Grade, Subject/Course: 7th Grade Physical Science	
Unit: Nature of Science	**__X___ Essential _____ Important _____ Compact**
Big Idea: Science involves making observations, forming hypotheses, conducting experiments, analyzing data, and drawing conclusions. It is a systematic and evidence-based approach to understanding the natural world.	
PA Core Content Standards/Anchors (or National Standards): ● CC.3.5.6-8.D: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics. PA Core Standard: ELA ● CC.3.6.6-8.B: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. PA Core Standard: ELA ● CC.2.2.6.B.3: Represent and analyze qualitative relationships between dependent and independent variables. ● CC.3.5.6-8.G: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).	**Interdisciplinary Standards (if applicable):**
Essential Questions:	**Understandings (CCCs - Cross-cutting Concepts [themes]):** ● Students will know that science assumes that objects and events in natural systems occur in consistent patterns that

1. . What methods are used to conduct a controlled scientific investigation? 2. What is the difference between qualitative and quantitative data?	are understandable through measurement and observation.
<u>Knowledge (DCIs - Disciplinary Core Ideas [what they will know]):</u> Students will know following intentional steps and isolating variables can help answer questions about how nature works. The scientific method can look different and is not used to answer all questions. Students will know the difference between qualitative and quantitative data.	**<u>Do/Skills (SEPs - Science and Engineering Practices [what they do])</u>:** **Planning and Carrying Out Investigations** Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. **Scientific Knowledge Is Based on Empirical Evidence** • Science knowledge is based upon logical and conceptual connections between evidence and explanations. • Science disciplines share common rules of obtaining and evaluating empirical evidence. **Constructing Explanations and Designing Solutions** • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future (uniformitarianism). • Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena.
<u>Vocabulary:</u> 1. scientific method 2. constant 3. control group 4. experimental group 5. independent variable 6. dependent variable 7. hypothesis 8. qualitative data 9. quantitative data	**<u>Core Resources</u>:** Unit notes slideshows, unit notes, lab equipment and supplies

10. observation 11. inference	
Common Assessment(s): Unit quizzes, lab activities	**Supplemental Resources:** Gizmos, Gimkit, Quizlet, Quizizz, Edpuzzle, Science World, NewsELA

Grade, Subject/Course: 7th - Physical Science	
Unit: Structure and Properties of Matter	**__X__ Essential _____ Important _____ Compact**
Big Idea: All forms of matter exist as a result of the combination or rearrangement of atoms.	
PA Core Content Standards/Anchors (or National Standards): ● 3.2.6-8.A Develop models to describe the atomic composition of simple molecules and extended structures. ● 3.2.6-8.B Develop a model that predicts and describes changes in the particle motion, temperature and state of a pure substance when thermal energy is added or removed.	**Interdisciplinary Standards (if applicable):**
Essential Questions: How do particles combine to form the variety of matter one observes?	**Understandings (CCCs - Cross-cutting Concepts [themes]):** ● Students will know that… **Scale, Proportion, and Quantity** Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. **Cause and effect** Relationships may be used to predict phenomena in natural or designed systems.

Knowledge (DCIs - Disciplinary Core Ideas [what they will know]): Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). Gasses and liquids are made of molecules or inert atoms that are moving about relative to each other. In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are cause and effect relationships that may be used to predict phenomena in natural or designed systems. The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. The term “heat” as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary) The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system’s material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of	**Do/Skills (SEPs - Science and Engineering Practices [what they do]):** ● Students will be able to… **Developing and Using Models** Develop a model to predict and/or describe phenomena.

atoms in the system, and the state of the material. (secondary)	
Vocabulary: Atoms Molecules Bonding Compounds Elements Gas Liquid Solid Molecular motion Temperature Thermal energy Heat Phase change (boiling, melting, freezing, sublimation) Pressure Temperature Potential energy Kinetic energy Pure substance	**Core Resources:** Unit Notes Slides Unit Notes Notes Lab Equipment and Supplies
Common Assessment(s): Unit Quizzes Lab Activities	**Supplemental Resources:** Interactive Online Sites e.g., GIZMO, EdPuzzle, PBS, Discovery Ed, Quizlet

Grade, Subject/Course: 7th - Physical Science	
Unit: Chemical Reactions	**__X_ Essential _____ Important _____ Compact**
Big Idea: The atoms of some substances combine or rearrange to form new substances that have different properties.	

PA Core Content Standards/Anchors (or National Standards	**Interdisciplinary Standards (if applicable):**
● 3.2.6-8.C Gather and make sense of information to describe how synthetic materials come from natural resources and impact society. ● 3.2.6-8.D Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred ● 3.2.6-8.E Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. ● 3.2.6-8.F Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.	
Essential Questions: How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them?	**Understandings (CCCs - Cross-cutting Concepts [themes]):** ● Students will know that… **Structure and Function** Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. **Patterns** Macroscopic patterns are related to the nature of microscopic and atomic level structure. **Energy and Matter** Matter is conserved because atoms are conserved in physical and chemical processes. The transfer of energy can be tracked as energy flows through a designed or natural system.

Knowledge (DCIs - Disciplinary Core Ideas [what they will know]):	**Do/Skills (SEPs - Science and Engineering Practices [what they do]):**
Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. The total number of each type of atom is conserved, and thus the mass does not change. Some chemical reactions release energy, others store energy.	Students will be able to… **Obtaining, Evaluating, and Communicating Information** Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. **Analyzing and Interpreting Data** Analyze and interpret data to determine similarities and differences in findings. **Developing and Using Models** Develop a model to describe unobservable. **Constructing Explanations and Designing Solutions** Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.
Vocabulary: Reactants Molecules Substance Synthetic material Natural resource Products Precipitate Chemical change Mixture Compounds Yields Physical properties	**Core Resources:** Unit Notes Slides Unit Notes Notes Lab Equipment and Supplies

Chemical properties Chemical equation Conservation of mass Open vs. Close System Electrical Endothermic Exothermic	
Common Assessment(s): Unit Quizzes Lab Activities Project	**Supplemental Resources:** Interactive Online Sites e.g., GIZMO, EdPuzzle, PBS, Discovery Ed, Quizlet

Grade, Subject/Course: 7th - Physical Science	
Unit: Wave Properties	**_X_ Essential _____ Important _____ Compact**
Big Idea: Waves are repeating patterns of motion that transfer energy and information without transferring matter.	
PA Core Content Standards/Anchors (or National Standards): ● 3.2.6-8.Q Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.	**Interdisciplinary Standards (if applicable):**
Essential Questions: What are the characteristic properties and behaviors of waves?	**Understandings (CCCs - Cross-cutting Concepts [themes]):** ● Students will know that… Patterns, Graphs, and charts can be used to identify patterns in data.

Knowledge (DCIs - Disciplinary Core Ideas [what they will know]): A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude.	**Do/Skills (SEPs - Science and Engineering Practices [what they do]):** ● Students will be able to… **Using Mathematics and Computational Thinking** Use mathematical representations to describe and/or support scientific conclusions and design solutions.
Vocabulary: amplitude frequency crest trough wavelength	**Core Resources:** Unit Notes Slides Unit Notes Notes Lab Equipment and Supplies
Common Assessment(s): Unit Quizzes Lab Activities	**Supplemental Resources:** Interactive Online Sites e.g., GIZMO, EdPuzzle, PBS, Discovery Ed, Quizlet

Grade, Subject/Course: 7th - Physical Science	
Unit: Electromagnetic Radiation	**_X Essential _____ Important _____ Compact**
Big Idea: Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave pattern of changing electric and magnetic fields that interact with matter	
PA Core Content Standards/Anchors (or National Standards): ● 3.2.6-8.R Develop and use a model to describe how waves are reflected, absorbed, or transmitted through various materials.	**Interdisciplinary Standards (if applicable):**
Essential Questions: What is light? How can one explain the varied effects	**Understandings (CCCs - Cross-cutting Concepts [themes]):** ● Students will know that…

that involve light? What other forms of electromagnetic radiation are there?	Structure and Function Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.
Knowledge (DCIs - Disciplinary Core Ideas [what they will know]): A sound wave needs a medium through which it is transmitted. When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. A wave model of light is useful for explaining brightness, color, and the frequency dependent bending of light at a surface between media. However, because light can travel through space, it cannot be a matter wave, like sound or water waves	**Do/Skills (SEPs - Science and Engineering Practices [what they do]):** ● Students will be able to… **Developing and Using Models** ● Develop and use a model to describe phenomena.
Vocabulary: frequency color light reflection transmission absorption	**Core Resources:** Unit Notes Slides Unit Notes Notes Lab Equipment and Supplies
Common Assessment(s): Unit Quizzes Lab Activities	**Supplemental Resources:** Interactive Online Sites e.g., GIZMO, EdPuzzle, PBS, Discovery Ed, Quizlet

Grade, Subject/Course: 7th - Physical Science	
Unit: Information Technologies and Instrumentation	**__X__ Essential _____ Important _____ Compact**
Big Idea: Useful modern technologies and instruments have been designed based on an understanding of waves and their interactions with matter.	
PA Core Content Standards/Anchors (or National Standards): ● 3.2.6-8.S Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.	**Interdisciplinary Standards (if applicable):**
Essential Questions: How are instruments that transmit and detect waves used to extend human senses?	**Understandings (CCCs - Cross-cutting Concepts [themes]):** ● Students will know that… **Structure and Function** Structures can be designed to serve particular functions.
Knowledge (DCIs - Disciplinary Core Ideas [what they will know]): Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.	**Do/Skills (SEPs - Science and Engineering Practices [what they do]):** ● Students will be able to… **Information Technologies and Instrumentation** Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.
Vocabulary: Waves Transmission	**Core Resources:** Unit Notes Slides Unit Notes Notes Lab Equipment and Supplies

Common Assessment(s):	**Supplemental Resources:**
Unit Quizzes Lab Activities	Interactive Online Sites e.g., GIZMO, EdPuzzle, PBS, Discovery Ed, Quizlet

Grade, Subject/Course: 7th - Physical Science	
Unit: Definitions of Energy	**__X__ Essential _____ Important _____ Compact**
Big Idea: Energy can be modeled as either motions of particles or as being stored in force fields.	
PA Core Content Standards/Anchors (or National Standards): 3.2.6-8.L Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass and speed of an object.	**Interdisciplinary Standards (if applicable):**
Essential Questions: What is energy?	**Understandings (CCCs - Cross-cutting Concepts [themes]):** ● Students will know that… **Scale, Proportion, and Quantity** Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.
Knowledge (DCIs - Disciplinary Core Ideas [what they will know]): Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed.	**Do/Skills (SEPs - Science and Engineering Practices [what they do]):** ● Students will be able to… **Analyzing and Interpreting Data** Construct and interpret graphical displays of data to identify linear and nonlinear relationships.

Vocabulary: Speed Velocity Acceleration Kinetic energy Mass	**Core Resources:** Unit Notes Slides Unit Notes Notes Lab Equipment and Supplies
Common Assessment(s): Unit Quizzes Lab Activities	**Supplemental Resources:** Interactive Online Sites e.g., GIZMO, EdPuzzle, PBS, Discovery Ed, Quizlet

Grade, Subject/Course: 7th - Physical Science	
Unit: Relationship Between Energy and Energy Forces	**__X__ Essential _____ Important _____ Compact**
Big Idea: Forces between objects can result in transfer of energy between these objects.	
PA Core Content Standards/Anchors (or National Standards): ● 3.2.6-8.P Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.	**Interdisciplinary Standards (if applicable):**
Essential Questions: How are forces related to energy?	**Understandings (CCCs - Cross-cutting Concepts [themes]):** ● Students will know that… **Systems and System Models -** Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems.

Knowledge (DCIs - Disciplinary Core Ideas [what they will know]):	**Do/Skills (SEPs - Science and Engineering Practices [what they do]):**
A system of objects may also contain stored (potential) energy, depending on their relative positions. When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object	● Students will be able to… **Developing and Using Models** - Develop a model to describe unobservable mechanisms.
Vocabulary: potential energy electric force magnetic force gravitational force	**Core Resources:** Unit Notes Slides Unit Notes Packet Lab Equipment and Supplies
Common Assessment(s): Unit Quizzes Lab Activities	**Supplemental Resources:** Interactive Online Sites e.g., GIZMO, EdPuzzle, PBS, Discovery Ed, Quizlet

Grade, Subject/Course: 7th - Physical Science	
Unit: Forces and Motion	**__X__ Essential _____ Important _____ Compact**
Big Idea: A change in motion of interacting objects can be explained and predicted by forces.	
PA Core Content Standards/Anchors (or National Standards): ● 3.2.6-8.G Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. ● 3.2.6-8.H Plan an investigation to provide evidence that the change in an object's motion	**Interdisciplinary Standards (if applicable):**

depends on the sum of the forces on the object and the mass of the object.	
Essential Questions: How can one predict an object's continued motion, changes in motion, or stability?	**Understandings (CCCs - Cross-cutting Concepts [themes]):** ● Students will know that… **Systems and System Models** Models can be used to represent systems and their interactions - such as inputs, processes and output - and energy and matter flows within systems. **Stability and Change** Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.
Knowledge (DCIs - Disciplinary Core Ideas [what they will know]): ● For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). ● The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.	**Do/Skills (SEPs - Science and Engineering Practices [what they do]):** ● Students will be able to… **Constructing Explanations and Designing Solutions** Apply scientific ideas or principles to design an object, tool, process or system. **Planning and Carrying Out Investigations** Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.

Vocabulary:	**Core Resources:**
Force Net force Balanced Unbalanced Newton's 1st law Newton's 2nd law Newton's 3rd law Reference point Force Mass Acceleration Motion	Unit Notes Slides Unit Notes Notes Lab Equipment and Supplies
Common Assessment(s): Unit Quizzes Lab Activities Project(s)	**Supplemental Resources:** Interactive Online Sites e.g., GIZMO, EdPuzzle, PBS, Discovery Ed, Quizlet

Grade, Subject/Course: 7th - Physical Science	
Unit: Types of Interactions	**__X___ Essential _____ Important _____ Compact**
Big Idea: All forces between objects, regardless of size or direction, arise from only a few types of interactions.	
PA Core Content Standards/Anchors (or National Standards): ● 3.2.6-8.I - Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.	**Interdisciplinary Standards (if applicable):**

● 3.2.6-8.J - Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. ● 3.2.6-8.K - Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.	
Essential Questions: What underlying forces explain the variety of interactions observed?	**Understandings (CCCs - Cross-cutting Concepts [themes]):** ● Students will know that… **Cause and Effect -** Cause and effect relationships may be used to predict phenomena in natural or designed systems. **Systems and System Models** - Models can be used to represent systems and their interactions— such as inputs, processes and outputs—and energy and matter flows within systems.
Knowledge (DCIs - Disciplinary Core Ideas [what they will know]): -Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. -Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. -Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively).	**Do/Skills (SEPs - Science and Engineering Practices [what they do]):** ● Students will be able to… **Asking Questions and Defining Problems** - Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. **Engaging in Argument from Evidence** - Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. -**Planning and Carrying Out Investigations** - Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can serve as the basis for evidence that can meet the goals of the investigation.

Vocabulary:	**Core Resources:**
Magnetic force Electric current Electromagnetic Gravitational forces Law of universal gravity Mass Weight Electric force	Unit Notes Slides Unit Notes Packet Lab Equipment and Supplies
Common Assessment(s): Unit Quizzes Lab Activities	**Supplemental Resources:** Interactive Online Sites e.g., GIZMO, EdPuzzle, PBS, Discovery Ed, Quizlet

Grade, Subject/Course: 7th - Physical Science	
Unit: Conservation of Energy and Energy Transfer	**__X__ Essential _____ Important _____ Compact**
Big Idea: The total change of energy in any system is always equal to the total energy transferred into or out of the system.	
PA Core Content Standards/Anchors (or National Standards): ● 3.2.6-8.M Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. ● 3.2.6-8.N Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in	**Interdisciplinary Standards (if applicable):**

the average kinetic energy of the particles as measured by the temperature of the sample. ● Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.	
Essential Questions: ● What is meant by conservation of energy? ● How is energy transferred between objects or systems?	**Understandings (CCCs - Cross-cutting Concepts [themes]):** ● Students will know that… **Energy and Matter** The transfer of energy can be tracked as energy flows through a designed or natural system. **Scale, Proportion, and Quantity** Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. **Scale, Proportion, and Quantity** Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.
Knowledge (DCIs - Disciplinary Core Ideas [what they will know]): ● Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. Energy is spontaneously transferred out of hotter regions or objects and into colder ones. ● Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment.	**Do/Skills (SEPs - Science and Engineering Practices [what they do]):** ● Students will be able to… **Constructing Explanations and Designing Solutions** Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. **Planning and Carrying Out Investigations** Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. **Developing and Using Models** Develop a model to predict and/or describe phenomena.

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Vocabulary: Thermal energy Temperature Heat Conductivity Energy transfer Motion Matter	**Core Resources:** Unit Notes Slides Unit Notes Notes Lab Equipment and Supplies
Common Assessment(s): Unit Quizzes Lab Activities Project(s)	**Supplemental Resources:** Interactive Online Sites e.g., GIZMO, EdPuzzle, PBS, Discovery Ed, Quizlet