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

Scope and Sequence for **Grade 3 Science**

Pennsylvania Long-Term Transfer Goals for Science
1. Approach science as a 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: Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.
Essential Question: How can one explain the structure, properties, and interactions of matter?

NGSS Performance Expectations	PA Academic Standards for Science*
Intentionally left blank.	**3.2.A Chemistry** **1. Properties of matter** **3.2.K.A1**** Identify and classify objects by observable properties of matter. Compare different kinds of materials and discuss their uses. **3.2.1.A1** Observe and describe the properties of liquids and solids. Investigate what happens when solids are mixed with water and other liquids are mixed with water. **2. Structure of Matter** **3.2.3.A2**** Recognize that all objects and materials in the world are made of matter. **3.2.43.A2**** Demonstrate that materials are composed of parts that are too small to be seen without magnification.
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NGSS Performance Expectations	PA Academic Standards for Science*
Continued…	***Continued…*** **4. Reactions** **3.2.1.A4**** Observe and describe what happens when substances are heated and cooled. Distinguish between changes that are reversible (melting, freezing) and not reversible (e.g. baking a cake, burning fuel). **3.2.2.A4**** Experiment and explain what happens when two or more substances are combined (e.g. mixing, dissolving, and separated (e.g. filtering, evaporation). **3.2.3.A4**** Use basic reactions to demonstrate observable changes in properties of matter (e.g. burning, cooking). **3.2.4.A4**** Recognize that combining two or more substances may make new materials with different properties. **5. Unifying Themes** **3.2.3.A5**** CONSTANCY AND CHANGE Recognize that everything is made of matter.
Pennsylvania System of School Assessment (Grade 4 PSSA)*	S4.C Physical Sciences
S4.C.1 Structure, Properties, and Interaction of Matter and Energy	
S4.C.1.1 Describe observable physical properties of matter.	**S4.C.1.1.1** Use physical properties [e.g., mass, shape, size, volume, color, texture, magnetism, state (i.e., solid, liquid, and gas), conductivity (i.e., electrical and heat)] to describe matter.
	S4.C.1.1.2 Categorize/group objects using physical characteristics.

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Big Idea: Interactions between any two objects can cause changes in one or both of them.
Essential Question: How can one explain or predict interactions between objects within systems?

NGSS Performance Expectations	PA Academic Standards for Science*
3-PS2 Motion and Stability: Forces and Interactions **PS2.A: Forces and Motion** **3-PS2-1** Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. **3-PS2-2** Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.	**3.2.B Physics** **1. Force & Motion of Particles and Rigid Bodies** **3.2.1.B1**** Demonstrate various types of motion. Observe and describe how pushes and pulls change the motion of objects. **3.2.3.B1**** Explain how movement can be described in many ways. **3.2.4.B1**** Explain how an object's change in motion can be observed and measured. **3.2.5.B1** Explain how mass of an object resists change to motion.

Pennsylvania System of School Assessment (Grade 4 PSSA)*	S4.A The Nature of Science
S4.A.3 Systems, Models, and Patterns	
S4.A.3.1 Identify systems and describe relationships among parts of a familiar system (e.g., digestive system, simple machines, water cycle).	**S4.A.3.1.1** Categorize systems as either natural or human-made (e.g., ballpoint pens, simple electrical circuits, plant anatomy, water cycle).

Pennsylvania System of School Assessment (Grade 4 PSSA)*	S4.C Physical Sciences
S4.C.3 Principles of Motion and Force	
★ S4.C.3.1 Identify and describe different types of force and motion resulting from these forces, or the effect of the interaction between force and motion.	**S4.C.3.1.1**** Describe changes in motion caused by forces (e.g., magnetic, pushes or pulls, gravity, friction).
	S4.C.3.1.2** Compare the relative movement of objects of describe types of motion that are evident (e.g., bouncing ball, moving in a straight line, back and forth, merry-go-round).
	S4.C.3.1.3** Describe the position of an object by locating it relative to another object or a stationary background (e.g., geographic direction, left, up).

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Big Idea: Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Question: How is energy transferred and conserved?

NGSS Performance Expectations	PA Academic Standards for Science*
3-PS2 Motion and Stability: Forces and Interactions **PS2.B: Types of Interactions** **3-PS2-3** Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. **3-PS2-4** Define a simple design problem that can be solved by applying scientific ideas about magnets.	**3.2.B Physics** **4. Electrical and Magnetic Energy** **3.2.3.B4** Identify and classify objects and materials that are conductors or insulators of electricity. Identify and classify objects and materials as magnetic or non-magnetic. **3.2.4.B4** Apply knowledge of basic electrical circuits to the design and construction of simple direct current circuits. Compare and contrast series and parallel circuits. Demonstrate that magnets have poles that repel and attract each other.

Pennsylvania System of School Assessment (Grade 4 PSSA)*	S4.C Physical Sciences
S4.C.1 Structure, Properties, and Interaction of Matter and Energy	
S4.C.1.1 Describe observable physical properties of matter.	**S4.C.1.1.1** Use physical properties [e.g., mass, shape, size, volume, color, texture, magnetism, state (i.e., solid, liquid, and gas), conductivity (i.e., electrical and heat)] to describe matter.
	S4.C.1.1.2 Categorize/group objects using physical characteristics.

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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*
3-LS1 From Molecules to Organisms: Structures and Processes **LS1.B: Growth and Development of an Organism** **3-LS1-1** Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. ***This section continues on the next page…***	**3.1.A Organisms and Cells** **1. Common Characteristics of Life** **3.1.1.A1** Categorize living and nonliving things by external characteristics. **3.1.3.A1** Describe characteristics of living things that help to identify and classify them. **3.1.4.A1**** Classify plants and animals according to the physical characteristics that they share. **2. Energy Flow** **3.1.4.A2** Describe the different resources that plants and animals need to live. **3. Life Cycles** **3.1.K.A3**** Observe, compare, and describe stages of life cycles for plants and/or animals. **3.1.2.A3**** Identify similarities and differences in the life cycles of plants and animals. **3.1.3.A3**** Illustrate how plants and animals go through predictable life cycles that include birth, development, reproduction, and death. **3.1.4.A3** Identify differences in the life cycles of plants and animals. **3.1.5.A3** Compare and contrast the similarities and difference in life cycles of different organisms. **5. Form and Function** **3.1.K.A5**** Observe and describe structures and behaviors of a variety of common animals. **3.1.1.A5**** Identify and describe plant parts and their function. **3.1.2.A5**** Explain how different parts of a plant work together to make the organism function. **3.1.3.A5**** Identify the structures in plants that are responsible for food production, support, water transport, reproduction, growth, and protection. **3.1.4.A5** Describe common functions living things share to help them function in a specific environment. **8. Unifying Themes** **3.1.4.A8**** MODELS Construct and interpret models and diagrams of various animal and plant life cycles. ***This section continues on the next page…***

NGSS Performance Expectations	PA Academic Standards for Science*
Continued…	***Continued…*** **4.1 Ecology** **A. The Environment** **4.1.K.A** Identify the similarities and differences of living and non-living things within the immediate and surrounding environment. **4.1.1.A** Identify and describe the basic needs of living things in a terrestrial habitat. **4.1.3.A** Differentiate between the living and nonliving components of an environment. **4.1.4.A** Explain how living things are dependent upon other living things. **C. Energy Flow** **4.1.1.C** Describe a simple food chain within a terrestrial habitat. **4.4 Agriculture and Society** **C. Applying Sciences to Agriculture** **4.4.K.C** Observe and describe stages of life cycles for plants and animals. **4.4.1.C** Describe the life cycles of different plants and animals in terrestrial habitats. **4.4.3.C** Use scientific inquiry to investigate what animals and plants need to grow.
Pennsylvania System of School Assessment (Grade 4 PSSA)*	S4.A The Nature of Science
S4.A.3 Systems, Models, and Patterns	
S4.A.3.1 Identify systems and describe relationships among parts of a familiar system (e.g., digestive system, simple machines, water cycle).	**S4.A.3.1.2** Explain a relationship between the living and nonliving components in a system (e.g., food web, terrarium).
	S4.A.3.1.3 Categorize the parts of an ecosystem as either living or nonliving and describe their roles in the system.
Pennsylvania System of School Assessment (Grade 4 PSSA)*	S4.B Biological Sciences
S4.B.1 Structure and Function of Organisms	
S4.B.1.1 Identify and describe similarities and differences between living things and their life processes.	**S4.B.1.1.1** Identify life processes of living things (e.g., growth, digestion, respiration).
	S4.B.1.1.2 Compare similar functions of external characteristics of organisms (e.g., anatomical characteristics: appendages. Type of covering, body segments).
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NGSS Performance Expectations	PA Academic Standards for Science*
Continued…	***Continued…***
	S4.B.1.1.3 Describe basic needs of plants and animals (e.g., air, water, food).
	S4.B.1.1.4 Describe how different parts of living thing work together to provide what the organism needs (e.g., parts of plants: roots, stems, leaves).
	S4.B.1.1.5 Describe the life cycles of different organisms (e.g., moth, grasshopper, frog, seed-producing plant).
S4.B.3 Ecological Behavior and Systems	
S4.B.3.1 Identify and describe living and nonliving things in the environment and their interaction.	**S4.B.3.1.1** Describe the living and nonliving components of a local ecosystem (e.g., lentic and lotic systems, forest, cornfield, grasslands, city park, playground).
	S4.B.3.1.2 Describe interactions between living and nonliving components (e.g., plants – water, soil, sunlight, carbon dioxide, temperature; animals – food, water, shelter, oxygen, temperature) of a local ecosystem).

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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*
3-LS2 Ecosystems: Interactions, Energy, and Dynamics **LS2.D: Social Interactions and Group Behavior** **3-LS2-1** Construct an argument that some animals form groups that help members survive. **3-LS4 Biological Evolution: Unity and Diversity** **LS2.A: Evidence of Common Ancestry and Diversity** **3-LS4-1** Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. **LS2.B: Natural Selection** **3-LS4-2** Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. **LS2.C: Adaptation** **3-LS4-3 C**onstruct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. **LS2.D: Biodiversity and Humans** **3-LS4-4** Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. ***This section continues on the next page…***	**3.1.C Evolution** **1. Natural Selection** **3.1.3.C1**** Recognize that plants survive through adaptations, such as stem growth towards light and root growth downward in response to gravity. Recognize that many plants and animals can survive harsh environments because of seasonal behaviors (e.g. hibernation, migration, trees shedding leaves). **3.1.4.C1**** Identify different characteristics of plants and animals that help some populations survive and reproduce in greater numbers. Describe how environmental changes can cause extinction in plants and animals. **3.1.5.C1** Describe how organisms meet some of their needs in an environment by using behaviors (patterns of activities) in response to information (stimuli) received from the environment. **2. Adaptation** **3.1.K.C2**** Describe changes animals and plants undergo throughout the seasons. **3.1.2.C2**** Explain that living things can only survive if their needs are being met. **3.1.3.C2**** Describe animal characteristics that are necessary for survival. **3.1.4.C2** Describe plant and animal adaptations that are important to survival. **3.1.5.C2** Give examples of inherited characteristics (e.g. shape of beak, length of neck, location of eyes, shape of teeth) may change over time as adaptations to changes in the environment that enable organisms to survive. **3. Unifying Themes** **3.1.1.C3**** CONSTANCY AND CHANGE Describe changes that occur as a result of habitat. **3.1.2.C3**** CONSTANCY AND CHANGE Describe some plants and animals that once lived on Earth, (e.g. dinosaurs) but cannot be found anymore. Compare them to now living things that resemble them in some way (e.g. lizards and birds). **3.1.3.C3**** CONSTANCY AND CHANGE Recognize that fossils provide us with information about living things that inhabited the Earth long ago. **3.1.4.C3**** CONSTANCY AND CHANGE Compare fossils to one another and to currently living organisms according to their anatomical similarities and differences. ***This section continues on the next page…***

NGSS Performance Expectations	PA Academic Standards for Science*
Continued…	***Continued…*** **<u>3.3.A Earth Structure, Processes and Cycles</u>** **3. Earth's History** **3.3.4.A3**** Recognize that fossils provide evidence about the plants and animals that lived long ago and the nature of the environment at that time. **<u>4.1 Ecology</u>** **D. Biodiversity** **4.1.K.D** Observe and describe what happens to living things when needs are met. **4.1.1.D** Identify living things that are threatened, endangered, or extinct. **4.1.2.D** Identify differences in living things (color, shape, size, etc.) and describe how adaptations are important for survival. **4.1.3.D** Identify organisms that are dependent on one another in a given ecosystem. Define habitat and explain how a change in habitat affects an organism. **4.1.4.D** Explain specific adaptations can help organisms survive in their environment. **4.1.5.D** Explain the differences between threatened, endangered, and extinct organisms. **E. Succession** **4.1.2.E** Identify how living things survive changes in their environment.
Pennsylvania System of School Assessment (Grade 4 PSSA)*	S4.A The Nature of Science
S4.A.1 Reasoning and Analysis	
S4.A.1.3 Recognize and describe change in natural or human-made systems and the possible effects of those changes.	**S4.A.1.3.4** Explain what happens to a living organism when its food supply, access to water, shelter, or space is changed (e.g., it might die, migrate, change behavior, eat something else).
Pennsylvania System of School Assessment (Grade 4 PSSA)*	S4.B Biological Sciences
S4.B.2 Continuity of Life	
S4.B.2.1 Identify and explain how adaptations help organisms to survive.	**S4.B.2.1.1** Identify characteristics for plant and animal survival in different environments (e.g., wetland, tundra, desert, prairie, deep ocean, forest.)
	S4.B.2.1.2 Explain how specific adaptations can help a living organism survive (e.g., protective coloration, mimicry leaf sizes and shapes, ability to catch or retain water.)
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	NGSS Performance Expectations	PA Academic Standards for Science*
	Continued… **S4.B.3 Ecological Behavior and Systems**	
	S4.B.3.2 Describe, explain, and predict change in natural or human-made systems and the possible effects of those changes on the environment.	**S4.B.3.2.1** Describe what happens to a living thing when its habitat is changed.
		S4.B.3.2.2 Describe and predict how changes in the environment (e.g., fire, pollution, flood, building dams) can affect systems.
		S4.B.3.2.3 Explain and predict how changes in seasons affect plants, animals, or daily human life (e.g., food availability, shelter, mobility).

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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?

NGSS Performance Expectations	PA Academic Standards for Science*
3-LS3 Heredity: Inheritance and Variation of Traits **LS3.A: Inheritance of Traits** **3-LS3-1** Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. **3-LS3-2** Use evidence to support the explanation that traits can be influenced by the environment.	**3.1.B Genetics** **1. Heredity** **3.1.3.B1**** Understand that plants and animals resemble their parents. **3.1.4.B1**** Describe features that are observable in both parents and their offspring. **3.1.5.B1** Differentiate between inherited and acquired characteristics of plants and animals. **2. Reproduction** **3.1.4.B2**** Recognize that reproduction is necessary for the continuation of life. **5. Unifying Themes** **3.1.3.B5**** PATTERNS Identify characteristics that appear in both parents and offspring. **3.1.4.B5**** PATTERNS Identify observable patterns in the physical characteristics of plants of groups of animals.

Pennsylvania System of School Assessment (Grade 4 PSSA)*	S4.B Biological Sciences
S4.B.2 Continuity of Life	
S4.B.2.2 Identify that characteristics are inherited and, thus, offspring closely resemble their parents.	**S4.B.2.2.1** Identify physical characteristics (e.g., height, hair color, eye color, attached earlobes, ability to toll tongue) that appear in both parents and could be passed on to offspring.

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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 Questions: How and why is the Earth constantly changing?

NGSS Performance Expectations	PA Academic Standards for Science*
3-ESS2 Earth's Systems **ESS2.D: Weather and Climate** **3-ESS2-1** Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. **3-ESS2-2** Obtain and combine information to describe climates in different regions of the world. ***This section continues on the next page…***	**3.3.A Earth Structure, Processes and Cycles** **1. Earth Features and the Processes that Change It** **3.3.4.A1** Describe basic landforms. Identify the layers of the earth. Recognize that the surface of earth changes due to slow processes and rapid processes. **3.3.5.A1** Describe how landforms are the result of a combination of destructive forces such as erosion and constructive erosion, deposition of sediment, etc. **4. Water** **3.3.1.A4**** Identify and describe types of fresh- and salt-water bodies (ocean, rivers, lakes, ponds). **3.3.2.A4**** Explore and describe that water exists in solid (ice) and liquid) form. Explain and illustrate evaporation and condensation. **3.3.3.A4**** Connect various forms of precipitation to the weather in a particular place and time. **3.3.4.A4**** Recognize Earth's different water resources, including both fresh and saltwater. Describe phase changes in the forms of water on Earth. **3.3.5.A4** Explain the basic components of the water cycle. **5. Weather and Climate** **3.3.K.A5**** Record daily weather conditions using simple charts and graphs. Identify seasonal changes in the environment. Distinguish between types if precipitation. **3.3.1.A5**** Become familiar with weather instruments. Collect, describe, and record basic information about weather over time. **3.3.3.A5**** Explain how air temperature, moisture, wind speed and direction, and precipitation make up the weather in a particular place and time. **3.3.4.A5**** Describe basic weather elements. Identify weather patterns over time. **3.3.5.A5** Differentiate between weather and climate. Explain how the cycling of water, both in and out of the atmosphere, has an affect on climate. **6. Unifying Themes** **3.3.4.A6** MODEL/SCALE Identify basic landforms using models and simple maps. CONSTANCY/CHANGE Identify simple changes in the earth system as air, water, soil, and rock interact. SCALE Explain how weather elements are measured. ***This section continues on the next page…***

NGSS Performance Expectations	PA Academic Standards for Science*
Continued…	***Continued…*** **<u>4.2 Watersheds and Wetlands</u>** **A. Watersheds** **4.2.K.A** Identify components of a water cycle. **4.2.1.A** Explain the path water takes as it moves through the water cycle. **4.2.3.A** Define the term watershed. Identify the watersheds in which you reside. **4.2.5.A** Explain the water cycle.
Pennsylvania System of School Assessment (Grade 4 PSSA)*	S4.D Earth and Space Sciences
S4.D.1 Earth Features and Processes that Change Earth and Its Resources	
S4.D.1.3 Describe Earth's different sources of water or describe changes in the form of water.	**S4.D.1.3.1** Describe types of freshwater and saltwater bodies (e.g., lakes, rivers, wetlands, oceans).
	S4.D.1.3.2** Explain how water goes through phase changes (i.e., evaporation, condensation, freezing, and melting).
	S4.D.1.3.3 Describe or compare lentic systems (i.e., ponds, lakes, and bays) and lotic systems (i.e., streams, creeks, and rivers).
	S4.D.1.3.4** Explain the role and relationship of a watershed or a wetland on water sources (e.g., water storage, groundwater recharge, water filtration, water source, water cycle).
S4.D.2 Weather, Climate, and Atmospheric Processes	
★ S4.D.2.3 Identify basic weather conditions and how they are measured.	**S4.D.2.1.1**** Identify basic cloud types (i.e., cirrus, cumulus, stratus, and cumulonimbus) and make connections to basic elements of weather (e.g., changes in temperature, precipitation).
	S4.D.2.1.2** Identify weather patterns from data charts or graphs of the data (e.g., temperature wind direction, wind speed, cloud types, precipitation).
	S4.D.2.1.3** Identify appropriate instruments (i.e., thermometer, rain gauge, weather vane, anemometer, and barometer) to study weather and what they measure.

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

NGSS Performance Expectations	PA Academic Standards for Science*
Intentionally left blank.	**<u>3.3.A Earth Structure, Processes, and Cycles</u>** **2. Earth's Resources/Materials** **3.3.4.A2** Identify basic properties and uses of Earth's materials including rocks, soils, water, and gases of the atmosphere. **3.3.5.A2** Describe the usefulness of Earth's physical resources as raw materials for the human made world. **4. Water** **3.3.K.A4**** Identify sources of water for human consumption and use. **<u>4.5 Humans and the Environment</u>** **A. Food and Fiber Systems** **4.5.1.A** Identify resources humans use from the environment. **4.5.2.A** Identify the natural resources used to make various products. **4.5.3.A** Identify resources humans take from the environment for their survival. **C. Pollution** **4.5.K.C** Identify different types of pollution (land, water or air) and their sources **4.5.1.C** Describe how pollution affects the health of a habitat. **4.5.2.C** Identify how people can reduce pollution. **4.5.3.C** Identify different types of pollution and their sources.
Pennsylvania System of School Assessment (Grade 4 PSSA)*	S4.B Biological Sciences
S4.B.3 Ecological Behavior and Systems	
S4.B.3.3 Identify and describe human reliance on the environment at the individual or the community level.	**S4.B.3.3.5** Describe the effects of pollution (e.g., litter) in the community.
Pennsylvania System of School Assessment (Grade 4 PSSA)*	S4.D Earth and Space Sciences
S4.D.1 Earth Features and Processes that Change Earth and Its Resources	
S4.D.1.2 Identify the types and uses of Earth's resources.	**S4.D.1.2.3**** Recognize ways that humans benefit from the use of water resources (e.g., agriculture, energy, recreation).

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Pennsylvania Inquiry and Design Practices (Grades 3-5)*

Asking questions and defining problems

- Ask questions about what would happen if a variable is changed.
- Identify scientific (testable) and non-scientific (non-testable) questions.
- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
- Use prior knowledge to describe problems that can be solved.
- Define a simple design problem that can be solved through the development of an object tool, process, or system and include several criteria for success and constraints on materials, time, or cost.

Developing and using models

- Identify limitations of models.
- Develop a simple model based on evidence to represent a proposed object or tool.
- Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.
- Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.
- Develop and/or use models to describe and/or predict phenomena.
- Develop a diagram or simple physical prototype to convey a proposed object, tool, or process.
- Use a model to test cause and effect relationships or interactions concerning the functioning of a natural designed system.

Planning and carrying out investigations

- Evaluate appropriate methods and/or tools for collecting data.
- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
- Make predictions about what would happen if a variable changes.
- Test two different models of the same proposed object, tool, or process to design solutions under a range of conditions.
- Collect data about the performance of a proposed object, tool, process or system under a range of conditions.

Constructing explanations and designing solutions

- Construct an explanation of observed relationships (e.g., the distribution of plants in the backyard.)
- Use evidence (e.g., measurements, observation, patterns) to construct or support an explanation or design a solution to a problem.
- Identify the evidence that supports particular points in an explanation.
- Apply scientific ideas to solve design problems.
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.

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Pennsylvania Inquiry and Design Practices (Grades 3-5)*

Continued…

Analyzing and interpreting data

- When possible and feasible, digital tools should be used.
- Represent data in tables and/or various graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.
- Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.
- Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.
- Analyze data to refine a problem statement or the design of a proposed object, tool, or process.
- Use data to evaluate and refine design solutions.

Using mathematics and computational thinking

- Decide if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success.
- Organize simple data sets to reveal patterns that suggest relationships.
- Describe, measure, estimate, and/or graph quantities (e.g., area, volume, weight, time) to address scientific and engineering questions and problems.
- Create and/or use graphs and/or charts generated from simple algorithms to compare alternative solutions to an engineering problem.

Engaging in argument from evidence

- Compare and refine arguments based on an evaluation of the evidence presented.
- Distinguish among facts, reasoned judgment, based on research findings, and speculation in an explanation.
- Respectfully provide and receive critiques from peers about a proposed procedure, explanation, or model by citing relevant evidence and posing specific questions.
- Construct and/or support an argument with evidence, data, and/or a model.
- Use data to evaluate claims about cause and effect.
- Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.

Obtaining, evaluating, and communicating information

- Compare and/or combine across complex texts and/or other reliable media to support the engagement in other scientific and/or engineering practices.
- Combine information in written text with that contained in corresponding tables, diagrams, and/or charts to support the engagement in other scientific and/or engineering practices.
- Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.
- Communicate scientific and/or technical information orally and/or in written formats, including various forms of media as well as tables, diagrams, and charts.

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Pennsylvania Inquiry and Design Practices (Grades 3-5)*

Continued…

Pennsylvania System of School Assessment (Grade 4 PSSA)*	S4.A The Nature of Science
S4.A.1 Reasoning and Analysis	
S4.A.1.1 Identify and explain the application of scientific, environmental, or technological knowledge to possible solutions to problems.	**S4.A.1.1.1** Distinguish between a scientific fact and an opinion, providing clear explanations that connect observations and results (e.g., a scientific fact can be supported by making observations.
	S4.A.1.1.2 Identify and describe examples of common technological changes past to present in the community (e.g., energy production, transportation, communications, agriculture, packaging materials) that have either a positive or negative impacts on society or the environment.
S4.A.1.3 Recognize and describe change in natural or human-made systems and the possible effects of those changes.	**S4.A.1.3.1** Observe and record change by using time and measurement.
	S4.A.1.3.2 Describe relative size, distance, or motion.
S4.A.2 Processes, Procedures, and Tools of Scientific Investigations	
S4.A.2.1 Apply skills necessary to conduct an experiment or design a solution to solve a problem.	**S4.A.2.1.1** Generate questions about objects, organisms, or events that can be answered through scientific investigations.
	S4.A.2.1.2 Design and describe an investigation (a fair test) to test one variable.
	S4.A.2.1.3 Observe a natural phenomenon (e.g., weather changes, length of daylight/night, movement of shadows, animal migrations, growth of plants), record observations, and then make a prediction based on those observations.
	S4.A.2.1.4 State a conclusion that is consistent with the information/data.
S4.A.2 Processes, Procedures, and Tools of Scientific Investigations	
S4.A.2.2 Identify appropriate instruments for a specific task and describe the information the instrument can provide. ***This section continues on the next page…***	**S4.A.2.2.1** Identify appropriate tools or instruments for specific tasks and describe the information they can provide (e.g., measuring: length – ruler, mass – balance scale, volume – beaker, temperature – thermometer; making observations: hand lens, binoculars, telescope). ***This section continues on the next page…***

Pennsylvania Inquiry and Design Practices (Grades 3-5)*

Continued…

Pennsylvania System of School Assessment (Grade 4 PSSA)*	S4.A The Nature of Science
S4.A.3 Systems, Models, and Patterns	
S4.A.3.2 Use models to illustrate simple concepts and compare the models to what they represent.	**S4.A.3.2.1** Identify what different models represent (e.g., maps show physical features, directions, distances; globes represent Earth; drawings of watershed depict terrain; dioramas show ecosystems; concept maps show relationships of ideas).
	S4.A.3.2.2 Use models to make observations to explain how systems work (e.g., water cycle, Sun-Earth-Moon system).
	S4.A.3.2.3 Use appropriate, simple modeling tools and techniques to describe or illustrate a system (e.g., two cans and string to model a communications system, terrarium to model an ecosystem).
S4.A.3.3 Identify and make observations about patterns that regularly occur and reoccur in nature.	**S4.A.3.3.1** Identify and describe observable patterns (e.g., growth patterns in plants, weather, water cycle).
	S4.A.3.3.2 Predict future conditions/events based on observable patterns (e.g., day/night, seasons, sunrise, lunar phases).

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?

* Students are working towards proficiency in the Pennsylvania Inquiry Design Practices and mastery of the listed PA Academic Standards and Grade 4 Science PSSA Eligible Content. The classroom application of the Inquiry and Design Practices should be age appropriate.
** Indicates that there will be no additional formal instruction on the eligible content, other than review, prior to the Grade 4 Science PSSA.