

## Chemistry 11. General Chemistry I: Properties and Structure

**INSTRUCTOR:** Prof. Keith T. Kuwata, Olin-Rice 318, 696-6768, kuwata@macalester.edu  
Web page: www.macalester.edu/~kuwata (for class handouts and answer keys)

**REQUIRED TEXTS: (Lecture)** Jean B. Umland and Jon M. Bellama, *General Chemistry*, 3rd ed., Brooks/Cole, 1999. **(Lab)** Emil J. Slowinski, Wayne C. Wolsey, and William L. Masterton, *Chemical Principles in the Laboratory*, 7th ed., Harcourt, 2001.

**OTHER REQUIRED MATERIALS:** Macalester College and the State of Minnesota both require that you wear safety goggles during all laboratory sessions. You may purchase a pair at the Ruminator Bookstore. You also need a scientific calculator for use in lab and on tests.

**DESCRIPTION:** This is the first of two courses in general chemistry (the second is Chemistry 13). In Chemistry 11, we first review basic ideas about atoms, molecules, and stoichiometry (Chapters 1-3). We next focus on the properties and reactions of chemicals in solution and in the gas phase (Chapters 4-6). We then return to a detailed study of atoms and molecules, explaining their physical properties, structure, and reactivity using a variety of simple, yet powerful, models (Chapters 7-10, 22). We conclude with the properties and interconversions of states of matter (Chapter 12) and oxidation-reduction reactions (Chapter 11).

If you have done well on the chemistry placement exam, you should consider taking Chemistry 13 this fall. Please talk with Prof. Tom Varberg (my boss!) for advice and permission. Remember that the deadline for adding classes is **Friday, September 21**.

Doing experiments is a critical part of learning chemistry, and can be a lot of fun as well! You are required to be registered in one of the five weekly lab sections. You must attend every lab session. (See p. 4 for the schedule of experiments.) You must also read the instructions for each experiment and complete its Advance Study Assignment before lab. If very special circumstances preclude your attendance at your regular lab section, you must notify your instructor beforehand (if possible) and make arrangements to attend another section. (Talk to the other instructor beforehand as well!) In addition, your report for that experiment must be signed by the instructor whose section you are visiting, or it will not be accepted for credit.

**LECTURES:** MWF from 10:50 a.m. to 11:50 a.m. in Olin-Rice 350. Attendance is not mandatory, but highly encouraged. (It may even prove entertaining from time to time.) It is your responsibility to read each chapter of Umland and Bellama before lectures on the material begin. (See p. 3 for the approximate lecture schedule.) Doing the reading will help you understand the lectures a lot more, and equip you to ask questions during class.

**PROBLEM SETS:** You will be required to turn in solutions to selected problems at the end of each chapter. (See p. 3 for the assigned problems and due dates.) **No late homework will be accepted for any reason.** However, I will drop your lowest two homework scores in computing your course grade. Also note that the final problem set of the semester (on Chapter 11) will not be collected.

Doing the assigned homework is essential for you to learn the material and do well on exams. 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



## LECTURE, READING, HOMEWORK, AND TEST SCHEDULE

Date	Day	Chap	Topics/Event
9/5	W	1	<u>Introduction</u> : Nomenclature, atoms and compounds, periodic table
9/7	F	1	<i>Ch 1 Hwk: 43,45,48,52,60,63,71,72,78,90,92,110; due 9/10</i>
9/10	M	2	<u>Measurement</u> : Units, significant figures, atomic masses and mole concept
9/12	W	2	<i>Ch 2 Hwk: 55,63,69,72,83,85,92,98,132; due 9/14</i>
9/14	F	3	<u>Stoichiometry</u> : Limiting reagents, empirical formulas
9/17	M	3	<i>Ch 3 Hwk: 20,28,29,33,37abc,43,46,49bc,51,88; due 9/19</i>
9/19	W	4	<u>Solutions</u> : Salts, acids, bases, and stoichiometry
9/21	F	4	<b>[Add/Drop Day]</b> <i>Ch 4 Hwk: 42,45,52,55,69,73,76,84,94,118; due 9/24</i>
9/24	M	5	<u>Gases</u> : Gas laws, kinetic-molecular theory, ideal vs. real gases
<b>9/26</b>	<b>W</b>		<b>Test 1: Chapters 1, 2, 3, 4</b>
9/28	F	5	<i>Ch 5 Hwk: 35,42,43,45,50,53,57,61,62,64,69,112,122; due 10/3</i>
10/1	M	5	
10/3	W	6	<u>Thermochemistry</u> : Basics, heat capacity, calorimetry, Hess' Law,
10/5	F	6	enthalpies of formation
10/8	M	6	<i>Ch 6 Hwk: 18,29,30,31,33,47,49,52,66,68; due 10/12</i>
10/10	W	6	
10/12	F	7	<b>[Family Weekend]</b> <u>Atoms</u> : Wave properties of light, spectroscopy
<b>10/15</b>	<b>M</b>		<b>Test 2: Chapters 5, 6</b>
10/17	W	7	<u>Atoms</u> : Bohr and Rutherford models, wave functions, quantum numbers,
10/19	F	7	orbital shapes, photochemistry
10/22	M	7	<i>Ch 7 Hwk: 36,44,53,55,56,61,64,76,78,92,116; due 10/24</i>
10/24	W	8	<u>Multi-Electron Atoms</u> : Shielding, electronic configurations, periodic trends
10/26	F		<b>Fall Break—no class</b>
10/29	M	8	<i>Ch 8 Hwk: 33,44,45,46,47,57,65,66,72,81,102,128,136abc; due 11/2</i>
10/31	W	8	
11/2	F	9	<b>[Withdraw Day]</b> <u>Chemical Bonds</u> : Electronegativity, ionic vs. covalent,
11/5	M	9	Lewis structures, resonance structures, bond energies
11/7	W	9	<i>Ch 9 Hwk: 50,51,59,60,62,64,67,69,74,78,86,102,114; due 11/9</i>
11/9	F	10	<u>Molecular Structure</u> : VSEPR theory (ideal and real), MO theory, hybridization
<b>11/12</b>	<b>M</b>		<b>Test 3: Chapters 7, 8, 9</b>
11/14	W	10	
11/16	F	10	<i>Ch 10 Hwk: Handout; due 11/21</i>
11/19	M	10	
11/21	W	*	<u>Organic Compounds</u> : Line structures, isomerism, functional groups, polymers
11/23	F		<b>Thanksgiving Holiday—no class</b>
11/26	M	*	* Read sections 22.1 to 22.7, 22.10, and 9.11
11/28	W	*	<i>Hwk: 10.34,10.64,10.90,22.30,22.31,22.34,22.54,22.58,22.71,22.116; due 11/30</i>
11/30	F	12	<u>States of Matter</u> : Intermolecular forces, liquids, solids, phase transitions
12/3	M	12	<i>Ch 12 Hwk: 25,26,31,32,38,44,46,51,54,61,92,112,114; due 12/7</i>
12/5	W	12	
12/7	F	11	<u>Redox Reactions</u> : Oxidation numbers, balancing in acidic and basic solutions
<b>12/10</b>	<b>M</b>		<b>Test 4: Chapters 10, 22, 12</b>
12/12	W	11	<i>Ch 11 Hwk: 25,29,35,37,44,45,46,52,58,75; not collected</i>
12/14	F	11	

**Final Examination (Chapters 1-12, 22): Wednesday, December 19, 8:00 a.m.—10:00 a.m.**

### LABORATORY SCHEDULE

(The **bold-face numbers** refer to experiments from your lab manual.)

Monday	Tuesday	Wednesday	Thursday	Friday
Sept. 3	4	5	6	7
Sept. 10 Check-in, Safety <b>Exp 1: Densities</b>	11 Check-in, Safety <b>Exp 1: Densities</b>	12	13 Check-in, Safety <b>Exp 1: Densities</b>	14
Sept. 17 <b>4: Empirical Formula</b>	18 <b>4: Empirical Formula</b>	19	20 <b>4: Empirical Formula</b>	21
Sept. 24 Chromatography*	25 Chromatography*	26	27 Chromatography*	28
Oct. 1 <b>9: Molar Mass</b>	2 <b>9: Molar Mass</b>	3	4 <b>9: Molar Mass</b>	5
Oct. 8 <b>14: Calorimetry</b>	9 <b>14: Calorimetry</b>	10	11 <b>14: Calorimetry</b>	12
Oct. 15 <b>11: Atomic Spectrum</b>	16 <b>11: Atomic Spectrum</b>	17	18 <b>11: Atomic Spectrum</b>	19
Oct. 22 Al/Zn Alloy*	23** Al/Zn Alloy*	24	25 Fall	26 Break
Oct. 29*** <b>No Monday Lab</b>	30** Al/Zn Alloy*	31	Nov. 1 <b>12: Alkaline Earths...</b>	2
Nov. 5 <b>12: Alkaline Earths...</b>	6 <b>12: Alkaline Earths...</b>	7	8 <b>43: Vitamin C Analysis</b>	9
Nov. 12 <b>43: Vitamin C Analysis</b>	13 <b>43: Vitamin C Analysis</b>	14	15 <b>13: Molecular Models</b>	16
Nov. 19 <b>13: Molecular Models</b>	20 <b>13: Molecular Models</b>	21	22 Thanksgiving	23 Break
Nov. 26 <b>41: Aspirin Synthesis</b>	27 <b>41: Aspirin Synthesis</b>	28	29 <b>41: Aspirin Synthesis</b>	30
Dec. 3 Vapor Pressure*	4 Vapor Pressure*	5	6 Vapor Pressure*	7
Dec. 10 <b>17: Classification...</b> and Check out	11 <b>17: Classification...</b> and Check out	12	13 <b>17: Classification...</b> and Check out	14

\*The instructions for these experiments will be handed out in class.

\*\*Students enrolled in the Thursday laboratory sections (11L08 and 11L10) will conduct the Al/Zn alloy experiment on Tuesday, October 23. (This is the Macalester tradition of "Tuesday becoming a Thursday.") Students enrolled in the Tuesday laboratory sections (11L04 and 11L06) will not have lab during the week of October 22. These students will conduct the Al/Zn alloy experiment on October 30.

\*\*\*The Monday evening laboratory section (11L02) will not meet on October 29.