CHEM102

Introductory University Chemistry II

3 Credits

Instructor: Dr. Raymond Anana
Phone: 780 871 5765
Original Developer: Kingsley Donkor
Current Developer: Dr. Raymond Anana
Reviewer: Dr. Robert Cuny

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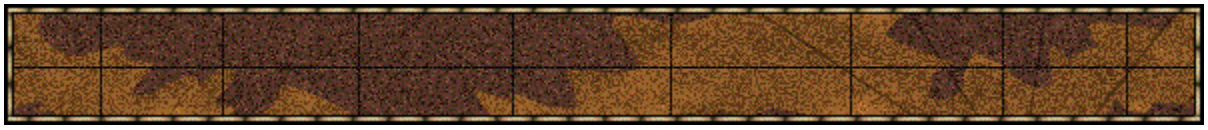

Introductory University Chemistry II

Calendar Description

Rates of reactions, thermodynamics and equilibrium, electro-chemistry, modern applications of chemistry.

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 such as lighting a match to more far-reaching matters such as the control of acid rain. Hundreds of materials that are currently in use 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

CHEM101

Co-Requisites

None

Course Learning Outcomes

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

1. explain aqueous equilibria, electron exchange reactions, thermodynamics, spontaneous processes, entropy, rates of reactions, transition metal and coordination chemistry.
2. apply principles of electrochemistry and chemical kinetics to solve problems.

3. conduct laboratory experiments that will exercise the skills necessary to perform experiments in an inorganic chemistry laboratory.
4. appreciate 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:

Biokess, R. S., and E. Edelson. *Chemical Principles* (3rd ed.). New York: Harper & Row, 1981. Print.

Considine, D. M., and G. D. Considine. *Encyclopaedia of Chemistry* (4th ed.). New York: Van Norstrand Reinhold, 1984. Print.

McQuarrie, C. H., D. A. McQuarrie, and P. A. Rock. *General Chemistry* (3rd ed.). New York: W. H. Freeman, 1984. Print.

McQuarrie, C. H., D. A. McQuarrie, and P. A. Rock. *Study Guide*. New York: W. H. Freeman, 1984. Print.

Mortimer, C. E. *Chemistry* (5th ed.). Belmont: Wadsworth Publishing, 1983. Print.

Parker, S. P. *Dictionary of Chemistry*. New York: McGraw-Hill, 1984. Print.

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

Weast, R. C. *Chemistry Tables, CRC Handbook of Chemistry and Physics*. Ranton: CRC Press, 1984. Print.

Conduct of Course

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

Chemistry 102 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.

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 B. 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 the 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:

Problem Sets/Assignments	10%
First Midterm Exam	15%
Second Midterm Exam	15%
Final Exam	35%
Laboratory	25%
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	5%
Total	25%

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, except for extenuating circumstances, the student is not 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.

Course Units/Topics

I. Chemical kinetics

1. Reaction rates
2. Rate law and reaction order
3. Integrated rate laws
4. Arrhenius model
5. Reaction mechanisms
6. Catalysis

II. Chemical equilibrium

1. Equilibrium conditions, Q, and K
2. Gas-phase equilibria, Le Chatelier's principle
3. ICE table and equilibrium calculations
4. Review of acid-base definitions
5. pH-scale, acid-base strengths, acid-base equilibria
6. Polyprotic acids and salts
7. Common ions and buffers
8. Solution and solubility rules
9. Solubility equilibria, qualitative analysis
10. Complex ion equilibria

First Midterm

III. Thermodynamics

1. First law: energy, heat and work
2. Enthalpy, bond energies and calorimetry
3. Hess' Law and standard enthalpies of formation
4. Sources of energy
5. Second and Third laws: entropy and spontaneity
6. Free energy, work and equilibrium

IV. Electrochemistry

1. Review of redox reactions, balancing reactions
2. Voltaic cells, reduction potentials and cell potentials
3. Free energy and electrical work
4. The Nernst equation
5. Applications of electochemistry: batteries, corrosion and electrolysis

Second Midterm

V. Coordination chemistry

1. Review of electron configurations
2. Coordination compounds
3. Isomers
4. Crystal field theory
5. Colours and magnetic properties
6. Complex ions, equilibrium, acid-base reactions and kinetic aspects
7. Applications

Final exam

Laboratory Schedule

1. Check-In and Effect of Temperature on rate of reaction
2. Hess' Law
3. Determination of the iodine-triiodide equilibrium constant
4. Titration of a weak acid
5. Buffers and antacids
6. Voltaic cells and redox reactions
7. The Nernst equation and its applications
8. Stoichiometry of a Nickel Coordination Compound
9. Lab Exam and Check-Out

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 E-mail: admissions@lakelandcollege.ca