

ODYSSEY Molecular Explorer

— Release 6 —

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.

→ **WORKSHEETS** *Atoms "Nuclei and Electrons"*

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

→ **WORKSHEETS** *Chemical Bonding "Exploring Ionic Interactions"*

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

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

→ **WORKSHEETS** *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).

→ **WORKSHEETS** *Chemical Matter* "Naming Molecular Compounds"

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

→ **DEMOS & VISUALS** *Kinetics* "What does a chemical reaction look like?"

→ **WORKSHEETS** *Kinetics* "Reactive Collisions Between Molecules"

→ **WORKSHEETS** *Kinetics* "Examining a Reaction Mechanism"

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

→ **CONCEPTS & APPLICATIONS** *Main Groups* "Alkali Metals"

→ **CONCEPTS & APPLICATIONS** *Main Groups* "Alkaline Earth Metals"

→ **CONCEPTS & APPLICATIONS** *Transition Metals* "d- and f-Blocks"

→ **CONCEPTS & APPLICATIONS** *Main Groups* "Boron Group"

→ **CONCEPTS & APPLICATIONS** *Main Groups* "Carbon Group"

→ **CONCEPTS & APPLICATIONS** *Main Groups* "Nitrogen Group"

→ **CONCEPTS & APPLICATIONS** *Main Groups* "Oxygen Group"

→ **CONCEPTS & APPLICATIONS** *Main Groups* "Halogens"

→ **CONCEPTS & APPLICATIONS** *Main Groups* "Noble Gases"

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.

→ **WORKSHEETS** *Chemical Matter* "Comparing the States of Matter"

→ **WORKSHEETS** *Chemical Matter* "Side-by-Side Comparison"

→ **WORKSHEETS** *Gases* "The Density of Liquids and Gases"

→ **WORKSHEETS** *Liquids & Solids* "Molecular Motion in the States of Matter"

→ **CONCEPTS & APPLICATIONS** *Liquids & Solids* "Compressibility"

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

- **WORKSHEETS** Gases "Gas Pressure"
- **WORKSHEETS** Gases "The Pressure-Volume Relationship"
- **WORKSHEETS** Gases "The Pressure-Temperature Relationship"
- **DEMOS & VISUALS** Gases "What is Boyle's Law?"
- **CONCEPTS & APPLICATIONS** Gases "Avogadro's Law"
- **CONCEPTS & APPLICATIONS** Gases "The Universality of the Ideal Gas Law"

SPS6 Students will investigate the properties of solutions.

a. Describe solutions in terms of

- solute/solvent
- conductivity
- concentration

- **DEMOS & VISUALS** *Solutions* "How do salts dissolve in water?"
- **WORKSHEETS** *Solutions* "Concentration of a Dissolved Pesticide"
- **CONCEPTS & APPLICATIONS** *Solutions* "Molarity vs. Molality"

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

- **WORKSHEETS** *Acids & Bases* "Strong Acids"
- **WORKSHEETS** *Acids & Bases* "Structure and Acidity"

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.

- **WORKSHEETS** *Thermochemistry* "Thermal Energy"
- **DEMOS & VISUALS** *Chemical Thermodynamics* "Spontaneity and disorder"

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

- **WORKSHEETS** *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.

→ **WORKSHEETS** *Chemical Matter* "Chemical and Physical 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)

→ **WORKSHEETS** *Chemical Matter* "Naming Molecular Compounds"

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

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

→ **WORKSHEETS** *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.

→ **WORKSHEETS** *Kinetics* "Examining a Reaction Mechanism"

f. Explain the role of equilibrium in chemical reactions.

→ **CONCEPTS & APPLICATIONS** *Equilibria* "The Dynamic Nature of Equilibria"

→ **WORKSHEETS** *Equilibria* "Equilibrium and Temperature"

→ **WORKSHEETS** *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.

→ **WORKSHEETS** *Atoms* "Nuclei and Electrons"

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

→ **WORKSHEETS** *Atoms* "s- and p-Orbitals"

→ **WORKSHEETS** *Atoms* "d-Orbitals"

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

→ **WORKSHEETS** *Atoms* "Nuclei and Electrons"

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

→ **WORKSHEETS** *Chemical Bonding* "Exploring Ionic Interactions"

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

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

→ **WORKSHEETS** *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.

→ **WORKSHEETS** *Kinetics* "Reactive Collisions Between Molecules"

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

→ **WORKSHEETS** *Kinetics* "Reactive Collisions Between Molecules"

→ **WORKSHEETS** *Kinetics* "Examining a Reaction Mechanism"

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.

→ **WORKSHEETS** *Chemical Matter* "Comparing the States of Matter"

→ **WORKSHEETS** *Chemical Matter* "Side-by-Side Comparison"

→ **WORKSHEETS** *Gases* "The Density of Liquids and Gases"

→ **WORKSHEETS** *Liquids & Solids* "Molecular Motion in the States of Matter"

→ **CONCEPTS & APPLICATIONS** *Liquids & Solids* "Compressibility"

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

→ **WORKSHEETS** *Kinetics* "Examining a Reaction Mechanism"

→ **WORKSHEETS** *Equilibria* "Equilibrium and Temperature"

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

→ **WORKSHEETS** *Liquids & Solids* "The Melting Transition"

→ **DEMOS & VISUALS** *Chemical Matter* "Physical changes"

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

→ **WORKSHEETS** *Gases* "Gas Pressure"

→ **WORKSHEETS** *Gases* "The Pressure-Volume Relationship"

→ **WORKSHEETS** *Gases* "The Pressure-Temperature Relationship"

→ **DEMOS & VISUALS** *Gases* "What is Boyle's Law?"

→ **CONCEPTS & APPLICATIONS** *Gases* "Avogadro's Law"

→ **CONCEPTS & APPLICATIONS** *Gases* "The 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,

→ **DEMOS & VISUALS** *Solutions* "How do salts dissolve in water?"

- Express concentrations as molarities,

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

- Prepare and properly label solutions of specified molar concentration,

→ **WORKSHEETS** *Acids & Bases* "Strong Acids"

- Relate molality to colligative properties.

→ **CONCEPTS & APPLICATIONS** *Solutions* "Molarity vs. Molality"

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

- Arrhenius, Bronsted-Lowry Acid/Bases

→ **WORKSHEETS** *Acids & Bases* "Structure and Acidity"

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

→ **WORKSHEETS** *Acids & Bases* "Strong Acids"