

ODYSSEY Molecular Explorer

— Release 7.0 —

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.
 - **D2** *Atoms* "Distribution of Mass in Atoms"
 - **D5** *Atoms* "Electron Cloud of Argon"
- Investigate and describe the effect of electrical and nuclear forces which hold atoms together.
 - **D5** *Atoms* "Electron Cloud of Argon"

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.
 - **F1** *Chemical Bonding* "The Attraction Between Ions"
 - **F7** *Chemical Bonding* "Electron Sharing"
 - **F8** *Chemical Bonding* "Energetics of Covalent Bonding"
 - **F11** *Chemical Bonding* "Polar Bonds and Molecules"
 - **F13** *Chemical Bonding* "Classifying by Bond Polarity"

- Investigate and explain the periodic table of elements in terms of repeating patterns of physical and chemical properties.
 - **C3** *Chemical Matter* "Examples of Elements"
 - **P1** *Main Groups & Transition Metals* "Alkali Metals"
 - **P2** *Main Groups & Transition Metals* "Alkaline Earth Metals"
 - **P3** *Main Groups & Transition Metals* "Boron Group"
 - **P4** *Main Groups & Transition Metals* "Carbon Group"
 - **P6** *Main Groups & Transition Metals* "Nitrogen Group"
 - **P7** *Main Groups & Transition Metals* "Oxygen Group"
 - **P10** *Main Groups & Transition Metals* "Halogens"
 - **P11** *Main Groups & Transition Metals* "Noble Gases"
 - **P12** *Main Groups & 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.
 - **D4** *Atoms* "Hydrogen Atom"
 - **D8** *Atoms* "Atomic Orbitals"
 - **D9** *Atoms* "Comparing Helium, Neon, and Argon"
 - **D14** *Atoms* "Orbitals of a Krypton Atom"
- Investigate and explain how the interactions among the molecules of a compound determine its physical and chemical properties.
 - **H11** *Liquids & Solids* "Intermolecular Forces"
 - **H14** *Liquids & Solids* "Elements with Hydrogen Bonding"
 - **H21** *Liquids & Solids* "Comparing Ice and Liquid Water"
- Investigate and use changes in energy to explain the differences among the states of matter.
 - **C7** *Chemical Matter* "Comparing States Side-by-Side"
 - **C6** *Chemical Matter* "States of Matter"
 - **C13** *Chemical Matter* "Physical Changes"
 - **H9** *Liquids & Solids* "Molecular Motion and Physical States"
 - **H20** *Liquids & Solids* "Melting Transition"
- Investigate and describe the bonding of carbon atoms in chains and rings to produce compounds essential to life.
 - **S1** *Organic Chemistry* "How Special is Carbon?"
 - **S2** *Organic Chemistry* "Straight-Chain Alkanes"
 - **S3** *Organic Chemistry* "Cyclic Hydrocarbons"
 - **T4** *Biochemistry* "Starch"
 - **T10** *Biochemistry* "Building a Model of a Protein"

→ **T24** *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.
 - **M1** *Kinetics* "Observing a Reaction"
 - **M2** *Kinetics* "Reactive Collisions"
- Investigate and describe the change of energy as a result of chemical reactions.
 - **M2** *Kinetics* "Reactive Collisions"
 - **M3** *Kinetics* "Mechanism of a Reaction"
 - **N2** *Equilibria* "Equilibrium and Temperature"
- Investigate and describe how electrons are involved in bond formation during chemical reactions.
 - **M3** *Kinetics* "Mechanism of a Reaction"
- Investigate and describe the factors influencing the rates of chemical reactions, including catalysts.
 - **M2** *Kinetics* "Reactive Collisions"

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.
 - **L4** *Thermochemistry* "Vibrating Diatomic Molecule"
- Investigate and distinguish between kinetic energy and potential energy.
 - **L2** *Thermochemistry* "Thermal Energy"
 - **L4** *Thermochemistry* "Vibrating Diatomic Molecule"
- Investigate and give examples of how systems tend to become more disorderly over time.
 - **01** *Chemical Thermodynamics* "Gas Expansions"
 - **03** *Chemical Thermodynamics* "Heat Conduction"