



Lakeshore Technical College

## 10-806-134 General Chemistry

### Course Outcome Summary

#### Course Information

|                        |  |
|------------------------|--|
| <b>Alternate Title</b> | General Chemistry  |
| <b>Description</b>     | Covers the fundamentals of chemistry. Topics include the metric system, problem-solving, atomic structure, chemical bonding, periodic relationships, chemical reactions, chemical equilibrium, properties of water; acids, bases, salts, buffers, oxidation-reduction, solutions, and solution concentrations; and gas laws. |
| <b>Total Credits</b>   | 4  |
| <b>Total Hours</b>     | 90   |

#### Pre/Corequisites

Prerequisite 10-804-109, Algebra for Chemistry or 10-834-110, Elementary Algebra with Applications, or 10-804-196, Technical Math 1A, with a grade of "C" or better.

#### Course Competencies

##### 1. Use accepted standards for safety and hygiene procedures in the chemistry laboratory

###### Linked Core Abilities

Apply learning  
Integrate technology

###### Assessment Strategies

- 1.1. on a written test
- 1.2. in lab performance

###### Criteria

*Your performance will be successful when:*

- 1.1. you identify safety equipment
- 1.2. you identify safety procedures
- 1.3. you identify laboratory equipment
- 1.4. You use Safety Data Sheets
- 1.5. you follow safety procedures when using laboratory equipment
- 1.6. You utilize the proper lab equipment for a specific task

###### Learning Objectives

- 1.a. Demonstrate proper use of safety equipment
- 1.b. Practice safety procedures
- 1.c. Demonstrate proper use of laboratory equipment
- 1.d. Interpret the information contained on an SDS sheet
- 1.e. Practice standard safety procedures in the lab

## 2. Utilize the scientific method to solve problems

### Linked Core Abilities

Apply learning  
Demonstrate critical thinking  
Integrate technology  
Use mathematics effectively

### Assessment Strategies

- 2.1. on homework assignments
- 2.2. in lab assignments

### Criteria

*Your performance will be successful when:*

- 2.1. you apply the steps in the scientific method to problems
- 2.2. you record quantitative observations
- 2.3. you record qualitative observations
- 2.4. you construct models that are supported by observations
- 2.5. you draw conclusions from your observations and model

### Learning Objectives

- 2.a. Identify the steps in the scientific method
- 2.b. Apply the scientific method to real-world problems
- 2.c. Differentiate between qualitative and quantitative observations
- 2.d. Explain the use of models
- 2.e. Draw valid conclusions from observations

## 3. Solve problems involving measurements and conversions

### Linked Core Abilities

Apply learning  
Use mathematics effectively

### Assessment Strategies

- 3.1. on a written test
- 3.2. on homework assignments
- 3.3. in lab assignments

### Criteria

*Your performance will be successful when:*

- 3.1. you use scientific tools and methods to solve problems
- 3.2. you use the various systems of measurements
- 3.3. you convert within and between systems of measurement
- 3.4. you round off numbers
- 3.5. you write numbers using appropriate significant figures
- 3.6. you use scientific notation
- 3.7. you distinguish between accuracy and precision
- 3.8. you solve word problems
- 3.9. you determine derived properties (such as density, heat capacity, volume, area)

### Learning Objectives

- 3.a. Use the metric system to solve problems
- 3.b. Use dimensional analysis to convert between the English and Metric system
- 3.c. Demonstrate how to round numbers
- 3.d. Demonstrate proper use of significant figures
- 3.e. Use scientific notation
- 3.f. Explain the terms "accuracy" and "precision"
- 3.g. Solve word problems
- 3.h. Solve algebraic equations for the unknown

## 4. Explain the characteristics of matter and the changes it undergoes

### **Linked Core Abilities**

Demonstrate critical thinking

### **Assessment Strategies**

- 4.1. on a written test
- 4.2. on homework assignments
- 4.3. in lab assignments

### **Criteria**

*Your performance will be successful when:*

- 4.1. you distinguish among the physical states of matter
- 4.2. you identify changes in physical states of matter
- 4.3. You categorize matter based on its physical properties
- 4.4. you distinguish between physical and chemical changes
- 4.5. you relate physical states to intermolecular forces

### **Learning Objectives**

- 4.a. Describe physical states
- 4.b. Explain the properties of mixtures and pure substances
- 4.c. Distinguish between an element and a compound
- 4.d. Explain how inter-molecular forces determine physical states

## **5. Evaluate the periodic relationships of the elements**

### **Linked Core Abilities**

Demonstrate critical thinking

### **Assessment Strategies**

- 5.1. on a written test
- 5.2. on homework assignments
- 5.3. in lab assignments

### **Criteria**

*Your performance will be successful when:*

- 5.1. you describe the basic structure of the atom
- 5.2. you describe the properties of subatomic particles
- 5.3. you use the periodic table to determine the atomic symbol, atomic number, and atomic mass of an element
- 5.4. you use the periodic table to determine the electronic configuration of an atom
- 5.5. you classify an element based on its location on the periodic table
- 5.6. you compare elemental properties based on their location on the periodic table

### **Learning Objectives**

- 5.a. Describe parts of the atom
- 5.b. Explain the properties of sub-atomic particles
- 5.c. Identify the atomic symbol, number, and mass of an element from the periodic table
- 5.d. Write the electronic configuration for an atom using periodic table
- 5.e. Classify an element as metal or non-metal
- 5.f. Explain trends in the periodic table

## **6. Explain chemical bonding**

### **Linked Core Abilities**

Apply learning

Demonstrate critical thinking

### **Assessment Strategies**

- 6.1. on a written test
- 6.2. on homework assignments
- 6.3. in lab assignments

### **Criteria**

*Your performance will be successful when:*

- 6.1. you determine valence electrons for main group elements
- 6.2. you relate octet rule to chemical bonding
- 6.3. you explain the formation of an ionic bond
- 6.4. you use the periodic table to determine ionic charge
- 6.5. you explain the formation of a covalent bond
- 6.6. You utilize the periodic table to determine an element's Lewis Dot Structure
- 6.7. you relate electronegativity differences between atoms to the type of bond they form
- 6.8. you create molecular models

#### **Learning Objectives**

- 6.a. Determine the valence electrons for a main group of elements
- 6.b. Explain the octet rule
- 6.c. Describe the formation of an ionic bond
- 6.d. Determine the charge on an ion using the periodic table
- 6.e. Describe the formation of a covalent bond
- 6.f. Determine if a compound is ionic or covalent using the the periodic table
- 6.g. Differentiate bond types based on electro-negativity
- 6.h. Make models of molecules

### **7. Explain the behavior of matter during a chemical reaction**

#### **Linked Core Abilities**

Demonstrate critical thinking

#### **Assessment Strategies**

- 7.1. on a written test
- 7.2. on homework assignments
- 7.3. in lab assignments

#### **Criteria**

*Your performance will be successful when:*

- 7.1. you differentiate between physical, nuclear and chemical changes
- 7.2. you describe chemical reactions using equations
- 7.3. you classify types of reactions
- 7.4. you relate experimental observations to chemical changes

#### **Learning Objectives**

- 7.a. Compare characteristics associated with physical and chemical changes
- 7.b. Write chemical equations
- 7.c. Classify reactions

### **8. Calculate quantities of reactants and products using balanced chemical equations**

#### **Linked Core Abilities**

Use mathematics effectively

#### **Assessment Strategies**

- 8.1. on a written test
- 8.2. on homework assignments
- 8.3. in lab assignments

#### **Criteria**

*Your performance will be successful when:*

- 8.1. you relate atomic mass to gram molecular weight
- 8.2. you balance chemical equations
- 8.3. you use the mole concept to solve stoichiometry problems

#### **Learning Objectives**

- 8.a. Determine atomic masses
- 8.b. Calculate molecular masses
- 8.c. Balance chemical equations

8.d. Solve stoichiometry problems

## 9. Calculate the concentration of aqueous solutions

### Linked Core Abilities

Use mathematics effectively

### Assessment Strategies

- 9.1. on a written test
- 9.2. on homework assignments
- 9.3. in lab assignments

### Criteria

*Your performance will be successful when:*

- 9.1. you explain the components of a solution
- 9.2. you calculate solution concentrations
- 9.3. you solve concentration problems
- 9.4. you explore factors affecting solubility
- 9.5. you explore colligative properties

### Learning Objectives

- 9.a. Identify the components of a solution
- 9.b. Calculate solution concentration using percentage, molarity, and normality units
- 9.c. Solve concentration and dilution problems
- 9.d. Explain factors that affect solubility
- 9.e. Apply colligative properties to solve real-world problems

## 10. Define chemical equilibrium

### Linked Core Abilities

Demonstrate critical thinking

### Assessment Strategies

- 10.1. on a written test
- 10.2. on homework assignments
- 10.3. in lab assignments

### Criteria

*Your performance will be successful when:*

- 10.1. you summarize dynamic equilibrium
- 10.2. you apply Le Chatelier's principle
- 10.3. you utilize  $K_{eq}$  values to describe relative amounts of reactants and products at equilibrium

### Learning Objectives

- 10.a. Explain the concept of equilibrium
- 10.b. Apply LeChatelier's principle to laboratory problems and real world problems

## 11. Compare the characteristics of acids, bases, salts, and buffers

### Linked Core Abilities

Demonstrate critical thinking  
Use mathematics effectively

### Assessment Strategies

- 11.1. on a written test
- 11.2. on homework assignments
- 11.3. in lab assignments

### Criteria

*Your performance will be successful when:*

- 11.1. you distinguish between the properties of acids and bases
- 11.2. you characterize acid-base reactions
- 11.3. you examine the pH scale

- 11.4. you calculate the pH of a solution
- 11.5. you summarize how a buffer works

#### **Learning Objectives**

- 11.a. Explain the properties of acids and bases
- 11.b. Describe acid/base reactions
- 11.c. Explain the use of the pH scale
- 11.d. Calculate the pH of a solution
- 11.e. Explain how a buffer works

## **12. Solve problems involving gas laws**

#### **Linked Core Abilities**

Demonstrate critical thinking  
Use mathematics effectively

#### **Assessment Strategies**

- 12.1. on a written test
- 12.2. on homework assignments

#### **Criteria**

*Your performance will be successful when:*

- 12.1. you utilize the kinetic molecular theory to describe the behavior of gases
- 12.2. you use appropriate units of measure for temperature, pressure and volume
- 12.3. you apply the gas laws to solve problems

#### **Learning Objectives**

- 12.a. Apply kinetic molecular theory to the properties of gases
- 12.b. Perform conversions for temperatures, pressures, and volumes needed to describe gases
- 12.c. Apply gas laws to solve problems