

ODYSSEY Molecular Explorer

— Release 7.0 —

Correlation with the

Georgia Performance Science Standards Grades 9-12

Revised July 13, 2006

Physical Science Co-Requisite Content

SPS1 Students will investigate our current understanding of the atom.

a. Examine the structure of the atom in terms of

- proton, electron, and neutron locations.
- atomic mass and atomic number.
- atoms with different numbers of neutrons (isotopes).
- explain the relationship of the proton number to the element's identity.

→ **D2** *Atoms* "Distribution of Mass in Atoms"

b. Compare and contrast ionic and covalent bonds in terms of electron movement.

→ **F1** *Chemical Bonding* "The Attraction Between Ions"

→ **F8** *Chemical Bonding* "Energetics of Covalent Bonding"

→ **F11** *Chemical Bonding* "Polar Bonds and Molecules"

→ **F13** *Chemical Bonding* "Classifying by Bond Polarity"

SPS2 Students will explore the nature of matter, its classifications, and its system for naming types of matter.

c. Use IUPAC nomenclature for transition between chemical names and chemical formulas of

- binary ionic compounds (containing representative elements).

- binary covalent compounds (i.e. carbon dioxide, carbon tetrachloride).

→ **C20** *Chemical Matter* "Naming Compounds"

d. Demonstrate the Law of Conservation of Matter in a chemical reaction.

→ **M1** *Kinetics* "Observing a Reaction"

→ **M2** *Kinetics* "Reactive Collisions"

→ **M3** *Kinetics* "Mechanism of a Reaction"

SPS4 Students will investigate the arrangement of the Periodic Table.

a. Determine the trends of the following:

- Number of valence electrons
- Types of ions formed by representative elements
- Location of metals, nonmetals, and metalloids
- Phases at room temperature

→ **P1** *Main Groups & Transition Metals* "Alkali Metals"

→ **P2** *Main Groups & Transition Metals* "Alkaline Earth Metals"

→ **P3** *Main Groups & Transition Metals* "Boron Group"

→ **P4** *Main Groups & Transition Metals* "Carbon Group"

→ **P6** *Main Groups & Transition Metals* "Nitrogen Group"

→ **P7** *Main Groups & Transition Metals* "Oxygen Group"

→ **P10** *Main Groups & Transition Metals* "Halogens"

→ **P11** *Main Groups & Transition Metals* "Noble Gases"

→ **P12** *Main Groups & Transition Metals* "Elements of the d- and f-Blocks"

SPS5 Students will compare and contrast the phases of matter as they relate to atomic and molecular motion.

a. Compare and contrast the atomic/molecular motion of solids, liquids, gases and plasmas.

→ **C6** *Chemical Matter* "States of Matter"

→ **C7** *Chemical Matter* "Comparing States Side-by-Side"

→ **G1** *Gases* "Density of Gases and Liquids"

→ **H3** *Liquids & Solids* "Compressibility"

→ **H9** *Liquids & Solids* "Molecular Motion and Physical States"

b. Relate temperature, pressure, and volume of gases to the behavior of gases.

- **G6** Gases "Gas Pressure"
- **G13** Gases "Pressure-Volume Relationship"
- **G14** Gases "Boyle's Law"
- **G16** Gases "Pressure and Temperature"
- **G18** Gases "Avogadro's Law"
- **G19** Gases "Universality of the Ideal Gas Law"

SPS6 Students will investigate the properties of solutions.

a. Describe solutions in terms of

- solute/solvent
- conductivity
- concentration

- **I2** Solutions "Process of Dissolving"
- **I6** Solutions "Concentration of a Dissolved Pesticide"
- **I7** Solutions "Molarity vs. Molality"

d. Compare and contrast the components and properties of acids and bases.

- **K1** Acids & Bases "Strong Acids"
- **K2** Acids & Bases "Comparing Oxoacids"

SPS7 Students will relate transformations and flow of energy within a system.

b. Investigate molecular motion as it relates to thermal energy changes in terms of conduction, convection, and radiation.

- **L2** Thermochemistry "Thermal Energy"
- **O3** Chemical Thermodynamics "Heat Conduction"

c. Determine the heat capacity of a substance using mass, specific heat, and temperature.

- **L6** Thermochemistry "Specific Heat"

Chemistry

Co-Requisite Content

SC1 Students will analyze the nature of matter and its classifications.

b. Identify substances based on chemical and physical properties.

→ **C12** *Chemical Matter* "Types of Properties"

d. Use IUPAC nomenclature for both chemical names and formulas:

- Ionic compounds (Binary and tertiary)
- Covalent compounds (Binary and tertiary)
- Acidic compounds (Binary and tertiary)

→ **C20** *Chemical Matter* "Naming Compounds"

→ **S2** *Organic Chemistry* "Straight-Chain Alkanes"

→ **S5** *Organic Chemistry* "Isomers of the Alkanes"

→ **S9** *Organic Chemistry* "Isomers of Alkenes and Alkynes"

SC2 Students will relate how the Law of Conservation of Matter is used to determine chemical composition in compounds and chemical reactions.

b. Experimentally determine indicators of a chemical reaction specifically precipitation, gas evolution, water production, and changes in energy to the system.

→ **M3** *Kinetics* "Mechanism of a Reaction"

f. Explain the role of equilibrium in chemical reactions.

→ **N1** *Equilibria* "Dynamics of Equilibria"

→ **N2** *Equilibria* "Equilibrium and Temperature"

→ **N3** *Equilibria* "Equilibrium and Pressure"

SC3 Students will use the modern atomic theory to explain the characteristics of atoms.

a. Discriminate between the relative size, charge, and position of protons, neutrons, and electrons in the atom.

→ **D2** *Atoms* "Distribution of Mass in Atoms"

b. Use the orbital configuration of neutral atoms to explain its effect on the atom's chemical properties.

→ **D9** *Atoms* "Comparing Helium, Neon, and Argon"

→ **D14** *Atoms* "Orbitals of a Krypton Atom"

c. Explain the relationship of the proton number to the element's identity.

→ **D2** *Atoms* "Distribution of Mass in Atoms"

e. Compare and contrast types of chemical bonds (i.e. ionic, covalent).

→ **F1** *Chemical Bonding* "The Attraction Between Ions"

→ **F8** *Chemical Bonding* "Energetics of Covalent Bonding"

→ **F11** *Chemical Bonding* "Polar Bonds and Molecules"

→ **F13** *Chemical Bonding* "Classifying by Bond Polarity"

SC5 Students will understand that the rate at which a chemical reaction occurs can be affected by changing concentration, temperature, or pressure and the addition of a catalyst.

a. Demonstrate the effects of changing concentration, temperature, and pressure on chemical reactions.

→ **M2** *Kinetics* "Reactive Collisions"

c. Explain the role of activation energy and degree of randomness in chemical reactions.

→ **M2** *Kinetics* "Reactive Collisions"

→ **M3** *Kinetics* "Mechanism of a Reaction"

SC6 Students will understand the effects motion of atoms and molecules in chemical and physical processes.

a. Compare and contrast atomic/molecular motion in solids, liquids, gases, and plasmas.

→ **C6** *Chemical Matter* "States of Matter"

→ **C7** *Chemical Matter* "Comparing States Side-by-Side"

→ **G1** *Gases* "Density of Gases and Liquids"

→ **H3** *Liquids & Solids* "Compressibility"

→ **H9** *Liquids & Solids* "Molecular Motion and Physical States"

b. Collect data and calculate the amount of heat given off or taken in by chemical or physical processes.

→ **M3** *Kinetics* "Mechanism of a Reaction"

→ **N2** *Equilibria* "Equilibrium and Temperature"

c. Analyzing (both conceptually and quantitatively) flow of energy during change of state (phase).

→ **C13** *Chemical Matter* "Physical Changes"

→ **H20** *Liquids & Solids* "Melting Transition"

Teacher Note: The use of Gas Laws to achieve this standard is permissible, but not mandated.

→ **G6** *Gases* "Gas Pressure"

→ **G13** *Gases* "Pressure-Volume Relationship"

→ **G14** *Gases* "Boyle's Law"

→ **G16** *Gases* "Pressure and Temperature"

→ **G18** *Gases* "Avogadro's Law"

→ **G19** *Gases* "Universality of the Ideal Gas Law"

SC7 Students will characterize the properties that describe solutions and the nature of acids and bases.

a. Explain the process of dissolving in terms of solute/solvent interactions:

- Observe factors that effect the rate at which a solute dissolves in a specific solvent,

→ **I2** *Solutions* "Process of Dissolving"

- Express concentrations as molarities,

→ **I6** *Solutions* "Concentration of a Dissolved Pesticide"

- Prepare and properly label solutions of specified molar concentration,

→ **K1** *Acids & Bases* "Strong Acids"

- Relate molality to colligative properties.

→ **I7** *Solutions* "Molarity vs. Molality"

b. Compare, contrast, and evaluate the nature of acids and bases:

- Arrhenius, Bronsted-Lowry Acid/Bases

→ **K2** *Acids & Bases* "Comparing Oxoacids"

- Strong vs. weak acids/bases in terms of percent dissociation

→ **K1** *Acids & Bases* "Strong Acids"