SOUTHERN LEHIGH SCHOOL DISTRICT
5775 Main Street
Center Valley, PA 18034

Scope and Sequence for **Grade 8 Earth and Space Sciences**

Pennsylvania Long-Term Transfer Goals for Science

1. Approach science as reliable and tentative way of knowing and explaining the natural world.
2. Weigh evidence and use scientific approaches to ask questions, investigate, and make informed decisions.
3. Make and use observations to analyze relationships and patterns in order to explain phenomena, develop models, and make predictions.
4. Evaluate systems, in order to connect how form determines function and how any change to one component affects the entire system.
5. Explain how the natural and designed worlds are interrelated and the application of scientific knowledge and technology can have beneficial, detrimental, or unintended consequences.

Big Idea: The universe is composed of a variety of different objects, which are organized into systems, each of which develops according to accepted physical processes and laws.
Essential Question: What is the universe and what is Earth's place in it?

NGSS Performance Expectations	PA Academic Standards for Science
MS-ESS1: Earth's Place in the Universe **ESS1.A: The Universe and Its Stars** **MS-ESS1-1** Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipse of the sun and moon, and season. **MS-ESS1-2** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. **ESS1.B: Earth and the Solar System** **MS-ESS1-3** Analyze and interpret data to determine scale properties of objects in the solar system. ***This section continues on the next page…***	**3.3.A: Earth Structure, Processes and Cycles** **1. Earth Features and the Processes that Change It** **3.3.7.A1** Define basic features of the rock cycle. Describe the layers of earth. Differentiate among mechanisms by which heat is transferred through the Earth system. **4. Water** **3.3.7.A4** Differentiate among Earth's water systems. Describe the motions of tides and identify their causes. **3.3.B Origin and Evolution of the Universe** **2. Unifying Themes** **3.3.8.B2** SCALE AND MEASUREMENT Explain measurements and evidence indicating the age of the universe. ***This section continues on the next page…***

NGSS Performance Expectations	PA Academic Standards for Science
Continued... **MS-ESS2: Earth's Systems** **ESS2.A: Earth's Materials and Systems** **MS-ESS2-1** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. **MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	***Continued…*** **3.3.B: Origin and Evolution of the Universe** **1. Composition and Structure** **3.3.6.B1** Compare and contrast thee size, composition, and surface features of the planets that comprise the solar system as well as the objects orbiting them. Recognize the role of gravity as a force that pulls all things on or near the earth towards the center of the earth and in the formation of the solar system and the motions of objects in the solar system. Explain why the planets orbit the sun in nearly circular paths. Describe how the planets change their position relative to the background of the stars. Explain how the tilt of the earth and its revolution around the sun case an uneven heating of the earth which in turn causes the seasons and weather patterns. **3.3.7.B1** Explain how gravity is the major force in the formation of the planets, stars, and the solar system. Describe gravity as a major force in determining the motions of planets, stars, and solar system. Compare and contrast properties and conditions of objects in the solar system to those on Earth. **3.3.8.B1** Explain how light, measured remotely, can be used to classify objects in the universe. **2. Unifying Themes** **3.3.6.B2** MODELS Use models to demonstrate that earth has different seasons and weather. MODELS Use models to demonstrate that the phases of the moon are a result of its orbit around Earth. **3.3.7.B2** SCALE AND MEASURE Identify a variety of instruments used to gather evidence about the universe. PATTERNS Describe repeating patterns in the Sun-Earth-Moon system and the positions of stars. SCALE Relate planetary size and distance in our solar system using an appropriate scale model.
Pennsylvania System of School Assessment (PSSA)	S8.C Structure, Properties, and Interaction of Matter and Energy
S8.C.2 Forms, Sources, Conversion, and Transfer of Energy	
S8.C.2.2 Compare the environmental impact of different energy sources chosen to support human endeavors.	**S8.C.2.2.1** Describe the Sun as the major source of energy that impacts the environment.
Pennsylvania System of School Assessment (PSSA)	S8.D Earth and Space Sciences
S8.D.3 Composition and Structure of the Universe	
S8.D.3.1 Explain the relationships between and among the objects of our solar system.	**S8.D.3.1.1** Describe patterns of earth's movements (i.e., rotation and revolution) in relation to the moon and sun (i.e., phases, eclipses, and tides)
	S8.D.3.1.2 Describe the role of gravity as the force that governs the movement of the solar system and universe.
	S8.D.3.1.3 Compare and contrast characteristics of celestial bodies found in the solar system (e.g., moons, asteroids, comets, meteors, inner and outer planets.

Big Idea: The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.
Essential Question: How and why is Earth constantly changing?

NGSS Performance Expectations	PA Academic Standards for Science
MS-ESS1: Earth's Place in the Universe **ESS1.B: Earth and the Solar System** **MS-ESS1-3** Analyze and interpret data to determine scale properties of objects in the solar system. **ESS1.C: The History of Planet Earth** **MS-ESS1-4** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. **MS-ESS2: Earth's Systems** **ESS2.A: Earth's Materials and Systems** **MS-ESS2-1** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. **MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. **ESS2.B: Plate Tectonics and Large-Scale System Interactions** **MS-ESS2-3** Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plat motions. **ESS2.C: The Roles of Water in Earth's Surface Processes** **MS-ESS2-4** Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. **MS-ESS2-5** Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. **MS-ESS2-6** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. ***This section continues on the next page…***	**3.3.A: Earth Structure, Processes and Cycles** **1. Earth Features and the Processes that Change It** **3.3.6.A1** Recognize and interpret various mapping representations of Earth's common features. **3.3.7.A1** Define basic features of the rock cycle. Describe the layers of earth. Differentiate among mechanisms by which heat is transferred through the Earth system. **3.3.8.A1** Distinguish between physical and chemical weathering. Compare and contrast the types of energy that drive Earth's systems. **2. Earth's Resources/Materials** **3.3.6.A2** Examine how soil fertility, composition, resistance to erosion and texture are affected by many factors. **3.3.7.A2** Explain land use in relation to soil type and topography. **3. Earth's History** **3.3.7.A3** Explain and give examples of how physical evidence, such as fossils and surface features of glaciation support theories that the Earth has evolved over geologic time. Compare geologic processes over time. **4. Water** **3.3.6.A4** Describe how water on earth cycles in different forms and in different locations, including underground and in the atmosphere. **3.3.8.A4** Explain how the oceans form one interconnected circulation system powered by wind, tides, the Earth's rotation, and water density differences. ***This section continues on the next page…***

NGSS Performance Expectations	PA Academic Standards for Science
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Pennsylvania System of School Assessment (PSSA)	S8.D Earth and Space Sciences
S8.D.1 Earth Features and Processes that Change Earth and Its Resources	
S8.D.1.1 Describe constructive and destructive natural processes that form different geologic structures and resources.	**S8.D.1.1.1** Explain the rock cycle as changes in the solid earth and rock types (igneous – granite, basalt, obsidian, pumice; sedimentary – limestone, sandstone, shale, coals; and metamorphic – slate, quartzite, marble, gneiss).
	S8.D.1.1.2 Describe natural processes that change Earth's surface (e.g., landslides, volcanic eruptions, earthquakes, mountain building, new land being formed, weathering, erosion, sedimentation,, soil formation).
	S8.D.1.1.3 Identify soil tupes (i.e., humus, topsoil, subsoil, loam, loess, and parent material) and their characteristics (ie., particle size, porosity, and permeability) found in different biomes and in Pennsylvania, and explain how they formed.
	S8.D.1.1.4 Explain how fossils provide evidence about plants and animals that once lived throughout Pennsylvania's history (e.g., fossils provide evidence of different environments).
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NGSS Performance Expectations	PA Academic Standards for Science
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Pennsylvania System of School Assessment (PSSA)	S8.D Earth and Space Sciences
S8.D.1 Earth Features and Processes that Change Earth and Its Resources	
S8.D.1.3 Describe characteristic features of Earth's water systems or their impact on resources.	**S8.D.1.3.1** Describe the water cycle and the physical processes on which it depends (i.e., evaporation, condensation, precipitation, transpiration, runoff, infiltration,, energy inputs, and phase changes).
	S8.D.1.3.2 Compare and contrast characteristics of freshwater and saltwater systems on the basis of their physical characteristics (i.e., composition, density, and electrical conductivity) and their use as natural resources.
	S8.D.1.3.3 Distinguish among different water systems (e.g., wetland systems, ocean systems, river systems, watersheds) and describe their relationship to each other as well as to landforms.
	S8.D.1.3.4 Identify the physical characteristics of a stream and how these characteristics determine the types of organisms found within the stream environment (e.g., biological diversity, water quality, flow rate, tributaries, surrounding watershed).
S8.D.2 Weather, Climate, and Atmospheric Processes	
S8.D.2.1 Explain how pressure, temperature, moisture, and wind are used to describe atmospheric conditions that affect regional weather or climate.	**S8.D.2.1.1** Explain the impact of water systems on the local weather or the climate of a region (e.g., lake effect snow, land/ocean breezes).
	S8.D.2.1.2 Identify how global patterns of atmospheric movement influence regional weather and climate.
	S8.D.2.1.3 Identify how cloud types, wind directions, and barometric pressure changes are associated with weather patterns in different regions of the country.

Big Idea: The Earth's surface processes affect and are affected by human activities.
Essential Question: How do Earth's processes and human activates affect each other?

NGSS Performance Expectations	PA Academic Standards for Science
MS-ESS3 Earth and Human Activity **ESS3.A Natural Resources** **MS-ESS3-1** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. **ESS3.B Natural Hazards** **MS-ESS3-2** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. **ESS3.C Human Impacts on Earth Systems** **MS-ESS3-3** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. **MS-ESS3-4** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. **ESS3.D Global Climate Change** **MS-ESS3-5** Ask questions to clarify evidence of the factors that have cased the rise in global temperatures over the past century. ***This section continues on the next page…***	**3.3.A: Earth Structure, Processes and Cycles** **1. Earth Features and the Processes that Change It** **3.3.6.A1** Recognize and interpret various mapping representations of Earth's common features. **2. Earth's Resources/Materials** **3.3.8.A2** Describe renewable and nonrenewable energy resources. **3. Earth's History** **3.3.8.A3** Explain how matter on earth is conserved throughout the geological processes over time. **5. Weather and Climate** **3.3.6.A5** Describe the composition and layers of the atmosphere. Explain the effects of oceans on climate. Describe how global patterns such as the jet stream and water currents influence local weather in measurable terms such as temperature, wind direction and speed, and precipitation. **3.3.7.A5** Describe basic elements of meteorology. Explain the relationship between energy provided by the sun and the temperature differences among water, land and atmosphere. **3.3.8.A5** Explain how the curvature of the earth contributes to climate. Compare and contrast water vapor, clouds, and humidity. **4.1 Ecology** **Biodiversity** **4.5.6.D** Identify reasons why organisms become threatened, endangered, and extinct. **Succession** **4.1.7.E** Identify factors that contribute to change in natural and human-made systems. • Explain the processes of primary and secondary succession in a given ecosystem. **4.2 Watersheds and Wetlands** **Watersheds** 3.2.6.A Identify the five major watersheds of Pennsylvania. 3.2.7.A Explain how water enters, moves through, and leaves a watershed. • Explain the concept of stream order • Describe factors that affect the flow and water quality within a watershed. 3.2.8.A Describe factors that affect the quality of ground and surface water ***This section continues on the next page…***

NGSS Performance Expectations	PA Academic Standards for Science
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NGSS Performance Expectations	PA Academic Standards for Science
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	Importance of Agriculture **4.4.6.B** Analyze how soil types and geographic regions have impacted agriculture in Pennsylvania. **4.4.7.B** Describe the economic importance of agriculture to society.
	Applying Sciences to Agriculture **4.4.7.C** Investigate resources, their relation to land use, and their impact on the food fiber system.
	Technology Influences on Agriculture **4.4.7.D** Identify positive and negative effects of technology used in agriculture and its effects on the food and fiber system and the environment over time.
	4.5 Humans and the Environment
	Sustainability **4.5.6.A** Examine how historical events have shaped the sustainably use of natural resources. **4.5.7.A** Describe how the development of civilization affects the use of natural resources. • Compare and contrast how people use natural resources in sustainable and non-sustainable ways throughout the world. **4.5.8.A** Explain how Best Management Practices can be used to mitigate environmental problems.
	Integrated Pest Management **4.5.7.B** Describe the impact of pests in different geographic locations and techniques used to manage those pests. • Identify introduced species that are classified as pest in their new environments. • Research integrated pest management.
	Pollution **4.5.6.C** Identify key people and events that shaped the environmental history in the United States **4.5.7.C** Explain how human actions affect the health of the environment. • Identify residential and industrial sources of pollution and their affects on environmental health. **4.5.8.C** Describe how humans can reduce pollution.
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NGSS Performance Expectations	PA Academic Standards for Science
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Pennsylvania System of School Assessment (PSSA)	S8.A Nature of Science
S8.A.1 Reasoning and Analysis	
S8.A.1.2 Identify and explain the impacts of applying scientific, environmental, or technological knowledge to address solutions to practical problems.	**S8.A.1.2.1** Describe the positive and negative, intended and unintended, effects of specific scientific results or technological developments (e.g., air/space travel, genetic engineering, nuclear fission/fusion, artificial intelligence, lasers, organ transplants.)
	S8.A.1.2.4 Explain society's standard of living in terms of technological advancements and how these advancements impact on agriculture (e.g., transpiration, processing, production, storage.)
Pennsylvania System of School Assessment (PSSA)	S8.B Biological Sciences
S8.B.3 Ecological Behavior and Systems	
S8.B.3.2 Identify evidence of change to infer and explain the ways different variables may affect change in natural or human-made systems.	**S8.B.3.2.1** Use evidence to explain factors that affect changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).
	S8.B.3.2.2 Use evidence to explain how diversity affects the ecological integrity of natural systems.
	S8.B.3.2.3 Describe the response of organisms to environmental changes (e.g., changes in climate, hibernation, migration, coloration) and how those changes affect survival.
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NGSS Performance Expectations	PA Academic Standards for Science
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Pennsylvania System of School Assessment (PSSA)	S8.B Biological Sciences
S8.B.3 Ecological Behavior and Systems	
S8.B.3.3 Explain how renewable and nonrenewable resources provide for human needs or how these needs impact the environment.	**S8.B.3.3.1** Explain how human activities may affect local, regional, and global environments.
	S8.B.3.3.2 Explain how renewable and nonrenewable resources provide for human needs (i.e., energy, food, water, clothing, and shelter.
	S8.B.3.3.3 Describe how water management affects the environment (e.g., recycling , composting, landfills, incineration, sewage treatment).
	S8.B.3.3.4 Explain the long-term effect of using integrated pest management (e.g., herbicides, natural predators, biogenetics) on the environment.
Pennsylvania System of School Assessment (PSSA)	S8.C Physical Sciences
S8.C.2 Forms, Sources, Conversion, and Transfer of Energy	
S8.C.2.2 Compare the environmental impact of different energy sources chosen to support human endeavors.	**S8.C.2.2.2** Compare the time span of renewability for fossil fuels and the time span of renewability for alternative fuels.
	S8.C.2.2.3 Describe the waste (i.e., kind and quantity) derived from the use of renewable and non renewable resources and their potential impact on the environment.
Pennsylvania System of School Assessment (PSSA)	S8.D Earth and Space Sciences
S8.D.1 Earth Features and Processes that Change Earth and Its Resources	
S8.D.1.1 Describe constructive and destructive natural processes that form different geologic structures and resources.	**S8.D.1.1.1** Explain the rock cycle as changes in the solid earth and rock types (igneous – granite, basalt, obsidian, pumice; sedimentary – limestone, sandstone, shale, coals; and metamorphic – slate, quartzite, marble, gneiss).
	S8.D.1.1.2 Describe natural processes that change Earth's surface (e.g., landslides, volcanic eruptions, earthquakes, mountain building, new land being formed, weathering, erosion, sedimentation,, soil formation).
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NGSS Performance Expectations	PA Academic Standards for Science
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Pennsylvania System of School Assessment (PSSA)	S8.D Earth and Space Sciences
S8.D.1 Earth Features and Processes that Change Earth and Its Resources	
S8.D.1.2 Describe the potential impact of human-made processes on changes to Earth's resources and how they affect everyday life.	**S8.D.1.2.1** Describe a product's transformation process from production to consumption (e.g., prospecting, propagating, growing, maintaining, adapting, treating, concerting, distributing, disposing) and explain the process's potential impact on Earth's resources.
	S8.D.1.2.2 Describe potential impacts of human-made processes (e.g., manufacturing, agriculture, transportation, mining) on Earth's resources, both nonliving (i.e., air, water, or earth materials) and living (i.e., plants and animals)
S8.D.2 Weather, Climate, and Atmospheric Processes	
S8.D.2.1 Explain how pressure, temperature, moisture, and wind are used to describe atmospheric conditions that affect regional weather or climate.	**S8.D.2.1.1** Explain the impact of water systems on the local weather or the climate of a region (e.g., lake effect snow, land/ocean breezes).
	S8.D.2.1.2 Identify how global patterns of atmospheric movement influence regional weather and climate.
	S8.D.2.1.3 Identify how cloud types, wind directions, and barometric pressure changes are associated with weather patterns in different regions of the country.

Pennsylvania Inquiry and Design Practices (Grades 6-8)

Asking questions and defining problems

- Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.
- Ask questions to identify and/or clarify evidence and/or the premise(s) of an argument.
- Ask questions to determine relationships between independent and dependent variables and relationships in models.
- Ask questions to clarify and/or refine a model, an explanation, or an engineering problem.
- Ask questions that require sufficient and appropriate empirical evidence to answer.
- 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.
- Ask questions that challenge the premise(s) of an argument or the interpretation of a data set.
- Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.

Developing and using models

- Evaluate limitations of a model for a proposed object or tool.
- Develop or modify a model—based on evidence – to match what happens if a variable or component of a system is changed.
- Use and/or develop a model of simple systems with uncertain and less predictable factors.
- Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena.
- Develop and/or use a model to predict and/or describe phenomena.
- Develop a model to describe unobservable mechanisms.
- Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales.

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.
- Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.
- Evaluate the accuracy of various methods for collecting data.
- Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.
- Collect data about the performance of a proposed object, tool, process or system under system under a range of conditions.

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Pennsylvania Inquiry and Design Practices (Grades 6-8)

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Constructing explanations and designing solutions

- Construct an explanation that includes qualitative or quantitative relationships between variables that
- Construct an explanation using models or representations.
- 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.
- Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events.
- Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion. Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system.
- Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.
- Optimize performance of a design by prioritizing criteria, making tradeoffs, testing, revising, and re- testing.

Analyzing and interpreting data

- Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.
- Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships.
- Distinguish between causal and correlational relationships in data.
- Analyze and interpret data to provide evidence for phenomena.
- Apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error), and/or seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials).
- Analyze and interpret data to determine similarities and differences in findings.
- Analyze data to define an optimal operational range for a proposed object, tool, process or system that best meets criteria for success.

Using mathematics and computational thinking

- Use digital tools (e.g., computers) to analyze very large data sets for patterns and trends.
- Use mathematical representations to describe and/or support scientific conclusions and design solutions.
- Create algorithms (a series of ordered steps) to solve a problem.
- Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems.
- Use digital tools and/or mathematical concepts and arguments to test and compare proposed solutions to an engineering design problem.

Engaging in argument from evidence

- Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence and/or interpretations of facts.
- Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail.
- Construct, use, and/or present an oral and written argument 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.
- Make an oral or written argument that supports or refutes the advertised performance of a device, process, or system based on empirical evidence concerning whether or not the technology meets relevant criteria and constraints.
- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.

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Pennsylvania Inquiry and Design Practices (Grades 6-8)

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Obtaining, evaluating, and communicating information

- Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s).
- Integrate qualitative and/or quantitative scientific and/or technical information in written text with that contained in media and visual displays to clarify claims and findings.
- 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 not supported by evidence.
- Evaluate data, hypotheses, and/or conclusions in scientific and technical texts in light of competing information or accounts.
- Communicate scientific and/or technical information (e.g. about a proposed object, tool, process, system) in writing and/or through oral presentations.

Pennsylvania System of School Assessment (PSSA)	S8.A Nature of Science
S8.A.1 Reasoning and Analysis	
S8.A.1.1 Explain, interpret, and apply scientific environmental, or technological knowledge presented in a variety of formats (e.g., visuals, scenarios, graphs.)	**S8.A.1.1.1** Distinguish between a scientific theory and an opinion, explaining how theory is supported with evidence, or how new data/information may change existing theories and practices.
	S8.A.1.1.2 Explain how certain questions can be answered through scientific inquiry and/or technological design.
	S8.A.1.1.3 Use evidence, such as observations or experimental results, to support inferences about a relation.
	S8.A.1.1.4 Develop descriptions, explanations, predictions, and models using evidence.
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Pennsylvania Inquiry and Design Practices (Grades 6-8)

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Pennsylvania System of School Assessment (PSSA)	S8.A Nature of Science
S8.A.2 Processes, Procedures, and Tools of Scientific Investigation	
S8.A.2.1 Apply knowledge of scientific investigation or technological design in different contexts to make inferences to solve problems.	**S8.A.2.1.1** Use evidence, observations, or a variety of scales (e.g., mass, distance, volume, temperature) to describe relationships.
	S8.A.2.1.2 Use space/time relationships, define concepts operationally, raise testable questions, or formulate hypotheses.
	S8.A.2.1.3 Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.
	S8.A.2.1.4 Interpret data/observations; develop relationships among variables based on data/observations to design models as solutions.
	S8.A.2.1.5 Use evidence from investigations to clearly communicate and support conclusions.
	S8.A.2.1.6 Identify a design flaw in a simple technological system and devise possible working solutions.
S8.A.2.2 Apply appropriate instruments for a specific purpose and describe the information the instrument can provide.	**S8.A.2.2.1** Describe the appropriate use of instruments and scales to accurately and safely measure time, mass, distance, volume, or temperature under a variety of conditions.
	S8.A.2.2.2 Apply appropriate measurement systems (e.g., time, mass, distance, volume, temperature) to record and interpret observations under varying conditions.
	S8.A.2.2.3 Describe ways technology (e.g., microscope, telescope, micrometer, hydraulic, barometer,) extends and enhances human abilities for specific purposes.
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Pennsylvania Inquiry and Design Practices (Grades 6-8)

Continued…

Pennsylvania System of School Assessment (PSSA)	S8.A Nature of Science
S8.A.3 Systems, Models, and Patterns	
S8.A.3.1 Explain the parts of a simple system, their roles, and their relationships to the system as a whole.	**S8.A.3.1.1** Describe a system as a group of related parts with specific roles that work together to achieve an observed result.
S8.A.3.2 Apply knowledge of models to make predictions, draw inferences, or explain technological concepts.	**S8.A.3.2.1** Describe how scientists use models to explore relationships in natural systems (e.g., an ecosystem, river system, the solar system.)
	S8.A.3.2.2 Describe how engineers use models to develop new and improved technologies to solve problems.
	S8.A.3.2.3 Given a model showing simple cause-and-effect relationships in a natural system, predict results that can be used to test the assumptions in the model (e.g., photosynthesis, water cycle, diffusion, infiltration).

Big Ideas	**Essential Questions**
Big Idea 1: Asking questions and defining problems are essential to developing scientific habits of mind.	What kinds of questions do scientists and engineers ask?
Big Idea 2: Scientists construct mental and conceptual models of phenomena to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others.	How do scientists and engineers develop and use models?
Big Idea 3: Scientists and engineers plan and investigate the world to systematically describe it and to develop and test theories and explanations about how the world works.	What do scientists and engineers do to find out more about our world and how it functions?
Big Idea 4: Data must be presented in a form that can reveal any patterns and relationships and that allows results to be communicated to others.	In what ways are data analyzed, interpreted, and communicated?
Big Idea 5: Mathematics enables numerical representation of variables, symbolic representation of relationships between physical entities, and prediction of outcomes.	How is mathematics utilized in doing science?
Big Idea 6: Scientific theories are developed to provide explanations about the nature of particular phenomena, predict future events, or make inferences about past events.	Why are theories valuable constructs in helping scientists understand and explain our world?
Big Idea 7: Scientists and engineers use reasoning and argumentation to make a justified claim about the world.	How do scientists and engineers communicate to others in order to advance science and engineering?
Big Idea 8: Science and engineering are ways of knowing that are represented and communicated by words, diagrams, charts, graphs, images, symbols, and mathematics.	In what ways do scientists and engineers communicate their knowledge?

Pennsylvania Core Standards for Reading in Science and Technical Subjects

Key Ideas and Details
CC.3.5.6-8.A. Cite specific textual evidence to support analysis of science and technical texts.
CC.3.5.6-8.B. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
CC.3.5.6-8.C. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Craft and Structure
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.
CC.3.5.6-8.E. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.

Integration of Knowledge and Ideas
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).
CC.3.5.6-8.H. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
CC.3.5.6-8.I. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Range and Level of Complex Texts
CC.3.5.6-8.J. By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.

Pennsylvania Core Standards for Writing in Science and Technical Subjects

Text Types and Purposes
CC.3.6.6-8.A. Write arguments focused on *discipline-specific content.*

- Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
- Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
- Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
- Establish and maintain a formal style.
- Provide a concluding statement or section that follows from and supports the argument presented.

CC.3.6.6-8.B. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

- Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
- Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
- Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
- Use precise language and domain-specific vocabulary to inform about or explain the topic.
- Establish and maintain a formal style and objective tone.
- Provide a concluding statement or section that follows from and supports the information or explanation presented.

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Pennsylvania Core Standards for Writing in Science and Technical Subjects

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Production and Distribution of Writing
CC.3.6.6-8.C. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CC.3.6.6-8.D. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
CC.3.6.6-8.E. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

Research to Build and Present Knowledge
CC.3.6.6-8.F. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
CC.3.6.6-8.G. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
CC.3.6.6-8.H. Draw evidence from informational texts to support analysis reflection, and research.

Range of Writing
CC.3.6.6-8.J.I. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.