EASTERN ARIZONA COLLEGE
An Introduction to General, Organic, and Biological Chemistry
Course Design
2016-2017

Course Information
Division: Science
Course Number: CHM 138
Title: An Introduction to General, Organic, and Biological Chemistry
Credits: 4
Developed by: Duane DeSpain
Lecture/Lab Ratio: 3 Lecture/3 Lab

Transfer Status
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<tr>
<th>ASU</th>
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Activity Course: No
CIP Code: 40.0500
Assessment Mode: Pre/Post Test (100 Questions/100 Points)
Semester Taught: Fall and Spring
GE Category: Lab Sciences
Separate Lab: Yes
Awareness Course: No
Intensive Writing Course: No

Prerequisites
ENG 091 with a grade of “C” or higher or reading placement test score as established by District policy

Educational Value
This course is designed for students preparing for careers in allied health such as nursing. This course is also appropriate for students seeking a general education laboratory sciences course. It also serves as a preparatory class for those students that need to take General Chemistry, but have not had high school chemistry.

Description
For students with little or no background in chemistry. The first half of this one semester course includes an introduction to general principles of chemistry including measurements, atomic structure, chemical bonding, naming compounds, states of matter, solutions, and chemical reactions with applications in health care. The second half of the course covers aspects of organic and biological chemistry that directly affect health care. They include sections on hydrocarbons, organic functional groups, carbohydrates, lipids, proteins, enzymes, nucleic acids, and metabolic pathways that provide energy for life.
Supplies
Scientific calculator

Competencies and Performance Standards
1. Describe matter, its properties, and the changes it undergoes.

   Learning objectives
   What you will learn as you master the competency:
   a. Recognize the different states of matter.
   b. Classify matter as an element, compound, or mixture.
   c. Distinguish between heterogeneous and homogenous mixtures.

   Performance Standards
   You will demonstrate your competence:
   o on written exams
   o by completing laboratory activities
   o through daily practice exercises
   o by participating in the class
   Your performance will be successful when:
   o learner's lab report includes a summary of the results
   o learner's lab report includes a description of the conclusions you drew and why
   o learner attends class regularly
   o learner offers questions or comments during class
   o learner arrives for class on time
   o learner listens attentively during class
   o learner completes assigned exercises
   o learner enters into class discussions

2. Perform calculations involving measurement.

   Learning objectives
   What you will learn as you master the competency:
   a. Convert metric system measurement units into related units.
   b. Express numbers using scientific notation.
   c. Express the answer to calculations to the proper number of significant figures.
   d. Complete calculations involving densities.

   Performance Standards
   You will demonstrate your competence:
   o on written exams
   o by completing laboratory activities
   o through daily practice exercises
   o by participating in the class
   Your performance will be successful when:
   o learner's lab report includes a summary of the results
3. Develop an understanding of atoms and molecules.

Learning objectives
What you will learn as you master the competency:

a. Use chemical element symbols to write formulas for compounds.
b. Identify the characteristics of protons, neutrons, and electrons.
c. Define isotope and give the mass number and number of neutrons for a specific isotope.
d. Calculate the atomic mass of an element from isotopic abundances and masses.
e. Use atomic weights to calculate molecular weights of compounds.

Performance Standards
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- by participating in the class

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4. Use the Periodic Law to describe the structure of the atom.

Learning objectives
What you will learn as you master the competency:

a. Locate elements in the periodic table on the basis of group and period designations.
b. Identify the location of electrons in orbitals, subshells, and shells.
c. Determine the number of valence electrons in an atom.
d. Write the electronic configuration of any of the first 56 elements.
e. Classify elements into representative elements, transition elements, metal, nonmetal, metalloid, alkali metal family, alkaline earth metal family, halogen, and noble gas.
f. Recognize property trends within the periodic table.
Performance Standards

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5. Develop an understanding of forces between particles.

Learning objectives

What you will learn as you master the competency:

a. Draw correct Lewis structures for atoms.

b. Write correct formulas for ionic compounds.

c. Write correct formulas for molecular compounds.

d. Predict the shapes of molecules using VSEPT Theory.

e. Determine whether a covalent molecule is polar or nonpolar.

f. Relate melting and boiling points of pure substances to the strength and type of intermolecular forces present.

Performance Standards

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6. **Evaluate the states of matter.**

   **Learning objectives**
   *What you will learn as you master the competency:*
   a. Use the Kinetic Molecular Theory to explain the properties of matter in different states.
   b. Perform calculations based on the Gas Laws.
   c. Perform calculations based on the energy changes that accompany the heating, cooling, or changing of state of a substance.

   **Performance Standards**
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7. **Acquire a basic understanding of solutions and colloids.**

   **Learning objectives**
   *What you will learn as you master the competency:*
   a. Classify mixtures as heterogeneous mixtures or homogeneous solutions.
   b. Predict the solubility of solutes in solvents based on molecular polarity.
   c. Calculate solution concentrations.
   d. Describe how to prepare solutions of specific concentration.
   e. Perform calculations based on solution concentration.
   f. Perform calculations based on colligative solution properties of boiling point, freezing point, and osmotic pressure.
   g. Describe the process of dialysis and compare it to osmosis.

   **Performance Standards**
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   o by participating in the class
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8. **Develop an understanding of reaction rates and equilibrium.**

   **Learning objectives**
   
   *What you will learn as you master the competency:*
   
   a. Use the concepts of energy and entropy to predict the spontaneity of reactions.
   
   b. Calculate reaction rates from experimental data.
   
   c. Use energy level diagrams to interpret energy relationships for reactions.
   
   d. Write equilibrium expressions based on reaction equations.
   
   e. Apply Le Chatelier's Principle to predict the influence of changes in concentration and reaction temperature on the position of equilibrium for a reaction.

   **Performance Standards**
   
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9. **Investigate the concept of acids and bases as applied to the medical community.**

   **Learning objectives**
   
   *What you will learn as you master the competency:*
   
   a. Define acids and bases.
   
   b. Identify acids and bases from written chemical equations.
   
   c. Name common acids.
   
   d. Apply the concept of pH in solving acid-base problems.
   
   e. Write reaction equations that represent neutralization reactions between acids and bases.
f. Explain the difference between weak and strong as applied to acids and bases.
g. Explain how buffers work and write equations to illustrate their action.
h. Perform an acid-base titration.

**Performance Standards**
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**10. Acquire a basic understanding of radioactivity and nuclear medicine.**

**Learning objectives**
What you will learn as you master the competency:
- Characterize the common forms of radiation emitted during radioactive decay and other nuclear processes.
- Write balanced equations for nuclear reactions.
- Solve half-life problems.
- Describe the effects of radiation on health.
- Describe medical and nonmedical uses of radioisotopes.
- Explain the difference between nuclear fission and nuclear fusion.

**Performance Standards**
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11. Develop a basic understanding of organic compounds.

Learning objectives

What you will learn as you master the competency:

a. Distinguish inorganic compounds from organic compounds.

b. Name organic compounds based on their functional group.

c. Describe the shapes of organic molecules.

d. Recognize the common functional groups of organic chemistry.

e. Use equations to describe the common addition and oxidation reactions.

f. Recognize aromatic compounds.

g. Distinguish between alcohols and phenols.

h. Describe the physical and chemical properties of amines.

i. Draw structures of simple aldehydes and ketones.

j. Write an equation to demonstrate the acidity of carboxylic acids.

k. Explain how hydrogen bonding affects the physical properties of organic compounds.

l. Recognize and write key reactions for organic compounds.

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12. Develop an understanding of the important characteristics of glucose and other carbohydrates.

Learning objectives

What you will learn as you master the competency:

a. Describe the four main functions of carbohydrates in living organisms.

b. Understand the formation of cyclic sugars and the glycosidic bond.

c. Identify the common disaccharides and describe their biological origin.

d. Describe the biological roles of polysaccharides.
Performance Standards
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13. Acquaint self with lipids and their biological importance.

Learning objectives
What you will learn as you master the competency:

a. List five major functions of lipids.
b. Draw the structure of a triacylglycerol and describe its role in energy storage.
c. Describe the structure and properties of polar lipids and explain the aggregation into micelles, bilayers, liposomes, and membranes.
d. Explain the fluid mosaic model for biological membranes and describe transport across these membranes.
e. Identify the structural characteristics of steroids and list important steroids in the body.

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14. **Acquire an understanding of proteins and their importance to the structure of the cell.**

   **Learning objectives**
   
   *What you will learn as you master the competency:*
   
   a. Classify amino acids as nonpolar, polar, acidic, or basic.
   
   b. Describe the formation of a peptide bond.
   
   c. Distinguish among primary, secondary, tertiary, and quaternary protein structure and explain the forces responsible for these structures.
   
   d. List common functions of proteins and explain the forces and interactions involved in protein solubility, denaturation, and electrophoresis.

   **Performance Standards**
   
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15. **Describe the general characteristics of enzymes and their importance to body chemistry.**

   **Learning objectives**
   
   *What you will learn as you master the competency:*
   
   a. Describe the binding of substrate to an enzyme and explain why enzymes have specificity.
   
   b. Explain the effects of concentration, temperature, and pH on enzyme activity.
   
   c. Identify the factors that contribute to enzyme activity.

   **Performance Standards**
   
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   o by participating in the class

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   o learner attends class regularly
16. **Explain the composition, structure, and function of DNA and other molecules involved in the use and expression of genetic information.**

**Learning objectives**

*What you will learn as you master the competency:*

a. Identify the components of nucleotides and correctly classify the sugars and bases.

b. Describe the structure of DNA and explain how it is replicated.

c. Explain how the genetic code consists of three-base sequences that store information.

d. Derive what is meant by transcription and translation.

**Performance Standards**

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17. **Discuss the metabolic reactions of the body.**

**Learning objectives**

*What you will learn as you master the competency:*

a. Explain the process of digestion, absorption, and transport.

b. Recognize metabolic pathways and coupled reactions.

c. Explain the role of ATP, NAD+, and NADPH in metabolism.

d. Trace the catabolism of glucose through the citric acid cycle.

e. Explain how electron transport and oxidative phosphorylation produce ATP.

**Performance Standards**

*You will demonstrate your competence:*

- on written exams
- by completing laboratory activities
18. Acquaint self with blood chemistry.

**Learning objectives**

What you will learn as you master the competency:

a. Explain how oxygen and carbon dioxide are transported within the bloodstream.

b. Explain how materials move from the blood into the body cells and from the body cells into the blood.

c. Discuss how proper fluid and electrolyte balance is maintained in the body.

d. Explain how acid-base balance is maintained in the body and how buffers work to control blood pH.

e. List the causes of acidosis and alkalosis.

**Performance Standards**

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**Types of Instruction**

Classroom Presentation
Laboratory
**Grading Information**

**Grading Rationale**
The lowest exam and lab score will be dropped.
The weight given to each method of evaluation:

- **Pre-test:** 0%
- **Homework and Quizzes:** 15%
- **Labs:** 25%
- **Exams:** 50%
- **Comprehensive Post-Test:** 10%

**Grading Scale**
- **A** 90-100%
- **B** 80-89%
- **C** 70-79%
- **D** 60-69%
- **F** 0-59%