – 12:00 noon

Recitation Hours: T, 8:00-8:55 a.m., 200 LSB; Th., 5:00-5:55 p.m., 100 LSB

Prerequisite: None

Textbook: Zumdahl and Zumdahl, Chemistry, 9th Edition, (Houghton Mifflin). Copies of the book are available at the University Bookstore.

Co-requisite: CHE 129 – Honors General Chemistry laboratory. Please be aware that the grades for the lab are completely independent from those in lecture. The CHE 129 laboratory will begin in the first week of classes.

Course Description: General chemistry for students in the Honors Program, chemistry majors, and others with strong science interests. Topics covered include quantitative, physical, and inorganic chemistry; and applications in current research. Credit is given for CHE 106, 116 or CHE 109, 119, but not both.

This course is the first semester of the General Chemistry course. General chemistry is required for the chemistry major and some other curricula, and is a prerequisite for other Chemistry courses. In General Chemistry we introduce you to all areas of chemistry: physical, organic, inorganic, quantum, biophysical, and analytical. While imparting some knowledge of all of these subjects, we attempt to show you how chemists and other scientists think and solve problems. By illustrating these examples we will show how important chemistry is for all of us.

In the first semester for General Chemistry we will cover the first 9 chapters of the text. Some of this consists of definitions and rules. Precise definitions are important in science, and aid logical thinking in any field. We discuss chemistry from both a macroscopic and molecular perspective, and will show the connections between the two.

After some very brief general definitions relating to scientific measurements and basic laws of physics (chapter 1) we will review rapidly some ideas about atomic structure (chapter 2). More detail on atomic structure will come at the end of the

semester. Turning to more specific chemical subjects we will explain the meaning of chemical formulas and equations (chapter 3), followed by calculations and a discussion of stoichiometry (chapter 3). In chapter 4 we will review different kinds of chemical reactions, with some applications to quantitative analysis. The gaseous state is described in chapter 5. We will discuss it first in terms of general laws and then in terms of molecules. We turn then to thermochemistry, (chapter 6). Chemical reactions are almost always connected with energy changes; in fact, energy changes are often the reason why chemical reactions happen! Then we will discuss in detail atomic and molecular structures, starting with some quantum mechanics (chapter 7), which is needed to understand the behavior of submicroscopic (molecules) particles like electrons, atoms and molecules. Atomic structures come next (chapter 7). From the atomic structures one can understand the chemical properties of the elements and periodic trends within the periodic table (chapter 7). Turning to the formation of compounds we consider ionic and covalent chemical bonds (chapter 8). In chapter 9 we consider two useful and much used theories of chemical bonding, Valence shell electron pair repulsion and molecular orbital theory, and show how they are used to predict molecular properties.

Assignments and Lectures: Reading assignments from the text are given on the course calendar. I *expect* that you will read the assignments *before* the class meetings for which they are listed. I also *expect* that you will attend all lectures. In lecture, we will reinforce important concepts from the readings and work through problems that build on these concepts. You will be tested on materials from the readings *and* from lecture. Some of this material will come *only* from the book, and some will come *only* from lecture. In the early chapters in the book, coverage in lecture will be brief to ensure enough time for the important and more advanced topics covered in the later chapters. Much of this material is a repetition of material covered in your high school chemistry class, and carefully reading the book will ensure that you will remember these topics.

In addition to the reading, exercises from the textbook will be assigned. It is strongly suggested and expected that you will do these exercises (and preferably more than the few that are assigned), because there is *no substitute* for this experience in the learning of chemical concepts. If you “do” the problems by looking up the answers in the solutions manual, you will learn very little. For effective use, the solutions manual should be referred to only after you have finished the problem. It is strongly recommended that you do these problems, it is *very* likely that related material will be included in the exams. Also: Doing the problems is the only way to be sure you really understand the material. If you have difficulties with the problems, seek assistance from the CHE 109 TA, any CHE 129 TA or your instructor – and please **DO NOT** wait until the day before the exam.

Since a common *lacuna* of most general chemistry courses is the absence of any descriptive material, you will be assigned some topics in descriptive chemistry to

study. The topics will be assigned in early September. The lecture material for this descriptive portion of the course will be made available on blackboard.syr.edu. You may sign in using your net ID and password. You will not be quizzed directly on the descriptive material. However, it will be used to provide extra credit questions on the hour examinations.

There will be occasional quizzes on Fridays, the official quiz days. These will be 5-10 minute quizzes and will count 10% of the grade. The topic of the quiz will be announced in class in an earlier session.

Getting help: There are multiple ways to get help, such as coming to me or to go to the CHE 109 or CHE 129 TA's office hours. If you cannot make it during the posted times because you have a class scheduled you can make an appointment preferably by sending an e-mail request or talking to me or the TA's in class. You can also get help at recitation sections.

Recitations: Recitation section M002 will meet on Tuesday, 8:00-8:55 a.m. in Life Science Building 200 and section M003 will meet on Thursday, 5:00-5:55 p.m. in Life Science Building 100. Recitation classes are optional.

Review Sessions: There will be a review session in the evening before each hour examination and the final examination. Times: See schedule below.

Examinations: There will be three one-hour examinations and a comprehensive two-hour final exam. All hour examinations will be held during the regular class times. **No** make-up examinations will be given. A student absent from a one-hour exam will receive a zero grade. If you have a proper medical or emergency excuse, (a written excuse from the health center (a note that you had an appointment is not sufficient!) or the emergency room) a missed exam will not be counted, and the final grade will be based on the remaining examinations.

First Examination: Sept. 21 (in class)

Second Examination: Oct. 21 (in class)

Third Examination: Nov. 18 (in class)

Final Examination: Dec. 16, 3:00-5:00 PM (CST 1-019, usual classroom)

Quizzes: Quizzes will be given in recitation, as well as in class. These will be factored in with the in-class quizzes to make up a total of 10% of the overall grade.

Policies: **Academic Honesty:** Complete academic honesty is expected of all students. Any incidence of academic dishonesty, as defined by the SU Academic Integrity Policy (see <http://academicintegrity.syr.edu>), will result in both course sanctions and formal notification of the College of Arts & Sciences. In this course, students are allowed and encouraged to work and study together, but all assignments turned in must be the work of the individual student and may not be copied from another student's work, the text, or any other source, except for short quotations with proper attribution.

Disability Accommodation: Students with any sort of disability who may need special accommodations should see me right away. In order to obtain authorized accommodations, students should be registered with the Office of Disability Services (ODS), 804 University Avenue, Room 309, 315-443-4498 and have an updated accommodation letter. Accommodations and related support services such as exam administration are not provided retroactively and must be requested in advance.

The Provost asked in his annual academic letter that instructors include in their syllabi information about the religious observances policy and course specific information about expectations for how and when academic requirements will be made up. Here is sample language:

SU's religious observances policy, found at

http://supolicies.syr.edu/emp_ben/religious_observance.htm

recognizes the diversity of faiths represented among the campus community and protects the rights of students, faculty, and staff to observe religious holy days according to their tradition. Under the policy, students are provided an opportunity to make up any examination, study, or work requirements that may be missed due to a religious observance provided they notify their instructors before the end of the second week of classes. For fall and spring semesters, an online notification process is available through MySlice/Student Services/Enrollment/My Religious Observances from the first day of class until the end of the second week of class.

Grade Calculation Information: Final Grades will be assigned upon the average of three examinations, the quizzes and the final examination.

Grading scheme

Hourly examinations	55%
Quizzes:	10%
Final examination	<u>35%</u>
	100%

Approximate Course Schedule

Date	Topic	Readings	Problem Assignment
Aug. 29	Syllabus		
	Introduction	1.1, 1.2	Chapter 1
	Units, Uncertainty	1.3 – 1.5	27, 30, 37, 46, 57, 68, 73
Aug. 31	Significant Figures	1.5	
	Dimensional analysis	1.6	
	Temperature	1.7	
	Density	1.8	
	Classification of Matter	1.9	
Sept. 2	Fundamental Chemical Laws	2.1, 2.2	Chapter 2
	Atomic Theory	2.3	34, 35, 37, 42, 47, 48,
	Atomic Structure	2.4	56, 57, 63, 68, 79 85,
	Modern view of atomic structure	2.5	111
Sept. 5	<i>No class – Labor Day</i>		
Sept. 7	Molecules and ions	2.6	Chapter 3
	Periodic Table	2.7	37, 42, 45, 48, 51, 57,
	Naming	2.8	64, 68, 71, 77, 82, 87, 94, 95, 100, 105, 109, 122
Sept. 9, 12	Atomic masses	3.1	
	The mole	3.2	
	Molar Mass	3.3	
Sept. 14	Percent composition	3.4	
	Determining the formula	3.5	
Sept. 16	Chemical equations	3.6	
	Balancing equations	3.7	
Sept. 19	Stoichiometric calculations	3.8	
	Limiting reagents	3.9	
Sept. 20	Review 6:00 p.m., CST 1-019		
Sept. 21	First Hour Examination		
Sept. 23	Water	4.1	Chapter 4
	Ions in Solution	4.2	24, 27, 31, 38, 43, 45, 52, 55, 62

Sept. 26	Composition of solns Types of chemical reactions	4.3 4.4	65, 68, 69, 75, 79 82, 83, 87, 120, 132
Sept. 28	Precipitation Reactions in Solution	4.5 4.6	
Sept. 30	Stoichiometry Acid-Base Rxn	4.7 4.8	
Oct. 3	Oxidation/Reduction Rxn Balancing Red/Ox reactions	4.9 4.10	
Oct. 5	Pressure, Gas laws Ideal Gas Law, Stoichiometry	5.1-5.3 5.3, 5.4	Chapter 5 37, 40, 41, 43, 46, 48, 55, 60, 65, 69, 76, 81, 85, 87, 92, 95, 101, 105, 106, 109, 113, 149, 152,
Oct. 7	Ideal Gas Law, Stoichiometry Dalton	5.3, 5.4 5.5	
Oct. 10	Kinetic Theory Diffusion Effusion	5.6 5.7	
Oct. 12	Real Gases	5.8	
Oct. 14	Chemistry in the Atmosphere	5.9	
Oct. 17	The Nature of Energy Enthalpy	6.1 6.2	Chapter 6 25, 27, 28, 29, 32, 35, 38, 41, 48, 50, 52, 53, 61, 71, 72, 77, 79, 82, 87, 91, 124
Oct. 19	Hess' law Standard Enthalpies	6.3 6.4	
Oct. 20	Review 6:00 p.m., CST 1-019		
Oct. 21	Second Hour Examination		
Oct. 24	Present sources of energy New energy sources	6.5 6.6	
Oct. 26	Electromagnetic radiation The nature of matter	7.1 7.2	Chapter 7 39, 45, 47, 56, 57, 61 65, 69, 71, 74, 77, 79, 82, 87, 91, 92, 97, 100, 104, 105, 108, 109, 113, 117, 125,
Oct. 28	Spectrum of hydrogen Bohr's Theory	7.3 7.4	

Oct. 31	Quantum mechanics		
Nov. 2	Quantum numbers	7.6	
	Orbitals	7.7	
Nov. 4	Electronic Structure of Atoms	7.8	
	Polyelectronic atom	7.9	
Nov. 7	History of Periodic Table	7.10	
	Electronic Configurations	7.11	
Nov. 9	Periodic Properties	7.12	
Nov. 11	Properties of alkali metals	7.13	
Nov. 14	Types of chemical bonds	8.1	Chapter 8
	Electronegativity	8.2	27, 29, 33, 37, 41,
			48, 49, 53, 57, 62,
Nov. 16	Bond polarity and Dipole moments	8.3	65, 70, 79, 81, 84,
	Ions	8.4	89, 95, 101, 103, 106,
	Binary ionic compounds	8.5	111, 115, 121, 158
Nov. 17	Review 6:00 p.m., CST 1-019		
Nov. 18	Third Hour Examination		
Nov. 19 - Nov. 27	<i>No class – Thanksgiving Break</i>		
Nov. 28	Partial ionic character	8.6	
	Covalent bond	8.7	
	Bond energies	8.8	
Nov. 30	Localized bonding model	8.9	
	Lewis structures	8.10	
Dec. 2	Exceptions to octet rule	8.11	
	Resonance	8.12	
Dec. 5	VSEPR	8.13	
Dec. 7	Hybridization	9.1	Chapter 9
	Molecular Orbital Theory	9.2	19, 29, 30, 33, 37,
			40, 41, 43, 46, 47,

Dec. 9	Homonuclear molecules Heteronuclear molecules	9.3 9.4	51, 59, 87, 97,
Dec. 15	Review 3:00 p.m., CST 1-019		
Dec. 16	Final examination 3:00-5:00 PM (CST 1-019).		

Descriptive Topics

<i>Topic</i>	<i>Discussion Date</i>
Mineralogy I: formulas and uses of garnet, galena, gypsum, bauxite, graphite, asbestos	Sept. 9
Mineralogy II: zeolites	Sept. 23
Mineralogy III: production and uses of iron	Oct. 7
Preparation and uses of sodium hydroxide	Oct. 14
Portland cement	Oct. 28
Nitrogen: natural abundance and distribution; production and uses; biological nitrogen fixation	Nov. 4
Iron biochemistry	Nov. 11