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ODYSSEY Molecular Explorer

— Release 6.2 —

Correlation with the

South Carolina Science Academic Standards

High School

November 2005

Chemistry

Standard C-2

Students will demonstrate an understanding of atomic structure and nuclear processes.

Indicators

C-2.1 Illustrate electron configurations by using orbital notation for representative elements.

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

→ **LAB** *Atoms* "Atomic Orbitals"

C-2.2 Summarize atomic properties (including electron configuration, ionization energy, electron affinity, atomic size, and ionic size).

→ **LAB** *Atoms* "d-Orbitals"

→ **LAB** *Periodicity* "Atomic Radii"

C-2.3 Summarize the periodic table's property trends (including electron configuration, ionization energy, electron affinity, atomic size, ionic size, and reactivity).

→ **LAB** *Atoms* "s- and p-Orbitals"

→ **LAB** *Periodicity* "Atomic Radii"

Standard C-3

The student will demonstrate an understanding of the structures and classifications of chemical compounds.

Indicators

C-3.1 Predict the type of bonding (ionic or covalent) and the shape of simple compounds by using Lewis dot structures and oxidation numbers.

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

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

C-3.2 Interpret the names and formulas for ionic and covalent compounds.

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

→ **STOCKROOM** *Many Pages*

C-3.3 Explain how the types of intermolecular forces present in a compound affect the physical properties of compounds (including polarity and molecular shape).

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

→ **MISCELLANEOUS** *Liquids & Solids* "Elements with HydrogenBonding"

→ **DEMONSTRATION** *Liquids & Solids* "How different are ice and liquid water?"

C-3.4 Explain the unique bonding characteristics of carbon that have resulted in the formation of a large variety of organic structures.

→ **LAB** *Organic Chem.* "Bonding Characteristics of Carbon"

C-3.5 Illustrate the structural formulas and names of simple hydrocarbons (including alkanes and their isomers and benzene rings).

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

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

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

The following indicators should be selected as appropriate to a particular course for additional content and depth:

C-3.6 Identify the basic structure of common polymers (including proteins, nucleic acids, plastics, and starches).

→ **LAB** *Biochemistry* "Starch"

→ **LAB** *Biochemistry* "Building a Model of a Protein"

→ **LAB** *Biochemistry* "Building a Model of DNA"

→ **STOCKROOM** *Organic* "Polyolefins"

→ **STOCKROOM** *Organic* "Polyamides"

→ **STOCKROOM** *Organic* "Polycarbonates"

C-3.7 Classify organic compounds in terms of their functional group.

→ **LAB** *Organic Chemistry* "Functional Groups"

→ **LAB** *Organic Chemistry* "Comparing and Identifying Organic Compounds"

C-3.8 Explain the effect of electronegativity and ionization energy on the type of bonding in a molecule.

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

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

Standard C-4

The student will demonstrate an understanding of the types, the causes, and the effects of chemical reactions.

Indicators

C-4.1 Analyze and balance equations for simple synthesis, decomposition, single replacement, double replacement, and combustion reactions.

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

C-4.3 Analyze the energy changes (endothermic or exothermic) associated with chemical reactions.

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

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

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

C-4.4 Apply the concept of moles to determine the number of particles of a substance in a chemical reaction, the percent composition of a representative compound, the mass proportions, and the mole-mass relationships.

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

C-4.6 Explain the role of activation energy and the effects of temperature, particle size, stirring, concentration, and catalysts in reaction rates.

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

The following indicators should be selected as appropriate to a particular course for additional content and depth:

C-4.9 Summarize the concept of chemical equilibrium and Le Châtelier's principle.

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

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

C-4.10 Explain the role of collision frequency, the energy of collisions, and the orientation of molecules in reaction rates.

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

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

Standard C-5

The student will demonstrate an understanding of the structure and behavior of the different phases of matter.

Indicators

C-5.1 Explain the effects of the intermolecular forces on the different phases of matter.

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

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

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

C-5.2 Explain the behaviors of gas; the relationship among pressure, volume, and temperature; and the significance of the Kelvin (absolute temperature) scale, using the kinetic-molecular theory as a model.

→ **LAB** *Gases* "Temperature Scales in Chemistry"

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

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

C-5.3 Apply the gas laws to problems concerning changes in pressure, volume, or temperature (including Charles's law, Boyle's law, and the combined gas law).

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

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

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

The following indicators should be selected as appropriate to a particular course for additional content and depth:

C-5.5 Analyze the energy changes involved in calorimetry by using the law of conservation of energy as it applies to temperature, heat, and phase changes (including the use of the formulas $q = mc\Delta T$ [temperature change] and $q = mLv$ and $q = mLf$ [phase change] to solve calorimetry problems).

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

C-5.7 Apply the ideal gas law ($pV = nRT$) to solve problems.

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

Standard C-6

The student will demonstrate an understanding of the nature and properties of various types of chemical solutions.

Indicators

C-6.1 Summarize the process by which solutes dissolve in solvents, the dynamic equilibrium that occurs in saturated solutions, and the effects of varying pressure and temperature on solubility.

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

C-6.2 Compare solubility of various substances in different solvents (including polar and nonpolar solvents and organic and inorganic substances).

→ **MISCELLANEOUS** *Solutions* "Miscible and Nonmiscible Liquids"

→ **STOCKROOM** *Organic* "Common Solvents"

→ **STOCKROOM** *Mixtures*

C-6.4 Carry out calculations to find the concentration of solutions in terms of molarity and percent weight (mass).

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

C-6.5 Summarize the properties of salts, acids, and bases.

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

→ **MISCELLANEOUS** *Acids & Bases* "Oxoacids"

C-6.6 Distinguish between strong and weak common acids and bases.

→ **MISCELLANEOUS** *Acids & Bases* "Oxoacids"

C-6.7 Represent common acids and bases by their names and formulas.

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