

**LAST REVIEW:** 2010-2011  
*(i.e. 2006-2007)*

**NEXT REVIEW:** 2015-2016  
*(i.e. 2011-2012)*

**STATUS:** A  
*(A, I, D)*

**COURSE TITLE:** Introduction to Chemistry

**COMMON COURSE NUMBER:** CHM1025

**CREDIT HOURS:** 3

**CONTACT HOUR BREAKDOWN**

*(Per 16 week term)*

**CLOCK HOURS:**  
*(Voc. Course ONLY)*

Lecture: 48      Lab:  
Clinic:              Other:

**PREREQUISITE(S):** MAT0024 with a grade of “C” or higher

**COREQUISITE(S):** CHM1025L for EST majors only

**PRE/COREQUISITE(S):**

**COURSE DESCRIPTION** *(750 characters, maximum):* Selected topics from general chemistry. Topics covered include chemical measurements, atomic structure, periodic table, chemical bonding, inorganic compound nomenclature and formula writing, stoichiometry, gases, liquids, solids, solutions, acid-base chemistry, oxidation-reduction chemistry, energy, and nuclear chemistry.

General Education Requirements – Associate of Arts Degree (AA), meets Area(s): 4B Area  
General Education Requirements – Associate in Science Degree (AS), meets Area(s): 4 Area  
General Education Requirements – Associate in Applied Science Degree (AAS), meets Area(s): Area

## **UNIT TITLES**

1. Reading and Writing in Chemistry
2. Introduction and Measurement
3. Atomic Structure
4. Bonding and the Nature of Compounds
5. Stoichiometry
6. Energy and States of Matter
7. Introduction to Gases
8. Concentration and Properties of Solutions
9. Acids and Bases
10. Oxidation-Reduction
11. Nuclear Chemistry

\*\*\* Complete the following only if course is seeking general education status \*\*\*

**GENERAL EDUCATION Competencies and Skills \*:**

In the box to the right of the Competency/Skill, enter all specific **student learning outcome** unit numbers, as indicated in the course outline (i.e. 1.1, 2.7, 4.2, 4.0 and 5.12) that apply.

<b>Course must include <u>all</u> of the following:</b>	
<b>1. Read with critical comprehension**</b>	1.1,1.2, 2.7, 3.12, 5.5, 7.4, 8.11
<b>2. Write clearly and coherently**</b>	1.1, 1.2, 1.3, 3.11, 4.1, 4.5, 4.6, 4.8, 8.9, 9.3, 9.5, 9.11, 9.12, 11.3, 11.4
<b>3. Demonstrate literacy as appropriate within a given discipline**</b>	b) 1.4 e) 1.1, 1.3, 2.3, 2.5, 2.6, 2.7, 3.7, 3.8, 3.12, 5.1, 5.2, 5.3, 5.5, 5.6, 6.4, 7.4, 8.10, 8.11, 8.12, 9.7, 10.2, 10.3, 11.6 f) 1.1, 1.2, 1.3, 2.1, 3.1, 3.3, 3.8, 3.12, 4.1, 4.2, 4.6, 4.11, 4.12, 6.1, 6.7, 6.8, 7.5, 8.1, 8.4, 8.5, 8.14, 8.15, 9.2, 9.8, 9.10, 9.11, 9.12, 9.13, 10.3, 10.5, 11.7, 11.8, 11.10 g) 4.12, 5.6, 6.5, 7.5, 8.15, 9.11, 9.12, 9.13, 10.5, 11.8, 11.9
<b>4. Apply problem solving skills or methods to make informed decisions in a variety of contexts**</b>	1.1, 1.2, 1.3, 2.7, 3.9, 3.12, 4.2, 4.3, 4.4, 4.7, 4.10, 4.11, 4.12, 5.5, 5.6, 6.3, 6.5, 6.6, 7.3, 7.4, 8.11, 8.14, 9.8, 10.3
<b>Course must include at least <u>one</u> of the following:</b>	
<b>5. Differentiate between ethical and unethical behavior</b>	4.12, 9.13
<b>6. Demonstrate an understanding of the physical, biological, and social environments and how individual behaviors impact this complex system.</b>	2.1, 4.12, 5.6, 6.5, 7.5, 8.15, 9.10, 9.12, 9.13, 11.8, 11.9, 11.10
<b>7. Demonstrate an understanding of, and appreciation for, human diversities and commonalities.</b>	
<b>8. Speak and listen effectively.</b>	

*\*General Education Competencies and Skills endorsed by 2010-2011 General Education Task Force*

**\*\*Required Competencies**

**1) Read with critical comprehension.**

The student will be introduced to the basic texts, concepts, vocabulary, and methods necessary for developing an understanding of the discipline and meeting the required benchmarks as stated in the course outline.

**2) Write clearly and coherently.**

The student will demonstrate an understanding and mastery of subject matter in a variety of ways, including writing. Writing activities may include both graded and ungraded essays, short answer quizzes, summaries, reactions, journals, and various other reports.

**3) Demonstrate and apply literacy across all the disciplines (indicate which ones apply).**

- a) **Information literacy** means understanding how to locate needed information, using the appropriate technology for the task, managing and evaluating the extracted information and using it effectively and ethically.
- b) **Technology literacy** is the ability to responsibly and effectively use appropriate technology to access, manage, integrate, or create information, and/or use technology to accomplish a given task.
- c) **Workplace literacy** is having the appropriate knowledge and skills to communicate and work with others effectively and perform job duties, whether it is through the use of computers and/or other technology.
- d) **Cultural literacy** is recognizing, understanding, and appreciating the similarities and differences between one’s own culture and the cultures of others through a study of the arts, customs, beliefs, values, and history that define a culture.

- e) **Quantitative literacy** is having the ability to formulate, solve and interpret mathematical/statistical operations and graphical/tabular representations to make informed decisions.
  
- f) **Scientific literacy** means understanding the methodology and application of the scientific process, the physical and biological worlds, and recognizing that scientific knowledge is continuously updated or revised as new information is discovered.
- g) **Environmental literacy** is creating a context within which environmental issues can be viewed, imparting knowledge to enhance one's ability to analyze the issues, make the connections between humans' decisions and actions and the challenges facing the environment, and instilling the desire to sustain the environment through ethical practices in both one's professional and personal lives.

**4. Apply problem-solving skills or methods to make informed decisions in a variety of contexts.**  
The student will use acquired skills or methods to recognize, analyze, adapt, and apply critical thinking to solve problems and make informed decisions.

**EVALUATION:**

In the box to the right of the Methods of Assessment, enter all specific learning outcome numbers (i.e. 1.1, 2.7, 4.0, 4.2 and 5.12) that apply.

1. Portfolio	
2. Short essays	1.1, 1.2, 1.3, 2.1, 4.12, 6.5, 7.5, 8.15, 9.10, 9.12, 9.13, 10.5, 11.8, 11.9, 11.10
3. Research Papers	1.1, 1.2, 1.3, 1.4, 2.1, 4.12, 6.5, 7.5, 8.15, 9.10, 9.12, 9.13, 10.5, 11.8, 11.9, 11.10
4. Group projects	1.1, 1.2, 1.3, 1.4, 2.1, 4.12, 6.5, 7.5, 8.15, 9.10, 9.12, 9.13, 10.5, 11.8, 11.9, 11.10
5. Discussions (In class and online)	2.1, 4.12, 6.5, 7.5, 8.15, 9.10, 9.12, 9.13, 10.5, 11.8, 11.9, 11.10
6. Multiple Choice tests	2.2-2.7, 3.1-3.12, 4.1-4.12, 5.1-5.5, 6.1-6.9, 7.1-7.5, 8.1-8.15, 9.1-9.13, 10.1-10.5, 11.1-11.7
7. Presentations	1.1, 1.2, 1.3, 1.4, 2.1, 4.12, 6.5, 7.5, 8.15, 9.10, 9.12, 9.13, 10.5, 11.8, 11.9, 11.10
8. Service Learning Projects	
9. Quizzes (pop, announced, etc.)	2.2-2.7, 3.1-3.12, 4.1-4.12, 5.1-5.5, 6.1-6.9, 7.1-7.5, 8.1-8.15, 9.1-9.13, 10.1-10.5, 11.1-11.7
10. Take-home tests	1.3, 2.2-2.7, 3.1-3.12, 4.1-4.12, 5.1-5.5, 6.1-6.9, 7.1-7.5, 8.1-8.15, 9.1-9.13, 10.1-10.5, 11.1-11.7
11. Summaries, critiques, and analyses	
12. Reaction papers	
13. Surveys	
14. Performance	
15. Short answer tests	1.3, 2.2-2.7, 3.1-3.12, 4.1-4.12, 5.1-5.5, 6.1-6.9, 7.1-7.5, 8.1-8.15, 9.1-9.13, 10.1-10.5, 11.1-11.7
16. Classroom debates and colloquia	1.2, 2.1, 4.12, 5.6, 6.5, 7.5, 8.15, 9.10, 9.12, 9.13, 10.5, 11.8, 11.9, 11.10
17. Blogs, wikis, web pages	
18. Other (Please explain)	

Common Course Number: CHM1025

## **UNITS**

### **Unit 1: Reading and Writing in Chemistry**

#### **General Outcome:**

**1.0 The student shall be able to clearly communicate in writing information derived from course related readings about the major concepts and themes in the chemical sciences.**

#### **Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 1.1 Demonstrate in writing the ability to analyze, evaluate, compare, and/or extract data relevant to chemistry from course related readings.**
- 1.2 Evaluate the validity of information from a variety of sources, including but not limited to such sources as electronic, print sources, and data bases.**
- 1.3 Demonstrate with the use of diagrams, drawings, outlines, concept maps, and/or other methods the connections among chemical concepts.**
- 1.4 Demonstrate the ability to use the appropriate technology to carry out course requirements.**

Common Course Number: CHM1025

## Unit 2 Introduction and Measurement

### General Outcome:

- 2.0 The student shall be able to demonstrate knowledge of the nature of chemistry and demonstrate their understanding of the measurement systems used in chemistry by solving related problems.**

### Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 2.1 Define chemistry and evaluate its modern applications and impact on complex systems such as the environment, medicine, industry, and technology.**
- 2.2 Differentiate and use the terms accuracy and precision.**
- 2.3 Perform calculations using scientific notation and significant figures and analyze their answer for correctness.**
- 2.4 Distinguish and apply the common metric/SI units for mass, length, volume, and energy; using the prefixes kilo, deci, centi, milli, and micro.**
- 2.5 Perform conversions among metric units and between certain English and metric units using dimensional analysis and analyze their answers for correctness.**
- 2.6 Interconvert temperatures among Celsius, Fahrenheit, and Kelvin scales.**
- 2.7 Read with critical comprehension experimental data to solve problems involving density and specific gravity; analyze and interpret their answers for correctness.**

Common Course Number: CHM1025

**Unit 3 Atomic Structure**

**General Outcome:**

- 3.0 The student shall be able to describe the structure and components of atoms and apply these concepts to the information contained in the Periodic Table.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 3.1 Differentiate between pure substances and mixtures, and correctly use specific terms such as atoms and elements, molecules and compounds, and homogeneous, and heterogeneous mixtures.**
- 3.2 State the chemical symbols for common elements such as H, Li, Na, K, Mg, Ca, Sr, Ba, Al, C, Si, Sn, Pb, N, P, As, O, S, F, Cl, Br, I, He, Ne, Ar, Fe, Co, Ni, Cu, Zn, Ag, Au, Hg, U.**
- 3.3 Differentiate between protons, electrons, and neutrons; particularly in regard to their relative masses, charges, and location.**
- 3.4 Identify atomic numbers and atomic masses from the periodic table.**
- 3.5 Use atomic numbers to establish the number of protons (and electrons) in the atom of a given element.**
- 3.6 Describe isotopes and how mass numbers uniquely identify them.**
- 3.7 Calculate atomic masses from isotopic masses and abundances.**
- 3.8 Diagram the electron arrangement for the first 20 elements using principal energy levels.**
- 3.9 Organize elements in the Periodic Table based on their chemical and physical properties, atomic numbers, and valence electrons.**
- 3.10 Use the Periodic Table to identify periods, groups, representative elements, transition elements, metals, non-metals, alkali metals, alkaline earth metals, halogens, and noble gases.**
- 3.11 Write electron dot formulas for the representative elements.**
- 3.12 Read with critical comprehension the changing frequencies and wavelength in the electromagnetic spectrum. Apply that information to explain what occurs when an electron changes energy levels. Perform calculations involving frequency, wavelength, and energy.**

Common Course Number: CHM1025

**Unit 4 Bonding and the Nature of Compounds**

**General Outcome:**

- 4.0** The student shall be able to explain the main types of chemical bonds and how they are formed; predict and draw structures for simple ionic and covalent compounds, including those containing common polyatomic ions; and name and write their chemical formulas.

**Specific Measurable Learning Outcomes:**

Upon successful completion of this unit, the student shall be able to:

- 4.1** Differentiate between ionic and covalent bonds and compounds, and compare and contrast their properties.
- 4.2** Predict which combinations of elements tend to bond ionically and which tend to bond covalently.
- 4.3** Explain cation and anion formation by using the chemical properties of metals and non-metals.
- 4.4** Apply the concept of valence electrons and the octet rule to construct ions from atoms of representative elements.
- 4.5** Write the name, formula, and charge for mono- and polyatomic ions. At a minimum, the following ions should be covered:  $\text{Li}^+$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{O}^{2-}$ ,  $\text{S}^{2-}$ ,  $\text{F}^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{Ag}^+$ ,  $\text{Zn}^{2+}$ ,  $\text{Cu}^+$ ,  $\text{Cu}^{2+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{NH}_4^+$ ,  $\text{H}_3\text{O}^+$ ,  $\text{OH}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ,  $\text{PO}_4^{3-}$ ,  $\text{HPO}_4^{2-}$ ,  $\text{H}_2\text{PO}_4^-$ ,  $\text{NO}_3^-$  and  $\text{NO}_2^-$ .
- 4.6** Construct the chemical formula for an ionic compound given its name, and write the name for an ionic compound given its chemical formula.
- 4.7** Apply the octet rule and/or electron pairing to explain covalent bonding.
- 4.8** Write Lewis structures for simple covalent compounds that contain single, double, and triple bonds.
- 4.9** Define electronegativity and interpret its trend within the Periodic Table.
- 4.10** Define polar covalent and non-polar covalent bonds, and use the Periodic Table to assess the type of bond formed between any two elements.
- 4.11** Define polar and non-polar molecules, and distinguish between simple examples of the two.

- 4.12 Evaluate the impact of different types of radiation (UV, IR, microwave) on covalent bonds. Apply this information to examine the impact of UV radiation in the oxygen/ozone cycle in the stratosphere (discuss chlorofluorocarbons and ozone hole) and the impact of IR radiation on greenhouse gases such as water and carbon dioxide (discuss global warming). Debate issues such as economics, rich vs. poor countries, jobs, politics, technology, and the ethics of balancing our interests against those of our grandchildren in addressing global problems such as the ozone hole and global warming.**

Common Course Number: CHM1025

## Unit 5 Stoichiometry

### General Outcome:

- 5.0 The student shall be able to define and use the concept of the mole to balance chemical equations and to calculate specific quantities of reactants and/or products involved.**

### Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 5.1 Calculate formula and molecular weights for ionic and covalent compounds.**
- 5.2 Explain the concept of the mole and its relationship to atoms and molecules by applying Avogadro's number as a conversion factor.**
- 5.3 Apply dimensional analysis to interconvert between the mass of a given substance and the corresponding number of moles.**
- 5.4 Balance chemical equations utilizing the mole concept.**
- 5.5 Given a balanced equation, read data with critical comprehension to construct a diagram that demonstrates the relationship between the number of moles and grams for various substances in a chemical equation. Use those relationships to calculate specific quantities of reactants and/or products involved.**
- 5.6 Examine how much carbon dioxide is produced from the burning of a certain amount of gasoline (e.g. 1 gallon) by using a balanced equation for the combustion of octane as a reasonable approximation.**

Common Course Number: CHM1025

**Unit 6 Energy and States of Matter**

**General Outcome:**

- 6.0 The students shall be able to define energy and use specific heats to calculate the amount of energy produced by a given substance. Students shall also be able to describe and compare the three states of matter, detail the transitions among them, and the energy involved in these transitions.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the students shall be able to:**

- 6.1 Differentiate between a chemical and a physical change.**
- 6.2 Describe and compare the three states of matter.**
- 6.3 Recognize the following changes of state: melting, freezing, boiling, condensation, sublimation, and deposition.**
- 6.4 Define energy and the common energy units (calories, kilocalories, joules).**
- 6.5 Explain how different substances can absorb different amounts of energy; yet increase their temperature by the same number of degrees. Apply that concept to define specific heat.**
- 6.6 Use specific heats to calculate the amount of energy produced by a given substance in a calorimetry experiment.**
- 6.7 Discuss the efficiency (calories per gram) in the combustion reaction of various oxygenated and non-oxygenated fossil fuels.**
- 6.8 Illustrate endothermic and exothermic reactions, and recognize when energy is absorbed or released.**

Common Course Number: CHM1025

### **Unit 7 Introduction to Gases**

#### **General Outcome:**

- 7.0 The students shall be able to explain the properties of gases and perform pressure, volume, and temperature calculations based on the gas laws.**

#### **Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the students shall be able to:**

- 7.1 Define pressure and the units commonly used to measure it.**
- 7.2 Define vapor pressure; explain its relationship to temperature, evaporation, boiling point, and atmospheric pressure.**
- 7.3 Examine the relationship between pressure, volume, and temperature. Use those relations to construct the gas laws: Boyle's, Charles's, Gay-Lussac's and the Combined Gas Law.**
- 7.4 Read with critical comprehension experimental data to solve problems involving the gas laws; analyze and interpret their answers for correctness.**
- 7.5 Discuss major air pollutants (sulfur and nitrogen oxides, carbon monoxide, ozone, etc.) and their primary sources.**

Common Course Number: CHM1025

**Unit 8 Concentration and Properties of Solutions**

**General Outcome:**

- 8.0** The students shall be able to define terms that are pertinent to solutions; describe the process of solution formation; write equations for precipitation reactions that occur in aqueous solutions; do calculations that are based on concentration; and compare and contrast diffusion and osmosis.

**Specific Measurable Learning Outcomes:**

Upon successful completion of this unit, the students shall be able to:

- 8.1** Characterize and differentiate between suspensions, colloids, and true solutions.
- 8.2** Define solution, solute, and solvent.
- 8.3** Explain the difference between a polar and a non-polar solvent.
- 8.4** Describe hydrogen bonding and illustrate some of the many examples of hydrogen bonding in nature: interactions among water molecules (water droplets, insects walking on water), base-pair recognition in DNA, protein folding, docking of specific substrates to enzymes, etc.
- 8.5** Describe the process of solution formation, with emphasis on solutes that are electrolytes dissolving in water.
- 8.6** Define heat of solution and examine examples of endothermic and exothermic dissolution.
- 8.7** List ways that can be used to increase the rate of dissolution.
- 8.8** Define solubility and discuss general solubility rules.
- 8.9** Write equations (in molecular, total ionic, and net ionic form) for precipitation reactions that occur in aqueous solution.
- 8.10** Define concentration; describe and calculate different units of concentration (percent by volume, percent by mass, ppm, ppb, and molarity).
- 8.11** Read with critical comprehension experimental data and apply each unit of concentration as a conversion factor to interconvert between the mass (moles) of solute and the mass (volume) of solution. Analyze and interpret their answers for correctness.
- 8.12** Describe the process of dilution, and solve problems involving dilutions.
- 8.13** Define diffusion, osmosis, concentration gradient, and semipermeable membranes.

- 8.14 Explain osmotic pressure and its relationship to hypertonic, hypotonic, and isotonic solutions. Analyze how a cell can undergo hemolysis or crenation in solutions with different osmotic pressures.**
- 8.15 Define and describe some common water quality concerns such as water hardness, contamination with heavy metals, solubility of gases with varying temperatures, and eutrophication.**

Common Course Number: CHM1025

## Unit 8 Acids and Bases

### General Outcome:

- 9.0 The students shall be able to define and describe acids and bases; write equations for acid-base neutralization reactions; perform fundamental calculations that involve pH; and understand the nature of buffers.

### Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the students shall be able to:

- 9.1 Characterize common properties of acids and bases.
- 9.2 Understand the Arrhenius and Brønsted-Lowry definitions of acids and bases. Give common examples that illustrate these definitions.
- 9.3 List and write formulas for some strong and weak acids (HCl, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>, H<sub>3</sub>PO<sub>4</sub>, HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>, H<sub>2</sub>CO<sub>3</sub>) and bases (NaOH, KOH, NH<sub>3</sub>), including acid and basic anhydrides (CO<sub>2</sub>, SO<sub>3</sub>, NO<sub>2</sub>, CaO, Na<sub>2</sub>O); write equations for the ionization/dissociation reaction of these common acids and bases in water.
- 9.4 Describe an electrolyte and differentiate between strong, weak, and non-electrolytes. Illustrate how common strong and weak acids and bases act as electrolytes in solution.
- 9.5 Define salts and write equations (in molecular, total ionic, and net ionic form) for simple neutralization reactions.
- 9.6 Describe the self-ionization of water and the relationship of [H<sub>3</sub>O<sup>+</sup>] and [OH<sup>-</sup>] in an aqueous solution using the K<sub>w</sub> expression. Use that expression to calculate [H<sub>3</sub>O<sup>+</sup>] from [OH<sup>-</sup>] and vice versa.
- 9.7 Define pH and calculate pH for aqueous solutions of strong acids and strong bases.
- 9.8 Examine how pH changes as [H<sub>3</sub>O<sup>+</sup>] changes; and define acidic, basic, and neutral solutions relative to the pH scale.
- 9.9 Describe a titration and perform simple titration calculations.
- 9.10 Explain how a buffer works and give some simple examples of buffers. Discuss alkalinity and its role as a buffer in various bodies of water.
- 9.11 Illustrate the equilibrium of CO<sub>2</sub>, H<sub>2</sub>CO<sub>3</sub>, and HCO<sub>3</sub><sup>-</sup> in water by writing the appropriate chemical equation. Use this equilibrium to explain why CO<sub>2</sub> in the atmosphere can make rain slightly acidic.

- 9.12 Examine how other gases ( $\text{SO}_x$ ,  $\text{NO}_x$ ) can also dissolve in water to generate acid rain. Write equations to show how these acid anhydrides are transformed into the corresponding acids in water.**
- 9.13 Identify the main producers of these gases and describe some of the effects of acid rain on human-made materials, lakes and streams, forests, visibility, and human health. Discuss the ethics of producing gases that will cause acid rain in other states and/or countries.**

Common Course Number: CHM1025

## **Unit 10 Oxidation-Reduction**

### **General Outcome:**

**10.0 The students shall be able to assign oxidation numbers to each element in a chemical compound, identify oxidation-reduction reactions, and perform fundamental calculations.**

### **Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the students shall be able to:**

- 10.1 Calculate oxidation numbers for each atom in an ion or molecule.**
- 10.2 Define the terms oxidation and reduction, and identify whether an equation represents an oxidation-reduction (redox) reaction.**
- 10.3 Identify the elements being oxidized and reduced in a reaction; determine how many electrons are involved; and write half-reactions representing the oxidation and reduction steps respectively.**
- 10.4 Define and identify the oxidizing agent and the reducing agent in a redox reaction.**
- 10.5 Recognize fundamental reactions in living systems and their environment (photosynthesis; aerobic and anaerobic respiration; nitrogen cycle) as redox reactions.**

Common Course Number: CHM1025

**Unit 11 Nuclear Chemistry**

**General Outcome:**

**11.0 The students shall be able to demonstrate knowledge of the fundamental principles of nuclear structure and nuclear changes.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the students shall be able to:**

- 11.1 Distinguish between nuclear changes and ordinary chemical changes.**
- 11.2 Define and use the terms: radiation, radioactivity, nuclide, isotope.**
- 11.3 Define and write nuclide symbols for common types of subatomic particles.**
- 11.4 Write and balance nuclear equations.**
- 11.5 List the methods used to detect and measure radiation.**
- 11.6 Define half-life and perform calculations involving half-life.**
- 11.7 Define and recognize equations that represent nuclear fission and fusion.**
- 11.8 Discuss how fission produces energy, and how nuclear reactors produce electricity.**
- 11.9 Analyze the risks and benefits of nuclear power.**
- 11.10 Describe and recognize other uses of radioactive nuclides, such as imaging and cancer treatment.**