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

Scope and Sequence for **Grade 6 Life 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: All organisms are made of cells and can be characterized by common aspects of their structure and functioning.
Essential Question: How do organisms live, grow, respond to their environment, and reproduce?

NGSS Performance Expectations	PA Academic Standards for Science
MS-LS1 From Molecules to Organisms: Structures and Processes **LS1.A: Structure and Function** **MS-LS1-1** Conduction an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. **MS-LS1-2** Develop and use a model to describe the function of a cell as a whole and ways that parts of cells contribute to the function. **MS-LS1-3** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. **LS1.B Growth and Development of Organisms** **MS-LS1-4** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. **MS-LS1-5** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. ***This section continues on the next page…***	**3.1.A Organisms and Cells** **1. Common Characteristics of Life** **3.1.6.A1** Describe the similarities and differences of major physical characteristics in plants, animals, fungi, protest, and bacteria. **3.1.7.A1** Describe the similarities and differences of physical characteristics in diverse organisms. **2. Energy Flow** **3.1.6.A2** Describe how energy derived from the sun is used by plants to produce sugars (photosynthesis) and is transferred within a food chain from producer (plants) to consumers to decomposers. **3.1.7.A2** Describe how organisms obtain and use energy throughout their lives. ***This section continues on the next page…***

NGSS Performance Expectations	PA Academic Standards for Science
Continued... **LS1.C Organization for Matter and Energy Flow in Organisms** **MS-LS1-6** Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. **MS-LS1-7** Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. **MS-LS2 Ecosystems: Interactions, Energy, and Dynamics** **LS2.A: Interdependent Relationships in Ecosystems** **MS-LS2-1** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. **MS-LS2-2** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. **LS2.B: Cycle of Matter and Energy Transfer in Ecosystems** **MS-LS2-3** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** **MS-LS2-4** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. **MS-LS2-5** Evaluate competing design solutions for maintaining biodiversity and ecosystem services. ***This section continues on the next page…***	***Continued…*** **3. Life Cycles** **3.1.7.A3** Explain why the life cycles of different organisms have varied lengths. **4. Cell Cycles** **3.1.6.A4** Recognize that all organisms are composed of cells and that many organisms are unicellular and must carry out all life functions in on cell. **3.1.7.A4** Explain how cells arise from pre-existing cells. **5. Form and Function** **3.1.6.A5** Describe basic structures that plants and animals have that contribute to their ability to make or find food and reproduce. **3.1.7.A5** Explain how the cell is the basic structural and functional unit of living things. **6. Organization** **3.1.6.A6** Identify examples of unicellular and multicellular organisms. **3.1.7.A6** Identify the levels of organization from cell to organism. **7. Molecular Basis of Life** **3.1.7.A7** Compare life processes (e.g., growth, digestion) at the organism level with life processes at the cellular level. **8. Unifying Themes** **3.1.6.A8** SCALE Explain why the details of most cells are visible only through a microscope **3.1.7.A8** MODELS Apply the appropriate models to show interactions among organisms in an environment. **3.1.8.A8** CHANGE AND CONSTANCY Explain mechanisms organism use to adapt to their environment. ***This section continues on the next page…***

NGSS Performance Expectations	PA Academic Standards for Science
Continued... **MS-LS4 Biological Evolution: Unity and Diversity** **LS4.C: Adaptation** **MS-LS4-6** Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.	***Continued…*** **4.1 Ecology** **Materials Cycles** **4.1.7.B** Explain biochemical cycles within an ecosystem.

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.3.1.2** Explain the concept of order in a system [e.g., (first to last: manufacturing steps, trophic levels); (simple to complex: cell, tissue, organ, organ system)]
	S8.A.3.1.3 Distinguish among system inputs, system processes, system outputs, and feedback (e.g., physical ecological, biological, informational.)
	S8.A.3.1.4 Distinguish between open loop (e.g., energy glow, food web) and closed loop., materials in the nitrogen and carbon cycles, closed-switch) systems.
	S8.A.3.1.5 Explain how components of natural and human-made systems play different roles in a working system.
S8.A.3.3 Describe repeated processes or recurring elements in natural, scientific, and technological patterns.	**S8.A.3.3.2** Describe repeating structure patterns in nature (e.g., veins in a leaf, tree ring, crystals, water waves) or periodic patterns (e.g., daily, monthly, annually).
Pennsylvania System of School Assessment (PSSA)	S8.B Biological Sciences
S8.B.1 Structure and Function of Organisms	
S8.B.1.1 Describe and compare structural and functional similarities and differences that characterize diverse living things.	**S8.B.1.1.1** Describe the structures of living things that help them function effectively in specific ways (e.g., adaptions, characteristics).
	S8.B.1.1.2 Compare similarities and differences in internal structures of organisms (e.g., invertebrate/vertebrate, vascular/nonvascular, single-celled/multi-celled) and external structures (e.g., appendages, body segments, type of covering, size, shape).
	S8.B.1.1.3 Apply knowledge of characteristic structures to identify or categorize organisms (i.e., plants, animals, fungi, bacteria, and protista.
	S8.B.1.1.4 Identify the levels of organization form cell to organism and describe how specific structures (parts), which underlie larger systems, enable the system to function as a whole.
This section continues on the next page…	***This section continues on the next page…***

NGSS Performance Expectations	PA Academic Standards for Science
Continued...	***Continued…***
Pennsylvania System of School Assessment (PSSA)	S8.B Biological Sciences
S8.B.3 Ecological Behavior and Systems	
S8.B.3.1 Explain the relationships among and between organisms in different ecosystems and their abiotic and biotic components.	**S8.B.3.1.1** Explain the flow of energy through an ecosystem (e.g., food chains, food webs).
	S8.B.3.1.3 Explain relationships among organisms (e.g., producers/consumer, predator/prey) in an ecosystem.

Big Idea: Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.
Essential Question: How and why do organisms interact with their environment and what are the effects of these interactions?

NGSS Performance Expectations	PA Academic Standards for Science
MS-LS1 From Molecules to Organisms: Structures and Processes **LS1.C Organization for Matter and Energy Flow in Organisms** **MS-LS1-7** Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. **MS-LS2 Ecosystems: Interactions, Energy, and Dynamics** **LS2.A: Interdependent Relationships in Ecosystems** **MS-LS2-1** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. **MS-LS2-2** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. **MS-LS3 Heredity: Inheritance and Variation of Traits** **LS3.A: Inheritance of Traits** **MS-LS3-1** Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. **MS-LS3-2** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation **MS-LS4 Biological Evolution: Unity and Diversity** **LS4.B: Natural Selection** **MS-LS4-4** Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. **MS-LS4-5** Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms. ***This section continues on the next page…***	**3.1.A: Organisms and Cells** **2. Energy Flow** **3.1.6.A2** Describe how energy derived from the sun is used by plants to produce sugars (photosynthesis) and is transferred within a food chain from producer (plants) to consumers to decomposers. **3.1.7.A2** Describe how organisms obtain and use energy throughout their lives. **3.1.B Genetics** **2. Reproduction** **3.1.7.B2** Compare sexual reproduction with asexual reproduction. **3.1.C Evolution** **1. Natural Selection** **3.1.7.C1** Describe how natural selection is an underlying factor in a population's ability to adapt to changes. **3.1.8.C1** Explain how reproductive success coupled with advantageous traits over many generations contributes to natural selection. **4.1 Ecology** **The Environment** **4.1.7.A** Describe the relationship between biotic and abiotic components of an ecosystem. • Compare and contrast different biomes and their characteristics. • Describe symbiotic and predator/prey relationships. **Energy Flow** **4.1.7.C** Explain the flow of energy within an ecosystem. • Compare and contrast the flow of energy between organisms in different habitats • Explain the concept of trophic level ***This section continues on the next page…***

NGSS Performance Expectations	PA Academic Standards for Science
Continued…	***Continued…*** **Biodiversity** **4.5.7.D** Explain how biological diversity relates to the viability of ecosystems • Explain how biodiversity relates to the ability of an ecosystem to adapt to change. • Explain how an adaptation is an inherited, structure, function, or behavior that helps and organism survive and reproduce. **4.5 Humans and the Environment** **Sustainability** **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. **Waste Management** **4.3.7.D** Describe the wastes derived from using resources, how the waste is managed, and the potential impact on the environment.

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.1.2.2** Identify environmental issues and explain their potential long-term health effects (e.g., pollution, pest controls, vaccinations).
S8.A.1.3 Identify and analyze evidence that certain variables my have caused measurable changes in natural or human-made systems.	**S8.A.1.3.2** Use evidence, observations, or explanations to make inference about change in systems over time (e.g., carrying capacity, succession, population dynamics, loss of mass in chemical reactions, indicator fossils in geologic time scale) and the variables affecting these changes.
	S8.A.1.3.3 Examine systems changing over time, identifying the possible variables causing this change, and drawing inferences about how these variables affect this change.
	S8.A.1.3.4 Given a scenario, explain how a dynamically changing environment provides for the sustainability of living systems.
This section continues on the next page…	***This section continues on the next page…***

NGSS Performance Expectations	PA Academic Standards for Science
Continued…	***Continued…***
Pennsylvania System of School Assessment (PSSA)	S8.B Biological Sciences
S8.B.2 Continuity of Life	
S8.B.2.1 Explain the basic concepts of natural selection.	**S8.B.2.1.1** Explain how inherited structures or behaviors help organisms survive and reproduce in different environments.
S8.B.3 Ecological Behavior and Systems	
S8.B.3.1 Explain the relationships among and between organisms in different ecosystems and their abiotic and biotic components.	**S8.B.3.1.1** Explain the flow of energy through an ecosystem (e.g., food chains, food webs).
	S8.B.3.1.2 Identify major biomes and describe abiotic and biotic components (e.g., abiotic: different soil types, air, water, sunlight; biotic: soil microbes, decomposers).
	S8.B.3.1.3 Explain relationships among organisms (e.g., producers/consumer, predator/prey) in an ecosystem.
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.

Big Idea: Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to their parents.
Essential Questions: How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characterizes? How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?

NGSS Performance Expectations	PA Academic Standards for Science
MS-LS3 Heredity: Inheritance and Variation of Traits **LS3.A: Inheritance of Traits** **MS-LS3-2** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. **MS-LS4 Biological Evolution: Unity and Diversity** **LS4.A: Evidence of Common Ancestry and Diversity** **MS-LS4-1** Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. **MS-LS4-2** Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. **MS-LS4-3** Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. **LS4.C: Adaptation** **MS-LS4-6** Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. ***This section continues on the next page…***	**3.1.B Genetics** **1. Heredity** **3.1.7.B1** Explain how genetic instructions influence inherited traits. Identify Mendelian patterns of inheritance. **2. Reproduction** **3.1.7.B2** Compare sexual reproduction with asexual reproduction. **4. Biotechnology** **3.1.7.B4** Describe how selective breeding and biotechnology can alter the genetic composition of organisms **5. Unifying Themes** **3.1.7.B5** Compare and contrast observable patterns in the physical characteristics across families, strains and species. **3.1.C Evolution** **1. Natural Selection** **3.1.6.C1** Differentiate between instinctive and learned animal behaviors that relate to survival. **3.1.7.C1** Describe how natural selection is an underlying factor in a population's ability to adapt to changes. **3.1.8.C1** Explain how reproductive success coupled with advantageous traits over many generations contributes to natural selection. **2. Adaptation** **3.1.7.C2** Explain why the extinction of a species may occur when the environment changes. Explain that mutations can alter a gene and are the original source of new variations in a population. ***This section continues on the next page…***

NGSS Performance Expectations	PA Academic Standards for Science
Continued…	***Continued…***
Pennsylvania System of School Assessment (PSSA)	S8.B Biological Sciences
S8.B.2 Continuity of Life	
S8.B.2.1 Explain the basic concepts of natural selection.	**S8.B.2.1.1** Explain how inherited structures or behaviors help organisms survive and reproduce in different environments.
	S8.B.2.1.2 Explain how different adaptations in individuals of the same species may affect survivability or reproduction success.
	S8.B.2.1.3 Explain that mutation can alter a gene and are the original source of new variations.
	S8.B.2.1.4 Describe how selective breeding or biotechnology can change the genetic makeup of organisms.
S8.B.2.2 Explain how a set of genetic instructions determines inherited traits of organisms.	**S8.B.2.2.1** Identify and explain differences between inherited and acquired traits.
	S8.B.2.2.2 Recognize that the gene is the basic unit of inheritance, that there are dominant and recessive genes, and that traits are inherited.
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.3.2.3** Describe the response of organisms to environmental changes (e.g., changes in climate, hibernation, migration, coloration) and how those changes affect survival.

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.

This section continues on the next page…

Pennsylvania Inquiry and Design Practices (Grades 6-8)

Continued…

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.

This section continues on the next page…

Pennsylvania Inquiry and Design Practices (Grades 6-8)

Continued…

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.
This section continues on the next page…	***This section continues on the next page…***

Pennsylvania Inquiry and Design Practices (Grades 6-8)

Continued…

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.
This section continues on the next page…	***This section continues on the next page…***

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.

This section continues on the same page…

Pennsylvania Core Standards for Writing in Science and Technical Subjects

Continued…

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.