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

Scope and Sequence for **Survey of Science**

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
HS-LS1 From Molecules to Organisms: Structures and Processes **LS1.B Growth and Development of Organisms** **HS-LS1-4** Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintain complex organisms. **LS1.C Organization for Matter and Energy Flow in Organisms** **HS-LS1-5** Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. **HS-LS1-6** Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. ***This section continues on the next page…***	**3.1.A Organisms and Cells** **1. Common Characteristics of Life** **3.1.10.A1** Explain the characteristics of life common to all organisms. **3.1.B.A1** Describe the common characteristics of life. Compare and contrast the cellular structures and degrees of complexity of prokaryotic and eukaryotic organisms. Explain that some structures in eukaryotic cells developed from early prokaryotic cells (e.g., mitochondria, chloroplasts) **2. Energy Flow** **3.1.10.A2** Explain cell processes in terms of chemical reactions and energy changes. **4. Cell Cycles** **3.1.10.A4** Describe the cell cycle and the process and significance of mitosis. **3.1.B.A4** Summarize the stages of the cell cycle. Examine how interactions among the different molecules in the cell cause the distinct stages of the cell cycle which can also be influenced by other signaling molecules. Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction. ***This section continues on the next page…***

NGSS Performance Expectations	PA Academic Standards for Science
Continued…	***Continued…*** **5. Form and Function** **3.1.10.A5** Relate life processes to sub-cellular and cellular structures to their functions. **3.1.B.A5** Relate the structure of cell organelles to their function (energy capture and release, transport, waste removal, protein synthesis, movement, etc.) Explain the role of water in cell metabolism. Explain how the cell membrane functions as a regulatory structure and protective barrier for the cell. Describe transport mechanisms across the plasma membrane. **6. Organization** **3.1.10.A6** Identify the advantages of multi-cellularity in organisms. **7. Molecular Basis of Life** **3.1.10.A7** Describe the relationship between the structure of organic molecules and the function they serve in living organisms. Explain how cells store and use information to guide their functions. **3.1.B Genetics** **1. Heredity** **3.1.10.B1** Describe how genetic information is inherited and expressed. **2. Reproduction** **3.1.10.B2** Explain the process of meiosis resulting in the formation of gametes. Compare and contrast the function of mitosis and meiosis. **3.1.B.B2** Describe how the process of meiosis results in the formation of haploid gametes and analyze the importance of meiosis in sexual reproduction. Compare and contrast the function of mitosis and meiosis. Illustrate that the sorting and recombining of genes in sexual reproduction results in a great variety of possible gene combinations in offspring. **3. Molecular Basis of Life** **3.1.10.B3** Describe the basic structure of DNA and its function in genetic inheritance. Describe the role of DNA in protein synthesis as it relates to gene expression. **3.1.C.B3** Describe the structure of the DNA and RNA molecules.
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NGSS Performance Expectations	PA Academic Standards for Science
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	3.1.C Evolution
	2. Adaptation **3.1.10.C2** Explain the role of mutations and gene recombination in changing a population of organisms.
	3.2.A Chemistry
	1. Properties of Matter **3.2.C.A1** Differentiate between physical properties and chemical properties. Differentiate between pure substances and mixtures; differentiate between heterogeneous and homogeneous mixtures.
	3.2.B Physics
	6. Unifying Themes **3.2.P.B6** PATTERNS SCALE MODELS CONSTANCY/CHANGE Use Newton's law of motion and gravitation to describe and predict the motion of objects ranging from atoms to the galaxies
	4.1 Ecology
	Energy Flow **4.1.10.C.** Evaluate the efficiency of energy flow within a food web. Describe how energy is converted from one form to another as it moves through a food web (photosynthetic, geothermal).
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NGSS Performance Expectations	PA Academic Standards for Science
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Biology Keystone Exam	Module A – Cells and Cell Processes
BIO.A.1 Basic Biological Principles	
BIO.A.1.1 Explain the characteristics common to all organisms.	**BIO.A.1.1.1** Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms.
BIO.A.1.2 Describe relationships between structure and function at biological levels of organization	**BIO.A.1.2.1** Compare cellular structures and their function in prokaryotic and eukaryotic cells.
	BIO.A.1.2.2 Describe and interpret relationships between structure and function at various levels of biological organization (i.e., organelles, cells, tissue, organs, organ systems, and multicellular organisms.)
BIO.A.2 The Chemical Basis for Life	
BIO.A.2.1 Describe how the unique properties of water support life on Earth.	**BIO.A.2.1.1** Describe the unique properties of water and how these properties support life on Earth (e.g., freezing point, high specific heat, cohesion).
BIO.A.2.2 Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e., atoms, molecules, and macromolecules).	**BIO.A.2.2.1** Explain how carbon is uniquely suited to form biological macromolecules.
Keystone Biology Exam	Module B – Continuity and Unity of Life
BIO.B.1 Cell Growth and Reproduction	
BIO.B.1.1 Describe the three stages of the cell cycle: interphase, nuclear division, cytokinesis.	**BIO.B.1.1.1** Describe the events that occur during the cell cycle: interphase, nuclear division (i.e., mitosis or meiosis), cytokinesis.
	BIO.B.1.1.2 Compare the processes and outcomes of mitotic and meiotic nuclear divisions.

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
NGSS Performance Expectations	PA Academic Standards for Science
	4.2 Watersheds and Wetlands **Watersheds** **4.2.10.A** Examine the interactions between abiotic and biotic factors within a watershed. **Wetlands** **4.2.10.B** Examine how human interactions impact wetlands and their surrounding environments. **Aquatic Ecosystems** **4.2.10.C** Explain the relationship between water quality and the diversity of life in a freshwater ecosystem. **4.3 Natural Resources** **Use of Natural Resources.** **4.3.12.A** Evaluate the advantages and disadvantages of using renewable and nonrenewable resources.
Keystone Biology Exam	Module B – Continuity and Unity of Life
BIO.B.4 Ecology	
BIO.B.4.1 Describe ecological levels of organization in the biosphere.	**BIO.B.4.1.2** Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems.
BIO.B.4.2 Describe interactions and relationships in an ecosystem.	**BIO.B.4.2.4** Describe how ecosystems change in response to natural and hum disturbances (e.g., climate changes, introduction of nonnative species, pollution, fires).
	BIO.B.4.2.5 Describe the effects of limiting factors on population dynamics and potential species extinction.

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
PS1.A Structure and Properties of Matter **HS-PS1 Matter and Its Interaction** **HS-PS1-1** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.	**3.2.A Chemistry** **1. Properties of Matter** **3.2.10.A1** Predict properties of elements using trends of the periodic table. Identify properties of matter that depend on sample size. Explain the unique properties of water (polarity, high boiling point, forms hydrogen bonds, high specific heat) that support life on Earth. **3.2.C.A1** Differentiate between physical properties and chemical properties. Differentiate between pure substances and mixtures; differentiate between heterogeneous and homogeneous mixtures. **3.2.12.A1** Compare and contrast colligative properties of mixtures. Compare and contrast the unique properties of water to other liquids.
Keystone Biology Exam	Module A – Cells and Cell Processes
BIO.A.4 Homeostasis and Transport	
BIO.A.4.1 Identify and describe the cell structures involved in transport of materials into, out of, and throughout a cell.	**BIO.A.4.1.1** Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell.
	BIO.A.4.1.2 Compare the mechanisms that transport materials across the plasma membrane (i.e., passive transport – diffusion, osmosis, facilitated diffusion; and active transport – pumps, endocytosis, exocytosis).

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

NGSS Performance Expectations	PA Academic Standards for Science
HS-PS2 Motion and Stability: Forces and Interactions **PS2.A: Forces and Motion** **HS-PS2-1** Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. **HS-PS2-2** Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. **HS-PS2-3** Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.	**3.2.B Physics** **1. Force & Motion of Particles and Rigid Bodies** **3.2.P.B1** Differentiate among translational motion simple harmonic motion and rotational motion in terms of position, velocity, and acceleration. Use force and mass to explain translational motion or simple harmonic motion of objects. Relate torque and rotational inertia to explain rotational motion. **4. Electrical and Magnetic Energy** **3.2.P.B4** Explain how stationary and moving participles result in electricity and magnetism. **6. Unifying Themes** **3.2.12.B6** CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

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
HS-PS3 Energy **PS3.A: Definitions of Energy** **HS-PS3-2** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative position of particles (objects). **PS3.B: Conservation of Energy and Energy Transfer** **HS-PS3-1** Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. **HS-PS3-2** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative position of particles (objects).	**3.2.B Physics** **2. Energy Storage and Transformations: Conservation Laws** **3.2.P.B2** Explain the translation and simple harmonic motion of objects using conservation of energy and conservation of momentum. Describe the rotational motion of objects using the conservation of energy and conservation of angular momentum. Explain how gravitational, electrical, and magnetic forces and torques give rise to rotational motion. **3.2.12.B2** Explain how energy flowing through an open system can be lost. Demonstrate how the law of conservation of momentum and conservation of energy provide alternative approaches to predict and describe the motion of objects. **3. Heat/Heat Transfer** **3.2.P.B3** Analyze the factors that influence convection, conduction, and radiation between objects or regions that are at different temperatures. **6. Unifying Themes** **3.2.12.B6** CONSTANCY/CHANGE Compare and contrast motions of objects using forces and conservation laws.

Big Idea: Waves are a repeating pattern of motion that transfers energy from place to place without overall displacement of matter.
Essential Question: How are waves used to transfer energy and information?

NGSS Performance Expectations	PA Academic Standards for Science
HS-PS4 Waves and Their Applications in Technologies for Information Transfer **PS4.A: Waves and their Applications in Technologies for Information Transfer** **4-PS4-1.** Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.	**3.2.B Physics** **5. Nature of Waves (Sound and Light Energy)** **3.2.P.B5** Explain how waves transfer energy without transferring matter. Explain how waves carry information from remote sources that can be detected and interpreted. Describe the causes of wave frequency, speed, and wavelength.

Pennsylvania Inquiry and Design Practices (Grades 9-12)

Asking questions and defining problems

- Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.
- Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.
- Ask questions to clarify and refine a model, an explanation, or an engineering problem.
- Evaluate a question to determine if it is testable and relevant.
- Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.
- Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.
- Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations.

Developing and using models

- Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism or system in order to select or revise a model that best fits the evidence or design criteria.
- Design a test of a model to ascertain its reliability.
- Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.
- Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.
- Develop a complex model that allows for manipulation and testing of a proposed process or system.
- Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Planning and carrying out investigations

- Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
- Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.
- Select appropriate tools to collect, record, analyze, and evaluate data.
- Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.
- Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables.

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Pennsylvania Inquiry and Design Practices (Grades 9-12)

Continued…

Constructing explanations and designing solutions

- Make a quantitative and/or qualitative claim regarding the relationship between dependent
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) 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 provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
- Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.
- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Analyzing and interpreting data

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.
- Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations.
- Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.
- Analyze data to identify design features or characteristics of the components of a proposed process or system to optimize it relative to criteria for success.

Using mathematics and computational thinking

- Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system.
- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
- Use simple limit cases to test mathematical expressions, computer programs, algorithms, or simulations of a process or system to see if a model "makes sense" by comparing the outcomes with what is known about the real world.
- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).

Engaging in argument from evidence

- Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (e.g., trade-offs), constraints, and ethical issues.
- Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.
- Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence, challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining additional information required to resolve contradictions.
- Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.
- Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.
- Evaluate competing design solutions to a real- world problem based on scientific ideas and principles, empirical evidence, and/or logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations).

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Pennsylvania Inquiry and Design Practices (Grades 9-12)

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Obtaining, evaluating, and communicating information

- Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
- Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.
- Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.
- Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible.
- Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

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.3.5.9-10.A. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
CC.3.5.9-10.B. Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
CC.3.5.9-10.C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Craft and Structure
CC.3.5.9-10.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 9–10 texts and topics.

Integration of Knowledge and Ideas
CC.3.5.9-10.G. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CC.3.5.9-10.H. Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
CC.3.5.9-10.I. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

Range and Level of Complex Texts
CC.3.5.9-10.J. By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Pennsylvania Core Standards for Writing in Science and Technical Subjects

Text Types and Purposes
CC.3.6.9-10.A. Write arguments focused on *discipline-specific content.*

- Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
- Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.
- Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- Provide a concluding statement or section that follows from or supports the argument presented.

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Pennsylvania Core Standards for Writing in Science and Technical Subjects

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CC.3.6.9-10.B. *
Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

- Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
- Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
- Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.
- Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
- Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

Production and Distribution of Writing
CC.3.6.9-10.C. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CC.3.6.9-10.D. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
CC.3.6.9-10.E. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

Research to Build and Present Knowledge
CC.3.6.9-10.H. Draw evidence from informational texts to support analysis, reflection, and research.