

## EarthComm Correlations to Pennsylvania

### Grades 10 and 12 Academic Standards for Science and Technology

<b>"XX" In-depth Coverage = In-depth coverage of concept in student edition.</b> <b>Coverage = Coverage in student edition and/or teacher edition supports the development of the concept.</b>	<b>Earth's Dynamic Geosphere</b>	<b>Understanding Your Environment</b>	<b>Earth's Fluid Spheres</b>	<b>Earth's Natural Resources</b>	<b>Earth System Evolution</b>
	V   PT   E	BG   RS   LU	O   SW   C	ER   MR   WR	A   CC   CL

#### Grade 10

##### 3.1 Unifying Themes

**A. Discriminate among the concepts of systems, subsystems, feedback and control in solving technological problems.**

· Identify the function of subsystems within a larger system (e.g., role of thermostat in an engine, pressure switch).	X	X	X		X	X	X	X	X	X	X	X	X	X	X
· Describe the interrelationships among inputs, processes, outputs, feedback and control in specific systems.	X	X	X		X	X	X	X	X	X	X	X	X	X	X
· Explain the concept of system redesign and apply it to improve technological systems.															
· Apply the universal systems model to illustrate specific solutions and troubleshoot specific problems.	X	X	X		X	X	X	X	X	X	X	X	X	X	X
· Analyze and describe the effectiveness of systems to solve specific problems.	X	X	X		X	X	X	X	X	X	X	X	X	X	X

**B. Describe concepts of models as a way to predict and understand science and technology.**

· Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA).	X	X	X		X	X	X	X	X	X	X	X	X	X	X
· Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability).	X	X	X		X	X	X	X	X	X	X	X	X	X	X
· Apply mathematical models to science and technology.	XX	XX	X		X	X	X	XX	X	X	X	X	X	X	X

**C. Apply patterns as repeated processes or recurring elements in science and technology.**

· Examine and describe recurring patterns that form the basis of biological classification, chemical periodicity, geological order and astronomical order.	XX	X	X	XX	X	X	X	X	X	X	X	X	X	X	XX
· Examine and describe stationary physical patterns.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Examine and describe physical patterns in motion.	X	X	X	X	X	XX	XX	XX	XX	X	X	X	XX	XX	X

**D. Apply scale as a way of relating concepts and ideas to one another by some measure.**

· Apply dimensional analysis and scale as a ratio.	X	X	X	X	X	X	X	X	X	X	X	X	X	XX	X	X
· Convert one scale to another.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

**E. Describe patterns of change in nature, physical and man made systems.**

· 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).	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Recognize that stable systems often involve underlying dynamic changes (e.g., a chemical reaction at equilibrium has molecules reforming continuously).	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Describe the effects of error in measurements.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Describe changes to matter caused by heat, cold, light or chemicals using a rate function.	XX	X	X	X	X	X	XX	XX	XX	XX	XX	XX	X	X	X

##### 3.2. Inquiry and Design

"XX" In-depth Coverage = In-depth coverage of concept in student edition. Coverage = Coverage in student edition and/or teacher edition supports the development of the concept.	Earth's Dynamic Geosphere			Understanding Your Environment			Earth's Fluid Spheres			Earth's Natural Resources			Earth System Evolution		
	V	PT	E	BG	RS	LU	O	SW	C	ER	MR	WR	A	CC	CL
<b>A. Apply knowledge and understanding about the nature of scientific and technological knowledge.</b>															
· Compare and contrast scientific theories and beliefs.	X	XX	X	X	X	X	X	X	X	X	X	X	X	X	X
· Know that science uses both direct and indirect observation means to study the world and the universe.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Integrate new information into existing theories and explain implied results.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<b>B. Apply process knowledge and organize scientific and technological phenomena in varied ways.</b>															
· Describe materials using precise quantitative and qualitative skills based on observations.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Use process skills to make inferences and predictions using collected information and to communicate, using space / time relationships, defining operationally.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
<b>C. Apply the elements of scientific inquiry to solve problems.</b>															
· Generate questions about objects, organisms and/or events that can be answered through scientific investigations.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Evaluate the appropriateness of questions.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Design an investigation with adequate control and limited variables to investigate a question.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Conduct a multiple step experiment.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Organize experimental information using a variety of analytic methods.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Judge the significance of experimental information in answering the question.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Suggest additional steps that might be done experimentally.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
<b>D. Identify and apply the technological design process to solve problems.</b>															
· Examine the problem, rank all necessary information and all questions that must be answered.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Propose and analyze a solution.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Implement the solution.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Evaluate the solution, test, redesign and improve as necessary.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Communicate the process and evaluate and present the impacts of the solution.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
<b>3.3. Biological Sciences</b>															
<b>D. Explain the mechanisms of the theory of evolution.</b>															
· analyze data from fossil records, similarities in anatomy and physiology, embryological studies and DNA studies that are relevant to the theory of evolution.				X											X
· Describe changes that illustrate major events in the earth's development based on a time line.	X	XX	X	X	X	X	X	X	X	X	X	X	XX	X	XX
<b>3.4. Physical Science, Chemistry and Physics</b>															
<b>C. Explain essential ideas about the composition and structure of the universe.</b>															
· Compare the basic structures of the universe (e.g., galaxy types, nova, black holes, neutron stars).														XX	

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· Describe the structure and life cycle of star, using the Hertzsprung-Russell diagram.													XX		
· Describe the nuclear processes involved in energy production in a star.													XX		
· Explain the "red-shift" and Hubble's use of it to determine stellar distance and movement.													XX		
· Compare absolute versus apparent star magnitude and their relation to stellar distance.													XX		
· Explain the impact of the Copernican and Newtonian thinking on man's view of the universe.													XX		
· Identify and analyze the findings of several space instruments in regard to the extent and composition of the solar system and universe.													XX		
<b>3.5. Earth Sciences</b>															
<b>A. Relate earth features and processes that change the earth.</b>															
· Illustrate and explain plate tectonics as the mechanism of continental movement and sea floor changes.	X	XX	X				X							X	
· 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).	X	XX	X	XX			X								
· Interpret topographic maps to identify and describe significant geologic history/structures in Pennsylvania.	XX				XX	XX		X			X				
· Evaluate and interpret geologic history using geologic maps.	XX	X	XX	XX	XX	XX					X			X	
· Explain several methods of dating earth materials and structures.	X	X		X										X	
· Correlate rock units with general geologic time periods in the history of the earth.	X	X	X	XX	X	X			X	X	X			X	
· Describe and identify major types of rocks and minerals.	X	X		XX						X	XX			X	
<b>B. Explain sources and uses of earth sources.</b>															
· Compare the locations of strategic minerals and earth resources in the world with their geologic history using maps and global information systems.	X			X		X			X	X	XX	X			
· Describe and identify major types of rocks and minerals.	XX			X	X				X	X	X			X	X
· Demonstrate the effects of sedimentation and erosion before and after a conservation plan is implemented.					X	XX									
· Evaluate the impact of geologic activities/hazards (e.g., earthquakes, sinkholes, landslides).	XX	XX	XX	X		XX			X				X		
· Evaluate land use (e.g., agricultural, recreational, residential, commercial) in Pennsylvania based upon soil characteristics.	X			X		XX			X						
<b>C. Interpret meteorological data.</b>															
· Analyze information from meteorological instruments and online sources to predict weather patterns.	X							XX							
· Describe weather and climate patterns on global levels.	X						XX	XX						XX	
· Evaluate specific adaptations plants and animals have made that enable them to survive in different climates.														X	X
<b>D. Assess the value of water as a resource.</b>															

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· Compare specific sources of potable water (e.g., wells, public systems, rivers) used by people in Pennsylvania.						X						XX			
· Identify the components of a municipal/agricultural water supply system and a wastewater treatment system.						X						XX			
· Relate aquatic life to water conditions (e.g., turbidity, temperature, salinity, dissolved oxygen, nitrogen levels, pressure).					X		X					X			
· Compare commercially important aquatic species in or near Pennsylvania.												X			X
· Identify economic resources found in marine areas.										X	X	X			
· Assess the natural and man-made factors that affect the availability of clean water (e.g., rock and mineral deposits, man-made pollution).										X	X	XX			
<b>3.6. Technology Education</b>															
<b>A. Apply biotechnologies that relate to propagating, growing, maintaining, adapting, treating and converting.</b>															
· Apply knowledge of plant and animal production processes in designing an improvement to existing processes.															
· Apply knowledge of biomedical technology applications in designing a solution to a simple medical problem (e.g., wheel chair design, artificial arteries).															
· Apply knowledge of how biomedical technology affects waste products in designing a solution that will result in reduced waste.															
· Apply ergonomic engineering factors when devising a solution to a specific problem.															
· Describe various methods of biochemical conversion.															
· describe specific examples that reflect the impact that agricultural science has had on biotechnology.															
<b>B. Apply knowledge of information technologies of encoding, transmitting, receiving, storing, retrieving and decoding.</b>															
· Describe the proper use of graphic and electronic communication systems.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Apply a variety of advanced mechanical and electronic drafting methods to communicate a solution to a specific problem.															
· Apply and analyze advanced communication techniques to produce an image that effectively conveys a message (e.g., desktop publishing, audio and/or video production).	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Illustrate an understanding of a computer network system by modeling, constructing or assembling its components.															
<b>C. Apply physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and</b>															
· Describe and classify common construction by their characteristics and composition.						X					X				
· Compare and contrast specific construction systems that depend on each other in order to complete a project.						X					X				
· Evaluate material failure common to specific applications.						X					X				
· Demonstrate knowledge of various construction systems by building or interpreting models.						X					X				
· Select and apply the necessary resources to successfully conduct a manufacturing enterprise.						X					X				

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· Apply concepts of design engineering and production engineering in the organization and application of a manufacturing activity.						X					X				
· Apply the concepts of manufacturing by redesigning an enterprise to improve productivity or reduce or eliminate waste and/or pollution.						X					X				
· Evaluate the interrelationship of various transportation systems in the community.						X				X					
· Analyze the impacts that transportation systems have on a community.						X				X					
<b>3.7. Technological Devices</b>															
<b>A. Identify and safely use a variety of tools, basic machines, materials and techniques to solve problems and answer questions.</b>															
· Select and safely apply appropriate tools, materials and processes necessary to solve complex problems.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Apply advanced tool and equipment manipulation techniques to solve problems.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
<b>B. Apply appropriate instruments and apparatus to examine a variety of objects and processes.</b>															
· Describe and use appropriate instruments to gather and analyze data.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Compare and contrast different scientific measurement systems; select the best measurement system for a specific situation.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Explain the need to estimate measurements within error of various instruments.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Apply accurate measurement knowledge to solve everyday problems.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· 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).	X		X		X	X	X	X	X	X	X	X	X	X	X
<b>C. Apply basic computer operations and concepts.</b>															
· Identify solutions to basic hardware and software problems.															
· Apply knowledge of advanced input devices.															
· Apply knowledge of hardware setup.															
· Describe the process for basic software installation and demonstrate it.															
· Analyze and solve basic operating systems problems.															
· Apply touch keyboarding skills and techniques at expectable speed and accuracy.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Demonstrate the ability to perform basic software installation.															
<b>D. Utilize computer software to solve specific problems.</b>															
· Identify legal restrictions in the use of software and the output of data.															
· Apply advanced graphic manipulation and desktop publishing techniques.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Apply basic multimedia applications.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX

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· Apply advanced word processing, database and spreadsheet skills.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Describe and demonstrate how two or more software applications can be used to produce an output.															
· Select and apply software designed to meet specific needs.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<b>E. Apply basic computer communications systems.</b>															
· Identify and explain various types of on-line services.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Identify and explain the function of the parts of a basic network.															
· Describe and apply the components of a web page and their function.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Explain and demonstrate file transfer within and out side of a computer network.															
· Identify, describe and complete advanced on-line research.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
<b>3.8. Science, Technology and Human Endeavors</b>															
<b>A. Analyze the relationship between societal demands and scientific and technological enterprises.</b>															
· Identify past and current tradeoffs between increased production, environmental harm and social values (e.g., increased energy needs, power plants, automobiles).			X			X	X	X	X	XX	XX	XX		X	
· Compare technologies that are applied and accepted differently in various cultures (e.g., factory farming, nuclear power).	X		X			X					X				
· Describe and evaluate social change as a result of technological developments.	X							X		X	X	X		X	
· Assess the social impacts of a specific international environmental problem by designing a solution that applies the appropriate technologies and resources.	X		X					XX	X	X	X	XX	X		X
<b>B. Analyze how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.</b>															
· Identify several problems and opportunities that exist in your community, apply various problem-solving methods to design and evaluate possible solutions.	X	X	XX	X	XX	XX	XX	XX	XX	XX	XX	XX	X	XX	X
· Analyze a recently invented item, describing the human need that prompted its invention and the current and potential social impacts of the specific invention.	X		X							X	X	X			
· 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.				XX		XX		X		X	X				
· Assess the impacts that agricultural science has had on meeting human needs and improving the quality of life.						X									
<b>C. Evaluate possibilities consequences and impacts of scientific and technological solutions.</b>															
· Relate scientific and technological advancements in terms of cause and effect.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Describe and evaluate the impacts that financial considerations have had on specific scientific and technological applications.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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· Compare and contrast potential solutions to technological, social, economic and environmental problems.	XX	X	XX	X	X	XX	X	X	X	X	XX	X	X	X	X
· Analyze the impacts on society of accepting or rejecting scientific and technological advances.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<b>Grade 12</b>															
<b>3.1. Unifying Themes</b>															
A. Apply concepts of systems, subsystems, feedback and control to solve complex technological problems.															
· Apply knowledge of control systems concept by designing and modeling control systems that solve specific problems.	X						X	X	X	X	X	X		X	
· Apply systems analysis to predict results.	X						X	X	X	X	X	X		X	
· Analyze and describe the function, interaction and relationship among subsystems and the system itself.	X				X	X	X	X	X	X	X	X		X	
· Compare and contrast several systems that could be applied to solve a single problem.					X	X	X	X	X	X	X	X		X	
· Evaluate the causes of a system's inefficiency.															
B. Apply concepts of models as a method to predict and understand science and technology.															
· Evaluate technological processes by collecting data and applying mathematical models (e.g., process control).	X		X		X	X	X	X	X	X	X	X		X	
· Apply knowledge of complex physical models to interpret data and apply mathematical models.	X	X	X		X	X	X	X	X	X	X	X		X	
· Appraise the importance of computer models in interpreting science and technological systems	XX	X	X		X	X	XX	X	X	X	X	X		X	
C. Assess and apply patterns in science and technology.															
· Assess and apply recurring patterns in natural and technological systems.	XX		XX		X		X	X	X				X	X	
· Compare and contrast structure and function relationships as they relate to patterns.															
· Assess patterns in nature using mathematical formulas.	X	X	X		X		X	X	X	X	X	X		X	
D. Analyze scale as a way of relating concepts and ideas to one another by some measure.															
· Compare and contrast various forms of dimensional analysis.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Assess the use of several units of measurement to the same problem.	X	X	X	X	X	X	X	X	X	XX	XX	XX	XX	X	X
· Analyze and apply appropriate measurement scales when collecting data.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
E. Evaluate change in nature, physical systems and man made systems.															
· Evaluate fundamental science and technology concepts and their development over time (e.g., DNA, cellular respiration, unified field theory, energy measurement, automation, miniaturization, Copernican and Ptolemaic universe theories).	X	XX	X		X	X	XX	X	X	X	X	X	XX	XX	X
· Analyze how models, systems and technologies have changed over time (e.g., germ theory, theory of evolution, solar system, cause of fire).	X	XX	X		X	X	X	X	X	X	X	X	X	X	X
· Explain how correlation of variables does not necessarily imply causation.	XX	X	X		X	X	X	X	X	X	X	X	X	X	X
· Evaluate the patterns of change within a technology (e.g., changes in engineering in the automotive industry).	X	X	X		X	X	X	X	X	X	X	X	X	X	X
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<b>A. Evaluate the nature of scientific and technological knowledge.</b>															
· Know and use the ongoing scientific processes to continually improve and better understand how things work.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Critically evaluate the status of existing theories (e.g., germ theory of disease, wave theory of light, classification of subatomic particles, theory of evolution, epidemiology of aids).	X	XX	X				X			X	X	X	XX	X	XX
<b>B. Evaluate experimental information for appropriateness and adherence to relevant science processes.</b>															
· Evaluate experimental data correctly within experimental limits.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Judge that conclusions are consistent and logical with experimental conditions.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Interpret results of experimental research to predict new information or improve a solution.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
<b>C. Apply the elements of scientific inquiry to solve multi-step problems.</b>															
· Generate questions about objects, organisms and/or events that can be answered through scientific investigations.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Evaluate the appropriateness of questions.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Design an investigation with adequate control and limited variables to investigate a question.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Organize experimental information using analytic and descriptive techniques.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Evaluate the significance of experimental information in answering the question.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Project additional questions from a research study that could be studied	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
<b>D. Analyze and use the technological design process to solve problems.</b>															
· Assess all aspects of the problem, prioritize the necessary information and formulate questions that must be answered.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Propose, develop and appraise the best solution and develop alternative solutions.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Implement and assess the solution.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Evaluate and assess the solution, redesign and improve as necessary.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Communicate and assess the process and evaluate and present the impacts of the solution.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
<b>3.4. Physical Science, Chemistry and Physics</b>															
<b>D. Analyze the essential ideas about the composition and structure of the universe.</b>															
· Analyze the Big Bang Theory's use of gravitation and nuclear reaction to explain a possible origin of the universe.														XX	
· Compare the use of visual, radio and x-ray telescopes to collect data regarding the structure and evolution of the universe.														XX	
· Correlate the use of the special theory of relativity and the life of a star.														XX	
<b>3.5. Earth Sciences</b>															
<b>A. Analyze and evaluate earth features and processes that change the earth.</b>															
· Apply knowledge of geophysical processes to explain the formation and degradation of earth structures (e.g., mineral deposition, cave formations, soil composition).	XX	XX	XX	XX	XX	X						X			

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· Interpret geological evidence supporting evolution.				X						X	X				XX
· Apply knowledge of radioactive decay to assess the age of various earth features and objects.	X			X									X		X
<b>B. Analyze the availability, location and extraction of earth resources.</b>															
· Describe how the location of earth's major resources has affected a country's strategic decisions.										XX	XX	XX		X	
· Compare locations of earth features and country boundaries.	X			X	X				X	X	X	X		X	
· Analyze the impact of resources (e.g., coal deposits, rivers) on the life of Pennsylvania's settlements and cities.				X						XX	XX	XX			
<b>C. Analyze atmospheric energy transfers.</b>															
· Describe how weather and climate involve the transfer of energy in and out of the atmosphere.							X	XX						X	
· Explain how unequal heating of the air, ocean and land produces wind and ocean currents.							XX	X							
· Analyze the energy transformations that occur during the greenhouse effect and predict the long-term effects of increased pollutant levels in the atmosphere.										X				XX	
· Analyze the mechanisms that drive a weather phenomena (e.g., El Nino, hurricane, tornado) using the correlation of three methods of heat energy transfer.							XX	XX							
<b>D. Analyze the principles and history of hydrology.</b>															
· Analyze the operation and effectiveness of a water purification and desalination system.												XX			
· Evaluate the pros and cons of surface water appropriation for commercial and electrical use.										X		XX			
· Analyze the historical development of water use in Pennsylvania (e.g., recovery of Lake Erie).						X						XX			
· Compare the marine life and type of water found in the intertidal, neritic and bathyal zones.							X								X
<b>3.6. Technology Education</b>															
<b>A. Analyze biotechnologies that relate to propagating, growing, maintaining, adapting, treating and converting.</b>															
· Analyze and solve a complex production process problem using biotechnologies (e.g., hydroponics, fish farming, crop propagation).															
· Analyze specific examples where engineering has impacted society in protection, personal health application or physical enhancement.	X							X		X	X	X			
· Appraise and evaluate the cause and effect and subsequent environmental, economic and societal impacts that result from biomass and biochemical conversion.										XX					
· Evaluate and apply biotechnical processes to complex plant and animal production methods.															
· Apply knowledge of biochemical-related technologies to propose alternatives to hazardous waste treatment.												X			
· apply knowledge of agricultural science to solve or improve a biochemical related problem.															

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B. Analyze knowledge of information technologies of processes encoding, transmitting, receiving, storing, retrieving and decoding.															
· Apply and analyze advanced information techniques to produce a complex image that effectively conveys a message (e.g., desktop publishing, audio and/or video production).	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Analyze and evaluate a message designed and produced using still, motion and animated communication techniques.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Describe the operation of fiber optic, microwave and satellite informational systems.		X													
· Apply various graphic and electronic information techniques to solve real world problems (e.g., data organization and analysis, forecasting, interpolation).	X	X	X		X	X	X	X	X	X	X	X	X	X	X
C. Analyze physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and															
· Apply knowledge of construction technology by designing, planning and applying all the necessary resources to successfully solve a construction problem.						X									
· Compare resource options in solving a specific manufacturing problem.						X					XX				
· Analyze and apply complex skills needed to process materials in complex manufacturing enterprises.						X					XX				
· Apply advanced information collection and communication techniques to successfully convey solutions to specific construction problems.						X									
· Assess the importance of capital on specific construction applications.						X									
· Analyze the positive and negative qualities of several different types of materials as they would relate to specific construction applications.			X			X									
· Analyze transportation technologies of propelling, structuring, suspending, guiding, controlling and supporting.						X									
· Analyze the concepts of vehicular propulsion, guidance, control, suspension and structural systems while designing and producing specific complex transportation systems.										X					
<b>3.7. Technological Devices</b>															
A. Apply advanced tools, materials and techniques to answer complex questions.															
· Demonstrate the safe use of complex tools and machines within their specifications.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Select and safely apply appropriate tools, materials and processes necessary to solve complex problems that could result in more than one solution.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Evaluate and use technological resources to solve complex multi-step problems.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
B. Evaluate appropriate instruments and apparatus to accurately measure materials and processes.															
· Apply and evaluate the use of appropriate instruments to accurately measure scientific and technologic phenomena within the error limits of the equipment.	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
· Evaluate the appropriate use of different measurement scales (macro and micro).	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX

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· Evaluate the utility and advantages of a variety of absolute and relative measurement scales for their appropriate application.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<b>C. Evaluate computer operations and concepts as to their effectiveness to solve specific problems.</b>															
· Describe and demonstrate atypical software installation.															
· Analyze and solve hardware and advanced software problems.															
· Assess and apply multiple input and output devices to solve specific problems.															
<b>D. Evaluate the effectiveness of computer software to solve specific problems.</b>															
· Evaluate the effectiveness of software to produce an output and demonstrate the process.															
· Design and apply advanced multimedia techniques.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Analyze, select and apply the appropriate software to solve complex problems.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Evaluate the effectiveness of the computer as a presentation tool.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Analyze the legal responsibilities of computer users.															
<b>E. Assess the effectiveness of computer communications systems.</b>															
· Assess the effectiveness of a computer based communications system.															
· Transfer files among different computer platforms.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Analyze the effectiveness of on-line information resources to meet the needs for collaboration, research, publications, communications and productivity.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Apply knowledge of protocol standards to solve connectivity problems.															
<b>3.8. Science, Technology and Human Endeavors</b>															
<b>A. Synthesize and evaluate the interactions and constraints of science and technology on society.</b>															
· Compare and contrast how scientific and technological knowledge is both shared and protected.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Evaluate technological developments that have changed the way humans do work and discuss their impacts (e.g., genetically engineered crops).	XX	X	XX		X	X	X	X	X	XX	XX	XX	X	XX	X
· Evaluate socially proposed limitations of scientific research and technological application.	X		X		X	X	X	X	X	X	X	X	X	X	X
<b>B. Apply the use of ingenuity and technological resources to solve specific societal needs and improve the quality of life.</b>															
· Apply appropriate tools, materials and processes to solve complex problems.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
· Use knowledge of human abilities to design or modify technologies that extend and enhance human abilities.	XX	X	XX		X	X	X	X	X	X	XX	X	X	X	X
· Apply appropriate tools, materials and processes to physical, informational or biotechnological systems to identify and recommend solutions to international problems.	X		XX		X	XX	XX	XX	X	XX	XX	X	X	XX	X
· apply knowledge of agricultural science to develop a solution that will improve on a human need or want.															
<b>C. Evaluate the consequences and impacts of scientific and technological solutions.</b>															

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· Propose solutions to specific scientific and technological applications, identifying possible financial considerations.	X		XX		X	XX	X	X	X	XX	XX	XX	X	XX	X
· Analyze scientific and technological solutions through the use of risk/benefit analysis.	X	X	X		X	X	X	X	X	X	X	X		X	
· Analyze and communicate the positive or negative impacts that a recent technological invention had on society.	XX	XX	XX		X	X	X	X	X	XX	XX	XX	X	X	
· Evaluate and describe potential impacts from emerging technologies and the consequences of not keeping abreast of technological advancements (e.g., assessment alternatives, risks, benefits, costs, economic impacts, constraints).	X	X	X		X	X	X	X	X	X	X	X	X	X	X