

General Science

SWTC - Southwest Wisconsin Technical College

Information

<i>Course Number</i>	10-806-105
<i>Credits</i>	3
<i>Contact Hours</i>	36
<i>Instructional Area</i>	Science
<i>Instructional Level</i>	Associate Degree
<i>Division</i>	General Education
<i>Developer(s)</i>	John Pluemer

Description

General Science is divided into three units: 1. Scientific Tools and Methods, 2. Introduction to Chemistry, 3. Introduction to Biology. Upon completion of unit 1, students convert measurements, design tables and graphs, create models, and use the scientific method. In unit 2, 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 relate technical applications to chemical properties. In unit 3, students examine basic cell structure and function. Students trace the development of body systems. They apply technical applications to human anatomy and physiology.

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. Examine basic cell structure
12. Interpret basic cell function
13. Analyze the levels of complexity in living organisms
14. Analyze the flow of matter and energy from plants to animals
15. Interpret the functional development of animal systems in relation to structural requirements

Prerequisites

1. None

Textbooks

John Pluemer. *Technical Science*. Publisher: Southwest Wisconsin Technical College

Supplies

Scientific Calculator

Core Abilities

- A. Communicate Clearly
- B. Solve Problems

Competencies and Performance Standards

1. Convert measurements to required accuracy

Performance Standards

Conditions - Competence will be demonstrated:

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

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

Learning objectives

What you will learn as you master the competency:

- 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

Performance Standards

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

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

Learning objectives

What you will learn as you master the competency:

- 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

Performance Standards

Conditions - Competence will be demonstrated:

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

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)

Learning objectives

What you will learn as you master the competency:

- 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

Performance Standards

Conditions - Competence will be demonstrated:

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

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

Learning objectives

What you will learn as you master the competency:

- 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

Performance Standards

Conditions - Competence will be demonstrated:

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

Criteria - Performance will be satisfactory when:

- 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

Learning objectives

What you will learn as you master the competency:

- a. Identify subatomic particles
- b. Determine charge, mass, and location of the subatomic particles
- c. Relate relative numbers of particles in an unreacted atom
- d. Define atomic number, atomic mass, element, isotope, and ion
- e. Differentiate between an electron's energy level and orbital

6. Use the Periodic Table

Performance Standards

Conditions - Competence will be demonstrated:

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

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

Learning objectives

What you will learn as you master the competency:

- a. Identify elements by symbol, atomic number, 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

Performance Standards

Conditions - Competence will be demonstrated:

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

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

Learning objectives

What you will learn as you master the competency:

- 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

Performance Standards

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

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

Learning objectives

What you will learn as you master the competency:

- 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

Performance Standards

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

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

Learning objectives

What you will learn as you master the competency:

- a. Describe the meaning of subscripts and coefficients in a chemical equation.
- b. Determine if an equation is balanced
- c. Explain the purpose of balancing an equation

10. Relate technical applications to chemical or physical properties

Performance Standards

Conditions - Competence will be demonstrated:

- o in a 2 page report

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

Learning objectives

What you will learn as you master the competency:

- a. describe some chemical properties of water
- b. describe some chemical properties of metals
- c. describe some chemical properties of salts
- d. describe some chemical properties of nonmetals
- e. describe some chemical properties of acids and bases
- f. describe some chemical properties of organic compounds

11. Examine basic cell structure

Performance Standards

Conditions for assessment:

- o without notes
- o in a quiz

Criteria - Performance will be satisfactory when:

- o Learner determines the functions of the four biochemicals according to the text
- o learner lists one example of each biochemical
- o learner describes the function of various organelles according to the text

Learning objectives

What you will learn as you master the competency:

- a. List the four biochemicals
- b. Describe the function of each biochemical
- c. Give an example of each biochemical
- d. Draw a model of a prokaryotic and eukaryotic cell

- e. List the functions of various organelles of a eukaryotic cell

12. Interpret basic cell function

Performance Standards

Criteria - Performance will be satisfactory when:

- o learner clearly states the natural tendency of substance movement from high concentration to low concentration
- o learner accurately identifies the type of transport being described
- 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 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

What you will learn as you master the competency:

- a. Explain the process of diffusion, osmosis, facilitative diffusion, and active transport
- b. Explain why active transport requires energy and facilitated diffusion doesn't
- c. Explain the function of DNA, mRNA, and tRNA in protein synthesis
- d. Explain the purpose of mitosis
- e. Determine the number of resulting daughter cells and chromosomal composition after mitosis
- f. Explain the purpose of meiosis
- g. Determine the chromosomal composition of daughter cells resulting from meiosis

13. Analyze the levels of complexity in living organisms

Performance Standards

Conditions for assessment:

- o without notes
- o in a quiz

Criteria - Performance will be satisfactory when:

- o learner defines terms (biochemical, organelle, cell, tissue, organ, organ system) according to text and/or lecture
- o learner sequences terms from least to most complex
- o learner gives 2 examples of higher and lower plants
- o learner clearly shows the relationship between structure and function

- o learner clearly shows the structural and functional limitations of lower plants based on maximum level of complexity (cell)
- o learner clearly shows the structural and functional limitations of higher plants based on maximum level of complexity (cell)

Learning objectives

What you will learn as you master the competency:

- a. Define the terms; biochemical, organelle, cell, tissue, organ, and organ system
- b. Sequence the terms above
- c. Compare lower and higher plants to levels of complexity
- d. Describe structural and functional limitation of lower plants
- e. Describe structural and functional limitation of higher plants

14. Analyze the flow of matter and energy from plants to animals

Performance Standards

Conditions for assessment:

- o in a quiz
- o without notes

Criteria - Performance will be satisfactory when:

- o learner explains that building process requires energy while a breaking process releases energy
- o learner explains via scenario that energy flows while matter is cycled
- o learner explains photosynthesis in general terms of matter and energy requirements
- o learner explains respiration in general terms of matter and energy requirements
- o learner explains the function of ATP according to text and/or lecture
- o learner describes various cycles in general terms

Learning objectives

What you will learn as you master the competency:

- a. Explain the process of photosynthesis
- b. Explain respiration
- c. Explain the function of ATP
- d. Describe the carbon / oxygen cycle
- e. Describe the nitrogen cycle
- f. Describe the water cycle

15. Interpret the functional development of animal systems in relation to structural requirements

Performance Standards

Conditions for assessment:

- o given appropriate diagrams or models
- o without notes
- o in a quiz

Criteria - Performance will be satisfactory when:

- o learner accurately matches animal and phylum
- o learner identifies all basic anatomical structures
- o learner accurately describes basic functions of organs and systems
- o learner lists 2 benefits and limitations of a organ system of a given animal (ex. exoskeleton)
- o learner traces development of an organ system by accurately contrasting similar organ systems in different animals (ex respiratory system in fish vs reptiles)
- o learner identifies necessary organ systems for a generalized animal

Learning objectives

What you will learn as you master the competency:

- a. Match an animal with its phylum
- b. Identify basic human anatomical structures
- c. Describe the basic function of organs and organ systems
- d. Follow the development of the respiratory, digestive, skeletal, circulatory, and nervous systems
- e. Describe the benefits and limitations of various organs and systems in various animals
- f. Explain structural requirements of a generalized animal

16. Analyze the process of evolution

Performance Standards

Conditions for assessment:

- o without notes
- o in a quiz

Criteria - Performance will be satisfactory when:

- o definitions match text and/or lecture
- o learner correctly determines genotypes and phenotypes of offspring using an monohybrid cross
- o learner explains changes in an individual are the result of genetic mutations
- o learner explains changes in a population according to the theory of natural selection

Learning objectives

What you will learn as you master the competency:

- a. Define terms; gene, trait, chromosome, alleles, homozygous, heterozygous, genotype, phenotype, mutation
- b. Perform a monohybrid cross
- c. Describe how changes in an individual occur
- d. Describe how changes in a population occur