

**Fundamentals of Chemistry**  
**Southwest Wisconsin Technical College**

**Information**

Project Title: Fundamentals of Chemistry

Developer(s): John Pluemer

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Revised By: John Pluemer

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Course Number: 10-806-109

Organization: SWTC - Southwest Wisconsin Technical College

Department: Science

Instructional Area: General Studies

Instructional Level: Associate Degree

Instruction Type	Periods	Outside Hours	Credits
A. Classroom Presentation	32	0	2

**Target Population**

Fundamentals of Chemistry is designed to build science skills of students entering the Health Occupations programs. It is also a prerequisite to the program for students who do not meet the science entrance guidelines and for students who have not had at least a high school chemistry course.

**Course Description**

Through Fundamentals of Chemistry students convert measurements, design tables and graphs, create models, and use the scientific method. Students interpret a model of the atom and use the periodic table. They distinguish physical, chemical, and nuclear changes and identify properties of common compounds. They analyze chemical equations and apply common chemical reactions to life science applications. Students examine biomolecules and their relation to life processes.

**Course Prerequisites**

None

**Textbooks**

**Technical Science**

Author: John W. Pluemer

Publisher: Southwest Wisconsin Technical College

Edition: 4th

Source: SWTC Bookstore

Required: Yes

**Supplies**

Scientific Calculator

Required: Yes

## Target Exit Learning Outcomes

### General Education Outcomes

- A. Apply general science concepts

### Core Abilities

- A. Communicate Clearly
- B. Act professionally
- C. Value learning
- D. Work productively
- E. Work cooperatively
- F. Solve Problems

### Performance Expectations

#### Goals

1. Convert measurements
2. Create tables and graphs to organize and present data
3. Create a model to illustrate a complex event or object
4. Use the Scientific Method to investigate a problem
5. Interpret a model of an atom
6. Use the Periodic Table to identify atomic, physical, and chemical properties of elements
7. Distinguish between physical, chemical, and nuclear changes
8. Determine chemical properties of basic compounds
9. Analyze a chemical equation
10. Relate technical applications to chemical or physical properties
11. Relate functions of biomolecules to life processes
12. Interpret basic cell function

#### 1. Convert measurements

##### Properties

Domain: Cognitive  
Level: Comprehension  
Difficulty: Medium  
Importance: Essential

##### Linked Core Abilities

Communicate Clearly

##### Linked General Education Outcomes

Apply general science concepts

Criteria - *Criteria - Performance will be satisfactory when:*

- o Definitions match text and/or lecture
- o learner shows work using conversion factor method for English - Metric and English - English conversions
- o calculation includes correct units
- o calculation show cancellation of units
- o calculation shows correct numerical value

Conditions for Assessment - *Conditions - Competence will be demonstrated:*

- o using a table of conversion factors
- o Using a scientific calculator
- o by completion of a quiz

### **Learning Objectives**

- a. Define qualitative and quantitative observations
- b. Distinguish between accuracy and precision
- c. Identify appropriate unit for desired measurement
- d. Make basic measurements of length, mass, and capacity
- e. Identify relative sizes of various units
- f. Move decimal point to convert within metric system
- g. Use conversion factor method to convert English to metric or English to English
- h. Convert numbers from standard form to scientific notation and vice versa
- i. Interpret appropriate multidimensional units (Area, Volume, Density, etc.)
- j. Convert multidimensional units using conversion factor method

## **2. Create tables and graphs**

### **Properties**

Domain: Cognitive

Level: Application

Difficulty: Medium

Importance: Important

### **Linked Core Abilities**

Communicate Clearly

### **Linked General Education Outcomes**

Apply general science concepts

Criteria - *Criteria - Performance will be satisfactory when:*

- o Table or graph has a title
- o Table or graph has appropriate categories
- o Table or graph has relevant data in appropriate categories
- o Table or graph fits purpose of the presentation
- o Table or graph is labeled
- o learner can make inferences based on given table or graph

Conditions for Assessment - *Conditions - Competence will be demonstrated:*

- o by creation of a graph and/ or table
- o given a set of data to organize
- o on a quiz

### **Learning Objectives**

- a. Organize data into a classification scheme
- b. List the purpose of a table
- c. List the purpose of a graph
- d. Identify the best uses of a circle, bar, and line graph
- e. Extract information from a table or graph (literal and inferential)
- f. Create tables and graphs

## **3. Create a model**

### **Properties**

Domain: Cognitive

Level: Synthesis

Difficulty: High

Importance: Important

**Linked Core Abilities**

Communicate Clearly

**Linked General Education Outcomes**

Apply general science concepts

Criteria - *Criteria - Performance will be satisfactory when:*

- o Model is consistent with the given information
- o Model can be used to make predictions about the event or object
- o Model is clearly presented (labeled, diagrammed, etc)

Conditions for Assessment - *Conditions - Competence will be demonstrated:*

- o by the creation of a model
- o given a scenario containing several variables
- o in a quiz

**Learning Objectives**

- a. Define the purpose of a model
- b. Identify examples of models
- c. Use a model to make predictions about an object or event
- d. Create a model

**4. Use the scientific method****Properties**

Domain: Cognitive

Level: Analysis

Difficulty: High

Importance: Essential

**Linked Core Abilities**

Communicate Clearly

**Linked General Education Outcomes**

Apply general science concepts

Criteria - *Criteria - Performance will be satisfactory when:*

- o learner defines the problem
- o learner develops a hypothesis consistent with the problem
- o learner explains experimental and control procedure (for one variable)
- o learner draws valid conclusions
- o learner collects, organizes, and presents data so it can be easily interpreted

Conditions for Assessment - *Conditions - Competence will be demonstrated:*

- o given an initial description of a problem
- o in a quiz

**Learning Objectives**

- a. Define the purpose of the scientific method
- b. Explain the steps of the scientific method
- c. Describe the reasons for working with only one variable at a time
- d. Explain the importance of a control procedure

**5. Interpret a model of an atom****Properties**

Domain: Cognitive  
Level: Comprehension  
Difficulty: High  
Importance: Essential

**Linked Core Abilities**

Communicate Clearly

**Linked General Education Outcomes**

Apply general science concepts

Criteria - *Criteria - Performance will be satisfactory when:*

- o learner accurately converts basic and multidimensional properties
- o learner uses the correct units of measure on basic and multidimensional units
- o learner states relationships between Temperature, Volume, and Pressure
- o learner accurately solves gas law problems using Temp, Vol, and Press relationships
- o learner identifies three subatomic particles (protons, neutrons, and electrons)
- o learner accurately determines the charge, mass, and location of the subatomic particles
- o learner accurately relates relative number of particles in an unreacted atom
- o learner differentiates between an electron's energy level and orbital according to the text
- o learner accurately relates number of particles to atomic number, atomic mass, element, isotope, and ion

Conditions for Assessment - *Conditions - Competence will be demonstrated:*

- o using appropriate models of an atom
- o without the use of notes
- o on a quiz

**Learning Objectives**

- a. Describe fundamental properties of matter
- b. Differentiate between basic and multidimensional properties
- c. Classify substances as solid, liquid, or gas
- d. Use gas laws to solve problems
- e. Identify subatomic particles
- f. Determine charge, mass, and location of the subatomic particles
- g. Relate relative numbers of particles in an unreacted atom
- h. Define atomic number, atomic mass, element, isotope, and ion
- i. Differentiate between an electron's energy level and orbital

**6. Use the Periodic Table**

**Properties**

Domain: Cognitive  
Level: Application  
Difficulty: High  
Importance: Essential

**Linked Core Abilities**

Communicate Clearly

**Linked General Education Outcomes**

Apply general science concepts

Criteria - *Criteria - Performance will be satisfactory when:*

- o learner identifies at least three metals, nonmetals, and noble gases
- o learner lists numbers of subatomic particles for any atom

- o learner writes an electron configuration for elements 1 - 20
- o learner accurately describes how atoms in groups 1,2,6,7,8 generally react
- o learner identifies relative reactivity of groups 1,2,6,7,8

Conditions for Assessment - *Conditions - Competence will be demonstrated:*

- o using a periodic table
- o without the use of notes
- o on a quiz

### **Learning Objectives**

- a. Identify elements by symbol, atomic number, and atomic mass
- b. Compare electron configuration to the structure of the Periodic Table
- c. Explain why atoms gain or lose electrons
- d. Identify metal, nonmetals, and noble gases
- e. Explain relationship between chemical properties and electron configuration.

## **7. Distinguish between physical, nuclear, and chemical changes**

### **Properties**

Domain: Cognitive

Level: Analysis

Difficulty: Medium

Importance: Important

### **Linked Core Abilities**

Communicate Clearly

### **Linked General Education Outcomes**

Apply general science concepts

Criteria - *Criteria - Performance will be satisfactory when:*

- o learner correctly classifies changes as physical, chemical, or nuclear
- o learner identifies at least two examples of physical, chemical, and nuclear changes
- o learner explains what happens to the structure of the atom during a physical, chemical, or nuclear change according to the text
- o learner accurately differentiates between a compound and a mixture

Conditions for Assessment - *Conditions - Competence will be demonstrated:*

- o Without the use of notes
- o in a quiz

### **Learning Objectives**

- a. Identify types of physical changes
- b. Identify types of chemical changes
- c. Identify types of nuclear changes
- d. Explain what happens to the structure of the atom during a physical, chemical or nuclear change

## **8. Determine chemical properties of basic compounds**

### **Properties**

Domain: Cognitive

Level: Application

Difficulty: High

Importance: Important

**Linked Core Abilities**

Communicate Clearly

**Linked General Education Outcomes**

Apply general science concepts

Criteria - *Criteria - Performance will be satisfactory when:*

- o learner describes the formation of an ionic and a covalent bond according to text and/or lecture
- o learner correctly determines which compounds are ionic and which are covalent using electronegativity
- o learner accurately determines charge of ions within a compound
- o learner accurately classifies compounds as acids, bases, salts, and nonmetal compounds
- o learner determines the correct formula of a compound given the name

Conditions for Assessment - *Conditions - Competence will be demonstrated:*

- o with the use of a periodic table
- o with the use of a table of electronegativities
- o in a quiz

**Learning Objectives**

- a. Define ionic bonds
- b. Define covalent bonds
- c. Define electronegativity
- d. Determine which type of bond will form
- e. Explain why compounds form in specific ratios
- f. Write the formula for a compound
- g. Determine the charge on ions that compose a compound

**9. Analyze a chemical equation****Properties**

Domain: Cognitive

Level: Analysis

Difficulty: High

Importance: Important

**Linked Core Abilities**

Communicate Clearly

**Linked General Education Outcomes**

Apply general science concepts

Criteria - *Criteria - Performance will be satisfactory when:*

- o learner clearly differentiates between coefficients and subscripts
- o learner determines if an equation is balanced
- o learner explains one reason for balancing equations
- o learner defines a mole according to text
- o learner accurately calculates gram molecular weight
- o learner accurately converts between grams and moles of a substance
- o learner accurately determines the amounts in grams of each reactant and product in a chemical reaction

Conditions for Assessment - *Conditions - Competence will be demonstrated:*

- o using a periodic table
- o given the amount in grams of one reactant or product in the equation

- o in a quiz

### **Learning Objectives**

- Describe the meaning of subscripts and coefficients in a chemical equation.
- Determine if an equation is balanced
- Explain the purpose of balancing an equation
- Determine the molecular weight of a compound
- Define a mole
- Determine the Gram Molecular Weight of a compound
- Convert between moles of a compound and grams of a compound
- Use the balanced chemical equation to determine amounts of reactants or products in grams

## **10. Relate technical applications to chemical or physical properties**

### **Properties**

Domain: Cognitive

Level: Analysis

Difficulty: Medium

Importance: Essential

### **Linked Core Abilities**

Communicate Clearly

### **Linked General Education Outcomes**

Apply general science concepts

Criteria - *Criteria - Performance will be satisfactory when:*

- o learner explains the common function and/or use of a chemical compound
- o learner explains the chemical properties responsible for the compounds function and/or use
- o report contains correct grammar and spelling
- o report contains at least two references
- o report is original

Conditions for Assessment - *Conditions - Competence will be demonstrated:*

- o in a 2 page report

### **Learning Objectives**

- describe some chemical properties of water
- describe some chemical properties of metals
- describe some chemical properties of salts
- describe some chemical properties of nonmetals
- describe some chemical properties of acids and bases
- describe some chemical properties of organic compounds

## **11. Relate functions of biomolecules to life processes**

### **Properties**

Domain: Cognitive

Level: Analysis

Difficulty: Medium

Importance: Essential

### **Linked Core Abilities**

Communicate Clearly

### **Linked General Education Outcomes**

Apply general science concepts

Criteria - *Criteria - Performance will be satisfactory when:*

- o Learner determines the functions of the four biomolecules according to the text
- o learner lists one example of each biochemical
- o learner clearly explains transcription in protein synthesis
- o learner clearly explains translation in protein synthesis
- o learner clearly explains how DNA and RNA "carry information"
- o learner explains the process of polymerization of 3 of the 4 biomolecules

Conditions for Assessment - *Conditions for assessment:*

- o without notes
- o in a quiz

### **Learning Objectives**

- a. List the four biomolecules
- b. Describe the function of each biochemical
- c. Give an example of each biochemical
- d. Explain the function of DNA, mRNA, and tRNA in protein synthesis

## **12. Interpret basic cell function**

### **Properties**

Domain: Cognitive

Level: Analysis

Difficulty: High

Importance: Essential

### **Linked Core Abilities**

Communicate Clearly

### **Linked General Education Outcomes**

Apply general science concepts

Criteria - *Criteria - Performance will be satisfactory when:*

- o learner clearly states the natural tendency of substance movement from high concentration to low concentration
- o learner describes the function of various organelles according to the text
- o learner accurately identifies the type of transport being described
- o learner states three purposes for mitosis
- o learner identifies the number of daughter cells and the number of chromosomes in cell after mitosis given number of chromosomes in the original cell
- o learner states the purpose of meiosis
- o learner clearly explains why egg or sperm can't be produced by mitosis
- o learner identifies the number and type of chromosomes in a cell after meiosis given the number of chromosomes in the original cell

### **Learning Objectives**

- a. Draw a model of a prokaryotic and eukaryotic cell
- b. List the functions of various organelles of a eukaryotic cell
- c. Explain the process of diffusion, osmosis, facilitative diffusion, and active transport
- d. Explain why active transport requires energy and facilitated diffusion doesn't
- e. Explain the purpose of mitosis
- f. Determine the number of resulting daughter cells and chromosomal composition after

mitosis

- g. Explain the purpose of meiosis
- h. Determine the chromosomal composition of daughter cells resulting from meiosis