

CHEM101
Introductory University Chemistry I
3 Credits

Instructor: Dr. Raymond Anana
Phone: 780 871 5765
Original Developer: Dr. Kingsley Donkor
Current Developer: Dr. Raymond Anana
Reviewer: Dr. Robert Cuny
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2602 - 59 Avenue, Lloydminster, Alberta, Canada T9V 3N7. Ph: 780 871 5700
5707 College Drive, Vermilion, Alberta, Canada T9X 1K5. Ph: 780 853 8400
Toll-free in Canada: 1 800 661 6490



CHEM101 Version: 11



Introductory University Chemistry I

Calendar Description

Atoms and molecules, states of matter, chemistry of the elements.

Rationale

Introductory chemistry is intended for students interested in further study in pure science such as chemistry, biology, geology, or physics and also for those who require a working understanding to achieve their career goals in medicine, engineering, forestry, and environmental sciences. In addition, introductory chemistry is useful for non-science majors who enjoy science and look for scientific knowledge to heighten their awareness of the material world.

Chemistry is the study of the enormous variety of materials of the universe and the changes that these materials undergo when they interact with each other. One of the joys of learning chemistry is seeing how chemical principles operate in all aspects of our lives, from everyday activities like lighting a match to more far-reaching matters like the control of acid rain. Hundreds of materials that are in use today are products of chemical research. For example, development of pharmaceuticals, plastics (nylon, Teflon, polyester, silicone, etc.), fertilizers, computer chips, steel, paper, and wood products are all results of chemical studies.

Prerequisites

Chemistry 30 or Equivalent

Co-Requisites

None

Course Learning Outcomes

Upon successful completion of this course, students will be able to

1. explain atomic structure, the way atoms combine to form a molecule, stoichiometry of a chemical reaction, states of matter and describe characteristics of main-group elements.
2. apply chemical principles and the elementary data and laws of chemistry in solving simple chemical problems.

3. conduct laboratory experiments that exercise the skills necessary to perform experiments in an inorganic chemistry lab on atoms.
4. develop an appreciation for the basic principles of chemistry.

Resource Materials

Required Texts:

Silberberg, Martin S., & Patricia Amateis. *Chemistry, the Molecular Nature of Matter and Change*. 9th ed. New York, NY: McGraw, 2020. Print.

Silberberg, Martin S., & Patricia Amateis. *Chemistry, the Molecular Nature of Matter and Change, Solutions Manual*. 9th ed. New York, NY: McGraw, 2020. Print.

Reference Texts:

The following recommended books are on reserve for your use in the library:

Chang, Raymond. *General Chemistry* (3rd ed.). McGraw-Hill, 2003. Print.

Silberberg, Martin. *Chemistry: The Molecular Nature of Matter and Change* (2nd ed.). McGraw-Hill, 2000. Print.

Tro, Nivaldo. *Principles of Chemistry: The Molecular Approach*. Prentice-Hall/Pearson, 2010. Print.

Petrucci, R. H, Harwood, W. S., Herring, F. G., and Madura, J. D. *General Chemistry* (9th ed.). Pearson-Prentice Hall, 2007. Print.

McMurry, J. and R. C. Fay. *Chemistry* (5th ed.). Englewood Cliffs, NJ: Prentice Hall Inc., 2007. Print.

McMurry, J. and R. C. Fay. *Solutions Manual* (5th ed.). Englewood Cliffs, NJ: Prentice Hall Inc., 2007. Print.

Conduct of Course

This is a 3 credit course with 3 hours of lecture 3 hours of lab per week. (3-0-3).

Chemistry 101 students attend lectures, participate in discussion, and run experiments in the laboratory. The class meets for a total of three hours (lecture/discussion) per week. An additional hour may be scheduled if necessary. The class also meets once a week for a three hour laboratory and computer assisted learning session. The instructor uses transparencies, videos, and computers as educational aids.

If necessary, a proficiency test may be given at the beginning of the course to identify areas of weakness of the students. The results are only be used to tailor the course to student needs.

Students are assigned problem sets and are also asked to do end-of-chapter questions as homework. The aim is to give students more practice to enhance their skills in problem solving that is so essential to doing well in this course. The results contribute to the final grade. In this regard, the Solutions Guide can also be of real benefit to the student. It provides detailed solutions for two-thirds of the end-of-chapter exercises using the strategies emphasized in the text. If interested, students can purchase their own copy of the Solutions Guide from the bookstore.

Laboratory

The laboratory sessions are once a week (3 hours). Students are required to study the "theoretical considerations" of every experiment before coming to the lab and may do a lab quiz at the start of the lab period. The "Prelab Assignment" is to be done and turned in before students start each lab. The "Prelab Assignment" is designed to help students understand the experiment and to give them step-by-step practice with calculations. Marks are given for its completion.

For every experiment there are two observation sheets and a report form (see the lab manual for each experiment). The two observation sheets are to be filled out as students are doing the experiments and they should be handed in at the end of the laboratory period, before leaving the lab. The lab report should be completed and turned in to the instructor within two days of completion of the experiment. For example, a lab that is done on Monday must be turned in by Wednesday before 4:30 pm.

There is a brief lecture (approximately 10 minutes) on experiments that need theoretical background not covered in the lectures because synchronizing lectures with labs has always been a problem in chemistry courses and very often lectures and labs do not correlate with one another. This is because it is often not possible to match the pace of lectures to topic changes in the lab.

In order to eliminate accidents in our laboratory, students are required to read and obey the rules of safety outlined in the manual. The chemistry laboratory is a potentially dangerous place if students fail to observe safety precautions. Every student must acquire a pair of safety glasses

(available at the bookstore at a minimal price). Contact lenses are not a substitute for safety glasses and are particularly dangerous if a chemical gets in the eye. Prescription glasses are acceptable if used with side guards.

Federal and Provincial Legislation (WHMIS) recognizes the workers "right" to know about hazardous materials in the workplace. Students carrying out experiments in a lab are considered workers, and the lab is their workplace. Therefore, they need to identify dangerous chemicals in the lab and be able to protect themselves. The required information is provided in what is called Material Safety Data Sheets (MSDS). Students are requested to consult the MSDS before running an experiment. Materials Safety Data Sheets (MSDS) of all chemicals used in the Lloydminster campus chemistry lab can be found in two locations:

1. One set is available in the library. Students can find them in the reference books section or ask the librarian for help.
2. The other set is in the Hazard Information Center in Room 1008 (chemistry lab).

Laboratory Schedule

The labs begin a week after classes start. There are eight experiments and one lab exam as listed in the Course Units/Calendar section of this outline. These follow the same sequence as found in your lab manual.

Evaluation Procedures

The final grade is an aggregate of the following components:

Assignments	10%
First Midterm Exam	15%
Second Midterm Exam	15%
Final Exam	35%
Laboratory	<u>25%</u>
Total	100%

The breakdown of the laboratory mark of 25% is as follows:

Prelab/Observation /Postlab Assignments	20%
End-of-Term Multiple Choice Lab Exam	<u>5%</u>
Total	25%

The date for the end-of-term lab exam is announced in class.

No supplemental assignments or examination re-writes are permitted in this course.

Grade Equivalents and Course Pass Requirements

A minimum grade of D (50%) (1.00) is required to pass this course.

Letter	F	D	D+	C-	C	C+	B-	B	B+	A-	A	A+
Percent Range	0-49	50-52	53-56	57-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-100
Points	0.00	1.00	1.30	1.70	2.00	2.30	2.70	3.00	3.30	3.70	4.00	4.00

Students must maintain a cumulative grade of C (GPA - Grade Point Average of 2.00) in order to qualify to graduate.

Attendance

Students are expected to attend all lectures and laboratories. If more than four lectures are missed then, except for extenuating circumstances, the student will not be allowed to write the final examination. Missing even one lab without legitimate excuse will result in a failing grade in the course regardless of exam marks. Missing three or more labs will definitely result in a failing grade and no excuse will be acceptable. Attending a lab session but not handing in the prelab and postlab assignments within the accepted time period (as stated under Conduct of Course) will be regarded as having missed that particular lab.

Course Units/Topics

Session	Topics
I. General principles	
1	Introduction, elements, and periodic table
2	Accuracy and precision; significant figures; rounding numbers
3	Properties of matter; density
4	Atoms, molecules and ions; isotopes
5	Balancing chemical equations; Avogadro's number and the Mole
6	Stoichiometry; yields of chemical reactions
7	Reactions with limiting reactants

8	Concentrations of reactants in solution; molarity; diluting concentrated solutions
9	Solution stoichiometry, titration
10	Percent composition and empirical formulas; molecular formulas
II. Atomic Structure	
11	Rutherford model of the atom; isotopes; mass spectrometry; periodic table
12	Nature of light; atomic spectra; Bohr model; quantum mechanics
13	Shapes and energies of hydrogen orbitals; electron spin; multielectron atoms; electron configurations
14	Periodic trends in atomic properties: atomic sizes, ionization energy, electron affinity; periodic properties of elements and compounds
15	First Midterm Exam
III. Bonding	
16	Types of bonds
17	Nomenclature; Lewis structures, octet rule, formal charge
18	Resonance; octet exceptions
19	VSEPR model; dipole moments
20	Bond order, bond length, bond energies
21	Valence bond theory; hybridization; molecular orbital model
IV. States of matter	
22	Gases; mixtures; partial pressures
23	Kinetic molecular theory; real gases
24	Intermolecular forces
25	Liquids, solutions, solubility

26	Structure of solids, cubic crystals; phase diagrams
27	Second Midterm Exam
V. Main group elements	
28	Acids and bases; Arrhenius/Bronsted/Lewis; nomenclature
29	Salts; inorganic acid/bases
30	Structure and reactivity
31	Oxidizing and reducing agents
32	H, Group 1: Li, Na, K, Rb, Cs, Fr
33	Group 2: Be, Mg, Ca, Sr, Ba, Ra
34	Group 13: B, Al, Ga, In, Tl
35	Group 14: C, Si, Ge, Sn Pb
36	Group 15: N, P, As, Sb, Bi
37	Group 16: O, S, Se, Te, Po
38	Halogens
39	Noble gases
40	Final Examination

Laboratory Schedule

See the 2010-11 Chemistry 101/103 Laboratory Manual from University of Alberta.



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