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ODYSSEY Molecular Explorer

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Correlation with the

Next Generation Science Standards*

High School

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Physical Sciences

Matter and Its Interactions

Students who demonstrate understanding can:

HS-PS1-1 Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

→ **LAB** *Atoms* "Atomic Orbitals"

→ **LAB** *Periodicity* "The Structures of the 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"

HS-PS1-3 Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

→ **DEMONSTRATION** *Liquids & Solids* "Do water droplets form spontaneously?"

→ **Demonstration** *Liquids & Solids* "How does temperature affect the vapor pressure?"

→ **Demonstration** *Chemical Matter* "Do physical changes affect the amount of matter?"

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

→ **Lab** *Liquids & Solids* "Bonding in Crystalline Solids"

HS-PS1-4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

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

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

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

HS-PS1-5 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.

→ **Demonstration** *Kinetics* "What does a chemical reaction look like at the molecular level?"

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

HS-PS1-6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

→ **Lab** *Equilibria* "Equilibrium and Temperature"

→ **Lab** *Equilibria* "Equilibrium and Pressure"

→ **Miscellaneous** *Equilibria* "The Dynamic Nature of Equilibria"

HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

→ **Demonstration** *Kinetics* "What does a chemical reaction look like at the molecular level?"

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

Motion and Stability: Forces and Interactions

Students who demonstrate understanding can:

HS-PS2-4 Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

→ **Demonstration** *Thermochemistry* "What is the energy of a vibrating diatomic molecule?"

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

HS-PS2-6 Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

→ **Miscellaneous** *Industrial Chemistry* "High Explosives"

→ **Miscellaneous** *Pharmaceut. Chem.* "Small-Molecule Prescription Drugs"

→ **Stockroom** *Organic* "Polyolefins"

→ **Stockroom** *Organic* "Rubber"

→ **Stockroom** *Organic* "Liquid Crystals"

Energy

Students who demonstrate understanding can:

HS-PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

→ **Demonstration** *Thermochemistry* "What is the energy of a vibrating diatomic molecule?"

→ **Lab** *Thermochemistry* "Thermal Energy"

→ **Lab** *Thermochemistry* "Specific Heat"

HS-PS3-2 Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

→ **Demonstration** *Thermochemistry* "What is the energy of a vibrating diatomic molecule?"

→ **Lab** *Thermochemistry* "Specific Heat"

HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

→ **Demonstration** *Thermochemistry* "What is the energy of a vibrating diatomic molecule?"

HS-PS3-4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

→ **DEMONSTRATION** *Chem. Thermodyn.* "Do all spontaneous processes involve a visible increase of disorder?"

HS-PS3-5 Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

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

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

→ **LAB** *Liquids & Solids* "The Attraction between Water Molecules"