

Chemistry 111 FYC. General Chemistry I—First Year Course

INSTRUCTOR: Prof. Keith T. Kuwata, Olin-Rice 318, 696-6768, kuwata@macalester.edu.

Web page: www.macalester.edu/~kuwata (for class handouts, class overheads, and answer keys)

REQUIRED TEXTS: (1) Martin S. Silberberg, *Chemistry: The Molecular Nature of Matter and Change*, 4th Edition, Boston: McGraw Hill, 2006. (2) Andrea A. Lunsford, *Easy Writer: A Pocket Guide*, Boston: Bedford/St. Martin's, 2002.

OTHER REQUIRED MATERIALS: (1) A pair of safety goggles (buy at the Lampert Building Bookstore). Macalester College and the State of Minnesota both require that you wear goggles during all laboratory sessions. **You will not be allowed to work in lab if you do not bring your own pair of goggles.** (2) **Two** composition books (5 x 5 Quad Ruled, 10" x 7 7/8"; buy at the Highlander Store) to use as lab notebooks. (3) A scientific calculator. Bring this to lecture and to lab.

DESCRIPTION: This course, along with Chemistry 112 offered in the spring semester, lays the foundation for all subsequent study in chemistry. During this semester, we will focus on the key chemical themes of structure and equilibrium. We start with a quick review of typical high school topics like atoms and molecules, mass and mole relationships, stoichiometry, and writing and balancing chemical reactions (Chapters 1-4). The first three lab experiments also help review this material.

The rest of the semester fleshes out these topics in greater detail. First, we introduce key concepts about light and quantum mechanics and use them to explain the properties of atoms and the structure of the periodic table (Chapters 7 and 8). Next, we develop a set of powerful models that explain how atoms form chemical bonds, and how macroscopic, observable properties result from the three-dimensional structures of molecules (Chapters 9, 10, 11, and 23). We conclude with a rigorous mathematical treatment of chemical equilibrium—that is, the mixture of reactants and products spontaneously sought in a chemical reaction. We pay particular attention to gas-phase reactions relevant to atmospheric chemistry, and the solution-phase reactions of acids and bases, whose properties are critical for understanding biological systems. Chemistry 112 will pick up the theme of spontaneity in chemical reactions, explaining equilibrium in terms of the laws of thermodynamics.

Scientific writing is another major focus of this course. You will write two formal reports on laboratory experiments (see the course schedule on pp. 3-4), as well as a final paper based on a close reading of the scientific literature and application of what you have learned in class. These assignments will include writing first drafts that will be evaluated by the writing assistant, Barbara Hirschman '06. More details to come.

LECTURES: MWF from 8:30 a.m. to 9:30 a.m. in Olin-Rice 301. Attendance is not mandatory, but highly encouraged. It is your responsibility to read the assigned sections of Silberberg (see p. 3) before lectures on the material begin. Doing the reading will help you understand the lectures a lot more, and equip you to ask questions during class.

LABORATORIES: Taught by Dr. Rob Rossi (OR 314, x6224, rossi@macalester.edu) Mondays from 7:00 to 10:00 p.m., usually in OR 343. Lab attendance every week is mandatory. If very special circumstances preclude your attendance at a session, you must notify Dr. Rossi beforehand and make arrangements to make that session up no later than one week after the original lab session. Please see pp. 3-4 for the schedule of experiments. More details will be provided separately. Note that you are doing

three fewer experiments than the regular sections of Chemistry 111 this semester. This is to provide you with additional time to work on the writing requirements for this class.

PROBLEM SETS: You will be required to turn in solutions to selected problems, usually at the end of a chapter. Assignments will be handed out at least one week before they are due (see p. 3 for the due dates.) Homework will be due by 5 p.m., and **no late homework will be accepted for any reason.** However, I will drop your lowest two homework scores (except for PS 10) in computing your course grade.

Doing the assigned homework is an essential part of learning the material and doing well on exams. You cannot learn chemistry without repeated problem solving. However, do not expect the specific problems I assign to be a targeted rehearsal for, or preview of, test questions. The goal is for you to master concepts and principles on which you will be tested. You are encouraged to work with other people, but what you turn in must be your own work.

You should show in writing the process by which you have obtained your answers. Explanations should be clear and concise. In addition, final numerical answers must contain the correct number of significant figures (see pp. 25-29 of Silberberg for rules) and have the right physical units attached to receive full credit. I will hold you to the same standards when I grade your exams.

You should also make time to do additional problems as you study for this course. Answers to the end-of-chapter problems numbered in blue can be found in Appendix E of your text. Please feel free to ask me about any problem, assigned or unassigned.

Note that Problem Sets 2 and 4, which are due the class periods immediately before tests, will not be graded by the student assistant before the tests are administered. However, my solutions for these (and all other) problems sets will be posted on the course web page to help you study.

TESTS: There will be four hour examinations consisting of math problems, short answer questions, essay questions, and a few multiple-choice questions. You will be responsible only for material from lecture and problem sets. These four tests will be held during the normal lecture time slot. Test 1, which covers the introductory material from Chapters 1-4, will be worth less than the other three hour exams.

There will be no final exam in this course. Instead, you are required to turn in the final draft of your final paper and the mandatory Problem Set 10 (the score on this PS will not be dropped!) by the day your final would have been administered, **Monday, December 19.**

If you have a legitimate reason for missing the scheduled time for an hour exam, such as an athletic event, you must take the test before you leave for the event. If you are seriously ill the day before an hour exam, I may grant you a postponement if you contact me before the exam. If I grant you a postponement, you must make every effort to make up the test before the next class period, when I will usually hand the graded exams back.

You are not to discuss anything about a test you have taken until after 12 noon on that day. I may use some of the same test questions for my 10:50 a.m. Chemistry 111 class, and making comments to a person in that section would give that person an unfair advantage.

GRADING: Homework: 10% Lab Work: 25% 4 Hour Exams: 50% Final Paper: 15% Grades will be assigned using a curve based on your cumulative percentage of points. However, everyone who earns at least 90% is guaranteed an A or an A-. Typically, if your cumulative score is close to the class average, you will receive a B. Note that non-permanent midterm grades will be assigned based on the first two hour exams only—homework and lab scores will not be included.

GETTING HELP: I will be available in my office Monday 1:30-2:30 p.m., Tuesday 4:00-5:00 p.m., Wednesday 2:30-3:30 p.m., and Thursday 9:00-10:00 a.m. If you cannot make one of these scheduled office hours, you can also make an appointment with me, or just come by—I'll usually be somewhere in Olin-Rice during the day. Other helpful people include Dr. Rossi, the chemistry major tutors in the department computer lab (OR 341, hours to be announced), the MAX Center tutors, and the other Chemistry 111 instructor, Prof. Paul Fischer. We are all eager to help you master the material in this course!

ACADEMIC INTEGRITY: Obtaining copies of tests prior to their administration, using unauthorized materials during tests, sharing or stealing information during an exam, alteration of a graded exam and then requesting a re-grade, copying another student's lab data, lab report, or homework, copying homework keys from past years, or talking about a test with people in the Chemistry 111-05 (10:50 a.m.) section before that section takes its exam on the same material all constitute cheating and are forbidden. As per the Macalester Student Handbook, I will report any clear violation of these integrity standards to Ellen Guyer, the Dean of Academic Programs.

You are also responsible for the standards articulated in the academic honesty handout.

COURSE SCHEDULE (Rooms in Olin-Rice unless otherwise noted)

Date	Day	What's Due?	Room	Topics/Event--Silberberg reading assignments in ()
9/4	Sun		301	Introduction to First Year Course
9/7	W		301	Fundamentals of Chemistry (skim Ch. 1 and 2)
9/9	F		301	(Fundamentals of Chemistry continued)
9/12	M		301	(Fundamentals of Chemistry continued)
	Lab		341	Exp. 1: An Atomic Introduction to Calculations with Excel
9/14	W	PS 1	301	Stoichiometry and Chemical Reactions (skim Ch. 3 and 4)
9/16	F		301	(Stoichiometry and Chemical Reactions continued)
9/19	M		301	(Stoichiometry and Chemical Reactions continued)
	Lab		343	Exp. 2: Ion Recovery
9/21	W	PS 2	301	Light, Quantum Mechanics, and the Atom (Ch. 7)
9/23	F		301	TEST 1: Lectures thru 9/19; PS 1 and 2 (75 Points)
9/26	M		301	(Light, Quantum Mechanics and the Atom continued)
	Lab	Exp 2	***	Meet in Library for Research Training Session
9/28	W		301	(Light, Quantum Mechanics, and the Atom continued)
9/30	F		301	(Light, Quantum Mechanics, and the Atom continued)
10/3	M	PS 3	301	Multi-Electron Atoms; Periodic Table (Ch. 8; skim 8.5)
	Lab		343	Exp. 4: The Reaction of Al and Zn with HCl
10/5	W		301	(Multi-Electron Atoms; Periodic Table continued)
10/7	F		301	(Multi-Electron Atoms; Periodic Table continued)
10/10	M	PS 4	301	Chemical Bonding (9.1, 9.3, 9.5, 10.1; skim 9.2)
	No Lab			
10/12	W		301	TEST 2: Lectures thru 10/7; PS 3 and 4 (100 Points)
10/14	F	Exp 4-Draft	341	(Chemical Bonding continued)

Date	Day	What's Due?	Room	Topics/Event
10/17	M Lab		301 ***	(Chemical Bonding continued) Discussion of Final Paper (place TBA)
10/19	W	PS 5	301	Molecular Shape and VSEPR Theory (10.2-10.3)
10/21	F		301	(Molecular Shape and VSEPR Theory continued)
10/24	M No Lab		301	(Molecular Shape and VSEPR Theory continued)
10/26	W	Exp 4-Final	301	Molecular Orbital Theory (11.3)
10/27	Th			Fall Break (no class)
10/28	F			Fall Break (no class)
10/31	M Lab	PS 6	301 341	(Molecular Orbital Theory continued) Exp. 6: An Exploration of Molecular Shapes
11/2	W		301	(Molecular Orbital Theory continued)
11/4	F	PS 7	301	Hybridization (11.1 and 11.2)
11/7	M Lab	Exp 6	301 341	(Hybridization continued) Exp. 7: Visualizing Molecular Orbitals
11/9	W		301	TEST 3: Lectures thru 11/2; PS 5, 6, and 7 (100 Points)
11/11	F		301	Coordination Compounds (8.5, 23.4, 23.5; skim 23.1)
11/14	M Lab	Exp 7	301 343	(Coordination Compounds continued) Exp. 8: Synthesis of a Coordination Compound
11/16	W		301	(Coordination Compounds continued)
11/18	F	PS 8	301	Chemical Equilibrium (Ch. 17)
11/21	M Lab		301 343	(Chemical Equilibrium continued) Exp. 9: Analysis of a Coordination Compound
11/23	W	Paper-Draft	301	(Chemical Equilibrium continued)
11/24	Th			Thanksgiving Break (no class)
11/25	F			Thanksgiving Break (no class)
11/28	M Lab		301 343	(Chemical Equilibrium continued) Exp. 10: Chemical Equilibrium
11/30	W	PS 9	301	Acid-Base Chemistry (18.1-18.5; 18.7)
12/2	F		301	(Acid-Base Chemistry Continued)
12/5	M No Lab		301	TEST 4: Lectures thru 11/28; PS 8 and 9 (100 Points)
12/7	W		301	(Acid-Base Chemistry Continued)
12/9	F		301	(Acid-Base Chemistry Continued)
12/12	M Lab	Exp 8,9-Final	301	Acid-Base Buffers (19.1) Exp. 12: pH and Buffers
12/14	W		301	Polyprotic Species, Solubility Equilibrium (pp. 786-788;19.3)
12/16	F			(Polyprotic Species, Solubility Equilibrium continued)
12/19	M	Paper-Final and PS 10		