

**Arizona High School Science
Science Contents Standards Mapping**

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Strand 5: Physical Science	Boardworks High School Chemistry Presentation
Concept 1: Structure and Properties of Matter - Understand physical, chemical, and atomic properties of matter.	
PO 1. Describe substances based on their physical properties.	Alcohols Carboxylic Acids Polysaccharides Properties of Acids and Alkalis Proteins Water
PO 2. Describe substances based on their chemical properties.	Alcohols Carboxylic Acids Hydrocarbons Polysaccharides Proteins Water
PO 3. Predict properties of elements and compounds using trends of the periodic table (e.g., metals, non-metals, bonding – ionic/covalent).	Electron Structure and the Periodic Table The Periodic Table
PO 4. Separate mixtures of substances based on their physical properties	Separating Mixtures
PO 5. Describe the properties of electric charge and the conservation of electric charge.	–
PO 6. Describe the following features and components of the atom: protons, neutrons, electrons, mass, number and type of particles, structure and organization	Atomic Number and Mass Number Atomic Structure Electron Configuration Electron Structure and The Periodic Table Introducing Atoms
PO 7. Describe the historical development of models of the atom.	Introducing Atoms

<p>PO 8. Explain the details of atomic structure (e.g., electron configuration, energy levels, isotopes).</p>	<p>Electron Configuration Electron Structure and The Periodic Table Energy Sublevels Isotopes Orbitals</p>
<p>Concept 2: Motions and Forces - Analyze relationships between forces and motion.</p>	
<p>PO 1. Determine the rate of change of a quantity (e.g., rate of erosion, rate of reaction, rate of growth, velocity).</p>	<p><i>See Boardworks High School Physics for relevant presentations.</i></p>
<p>PO 2. Analyze the relationships among position, velocity, acceleration, and time:</p>	
<p>graphically</p>	
<p>mathematically</p>	
<p>PO 3. Explain how Newton's 1st Law applies to objects at rest or moving at constant velocity.</p>	
<p>PO 4. Using Newton's 2nd Law of Motion, analyze the relationships among the net force acting on a body, the mass of the body, and the resulting acceleration:</p>	
<p>graphically</p>	
<p>mathematically</p>	
<p>PO 5. Use Newton's 3rd Law to explain forces as interactions between bodies (e.g., a table pushing up on a vase that is pushing down on it; an athlete pushing on a basketball as the ball pushes back on her).</p>	
<p>PO 6. Analyze the two-dimensional motion of objects by using vectors and their components.</p>	
<p>PO 7. Give an example that shows the independence of the horizontal and vertical components of projectile motion.</p>	
<p>PO 8. Analyze the general relationships among force, acceleration, and motion for an object undergoing uniform circular motion.</p>	
<p>PO 9. Represent the force conditions required to maintain static equilibrium.</p>	
<p>PO 10. Describe the nature and magnitude of frictional forces.</p>	
<p>PO 11. Using the Law of Universal Gravitation, predict how the gravitational force will change when the distance between two masses changes or the mass of one of them changes.</p>	
<p>PO 12. Using Coulomb's Law, predict how the electrical force will change when the distance between two point charges changes or the charge of one of them changes.</p>	
<p>PO 13. Analyze the impulse required to produce a change in momentum.</p>	
<p>PO 14. Quantify interactions between objects to show that the total momentum is conserved in both collision and recoil situations.</p>	
<p>Concept 3: Conservation of Energy and Increase in Disorder - Understand ways that energy is conserved, stored, and transferred.</p>	
<p>PO 1. Describe the following ways in which energy is stored in a system:</p>	

mechanical	<p style="text-align: center;"><i>See Boardworks High School Physics for relevant presentations.</i></p>
electrical	
chemical	
nuclear	
PO 2. Describe various ways in which energy is transferred from one system to another (e.g., mechanical contact, thermal conduction, electromagnetic radiation.)	
PO 3. Recognize that energy is conserved in a closed system.	
PO 4. Calculate quantitative relationships associated with the conservation of energy.	
PO 5. Analyze the relationship between energy transfer and disorder in the universe (2nd Law of Thermodynamics).	
PO 6. Distinguish between heat and temperature.	
PO 7. Explain how molecular motion is related to temperature and phase changes.	
Concept 4: Chemical Reactions - Investigate relationships between reactants and products in chemical reactions.	
PO 1. Apply the law of conservation of matter to changes in a system.	Conservation of Mass Reacting Masses
PO 2. Identify the indicators of chemical change, including formation of a precipitate, evolution of a gas, color change, absorption or release of heat energy.	Combustion Endothermic Reaction Exothermic Reaction
PO 3. Represent a chemical reaction by using a balanced equation.	Reacting Masses
PO 4. Distinguish among the types of bonds (i.e., ionic, covalent, metallic, hydrogen bonding).	Covalent Bonding Ionic Bonding Intermolecular Forces Metallic Bonding
PO 5. Describe the mole concept and its relationship to Avogadro's number.	What are moles?
PO 6. Solve problems involving such quantities as moles, mass, molecules, volume of a gas, and molarity using the mole concept and Avogadro's number.	What are moles? Gases and Moles Molar Mass
PO 7. Predict the properties (e.g., melting point, boiling point, conductivity) of substances based upon bond type.	Comparing Bonding Ionic Compounds Intermolecular Forces

PO 8. Quantify the relationships between reactants and products in chemical reactions (e.g., stoichiometry, equilibrium, energy transfers).	Dynamic Equilibrium Equilibrium - Changing Conditions Percentage Composition by Mass Reacting Masses Types of Formulae What are moles?
PO 9. Predict the products of a chemical reaction using types of reactions (e.g., synthesis, decomposition, replacement, combustion).	Combustion Extracting Aluminum Neutralization Thermal Decomposition
PO 10. Explain the energy transfers within chemical reactions using the law of conservation of energy.	Conservation of Mass
PO 11. Predict the effect of various factors (e.g., temperature, concentration, pressure, catalyst) on the equilibrium state and on the rates of chemical reaction.	Concentration, Pressure and Reaction Rates Equilibrium - Changing Conditions Rates of Reaction Surface Area, Catalysts and Reaction Rates Temperature and Reaction Rates
PO 12. Compare the nature, behavior, concentration, and strengths of acids and bases.	Neutralization Properties of Acids and Alkalis pH and Indicators
PO 13. Determine the transfer of electrons in oxidation/reduction reactions.	Redox Reactions
Concept 5: Interactions of Energy and Matter - Understand the interactions of energy and matter.	
PO 1. Describe various ways in which matter and energy interact (e.g., photosynthesis, phase change).	Changing State Bonds and Activation Energy Particles in Action
PO 2. Describe the following characteristics of waves - wavelength, frequency, period and amplitude	–
PO 3. Quantify the relationships among the frequency, wavelength, and the speed of light.	–
PO 4. Describe the basic assumptions of kinetic molecular theory.	–
PO 5. Apply kinetic molecular theory to the behavior of matter (e.g., gas laws).	Ideal Gas Laws
PO 6. Analyze calorimetric measurements in simple systems and the energy involved in changes of state.	Calorimetry
PO 7. Explain the relationship between the wavelength of light absorbed or released by an atom or molecule and the transfer of a discrete amount of energy.	Observing Line Spectra
PO 8. Describe the relationship among electric potential, current, and resistance in an ohmic system.	–
PO 9. Quantify the relationships among electric potential, current, and resistance in an ohmic system.	–