

Chemistry 115: Principles of Chemistry I

Autumn 2004

Course locations, times, and credit

Chemistry 115 is a 5 credit hour course that includes lecture, discussion, and laboratory periods. The schedule is as follows:

Lecture	DEV 138E	8:30–9:50 Tuesday and Thursday, 9:00–9:50 Wednesday
Discussion	EC 423	10:00–10:50 Tuesday (D1) and Thursday (D2)
Laboratory	DEV 313E	10:00–12:50 Monday (sec. 20), 10:00–12:50 Friday (sec. 18), 1:00–3:50 Friday (sec. 19)

Each student should be enrolled in one discussion and one lab section in addition to the lecture. Attendance in discussion and lab are mandatory; attendance in lecture is not required except on exam days. However, a small fraction of the course grade is contributed by assignments done during the lecture period, and students who miss lecture will not be able to receive credit for those.

Objectives

CHM 115 is the first half of a two-semester course in general chemistry intended primarily for students majoring in the sciences and engineering. It addresses the constitution of matter from atoms, the structures of atoms, the periodic table, structures of molecules and ionic solids, types of bonding and corresponding molecular shapes, stoichiometry in neat mixtures and solutions, intermolecular forces, and physical properties of gases, liquids, and solids. Throughout the course, the energy changes that accompany changes in the arrangements of matter are considered carefully.

Instructor

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Office Hours

I will hold regular office hours from 10:00 to 11:00 on Wednesday and 11:00 to 12:00 on Thursday, at a location on the Grand Rapids campus to be announced in class. I also hold office hours in Allendale from 3:00 to 4:00 every Tuesday and 2:00 to 3:00 every Wednesday.

Prerequisites

Chemistry 109 or high school chemistry, and Math 110 or placement beyond Math 110 on the GVSU Math Placement Test. Students who have not met these prerequisites by the end of the first week of class will be dropped from the course. Students may schedule the Math Placement Test by contacting Ann Chavez in the Academic Resource Center.

Students who plan to take CHM 116 next semester should be enrolled in MTH 122 or 125, or have placed out of those courses, concurrently with CHM 115. MTH 122 is a prerequisite for CHM 116.

Textbooks

1. R. Chang, *Chemistry*, 7th edition (McGraw-Hill, 2002.) (The 8th edition is available from the publisher, but UBS and Brian's Books have the 7th edition on the shelves, and problem assignments will come from the 7th edition.)
2. *Laboratory Manual for Principles of Chemistry I*, 2004–2005 edition, GVSU Chemistry Department.

Calculators

Students will need calculators capable of trigonometric and logarithmic functions. Calculators or computers with full keyboards (BlackBerry, TI-92, etc.) are not permitted on exams or quizzes.

Assignments and Grading

Evaluation methods The following assignments will be used to evaluate student accomplishment in the course.

- Weekly homework [8%]. Problem sets will be available on the course website to be done, submitted and graded electronically. These problems are randomly generated so each student will receive a unique problem set. Each problem set will be available for approximately one week. You must complete all assigned problems during this week. You may repeat each homework set as many times as you wish during the time allowed. Your last submission for each set is the only submission that will count toward your homework grade.

Supplementary problems will also be suggested during lecture for most topics. These problems will not be graded, but students are strongly encouraged to do them.

- Quizzes and in-class exercises [15%]. Five quizzes will be given during discussion; the four highest scores will count toward the quiz grade. In addition, written in-class exercises will occasionally be collected both during lecture and discussion, and the sum of those scores will count as a single quiz score.
- Laboratory [12%]. A series of weekly laboratory experiments is an important component of 115. The experiments are designed to demonstrate and reinforce concepts covered in the lecture, and to teach scientific approaches to investigation and presentation of results. The laboratory work is a mandatory part of the course, even for students who are repeating 115. While the lab score counts for only 12% of the final grade, a failing grade (< 60%) in the lab results in a grade of F for the course.
- Midterm exams [15% each]. We will have three in-class exams, on October 7, November 4, and December 7. The exams will have both multiple choice and written components.
- Final exam [20%]. The cumulative final exam will be held at 10 am on December 13. Its format will be similar to that of the midterms. No early final exams will be given.

Grading scale Any student who earns 90% of the possible points will receive an A; any student who earns 80% of the possible points will receive a grade not less than B, and so on. I reserve the right to revise the grade boundaries downward (that is, in favor of the students) but will not revise them upward.

Makeups No makeup work will be given. Students who miss homework assignments for any reason will not receive credit for them. Students who miss quizzes or exams for acceptable reasons, and provide documentation (letter from coach, physician, judge, funeral director, etc.) supporting those reasons, will not be penalized. Acceptable reasons include medical and family emergencies, court appearances, and University sponsored travel. Family vacations, student road trips, and failed alarm clocks are not acceptable.

Final grades are available through the Registrar's web site shortly after they are turned in. If I have the grades prepared earlier, I will report them to students who either (a) come to my office in person, or (b) send an email from an official GVSU email address requesting the grade; I will return the grade to that address only. I do not post grades or give them out by telephone.

Cheating

I subscribe to the Academic Honesty rules and definitions given on p. 91 of the 2004–2005 GVSU Catalog. Attempts to receive credit for other's work as your own, or to gain advantages not available to other students (other than accommodations for documented handicaps) constitute cheating. Examples include the use of cheat sheets on exams and quizzes and copying of other students' work for exams, quizzes, or lab reports.

If I strongly suspect a student of cheating, I will assemble the evidence I have that cheating occurred and send it along with a letter explaining my suspicions to the Dean of the College in which the student is enrolled. I will inform the student in question of my action and provide him or her with a copy of my letter. I will then follow the recommendation of the Dean with regard to sanctions against the student.

Students are encouraged to study together, and are permitted to work together while they do online homework and prepare for exams. Each student gets a unique set of homework problems; the requirement is simply that each student's online submissions represent answers he has obtained himself.

Similarly, when you are writing up your laboratory work, you may work with other students and discuss both the data analysis and the best means of presentation. However, any work you turn in must be your own. You must write your own text; you must do your own plots and linear fits; you must prepare your own tables, graphs and figures. It is *not* acceptable for two students to work together to prepare a single graph and then print two copies.

Special needs

Any students who have special needs because of learning or physical disabilities should contact the Office of Academic Support (OAS) at 331-2490.

Web page

This course has a BlackBoard web page, where copies of the syllabus and homework assignments will be kept.

To visit the BlackBoard page, visit <http://bb.gvsu.edu>. Give everything before the @ in your email address as your username, and use your GVSU network password. It should be clear how to navigate to Chemistry 115 from there. Please try it and let me know if you have trouble.

Course outline

We will study the material in roughly the following order.

Section	Topics	Readings from Chang
Atoms	Size, mass, and basic structure of atoms. Atomic number, mass number, isotopes, atomic weight. Elements, compounds, and mixtures. The mole. Ionization energies, atomization energies.	Chap. 1, 2.2–2.6, 3.1–3.3
Atomic structure	Coulomb's Law. Quantum mechanics; energy levels, wavefunctions, orbitals. Quantum numbers and spin. Electromagnetic radiation; photons and the Einstein relation; atomic spectra.	7.1–7.7
Periodic properties	Aufbau; electron configurations. Magnetic properties. Screening. Periodic properties: ionization energies, electron affinities, and electronegativity. Configurations of stable ions in crystals and in solution. Macroscopic properties of metals and nonmetals, heat capacities.	7.8–7.9, 8.1–8.5
Electron transfer and ionic bonding	Electron transfer, Lewis structures of atomic ions. Lattice energies and the Born-Haber cycle; enthalpies of formation. Nomenclature of binary ionic compounds. Oxidation numbers. Stoichiometry of simple reactions; limiting reagents. Dissolution of ionic compounds; concentrations and dilution; conductivities; enthalpy of solution.	9.1–9.3, 2.5–2.7, 3.7–3.9, 4.1–4.2, 6.6
Covalent bonding	Lewis structures of molecules and polyatomic ions. Polar and nonpolar bonds; molecular dipole moments and solubility of molecular compounds. Molecular shapes and VSEPR. Nomenclature of compounds with polyatomic ions and compounds of inorganic nonmetals.	9.4–9.10, 10.1–10.2, 2.7
Descriptive chemistry and reactions	Reaction stoichiometry; balancing equations. Characteristic reactions of Groups 1, 2, 16, and 17. Enthalpies of reaction and Hess's Law. Solution stoichiometry.	8.6, 3.7, 6.2–6.4, 4.1–4.3
Gases	Kinetic molecular theory and the ideal gas law. Work of isothermal compression and expansion; relation between ΔU and ΔH . Solubility of gases, Henry's Law.	5.1–5.7, 12.5, 6.7
Intermolecular forces and liquids	Deviations from ideal gas law; intermolecular forces; evaporation and condensation; enthalpy of vaporization. Structure of simple liquids and solutions.	5.8, 11.1–11.3