

## WTCS Repository

# 10-806-199 Gen, Organic and Bio Chemistry

## Course Outcome Summary

### Course Information

**Description** A one semester course covering the fundamentals aspects of inorganic and organic chemistry. Topics include lab safety, measurement, elementary problem solving, atomic structure, periodicity, chemical bonding, types of chemical reactions, properties of water, acids, bases, and salts, types of solutions and calculations of concentrations, gas laws, oxidation-reduction concepts, ionization, pH and buffers, hydrocarbons, types of organic compounds and functional groups, biochemical compounds including lipids, carbohydrates, proteins, and nucleic acids.

**Total Credits** 4.00

### Pre/Corequisites

**Prerequisite** Each Wisconsin Technical College determines the General Education course prerequisites used by their academic institution. If prerequisites for a course are determined to be appropriate, the final Course Outcome Summary must identify the prerequisites approved for use by the individual Technical College.

### Course Competencies

#### 1. Follow laboratory safety procedures.

##### Assessment Strategies

- 1.1. written exam taken in class with no reference material.
- 1.2. observation of behavior while working in the chemistry laboratory.

##### Criteria

*Performance will be satisfactory when:*

- 1.1. learner completes a written safety exam without errors.
- 1.2. learner wears chemical splash goggles during all laboratory exercises.
- 1.3. learner adheres to all of the instructors stated instructions during laboratory exercises.
- 1.4. learner adheres to all other safety procedures established for the chemistry laboratory.

#### 2. Use dimensional analysis (factor-label method) to convert between measurement units.

##### Assessment Strategies

- 2.1. written exam without reference material
- 2.2. laboratory report
- 2.3. homework problems

##### Criteria

*Performance will be satisfactory when:*

- 2.1. learner converts measurements from the English to the SI system and vice versa.
- 2.2. learner converts between units within the SI system.

### **3. Describe the properties of matter and how these properties are measured.**

#### **Assessment Strategies**

- 3.1. written exam in class without reference material. Calculator is allowed.
- 3.2. laboratory report
- 3.3. homework problems

#### **Criteria**

*Performance will be satisfactory when:*

- 3.1. learner describes the SI system of measurement.
- 3.2. learner describes the properties of length, mass, temperature, time and volume and describes their measurement.
- 3.3. learner describes the properties of density, specific gravity and specific heat and describes their measurement.
- 3.4. learner uses the proper figures and symbols to represent SI units of measurement.
- 3.5. learner distinguishes between accuracy and precision.

### **4. Explain the nature of matter.**

#### **Assessment Strategies**

- 4.1. written exam without reference material
- 4.2. laboratory report
- 4.3. homework problems

#### **Criteria**

*Performance will be satisfactory when:*

- 4.1. learner distinguishes between mixtures and pure substances.
- 4.2. learner distinguishes between compounds and elements.

### **5. Use various symbols to represent the structure of the atom.**

#### **Assessment Strategies**

- 5.1. written exam with provided reference material.
- 5.2. homework problems.

#### **Criteria**

*Performance will be satisfactory when:*

- 5.1. learner describes the basic structure of the atom.
- 5.2. learner uses the periodic table to determine the symbol, atomic number, and atomic weight of an element, and the structure of the element's atoms.
- 5.3. learner draws electron-dot symbols and determines the electron formulas for the first 20 elements.

### **6. Explain the formation of ionic and covalent bonds.**

#### **Assessment Strategies**

- 6.1. written exam with provided reference material.
- 6.2. laboratory report.
- 6.3. homework problems.

#### **Criteria**

*Performance will be satisfactory when:*

- 6.1. learner describes the formation of an ion.
- 6.2. learner uses the periodic table to determine an ion's charge.
- 6.3. learner describes the formation of a covalent bond.
- 6.4. learner uses the periodic table to determine an element's covalence.
- 6.5. learner describes the development of polar covalent bonds.
- 6.6. learner distinguishes between ionic and molecular compounds.
- 6.7. learner writes bond-line structures for simple molecular compounds.

## **7. Write formulas for and name inorganic compounds.**

### **Assessment Strategies**

- 7.1. written exam with provided reference material.
- 7.2. homework problems.

### **Criteria**

*Performance will be satisfactory when:*

- 7.1. learner writes formulas for inorganic compounds.
- 7.2. learner determines the charge on an ion from a formula.
- 7.3. learner names inorganic compounds.

## **8. Interpret chemical equations.**

### **Assessment Strategies**

- 8.1. written exam with provided reference material.
- 8.2. homework problems.
- 8.3. laboratory report.

### **Criteria**

*Performance will be satisfactory when:*

- 8.1. learner balances chemical equations.
- 8.2. learner performs mole-mole stoichiometric calculations.
- 8.3. learner performs mass-mass stoichiometric calculations.

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

### **Assessment Strategies**

- 9.1. written exam with provided reference material.
- 9.2. homework problems.
- 9.3. laboratory report.

### **Criteria**

*Performance will be satisfactory when:*

- 9.1. learner describes oxidation-reduction reactions in terms of the electron transfer between the reactants.
- 9.2. learner completes chemical equations.
- 9.3. learner predicts the effects of temperature, concentration, and catalysts on the rate of chemical reactions.
- 9.4. learner applies Le Chatelier's principle to predict the effect of stress on an equilibrium reaction.

## **10. Explain the effects of temperature, pressure and number of moles on the volume of a gas.**

### **Assessment Strategies**

- 10.1. written exam without reference material.
- 10.2. homework problems.
- 10.3. laboratory report.

### **Criteria**

*Performance will be satisfactory when:*

- 10.1. learner applies the kinetic theory to the behavior of gases.
- 10.2. learner calculates changes in gas pressure, temperature, or volume resulting from changes in the other two variables.
- 10.3. learner calculates changes in gas pressure resulting from temperature changes and vice versa
- 10.4. learner calculates changes in gas volume resulting from temperature changes and vice versa.
- 10.5. learner calculates changes in gas volume resulting from pressure changes and vice versa.

**11. Integrate the gas law equations with the relationships implied in a chemical equation to solve stoichiometric problems involving gases.**

**Assessment Strategies**

- 11.1. written exam with provided reference material.
- 11.2. homework problems.
- 11.3. laboratory report.

**Criteria**

*Performance will be satisfactory when:*

- 11.1. learner solves stoichiometric problems.

**12. Relate the chemical and physical properties of water.**

**Assessment Strategies**

- 12.1. written exam without reference material.
- 12.2. homework problems.
- 12.3. laboratory report.

**Criteria**

*Performance will be satisfactory when:*

- 12.1. learner uses the concept of hydrogen bonding to explain the high melting point, boiling point, heat of fusion, heat of vaporization and surface tension of water.
- 12.2. learner describes the role of water as a solvent.

**13. Predict the behavior of solutions in equilibrium.**

**Assessment Strategies**

- 13.1. written exam without reference material.
- 13.2. homework problems.
- 13.3. laboratory report.

**Criteria**

*Performance will be satisfactory when:*

- 13.1. learner describes the roles of gas tension and partial pressure in the solubility of gases
- 13.2. learner uses Le Chatelier's principle to describe the behavior of saturated solutions.

**14. Use various methods to measure and express the concentration of a solution and make dilutions.**

**Assessment Strategies**

- 14.1. written exam without reference material.
- 14.2. homework problems.
- 14.3. laboratory report.

**Criteria**

*Performance will be satisfactory when:*

- 14.1. learner calculates the pH of a solution given the hydronium or hydroxide ion concentration.
- 14.2. learner calculates solution concentrations using percent, parts per million, molarity and normality.
- 14.3. learner performs calculations based on the preparation of dilute solutions.

**15. Predict the products of reactions involving common acids and bases.**

**Assessment Strategies**

- 15.1. written exam with provided reference material.
- 15.2. homework problems.
- 15.3. laboratory report.

## Criteria

*Performance will be satisfactory when:*

- 15.1. learner describes the properties of strong and weak acids and bases, and gives examples of each.
- 15.2. learner completes and balances equations for reactions involving acids and bases.

## 16. Predict the effect of a salt on the pH of a solution.

### Assessment Strategies

- 16.1. written exam with provided reference material.
- 16.2. homework problems.
- 16.3. laboratory report.

## Criteria

*Performance will be satisfactory when:*

- 16.1. learner predicts if hydrolysis will occur.
- 16.2. learner uses Bronsted's acid/base concept to predict the pH change in a salt solution.

## 17. Relate the organic functional groups to their names and chemical properties.

### Assessment Strategies

- 17.1. written exam with provided reference material.
- 17.2. homework problems.
- 17.3. laboratory report.

## Criteria

*Performance will be satisfactory when:*

- 17.1. learner recognizes functional groups.
- 17.2. learner draws structural formulas for each of the functional groups.
- 17.3. learner gives IUPAC names for alkanes, cycloalkanes, alkenes, and alcohols.
- 17.4. learner gives common names for alcohols, thiols, disulfides, ethers, aldehydes, ketones, carboxylic acids, carboxylic salts, esters, amines and amides.
- 17.5. learner predicts the products of the halogenation of alkanes.
- 17.6. learner predicts the products of hydrogenation, addition and polymerization of alkenes.
- 17.7. learner predicts the products of dehydration and oxidation of alcohols.
- 17.8. learner predicts the products of oxidation and reduction of aldehydes and ketones.
- 17.9. learner describes the formation of acetals, ketals, and amides.
- 17.10. learner predicts the products of saponification and hydrolysis of esters.
- 17.11. learner predicts the products of amide hydrolysis.

## 18. Explain how the various organic functional groups combine to form the major biochemical compounds.

### Assessment Strategies

- 18.1. written exam with provided reference material.
- 18.2. homework problems.

## Criteria

*Performance will be satisfactory when:*

- 18.1. learner classifies a carbohydrate as a monosaccharide, disaccharide, or polysaccharide.
- 18.2. learner recognizes the structures of the common monosaccharides and disaccharides.
- 18.3. learner describes the components of each of the classes of lipids containing fatty acids.
- 18.4. learner identifies the general structure of steroids and the function of several steroid hormones.
- 18.5. learner classifies triacylglycerols as fats or oils.
- 18.6. learner lists some of the function of proteins.
- 18.7. learner describes the primary, secondary, tertiary and quaternary structure of proteins.
- 18.8. learner distinguishes between DNA and RNA.
- 18.9. learner states the function of DNA and RNA.