

# **ODYSSEY Molecular Explorer**

— Release 6 —

*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)

→ **WORKSHEETS** *Atoms* "Nuclei and Electrons"

→ **WORKSHEETS** *Atoms* "Isotopes"

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

→ **WORKSHEETS** *Atoms* "Atomic Orbitals"

→ **WORKSHEETS** *Atoms* "s- and p-Orbitals"

→ **WORKSHEETS** *Atoms* "d-Orbitals"

#### **3. The Structure and Properties of Matter:**

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

→ **CONCEPTS & APPLICATIONS** *Chemical Matter* "Examples of Elements"

→ **CONCEPTS & APPLICATIONS** *Chemical Matter* "The Types of Compounds"

→ **CONCEPTS & APPLICATIONS** *Chemical Matter* "The Types of Mixtures"

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

→ **WORKSHEETS** *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

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

→ **WORKSHEETS** *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

→ **WORKSHEETS** *Organic Chemistry* "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

→ **WORKSHEETS** *Chemical Matter* "Side-by-Side Comparison"

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

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

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

→ **DEMOS & VISUALS** *Liquids & Solids* "Do liquids have a volume or shape?"

→ **WORKSHEETS** *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

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

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

→ **WORKSHEETS** *Equilibria* "Equilibrium and Temperature"

→ **WORKSHEETS** *Equilibria* "Equilibrium and Pressure"

#### 6. Energy:

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

→ **DEMOS & VISUALS** *Thermochemistry* "Energy of a Vibrating Diatomic"

## 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)

→ **WORKSHEETS Gases "Gas Pressure"**

→ **WORKSHEETS 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

→ **WORKSHEETS 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

→ **WORKSHEETS 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

→ **CONCEPTS & APPLICATIONS Chemical Matter "Examples of Elements"**

→ **CONCEPTS & APPLICATIONS Chemical Matter "The Types of Compounds"**

→ **CONCEPTS & APPLICATIONS 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

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

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

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

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

→ **WORKSHEETS 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

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

20. Predict the particle motion as a substance changes phases

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

→ **DEMOS & VISUALS Chemical Matter "Physical Changes"**

## Chemical Reactions

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

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

27. Distinguish between endothermic and exothermic reactions

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

→ **WORKSHEETS** *Equilibria* "Equilibrium and Temperature"

## Energy

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

→ **DEMOS & VISUALS** *Thermochemistry* "Energy of a Vibrating Diatomic"

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

→ **WORKSHEETS** *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

→ **WORKSHEETS** *Chemical Bonding* "Comparing 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)

→ **CONCEPTS & APPLICATIONS** *Chemical Matter* "Examples of Elements"

→ **CONCEPTS & APPLICATIONS** *Chemical Matter* "The Types of Compounds"

→ **CONCEPTS & APPLICATIONS** *Chemical Matter* "The Types of Mixtures"

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

→ **WORKSHEETS** *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)

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

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

→ **WORKSHEETS** *Chemical Bonding* "Comparing Shapes for a Molecule"

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

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

25. Name selected structural formulas of organic compounds

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

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

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

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

→ **CONCEPTS & APPLICATIONS** *Biochemistry* "Carbohydrates"

→ **WORKSHEETS** *Biochemistry* "Starch"

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

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

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

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

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

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

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

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

→ **DEMOS & VISUALS** *Gases* "What is Boyle's Law?"

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

→ **CONCEPTS & APPLICATIONS** *Gases* "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

→ **WORKSHEETS** *Thermochemistry* "Specific Heat"

## Chemical Reactions

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

→ **DEMOS & VISUALS** *Kinetics* "What does a chemical reaction look like?"

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

→ **WORKSHEETS** *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

→ **WORKSHEETS** *Equilibria* "Equilibrium and Temperature"

→ **WORKSHEETS** *Equilibria* "Equilibrium and Pressure"

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

→ **WORKSHEETS** *Chemical Matter* "Percent Composition"

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

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

## Forces and Motion

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

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

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

→ **CONCEPTS & APPLICATIONS** *Liquids & Solids* "Elements with H-Bonding"