

### I. Content Standard: Scientific Processes/Nature of Science

The student will understand the nature of science.

#### Performance Standards:

- A. Conduct field and laboratory investigations using safe, environmentally appropriate, and ethical practices.
- B. Use scientific methods during field and laboratory investigations.
- C. Apply critical thinking and scientific problem-solving to make informed decisions.

#### Essential & Enduring Knowledge

*(What the student must know...)*

- A. Field and laboratory investigations  
Conservation, disposal, and recycling
- B. Investigations  
Scientific methods
- C. Critical thinking skills  
Scientific problem-solving

#### Essential Skills

*(What the student must do...)*

- A. Demonstrate safe practices during field and laboratory investigations.  
Make wise choices in the use and conservation of resources and the disposal or recycling of materials.
- B. Plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting equipment and technology.  
Collect data and make measurements with precision.  
Express and manipulate chemical quantities using scientific conventions and mathematical procedures, such as dimensional analysis, scientific notation, and significant figures.  
Organize, analyze, evaluate, make inferences, and predict trends from data.  
Communicate valid conclusions.
- C. Analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information.  
Make responsible choices in selecting everyday products and services using scientific information.  
Evaluate the impact of research on scientific thought, society, and the environment.  
Describe connections between chemistry, and future careers.  
Research and describe the history of chemistry and contributions of scientists.

### II. Content Standard: Scientific Concepts/Matter – Atoms

The student will demonstrate an understanding of matter and its composition.

#### Performance Standards:

- A. Distinguish the characteristics of matter.
- B. Understand that atomic structure is determined by nuclear composition, allowable electron cloud, and subatomic particles.
- C. Relate how atoms form bonds to the stable arrangement of electrons.

#### Essential & Enduring Knowledge

*(What the student must know...)*

- A. Physical and chemical properties  
Solids, liquids, gases  
Mixtures, pure substances  
Elements
- B. Subatomic particles  
Periodic table
- C. Bonding atoms  
Ionic and covalent compounds  
Atom arrangement  
Intermolecular forces

#### Essential Skills

*(What the student must do...)*

- A. Differentiate between physical and chemical properties of matter.  
Analyze examples of solids, liquids, and gases to determine their compressibility, structure, motion of particles, shape, and volume.  
Investigate and identify properties of mixtures and pure substances.  
Describe the physical and chemical characteristics of an element using the periodic table and make inferences about its chemical behavior.
- B. Describe the existence and properties of subatomic particles.  
Summarize the historical development of the periodic table to understand the concept of periodicity.
- C. Identify the characteristics of atoms involved in chemical bonding.  
Investigate and compare the physical and chemical properties of ionic and covalent compounds.  
Compare the arrangement of atoms in molecules, ionic crystals, polymers, and metallic substances.  
Describe the influence of intermolecular forces on the physical and chemical properties of covalent compounds.

### III. Content Standard: Scientific Concepts/Physical and Chemical Changes of Matter

The student will understand physical and chemical changes of matter and the representations of those changes.

#### Performance Standards:

- A. Recognize that energy transformations occur during physical and chemical changes in matter.
- B. Relate the variables that influence the behavior of gases.
- C. Use balanced chemical equations to interpret and describe the interactions of matter.
- D. Describe factors involved in chemical reactions.
- E. Identify common oxidation-reduction processes.

#### Essential & Enduring Knowledge

*(What the student must know...)*

- A. Nature of changes and energy involved  
Energy in chemical reactions  
Heat energy
- B. Measurements of a gas in a system  
Universal Gas Law
- C. Scientific nomenclature  
Symbols, formulas, and equations

#### Essential Skills

*(What the student must do...)*

- A. Identify changes in matter, determine the nature of the change, and examine the forms of energy involved.  
Identify and measure energy transformations and exchanges involved in chemical reactions.  
Measure the effects of the gain or loss of heat energy on the properties of solids, liquids, and gases.
- B. Describe interrelationships among temperature, particle number, pressure, and volume of gases contained within a closed system.  
Illustrate the data obtained from investigations with gases in a closed system and determine if the data are consistent with the Universal Gas Law.
- C. Identify common elements and compounds using scientific nomenclature.

#### Essential & Enduring Knowledge

*(What the student must know...)*

- C., cont.  
Chemical and nuclear equations  
Corrosion and electroplating
- D. Conservation of energy  
Reaction rates
- E. Oxidation-reduction

#### Essential Skills

*(What the student must do...)*

- C., cont.  
Demonstrate the use of symbols, formulas, and equations in describing interactions of matter, such as chemical and nuclear reactions.  
Explain and balance chemical and nuclear equations using number of atoms, masses, and charge.
- D. Verify the law of conservation of energy by evaluating the energy exchange that occurs as a consequence of a chemical reaction.  
Relate the rate of a chemical reaction to temperature, concentration, surface area, and presence of a catalyst.
- E. Identify oxidation-reduction processes.  
Demonstrate and document the effects of a corrosion process and evaluate the importance of electroplating metals.

