



**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. A comprehensive Workshop on lab techniques and lab safety and on report writing will be held during the early weeks of the semester.

**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.
- 10) Apply the gas laws
- 11) Describe the theory of ions in solution, recognize precipitation, acid-base and gas forming reactions and write 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:

- outline the steps in the process known as the scientific method,
- 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, atomic mass units and atomic weight,
- given the isotope mass and fractional abundance calculate the relative atomic weight,

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,
- 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.
- draw Lewis structures for polyatomic ions, taking their charge into account.
- explain what a coordinate covalent bond is.

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.
- 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
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 and these will be selected from the following:

1. Determine the density of an unknown solid and liquid using gravimetric (weighing) techniques.
2. Periodic classification of the elements.
3. Structure of compounds.
4. Separate an unknown in nature into its components based on differences in physical properties.
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.
7. Determine the chemical formula of a compound formed in a chemical reaction based on mass and moles.
8. Recover a mass of a substance which has been subjected to a sequence of chemical reactions.

**V. REQUIRED RESOURCES/TEXTS/MATERIALS:**

Textbook: General, Organic and Biochemistry, Second Edition by Blei and Odian, W.H. Freeman, 2006

Lab Materials: Lab Coat, Safety Glasses

**VI. EVALUATION PROCESS/GRADING SYSTEM**

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.	

The final grade is calculated by adding the test marks (60%) and the term marks (40%). The term mark is the sum of all marks awarded for the analysis plus the written report for each of the experiments. The analysis is graded on accuracy and precision. The report is graded on format, content, and neatness. Assignments and quizzes are included as part of the term mark. The test mark is the sum of two tests and a final examination which covers all material covered in the course.

Term Tests/Final Exam	60 marks
Lab Work/Assignments/Quizzes	<u>40 marks</u>
	100 marks



Assignments are due on the date specified at the beginning of the class. Late assignments will not be accepted so it is critical that you submit as much of the assignment as possible on the due date. Quizzes may be given unannounced and missed quizzes can't be made up. Lab reports are due one week from completion of the lab. Late labs will be downgraded 20% per week. (See details below regarding missed labs)

#### 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 medical slip) is the only valid excuse.

Each laboratory activity requires a pre-lab assignment in which the student will familiarize him/herself with the procedure, equipment and safety concerns. This will include researching the hazards and precautions for each chemical used in the lab as described in the Material Safety Data Sheets (MSDS) to be found in the chemistry lab.

A pre-lab lecture will discuss the theoretical and practical aspects of the lab and identify any safety precautions. Consequently attendance at these pre-lab lectures is mandatory and any student missing this lecture must prepare a step by step procedure which also must identify all safety concerns before you will be allowed to begin the lab.

Labs missed without prior agreement of the instructor will be give an **maximum of 50%** of the lab mark once completed to the instructor's satisfaction.

#### VII. SPECIAL NOTES:

- Plagiarism

Students should refer to the definition of "academic dishonesty" in the Student Code of Conduct Booklet. Students who engage in "academic dishonesty" will receive an automatic zero for that submission or test and/or such other penalty, up to and including failure in the course or expulsion from the course/program, as may be decided by the professor/dean.

In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

Also as part of your student responsibilities you should ensure that your course assignments and tests are not susceptible to copying. This includes taking precautions during tests that your work is not on view so as to avoid the "wandering eyes" of others as well as not engaging in these practices yourself.

- Communication:

The College considers WebCT/LMS as the primary channel of communication for each course. Regularly checking this software platform is critical as it will keep you directly connected with faculty and current course information. Success in this course may be directly related to your willingness to take advantage of the Learning Management System communication tool.

- Special Needs  
If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, and learning disabilities), you are encouraged to discuss required accommodations with the instructor and/or contact the Special Needs Office, Room E1204, Ext. 2703, so that support services can be arranged for you.
- Retention of Course Outlines  
It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other post-secondary institutions.
- While every attempt will be made to accommodate all special learning needs, the college should be contacted to discuss these needs before enrolling in any program.
- Substitute Course Information is available at the Registrar's Office.

### **VIII. PRIOR LEARNING ASSESSMENT**

Students who wish to apply for advanced credit in the course should consult the instructor. Credit for prior learning may be given if it can be established that all learning outcomes have been met.

#### **ADVANCE CREDIT TRANSFER:**

Students who wish to apply for advance credit transfer (advanced standing) should obtain an Application for Advance Credit from the program coordinator (or the course coordinator regarding a general education transfer request) or academic assistant.

Students will be required to provide an unofficial transcript and course outline related to the course in question.

Credit for prior learning will also be given upon successful completion of a challenge exam or portfolio.