

**ORIGINAL COURSE IMPLEMENTATION DATE: REVISED COURSE IMPLEMENTATION DATE:** COURSE TO BE REVIEWED (six years after UEC approval): Course outline form version: 10/27/2017

1993 September 2018

June 2022

# **OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM**

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

Course Code and Number: CHEM 083	1	Number of Credits: 3 Course credit policy (105)								
Course Full Title: Advanced-Level Chemistry										
Course Short Title:										
Faculty: Faculty of Access and Continuing Education Departm			ent: Upgrading and University Preparation							
Calendar Description:										
Introduction to chemistry for students who wish to prepare for entry into first-year courses in sciences, health sciences, or technology. Atomic structure, stoichiometry, and chemical properties of the elements are emphasized. Laboratory work is closely related to material covered in lectures.										
Prerequisites (or NONE):	Science 10. Foundations	Note: One of s of Mathemati	Principles cs 11, Pre	of Mathematics 11, Appl e-calculus 11, or MATH 0	ications of Mathematics 11, 85 is highly recommended.					
Corequisites (if applicable, or NONE):	NONE									
Pre/corequisites (if applicable, or NONE): NONE										
Antirequisite Courses (Cannot be taken for additional credit.)			Special Topics							
Former course code/number: N/A			This course is offered with different topics:							
Cross-listed with: N/A			🖾 No 🗋 Yes							
Dual-listed with: N/A			If yes, different lettered courses may be taken for credit:							
Equivalent course(s): N/A			□ No □ Yes, repeat(s) □ Yes, no limit							
				Transfer Credit						
Typical Structure of Instructional Hours			Transfer credit already exists: (See <u>bctransferguide.ca</u> .)							
Lecture/seminar hours			🖾 No 🔲 Yes							
Tutorials/workshops	66	Submit	Submit revised outline for rearticulation:							
Supervised laboratory hours	24	🖾 No								
Experiential (field experience, practicum, internship, etc.)			Gradin	Grading System						
Supervised online activities		🛛 Letter Grades 🛛 Credit/No Credit								
Other contact hours:			Expect	ed Frequency of Cours	e Offerings:					
Total hours 90			Every semester							
Labs to be scheduled independent of lecture hours: 🖾 No 📋 Yes										
Department / Program Head or Director: Greg St. Hilaire				Date approved:	January 10, 2018					
Faculty Council approval				Date approved:	January 31, 2018					
Dean/Associate VP: Sue Brigden				Date approved:	January 31, 2018					
Campus-Wide Consultation (CWC)				Date of posting:	February 16, 2018					
Undergraduate Education Committee (UEC) approval				Date of meeting:	February 23, 2018					

## Learning Outcomes:

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

- A. Measurement
  - Demonstrate the concepts of precision and accuracy and how they differ, utilizing significant figures
  - Perform calculations using scientific notation
  - Perform conversions with the SI system
  - B. Properties of Substances
    - Differentiate between the phases of matter
    - Identify chemical or physical properties of substances
    - Describe Dalton's Atomic Theory and the Law of Constant Composition
  - C. Periodic Trends
    - Use the periodic table to determine atomic composition of isotopes
    - Use the periodic table to predict electron arrangement of chemical families in order to predict trends in ion charge,
    - reactivity, ionization energy, electronegativity, atomic radii, and ionic radii
  - D. Atomic Structure
    - Analyze the historical development of atomic theory
    - Describe the Bohr and Wave Mechanical model of the atom and cite evidence for these models including absorption and emission spectra and their use in modern technology
  - E. Mole Concept
    - Define a mole and its significance
    - Perform calculations including molar and formula mass, mole to mass conversions, and percent composition by mass of compounds
  - F. Bonding
    - Define covalent and ionic bonding
    - Construct the formulas of compounds
    - Use electronegativity to predict bond types
    - Draw Lewis structures, predict molecular shapes, and determine polarity
  - G. Nomenclature
    - Write names for compounds given the formulae and write formulae for compounds given the names for the following types of compounds:
      - Covalent compounds
      - Ionic compounds
      - Compounds containing polyatomic ions
      - Compounds containing transition metals
      - Acids
  - H. Chemical Reactions
    - Balance equations
    - Classify and predict single and double replacement reactions, combustion reactions, and acid- base neutralizations
    - Classify synthesis, decomposition, exothermic and endothermic reactions
    - · Perform stoichiometric calculations including mass-to-mass, limiting reagent, and percent yield
  - I. Solutions
    - · Predict solubility and conductivity of polar and non-polar compounds
    - Define Arrhenius acids and bases
    - Relate the pH scale to acids and bases
    - Perform calculations involving dilutions
    - Perform stoichiometric calculations involving solutions including titrations
  - J. Organic Chemistry
    - Classify substances as organic
    - Differentiate the various types of bonding between carbon atoms
    - Write names and draw structures of hydrocarbons
    - Categorize organic compounds based on their functional groups

Options may include additional organic chemistry, nuclear chemistry, gas laws, and environmental ethics.

## Laboratories

Chemistry laboratories are an essential component of the study of chemistry. During laboratories, students reinforce theory through practice. Laboratories develop skills in safety, procedures, techniques, data collection, analysis, and communication.

In the laboratory exercises, students will:

- List the safety and protective equipment available in a laboratory setting
- Demonstrate the appropriate procedures and techniques for dealing with particular hazards and hazardous materials
- Follow instructions and procedures
- Handle appropriate equipment for measuring mass, volume, and temperature
- Prepare solutions
- Perform titrations
- Collect and record data effectively
- Analyze and interpret data

Communicate results and conclusions

A minimum of eight labs are to be completed covering the core concepts

### Prior Learning Assessment and Recognition (PLAR)

Yes INO, PLAR cannot be awarded for this course because

**Typical Instructional Methods** (*Guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion.*) Presentation of the course will be by interrelated theory classes, discussion periods, and laboratory sessions.

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

Typical Text(s) and Resource Materials													
	Author	Title (article,		Current ed.	Publisher	Year							
1.	TRO	Introductory (	Chemistry Essentials	ard Ed	5	Pearson	2014						
2.		CHEM 083 Course Materials						UFV CP	2016				
Required Additional Supplies and Materials (Software, hardware, tools, specialized clothing, etc.) Lab coat													
Typical Evaluation Methods and Weighting													
Fi	nal exam:	30%	Assignments:	10%	Field experience:	%	Portfolio:		%				
Q	uizzes/tests:	40%	Lab work:	20%	Shop work:	%	Total:		100%				

### **Typical Course Content and Topics**

Unit 1: Introduction to Chemistry

Course outline, brief historical perspective of chemistry. The scientific method. Scientific mathematics - a review of basic math. Measurement of mass, volume, density and temperature. Units and significant figures. SI system and exponential notation. Conversion factor method.

Unit 2: Properties of Matter

Classification of matter. Physical and chemical changes. Homogeneous and heterogeneous mixtures. Conservation of energy.

Unit 3: Atoms and Molecules

Names and symbols of elements. Compounds, their composition, names, and formulae. Metals and non-metals. Chemical equations.

Unit 4: Stoichiometry and the Mole

The mole. Percentage composition, empirical and molecular formulae. Mole-mole, mole-mass and mass-mass calculations using stoichiometric equations. Calculations involving a limiting reagent. Molarity calculations.

Unit 5: Atomic Structure

The atom and fundamental particles. Isotopes and atomic mass. Energy levels, quantum numbers and electron configurations.

Unit 6: Chemical Families

Classification of elements in the Periodic Table and the relationship between position in the table, electron configuration, and physical and chemical properties.

Unit 7: Compounds and Bonding

Lewis electron-dot representations of atoms and molecules. Ions, oxidation numbers and simple oxidation/reduction reactions.

Unit 8: Organic Chemistry Bonding in organic molecules. Alkanes, alkenes and alkynes. Naming and isomerism. Simple organic reactions. Polymers.

Laboratory Experiments (8 or 9 labs will typically be chosen). Examples include:

- 1. Measurements
- 2. Separating Mixtures
- 3. Water of Hydration
- 4. Recycling Copper
- 5. The Reaction Between Iron and Copper Sulphate
- 6. The Copper-Silver Nitrate Reaction
- 7. Acid-base Titrations: The Percentage of Acetic Acid in Vinegar
- 8. Periodic Trends in Properties
- 9. Organic Chemistry
- 10. Determination of the Molar Mass of an Unknown Acid
- 11. Determination of the Percentage Oxygen in Potassium Chlorate
- 12. Conservation of Mass