

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

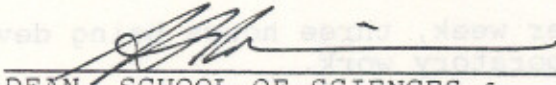
COURSE TITLE: PRINCIPLES OF CHEMISTRY I

CODE NO.: CHM 104-4 SEMESTER: I

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

AUTHOR: D. TROWBRIDGE/ D. HEGGART

DATE: MARCH 1992 PREVIOUS OUTLINE DATED: JULY 1991

APPROVED:  DEAN, SCHOOL OF SCIENCES & NATURAL RESOURCES
DATE MAR 12/92

PRIN. OF CHEMISTRY I

CHM 104-4

COURSE NAME

COURSE NUMBER

TOTAL CREDIT HOURS: 64

PREREQUISITE(S): CHM 099 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 five hours per week, three hours being devoted to theory and two hours spent on laboratory work.

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III. TOPICS TO BE COVERED: Approximate Time Frames

UNIT I: ATOMIC THEORY: PURE SUBSTANCES AND MIXTURES, NOMENCLATURE
CHAPTER 2 (18 hours)

- 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; writing molecular, ionic and net ionic equations
- 1.5 Classification of Matter
Chemical Constitution - Element, Compound, or Mixture
Physical State - Solid, Liquid or Gas

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UNIT II: CALCULATIONS WITH CHEMICAL FORMULAS AND EQUATIONS
CHAPTERS 3 & 4 (12 hours)

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

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UNIT III: ATOMIC STRUCTURE: ELECTRON CONFIGURATIONS AND PERIODICITY
CHAPTERS 7 & 8 (5 hours)

- 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 (5 hours)

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

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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%
	100	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 except 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.

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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.

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
 - 2 wks 5. Chemical Formulas
 - 2 wks 6. A Sequence of Chemical Reactions
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- 12 wks

- 1 wk Lab Safety
- 1 wk Report Format

Total 14 wks

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Students with special needs (e.g. physical limitations, visual impairments, hearing impairments, learning disabilities) are encouraged to discuss required accommodations confidentially with the instructor.

Your instructor reserves the right to modify the course as he/she deems necessary to meet the needs of students.

Lab Manual for Chemistry 104, Saint College, 1990
Ewing, Garrell, G., General Chemistry, 3rd edition, Houghton Mifflin Co., 1991.

VI. SPECIAL NOTES:

LABORATORY

1. Weighing Operations, Densities of Liquids and Solids	1 wk
2. Separation of the Components of a Mixture	1 wk
3. Formula of Hydrate	1 wk
4. Chemical Reactions	1 wk
5. Chemical Formulas	1 wk
6. A Sequence of Chemical Reactions	1 wk
	12 wks
Lab Safety	1 wk
Report Format	1 wk
	Total 14 wks