

ODYSSEY Molecular Explorer

— Release 7.0 —

Correlation with the

Colorado Model Content Standards in Science

Adopted June 8, 1995

Amended February 8, 2007

Standard 2

Physical Science

Students know and understand common properties, forms, and changes in matter and energy.

RATIONALE

Everyone has experience with matter in a variety of forms. Such experiences help build students' understanding of similarities and differences in the properties of matter. Their personal experiences help students understand common properties such as hardness, strength, color, shapes and states of matter (solid, liquid, gas and plasma). Knowledge of observable properties of matter and its microscopic/macrosopic structure and composition is helpful in considering matter's varied uses, availability, and limitations in our world.

Energy is a central concept in science because all physical interactions involve changes in energy. Students need to understand that all physical events involve transferring energy, or changing one form of energy into another, such as when forces act on matter producing changes in motion. Knowledge of forms of energy, its transfer and transformation, is essential to interpreting, explaining, predicting, and influencing change in our world.

Interactions between matter and energy account for changes observed in everyday events that are sometimes misunderstood. Understanding how matter and energy interact and are conserved extends students' knowledge of the physical world, and allows them to monitor and explain a wide variety of changes and to predict future physical and chemical changes.

BENCHMARKS

GRADES 9-12

1. elements can be organized by their physical and chemical properties (Periodic Table)

- **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"

2. the spatial configuration of atoms and the structure of the atoms in a molecule determine the chemical properties of the substance

- **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"
- **F7** *Chemical Bonding* "Electron Sharing"
- **F8** *Chemical Bonding* "Energetics of Covalent Bonding"
- **F14** *Chemical Bonding* "VSEPR Theory"
- **F15** *Chemical Bonding* "Comparing Shapes"

3. there are observable and measurable physical and chemical properties that allow one to compare, contrast, and separate substances (*for example: pH, melting point, conductivity, magnetic attraction*)

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

4. word and chemical equations are used to relate observed changes in matter to its composition and structure (*for example: conservation of matter*)

- **M1** *Kinetics* "Observing a Reaction"
- **M2** *Kinetics* "Reactive Collisions"
- **M3** *Kinetics* "Mechanism of a Reaction"

5. quantitative relationships involved with thermal energy can be identified, measured, calculated and analyzed (*for example: heat transfer in a system involving mass, specific heat, and change in temperature of matter*)

- **G10** *Gases* "The Meaning of Temperature"
- **G12** *Gases* "Mean Speed and Temperature"

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

6. energy can be transferred through a variety of mechanisms and in any change some energy is lost as heat
(for example: conduction, convection, radiation, motion, electricity, chemical bonding changes)

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

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

→ **N3** *Equilibria* "Equilibrium and Pressure"

8. quantities that demonstrate conservation of mass and conservation of energy in physical interactions can be measured and calculated

→ **L4** *Thermochemistry* "Vibrating Diatomic Molecule"