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ODYSSEY Molecular Explorer

— Release 6.2 —

Correlation with the Pennsylvania

Academic Standards for Science and Technology

January 5, 2002

3.4 Physical Science, Chemistry and Physics

Grade 10

A. Explain concepts about the structure and properties of matter.

- Know that atoms are composed of even smaller sub-atomic structures whose properties are measurable.

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

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

- Predict the behavior of gases through the use of Boyle's, Charles' or the ideal gas law, in everyday situations.

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

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

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

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

- Describe phases of matter according to the Kinetic Molecular Theory.

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

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

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

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

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

- Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent).

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

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

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

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

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

- Describe various types of chemical reactions by applying the laws of conservation of mass and energy.

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

- Understand that carbon can form several types of compounds.

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

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

→ **Lab** *Organic Chemistry* "Cyclic Hydrocarbons"

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

B. Analyze energy sources and transfers of heat.

- Evaluate energy changes in chemical reactions.

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

→ **Lab** *Equilibria* "Equilibrium and Temperature"

Grade 12

A. Apply concepts about the structure and properties of matter.

- Apply rules of systematic nomenclature and formula writing to chemical substances.

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

- Explain how the forces that bind solids, liquids and gases affect their properties.

→ **Miscellaneous** *Liquids & Solids* "Compressibility"

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

→ **Lab** *Liquids & Solids* "Dipole-Dipole Forces"

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

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

- Characterize and identify important classes of compounds (e.g., acids, bases, salts).

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

⟶ **LAB** *Acids & Bases* "Strong Acids"

- Quantify the properties of matter (e.g., density, solubility coefficients) by applying mathematical formulas.

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

B. Apply and analyze energy sources and conversions and their relationship to heat and temperature.

- Determine the heat involved in illustrative chemical reactions.

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

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

⟶ **LAB** *Equilibria* "Equilibrium and Temperature"

- Apply appropriate thermodynamic concepts (e.g., conservation, entropy) to solve problems relating to energy and heat.

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

⟶ **LAB** *Thermochemistry* "Thermal Energy"

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