

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO



COURSE OUTLINE

COURSE TITLE: GENERAL CHEMISTRY I

CODE NO. : CHM102 **SEMESTER:** I

PROGRAM: PRE-HEALTH SCIENCES, GENERAL ARTS AND SCIENCE

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APPROVED: "B.Punch"

	CHAIR	DATE
TOTAL CREDITS:	4	

PREREQUISITE(S): GRADE TEN SCIENCE OR EQUIVALENT

HOURS/WEEK: 3 HOURS LECTURE, 2 HOURS LAB (alternate weeks)

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I. COURSE DESCRIPTION:

This course gives an introduction to the fundamentals of general chemistry for those entering a health science or environmental field of study. The course does not require any previous chemistry background but most students will have taken high school science upon which this course will build.

The emphasis will be on the following topics: measurement systems, scientific method, physical and chemical properties of materials, atomic structure, chemical bonding, chemical nomenclature, shape and polarity of molecules, chemical reactions, the mole concept, stoichiometry of chemical reactions, states of matter, interactions between molecules, the gas laws, solubility and solutions.

The theory will be supported by laboratory experiments where students will be required to carry out common lab procedures. The purpose of the lab work is to develop practical skills while gaining a better understanding of the theoretical concepts. Instruction for lab safety and techniques will be provided during pre-laboratory sessions.

II. LEARNING OUTCOMES:

Upon successful completion of this course the student will demonstrate the ability to:

1. Use the S.I. measurement system and the basic terms commonly found in chemistry.
2. State the properties of matter and describe the atomic structure of matter.
3. Distinguish between atomic, molecular, and ionic substances
4. Describe the difference between ionic and covalent bonds.
5. Predict the formulas of binary ionic, covalent, and ternary compounds.
6. Construct the names of ionic compounds.
7. Construct the names of covalent compounds.
8. Create Lewis structures.
9. Perform chemical calculations and balance chemical equations.
10. Apply the gas laws.
11. Describe the theory of ions in solution, recognize precipitation, acid-base, and gas forming reactions and write and balance ionic and non-ionic equations.

III. ELEMENTS OF THE PERFORMANCE

Upon successful completion of this course the student will demonstrate the ability to:

- 1) Use the S.I. measurement system and the basic terms commonly found in chemistry.

Potential Elements of the Performance:

- define matter, mass, weight, volume and state their main characteristics.
- state and use the law of conservation of mass to calculate an unknown mass given the other masses in a chemical reaction.
- distinguish between the three states of matter.
- identify physical and chemical changes and properties.
- define the terms substance, element, compound and mixtures and the relationship between them.
- define and use mass, volume, and density to calculate one quantity given the other two.
- describe three commonly used temperature scales and conversions from one to the other.
- identify and explain the workings of measuring devices for the common characteristics of matter.
- perform basic calculations and round off the answer to the correct number of significant digits.
- use the unit-factor method to make conversions within the S.I. system.
- define and calculate the density and specific gravity of various forms of matter.

- 2) State the properties of matter and describe the atomic structure of matter.

Potential Elements of the Performance:

- list the postulates in Dalton's atomic theory.
- state the deductions following from Dalton's theory including the law of multiple proportions.
- identify elements from symbols and give the correct symbol for any element.
- describe the structure of the atom and its fundamental components.
- characterize three major subatomic particles and give one theory on their general arrangement.
- define atomic number and mass number and use these to determine the number of particles in an atom.
- explain the difference in structure of isotopes of an element and the effects on atomic mass.
- write nuclide symbols given the atomic and mass numbers.
- define atomic mass.

3) Distinguish between atomic, molecular and ionic substances

Potential Elements of the Performance:

- define an element, give examples and state their relationship to atoms.
- list the 10 most common elements in the earth's crust and the 6 most common in the human body.
- identify the group and period of elements in the periodic table.
- explain the ordering and chemical characteristics of elements based on their position in the periodic table.
- describe and explain the periodic trends of size, ionization energy, electron affinity, and electronegativity.
- define chemical formula and given a formula, state the identity and number of elements involved.
- describe the type and nature of the chemical bonds that occur in pure substances.
- define and give examples of compounds, ionic substances, molecular compounds, ions and molecules.

4) Describe the difference between ionic and covalent bonds.

Potential Elements of the Performance:

- explain the necessary conditions for the formation of each type of bond.
- state the relationship between ionization energy and periodicity.
- write ionic charges for all main group elements.
- use Lewis symbols to depict reactions between elements.
- identify the correct ratios of elements involved in electron transfer reactions.
- use subscripts to correctly express the ratios of atoms in binary compounds.
- write the electrical charges of ions formed from main group elements.
- describe how it can be determined if an atom will gain or lose electrons in a chemical reaction.
- define the term "electronegativity".
- explain how electronegativity varies throughout the periodic table.
- classify compounds as ionic or covalent, based on their electronegativity difference.
- describe what causes a binary molecule to be polar.
- define the term "dipole moment".
- give at least two examples of how the three-dimensional arrangement of a molecule affects its biological function

5) Predict the formulas of binary ionic, covalent and ternary compounds.

Potential Elements of the Performance:

- use information from the charges of individual elements to determine how many of each atom is necessary to achieve a net electrical charge of zero in a compound.
- express the previously determined ratio using the necessary subscripts to indicate the relative numbers of atoms in a chemical formula. This may be done via the “cross-over approach” or the net charge approach.

6) Construct the names of ionic compounds.

Potential Elements of the Performance:

- name binary compounds formed by elements in the first three periods by writing the name of the metal followed by the name of the nonmetal combined with the suffix “ide”.
- identify cases in which the Stock system must be used to name binary ionic compounds.
- write Stock system names for compounds containing ions with more than one possible charge.
- recall the names of common polyatomic ions.
- write formulas for compounds containing polyatomic ions, using subscripts as needed.
- write names for compounds containing polyatomic ions.
- explain the difference between electrolytes and non-electrolytes.
- name at least three examples of ions in the human body.
- describe the difference between ionic solids and molecules when they are in various physical states.

7) Construct the names of covalent compounds.

Potential Elements of the Performance:

- know when a Greek prefix is required in the name of a covalent compound.
- write the names of covalent compounds using Greek prefixes in order to express the ratios of elements in each compound.

8) Create Lewis structures.

Potential Elements of the Performance:

- apply the octet rule and information from the periodic table to predict the formula of the product of the reaction between two elements.
- draw Lewis structures that represent the reaction of two elements to form a binary compound.
- explain the difference between bonding pairs and lone pairs.
- simplify Lewis structure into a structural formula.
- identify exceptions to the octet rule.
- draw Lewis structures for molecules with a well-defined central atom.
- draw Lewis structures for simple organic compounds (alkanes).
- write Lewis structures for compounds containing multiple bonds.
- determine when it is necessary to include multiple bonds in a Lewis structure and the appropriate multiplicity (i.e. double, triple) of each bond.

9) Perform chemical calculations

Potential Elements of the Performance:

- calculate the formula mass of a compound.
- define the mole.
- use the mole as a unit conversion factor for converting mass into moles and moles into mass.
- state the magnitude of Avogadro's number and what it implies about the size of atoms and molecules and the numbers of them in a weighable sample.
- calculate the empirical and molecular formulas of a compound.
- describe synthesis, decomposition, single displacement, and double displacement reactions.
- write a chemical reaction as an equation.
- balance a chemical equation.
- use a balanced chemical equation to predict the masses of compounds produced and used up in a chemical process.

- 10) Describe the theory of ions in solution; recognize precipitation, acid-base, and gas forming reactions and write ionic and non ionic equations.

Potential Elements of the Performance:

- describe how the formation of a solution depends on the molecular properties of the solute and solvents.
- give the quantitative definitions of concentration and use them as conversion factors in calculations.
- specify reasons and methods for preparing dilute solutions from concentrated solutions.
- describe diffusion and the characteristics of semipermeable membranes from a molecular point of view.
- describe the origin of osmotic pressure and how it is measured and used in calculations.
- describe the properties of macromolecules and colloidal solutions.

- 11) Apply the gas laws.

Potential Elements of the Performance:

- define gas pressure and its units and describe how it is measured.
- summarize the gas laws' quantitative descriptions of the physical behavior of gases.
- apply the appropriate gas laws to particular experimental conditions.
- describe the properties of mixtures of gases.
- use the gas laws to determine molecular mass.
- determine the amount of gas dissolved in a liquid.

IV. TOPICS

1. Measurement and Measurement Systems
2. Properties of Matter
3. Atoms, Molecules and Ions
4. Ionic and Covalent Bonding
5. Chemical Nomenclature
6. Chemical Calculations and Reactions
7. Solutions and Solubility
8. Properties of Gases

LABORATORY WORK

In a laboratory setting, the student will conduct experimental procedures to support the theoretical concepts. The laboratory topics will include:

- 1) Reading instruments and recording measurements using correct precision.
- 2) Determine the density of an unknown solid and liquid using gravimetric (weighing) technique.
- 3) Separation of an unknown into its components based on differences in physical properties.
- 4) Chromatography to separate compounds based on polarity.
- 5) Determine the mass percentage of water in a hydrate and calculate the formula of an unknown hydrate.
- 6) Conduct chemical reactions and identify the products formed from the given reactants.

V. REQUIRED RESOURCES/TEXTS/MATERIALS:

1. Textbook: Corwin, Charles H. (2011). *Introductory Chemistry*, 6th Edition. New Jersey: Pearson Prentice Hall.
2. Lab Materials: Lab Coat, Safety Glasses

VI. EVALUATION PROCESS/GRADING SYSTEM

Evaluation methods:

Unit Tests (5 units at 10% each)	50%
Lab Work	30%
Final Exam	20%

Notes:

1. *Students must achieve an average of at least 50% on test and exam material, independent from the lab work, to obtain a passing grade in the course.*
2. *Students must achieve a minimum grade of 50% on lab material, independent from the test/exam grade, to obtain a passing grade in the course.*
3. *Missed tests, labs, or exam will be given a grade of 0 unless notification of a legitimate reason is given PRIOR to test/lab time. Regardless of the circumstances, please discuss the situation and available options with your professor upon return to class.*

The following semester grades will be assigned to students in postsecondary courses:

Grade	Definition	Grade Point Equivalent
A+	90 – 100%	4.00
A	80 – 89%	3.00
B	70 - 79%	2.00
C	60 - 69%	1.00
D	50 – 59%	0.00
F (Fail)	49% and below	
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field /clinical placement or non-graded subject area.	
U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.	
X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.	
NR	Grade not reported to Registrar's office.	
W	Student has withdrawn from the course without academic penalty.	

VI. SPECIAL NOTES:

Attendance:

Sault College is committed to student success. There is a direct correlation between academic performance and class attendance; therefore, for the benefit of all its constituents, all students are encouraged to attend all of their scheduled learning and evaluation sessions. This implies arriving on time and remaining for the duration of the scheduled session.

VII. COURSE OUTLINE ADDENDUM:

The provisions contained in the addendum located on the portal form part of this course outline.