CHE 151 GENERAL CHEMISTRY
Fall 2007
Marian College
3200 Cold Spring Road, Indianapolis IN 46222

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Office Hours:	MWF 10.00-10.50 am R 2.00-4.00 pm and by appointment	
Lecture:	3 semester hours 9.00-9.50 am MWF Room 355	
Laboratory:	1 semester hour:	A section 8.30-11.20 am T Room 353
		B section 1.30-4.30 pm T Room 353

Web site: http://chemphys.marian.edu
Further course documents are available on CAMS to registered students.

Course Description: Study of the atomic and molecular structure of matter, the nature of chemical bonding, and the principles underlying the periodic table of the elements, together with chemical nomenclature, chemical equations and quantitative chemistry, thermochemistry, states of matter, and nuclear chemistry.

Textbooks:	Chemistry: The Molecular Nature of Matter and Change, Martin Silberberg, 4th Ed., McGraw-Hill, 2006.
Lab text:	None required.
Other needs:	Scientific calculator.

Course Summary: CHE 151 is a required course for chemistry majors and a recommended course for biology, medical technology, and mathematics majors. Taken together with CHE 152, these general chemistry courses present the fundamental principles underlying inorganic and organic chemistry, together with their connections to industrial chemistry, environmental chemistry, and biochemistry, from a perspective that emphasizes both the scientific methods leading to chemical discovery and the roles of chemistry in human society and the physical environment.

The course emphasizes inquiry-based methods of learning both in the lecture and in the laboratory. Science is a hands-on, "doing" activity, and the laboratory is an opportunity for you to learn scientific methods first-hand, and to learn chemistry by discovery.

CHE151 is included in the General Education Program because successful attainment of the Course Objectives (below) contributes to attainment of General Education objectives in the areas of Scientific and Quantitative Understanding and of Effective Communication. Particular areas include:

1. Scientific (empirical) method of problem-solving and inquiry.
2. Fundamental laws of nature and their significance.
3. Mathematical reasoning, techniques of understanding numerical data, computer literacy.
4. Critical, analytical, and creative thinking skills in written and oral communications.

Assessment of the Course Objectives is through (1) 3-4 semester tests and a comprehensive final examination, (2) written assignments and a poster or oral presentation, (3) written laboratory reports, and (4) performance and participation in laboratories and group inquiry activities. Additionally, there will be homework which, while it may be graded, is weighted lightly in the overall grade and should be regarded as a method of self-assessment.

Learning Objectives: This class has two main goals: to introduce you to the areas in chemistry that are important for someone pursuing a degree in science, and to develop skills needed for scientific work, including problem solving, communication/expression, laboratory competence, and the ability both to work collaboratively and to think independently. Each assignment you receive will have some role in working towards these objectives. What you get out of the class will, however, depend on what you put in. While learning a certain number of facts is important (and unavoidable), you will find that in chemistry it is more important to grasp *concepts*, and to develop analytical, inquiry-based ways of thinking about problems.

In more detail, on completing this semester you should:

1. Be able to give an account of the structure of the atom and the nature of matter.
2. Show familiarity with the wave and particle pictures of electromagnetic radiation.
3. Demonstrate an understanding of how atoms formed in the early universe.
4. Show an understanding of the nature of radioactivity and the factors determining the stability of the elements.
5. Be able to explain the arrangement of electrons in orbitals and the organizational principle of the periodic table.
6. Demonstrate familiarity with the concept of valence and be able to distinguish the different types of chemical bond.
7. Show an understanding of the structure of molecules and of non-molecular matter.
8. Correctly use oxidation numbers and understand the concept of a redox process.
9. Be able to explain the behavior of solids, liquids, and gases and how it is determined in each case by molecular interactions.
10. Be able to write the correct formula for a compound given its name, and vice versa.
11. Use chemical symbols correctly and be able to write and balance chemical equations.
12. Show familiarity with the properties of several classes of elements and simple compounds (e.g. metals, halogens, acids, bases).
13. Be able to identify ions by color and solubility.
14. Be able to describe how different types of electromagnetic radiation interact with matter.
15. Demonstrate a quantitative understanding of chemical units and the concept of the mole.
16. Use the factor label method (also known as dimensional analysis) in all chemical calculations.
17. Show care in the use of sign (+ or -) and significant figures.
18. Be able to give an account of some relevant aspects of the history of chemistry and to show how systematic data acquisition, model building, and scientific reasoning lead to progress in understanding.
19. Develop laboratory skills and learn the technique of using simple laboratory equipment.
20. Be able to plan, perform, and analyze an experiment.
21. Be able to use appropriate computer tools (LoggerPro, Graphical Analysis, WebMO, Mathcad) to understand molecular structure and collect and analyze experimental data.
22. Demonstrate the ability to communicate chemical information clearly through a laboratory report, project report, poster, or other written work.

Class schedule (tentative):

Week	Chapter	Content	
1 (8/20)	1	Scientific method, classification of matter, measurement	
2 (8/27)	7	Light and matter, origin of matter	
3 (9/03)	24	Nuclear processes, radiation, evolution of the elements	
4 (9/10)	2, 7	Atomic spectra, atomic structure, Bohr model	
5 (9/17)	7, 8	Electron configurations and orbitals	*test 1*
6 (9/24)	2, 3	Composition/naming of compounds, the mole	
7 (10/01)	3	Equation-balancing, empirical formula, limiting reagents	
8 (10/08)	4	Solution chemistry, aqueous reactions, titrations	
9 (10/15)	9	Fall break; Lewis structures, molecular orbitals	*test 2*
10 (10/22)	10	Bond vibrations, VSEPR theory, molecular shape	
11 (10/29)	11	Bond polarity, valence bond theory, hybrid orbitals	
12 (11/05)	6	Thermochemistry	
13 (11/12)	5	Kinetic-molecular theory, ideal gases, real gases	*test 3*
14 (11/19)	10	Lattice energy; Thanksgiving break	
15 (12/26)	11	Types of intermolecular interaction, solubility	
16 (12/03)	11	Vapor pressure, phase diagrams	

Laboratory Experiments:
These are mostly "inquiry-based" experiments, and so may cover material before it is presented in lecture. Other laboratories will concentrate on computer methods. Where possible, the experimental procedure will be distributed before the day of the laboratory, and should be read before beginning the experiment. Most laboratory sessions will be held in MH353, but we will meet in MH355.

Schedule of experiments (tentative):

1. Laboratory safety policies; writing laboratory reports (in MH 355).
2. Quantitative data, measurement, and graphing.
3. Introduction to data analysis using computers: Graphical Analysis.
4. Nuclear chemistry.
5. Color and spectra.
6. Atomic spectra.
7. Stoichiometry I: hydrates.
8. Stoichiometry II: study of a precipitation reaction.
9. Stoichiometry III: quantitative spectral analysis for Cu^{2+}.
10. Covalent bonding and molecular structure.
11. Computer modeling of molecular structures.
12. Reactivity series: properties of halogens.
13. Introduction to LoggerPro. Potassium hydroxide and hydrochloric acid.
14. Pressure, volume, and temperature of a gas.
15. Project presentations.

Course Requirements and Assessment Method:

1. Laboratory reports and written assignments should be word processed (and spellchecked). Laboratory reports are due **one week** after the experiment. Late work will be penalized.
2. If a laboratory experiment is missed for a valid reason, you should come in as soon as possible after the scheduled laboratory day to be assigned a make-up exercise.
3. There will be 3 tests and a comprehensive final exam. **The final exam will be held on Monday, December 10, from 8.00 to 9.30 a.m.** All exams must be taken on the scheduled days unless there is a valid reason not to take the exam at that time. If you miss an exam for a valid reason, the exam must be taken as soon as possible after the scheduled day.
4. While the final will be entirely or mostly multiple-choice in nature, class tests and homework exercises will be based on your ability to use the principles you have learned to solve quantitative problems in modern chemistry. Also, remember that correctly answering a multiple choice question may require considerable analysis or even a detailed calculation – do not rush through questions.
5. You will be required to write a term paper and/or give a presentation on a topic to be announced, and you will participate in the production of a poster as a group project.
6. Class will not consist of one-way lecturing. There will be graded group activities, and you are encouraged to participate actively in class by reading the relevant material beforehand, asking questions, and taking notes. Ideally, the class should form a fertile environment for mastery of chemical ideas. You are encouraged to form study groups of 3-6 students to meet regularly and review the material.
7. Homework will be assigned in one lecture period and collected at the start of the next lecture period. Online quizzes will be available for self-study.
8. In addition to any assigned homework, you should work through as many of the end-of –chapter problems as you can. (Those with colored numbers have answers in Appendix E.) You should aim to spend 2 to 3 hours on work outside of class for every hour spent in class.
9. We will aim to cover Chapters 1-11 (although not in that order) and 24 in Silberberg this semester.
10. Peer tutors may be available from the Learning and Counseling Center. Please make use of them.
11. You are expected to understand and adhere to the College's policy on academic honesty as outlined in the Marian College *Code of Student Rights*. (/forms/studentcodebook.pdf on the Marian web site.)
12. The emphasis in the course will be on conceptual understanding, critical/analytical thinking, and active learning.

Attendance, punctuality, and classroom courtesy:
Regular attendance in lecture and laboratory is important for your learning and for maximizing your interaction with the instructor and with others in the class. Therefore, attendance will be taken, and there will be a grade penalty for absence. Unavoidable absences (for example due to illness) will be considered differently from unexcused absences. Therefore, you must inform the instructor of the reasons for your absence promptly. An *unexcused* absence from laboratory will lead to a grade of zero for that laboratory.

Lateness is disruptive to the classroom environment and inconsiderate to your fellow-students. Repeated lateness will result in a grade penalty.

When in class you are expected to be actively involved in classroom activities, by listening and note-taking, asking relevant questions, and participating in discussions. In order to promote a good learning environment, cellphones should be turned off while in class. The reading of newspapers, while encouraged in general, is not encouraged in class. Children should not be present in class. Persons not enrolled in the class should not be present in class without advance permission.

Grading Criteria:
1. The overall grade is calculated as follows:

Homework, class tests, and assignments:	40%
Final exam:	35%
Laboratory:	25%

   The letter grading scale follows common standards, with >90% corresponding to A, 80-89% corresponding to B, 70-79% corresponding to C, 60-69% corresponding to D, and <60% corresponding to F. The marks may be curved if needed.
2. Laboratory reports (usually marked out of 20) are graded on the following criteria: handed in on time, correct calculations (including units), good English exposition (full sentences, correct grammar and punctuation), correct responses to all questions, correct conclusions from the data. Late reports will be docked two points per day late.
3. The term paper is to be checked by the Writing Center for its compositional and stylistic aspects before being handed in. A complete rough draft should be turned in to the instructor for comments on chemistry content before the final product is submitted.