

## Physical Science

State Standard Number	State Standard Area/Description	Unit Name	Course Topic Description
3.1.10	Unifying Themes		
3.1.10.A	Discriminate among the concepts of systems, subsystems, feedback and control in solving technological problems.		
3.1.10.A.1	Identify the function of subsystems within a larger system (e.g., role of thermostat in an engine, pressure switch).		
3.1.10.A.2	Describe the interrelationships among inputs, processes, outputs, feedback and control in specific systems.		
3.1.10.A.3	Explain the concept of system redesign and apply it to improve technological systems.		
3.1.10.A.4	Apply the universal systems model to illustrate specific solutions and troubleshoot specific problems.	Scientific inquiry	Section B Applying the Universal Systems Model
3.1.10.A.5	Analyze and describe the effectiveness of systems to solve specific problems.		
3.1.10.B	Describe concepts of models as a way to predict and understand science and technology.		
3.1.10.B.1	Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA).	Scientific Nature	Section B Models Mathematical Models Self-check: Solar System Model
3.1.10.B.2	Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability).		
3.1.10.B.3	Apply mathematical models to science and technology.	Scientific Nature	Section B Mathematical Models Self-check: Solar System Model

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3.1.10.C	Apply patterns as repeated processes or recurring elements in science and technology.		
3.1.10.C.1	Examine and describe recurring patterns that form the basis of biological classification, chemical periodicity, geological order and astronomical order.	Standard partially addressed as follows: Elements, Compounds and Mixtures	Section B Patterns on the Periodic Table
3.1.10.C.2	Examine and describe stationary physical patterns.		
3.1.10.C.3	Examine and describe physical patterns in motion.		
3.1.10.D	Apply scale as a way of relating concepts and ideas to one another by some measure.		
3.1.10.D.1	Apply dimensional analysis and scale as a ratio.	Scientific Nature	Section B Mathematical Models Self-check: Solar System Model
3.1.10.D.2	Convert one scale to another.	Scientific Nature	Section B Mathematical Models Self-check: Solar System Model

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3.1.10.E	Describe patterns of change in nature, physical and man made systems.		
3.1.10.E.1	Describe how fundamental science and technology concepts are used to solve practical problems (e.g., momentum, Newton's laws of universal gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, gas laws, feedback systems).	Energy in Motion	Section C Journal: The Laws of Motion
3.1.10.E.2	Recognize that stable systems often involve underlying dynamic changes (e.g., a chemical reaction at equilibrium has molecules reforming continuously).		
3.1.10.E.3	Describe the effects of error in measurements.	Scientific Inquiry	Section E Measurement Errors
3.1.10.E.4	Describe changes to matter caused by heat, cold, light or chemicals using a rate function.		
3.2.10	Inquiry and Design		
3.2.10.A	Apply knowledge and understanding about the nature of scientific and technological knowledge.		
3.2.10.A.1	Compare and contrast scientific theories and beliefs.	Scientific Nature	Section E Avatar: A Closer Look at Laws and Theories

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3.2.10.A.2	Know that science uses both direct and indirect observation means to study the world and the universe.	Scientific Nature	Section B Observations
3.2.10.A.3	Integrate new information into existing theories and explain implied results.	Scientific Nature	Section E Acceptance of Plate Tectonic Theory
3.2.10.B	Apply process knowledge and organize scientific and technological phenomena in varied ways.		
3.2.10.B.1	Describe materials using precise quantitative and qualitative skills based on observations.	Scientific Nature	Section B Journal: Quantitative and Qualitative Data
3.2.10.B.2	Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions.	Scientific Inquiry	Sections A - E Unit Project: Scientific Inquiry
3.2.10.B.3	Use process skills to make inferences and predictions using collected information and to communicate, using space / time relationships, defining operationally.	Scientific Inquiry	Sections C Unit Project: Scientific Inquiry
3.2.10.C	Apply the elements of scientific inquiry to solve problems.		
3.2.10.C.1	Generate questions about objects, organisms and/or events that can be answered through scientific investigations.	Scientific Nature	Section B Questions and Hypotheses

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3.2.10.C.2	Evaluate the appropriateness of questions.		
3.2.10.C.3	Design an investigation with adequate control and limited variables to investigate a question.	Scientific Inquiry	Section B Unit Project: Scientific Inquiry
3.2.10.C.4	Conduct a multiple step experiment	Scientific Inquiry	Section C Scientific Inquiry Unit Project, Part 3
3.2.10.C.5	Organize experimental information using a variety of analytic methods.	Scientific Inquiry	Section C The Importance of Organizing Data
3.2.10.C.6	Judge the significance of experimental information in answering the question.	Scientific Inquiry	Section D Unit Project: Scientific Inquiry, Part 4
3.2.10.C.7	Suggest additional steps that might be done experimentally.		
3.2.10.D	Identify and apply the technological design process to solve problems.		
3.2.10.D.1	Examine the problem, rank all necessary information and all questions that must be answered.	Scientific Inquiry	Section D Unit Project: Scientific Inquiry, Part 4

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3.2.10.D.2	Propose and analyze a solution.	Scientific Inquiry	Section D Unit Project: Scientific Inquiry, Part 4
3.2.10.D.3	Implement the solution.		
3.2.10.D.4	Evaluate the solution, test, redesign and improve as necessary.	Scientific Inquiry	Section E Unit Project: Scientific Inquiry
3.2.10.D.5	Communicate the process and evaluate and present the impacts of the solution.	Scientific Inquiry	Section E Unit Project: Scientific Inquiry
3.3.10	Biological Sciences		
3.3.10.A	Explain the structural and functional similarities and differences found among living things.		
3.3.10.A.1	Identify and characterize major life forms according to their placement in existing classification groups.		
3.3.10.A.2	Explain the relationship between structure and function at the molecular and cellular levels.		

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3.3.10.A.3	Describe organizing schemes of classification keys.		
3.3.10.A.4	Identify and characterize major life forms by kingdom, phyla, class and order		
3.3.10.B	Describe and explain the chemical and structural basis of living organisms.		
3.3.10.B.1	Describe the relationship between the structure of organic molecules and the function they serve in living organisms.		
3.3.10.B.2	Identify the specialized structures and regions of the cell and the functions of each.		
3.3.10.B.3	Explain how cells store and use information to guide their functions.		
3.3.10.B.4	Explain cell functions and processes in terms of chemical reactions and energy changes.		
3.3.10.C	Describe how genetic information is inherited and expressed.		

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3.3.10.C.1	Compare and contrast the function of mitosis and meiosis.		
3.3.10.C.2	Describe mutations' effects on a trait's expression.		
3.3.10.C.3	Distinguish different reproductive patterns in living things (e.g., budding, spores, fission).		
3.3.10.C.4	Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria).		
3.3.10.C.5	Explain the relationship among DNA, genes and chromosomes		
3.3.10.C.6	Explain different types of inheritance (e.g., multiple allele, sex-influenced traits).		
3.3.10.C.7	Describe the role of DNA in protein synthesis as it relates to gene expression.		
3.3.10.D	Explain the mechanisms of the theory of evolution.		

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3.3.10.D.1	analyze data from fossil records, similarities in anatomy and physiology, embryological studies and DNA studies that are relevant to the theory of evolution.		
3.3.10.D.2	Explain the role of mutations and gene recombination in changing a population of organisms.		
3.3.10.D.3	Compare modern day descendants of extinct species and propose possible scientific accounts for their present appearance.		
3.3.10.D.4	describe the factors (e.g., isolation, differential reproduction) affecting gene frequency in a population over time and their consequences.		
3.3.10.D.5	describe and differentiate between the roles of natural selection and genetic drift.		
3.3.10.D.6	Describe changes that illustrate major events in the earth's development based on a time line.		
3.3.10.D.7	explain why natural selection can act only on inherited traits.		
3.3.10.D.8	Apply the concept of natural selection to illustrate and account for a species' survival, extinction or change over time.		

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3.4.10	Physical Science, Chemistry and Physics		
3.4.10.A	Explain concepts about the structure and properties of matter.		
3.4.10.A.1	Know that atoms are composed of even smaller sub-atomic structures whose properties are measurable.	Elements, Compounds and Mixtures	Section A The Nuclear Atom
3.4.10.A.2	Explain the repeating pattern of chemical properties by using the repeating patterns of atomic structure within the periodic table.	Elements, Compounds and Mixtures	Section B Patterns on the Periodic Table
3.4.10.A.3	Predict the behavior of gases through the use of Boyle's, Charles' or the ideal gas law, in everyday situations.	Matter, Energy and Change	Section B Robert Boyle and Boyle's Law Jacques Charles and Charles's Law
3.4.10.A.9	Describe phases of matter according to the Kinetic Molecular Theory.	Matter, Energy and Change	Section B Kinetic Theory of Matter
3.4.10.A.4	Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent).	Elements, Compounds and Mixtures	Section C Ionic Bonds Covalent Bonds
3.4.10.A.5	Recognize formulas for simple inorganic compounds.	Chemical Reactions	Section A Chemical Symbols in Reaction Equations

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3.4.10.A.6	Describe various types of chemical reactions by applying the laws of conservation of mass and energy.	Chemical Reactions	Section B Law of Conservation of Energy Conservation of Matter
3.4.10.A.7	Apply knowledge of mixtures to appropriate separation techniques.	Elements, Compounds and Mixtures	Section E Separating Mixtures
3.4.10.A.8	Understand that carbon can form several types of compounds.	Elements, Compounds and Mixtures	Section C Organic Compounds
3.4.10.B	Analyze energy sources and transfers of heat.		
3.4.10.B.1	Determine the efficiency of chemical systems by applying mathematical formulas.	Chemical Reactions	Section B Think and Click: Working With Enthalpy Values
3.4.10.B.2	Use knowledge of chemical reactions to generate an electrical current.		
3.4.10.B.3	Evaluate energy changes in chemical reactions.	Chemical Reactions	Section B Think and Click: Working With Enthalpy Values
3.4.10.B.4	Use knowledge of conservation of energy and momentum to explain common phenomena (e.g., refrigeration system, rocket propulsion).	Matter, Energy and Change	Section C Applying Heat Transfer to Cooling Systems

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3.4.10.B.5	Explain resistance, current and electro-motive force (Ohm's Law).	Electricity and Magnetism	Section B Ohm's Law
3.4.10.C	Distinguish among the principles of force and motion.		
3.4.10.C.1	Identify the relationship of electricity and magnetism as two aspects of a single electromagnetic force.	Electricity and Magnetism	Section C Electric Currents and Magnetic fields
3.4.10.C.2	Identify elements of simple machines in compound machines.	Machines	Section B Simple Machines Section C Compound Machines
3.4.10.C.3	Explain fluid power systems through the design and construction of appropriate models.		
3.4.10.C.4	Describe sound effects (e.g., Doppler effect, amplitude, frequency, reflection, refraction, absorption, sonar, seismic).	Waves	Section B The Doppler Effect Section C Reflection and Refraction of Sound Waves
3.4.10.C.5	Describe light effects (e.g., Doppler effect, dispersion, absorption, emission spectra, polarization, interference).	Waves	Section D Light Reflection Refraction of Light Diffraction of Light Polarization of Light
3.4.10.C.6	Describe and measure the motion of sound, light and other objects.		

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3.4.10.C.7	Know Newton's laws of motion (including inertia, action and reaction) and gravity and apply them to solve problems related to forces and mass.	Energy in Motion	Section C Newton's Laws of Motion
3.4.10.C.8	Determine the efficiency of mechanical systems by applying mathematical formulas.	Matter, Energy and Change	Section D A closer Look at Energy Efficiency
3.4.10.D	Explain essential ideas about the composition and structure of the universe.		
3.4.10.D.1	Compare the basic structures of the universe (e.g., galaxy types, nova, black holes, neutron stars).	The Universe	Section A The Structure of the Universe
3.4.10.D.2	Describe the structure and life cycle of star, using the Hertzsprung- Russell diagram.	The Universe	Section B HR Diagrams
3.4.10.D.3	Describe the nuclear processes involved in energy production in a star.	Chemical Reactions  The Universe	Section C Nuclear Reactions: Fission Nuclear Reactions: Fusion  Section B A Star is Born Star Maturity Death of Low-Mass Stars Death of High-Mass Stars
3.4.10.D.4	Explain the "red-shift" and Hubble's use of it to determine stellar distance and movement.	The Universe	Section C Cosmological Red shift
3.4.10.D.5	Compare absolute versus apparent star magnitude and their relation to stellar distance.	The Universe	Section C Writing Assignment: Distances in the Universe

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3.4.10.D.6	Explain the impact of the Copernican and Newtonian thinking on man's view of the universe.		
3.4.10.D.7	Identify and analyze the findings of several space instruments in regard to the extent and composition of the solar system and universe.		
3.5.10	Earth Sciences		
3.5.10.A	Relate earth features and processes that change the earth.		
3.5.10.A.1	Illustrate and explain plate tectonics as the mechanism of continental movement and sea floor changes.		
3.5.10.A.2	Compare examples of change to the earth's surface over time as they related to continental movement and ocean basin formation (e.g., Delaware, Susquehanna, Ohio Rivers system formations, dynamics).		
3.5.10.A.3	Interpret topographic maps to identify and describe significant geologic history/structures in Pennsylvania.		
3.5.10.A.4	Evaluate and interpret geologic history using geologic maps.		

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3.5.10.A.5	Explain several methods of dating earth materials and structures.		
3.5.10.A.5	Explain several methods of dating earth materials and structures.		
3.5.10.A.6	Correlate rock units with general geologic time periods in the history of the earth.		
3.5.10.A.7	Describe and identify major types of rocks and minerals.		
3.5.10.B	Explain sources and uses of earth resources.		
3.5.10.B.1	Compare the locations of strategic minerals and earth resources in the world with their geologic history using maps and global information systems.		
3.5.10.B.2	Demonstrate the effects of sedimentation and erosion before and after a conservation plan is implemented.		
3.5.10.B.3	Evaluate the impact of geologic activities/hazards (e.g., earthquakes, sinkholes, landslides).		

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3.5.10.B.4	Evaluate land use (e.g., agricultural, recreational, residential, commercial) in Pennsylvania based upon soil characteristics.		
3.5.10.C	Interpret meteorological data.		
3.5.10.C.1	Analyze information from meteorological instruments and online sources to predict weather patterns.		
3.5.10.C.2	Describe weather and climate patterns on global levels.		
3.5.10.C.3	Evaluate specific adaptations plants and animals have made that enable them to survive in different climates.		
3.5.10.D	Assess the value of water as a resource.		
3.5.10.D.1	Compare specific sources of potable water (e.g., wells, public systems, rivers) used by people in Pennsylvania.		
3.5.10.D.2	Identify the components of a municipal/agricultural water supply system and a wastewater treatment system.		

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3.5.10.D.3	Relate aquatic life to water conditions (e.g., turbidity, temperature, salinity, dissolved oxygen, nitrogen levels, pressure).		
3.5.10.D.4	Compare commercially important aquatic species in or near Pennsylvania.		
3.5.10.D.5	Identify economic resources found in marine areas.		
3.5.10.D.6	Assess the natural and man-made factors that affect the availability of clean water (e.g., rock and mineral deposits, man-made pollution).		
3.6.10	Technology Education		
3.6.10.A	Apply biotechnologies that relate to propagating, growing, maintaining, adapting, treating and converting.		
3.6.10.A.1	Apply knowledge of plant and animal production processes in designing an improvement to existing processes.		
3.6.10.A.2	Apply knowledge of biomedical technology applications in designing a solution to a simple medical problem (e.g., wheel chair design, artificial arteries).		

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3.6.10.A.3	Apply knowledge of how biomedical technology affects waste products in designing a solution that will result in reduced waste.		
3.6.10.A.4	Apply ergonomic engineering factors when devising a solution to a specific problem.		
3.6.10.A.5	Describe various methods of biochemical conversion.		
3.6.10.A.6	describe specific examples that reflect the impact that agricultural science has had on biotechnology.		
3.6.10.B	Apply knowledge of information technologies of encoding, transmitting, receiving, storing, retrieving and decoding.		
3.6.10.B.1	Describe the proper use of graphic and electronic communication systems.		
3.6.10.B.2	Apply a variety of advanced mechanical and electronic drafting methods to communicate a solution to a specific problem.		
3.6.10.B.3	Apply and analyze advanced communication techniques to produce an image that effectively conveys a message (e.g., desktop publishing, audio and/or video production).		

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3.6.10.B.4	Illustrate an understanding of a computer network system by modeling, constructing or assembling its components.		
3.6.10.C	Apply physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and design to real world problems.		
3.6.10.C.1	Describe and classify common construction by their characteristics and composition.		
3.6.10.C.2	Compare and contrast specific construction systems that depend on each other in order to complete a project.		
3.6.10.C.3	Evaluate material failure common to specific applications.		
3.6.10.C.4	Demonstrate knowledge of various construction systems by building or interpreting models.		
3.6.10.C.5	Select and apply the necessary resources to successfully conduct a manufacturing enterprise.		
3.6.10.C.6	Apply concepts of design engineering and production engineering in the organization and application of a manufacturing activity.		

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3.6.10.C.7	Apply the concepts of manufacturing by redesigning an enterprise to improve productivity or reduce or eliminate waste and/or pollution.		
3.6.10.C.8	Evaluate the interrelationship of various transportation systems in the community.		
3.6.10.C.9	Analyze the impacts that transportation systems have on a community.		
3.7.10	Technological Devices		
3.7.10.A	Identify and safely use a variety of tools, basic machines, materials and techniques to solve problems and answer questions.		
3.7.10.A.1	Select and safely apply appropriate tools, materials and processes necessary to solve complex problems.		
3.7.10.A.2	Apply advanced tool and equipment manipulation techniques to solve problems.		
3.7.10.B	Apply appropriate instruments and apparatus to examine a variety of objects and processes.		

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3.7.10.B.1	Describe and use appropriate instruments to gather and analyze data.		
3.7.10.B.2	Compare and contrast different scientific measurement systems; select the best measurement system for a specific situation.		
3.7.10.B.3	Explain the need to estimate measurements within error of various instruments.		
3.7.10.B.4	Apply accurate measurement knowledge to solve everyday problems.		
3.7.10.B.5	Describe and demonstrate the operation and use of advanced instrumentation in evaluating material and chemical properties (e.g., scanning electron microscope, nuclear magnetic resonance machines).		
3.7.10.C	Apply basic computer operations and concepts.		
3.7.10.C.1	Identify solutions to basic hardware and software problems.		
3.7.10.C.2	Apply knowledge of advanced input devices.		

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3.7.10.C.3	Apply knowledge of hardware setup.		
3.7.10.C.4	Describe the process for basic software installation and demonstrate it.		
3.7.10.C.5	Analyze and solve basic operating systems problems.		
3.7.10.C.6	Apply touch keyboarding skills and techniques at expectable speed and accuracy.		
3.7.10.C.7	Demonstrate the ability to perform basic software installation.		
3.7.10.D	Utilize computer software to solve specific problems.		
3.7.10.D.1	Identify legal restrictions in the use of software and the output of data.		
3.7.10.D.2	Apply advanced graphic manipulation and desktop publishing techniques.		

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3.7.10.D.3	Apply basic multimedia applications.		
3.7.10.D.4	Apply advanced word processing, database and spreadsheet skills.		
3.7.10.D.5	Describe and demonstrate how two or more software applications can be used to produce an output.		
3.7.10.D.6	Select and apply software designed to meet specific needs.		
3.7.10.E	Apply basic computer communications systems.		
3.7.10.E.1	Identify and explain various types of on-line services.		
3.7.10.E.2	Identify and explain the function of the parts of a basic network.		
3.7.10.E.3	Describe and apply the components of a web page and their function.		

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3.7.10.E.4	Explain and demonstrate file transfer within and out side of a computer network.		
3.7.10.E.5	Identify, describe and complete advanced on-line research.		
3.8.10	Science, Technology and Human Endeavors		
3.8.10.A	Analyze the relationship between societal demands and scientific and technological enterprises.		
3.8.10.A.1	Identify past and current tradeoffs between increased production, environmental harm and social values (e.g., increased energy needs, power plants, automobiles).	Scientific Nature	Section A Tradeoffs
3.8.10.A.2	Compare technologies that are applied and accepted differently in various cultures (e.g., factory farming, nuclear power).		
3.8.10.A.3	Describe and evaluate social change as a result of technological developments.	Scientific Nature	Section A Science and Society Tradeoffs
3.8.10.A.4	Assess the social impacts of a specific international environmental problem by designing a solution that applies the appropriate technologies and resources.		

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3.8.10.B	Analyze how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.	Scientific Nature	Section A Scientific Endeavor Science and Society Scientific Advantages
3.8.10.B.1	Identify several problems and opportunities that exist in your community, apply various problem-solving methods to design and evaluate possible solutions.		
3.8.10.B.2	Analyze a recently invented item, describing the human need that prompted its invention and the current and potential social impacts of the specific invention.		
3.8.10.B.3	Apply knowledge of oceanography, meteorology, geology and human anatomy to explain important considerations that need to be made for construction of homes, buildings and businesses in the United States.		
3.8.10.B.4	Assess the impacts that agricultural science has had on meeting human needs and improving the quality of life.		
3.8.10.C	Evaluate possibilities consequences and impacts of scientific and technological solutions.	Scientific Nature	Section A Tradeoffs
3.8.10.C.1	Relate scientific and technological advancements in terms of cause and effect.		
3.8.10.C.2	Describe and evaluate the impacts that financial considerations have had on specific scientific and technological applications.		



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3.8.10.C.3	Compare and contrast potential solutions to technological, social, economic and environmental problems.		
3.8.10.C.4	Analyze the impacts on society of accepting or rejecting scientific and technological advances.		