

PHYSICAL SCIENCE ALTERNATE CONTENT EXPECTATIONS – HIGH SCHOOL (GRADES 9-12)

Topic Bundle 1: Structure and Properties of Matter

Target Alternate Content Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan K-12 Science Content Standard: 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.</p>			
<p>EE.HS-PS1-1: Use the periodic table to identify patterns among familiar elements (such as, their location in the Periodic Table, the number of electrons, their relative size, and/or how they are classified). Familiar Elements include: Hydrogen, Helium, Oxygen, Copper, Tin, Nickel, Carbon, Sodium, Potassium, Calcium, Lead, Iron, Gold, Silver, Aluminum, Neon.</p>	<p>EE.HS-PS1-H.1: Use the periodic table to identify patterns among familiar elements (such as their location in the Periodic Table, the number of electrons, their relative size, and/or how they are classified). Familiar Elements include: Hydrogen, Helium, Oxygen, Copper, Tin, Nickel, Carbon, Sodium, Potassium, Calcium, Lead, Iron, Gold, Silver, Aluminum, Neon.</p>	<p>EE.HS-PS1-M.1: Use illustrations or models to identify how familiar elements are used in real-world situations. Familiar elements include: Helium, Oxygen, Copper, Tin, Nickel, Carbon, Sodium, Potassium, Calcium, Lead, Iron, Gold, Silver, Aluminum, Neon.</p>	<p>EE.HS-PS1-L.1: Given the name and description of a familiar element, identify a real-world use. Familiar elements include: Helium, Oxygen, Copper, Nickel, Sodium, Calcium, Iron, Gold, Silver, Aluminum, Neon.</p>

Topic Bundle 1: Structure and Properties of Matter

Target Alternate Content Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan K-12 Science Content Standard: 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.</p>			
<p>EE.HS-PS1-3: Use an investigation to describe the relationship between the melting and/or boiling points of a common substance and/or that as the temperature increases, so does the spacing and motion of the particles of the substance.</p>	<p>EE.HS-PS1-H.3: Use an investigation to describe the relationship between the melting and/or boiling points of a common substance and/or that as the temperature increases, so does the spacing and motion of the particles of the substance.</p>	<p>EE.HS-PS1-M.3: Use an investigation to identify the melting point and/or boiling point of a familiar substance.</p>	<p>EE.HS-PS1-L.3: Identify a familiar substance as boiling or melting.</p>

Topic Bundle 1: Structure and Properties of Matter

Target Alternate Content Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan K-12 Science Content Standard: HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.</p> <p>Caution – Do not use magnets in the vicinity of a student with a Vagus Nerve Stimulator (VNS).</p>			
<p>EE.HS-PS2-6: Use evidence to describe the relationship between the structure (properties) and function of natural materials or those made by humans.</p>	<p>EE.HS-PS2-H.6: Use evidence to describe the relationship between the structure (properties) and function of natural materials or those made by humans.</p>	<p>EE.HS-PS2-M.6: Use evidence to identify one or more structure properties (such as strength, weight, heat conductivity, durability, flexibility, magnetism, or buoyancy, etc.) of a given natural material or one made by humans.</p>	<p>EE.HS-PS2-L.6: Observe and identify a material (such as metal, plastic, or plant material) used to make a familiar product.</p>

Topic Bundle 2: Chemical Reactions

Target Alternate Content Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan K-12 Science Content Standards: HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.</p>			
<p>EE.HS-PS1-2: Use models, simulations, or illustrations to explain patterns of chemical properties that occur in a substance during a common chemical reaction (e.g., baking soda and vinegar).</p>	<p>EE.HS-PS1-H.2: Use models, simulations, or illustrations to explain patterns of chemical properties that occur in a substance during a common chemical reaction (e.g., baking soda and vinegar).</p>	<p>EE.HS-PS1-M.2: Use illustrations, models, or simulations to identify the changes that occur during a chemical reaction.</p>	<p>EE.HS-PS1-L.2: After observing a familiar chemical reaction, identify a result of the chemical reaction.</p>

Topic Bundle 2: Chemical Reactions

Target Alternate Content Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan K-12 Science Content Standard: 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.</p>			
<p>EE.HS-PS1-5: Use evidence to explain how changes in temperature and/or concentration of the reacting particles can affect the rate of reactions.</p>	<p>EE.HS-PS1-H.5: Use evidence to explain how changes in temperature and/or concentration of the reacting particles can affect the rate of reactions.</p>	<p>EE.HS-PS1-M.5: While observing a chemical reaction identify that increasing the temperature makes the reaction happen faster.</p>	<p>EE.HS-PS1-L.5: While observing a chemical reaction involving the increase of temperature, identify the source of change (i.e., heat).</p>

Topic Bundle 3: Forces and Interactions

Target Alternate Content Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan K-12 Science Content Standard: HS-PS2-1. Analyze data to support the claim that Newton’s second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.</p>			
<p>EE.HS-PS2-1: Use data to describe how the net force acting on an object, or the mass of the object impacts its acceleration (as increasing, decreasing, or staying the same) or the direction of the object.</p>	<p>EE.HS-PS2-H.1: Use data to describe how the net force acting on an object, or the mass of the object impacts its acceleration (as increasing, decreasing, or staying the same) or the direction of the object.</p>	<p>EE.HS-PS2-M.1: Use data or simulations to determine how a force (e.g., push, pull, gravity, or friction) acting on an object changes the speed of an object. (e.g., faster, slower, stays same, or stops).</p>	<p>EE.HS-PS2-L.1: Given an object that has a push/pull force applied and an object without a force applied, identify which of the two objects goes faster as it moves down a ramp or along a flat surface.</p>

Topic Bundle 3: Forces and Interactions

Target Alternate Content Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan K-12 Science Content Standard: HS-PS2-2. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.</p>			
<p>EE.HS-PS2-2: Use models, illustrations, or simulations to show the change in momentum of each object after two objects collide or show that the total momentum remains the same as before the collision.</p>	<p>EE.HS-PS2-H.2: Use models, illustrations, or simulations to show the change in momentum of each object after two objects collide or show that the total momentum remains the same as before the collision.</p>	<p>EE.HS-PS2-M.2: Using models, illustrations, or simulations, to describe that, after a collision between two objects, the force of movement (momentum) for each object is in the opposite direction of the original movement.</p>	<p>EE.HS-PS2-L.2: Given objects with and without momentum, identify the object that is moving.</p>

Topic Bundle 3: Forces and Interactions

Target Alternate Content Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan K-12 Science Content Standard: 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.</p>			
<p>EE.HS-PS2-4: Use models, illustrations, or simulations to show how factors, such as relative size, charge of particles, relative quantity of charges, and/or relative distance between objects affect the gravitational or electrostatic force between objects.</p>	<p>EE.HS-PS2-H.4: Use models, illustrations, or simulations to show how factors, such as relative size, charge of particles, relative quantity of charges, and/or relative distance between objects affect the gravitational or electrostatic force between objects.</p>	<p>EE.HS-PS2-M.4: Use models, illustrations, or simulations to show how factors, such as charge of particles, and/or relative distance between objects affect the electrostatic force between the objects.</p>	<p>EE.HS-PS2-L.4: Identify the objects that attract (stick together) or repel (push apart) due to electrostatic forces.</p>

Topic Bundle 3: Forces and Interactions

Target Alternate Content Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan K-12 Science Content Standard: HS-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.</p> <p>Caution – Do not use magnets in the vicinity of a student with a Vagus Nerve Stimulator (VNS).</p>			
<p>EE.HS-PS2-5: Use an investigation to identify evidence that an electric current produces a magnetic field and/or a changing magnetic field produces an electric current.</p>	<p>EE.HS-PS2-H.5: Use an investigation to identify evidence that an electric current produces a magnetic field and/or a changing magnetic field produces an electric current.</p>	<p>EE.HS-PS2-M.5: Use evidence to identify when a magnetic field and/or an electric current is flowing.</p>	<p>EE.HS-PS2-L.5: Given a simple electric circuit, identify when an electric current is flowing (such as when an appliance or device is on).</p>

Topic Bundle 4: Energy

Target Alternate Content Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan K-12 Science Content Standards: HS-PS3-2 and HS-PS3-3.</p> <p>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 position of particles (objects).</p> <p>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.</p>			
<p>EE.HS-PS3-2-3: Use evidence to describe devices that convert one form of energy into another form of energy.</p>	<p>EE.HS-PS3-H.2-3: Use evidence to describe devices that convert one form of energy into another form of energy.</p>	<p>EE.HS-PS3-M.2-3: Given evidence, identify one or more form(s) of energy used by a device.</p>	<p>EE.HS-PS3-L.2-3: Given demonstrations or models of energy, identify the form of energy.</p>

Topic Bundle 4: Energy

Target Alternate Content Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan K-12 Science Content Standards: 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).</p>			
<p>EE.HS-PS3-4: Use an investigation to provide evidence that heat transfers between substances until energy is uniformly distributed.</p>	<p>EE.HS-PS3-H.4: Use an investigation to provide evidence that heat transfers between substances until energy is uniformly distributed.</p>	<p>EE.HS-PS3-M.4: Use evidence to compare the temperatures of two substances of different temperatures before and after combining.</p>	<p>EE.HS-PS3-L.4: Given two materials with different temperatures, identify which material is hotter or cooler, before or after a transfer of thermal energy.</p>

Topic Bundle 4: Energy

Target Alternate Content Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan K-12 Science Content Standards: 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.</p> <p>Caution – Do not use magnets in the vicinity of a student with a Vagus Nerve Stimulator (VNS).</p>			
<p>EE.HS-PS3-5: Use a model to describe the magnetic or electric forces and fields of two interacting objects and/or the resulting change in the motion of the objects.</p>	<p>EE.HS-PS3-H.5: Use a model to describe the magnetic or electric forces and fields of two interacting objects and/or the resulting change in the motion of the objects.</p>	<p>EE.HS-PS3-M.5: Use a magnet to demonstrate that objects with opposite charges attract and objects with like charges repel.</p>	<p>EE.HS-PS3-L.5: Use the results of an experiment to identify materials that are attracted to a magnet.</p>

Topic Bundle 5: Waves and Electromagnetic Radiation

Target Alternate Content Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan K-12 Science Content Standards: HS-PS4-1 and HS-PS4-5.</p> <p>HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.</p> <p>HS-PS4-5. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.</p>			
<p>EE.HS-PS4-1-5: Use a wave model to provide evidence to describe/identify a relationship between two wave properties (vibration, speed, wavelength, frequency) or how a device uses waves to transmit information.</p>	<p>EE.HS-PS4-H.1-5: Use a wave model to provide evidence to describe/identify a relationship between two wave properties (vibration, speed, wavelength, frequency) or how a device uses waves to transmit information.</p>	<p>EE.HS-PS4-M.1-5: Use evidence to compare effects of sound or light traveling through media or recognize that a device uses waves to transmit information.</p>	<p>EE.HS-PS4-L.1-5: Use models or a demonstration to identify the type of wave (sound, light, etc.) used in devices.</p>

Topic Bundle 5: Waves and Electromagnetic Radiation

Target Alternate Content Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan K-12 Science Content Standard: HS-PS4-2. Evaluate questions about the advantages of using a digital transmission and storage of information.</p>			
<p>EE.HS-PS4-2: Use evidence to describe advantages of digital devices and digital information storage.</p>	<p>EE.HS-PS4-H.2: Use evidence to describe advantages of digital devices and digital information storage.</p>	<p>EE.HS-PS4-M.2: Use evidence to identify how digital devices are beneficial.</p>	<p>EE.HS-PS4-L.2: Given a digital device and an analog device, identify the digital device.</p>