

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY  
SAULT STE. MARIE, ONTARIO

COURSE OUTLINE


COURSE TITLE: PRINCIPLES OF CHEMISTRY I

CODE NO.: CHM 104-4 SEMESTER: One

PROGRAM: ENVIRONMENTAL, WATER RESOURCES  
AND PULP & PAPER ENGINEERING TECHNOLOGY

DATE: JULY 1990 PREVIOUS OUTLINE DATED: JULY 1989

AUTHOR: D. TROWBRIDGE/D. HEGGART

APPROVED:  DEAN June 28/90 DATE

PRINCIPLES OF CHEMISTRY I

CHM 104-4

---

COURSE NAME

---

CODE NUMBER

TOTAL CREDIT HOURS: 64

PREREQUISITES: CHM099 or Grade 12 Chemistry

**I. PHILOSOPHY/GOALS:**

An introductory course in Chemistry which deals with the structure of matter, electronic structure of atoms, periodic nature of the elements, bonding, Lewis Structures, nomenclature, chemical reactions, solubility and stoichiometry of reactions.

A comprehensive Workshop on report writing will be held during the second week of the semester.

**II. STUDENT PERFORMANCE OBJECTIVES:**

Principles of Chemistry is taught to students in the Environmental Engineering, Water Resources and Pulp & Paper Technology programs in both the first and second semesters.

CHM 104 is taught in the first semester of the program and is a pre-requisite for CHM 218 which is a continuation of Principles of Chemistry theory in Semester 2. CHM 218 can be taken upon successful completion of CHM 104 or with prior approval of the instructor.

Students enrolling in CHM104 must have a high school credit in Chemistry or completed CHM099 or equivalent.

CHM 104 consists of four hours per week, two hours being devoted to theory and two hours spent on laboratory work.

PRINCIPLES OF CHEMISTRY I

CHM 104-4

---

COURSE NAME

---

CODE NUMBER

III. TOPICS TO BE COVERED:

UNIT I: ATOMIC THEORY: PURE SUBSTANCES AND MIXTURES, NOMENCLATURE  
CHAPTER 2

- 1.1 Atoms, Molecules, and Ions  
Atoms  
Molecules and Molecular Substances  
Ions and Ionic Substances  
A Word on Naming Substances  
Chemical Reactions  
Nomenclature
- 1.2 Oxidation Numbers
- 1.3 Naming Simple Compounds  
Binary Compounds  
Acids  
Ionic Substances
- 1.4 Balancing Simple Chemical Equations
- 1.5 Classification of Matter  
Chemical Constitution - Element, Compound, or Mixture?  
Physical State - Solid, Liquid or Gas?

UNIT II: CALCULATIONS WITH CHEMICAL FORMULAS AND EQUATIONS  
CHAPTERS 3 & 4

- 2.1 Atomic Weights
- 2.2 Formula Weights
- 2.3 The Mole Concept  
Definition of Mole  
Mole Calculations
- 2.4 Mass Percentages from the Formula
- 2.5 Elemental Analysis
- 2.6 Determining Molecular Formulas  
Empirical Formula from Elemental Composition  
Molecular Formula from Empirical Formula
- 2.7 Molecular Interpretation of a Chemical Equation

PRINCIPLES OF CHEMISTRY I

CHM 104-4

---

COURSE NAME

---

CODE NUMBER

UNIT II - Continued

- 2.8 Stoichiometry of a Chemical Reaction
- 2.9 Limiting Reactant; Theoretical and Percentage Yields

UNIT III: ATOMIC STRUCTURE: ELECTRON CONFIGURATIONS AND PERIODICITY  
CHAPTERS 7 & 8

- 3.1 The Bohr Theory of the Hydrogen Atom  
Atomic Line Spectra  
Bohr's Postulates
- 3.2 Quantum Mechanics
- 3.3 Quantum Numbers and Atomic Orbitals
- 3.4 Electron Spin and the Pauli Exclusion Principle  
Electron Configurations and Orbital Diagrams
- 3.5 Building-Up Principle (Aufbau Principle)
- 3.6 Hund's Rule; Paramagnetism
- 3.7 Periodic Classification of the Elements  
Predictions from the Periodic Table  
Arrangement of the Elements by Atomic Number  
Relationship to Electron Configurations
- 3.8 Some Periodic Properties  
Atomic Radius  
Ionization Energy  
Electron Affinity
- 3.9 A Brief Description of the Main-Group Elements  
Group 1A - 8A  
Valence-Shell Configurations

UNIT IV: IONIC AND COVALENT BONDING - CHAPTER 9

- 4.1 Describing Ionic Bonds  
Lewis Electron-Dot Symbols  
Energy Involved in Ionic Bonding

PRINCIPLES OF CHEMISTRY I

CHM 104-4

COURSE NAME

CODE NUMBER

UNIT IV - Continued

- 4.2      Some Common Ions  
Monatomic Ions of the Main-Group Elements  
Transition-Metal Ions  
Polyatomic Ions  
Formulas of Ionic Compounds
- 4.3      Ionic Radii
- 4.4      Describing Covalent Bonds  
Lewis Formulas  
Coordinate Covalent Bond  
Octet Rule  
Multiple Bonds
- 4.5      Polar Covalent Bond; Electronegativity
- 4.6      Writing Lewis Electron-Don Formulas  
Skeleton Structure of a Molecule  
Steps in Writing Lewis Formulas
- 4.7      Exceptions to the Octet Rule
- 4.8      Delocalized Bonding; Resonance

IV. EVALUATION METHODS:

Theory	50	A+ = 90 - 100%
Lab	50	A = 80 - 89%
	<u>100</u>	B = 70 - 79%
		C = 60 - 69%
		R = Less than 60%

The theory grade is the sum of all tests and assignments. Tests will include all work up to the time of each test. All students having 70% or more on theory term work may be exempt from the final exam which will cover the whole course and counts 50% of the theory grade. The minimum required to pass CHM104 is 50% on theory and 70% on lab.

ATTENDANCE:

Your grade will be greatly affected by attendance at scheduled classes and labs. 85% is required at all theory classes while 100% is needed for all labs. Serious illness (doctor's care) is the only valid excuse.

PRINCIPLES OF CHEMISTRY I

CHM 104-4

---

COURSE NAME

---

CODE NUMBER

V. REQUIRED STUDENT RESOURCES:

Ebbing, Darrell D., General Chemistry, 3rd. edition, Houghton Mifflin Co., 1990.

Lab Manual for Chemistry 104, Sault College, 1990

VI. SPECIAL NOTES:

LABORATORY

2 wk	1. Weighing Operations, Densities of Liquids and Solids
2 wk	2. Separation of the Components of a Mixture.
2 wk	3. Formula of Hydrate
2 wk	4. Chemical Reactions
3 wks	5. Chemical Formulas
2 wks	6. A Sequence of Chemical Reactions
<hr/>	
13 wks	
1 wk	Lab Safety
1 wk	Report Format
<hr/>	
Total 15 wks	