

ODYSSEY Molecular Explorer

— Release 6.2 —

Correlation with the

Nebraska Science Standards

Grades 9-12

Adopted May 8, 1998

12.3 Physical Science

Physical science focuses on the science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

12.3.1 By the end of twelfth grade, students will develop an understanding of the structure of the atom.

Example Indicators:

- Investigate and describe the structure of atoms, focusing on properties of subatomic particles.
 - **LAB Atoms** "Nuclei and Electrons"
 - **LAB Atoms** "The Electron Cloud of an Argon Atom"
- Investigate and describe the effect of electrical and nuclear forces which hold atoms together.
 - **LAB Atoms** "The Electron Cloud of an Argon Atom"

12.3.2 By the end of twelfth grade, students will develop an understanding of the structure and properties of matter.

Example Indicators:

- Investigate and understand that atoms interact with one another by transferring or sharing electrons.
 - **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"

- Investigate and explain the periodic table of elements in terms of repeating patterns of physical and chemical properties.
 - **MISCELLANEOUS** *Chemical Matter* "Examples of Chemical Elements"
 - **MISCELLANEOUS** *Main Groups* "Alkali Metals"
 - **MISCELLANEOUS** *Main Groups* "Alkaline Earth Metals"
 - **MISCELLANEOUS** *Main Groups* "Boron Group"
 - **MISCELLANEOUS** *Main Groups* "Carbon Group"
 - **MISCELLANEOUS** *Main Groups* "Nitrogen Group"
 - **MISCELLANEOUS** *Main Groups* "Oxygen Group"
 - **MISCELLANEOUS** *Main Groups* "Halogens"
 - **MISCELLANEOUS** *Main Groups* "Noble Gases"
 - **MISCELLANEOUS** *Transition Metals* "Elements of the d- and f-Blocks"
- Investigate and describe how the structure of an atom determines the chemical properties of an element.
 - **DEMONSTRATION** *Atoms* "What does a hydrogen atom look like?"
 - **LAB** *Atoms* "Atomic Orbitals"
 - **LAB** *Atoms* "s- and p-Orbitals"
 - **LAB** *Atoms* "d-Orbitals"
- Investigate and explain how the interactions among the molecules of a compound determine its physical and chemical properties.
 - **LAB** *Liquids & Solids* "Intermolecular Forces"
 - **MISCELLANEOUS** *Liquids & Solids* "Elements with Hydrogen Bonding"
 - **DEMONSTRATION** *Liquids & Solids* "How different are ice and liquid water?"
- Investigate and use changes in energy to explain the differences among the states 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* "Molecular Motion in the States of Matter"
 - **LAB** *Liquids & Solids* "The Melting Transition"
 - **DEMONSTRATION** *Chemical Matter* "Do physical changes affect the amount of matter?"
- Investigate and describe the bonding of carbon atoms in chains and rings to produce compounds essential to life.
 - **LAB** *Organic Chem.* "Bonding Characteristics of Carbon"
 - **LAB** *Organic Chemistry* "Straight-Chain Alkanes"
 - **LAB** *Organic Chemistry* "Cyclic Hydrocarbons"
 - **LAB** *Biochemistry* "Starch"

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

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

12.3.3 By the end of twelfth grade, students will develop an understanding of chemical reactions.

Example Indicators:

- Investigate and describe common chemical reactions.
 - **DEMONSTRATION Kinetics** "What does a chemical reaction look like at the molecular level?"
 - **LAB Kinetics** "Reactive Collisions Between Molecules"
- Investigate and describe the change of energy as a result of chemical reactions.
 - **LAB Kinetics** "Reactive Collisions Between Molecules"
 - **LAB Kinetics** "Examining a Reaction Mechanism"
 - **LAB Equilibria** "Equilibrium and Temperature"
- Investigate and describe how electrons are involved in bond formation during chemical reactions.
 - **LAB Kinetics** "Examining a Reaction Mechanism"
- Investigate and describe the factors influencing the rates of chemical reactions, including catalysts.
 - **LAB Kinetics** "Reactive Collisions Between Molecules"

12.3.5 By the end of twelfth grade, students will develop an understanding of the conservation of energy and increase in disorder.

Example Indicators:

- Understand that the total energy in the universe is constant and can never be destroyed.
 - **DEMONSTRATION Thermochemistry** "What is the energy of a vibrating diatomic molecule?"
- Investigate and distinguish between kinetic energy and potential energy.
 - **DEMONSTRATION Thermochemistry** "What is the energy of a vibrating diatomic molecule?"
 - **LAB Thermochemistry** "Thermal Energy"
- Investigate and give examples of how systems tend to become more disorderly over time.
 - **DEMONSTRATION Chem. Thermodyn.** "Do all spontaneous processes involve a visible increase of disorder?"
 - **DEMONSTRATION Chemical Thermodynamics** "Are gas expansions irreversible?"