

Chemistry 112 FYC. General Chemistry II—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) Peter Atkins and Loretta Jones, *Chemical Principles: The Quest for Insight*, 3rd Edition, New York: W. H. Freeman, 2005. (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). These will serve as your lab notebooks. (3) A scientific calculator.

DESCRIPTION: This course, along with your strong preparation in high school, lays the foundation for all subsequent study in chemistry. You will learn to think about phenomena as chemists by using the key paradigms of structure, energetics, and their interrelationship. Units 1 and 2 focus on structure. First, we use fundamental ideas about light and quantum mechanics to rationalize and predict the properties of atoms and molecules (Chapters 1 and 2). Next, we develop powerful models for understanding chemical bonding and the three-dimensional structures of both molecules and macroscopic samples of matter (Chapters 3, 4, and 5). In Unit 3 and 4, we switch our focus to energetics. We begin with a qualitative and quantitative treatment of the laws of thermodynamics (Chapters 6 and 7). We then learn how thermodynamics controls chemical reactions in both the gas and solution phases, paying particular attention to acid/base reactions (Chapters 9, 10, and 11). We end with a study of the rates of reactions (kinetics) that integrates both structural and energetic considerations (Chapter 13).

Scientific writing is another major focus of this course. You will write three formal reports on laboratory experiments (see the course schedule on pp. 3-4), the first two in close consultation with the writing assistant, Emma Whitcomb '05. You will also write a final paper based on a close reading of the scientific literature. More details to come.

LECTURES: MWF from 10:50 a.m. to 11:50 a.m. in Olin-Rice 370. It is your responsibility to read the assigned sections (see pp. 3-4) of Atkins and Jones 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. Also, please bring a calculator for in-class exercises.

LABORATORIES: Taught by Dr. Rob Rossi (OR 314, x6224, rossi@macalester.edu) Thursdays from 8:30 to 11:40 a.m., usually in OR 347. 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. You will work in pairs of your choosing throughout the semester; be paired up by the first day of lab work (September 16). More details will be provided separately.

PROBLEM SETS: You will be required to turn in solutions to selected problems at the end of each chapter. Assignments will be handed out at least one week before they are due (see pp. 3-4 for the due dates.) Note that in order to spread out your workload better, some problems are due (in my office) on Tuesdays, when we do not meet for class or lab. **No late homework will be accepted for any reason.** However, I will drop your lowest two homework scores (except for PS 11) in computing your 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.

Unless told otherwise, you should always show in writing the process by which you have obtained your answers. Explanations, such as showing the intermediate steps of a calculation, should be clear and concise. In addition, final numerical answers must contain the correct number of significant figures (see pp. A6-A7 of Atkins and Jones 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 odd-numbered end-of-chapter problems can be found in Appendix C of your text. (Please feel free to ask me about any problem, assigned or unassigned.)

The homework grader (Kawuma Busuulwa '05) will make every effort to return Problem Sets 3, 6, 8 and 10 before you take the tests on the material covered in those assignments. In any case, 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 examinations, corresponding to the four units described above, that will consist of math problems, short essay questions, and a few multiple-choice questions. The first midterm will be held during the normal lecture time slot, and the last three will be held during the lab time slot in order to give you more time to tackle more challenging problems. Note that I will not administer a final. Instead, you are required to turn in the final draft of your final paper and the mandatory Problem Set 11 (the score on this PS will not be dropped!) by the last day of exams, **Tuesday, December 21.**

You must talk with me before an exam if you have a legitimate reason (e.g. serious illness) for missing the scheduled times for the exams. If I grant you a postponement, you must make every effort to make up the test within two days (when I will usually hand the graded exams back).

GRADING: Homework: 10% Lab Work: 25% 4 Midterms: 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—but this is not guaranteed. Note that non-permanent midterm grades will be assigned based on the first two midterms 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 9:00-10:00 a.m., Wednesday 2:30-3:30 p.m., and Thursday 4:00-5:00 p.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. Other helpful people include Dr. Rossi, the chemistry major tutors in the department computer lab (OR 341, hours to be announced) and the MAX Center tutors. We are all eager to help you do well in this course!

ACADEMIC INTEGRITY: Please see the handout from the Academic Programs office for a statement of the College's expectations.

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

Date	Day	What's Due?	Room	Topics/Event--Atkins/Jones reading assignments in ()
9/5	Sun		370	Light, Quantum Mechanics, and the Atom (1.1-1.10; skim 1.5)
9/6	M			
9/7	Tu			
9/8	W		370	(Light, Quantum Mechanics, and the Atom continued)
9/9	Th		***	Computer Orientation (meet in Humanities 302)
9/10	F	Summer PS	370	(Light, Quantum Mechanics, and the Atom continued)
9/13	M		370	(Light, Quantum Mechanics, and the Atom continued)
9/14	Tu			
9/15	W	PS 1	370	Multi-Electron Atoms and the Periodic Table (1.11-1.17)
9/16	Th		***	Exp 1: Atomic Spectra and Excel (meet in Humanities 304)
9/17	F		370	(Multi-Electron Atoms continued) [Validation Deadline]
9/20	M		370	(Multi-Electron Atoms continued)
9/21	Tu			
9/22	W	PS 2	370	Chemical Bonding (Chap. 2; skim 2.1 and 2.2)
9/23	Th	Exp 1	347	Exp 2: Periodic Trends
9/24	F		370	(Chemical Bonding continued) [Add/Drop Deadline]
9/27	M		370	(Chemical Bonding continued)
9/28	Tu	PS 3		
9/29	W		370	Molecular Shape and VSEPR Theory (3.1-3.3)
9/30	Th	Exp 2	347	Exp 3: Determination of a Chemical Formula (with report)
10/1	F		370	TEST 1: Lectures thru 9/27; PS 1, 2, and 3
10/4	M		370	(Molecular Shape and VSEPR Theory continued)
10/5	Tu			
10/6	W		370	(Molecular Shape and VSEPR Theory continued)
10/7	Th	Exp 3-Draft 1	341	Exp 4: Molecular Shapes
10/8	F	PS 4	370	Molecular Orbital and Hybridization Theories (3.4-3.13)
10/11	M	Meet with	370	(Molecular Orbital and Hybridization Theories continued)
10/12	Tu	Writing		
10/13	W	Assistant	370	(Molecular Orbital and Hybridization Theories continued)
10/14	Th	Exp 4	370	Gases (4.1-4.14; skim 4.12-4.14)
10/15	F	PS 5	341	Exp 5: Visualizing Molecular Orbitals
10/18	M		370	(Gases continued)
10/19	Tu	Exp 3-Final		
10/20	W		370	Intermolecular Forces (skim 4.17; 5.1-5.5)
10/21	Th	Exp 5	347	Exp 6: Reaction of Al/Zn with HCl (with report)
10/22	F	PS 6	370	(Intermolecular Forces continued)
10/25	M		370	Energy and Enthalpy; 1st Law (6.1-6.21)
10/26	Tu		350	TEST 2: Lectures thru 10/22; PS 4, 5, and 6
10/27	W		370	(Energy and Enthalpy continued) [Midterm Grades Due]
10/28	Th			Fall Break (no class)
10/29	F			Fall Break (no class)

Date	Day	What's Due?	Room	Topics/Event
11/1	M		370	(Energy and Enthalpy continued)
11/2	Tu	Baby Kuwata		
11/3	W	Exp 6-Draft 1	370	(Energy and Enthalpy continued)
11/4	Th		***	Library Orientation; Intro to Final Paper (meet in Library)
11/5	F		370	(Energy and Enthalpy continued) [Withdraw Deadline]
11/8	M	PS 7	370	Entropy and Free Energy; 2nd Law (Chap. 7)
11/9	Tu	Meet with		
11/10	W	Writing	370	(Entropy and Free Energy continued)
11/11	Th	Assistant	347	Exp 7: Calorimetry
11/12	F	Exp 6-Final	370	(Entropy and Free Energy continued)
11/15	M		370	(Entropy and Free Energy continued)
11/16	Tu	PS 8		
11/17	W		370	Chemical Equilibrium (9.1-9:11; skim 9.3)
11/18	Th		350	TEST 3: Lectures thru 11/15; PS 7 and 8
11/19	F		370	(Chemical Equilibrium continued)
11/22	M	Exp 7	370	(Chemical Equilibrium continued)
11/23	Tu			
11/24	W	Paper-Draft 1	370	(Chemical Equilibrium continued)
11/25	Th			Thanksgiving Break (no class)
11/26	F			Thanksgiving Break (no class)
11/29	M		370	Acid-Base Chemistry (10.1-10.8; 10:11-10.13)
11/30	Tu	PS 9		
12/1	W	Meet with	370	(Acid-Base Chemistry Continued)
12/2	Th	Writing	347	Exp 8: Chemical Equilibrium (with report)
12/3	F	Assistant	370	(Acid-Base Chemistry Continued)
12/6	M		370	Solubility Equilibrium and Polyprotic Species (11.8-11.12)
12/7	Tu	PS 10		
12/8	W		370	Kinetics (Chap. 13)
12/9	Th		350	TEST 4: Lectures thru 12/6; PS 9 and 10
12/10	F		370	(Kinetics continued)
12/13	M	Meet with	370	(Kinetics continued)
12/14	Tu	Classmates		
12/15	W	re: Exp 8	370	(Kinetics continued) [Last Day]
12/16	Th			
12/17	F	Exp 8-Final		
12/20	M			
12/21	Tu	Paper-Final and PS 11		