

# ODYSSEY Molecular Explorer

— Release 6.2 —

Correlation with

## Indiana's Academic Standards for Science Grades 9-12

Adopted November 2000

Standard 1

### Principles of Chemistry

Students begin to conceptualize the general structure of the atom and the roles played by the main parts of the atom in determining the properties of materials. They investigate, through such methods as laboratory work, the nature of chemical changes and the role of energy in those changes.

#### Properties of Matter

1. Differentiate between pure substances and mixtures based on physical properties such as density, melting point, boiling point, and solubility.

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

2. Determine the properties and quantities of matter such as mass, volume, temperature, density, melting point, boiling point, conductivity, solubility, color, numbers of moles, and pH (calculate pH from the hydrogen-ion concentration), and designate these properties as either extensive or intensive.

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

4. Describe solutions in terms of their degree of saturation.

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

5. Describe solutions in appropriate concentration units (be able to calculate these units), such as molarity, percent by mass or volume, parts per million (ppm), or parts per billion (ppb).

→ **LAB** *Solutions* "Specifying the Molarity"

7. Use appropriate nomenclature when naming compounds.

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

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

→ **LAB** *Organic Chemistry* "Cyclic Hydrocarbons"

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

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

8. Use formulas and laboratory investigations to classify substances as metal or nonmetal, ionic or molecular, acid or base, and organic or inorganic.

→ *Many Stockroom Pages*

## The Nature of Chemical Change

9. Describe chemical reactions with balanced chemical equations.

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

16. Calculate the percent composition by mass of a compound or mixture when given the formula.

→ **LAB Chemical Matter** "Percent Composition"

17. Perform calculations that demonstrate an understanding of the relationship between molarity, volume, and number of moles of a solute in a solution.

→ **LAB Solutions** "Specifying the Molarity"

21. Predict how changes in temperature, surface area, and the use of catalysts will qualitatively affect the rate of a reaction.

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

## The Structure of Matter

26. Describe physical changes and properties of matter through sketches and descriptions of the involved materials.

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

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

27. Describe chemical changes and reactions using sketches and descriptions of the reactants and products.

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

28. Explain that chemical bonds between atoms in molecules, such as H<sub>2</sub>, CH<sub>4</sub>, NH<sub>3</sub>, C<sub>2</sub>H<sub>4</sub>, N<sub>2</sub>, Cl<sub>2</sub>, and many large biological molecules are covalent.

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

→ **LAB Chemical Bonding** "Electron Sharing in Molecules"

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

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

29. Describe dynamic equilibrium.

→ **DEMONSTRATION** *Liquids & Solids* "How does temperature affect the vapor pressure?"

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

30. Perform calculations that demonstrate an understanding of the gas laws. Apply the gas laws to relations between pressure, temperature, and volume of any amount of an ideal gas or any mixture of ideal gases.

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

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

→ **MISCELLANEOUS** *Gases* "The Universality of the Ideal Gas Law"

31. Use kinetic molecular theory to explain changes in gas volumes, pressure, and temperature (Solve problems using  $pV=nRT$ ).

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

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

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

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

32. Describe the possible subatomic particles within an atom or ion.

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

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

35. Infer and explain physical properties of substances, such as melting points, boiling points, and solubility, based on the strength of molecular attractions.

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

36. Describe the nature of ionic, covalent, and hydrogen bonds and give examples of how they contribute to the formation of various types of compounds.

→ **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"

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

## The Nature of Energy and Change

39. Solve problems involving heat flow and temperature changes, using known values of specific heat and latent heat of phase change.

→ **LAB** *Thermochemistry* "Specific Heat"

40. Classify chemical reactions and/or phase changes as exothermic or endothermic.

- **LAB Kinetics** "Reactive Collisions Between Molecules"
- **LAB Kinetics** "Examining a Reaction Mechanism"
- **LAB Equilibria** "Equilibrium and Temperature"

## The Basic Structures and Reactions of Organic Chemicals

44. Convert between formulas and names of common organic compounds.

- **LAB Organic Chemistry** "Straight-Chain Alkanes"
- **LAB Organic Chemistry** "Cyclic Hydrocarbons"
- **LAB Organic Chemistry** "Isomers of the Alkanes"
- **LAB Organic Chemistry** "Isomers of Alkenes and Alkynes"

45. Recognize common functional groups and polymers when given chemical formulas and names.

- **LAB Organic Chemistry** "Functional Groups"
- **LAB Organic Chemistry** "Comparing and Identifying Organic Compounds"