

ODYSSEY Molecular Explorer

— Release 7.0 —

Correlation with the
North Carolina Science Standards
Revised 2004

PHYSICAL SCIENCE

Grades 9-12

COMPETENCY GOAL 3

The learner will analyze energy and its conservation.

3.01 Investigate and analyze storage of energy:

- Kinetic energy.
- Potential energies: gravitational, chemical, electrical, elastic, nuclear.
- Thermal energy.

→ **G12** *Gases* "Mean Speed and Temperature"

→ **L2** *Thermochemistry* "Thermal Energy"

COMPETENCY GOAL 5

The learner will build an understanding of the structure and properties of matter.

5.01 Develop an understanding of how scientific processes have led to the current atomic theory.

- Dalton's atomic theory.
- J.J. Thomson's model of the atom.
- Rutherford's gold foil experiment
- Bohr's planetary model.
- Electron cloud model.

→ **D2** *Atoms* "Distribution of Mass in Atoms"

→ **D5** *Atoms* "Electron Cloud of Argon"

5.02 Examine the nature of atomic structure:

- Protons.

- Neutrons.
- Electrons.
- Atomic mass.
- Atomic number.
- Isotopes.

→ **D2** *Atoms* "Distribution of Mass in Atoms"

→ **D5** *Atoms* "Electron Cloud of Argon"

→ **D9** *Atoms* "Comparing Helium, Neon, and Argon"

→ **D14** *Atoms* "Orbitals of a Krypton Atom"

5.03 Identify substances through the investigation of physical properties:

- Density.
- Melting point.
- Boiling point.

→ **C12** *Chemical Matter* "Types of Properties"

COMPETENCY GOAL 6

The learner will build an understanding of regularities in chemistry.

6.01 Analyze the periodic trends in the physical and chemical properties of elements.

- Groups (families).
- Periods.

→ **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"

6.02 Investigate and analyze the formation and nomenclature of simple inorganic compounds.

- Ionic bonds (including oxidation numbers).
- Covalent bonds.
- Metallic bonds.

→ **C20** *Chemical Matter* "Naming Compounds"

- **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"

6.03 Identify the reactants and products of chemical reactions and balance simple equations of various types:

- Single replacement.
- Double replacement.
- Decomposition.
- Synthesis.

- **I2** *Solutions* "Process of Dissolving"
- **M1** *Kinetics* "Observing a Reaction"
- **M3** *Kinetics* "Mechanism of a Reaction"

6.05 Investigate and analyze the properties and composition of solutions:

- Solubility curves.
- Concentration.
- Polarity.
- pH scale.
- Electrical conductivity.

- **I6** *Solutions* "Concentration of a Dissolved Pesticide"
- **I11** *Solutions* "Energetics of Solution Formation"
- **I17** *Solutions* "Miscible and Nonmiscible Liquids"

CHEMISTRY

Grades 9-12

COMPETENCY GOAL 2

The learner will build an understanding of the structure and properties of matter.

2.02 Examine the nature of atomic structure.

- Subatomic particles: protons, neutrons, and electrons.
- Mass number.
- Atomic number.

- Isotopes.

→ **D2** *Atoms* "Distribution of Mass in Atoms"

→ **D5** *Atoms* "Electron Cloud of Argon"

2.03 Apply the language and symbols of chemistry.

- Name compounds using the IUPAC conventions.
- Write formulas of simple compounds from their names.

→ **C20** *Chemical Matter* "Naming Compounds"

→ **S2** *Organic Chemistry* "Straight-Chain Alkanes"

→ **S3** *Organic Chemistry* "Cyclic Hydrocarbons"

→ **S5** *Organic Chemistry* "Isomers of the Alkanes"

→ **S9** *Organic Chemistry* "Isomers of Alkenes and Alkynes"

2.04 Identify substances using their physical properties:

- Melting points.
- Boiling points.
- Density.
- Solubility.

→ **C12** *Chemical Matter* "Types of Properties"

→ **I17** *Solutions* "Miscible and Nonmiscible Liquids"

2.05 Analyze the basic assumptions of kinetic molecular theory and its applications:

- Ideal Gas Equation.
- Combined Gas Law.
- Dalton's Law of Partial Pressures.

→ **G13** *Gases* "Pressure-Volume Relationship"

→ **G14** *Gases* "Boyle's Law"

→ **G16** *Gases* "Pressure and Temperature"

→ **G18** *Gases* "Avogadro's Law"

→ **G19** *Gases* "Universality of the Ideal Gas Law"

2.06 Assess bonding in metals and ionic compounds as related to chemical and physical properties.

→ **F1** *Chemical Bonding* "The Attraction Between Ions"

→ **H24** *Liquids & Solids* "Types of Bonding in Solids"

2.07 Assess covalent bonding in molecular compounds as related to molecular geometry and chemical and physical properties.

- Molecular.
- Macromolecular.

- Hydrogen bonding and other intermolecular forces (dipole/dipole interaction, dispersion).
- VSEPR theory.

→ **F15** *Chemical Bonding* "Comparing Shapes"

→ **H11** *Liquids & Solids* "Intermolecular Forces"

→ **H14** *Liquids & Solids* "Elements with Hydrogen Bonding"

→ **H19** *Liquids & Solids* "Liquid Water"

2.08 Assess the dynamics of physical equilibria.

- Interpret phase diagrams.
- Factors that affect phase changes.

→ **C13** *Chemical Matter* "Physical Changes"

→ **H20** *Liquids & Solids* "Melting Transition"

COMPETENCY GOAL 3

The learner will build an understanding of regularities in chemistry.

3.01 Analyze periodic trends in chemical properties and use the periodic table to predict properties of elements.

- Groups (families).
- Periods.
- Representative elements (main group) and transition elements.
- Electron configuration and energy levels.
- Ionization energy.
- Atomic and ionic radii.
- Electronegativity.

→ **D9** *Atoms* "Comparing Helium, Neon, and Argon"

→ **P1** *Main Groups & Transition Metals* "Alkali Metals"

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→ **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"

3.02 Apply the mole concept, Avogadro's number and conversion factors to chemical calculations.

- Particles to moles.

- Mass to moles.
- Volume of a gas to moles.
- Molarity of solutions.
- Empirical and molecular formula.
- Percent composition.

→ **I6** *Solutions* "Concentration of a Dissolved Pesticide"

→ **I7** *Solutions* "Molarity vs. Molality"

COMPETENCY GOAL 4

The learner will build an understanding of energy changes in chemistry.

4.02 Analyze the law of conservation of energy, energy transformation, and various forms of energy involved in chemical and physical processes.

- Differentiate between heat and temperature.
- Analyze heating and cooling curves.
- Calorimetry, heat of fusion and heat of vaporization calculations.
- Endothermic and exothermic processes including interpretation of potential energy.
- Diagrams (energy vs reaction pathway), enthalpy and activation energy.

→ **L2** *Thermochemistry* "Thermal Energy"

→ **L6** *Thermochemistry* "Specific Heat"

→ **M2** *Kinetics* "Reactive Collisions"

→ **M3** *Kinetics* "Mechanism of a Reaction"

→ **N2** *Equilibria* "Equilibrium and Temperature"

4.03 Analyze the relationship between entropy and disorder in the universe.

→ **01** *Chemical Thermodynamics* "Gas Expansions"

→ **03** *Chemical Thermodynamics* "Heat Conduction"

→ **04** *Chemical Thermodynamics* "Entropy and the States of Matter"

COMPETENCY GOAL 5

The learner will develop an understanding of chemical reactions.

5.04 Identify the physical and chemical behaviors of acids and bases.

- General properties of acids and bases.
- Concentration and dilution of acids and bases.
- Ionization and the degree of dissociation (strengths) of acids and bases.
- Indicators.
- Acid-base titration.
- pH and pOH.

→ **I2** *Solutions* "Process of Dissolving"

→ **K1** *Acids & Bases* "Strong Acids"

→ **K2** *Acids & Bases* "Comparing Oxoacids"

5.06 Assess the factors that affect the rates of chemical reactions.

- The nature of the reactants.
- Temperature.
- Concentration.
- Surface area.
- Catalyst.

→ **M2** *Kinetics* "Reactive Collisions"