Wavefunction, Inc.
www.wavefun.com

ODYSSEY Molecular Explorer

— Release 6.2 —

Correlation with the

Alabama Course of Study: Science

Grades 9-12

Adopted February 2005

Chemistry Core

Students will:

1. Differentiate among pure substances, mixtures, elements, and compounds.

Objective C.1.1: Define substance, mixture, element, and compound.

→ **MISCELLANEOUS** *Chemical Matter* "Examples of Chemical Elements"
→ **MISCELLANEOUS** *Chemical Matter* "The Types of Compounds"
→ **MISCELLANEOUS** *Chemical Matter* "The Types of Mixtures"

Objective C.1.2: Compare mixtures and compounds.

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

Additional content to be taught:

• Distinguishing between intensive and extensive properties of matter

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

• Distinguishing between homogeneous and heterogeneous forms of matter

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

2. Describe the structure of carbon chains, branched chains, and rings.

Objective C.2.1: Describe types of covalent bonding between carbon atoms as single, double, or triple bonds.

⟶ **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"

3. Use the periodic table to identify periodic trends, including atomic radii, ionization energy, electronegativity, and energy levels.

Objective C.3.1: Define atomic radii, ionization energy, electronegativity, and energy levels.

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

Additional content to be taught:

• Utilizing electron configurations, Lewis dot structures, and orbital notations to write chemical formulas

⟶ **LAB** *Chemical Bonding* "Comparing Conceivable Shapes for a Molecule"

⟶ *Many Stockroom Pages*

• Calculating the number of protons, neutrons, and electrons in an isotope

⟶ **LAB** *Atoms* "Nuclei and Electrons"

4. Describe solubility in terms of energy changes associated with the solution process.

Objective C.4.1: Define solute, unsaturated, supersaturated, exothermic, exergonic, and endogonic.

⟶ **LAB** *Solutions* "Specifying the Molarity"

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

Objective C.4.2: Identify solute and solvent particle interactions as energy-releasing processes.

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

Objective C.4.3: Relate energy release to the solvating process.

⟶ **Miscellaneous** *Solutions* "Energetics of Solutions"

Additional content to be taught:

• Describing acids and bases in terms of strength, concentration, pH, and neutralization reactions

⟶ **Lab** *Acids & Bases* "Strong Acids"

⟶ **Miscellaneous** *Acids & Bases* "Oxoacids"

• Describing factors that affect the rate of solution

⟶ **Demonstration** *Solutions* "How do salts dissolve in water?"

• Solving problems involving molarity, including solution preparation and dilution

⟶ **Lab** *Solutions* "Specifying the Molarity"

5. Use the kinetic theory to explain states of matter, phase changes, solubility, and chemical reactions.

Example: water at 25 degrees Celsius remains in the liquid state because of the strong attraction between water molecules while kinetic energy allows the sliding of molecules past one another

Objective C.5.1: State the kinetic theory of matter.

⟶ **Lab** *Thermochemistry* "Thermal Energy"

⟶ **Lab** *Gases* "Gas Pressure"

⟶ **Lab** *Gases* "The Meaning of Temperature"

Objective C.5.2: Describe states of matter based on kinetic energy of particles in matter.

⟶ **Lab** *Chemical Matter* "Side-by-Side Comparison of Solids, Liquids, and Gases

⟶ **Lab** *Chemical Matter* "Comparing the States of Matter"

⟶ **Lab** *Liquids & Solids* "Molecular Motion in the States of Matter"

Objective C.5.3: Describe phase changes in terms of energy absorption or release.

⟶ **Lab** *Liquids & Solids* "The Melting Transition"

⟶ **Demonstration** *Chemical Matter* "Do physical changes affect the amount of matter?"

Objective C.5.4: Explain the effect of temperature on solubility and rate of reaction.

⟶ **Lab** *Kinetics* "Reactive Collisions Between Molecules"

6. Solve stoichiometric problems involving relationships among the number of particles, moles, and masses of reactants and products in a chemical reaction.

Objective C.6.1: Define stoichiometry, reactant, and products.

⟶ **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"

Additional content to be taught:

• Predicting ionic and covalent bond types and products given known reactants

⟶ **Lab** *Chemical Bonding* "Polar Bonds and Molecules"

⟶ **Lab** *Chemical Bonding* "Classifying by Bond Polarity"

• Assigning oxidation numbers for individual atoms of monatomic and polyatomic ions

⟶ **Lab** *Chemical Bonding* "Polyatomic Ions"

• Identifying the nomenclature of ionic compounds, binary compounds, and acids

⟶ **Lab** *Chemical Matter* "Naming Molecular Compounds"

⟶ *Many Stockroom Pages*

• Classifying chemical reactions as composition, decomposition, single replacement, or double replacement

⟶ **Demonstration** *Solutions* "How do salts dissolve in water?"

• Determining the empirical or molecular formula for a compound using percent composition data

⟶ **Lab** *Chemical Matter* "Percent Composition"

7. Explain the behavior of ideal gases in terms of pressure, volume, temperature, and number of particles using Charles's law, Boyle's law, Gay-Lussac's law, the combined gas law, and the ideal gas law.

Objective C.7.1: Relate gas laws to the appropriate formula.

⟶ **Lab** *Gases* "The Pressure-Volume Relationship"

⟶ **Lab** *Gases* "The Pressure-Temperature Relationship"

⟶ **Miscellaneous** *Gases* "The Universality of the Ideal Gas Law"

Objective C.7.2: Explain the effect of a change in pressure, volume, or temperature on other quantities in each formula.

⟶ **Demonstration** *Gases* "What is Boyle's Law?"

⟶ **Demonstration** *Gases* "What is Avogadro's Law?"

8. Distinguish among endothermic and exothermic physical and chemical changes.

Examples: endothermic physical—phase change from ice to water, endothermic chemical—reaction between citric acid solution and baking soda, exothermic physical—phase change from water vapor to water, exothermic chemical—formation of water from combustion of hydrogen and oxygen

Objective C.8.2: Describe physical and chemical changes in terms of endothermic and exothermic processes.

⟶ **Lab** *Kinetics* "Reactive Collisions Between Molecules"

⟶ **Lab** *Kinetics* "Examining a Reaction Mechanism"

⟶ **Lab** *Equilibria* "Equilibrium and Temperature"

Objective C.8.3: Compare chemical and physical properties of matter.

⟶ **Lab** *Chemical Matter* "Chemical and Physical Properties"

Objective C.8.4: Differentiate between chemical and physical changes of matter.

⟶ **Lab** *Liquids & Solids* "The Melting Transition"

⟶ **Demonstration** *Chemical Matter* "Do physical changes affect the amount of matter?"

⟶ **Demonstration** *Kinetics* "What does a chemical reaction look like at the molecular level?"

Additional content to be taught:

• Calculating temperature change by using specific heat

⟶ **Lab** *Thermochemistry* "Specific Heat"

• Using Le Châtelier's principle to explain changes in physical and chemical equilibrium

⟶ **Lab** *Equilibria* "Equilibrium and Temperature"

⟶ **Lab** *Equilibria* "Equilibrium and Pressure"

9. Distinguish between chemical and nuclear reactions.

Objective C..9.1: Describe the structure of atoms, including the location of protons, neutrons, and electrons.

⟶ **LAB** *Atoms* "Nuclei and Electrons"

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

Objective C.9.3: Identify the role of electrons in chemical reactions.

⟶ **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"