UNIVERSITY OF THE FRASER VALLEY

ORIGINAL COURSE IMPLEMENTATION DATE: September 2002
REVISED COURSE IMPLEMENTATION DATE: September 2026
COURSE TO BE REVIEWED (six years after UEC approval)**:** January 2032
Course outline form version: 29/08/2024

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

Note: The University reserves the right to amend course outlines as needed without notice.

Course Code and Number: CHEM 114	**Number of Credits:** 5 Course credit policy (105)
Course Full Title: Principles of Chemistry II **Course Short Title:** Principles of Chemistry II	
Faculty: Faculty of Science	**Department/School:** Chemistry

Calendar Description:

Topics include chemical thermodynamics and kinetics, aqueous equilibria, and the reactivity of organic molecules.

Prerequisites (or NONE):	CHEM 113.
Corequisites (if applicable, or NONE):	None.
Pre/corequisites (if applicable, or NONE):	None.

Antirequisite Courses *(Cannot be taken for additional credit.)*

Former course code/number: **CHEM 112**

Cross-listed with:

Equivalent course(s): **CHEM 112**

(If offered in the previous five years, antirequisite course(s) will be included in the calendar description as a note that students with credit for the antirequisite course(s) cannot take this course for further credit.)

Typical Structure of Instructional Hours

Lecture/seminar	45
Tutorials/workshops	12
Supervised laboratory hours (science lab)	45
Total hours	**102**

Scheduled Laboratory Hours

Labs to be scheduled independent of lecture hours: **Yes**

Course Details

Special Topics course: **No**
(If yes, the course will be offered under different letter designations representing different topics.)

Directed Study course: **No**
(See policy 207 for more information.)

Grading System: **Letter grades**

Delivery Mode: **Face-to-face only**

Expected frequency: **Every semester**

Maximum enrolment (for information only)**: 36**

Prior Learning Assessment and Recognition (PLAR)

PLAR is available for this course.

Transfer Credit *(See **bctransferguide.ca**.)*

Transfer credit already exists: **Yes**

Submit outline for (re)articulation: **No**
(If yes, fill in transfer credit form.)

Department approval	**Date of meeting:**	June 6, 2025
Faculty Council approval	**Date of meeting:**	October 31, 2025
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	January 30, 2026

Learning Outcomes *(These should contribute to students' ability to meet program outcomes and thus Institutional Learning Outcomes.)*

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

1. Define the basic terminology, conventions, and laws of thermodynamics.
2. Explain concepts of enthalpy, entropy, and free energy, and how they relate to spontaneity and equilibrium.
3. Apply thermodynamic principles to solve problems involving simple chemical and physical systems.
4. Describe the properties and theories of acids and bases, and solve quantitative problems related to acid/base equilibria.
5. Explain the basic terminology and concepts of chemical kinetics.
6. Derive rate laws and apply them quantitatively to solve problems in chemical kinetics.
7. Explain and predict the kinetics, mechanisms, and stereochemical outcomes of organic substitution reactions.
8. Exhibit safe handling and disposal of chemicals.
9. Write formal chemistry laboratory reports.
10. Use basic chemical equipment and techniques to measure or analyze acid dissociation constants, thermodynamic values, partition coefficients, kinetic rate constants, rate orders, equilibrium constants and solution concentrations.

Recommended Evaluation Methods and Weighting *(Evaluation should align to learning outcomes.)*

Final exam:	40%	Assignments:	10%	
Quizzes/tests/midterm:	30%	Lab work:	20%	%

Details: Students must receive at least 50% in the lab and at least 40% on both lecture and lab final exams in order to receive a passing grade.

NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.

Typical Instructional Methods *(Guest lecturers, presentations, online instruction, field trips, etc.)*

Lectures, labs, group problem-solving sessions, computer-based problem solving.

Texts and Resource Materials *(Include online resources and Indigenous knowledge sources. Open Educational Resources (OER) should be included whenever possible. If more space is required, use the Supplemental Texts and Resource Materials form.)*

	Type	Author or description	Title and publication/access details	Year
1.	Textbook	John A. Olmsted, Gregory M. Williams, Robert C. Burk.	Chemistry: 4th Canadian Edition	2020
2.	Other	Fritzke, G., Webb, J.	Chemistry 114 Lab Manual	
3.	Online resource	Macmillan Learning Achieve		

Required Additional Supplies and Materials *(Software, hardware, tools, specialized clothing, etc.)*

Lab coat and safety glasses required.

Course Content and Topics

1. Principles of thermodynamics. Thermodynamic terminology and definitions. Gas Laws. Heat, work, enthalpy and the First Law of Thermodynamics. Entropy and the Second law of Thermodynamics. Gibbs free energy and the relationship to spontaneity and equilibrium. Application of these principles to problems involving physical and chemical systems.
2. Equilibria. Thermodynamics of aqueous equilibria, Le Châtelier's principle, and relationship to kinetics. Solubility equilibria. Brønsted Lowry and Lewis theories of acids and bases. Weak and strong acids, monoprotic and polyprotic acids, buffers, and titrations.
3. Chemical Kinetics. Concepts of reaction order and molecularity, elementary reaction steps, reaction mechanisms, rate-limiting steps, transition states and reaction coordinate diagrams. Derivation of zeroth, first, and second order rate laws and their application to chemical reactions. The effect of temperature on reaction rates.
4. Organic Chemistry. Introduction to organic reactivity through the study of nucleophilic substitution reactions of alkyl halides. Properties, kinetics, and mechanisms of SN1 and SN2 reactions of alkyl halides. Effect on substitution reaction rates of the properties of the nucleophile, leaving group, solvent, and substrate structure. Stereochemical outcomes of substitution mechanisms.

Laboratory content:

1. Determination of sodium, calcium and magnesium ions in a sample of seawater
2. Chemical Equilibrium: Reversible reactions and chemical equilibrium
3. Determination of an equilibrium constant
4. Potentiometric acid-base titrations and identification of a weak acid
5. Investigation of buffer systems
6. Thermodynamics: The entropy and enthalpy of solution for potassium hydrogen tartrate in water
7. Rates of Chemical Reactions: The iodination of acetone
8. Determination of the Universal Gas Constant
9. Preparation and analysis of benzoic acid
10. Extraction: The determination of a partition coefficient