

**LAST REVIEW:** 2010-2011

*(i.e. 2006-2007)*

**NEXT REVIEW:** 2015-2016

*(i.e. 2011-2012)*

**STATUS:** A

*(A, I, D)*

**COURSE TITLE:** General Chemistry A

**COMMON COURSE NUMBER:** CHM1040

**CREDIT HOURS:** 3

**CONTACT HOUR BREAKDOWN**

*(Per 16 week term)*

**CLOCK HOURS:**

*(Voc. Course ONLY)*

Lecture: 48

Lab:

Clinic:

Other:

**PREREQUISITE(S):**

**COREQUISITE(S):** MAT1033

**PRE/COREQUISITE(S):**

**COURSE DESCRIPTION** *(750 characters, maximum)*: This is the first course in a three semester sequence, CHM1040, CHM1041 and CHM1046. This sequence includes two laboratories: CHM1045L to be taken concurrently with CHM-1041 and CHM1046L to be taken with CHM1046. Topics covered include: measurements, stoichiometry, atomic structure, periodic table, chemical bonding, ionic and covalent compounds, nomenclature, and formula writing.

General Education Requirements – Associate of Arts Degree (AA), meets Area(s): 4 Area

General Education Requirements – Associate in Science Degree (AS), meets Area(s): 4 or 5 Area

General Education Requirements – Associate in Applied Science Degree (AAS), meets Area(s): Area

## **UNIT TITLES**

- 1. Introduction and Measurement**
- 2. Atomic Structure and Periodicity**
- 3. Ionic and Covalent Bonding**
- 4. Ionic and Covalent Formula Writing and Nomenclature**
- 5. Stoichiometry**

\*\*\* 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>	1.10, 5.5
<b>2. Write clearly and coherently**</b>	2.7, 2.8, 2.10, 3.1, 3.3, 3.4, 4.2, 4.3, 5.7
<b>3. Demonstrate literacy as appropriate within a given discipline**</b>	e) 1.6, 1.8, 1.9, 1.10, 2.3, 2.4, 2.5, 2.7, 5.3, 5.4, 5.5, 5.7, 5.8, 5.9; f) 1.0, 2.0, 3.0, 4.0, 5.0
<b>4. Apply problem solving skills or methods to make informed decisions in a variety of contexts**</b>	1.10, 2.7, 3.2, 3.6, 5.5, 5.7, 5.8
<b>Course must include at least <u>one</u> of the following:</b>	
<b>5. Differentiate between ethical and unethical behavior</b>	
<b>6. Demonstrate an understanding of the physical, biological, and social environments and how individual behaviors impact this complex system.</b>	1.1, 1.2
<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.

**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, 2.1
3. Research Papers	1.1, 1.2, 2.1
4. Group projects	1.1, 1.2, 2.1
5. Discussions (In class and online)	1.1, 1.2, 2.1
6. Multiple Choice tests	1.0, 2.0, 3.0, 4.0, 5.0
7. Presentations	1.1, 1.2, 2.1
8. Service Learning Projects	
9. Quizzes (pop, announced, etc.)	1.0, 2.0, 3.0, 4.0, 5.0
10. Take-home tests	1.0, 2.0, 3.0, 4.0, 5.0
11. Summaries, critiques, and analyses	
12. Reaction papers	
13. Surveys	
14. Performance	
15. Short answer tests	1.0, 2.0, 3.0, 4.0, 5.0
16. Classroom debates and colloquia	1.1, 1.2
17. Blogs, wikis, web pages	
18. Other (Please explain)	

Common Course Number:

## UNITS

### Unit 1

#### General Outcome:

- 1.0 The student shall be able to demonstrate knowledge of the nature of chemistry; its classification, properties, types of changes of matter, and scientific measurements.**

#### Specific Measurable Learning Outcomes:

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

- 1.1 Define chemistry and evaluate its modern applications and impact on complex systems such as the environment, medicine, industry, and technology.**
- 1.2 Distinguish among factual data, laws, theories, and hypotheses in the scientific method to create knowledge and solve problems that benefit humanity and its environment.**
- 1.3 Differentiate between pure substances and mixtures, and correctly use specific terms such as elements, compounds, atoms, molecules, homogeneous, heterogeneous, phases and solutions.**
- 1.4 Interpret chemical symbols and formulas, in order to determine the information they convey.**
- 1.5 Differentiate between chemical and physical properties and changes, and between intensive and extensive properties.**
- 1.6 Perform calculations using scientific notation and significant figures and to analyze their answers for correctness.**
- 1.7 Distinguish and apply the common metric/SI units for mass, length, volume, and energy and the prefixes from tera- through pico-.**
- 1.8 Perform conversions among metric units and between certain English and metric units using dimensional analysis and analyze their answers for correctness.**
- 1.9 Interconvert temperatures among Celsius, Fahrenheit, and Kelvin scales.**
- 1.10 Read with critical comprehension experimental data to solve problems involving density and specific gravity; analyze and interpret their answers for correctness.**

Common Course Number:

**Unit 2**

**General Outcome:**

- 2.0 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, as well as construct knowledge of present day models from classical experiments.**

**Specific Measurable Learning Outcomes:**

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

- 2.1 Analyze the historical development of the atomic concept leading to the modern view of the atom.**
- 2.2 Differentiate the fundamental sub-atomic particles and their properties.**
- 2.3 Apply the mass number and atomic number to determine the number of protons, neutrons and electrons in a given nuclide.**
- 2.4 Explain the basis of the atomic mass system and calculate atomic masses from isotopic masses and abundances.**
- 2.5 Identify the regions of the electromagnetic spectrum and perform calculations involving frequency, wavelength and energy.**
- 2.6 Interpret the four quantum numbers and relate them to the electronic structure of the atom.**
- 2.7 Formulate and write electronic configurations utilizing Pauli's Exclusion Principle, the Aufbau Principle, and Hund's Rule.**
- 2.8 Write valence electron configurations and use orbital diagrams to predict paramagnetism, diamagnetism, and bonding behavior.**
- 2.9 Employing the Periodic Law, analyze the Periodic Table to interpret terms such as period, group, representative or main group elements, and transition and inner transition elements.**
- 2.10 Categorize elements in the Periodic Table as metals, non-metals, or metalloids, and compare and contrast the general properties of these classifications.**
- 2.11 Use the Periodic Table to predict trends in ionization energies, electron affinities, electronegativities, and atomic and ionic sizes.**

Common Course Number:

**Unit 3**

**General Outcome:**

- 3.0 The student shall be able to explain concepts of ionic and covalent bonding, including the ability to predict formulas, molecular shapes and infer properties due to shape, such as polarity.**

**Specific Measurable Learning Outcomes:**

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

- 3.1 Differentiate between ionic and covalent bonding modes, and compare and contrast the properties of ionic and covalent substances.**
- 3.2 Predict which combinations of elements tend to bond ionically and which tend to bond covalently.**
- 3.3 Use the concept of valence electrons and the octet rule to construct ions and molecules from atoms. Write Lewis structures for those ions and molecules.**
- 3.4 Write resonance contributing forms and calculate formal charges.**
- 3.5 Apply the valence shell electron pair repulsion theory(VSEPR) to predict shapes of molecules from molecular formulas.**
- 3.6 Predict the presence and direction of dipoles in covalent molecules.**
- 3.7 Apply the valence bond theory to account for hybrid orbitals, multiple bond formation, and molecular geometry as predicted by VSEPR.**
- 3.8 (Optional) Apply the molecular orbital theory to write MO configurations for molecules and to calculate bond order.**

Common Course Number:

**Unit 4**

**General Outcome:**

- 4.0 The student shall be able to write formulas and name common ionic and covalent substances.**

**Specific Measurable Learning Outcomes:**

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

- 4.1 Determine charges of ions from ionic formulas.**
- 4.2 Write the name, formula, and charge for mono- and polyatomic ions. At a minimum, the following ions should be covered:  $\text{Li}^+$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{O}^{2-}$ ,  $\text{S}^{2-}$ ,  $\text{F}^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{Ag}^+$ ,  $\text{Zn}^{2+}$ ,  $\text{Cu}^+$ ,  $\text{Cu}^{2+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{NH}_4^+$ ,  $\text{H}_3\text{O}^+$ ,  $\text{OH}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ,  $\text{PO}_4^{3-}$ ,  $\text{HPO}_4^{2-}$ ,  $\text{H}_2\text{PO}_4^-$ , and  $\text{NO}_3^-$ .**
- 4.3 Compose the formula and write the name for simple ionic and covalent compounds.**

Common Course Number:

**Unit 5**

**General Outcome:**

- 5.0 The student shall utilize the concept of the mole to evaluate numerical relationships involving formulas and balanced equations.**

**Specific Measurable Learning Outcomes:**

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

- 5.1 Illustrate the relationship between Avogadro's number and formula weights (molar mass) of elements and compounds.**
- 5.2 Identify the seven elements that exist as diatomic molecules in their elemental state.**
- 5.3 Apply dimensional analysis to interconvert between the mass of a given substance and the corresponding number of moles.**
- 5.4 Calculate the percent composition of a compound from its formula.**
- 5.5 Read with critical comprehension and apply the quantitative analytical data needed to calculate the empirical and molecular formula of a compound.**
- 5.6 Balance chemical equations utilizing the mole concept.**
- 5.7 Given a balanced equation construct a diagram to demonstrate 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.**
- 5.8 Evaluate the limiting reagent in a given chemical reaction based on previous stoichiometric calculations involving that reaction.**
- 5.9 Calculate the theoretical yield in a chemical reaction. Determine the percentage yield of a chemical reaction based on quantitative experimental data.**