

ODYSSEY Molecular Explorer

— Release 6.2 —

Correlation with the
Arizona Science Standards
High School

Approved May 24, 2004

Physical Science

Concept 1: Structure and Properties of Matter

Understand physical, chemical, and atomic properties of matter.

1. Describe substances based on their physical properties.

→ **LAB Chemical Matter** "Chemical and Physical Properties"

2. Describe substances based on their chemical properties.

→ **LAB Chemical Matter** "Chemical and Physical Properties"

3. Predict properties of elements and compounds using trends of the periodic table (e.g., metals, non-metals, bonding – ionic/covalent).

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

4. Separate mixtures of substances based on their physical properties.

→ **MISCELLANEOUS Chemical Matter** "The Types of Mixtures"

6. Describe the following features and components of the atom:

- protons
- neutrons
- electrons
- mass
- number and type of particles
- structure
- organization

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

→ **LAB Atoms** "The Electron Cloud of an Argon Atom"

8. Explain the details of atomic structure (e.g., electron configuration, energy levels, isotopes).

→ **LAB Atoms** "s- and p-Orbitals"

→ **LAB Atoms** "The Electron Cloud of an Argon Atom"

→ **LAB Atoms** "d-Orbitals"

Concept 3: Conservation of Energy and Increase in Disorder

Understand ways that energy is conserved, stored, and transferred.

3. Recognize that energy is conserved in a closed system.

→ **DEMONSTRATION Thermochemistry** "What is the energy of a vibrating diatomic molecule?"

4. Calculate quantitative relationships associated with the conservation of energy.

→ **DEMONSTRATION Thermochemistry** "What is the energy of a vibrating diatomic molecule?"

5. Analyze the relationship between energy transfer and disorder in the universe (2nd Law of Thermodynamics).

→ **DEMONSTRATION Chemical Thermodynamics** "Are gas expansions irreversible?"

→ **DEMONSTRATION Chem. Thermodyn.** "Do all spontaneous processes involve a visible increase of disorder?"

6. Distinguish between heat and temperature.

→ **LAB Thermochemistry** "Thermal Energy"

7. Explain how molecular motion is related to temperature and phase changes.

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

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

→ **LAB Gases** "The Meaning of Temperature"

→ **LAB Gases** "Mean Speed and Temperature"

Concept 4: Chemical Reactions

Investigate relationships between reactants and products in chemical reactions.

1. Apply the law of conservation of matter to changes in a system.

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

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

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

3. Represent a chemical reaction by using a balanced equation.

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

4. Distinguish among the types of bonds (i.e., ionic, covalent, metallic, hydrogen bonding).

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

→ **DEMONSTRATION** *Atoms* "What does a hydrogen atom look like?"

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

→ **LAB** *Liquids & Solids* "Structure and Dynamics of Liquid Water"

→ **LAB** *Liquids & Solids* "Intermolecular Forces"

→ **MISCELLANEOUS** *Liquids & Solids* "Elements with Hydrogen Bonding"

6. Solve problems involving such quantities as moles, mass, molecules, volume of a gas, and molarity using the mole concept and Avogadro's number.

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

7. Predict the properties (e.g., melting point, boiling point, conductivity) of substances based upon bond type.

→ **MISCELLANEOUS** *Chemical Bonding* "Dipole Moments"

8. Quantify the relationships between reactants and products in chemical reactions (e.g., stoichiometry, equilibrium, energy transfers).

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

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

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

→ **LAB** *Equilibria* "Equilibrium and Pressure"

10. Explain the energy transfers within chemical reactions using the law of conservation of energy.

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

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

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

11. Predict the effect of various factors (e.g., temperature, concentration, pressure, catalyst) on the equilibrium state and on the rates of chemical reaction.

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

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

→ **LAB Equilibria** "Equilibrium and Pressure"

12. Compare the nature, behavior, concentration, and strengths of acids and bases.

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

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

Concept 5: Interactions of Energy and Matter

Understand the interactions of energy and matter.

4. Describe the basic assumptions of kinetic molecular theory.

→ **LAB Gases** "The Distribution of Kinetic Energies"

→ **LAB Gases** "The Meaning of Temperature"

→ **LAB Gases** "Mean Speed and Temperature"

5. Apply kinetic molecular theory to the behavior of matter (e.g., gas laws).

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

→ **DEMONSTRATION Gases** "Do gases have a definite volume?"

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

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

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

6. Analyze calorimetric measurements in simple systems and the energy involved in changes of state.

→ **LAB Thermochemistry** "Specific Heat"