

ODYSSEY Molecular Explorer

— Release 6.2 —

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.

→ **LAB Atoms** "Nuclei and Electrons"

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

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

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

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

→ **LAB 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).

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

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

→ **DEMONSTRATION Kinetics** "What does a chemical reaction look like at the molecular level?"

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

→ **LAB 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

→ **MISCELLANEOUS Main Groups** "Alkali Metals"

→ **MISCELLANEOUS Main Groups** "Alkaline Earth Metals"

→ **MISCELLANEOUS Transition Metals** "Elements of the d- and f-Blocks"

→ **MISCELLANEOUS Main Groups** "Boron Group"

→ **MISCELLANEOUS Main Groups** "Carbon Group"

→ **MISCELLANEOUS Main Groups** "Nitrogen Group"

→ **MISCELLANEOUS Main Groups** "Oxygen Group"

→ **MISCELLANEOUS Main Groups** "Halogens"

→ **MISCELLANEOUS 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.

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

→ **LAB Chemical Matter** "Side-by-Side Comparison of Solids, Liquids, and Gases"

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

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

→ **MISCELLANEOUS Liquids & Solids** "Compressibility"

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

- **LAB Gases** "Gas Pressure"
- **LAB Gases** "The Pressure-Volume Relationship"
- **LAB Gases** "The Pressure-Temperature Relationship"
- **DEMONSTRATION Gases** "What is Boyle's Law?"
- **DEMONSTRATION Gases** "What is Avogadro's Law?"
- **MISCELLANEOUS 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

- **DEMONSTRATION Solutions** "How do salts dissolve in water?"
- **LAB Solutions** "Concentration of a Dissolved Pesticide"
- **MISCELLANEOUS Solutions** "Molarity vs. Molality"

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

- **LAB Acids & Bases** "Strong Acids"
- **LAB 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.

- **LAB Thermochemistry** "Thermal Energy"
- **DEMONSTRATION Chem. Thermodyn.** "Do all spontaneous processes involve a visible increase of disorder?"

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

- **LAB 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.

→ **LAB 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)

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

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

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

→ **LAB 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.

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

f. Explain the role of equilibrium in chemical reactions.

→ **MISCELLANEOUS Equilibria** "The Dynamic Nature of Equilibria"

→ **LAB Equilibria** "Equilibrium and Temperature"

→ **LAB 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.

→ **LAB Atoms** "Nuclei and Electrons"

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

→ **LAB Atoms** "s- and p-Orbitals"

→ **LAB Atoms** "d-Orbitals"

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

→ **LAB Atoms** "Nuclei and Electrons"

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

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

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

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

→ **LAB 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.

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

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

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

→ **LAB 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.

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

→ **LAB Chemical Matter** "Side-by-Side Comparison of Solids, Liquids, and Gases"

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

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

→ **MISCELLANEOUS Liquids & Solids** "Compressibility"

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

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

→ **LAB Equilibria** "Equilibrium and Temperature"

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

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

→ **DEMONSTRATION Chemical Matter** "Do physical changes affect the amount of matter?"

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

→ **LAB Gases** "Gas Pressure"

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

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

→ **DEMONSTRATION Gases** "What is Boyle's Law?"

→ **DEMONSTRATION Gases** "What is Avogadro's Law?"

→ **MISCELLANEOUS 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,

→ **DEMONSTRATION Solutions** "How do salts dissolve in water?"

- Express concentrations as molarities,

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

- Prepare and properly label solutions of specified molar concentration,

→ **LAB Acids & Bases** "Strong Acids"

- Relate molality to colligative properties.

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

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

- Arrhenius, Bronsted-Lowry Acid/Bases

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

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

→ **LAB** *Acids & Bases* "Strong Acids"