

ODYSSEY Molecular Explorer

— Release 6.2 —

Correlation with the

Louisiana Science Content Standards

Promulgated November 2005

Physical Science

Benchmarks 9-12

As students in Grades 9-12 extend their knowledge and abilities, what they know and are able to do includes:

2. Atomic Structure:

- a. describing the structure of the atom and identifying and characterizing the particles that compose it (including the structure and properties of isotopes)

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

→ **LAB Atoms** "Isotopes"

- c. understanding that an atom's electron configuration, particularly that of the outermost electrons, determines the chemical properties of that atom

→ **LAB Atoms** "Atomic Orbitals"

→ **LAB Atoms** "s- and p-Orbitals"

→ **LAB Atoms** "d-Orbitals"

3. The Structure and Properties of Matter:

- a. distinguishing among elements, compounds, and/or mixtures

→ **MISCELLANEOUS Chemical Matter** "Examples of Chemical Elements"

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

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

- c. understanding that physical properties of substances reflect the nature of interactions among its particles

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

e. understanding that chemical bonds are formed between atoms when the outermost electrons are transferred or shared to produce ionic and covalent compounds

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

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

f. recognizing that carbon atoms can bond to one another in chains, rings, and branching networks to form a variety of structures

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

g. using the kinetic theory to describe the behavior of atoms and molecules during phase changes and to describe the behavior of matter in its different phases

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

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

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

→ **LAB Liquids & Solids** "Comparing Salt Crystals"

→ **DEMONSTRATION Liquids & Solids** "Do liquids have a definite volume or shape?"

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

4. Chemical Reactions:

d. analyzing the factors that affect the rate and equilibrium of a chemical reaction

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

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

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

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

6. Energy:

b. applying the universal law of conservation of matter, energy, and momentum, and recognizing their implications

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

Grade Level Expectations

Physical Science (Grade 9)

Measurement and Symbolic Representation

1. Measure the physical properties of different forms of matter in metric system units (e.g., length, mass, volume, temperature)

→ **LAB Gases** "Gas Pressure"

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

2. Gather and organize data in charts, tables, and graphs

→ *Many Labs*

Atomic Structure

5. Identify the three subatomic particles of an atom by location, charge, and relative mass

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

6. Determine the number of protons, neutrons, and electrons of elements by using the atomic number and atomic mass from the periodic table

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

The Structure and Properties of Matter

11. Investigate and classify common materials as *elements*, *compounds*, or *mixtures* (heterogeneous or homogeneous) based on their physical and chemical properties

→ **MISCELLANEOUS Chemical Matter** "Examples of Chemical Elements"

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

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

17. Name and predict the bond type formed between selected elements based on their locations in the periodic table

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

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

18. Diagram or construct models of simple hydrocarbons (four or fewer carbons) with single, double, or triple bonds

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

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

19. Analyze and interpret a graph that relates temperature and heat energy absorbed during phase changes of water

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

20. Predict the particle motion as a substance changes phases

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

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

Chemical Reactions

21. Classify changes in matter as *physical* or *chemical*

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

27. Distinguish between endothermic and exothermic reactions

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

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

Energy

38. Analyze diagrams to identify changes in kinetic and potential energy

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

39. Distinguish among thermal, chemical, electromagnetic, mechanical, and nuclear energy

→ **LAB** *Thermochemistry* "Thermal Energy"

Chemistry (Grades 11-12)

Atomic Structure

13. Identify the number of bonds an atom can form given the number of valence electrons

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

The Structure and Properties of Matter

14. Identify unknowns as elements, compounds, or mixtures based on physical properties (e.g., density, melting point, boiling point, solubility)

→ **MISCELLANEOUS** *Chemical Matter* "Examples of Chemical Elements"

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

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

20. Express concentration in terms of molarity, molality, and normality

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

22. Predict the kind of bond that will form between two elements based on electronic structure and electronegativity of the elements (e.g., ionic, polar, nonpolar)

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

23. Model chemical bond formation by using Lewis dot diagrams for ionic, polar, and nonpolar compounds

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

24. Describe the influence of intermolecular forces on the physical and chemical properties of covalent compounds

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

25. Name selected structural formulas of organic compounds

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

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

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

26. Differentiate common biological molecules, such as carbohydrates, lipids, proteins, and nucleic acids by using structural formulas

→ **MISCELLANEOUS Biochemistry** "Carbohydrates"

→ **LAB Biochemistry** "Starch"

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

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

28. Name, classify, and diagram *alkanes*, *alkenes*, and *alkynes*

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

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

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

29. Predict the properties of a gas based on gas laws (e.g., temperature, pressure, volume)

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

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

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

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

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

→ **LAB Thermochemistry** "Specific Heat"

Chemical Reactions

31. Describe chemical changes and reactions using diagrams and descriptions of the reactants, products, and energy changes

→ **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"

37. Predict the direction of a shift in equilibrium in a system as a result of stress by using LeChatelier's principle

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

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

40. Compute percent composition, empirical formulas, and molecular formulas of selected compounds in chemical reactions

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

42. Differentiate between activation energy in endothermic reactions and exothermic reactions

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

Forces and Motion

46. Identify and compare intermolecular forces and their effects on physical and chemical properties

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

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

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