

SC 110
Inorganic Chemistry

3 Credits

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SC 110 Version: 14



Inorganic Chemistry

Calendar Description

This is a basic course in inorganic chemistry with an emphasis on environmental applications. Basic chemical concepts are presented in the lecture series with application of those concepts in the laboratory component.

Rationale

This course is required for first year students within the Environmental Sciences diploma. This course is designed to provide you with the background knowledge and understanding of chemistry that is required in many other science courses, as well as in the work place. Chemistry plays a pervasive role in our lives. Hundreds of materials that you use directly or indirectly every day are products of chemical research. Most of the world's problems, such as environmental pollution, alternative energy sources, health, drugs, medicine and nutrition that we hear about almost daily in the media, require some knowledge of chemistry for their understanding and solution.

Pre-requisite to or desirable for the following courses:

SC 200 - Organic Chemistry, SC 307 Environmental Site Assessment, SC 316 Solid Waste & Wastewater Management, SC 336 Environmental Contaminants, SC352 Environmental Monitoring & Sampling.

SO 210 - Introductory Soil Science

Prerequisites

None

Co-Requisites

None

Course Learning Outcomes

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

1. explain the concepts of scientific method, states of matter, solution, solute, solvent, solubility, concentration (including calculating percent, molarity, normality, parts per million, mole fraction, osmolarity, density, specific gravity), toxicity, half-life
2. perform unit conversions
3. describe atoms and their subatomic particles, electron configuration, cations and anions, electronegativity and periodicity, including drawing Lewis Dot and Orbital Box diagrams
4. describe chemical bonds, polarity, resonance, and molecular shape
5. name and write chemical formulas for ionic and covalent molecules
6. explain chemical reactions, including balancing chemical equations, calculating reaction rates and equilibrium constants, calculate equilibrium concentrations, describing reaction mechanism, action of catalyst, equilibrium, and reversible reactions
7. describe hydrolysis, combustion, acid-base reactions
8. describe oxidation and reduction reactions, identify oxidizing and reducing reagents from equations
9. calculate mass relationships from chemical equations, including applying the concept of limiting reagents
10. describe the relationship between chemical equilibrium and reaction rate, using examples of equilibrium principles from the real world
11. explain the relationship of pressure, temperature and volume of gases, including performing calculations applying gas laws
12. identify and explain intermolecular forces, and calculate energy change during phase changes of matter
13. discuss solubility of minerals and organic compounds as it relates to nutrient and contamination of surface and soil water
14. explain freezing point depression, boiling point elevation
15. explain the concepts and use of pH, pOH, buffering, acidity, alkalinity, electrolytes, amphiprotic substances, and give examples from the real world
16. explain the equilibrium constant K , K_a , pK_a , K_w , and use these to calculate pH
17. discuss the properties of radioactive materials, creation of isotopes, and their use in environmental monitoring and research
18. explain and practice safe laboratory procedures, including WHMIS legislation and MSDS labelling, as it applies to the workplace
19. perform titrimetric, gravimetric, and spectrophotometric analyses of typical environmental concern
20. use analytical balances, glassware and instruments in a typical wet laboratory setting using micro and macro techniques with accuracy and safety
21. prepare standardized solutions in molarity, normality, parts per million

Essential Employability Skills

Essential employability skills are critical for workplace success and lifelong learning. Lakeland College prepares its graduates for the workplace and lifelong learning by integrating and promoting essential employability skills development in its curricula. Each credit course offered at Lakeland College emphasizes one or more of the following five essential employability skills:

- A. **Communication Skills** that enable individuals to listen, interpret, express, and convey knowledge and ideas so that they are received and understood.
- B. **Teamwork Skills** that enable individuals to respect the thoughts and opinions of others as they work together to plan activities, meet deadlines, complete projects, and contribute to an organization's goals.
- C. **Critical Thinking Skills** that enable individuals to conceptualize and analyze issues from various perspectives while rationally evaluating the strengths and limitations of each perspective and deciding what action to take.
- D. **Adaptability Skills** that enable individuals to respond quickly, willingly, and positively to new conditions and changing times.
- E. **Positive Attitude and Behavioural Skills** that enable individuals to be confident about themselves and to deal with people, problems, and situations with honesty, integrity, and personal ethics.

Resource Materials

Required Texts:

Bettelheim, F., W. Brown, M. Campbell, S. Farrell, and O. Torres. 2020. Introduction to General, Organic and Biochemistry. 12th ed. Harcourt, Brace, Toronto.

SC 110 - Inorganic Chemistry Lab Manual.

The Worker's WHMIS Reference Guide. Tri Canada Safety Training and Supplies.

Note: General Chemistry texts available in the Library, mainly the QD section are also available to students.

Laboratory Supplies:

Glasses - safety or prescription with side shields.

Lab Coats - knee length of cotton or fire resistant material.

Lab book

Conduct of Course

The course is presented using a combination of lectures (37 hours) and laboratory (20 hours). Students are encouraged and expected to ask questions and participate in discussion throughout the course.

Evaluation Procedures

The final grade is an aggregate of the following components:

Quizzes	20%
Midterm Exam	25%
Final Exam	30%
Labs	<u>25%</u>
TOTAL	100%

To obtain credit in this course, all assignments must be completed and handed in on time. Late assignments are not marked, and a grade of "0" is assigned.

The marks for this course are derived from lecture exams and lab marks. Percentage mark is converted to the college grade system.

Knowledge/Skills Matrix

Students apply and demonstrate their knowledge and skills to use

A. Communication Skills

A1. by listening, reading, interpreting information, and communicating effectively
Evaluation(s)/Goal(s): Midterm and Final Exam/Goal 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 16; Labs and Assignments/Goal 3, 6, 7, 9, 13, 14, 15; Quizzes/Goal 3, 4, 5, 7, 11, 12
A2. by using written, spoken, and/or visual formats and media to communicate and meet needs of each particular audience
Evaluation(s)/Goal(s): Labs and Assignments/Goal 3, 6, 7, 13, 14, 15; Quizzes/Goal 3, 4, 5, 7, 11, 12
A3. by using libraries, Internet, technical publications, journals and other sources to find pertinent information
Evaluation(s)/Goal(s): Labs and Assignments/Goal 3, 6, 7, 13, 14, 15

B. Teamwork Skills

B1. by using interpersonal skills to create an atmosphere that maximizes the strengths of group members to accomplish tasks
Evaluation(s)/Goal(s): Labs and Assignments/Goal 3, 6, 7, 13, 14, 15
B2. by using interpersonal skills to resolve conflict, relate to others, and assist others
Evaluation(s)/Goal(s): N/A

B3. by contributing and listening to others as group determines realistic objectives, prioritizes tasks, and identifies resources and timelines
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Evaluation(s)/Goal(s): N/A

B4. by treating other members of the group open-mindedly and fairly
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Evaluation(s)/Goal(s): N/A

B5. by developing tactics/strategies to accomplish tasks

Evaluation(s)/Goal(s): Labs and Assignments/Goal 3, 6, 7, 13, 14, 15; Quizzes/Goal 3, 4, 5, 7, 11, 12

C. Critical Thinking Skills

C1. by seeing critical thinking as a lifelong process of self-assessment

Evaluation(s)/Goal(s): Labs and Assignments/Goal 3, 6, 7, 13, 14, 15; Quizzes/Goal 3, 4, 5, 7, 11, 12; Midterm and Final Exam/Goal 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 16

C2. by examining problems closely
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Evaluation(s)/Goal(s): Midterm and Final Exam/Goal 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 16

C3. by examining beliefs, assumptions, and opinions, and weigh them against the facts
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Evaluation(s)/Goal(s): N/A

C4. by seeking out the truth

Evaluation(s)/Goal(s): N/A

C5. by finding solutions; make decisions

Evaluation(s)/Goal(s): N/A

C6. by incorporating new ideas that may not necessarily agree with previous thought on the topic

Evaluation(s)/Goal(s): Final Exam/Goal 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 16
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C7. by seeing connections between topics and use knowledge from other disciplines to enhance reading and learning experiences
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Evaluation(s)/Goal(s): Labs and Assignments/Goal 3, 6, 7, 13, 14, 15
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D. Adaptability Skills

D1. by working independently or as part of team
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Evaluation(s)/Goal(s): Labs and Assignments/Goal 3, 6, 7, 13, 14, 15
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D2. by carrying out multiple tasks or projects

Evaluation(s)/Goal(s): N/A

D3. by being innovative and resourceful: identify and suggest alternative ways to get the job done

Evaluation(s)/Goal(s): N/A

D4. by being open and respond constructively to change and uncertainty

Evaluation(s)/Goal(s): N/A

E. Positive Attitude and Behavioural Skills

E1. by dealing with people, problems, and situations with honesty, integrity, and personal ethics
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Evaluation(s)/Goal(s): N/A

E2. by showing interest, initiative, and effort
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Evaluation(s)/Goal(s): Labs and Assignments/Goal 3, 6, 7, 13, 14, 15; Quizzes/Goal 3, 4, 5, 7, 11, 12

E3. by affirming the need for positive solutions and encourage positive interaction and feedback

Evaluation(s)/Goal(s): N/A

E4. by balancing personal and family activities with job-related activities
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Evaluation(s)/Goal(s): N/A

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.

WHMIS Certification:

To receive a WHMIS certificate, students must attain 76% on the WHMIS final exam.

Grades for WHMIS Certification:

Mark	0-75%	76-100%
Grade	Fail	Pass

Attendance

Classroom and laboratory attendance is considered vital to the learning process and as significant to the students' evaluation as examinations and reports, therefore absenteeism is recorded.

- Students having a combination of excused and/or unexcused absence of 20 percent or higher for the scheduled course hours can be required to withdraw and would then automatically receive a "RW" (required withdrawal) for the course, regardless of any other evaluation results. (RW is a failing grade).
- An excused absence is one that is verified with your instructor. Verification should be prior to the absence or the next class day following the absence. Verification of the absence may take the form of a note from your doctor/College nurse regarding illness, or a note from another instructor regarding a field trip or other activity, or authorization by your instructor following an in-person meeting. Be sure to contact your instructor and ask what they will require from you as verification for each absence. An unexcused absence is anything NOT verified by the instructor prior to the absence or the next class day following the absence.

NOTE: Any exceptions to the above attendance policy (e.g. timetable conflicts, work-related issues) must be approved in writing by the Department Chair prior to the beginning of the course.

It is the students' responsibility to know their own absentee record.

Normal hours are 8:30 a.m. to 6:30 p.m., with potential for evening courses, exams or extended field trips. Students are expected to be available for classes during these times.

Course Units/Topics

1. Chemistry - Matter, Energy and Measurement
2. Atoms, Molecules, and Ions
3. Periodicity and Atomic Structure
4. Ionic Bonds and Some Main-group Chemistry
5. Covalent Bonds and Molecular Structure
6. Formulas, Equations, and Moles
7. Chemical Reactions in Aqueous Solutions
8. Gases, their properties, and Behaviour
9. Liquid, Solids, and Changes of State
10. Solutions and their Properties
11. Chemical Kinetics
12. Chemical Equilibrium
13. Hydrogen, Oxygen, and Water
14. Aqueous Equilibrium, Acids, Bases and Salts
15. Applications of Aqueous Equilibria, Common Ion Effect, Buffer Solutions, and pH
16. Nuclear Chemistry

Laboratory:

1. Orientation, Laboratory Safety and WHMIS System, & Density Determination
2. Law of Constant Composition
3. Classes of Chemical Reactions
4. Sulfate Analysis: Turbidometric Method
5. Titration



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