

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.1. Unifying Themes			
3.1.K. GRADE K	3.1.1. GRADE 1	3.1.2. GRADE 2	3.1.3. GRADE 3
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>B. Use classroom models to role play.</p> <ul style="list-style-type: none"> • Use common objects as models (e.g. grocery items, stuffed animals, blocks). 	<p>A. Identify parts of a system.</p> <ul style="list-style-type: none"> • Describe simple systems (e.g., parts of body, parts of plants). • <i>Identify and describe what parts make up a system</i> 	<p>A. Identify parts of natural/human-made system.</p> <ul style="list-style-type: none"> • <i>Identify system parts that are natural and human-made.</i> • Distinguish between natural and human-made objects. <p>B. Identify different types of models and their uses.</p> <ul style="list-style-type: none"> • Explore classroom models (e.g., globes, maps). • <i>Identify different types of models.</i> 	<p>A. Explain the purpose of individual parts of human-made systems.</p> <ul style="list-style-type: none"> • Identify human-made systems (e.g., technology, construction, manufacturing, transportation). • Explain how the parts of human-made systems work together. <p>B. Know models as useful simplifications of objects or processes.</p> <ul style="list-style-type: none"> • Use models for prediction (e.g., dinosaur skeleton to predict type of dinosaur and lifestyle). • <i>Identify and apply models as tools for prediction and insight.</i>

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3.1.K. GRADE K	3.1.1. GRADE 1	3.1.2. GRADE 2	3.1.3. GRADE 3
<p>D. Develop an awareness of size.</p> <ul style="list-style-type: none"> • Identify and classify objects as bigger or smaller in relation to a given object. 	<p>C. Observe and identify patterns in nature.</p> <ul style="list-style-type: none"> • Observe patterns of growth (e.g. in plants and animals). <p>E. Observe changes in systems.</p> <ul style="list-style-type: none"> • Observe changes in systems (e.g., moon, plant growth). 	<p>D. Develop an awareness of scale.</p> <ul style="list-style-type: none"> • Identify scale on different scientific tools (e.g., ruler, thermometer, etc.). • <i>Identify the use of scale as it relates to the measurement of distance, volume, and mass.</i> <p>E. Recognize change in systems.</p> <ul style="list-style-type: none"> • <i>Describe change to objects caused by heat, cold, light or chemicals.</i> 	<p>C. Illustrate patterns that regularly occur and reoccur in nature.</p> <ul style="list-style-type: none"> • Use knowledge of natural patterns to predict next occurrences (e.g., seasons, leaf patterns, lunar phases). <p>E. Examine change through measurement.</p> <ul style="list-style-type: none"> • <i>Examine and explain change by using time and measurement.</i>

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3.1. Unifying Themes			
3.1.4. GRADE 4	3.1.5. GRADE 5	3.1.6. GRADE 6	3.1.7. GRADE 7
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to . . .</i>			
<p>A. Know that natural and human-made objects are made up of parts.</p> <ul style="list-style-type: none"> • Identify and describe what parts make up a system. • Identify system parts that are natural and human-made (e.g., ball point pen, simple electrical circuits, plant anatomy). • <i>Describe the purpose of analyzing systems.</i> • <i>Know that technologies include physical technology systems (e.g., construction, manufacturing, transportation), informational systems and biochemical-related systems.</i> <p>B. Know models as useful simplifications of objects or processes.</p> <ul style="list-style-type: none"> • Identify different types of models. • Identify and apply models as tools for prediction and insight. • Apply appropriate simple modeling tools and techniques. • Identify theories that serve as models (e.g., molecules). 	<p>A. Identify/Explore parts of a natural/human-made system.</p> <ul style="list-style-type: none"> • Describe the component parts of a natural system (e.g. nervous, skeletal, reproductive) • Use technology (microscopes and software) to develop an awareness of order in a system. • Describe a system as a group of related parts that work together to achieve a desired result (e.g., digestive system). <p><i>B. Identify parts of models.</i></p> <ul style="list-style-type: none"> • <i>Identify parts of different models (e.g., body systems, cells, atoms, and molecules).</i> • <i>Identify and describe different types of models and their functions.</i> 	<p>A. Identify/explore parts of a natural/human-made system.</p> <ul style="list-style-type: none"> • Identify systems that are closed (e.g., the water cycle). • Identify the input and output of systems. • Construct flow charts to show input and output of a system. • <i>Distinguish between system inputs, system processes and system outputs.</i> • <i>Distinguish between open loop and closed loop systems.</i> <p>B. Describe the use of models as an application of scientific or technological concepts.</p> <ul style="list-style-type: none"> • Use models to demonstrate scientific concepts (i.e., circuits to demonstrate the flow of a charge). • <i>Explain systems by outlining a system’s relevant parts and its purpose and/or designing a model that illustrates its function.</i> 	<p>A. Explain the parts of a simple system and their relationship to each other.</p> <ul style="list-style-type: none"> • <i>Describe a system as a group of related parts that work together to achieve a desired result (e.g., digestive system).</i> • <i>Explain the importance of order in a system.</i> • Distinguish between system inputs, system processes and system outputs. • Distinguish between open loop and closed loop systems. • Apply systems analysis to solve problems. <p>B. Describe the use of models as an application of scientific or technological concepts.</p> <ul style="list-style-type: none"> • Identify and describe different types of models and their function. • Apply models to predict specific results and observations (e.g., population growth, effects of infectious organisms).

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3.1. Unifying Themes			
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<p>C. Illustrate patterns that regularly occur and reoccur in nature.</p> <ul style="list-style-type: none"> • Identify observable patterns (e.g., growth patterns in plants, crystal shapes in minerals, climate, structural patterns in bird feathers). • Use knowledge of natural patterns to predict next occurrences (e.g., seasons, leaf patterns, lunar phases). <p>D. Know that scale is an important attribute of natural and human made objects, events and phenomena.</p> <ul style="list-style-type: none"> • Identify the use of scale as it relates to the measurement of distance, volume and mass. • <i>Describe scale as a ratio (e.g., pipefitting).</i> • <i>Explain the importance of scale in producing models and apply it to a model.</i> 	<p>C. Identify patterns as repeated processes or recurring elements in science and technology.</p> <ul style="list-style-type: none"> • <i>Identify different forms of patterns and use them to group and classify specific objects.</i> <p>D. Demonstrate and describe scale as a way to compare measurements.</p> <ul style="list-style-type: none"> • Create a model showing an object to scale (e.g., floor plan of classroom, scale drawing of body). 	<p>C. Identify patterns as repeated processes or recurring elements in science and technology.</p> <ul style="list-style-type: none"> • <i>Identify repeating structure patterns.</i> <p>D. Explain scale as a way of relating concepts and ideas to one another by some measure.</p> <ul style="list-style-type: none"> • <i>Apply various applications of size and dimensions of scale to scientific, mathematical, and technological applications</i> • <i>Describe scale as a form of ratio and apply to a life situation..</i> 	<ul style="list-style-type: none"> • Explain systems by outlining a system’s relevant parts and its purpose and/or designing a model that illustrates its function. <p>C. Identify patterns as repeated processes or recurring elements in science and technology.</p> <ul style="list-style-type: none"> • Identify different forms of patterns and use them to group and classify specific objects. • Identify repeating structure patterns. • <i>Identify and describe patterns that occur in physical systems (e.g., construction, manufacturing, transportation), informational systems and biochemical-related systems.</i> <p>D. Explain scale as a way of relating concepts and ideas to one another by some measure.</p> <ul style="list-style-type: none"> • Apply various applications of size and dimensions of scale to scientific, mathematical, and technological applications. • Describe scale as a form of ratio and apply to a life situation.

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3.1. Unifying Themes			
3.1.4. GRADE 4	3.1.5. GRADE 5	3.1.6. GRADE 6	3.1.7. GRADE 7
<p>E. Recognize change in natural and physical systems.</p> <ul style="list-style-type: none"> • Recognize change as fundamental to science and technology concepts • Examine and explain change by using time and measurement. • Describe relative motion. • Describe the change to objects caused by heat, cold, light or chemicals. 		<p>E. Describe the effects of making a change in one part of a whole system.</p> <ul style="list-style-type: none"> • <i>Describe the components of a system (e.g., body system, ecosystem, electrical circuit).</i> • <i>Describe the effect of making a change in one part of a system on the system as a whole.</i> 	<p>E. Identify change as a variable in describing natural and physical systems.</p> <ul style="list-style-type: none"> • Describe fundamental science and technology concepts that could solve practical problems. • Explain how ratio is used to describe change. • Describe the components of a system (e.g., body system, ecosystem, electrical circuit). • Describe the effect of making a change in one part of a system on the system as a whole. • Describe the effect of making a change in one part of a system on the system as a whole.

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3.1. Unifying Themes			
3.1.8. GRADE 8	3.1.9. GRADE 9	3.1.10. GRADE 10	3.1.11. GRADE 11
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to . . .</i>			
<p>A. Discriminate among the concepts of systems, subsystems, feedback and control in solving technological problems.</p> <ul style="list-style-type: none"> • <i>Identify the function of subsystems within a larger system (e.g., role of thermostat in an engine, pressure switch).</i> • <i>Describe the interrelationships among input, processes, outputs, feedback and control in specific systems.</i> 	<p>A. Discriminate among the concepts of systems, subsystems, feedback and control in solving technological problems.</p> <ul style="list-style-type: none"> • Examine examples of system redesign (e.g., circuits, optical devices, automotive systems, compound machines). • <i>Explain the concepts of system redesign and apply it to improve technological systems.</i> • <i>Apply the universal systems model to illustrate specific solutions and troubleshoot specific problems.</i> • <i>Analyze and describe the effectiveness of systems to solve specific problems.</i> <p>B. <i>Describe concepts of models as a way to predict and understand science and technology.</i></p> <ul style="list-style-type: none"> • <i>Apply mathematical models to science and technology (gas laws balancing equations, efficiency of machines, wave properties).</i> 	<p>A. Discriminate among the concepts of systems, subsystems, feedback and control in solving technological problems.</p> <ul style="list-style-type: none"> • Identify the function of subsystems within a larger system (e.g., role of thermostat in an engine, pressure switch). • Describe the interrelationships among inputs, processes, outputs, feedback and control in specific systems. • 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. • Analyze and describe the effectiveness of systems to solve specific problems. <p>B. Describe concepts of models as a way to predict and understand science and technology.</p> <ul style="list-style-type: none"> • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). 	<p>A. Apply concepts of systems, subsystems, feedback and control to solve complex technological problems.</p> <ul style="list-style-type: none"> • <i>Analyze and describe the function, interaction and relationship among subsystems and the system itself.</i> • <i>Compare and contrast several systems that could be applied to solve a single problem [e.g. pollution control devices (scrubbers, cyclone collector, electrostatic)].</i> <p>B. Apply concepts of models as a method to predict and understand science and technology.</p> <ul style="list-style-type: none"> • <i>Explain why computer models are needed to interpret science and technology systems (e.g., use graphical analysis, graphing calculators, computer probes).</i>

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3.1. Unifying Themes			
3.1.8. GRADE 8	3.1.9. GRADE 9	3.1.10. GRADE 10	3.1.11. GRADE 11
<p>C. Apply patterns as repeated processes or recurring elements in science and technology.</p> <ul style="list-style-type: none"> • Examine and describe recurring patterns that form the basis of geological order and astronomical order. <p>D. Apply scale as a way of relating concepts and ideas to one another by some measure.</p> <ul style="list-style-type: none"> • Convert one scale to another. 	<p>C. Apply patterns as repeated processes or recurring elements in science and technology.</p> <ul style="list-style-type: none"> • <i>Examine and describe recurring patterns that form the basis of biological classification.</i> • <i>Examine and describe recurring patterns that form the basis of biological classification, chemical periodicity, geological order and astronomical order.</i> • <i>Examine and describe stationary physical patterns.</i> • <i>Examine and describe physical patterns in motion.</i> <p>D. <i>Apply scale as a way of relating concepts and ideas to one another by some measure.</i></p> <ul style="list-style-type: none"> • <i>Apply dimensional analysis and scale as a ratio.</i> 	<ul style="list-style-type: none"> • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology. <p>C. Apply patterns as repeated processes or recurring elements in science and technology.</p> <ul style="list-style-type: none"> • Examine and describe recurring patterns that form the basis of biological classification, chemical periodicity, geological order and astronomical order. • Examine and describe stationary physical patterns. • Examine and describe physical patterns in motion. <p>D. Apply scale as a way of relating concepts and ideas to one another by some measure.</p> <ul style="list-style-type: none"> • Apply dimensional analysis and scale as a ratio. 	<ul style="list-style-type: none"> • Appraise the importance of computer models in interpreting science and technological systems. <p>C. Assess and apply patterns in science and technology.</p> <ul style="list-style-type: none"> • <i>Compare and contrast structure and function relationships as they relate to patterns.</i> <p>D. Analyze scale as a way of relating concepts and ideas to one another by some measure.</p> <ul style="list-style-type: none"> • <i>Assess the use of several units of measurement to the same problem.</i>

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3.1. Unifying Themes			
3.1.8. GRADE 8	3.1.9. GRADE 9	3.1.10. GRADE 10	3.1.11. GRADE 11
<p>E. Describe patterns of change in nature, physical and man-made systems.</p> <ul style="list-style-type: none"> • <i>Describe the effects of error in measurement.</i> 	<p>E. Describe patterns of change in nature, physical and man-made systems.</p> <ul style="list-style-type: none"> • <i>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, atomic theory, theory of relativity, Pasteur’s Germ Theory, Galileo’s Heliocentric Solar System, gas laws, feedback systems).</i> • <i>Recognize that stable systems often involve underlying dynamic changes (e.g., a chemical reaction at equilibrium has molecules reforming continuously).</i> • <i>Describe the effects of error in measurements.</i> • <i>Describe changes to matter caused by heat, cold, light or chemicals using a rate function.</i> 	<p>E. Describe patterns of change in nature, physical and man made systems.</p> <ul style="list-style-type: none"> • 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, atomic theory, theory of relativity, Pasteur’s Germ Theory, Galileo’s Heliocentric Solar System, gas laws, feedback systems). • Recognize that stable systems often involve underlying dynamic changes (e.g., a chemical reaction at equilibrium has molecules reforming continuously). • Describe the effects of error in measurements. • Describe changes to matter caused by heat, cold, light or chemicals using a rate function. 	<p>E. Evaluate change in nature, physical systems and man-made systems.</p> <ul style="list-style-type: none"> • <i>Analyze how models, systems and technologies have changed over time (e.g., germ theory of disease, solar system, cause of fire).</i> • Evaluate the patterns of change within a technology (e.g., changes in engineering in the automotive industry).

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3.1. Unifying Themes			
3.12.K. GRADE 12			
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to . . .</i>			
<p>A. Apply concepts of systems, subsystems, feedback and control to solve complex technological problems.</p> <ul style="list-style-type: none"> • Apply knowledge of control systems concept by designing and modeling control systems that solve specific problems. • Apply systems analysis to predict results. • Analyze and describe the function, interaction and relationship among subsystems and the system itself. • Compare and contrast several systems that could be applied to solve a single problem. • Evaluate the causes of a system's inefficiency. <p>B. Apply concepts of models as a method to predict and understand science and technology.</p> <ul style="list-style-type: none"> • <i>Evaluate technological processes by collecting data and applying mathematical models (e.g., process control).</i> • <i>Apply knowledge of complex physical models to interpret data and apply mathematical models.</i> 			

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3.1. Unifying Themes			
3.12.K. GRADE 12			
<ul style="list-style-type: none"> • <i>Appraise the importance of computer models in interpreting science and technological systems.</i> <p>C. Assess and apply patterns in science and technology.</p> <ul style="list-style-type: none"> • <i>Assess and apply recurring patterns in natural and technological systems.</i> • Compare and contrast structure and function relationships as they relate to patterns. • <i>Assess patterns in nature using mathematical formulas.</i> <p>D. Analyze scale as a way of relating concepts and ideas to one another by some measure.</p> <ul style="list-style-type: none"> • <i>Compare and contrast various forms of dimensional analysis.</i> • Assess the use of several units of measurement to the same problem. • <i>Analyze and apply appropriate measurement scales when collecting data.</i> 			

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3.1. Unifying Themes			
3.12.K. GRADE 12			
<p>E. Evaluate change in nature, physical systems and man made systems.</p> <ul style="list-style-type: none"> • <i>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).</i> • Analyze how models, systems and technologies have changed over time (e.g., germ theory of disease, solar system, cause of fire). • <i>Explain how correlation of variables does not necessarily imply causation.</i> • <i>Evaluate the patterns of change within a technology (e.g., changes in engineering in the automotive industry).</i> 			

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3.2. Inquiry and Design			
3.2.K. GRADE K	3.2.1. GRADE 1	3.2.2. GRADE 2	3.2.3. GRADE 3
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to . . .</i>			
<p>A. Develop an awareness of the importance of language to communicate an idea.</p> <ul style="list-style-type: none"> • Use oral language to describe observations. <p>B. Develop an awareness of the five senses.</p> <ul style="list-style-type: none"> • Use the five senses to gather information about objects. 	<p>A. Develop an awareness of the importance of language to communicate an idea.</p> <ul style="list-style-type: none"> • Use oral language to describe observations. <p>B. Describe objects through observation.</p> <ul style="list-style-type: none"> • Use the five senses to describe objects. • Use standard and non-standard measurement during science. 	<p>A. Recognize the importance of language to communicate an idea.</p> <ul style="list-style-type: none"> • Use written and oral language to describe observations and develop explanations. <p>B. Describe objects through scientific observations.</p> <ul style="list-style-type: none"> • Use observations to develop a descriptive vocabulary. • Use measurement (length and mass) during the collection of scientific data. 	<p>A. Recognize the nature of scientific and technological knowledge.</p> <ul style="list-style-type: none"> • Use data or observations to construct a reasonable explanation. • Modify ideas based on observations and data. <p>B. Describe objects through scientific observations.</p> <ul style="list-style-type: none"> • <i>Recognize observational descriptors from each of the five senses (e.g., see-blue, feel-rough).</i> • <i>Use observations to develop a descriptive vocabulary.</i> • Use metric measurements (length, mass, volume) during collection of scientific data.

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3.2. Inquiry and Design			
3.2.K. GRADE K	3.2.1. GRADE 1	3.2.2. GRADE 2	3.2.3. GRADE 3
<p>C. Develop an awareness of the scientific method.</p> <ul style="list-style-type: none"> • Generate questions that could start an investigation. • Participate in simple guided experiments. <p>D. Develop an awareness of problem solving.</p> <ul style="list-style-type: none"> • Discuss possible solutions to a given problem. 	<p>C. Develop an awareness of the scientific method.</p> <ul style="list-style-type: none"> • Generate questions that could start an investigation. • Participate in simple guided experiments. <p>D. Develop an awareness of problem solving.</p> <ul style="list-style-type: none"> • Recognize basic problems. • Discuss possible solutions. 	<p>C. Use the elements of scientific inquiry to solve problems.</p> <ul style="list-style-type: none"> • Generate questions that could start an investigation. • Make predictions about the outcome of the experiment. • Complete simple group experiments. • Record results and develop a conclusion for the experiment as a class. <p>D. Recognize a problem and propose a solution.</p> <ul style="list-style-type: none"> • Recognize and explain basic problems. • Explore possible solutions. 	<p>C. Recognize and use the elements of scientific inquiry to solve problems.</p> <ul style="list-style-type: none"> • Generate questions that could start an investigation. • Make predictions about the outcome of the experiment. • Complete experiment and record results. • State a conclusion that is consistent with the information. <p>D. Develop an awareness of the technological design process.</p> <ul style="list-style-type: none"> • Recognize and explain basic problems. • Identify and try possible solutions. • Evaluate the solutions.

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3.2. Inquiry and Design			
3.2.4. GRADE 4	3.2.4. GRADE 5	3.2.6. GRADE 6	3.2.7. GRADE 7
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>A. <i>Identify and use the nature of scientific and technological knowledge.</i></p> <ul style="list-style-type: none"> • <i>Distinguish between a scientific fact and a belief.</i> • <i>Provide clear explanations that account for observations and results.</i> • <i>Relate how new information can change existing perceptions.</i> <p>B. Describe objects in the world using the five senses.</p> <ul style="list-style-type: none"> • Recognize observational descriptors from each of the five senses (e.g., see-blue, feel-rough). • <i>Use observations to develop a descriptive vocabulary.</i> 	<p>A. Examine the relationship between scientific theory and evidence.</p> <ul style="list-style-type: none"> • Distinguish between a scientific theory and a belief. • Recognize that scientific theory is supported by evidence (observation and data). • Recognize that observations can change based on differing circumstances. <p>B. Describe materials using the metric system.</p> <ul style="list-style-type: none"> • Select and use appropriate scientific tools (e.g., balances, metric rulers, graduated cylinders, thermometers) to describe materials in metric terms (e.g., weight, length, volume, temperature). 	<p>A. Explain changes in scientific theory</p> <ul style="list-style-type: none"> • Examine the evolution of specific theories with regards to major concepts being studied. • Explore factors that cause a modification of theory (e.g., skepticism, unexpected observations, and “accidents”). <p>B. Use process knowledge to make and interpret observations.</p> <ul style="list-style-type: none"> • Use the process involved in making scientific observation (e.g., raising questions, using prior knowledge, predicting, inferring, etc.). • Identify and examine variables within a controlled experiment. 	<p>A. <i>Explain and apply scientific and technological knowledge.</i></p> <ul style="list-style-type: none"> • <i>Distinguish between a scientific theory and a belief.</i> • <i>Answer “What if” questions based on observation, inference or prior knowledge or experience.</i> • <i>Explain how skepticism about an accepted scientific explanation led to a new understanding.</i> • <i>Explain how new information may change existing theories and practice.</i> <p>B. <i>Apply process knowledge to make and interpret observations.</i></p> <ul style="list-style-type: none"> • <i>Measure materials using a variety of scales.</i> • <i>Describe relationships by making inferences and predictions.</i> • <i>Communicate, use space / time relationships, define operationally, raise questions, formulate hypotheses, test and experiment,</i> • <i>Design controlled experiments, recognize variables, manipulate variables.</i> • <i>Interpret data, formulate models,</i>

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3.2. Inquiry and Design			
3.2.4. GRADE 4	3.2.4. GRADE 5	3.2.6. GRADE 6	3.2.7. GRADE 7
<p>C. Recognize and use the elements of scientific inquiry to solve problems.</p> <ul style="list-style-type: none"> • Generate questions about objects, organisms and/or events that can be answered through scientific investigations. • Design an investigation. • Conduct an experiment. • State a conclusion that is consistent with the information. <p>D. Recognize and use the technological design process to solve problems.</p> <ul style="list-style-type: none"> • Recognize and explain basic problems. • Identify possible solutions and their course of action. • Try a solution. • Describe the solution, identify its impacts and modify if necessary. • Show the steps taken and the results. 	<p>C. Explore problems using scientific inquiry.</p> <ul style="list-style-type: none"> • Generate and refine questions so that they may be answered through a scientific investigation. • Design an investigation with limited variables to investigate a question. • Conduct an experiment to answer a question. • Write a conclusion based on the results of the experiment. <p>D. Know and use the technological design process to solve problems.</p> <ul style="list-style-type: none"> • State the steps of the technological design process (e.g. problem identification, solution design, implementation, and evaluation). • Identify different types of problems. 	<p>C. Explore problems using scientific inquiry.</p> <ul style="list-style-type: none"> • Generate and refine questions so that they may be answered through a scientific investigation. • Design and conduct an investigation to answer a question. • Judge the significance of experimental information in answering the question. • Write a conclusion consistent with the results of the experiment. • Generate questions for further study based on experimental results. <p>D. Know and use the technological design process to solve problems.</p> <ul style="list-style-type: none"> • Propose a variety of solutions for a problem. • Propose a variety of methods to achieve a solution. • Try a solution. • Explain the results and explore the impact of the solution. • Suggest improvements to the solution. 	<p style="text-align: center;"><i>design models, and produce solutions.</i></p> <p>C. Identify and use the elements of scientific inquiry to solve problems.</p> <ul style="list-style-type: none"> • <i>Generate questions about objects, organisms and/or events that can be answered through scientific investigations.</i> • <i>Evaluate the appropriateness of questions.</i> • <i>Design an investigation with limited variables to investigate a question.</i> • <i>Conduct a two-part experiment.</i> • <i>Judge the significance of experimental information in answering the question.</i> • <i>Communicate appropriate conclusions from the experiment.</i> <p>D. Know and use the technological design process to solve problems.</p> <ul style="list-style-type: none"> • <i>Define different types of problems.</i> • <i>Define all aspects of the problem, necessary information and questions that must be answered.</i> • <i>Propose the best solution.</i> • <i>Design and propose alternative methods to achieve solutions.</i>

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3.2. Inquiry and Design			
3.2.4. GRADE 4	3.2.4. GRADE 5	3.2.6. GRADE 6	3.2.7. GRADE 7
	<ul style="list-style-type: none"> • Identify aspects of a problem that must be addressed in proposed solutions. • Try a variety of solutions. • Identify the best solution to a problem. 		<ul style="list-style-type: none"> • <i>Apply a solution.</i> • <i>Explain the results, present improvements, identify and infer the impacts of the solution.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.2. Inquiry and Design			
3.2.8. GRADE 8	3.2.9. GRADE 9	3.2.10. GRADE 10	3.2.11. GRADE 11
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>A. Apply knowledge and understanding about the nature of scientific and technological knowledge.</p> <ul style="list-style-type: none"> • Compare and contrast scientific theories and beliefs with regards to a major concept being studied. • Recognize that scientific knowledge is based on evidence and can be modified by new information. <p>B. Apply process knowledge and organize scientific and technological phenomena in varied ways.</p> <ul style="list-style-type: none"> • Describe materials using precise quantitative and qualitative skills based on observations. • Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions. • Make inferences and predictions based on observations. • Communicate and defend the scientific thinking that resulted in inferences and predictions. 	<p>A. Apply knowledge and understanding about the nature of scientific and technological knowledge.</p> <ul style="list-style-type: none"> • Compare and contrast scientific theories and beliefs with regards to a major concept being studied. • Relate changes in scientific knowledge to the discovery of new information. <p>B. Apply process knowledge and organize scientific and technological phenomena in varied ways.</p> <ul style="list-style-type: none"> • Describe materials using precise quantitative and qualitative skills based on observations. • Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions. • Make inferences and predictions based on observations. • Communicate and defend the scientific thinking that resulted in inferences and predictions. 	<p>A. Apply knowledge and understanding about the nature of scientific and technological knowledge.</p> <ul style="list-style-type: none"> • <i>Compare and contrast scientific theories and beliefs.</i> • <i>Know that science is limited to the study of observable aspects of the world and the universe.</i> • <i>Integrate new information into existing theories and explain implied results.</i> <p>B. Apply process knowledge and organize scientific and technological phenomena in varied ways.</p> <ul style="list-style-type: none"> • <i>Describe materials using precise quantitative and qualitative skills based on observations.</i> • <i>Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions.</i> • <i>Use process skills to make inferences and predictions using collected information and to communicate, using space / time relationships, defining operationally.</i> 	<p>A. Evaluate the nature of scientific and technological knowledge.</p> <ul style="list-style-type: none"> • <i>Know and use the ongoing scientific processes to continually improve and better understand how things work.</i> • <i>Critically evaluate.</i> <p>B. Evaluate experimental information for appropriateness and adherence to relevant science process.</p> <ul style="list-style-type: none"> • <i>Evaluate experimental data correctly within experimental limits.</i> • <i>Judge that conclusions are consistent and logical with experimental conditions.</i> • <i>Interpret results.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.2. Inquiry and Design			
3.2.8. GRADE 8	3.2.9. GRADE 9	3.2.10. GRADE 10	3.2.11. GRADE 11
<p>C. Apply the elements of scientific inquiry to solve problems.</p> <ul style="list-style-type: none"> • Generate questions about objects, organisms and/or events that can be answered through scientific investigations. • Design an investigation with adequate control and limited variables to investigate a question. • Evaluate the appropriateness of questions. • Conduct a multiple step experiment. • Organize experimental information using a variety of analytic methods. • Judge the significance of experimental information in answering the question. • Suggest additional steps that might be done experimentally. <p>D. Identify and apply the technological design process to solve problems.</p> <ul style="list-style-type: none"> • Examine the problem, list necessary information, and questions that must be answered. • Propose and analyze a solution. • Test a solution. 	<p>C. Apply the elements of scientific inquiry to solve problems.</p> <ul style="list-style-type: none"> • Generate questions about objects, organisms and/or events that can be answered through scientific investigations. • Evaluate the appropriateness of questions. • Design an investigation with adequate control and limited variables to investigate a question. • Conduct a multiple step experiment. • Organize experimental information using a variety of analytic methods. • Judge the significance of experimental information in answering the question. • Suggest additional steps that might be done experimentally. <p>D. Identify and apply the technological design process to solve problems.</p> <ul style="list-style-type: none"> • Examine the problem, list necessary information, and questions that must be answered. • Propose and analyze a solution. • Test a solution. 	<p>C. Apply the elements of scientific inquiry to solve problems.</p> <ul style="list-style-type: none"> • <i>Generate questions about objects, organisms and/or events that can be answered through scientific investigations.</i> • <i>Evaluate the appropriateness of questions.</i> • <i>Design an investigation with adequate control and limited variables to investigate a question.</i> • <i>Conduct a multiple step experiment.</i> • <i>Organize experimental information using a variety of analytic methods.</i> • <i>Judge the significance of experimental information in answering the question.</i> • <i>Suggest additional steps that might be done experimentally.</i> <p>D. Identify and apply the technological design process to solve problems.</p> <ul style="list-style-type: none"> • <i>Examine the problem; rank all necessary information and all questions that must be answered.</i> • <i>Propose and analyze a solution.</i> • <i>Implement the solution.</i> 	<p>C. Apply the elements of scientific inquiry to solve multi-step problems.</p> <ul style="list-style-type: none"> • <i>Generate questions about objects, organisms and/or events that can be answered through scientific investigations.</i> • <i>Evaluate the appropriateness of questions.</i> • <i>Design an investigation with adequate control and limited variables to investigate a question.</i> • <i>Organize experimental information using analytic and descriptive techniques.</i> • <i>Evaluate the significance of experimental information in answering the question.</i> • <i>Compare experimental results with an outside source.</i> <p>D. Analyze and use the technological design process to solve problems.</p> <ul style="list-style-type: none"> • <i>Assess all aspects of the problem, prioritize the necessary information and formulate questions that must be answered.</i> • <i>Propose, develop, and appraise</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.2. Inquiry and Design			
3.2.8. GRADE 8	3.2.9. GRADE 9	3.2.10. GRADE 10	3.2.11. GRADE 11
<ul style="list-style-type: none"> • Draw conclusions from the solution, redesign, retest, and improve as necessary. • Communicate the process and list impacts of the solution. 	<ul style="list-style-type: none"> • Draw conclusions from the solution, redesign, retest, and improve as necessary. • Communicate the process and evaluate the impacts of the solution. 	<ul style="list-style-type: none"> • <i>Evaluate the solution, test, redesign and improve as necessary</i> • <i>Communicate the process and evaluate and present the impacts of the solution.</i> 	<p style="text-align: center;"><i>the best solution and develop alternative solutions.</i></p> <ul style="list-style-type: none"> • <i>Implement and assess the solution.</i> • <i>Evaluate and assess the solution, redesign and improve as necessary.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.2. Inquiry and Design			
3.2.12. GRADE 12			
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to . . .</i>			
<p>A. Evaluate the nature of scientific and technological knowledge.</p> <ul style="list-style-type: none"> • Know and use the ongoing scientific processes to continually improve and better understand how things work. • Critically evaluate the status of existing theories. <p>B. Evaluate experimental information for appropriateness and adherence to relevant science processes.</p> <ul style="list-style-type: none"> • Evaluate experimental data correctly within experimental limits. • Judge that conclusions are consistent and logical with experimental conditions. • Interpret results of experimental research to predict new information or improve a solution. 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.2. Inquiry and Design			
3.2.12. GRADE 12			
<p>C. Apply the elements of scientific inquiry to solve multi-step problems.</p> <ul style="list-style-type: none"> • Generate questions about objects, organisms and/or events that can be answered through scientific investigations. • Evaluate the appropriateness of questions. • Design an investigation with adequate control and limited variables to investigate a question. • Organize experimental information using analytic and descriptive techniques. • Evaluate the significance of experimental information in answering the question. • Project additional questions from a research study that could be studied. <p>D. Analyze and use the technological design process to solve problems.</p> <ul style="list-style-type: none"> • Assess all aspects of the problem, prioritize the necessary information and formulate questions that must be answered. • Propose, develop and appraise the best solution and develop alternative solutions. 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.2. Inquiry and Design			
3.2.12. GRADE 12			
<ul style="list-style-type: none"> • Implement and assess the solution. • Evaluate and assess the solution, redesign and improve as necessary. • Communicate and assess the process and evaluate and present the impacts of the solution. 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.3. Biological Sciences			
3.3.K. GRADE K	3.3.1. GRADE 1	3.3.2. GRADE 2	3.3.3. GRADE 3
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to . . .</i>			
<p>A. Recognize characteristics of living things.</p> <ul style="list-style-type: none"> • Be aware that plants and animals grow and change. 	<p>A. Identify characteristics of living things.</p> <ul style="list-style-type: none"> • Identify and describe life cycles of plants and animals. • <i>Describe the basic needs of plants and animals.</i> <p>(See Technology 3.6.)</p> <p>B. Recognize that living things are made up of parts that have specific functions.</p> <ul style="list-style-type: none"> • Identify basic plant parts and their functions (i.e., roots, stems, leaves) • Become aware that different parts of living things work together to accomplish tasks. <p>(See Technology 3.6.)</p>	<p>A. Recognize the similarities and differences of living things.</p> <ul style="list-style-type: none"> • <i>Know that some organisms have similar external characteristics (e.g., anatomical characteristics; appendages, type of covering, body segments) and that similarities and differences are related to environmental circumstances.</i> • Group plants and animals by their external characteristics. 	<p>A. Identify the similarities and differences of living things.</p> <ul style="list-style-type: none"> • <i>Identify life processes of living things (e.g., growth, digestion, react to environment).</i> <p>B. Know that living things are made up of parts that have specific functions.</p> <ul style="list-style-type: none"> • Recognize that all living things are made up of cells. • <i>Identify examples of unicellular and multi-cellular organisms.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.3. Biological Sciences			
3.3.K. GRADE K	3.3.1. GRADE 1	3.3.2. GRADE 2	3.3.3. GRADE 3
<p>C. Recognize the resemblance between parents and their offspring in a variety of living things.</p> <ul style="list-style-type: none"> • Match animal offspring to their correct parent. • Describe similarities and differences in the offspring of animals. 	<p>D. Develop an awareness of changes in living things over time.</p> <ul style="list-style-type: none"> • Recognize that some animals of long ago are different than animals that live today. 		

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.3. Biological Sciences			
3.3.4. GRADE 4	3.3.5. GRADE 5	3.3.6. GRADE 6	3.3.7. GRADE 7
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>A. Know the similarities and differences of living things.</p> <ul style="list-style-type: none"> • Identify life processes of living things (e.g., growth, digestion, react to environment). • Know that some organisms have similar external characteristics (e.g., anatomical characteristics; appendages, type of covering, body segments) and that similarities and differences are related to environmental circumstances. • Describe basic needs of plants and animals. <p>B. Know that living things are made up of parts that have specific functions.</p> <ul style="list-style-type: none"> • Identify examples of unicellular and multicellular organisms. • Determine how different parts of a living thing work together to make the organism function. 	<p>A. Describe the similarities and differences that characterize diverse living things.</p> <ul style="list-style-type: none"> • <i>Describe how the structures of living things help them function in unique ways.</i> <p>B. Describe the cell as the basic structural and functional unit of living things.</p> <ul style="list-style-type: none"> • <i>Identify the levels of organization from cell to organism.</i> • <i>Compare life processes at the organism level with life processes at the cellular level.</i> 	<p>A. Identify the similarities and differences that categorize diverse living things.</p> <ul style="list-style-type: none"> • <i>Explain how to use a dichotomous key to identify plants and animals.</i> • <i>Account for adaptations among organisms that live in a particular environment.</i> 	<p>A. Describe the similarities and differences that characterize diverse living things.</p> <ul style="list-style-type: none"> • Describe how the structures of living things help them function in unique ways. • Explain how to use a dichotomous key to identify plants and animals. • Account for adaptations among organisms that live in a particular environment. <p>B. Describe the cell as the basic structural and functional unit of living things.</p> <ul style="list-style-type: none"> • Identify the levels of organization from cell to organism. • Compare life processes at the organism level with life processes at the cell level. • <i>Explain that cells and organisms have particular structures that underlie their functions.</i> • <i>Describe and distinguish among cell cycles, reproductive cycles and life cycles.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.3. Biological Sciences			
3.3.4. GRADE 4	3.3.5. GRADE 5	3.3.6. GRADE 6	3.3.7. GRADE 7
<p>C. <i>Know that characteristics are inherited and thus offspring closely resemble their parents.</i></p> <ul style="list-style-type: none"> • <i>Identify characteristics for animal and plant survival in different climates.</i> • <i>Distinguish between learned and inherited characteristics.</i> <p>D. Identify changes in living things over time.</p> <ul style="list-style-type: none"> • Compare extinct life forms with living organisms. • Know that differences in individuals of the same species may give some advantage in surviving and reproducing. 		<p>C. Know that every organism has a set of genetic instructions that determines its inherited traits.</p> <ul style="list-style-type: none"> • <i>Identify and explain inheritable characteristics.</i> • <i>Identify that the gene is the basic unit of inheritance.</i> • <i>Identify basic patterns of inheritance (e.g., dominance, recessive, co-dominance).</i> • <i>Describe how traits are inherited.</i> <p>D. Explain basic concepts of natural selection.</p> <ul style="list-style-type: none"> • <i>Identify adaptations that allow organisms to survive in their environment.</i> • <i>Describe how an environmental change can affect the survival of organisms and entire species.</i> 	<ul style="list-style-type: none"> • <i>Explain disease effects on structures or functions of an organism.</i> <p>C. Know that every organism has a set of genetic instructions that determines its inherited traits.</p> <ul style="list-style-type: none"> • Identify and explain inheritable characteristics. • Identify that the gene is the basic unit of inheritance. • Identify basic patterns of inheritance (e.g., dominance, recessive, co-dominance). • Describe how traits are inherited. • <i>Distinguish how different living things reproduce (e.g., vegetative budding, sexual).</i> • <i>Describe how selective breeding and genetic technologies can change genetic makeup of organisms.</i> <p>D. Explain basic concepts of natural selection.</p> <ul style="list-style-type: none"> • Identify adaptations that allow organisms to survive in their environment. • Describe how an environmental change can affect the survival of organisms and entire species.

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.3. Biological Sciences			
3.3.4. GRADE 4	3.3.5. GRADE 5	3.3.6. GRADE 6	3.3.7. GRADE 7
			<ul style="list-style-type: none"> • <i>Describe the role that fossils play in studying the past.</i> • <i>Explain how biologic extinction is a natural process.</i>
Ecosystem Standards are in the Environment and Ecology Standard Category (4.6).			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.3. Biological Sciences			
3.3.8. GRADE 8	3.3.9. GRADE 9	3.3.10. GRADE 10	3.3.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>A. Explain the structural and functional similarities and differences found among living things.</p> <ul style="list-style-type: none"> • <i>Describe organizing schemes of classification keys.</i> <p>B. Explain the chemical and structural units of living organisms.</p> <ul style="list-style-type: none"> • Differentiate between a prokaryote and an eukaryote and the role of its nucleus. 	<p>A. Explain the structural and functional similarities and differences found among living things.</p> <ul style="list-style-type: none"> • <i>Identify and characterize major life forms according to their placement in existing classification groups.</i> • <i>Identify and characterize major life forms by kingdom, phyla, class and order.</i> <p>B. Describe and explain the chemical and structural basis of living organisms.</p> <ul style="list-style-type: none"> • Compare and contrast the structures of plant and animal cells. • Describe the relationships between photosynthesis and respiration in terms of energy changes. • <i>Identify the specialized structures and regions of the cell and the</i> 	<p>A. Explain the structural and functional similarities and differences found among living things.</p> <ul style="list-style-type: none"> • Identify and characterize major life forms according to their placement in existing classification groups. • <i>Explain the relationship between structure and function at the molecular and cellular levels.</i> • Describe organizing schemes of classification keys. • Identify and characterize major life forms by kingdom, phyla, class and order. <p>B. Describe and explain the chemical and structural basis of living organisms.</p> <ul style="list-style-type: none"> • <i>Describe the relationship between the structure of organic molecules and the function they serve in living organisms.</i> • Identify the specialized structures and regions of the cell and the functions of each. 	<p>A. Explain the relationship between structure and function found among living things.</p> <ul style="list-style-type: none"> • <i>Identify and explain interactions among organisms (e.g., mutually beneficial, harmful relationships).</i> • <i>Describe and explain structural and functional relationships in each of the five (or six) kingdoms.</i> • <i>Explain significant biological diversity found in each of the biomes.</i> • <i>Explain and analyze the relationship between structure and function at the molecular, cellular and organ-system level.</i> <p>B. Analyze the chemical and structural basis of living organisms.</p> <ul style="list-style-type: none"> • Investigate metabolic activities by conducting experiments with the enzymes. • <i>Evaluate metabolic activities using experimental knowledge of enzymes.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.3. Biological Sciences			
3.3.8. GRADE 8	3.3.9. GRADE 9	3.3.10. GRADE 10	3.3.11. GRADE 11
<p>C. Describe how genetic information is inherited.</p> <ul style="list-style-type: none"> • Identify the genetic components of the nucleus of a cell. (e.g., DNA, gene, chromosome) • Explain the role of chromosomes in mitosis and meiosis. • <i>Compare the function and process of mitosis.</i> • <i>Distinguish different reproductive patterns in living things (e.g., budding, spores, fission).</i> 	<p><i>functions of each.</i></p>	<ul style="list-style-type: none"> • <i>Explain how cells store and use information to guide their functions.</i> • <i>Explain cell functions and processes in terms of chemical reactions and energy changes.</i> <p>C. Describe how genetic information is inherited and expressed.</p> <ul style="list-style-type: none"> • Compare and contrast the function and process of mitosis. • <i>Describe mutations' effects on a trait's expression.</i> • Distinguish different reproductive patterns in living things (e.g., budding, spores, fission). • <i>Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria).</i> • <i>Explain the relationship among DNA, genes and chromosomes.</i> • <i>Explain different types of inheritance (e.g., multiple allele, sex-influenced traits).</i> • <i>Describe the role of DNA in protein synthesis as it relates to gene expression.</i> 	<p>C. Explain gene inheritance and expression at the molecular level.</p> <ul style="list-style-type: none"> • <i>Analyze gene expression at the molecular level.</i> • <i>Describe the roles of nucleic acids in cellular reproduction and protein synthesis.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.3. Biological Sciences			
3.3.8. GRADE 8	3.3.9. GRADE 9	3.3.10. GRADE 10	3.3.11. GRADE 11
<p>D. Explain the mechanism of the theory of evolution.</p> <ul style="list-style-type: none"> • <i>Analyze evidence of evolution in the form of fossils, similarities in body structures, embryological studies and DNA studies.</i> • <i>Compare modern day descendants of extinct species and propose possible accounts for their present appearance.</i> • <i>Describe changes that illustrate major events in the earth's development based on a time line.</i> • <i>Apply the concept of natural selection to illustrate and account for a species' survival, extinction or change over time.</i> 	<p>D. Explain the mechanism of the theory of evolution.</p> <ul style="list-style-type: none"> • <i>Distinguish between inherited characteristics and learned behaviors in life forms.</i> • <i>Explain the role of mutations and gene recombination in changing a population of organisms.</i> • <i>Describe changes that illustrate major events in the earth's development based on a time line.</i> • <i>Apply the concept of natural selection to illustrate and account for a species' survival, extinction or change over time.</i> 	<p>D. Explain the mechanism of the theory of evolution.</p> <ul style="list-style-type: none"> • Analyze evidence of evolution in the form of fossils, similarities in body structures, embryological studies and DNA studies. • <i>Explain the role of mutations and gene recombination in changing a population of organisms.</i> • Compare modern day descendants of extinct species and propose possible accounts for their present appearance. • Distinguish between inherited characteristics and learned behaviors in life forms. • Describe changes that illustrate major events in the earth's development based on a time line. • Apply the concept of natural selection to illustrate and account for a species' survival, extinction or change over time. 	

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.3. Biological Sciences			
3.3.12. GRADE 12			
<p>A. Explain the relationship between structure and function at all levels of organization.</p> <ul style="list-style-type: none"> • Identify and explain interactions among organisms (e.g., mutually beneficial, harmful relationships). • Explain and analyze the relationship between structure and function at the molecular, cellular and organ-system level. • Describe and explain structural and functional relationships in each of the five (or six) kingdoms. • Explain significant biological diversity found in each of the biomes. <p>B. Analyze the chemical and structural basis of living organisms.</p> <ul style="list-style-type: none"> • <i>Identify and describe factors affecting metabolic function (e.g., temperature, acidity, hormones).</i> • Evaluate metabolic activities using experimental knowledge of enzymes. • <i>Evaluate relationships between structure and functions of different anatomical parts given their structure.</i> 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.3. Biological Sciences			
3.3.12. GRADE 12			
<ul style="list-style-type: none"> • <i>Describe potential impact of genome research on the biochemistry and physiology of life.</i> <p>C. Explain gene inheritance and expression at the molecular level.</p> <ul style="list-style-type: none"> • Analyze gene expression at the molecular level. • Describe the roles of nucleic acids in cellular reproduction and protein synthesis. • <i>Describe genetic engineering techniques, applications and impacts.</i> • <i>Explain birth defects from the standpoint of embryological development and/or changes in genetic makeup.</i> • <i>Describe the factors affecting gene frequency in a population over time and their consequences.</i> • <i>Describe and differentiate between the roles of natural selection and genetic drift.</i> 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.3. Biological Sciences			
3.3.12. GRADE 12			
<p><i>D. Explain the theory of evolution.</i></p> <ul style="list-style-type: none"> • <i>Analyze the impact of new scientific facts on the theory of evolution.</i> • <i>Examine human history by describing the progression from early hominids to modern humans.</i> • <i>Evaluate the concept of natural selection in illustrating evolution theory.</i> 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.4. Physical Science, Chemistry and Physics			
3.4.K. GRADE K	3.4.1. GRADE 1	3.4.2. GRADE 2	3.4.3. GRADE 3
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>C. Observe and describe different types of motion.</p> <ul style="list-style-type: none"> • Follow oral directions such as right, left, forward, and backward. • Discuss types of motion (moving in 	<p>A. Develop an awareness of matter.</p> <ul style="list-style-type: none"> • Explore the physical characteristics or properties of objects (e.g., texture, color, hardness, odor). 	<p>A. Identify matter and its properties.</p> <ul style="list-style-type: none"> • Describe matter in terms of mass and volume. • Classify a variety of common items as solid, liquids. • Investigate physical and chemical changes (e.g., ripping paper vs. burning paper). <p>C. Describe basic characteristics of sound.</p> <ul style="list-style-type: none"> • Identify that sound is caused by vibration. • <i>Identify characteristics of sound such as pitch, loudness, and</i> 	<p>B. Investigate electricity and energy conversion.</p> <ul style="list-style-type: none"> • Observe and experiment with static electricity. • <i>Describe static electricity in terms attraction, repulsion, and sparks.</i> • Create a continuous flow of energy using a battery, bulb, and wire. • <i>Apply knowledge of the basic electrical circuits to design and construct simple direct current circuits.</i> • <i>Classify materials as conductors and nonconductors.</i> <p>C. Observe and describe different types of force and motion.</p> <ul style="list-style-type: none"> • Distinguish between push and pull. • <i>Recognize forces that attract or</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.4. Physical Science, Chemistry and Physics			
3.4.K. GRADE K	3.4.1. GRADE 1	3.4.2. GRADE 2	3.4.3. GRADE 3
a circle vs. a straight line)	<p>D. Describe the composition and structure of the solar system and the earth's place in it.</p> <ul style="list-style-type: none"> • Name and identify properties of the planets. • <i>Recognize earth's place in the solar system.</i> • Observe a model of the solar system. 	<i>echoes.</i>	<p><i>repel other objects and demonstrate them.</i></p> <ul style="list-style-type: none"> • Demonstrate an understanding of forces such as gravity, friction and magnetism. • Describe the nature of magnetic forces (i.e., attraction and repulsion).

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.4. Physical Science, Chemistry and Physics			
3.4.4. GRADE 4	3.4.5. GRADE 5	3.4.6. GRADE 6	3.4.7. GRADE 7
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to . . .</i>			
<p>A. <i>Recognize basic concepts about the structure and properties of matter.</i></p> <ul style="list-style-type: none"> • <i>Describe properties of matter (e.g., hardness, reactions to simple chemical tests).</i> • <i>Know that combining two or more substances can make new materials with different properties</i> • <i>Know different material characteristics (e.g., texture, state of matter, solubility).</i> <p>B. Know basic energy types, sources and conversions.</p> <ul style="list-style-type: none"> • <i>Identify energy forms and examples (e.g., sunlight, heat, stored, motion).</i> • <i>Know the concept of the flow of energy by measuring flow through an object or system.</i> • Describe static electricity in terms of attraction, repulsion and sparks. • Apply knowledge of the basic electrical circuits to design and construction simple direct current circuits. 	<p>A. Recognize basic concepts about the structure and properties of matter.</p> <ul style="list-style-type: none"> • Explore atoms and their structure. • Explain the relationship between atoms and elements. • Explore the characteristics of the Periodic Table of Elements (e.g. symbol, atomic number). • <i>Identify elements as basic building blocks of matter that cannot be broken down chemically.</i> • Explain the relationship between molecules and compounds. • <i>Distinguish compounds from mixtures.</i> 	<p>A. Describe concepts about the structure and properties of elements.</p> <ul style="list-style-type: none"> • Identify chemical properties of matter. • Contrast chemical and physical properties. • Explore simple chemical reactions. • <i>Describe and conduct experiments that identify chemical and physical properties.</i> • <i>Describe reactants and products of simple chemical reactions.</i> <p>B. Explore types of energy and the transfer of energy.</p> <ul style="list-style-type: none"> • Describe how an object acquires an electrical charge. • Describe that electric charge flows along a path called a circuit. • <i>Explain the parts and functions in an electrical circuit.</i> 	<p>A. Describe concepts about the structure and properties of matter.</p> <ul style="list-style-type: none"> • Identify elements as basic building blocks of matter that cannot be broken down chemically. • Distinguish compounds from mixtures. • Describe and conduct experiments that identify chemical and physical properties. • Describe reactants and products of simple chemical reactions. <p>B. Relate energy sources and transfers to heat and temperature.</p> <ul style="list-style-type: none"> • <i>Identify and describe sound changes in moving objects.</i> • <i>Know that the sun is a major source of energy that emits wavelengths of visible light, infrared and ultraviolet radiation.</i> • <i>Explain the conversion of one form of energy to another by applying knowledge of each form of energy.</i> • Explain the parts and functions in an electrical circuit.

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.4. Physical Science, Chemistry and Physics			
3.4.4. GRADE 4	3.4.5. GRADE 5	3.4.6. GRADE 6	3.4.7. GRADE 7
<ul style="list-style-type: none"> • Classify materials as conductors and nonconductors. • <i>Know and demonstrate the basic properties of heat by producing it in a variety of ways.</i> • <i>Know the characteristics of light (e.g., reflection, refraction, absorption) and use them to produce heat, color or a virtual image.</i> <p>C. Observe and describe different types of force and motion.</p> <ul style="list-style-type: none"> • Identify characteristics of sound such as pitch, loudness and echoes. • Recognize forces that attract or repel other objects and demonstrate them. • Describe various types of motions. • Compare the relative movement of objects and describe types of motion that are evident. • Describe the position of an object by locating it relative to another object or the background (e.g., geographic direction, left, up). 	<p>C. Explore different types of force and motion.</p> <ul style="list-style-type: none"> • Investigate various types of motion (e.g., periodic, circular). • Use quantitative descriptions of motion. (e.g. distance ÷ time = speed). • Graphically represent motion. • Explore the Laws of Motion by examining factors that affect motion (e.g., how mass/inertia and forces such as friction affect speed). • <i>Describe the motion of an object based on its position, direction and speed.</i> 		<p>C. Identify and explain the principles of force and motion.</p> <ul style="list-style-type: none"> • Describe the motion of an object based on its position, direction and speed. • <i>Classify fluid power systems according to fluid used or mode of power transmission (e.g., air, oil).</i> • <i>Explain various motions using models.</i> • <i>Explain how convex and concave mirrors and lens change light images.</i> • <i>Explain how sound and light travel in waves of differing speeds, sizes and frequencies.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.4. Physical Science, Chemistry and Physics

3.4.4. GRADE 4	3.4.5. GRADE 5	3.4.6. GRADE 6	3.4.7. GRADE 7
<p>D. Describe the composition and structure of the universe and the earth’s place in it.</p> <ul style="list-style-type: none"> • Recognize earth’s place in the solar system. • <i>Explain and illustrate the causes of seasonal changes.</i> • <i>Identify planets in our solar system and their general characteristics.</i> • <i>Describe the solar system motions and use them to explain time (e.g., days, seasons), major lunar phases and eclipses.</i> 		<p>D. Describe the composition and structure of the universe and the earth’s place in it.</p> <ul style="list-style-type: none"> • Distinguish among various objects within the solar system (e.g., planets, comets, moons, asteroids, and meteors). • <i>Compare various planets characteristics.</i> • <i>Describe and differentiate comets, asteroids and meteors.</i> • <i>Identify gravity as the force that keeps planets in orbit around the sun and governs the rest of the movement of the solar system and the universe</i> • <i>Identify the accomplishments and contributions provided by selected past and present scientists in the field of astronomy.</i> • <i>Identify and articulate space program efforts to investigate possibilities of living in space and on other planets.</i> 	<p>D. Describe essential ideas about the composition and structure of the universe and the earth’s place in it.</p> <ul style="list-style-type: none"> • Compare various planets’ characteristics. • <i>Describe basic star types and identify the sun as a star type.</i> • Describe and differentiate comets, asteroids and meteors. • Identify gravity as the force that keeps planets in orbit around the sun and governs the rest of the movement of the solar system and the universe. • <i>Illustrate how the positions of stars and constellations change in relation to the Earth during an evening and from month to month.</i> • <i>Identify equipment and instruments that explore the universe.</i> • Identify the accomplishments and contributions provided by selected past and present scientists in the field of astronomy. • Identify and articulate space program efforts to investigate possibilities of living in space and on other planets.

Refer to Technology Standard Category 3.6 for applied uses of these concepts and principles.

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.4. Physical Science, Chemistry and Physics

3.4.8. GRADE 8	3.4.9. GRADE 9	3.4.10. GRADE 10	3.4.11. GRADE 11
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Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to . .

<p>A. Explain concepts about the structure and properties of matter.</p> <ul style="list-style-type: none"> • <i>Know that atoms are composed of even smaller sub-atomic structures whose properties are measurable.</i> • Distinguish among the subatomic particles in terms of mass, change and position in the atom. • Define characteristics of the atoms of a given element including atomic number, atomic mass, atomic radius and ionization energy. • Explain the development of the modern periodic table. • <i>Explain the repeating pattern of chemical properties by using the repeating patterns of atomic structure within the periodic table.</i> • Explain the relationship between the volume and pressure of a gas (Boyle's Law). • Explain the relationship between the temperature and volume of a gas (Charles Law). • Explain the relationship between the temperature, pressure, and volume of a gas (Ideal Gas Law). 	<p>A. Explain concepts about the structural properties of matter.</p> <ul style="list-style-type: none"> • Explain why compounds form. • <i>Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent).</i> • Describe the properties of covalent and ionic compounds. • Explain the meaning of chemical formulas including coefficients and subscripts. • Explain the meaning of the parts and symbols of a chemical equation. • Apply the laws of conservation of mass to balance equations. • <i>Describe various types of chemical reactions by applying the laws of conservation of mass and energy.</i> • Identify the types of chemical reactions including synthesis, decomposition, single replacement, and double replacement. 	<p>A. Explain concepts about the structure and properties of matter.</p> <ul style="list-style-type: none"> • Know that atoms are composed of even smaller sub-atomic structures whose properties are measurable. • Explain the repeating pattern of chemical properties by using the repeating patterns of atomic structure within the periodic table. • Predict the behavior of gases through the use of Boyle's, Charles' or the ideal gas law, in everyday situations. • Describe phases of matter according to the Kinetic Molecular Theory. • Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent). • <i>Recognize formulas for simple inorganic compounds.</i> • Describe various types of chemical reactions by applying the laws of conservation of mass and energy. • Apply knowledge of mixtures to appropriate separation techniques. • Understand that carbon can form several types of compounds. 	<p>A. Apply concepts about the structure and properties of matter.</p> <ul style="list-style-type: none"> • <i>Apply rules of systematic nomenclature and formula writing to chemical substances.</i> • <i>Classify and describe, in equation form, types of chemical and nuclear reactions.</i> • <i>Explain how radioactive isotopes that are subject to decay can be used to estimate the age of materials.</i> • <i>Explain how the forces that bind solids, liquids, and gases affect their properties.</i> • <i>Characterize and identify important classes of compounds (e.g., acids, bases, and salts).</i> • <i>Apply the conservation of energy concept to fields as diverse as mechanics, nuclear particles and studies of the origin of the universe.</i> • <i>Apply the predictability of nuclear decay to estimate the age of materials that contain radioactive isotopes.</i> • <i>Quantify the properties of matter (e.g., density, solubility coefficients) by applying mathematical formulas.</i>
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Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.4. Physical Science, Chemistry and Physics			
3.4.8. GRADE 8	3.4.9. GRADE 9	3.4.10. GRADE 10	3.4.11. GRADE 11
<ul style="list-style-type: none"> • <i>Predict the behavior of gases through the use of Boyle’s, Charles’ or the ideal gas law, in everyday situations.</i> • Distinguish among solids, liquids, and gases in terms of particle arrangement kinetic energy and heat content. • <i>Describe phases of matter according to the Kinetic Molecular Theory.</i> • <i>Apply knowledge of mixtures to appropriate separation techniques.</i> • <i>Understand that carbon can form several types of compounds.</i> <p>B. Analyze energy sources and their transformations.</p> <ul style="list-style-type: none"> • Use a calorimeter to measure heat transfer. • Identify the energy changes that take place in a variety of endothermic and exothermic reactions. • Recognize that various forms of energy are different manifestations of the same basic “stuff.” 	<p>B. Analyze energy sources and their transformations.</p> <ul style="list-style-type: none"> • Build a wet cell and describe how it generates voltage. • Use the concept of electric charge to account for the energy exchanges within an electric circuit. • Explain the effects of the parts of an electric circuit on the charges that flow through the circuit. • <i>Use knowledge of chemical reactions to generate an electrical current.</i> 	<p>B. Analyze energy sources and transfers of heat.</p> <ul style="list-style-type: none"> • <i>Determine the efficiency of chemical systems by applying mathematical formulas.</i> • Use knowledge of chemical reactions to generate an electrical current. • <i>Evaluate energy changes in chemical reactions.</i> • Use knowledge of conservation of energy and momentum to explain common phenomena (e.g., refrigeration system, rocket propulsion). 	<p>B. Analyze energy sources and transfers of heat.</p> <ul style="list-style-type: none"> • Explain differences between the system and surroundings in a chemical reaction including the use of energy diagrams. • Use information about endothermic or exothermic reactions to evaluate the heat lost or gained in a chemical reaction. • Assign oxidation numbers to elements in a chemical reaction and identify which one is undergoing oxidation or reduction.

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.4. Physical Science, Chemistry and Physics			
3.4.8. GRADE 8	3.4.9. GRADE 9	3.4.10. GRADE 10	3.4.11. GRADE 11
<ul style="list-style-type: none"> • Understand that when energy changes from one form to another or flows from one object to another, the total amount of energy remains constant. • Understand that when momentum is transferred from one object to another, the total amount of momentum remains constant. • <i>Use knowledge of conservation of energy and momentum to explain common phenomena (e.g., refrigeration systems, rocket propulsion).</i> <p>C. Identify and explain the principles of force and motion.</p> <ul style="list-style-type: none"> • Identify wave parameters (frequency, wavelength, amplitude, and velocity). • Recognize that sound is caused by vibration and explain the mechanism by which the sound wave is transmitted through a medium. • Recognize that light (or electromagnetic wave) is produced by a vibrating electric charge. 	<p>C. Identify and explain the principles of force and motion.</p> <ul style="list-style-type: none"> • Determine the affect of a simple machine on the magnitude and direction of the applied force. • <i>Identify elements of simple machines in compound machines.</i> • <i>Determine the efficiency of mechanical systems by applying mathematical formulas.</i> • Describe an object’s position in space, position in time, velocity and acceleration in terms of algebraic variables. 	<ul style="list-style-type: none"> • <i>Explain resistance, current and electro-motive forces (Ohm’s Law).</i> <p>C. Distinguish among the principles of force and motion.</p> <ul style="list-style-type: none"> • Identify the relationship of electricity and magnetism as two aspects of a single electromagnetic force. • Identify elements of simple machines in compound machines. • <i>Explain fluid power systems through the design and construction of appropriate models.</i> • <i>Describe sound effects (e.g., Doppler effect, amplitude, frequency, reflection, refraction, absorption, sonar, seismic).</i> 	<ul style="list-style-type: none"> • <i>Use knowledge of oxidation and reduction to balance complex reactions.</i> • <i>Calculate the efficiency of mechanical systems (e.g., automotive systems).</i> • Use the Kinetic Molecular Theory to explain the concepts of heat and temperature. • <i>Apply appropriate thermodynamic concepts (e.g., conservation, entropy) to solve problems relating to energy and heat.</i> <p>C. Analyze the principles of force and motion.</p> <ul style="list-style-type: none"> • Demonstrate an understanding of the independence of vertical and horizontal components of projectile motion using an appropriate verbal, graphical, or mechanical example. • Use the parameters of rotational motion to describe the motion of a rotating object and relate them to their translational analogs. • Demonstrate an understanding that uniform circular motion is caused an inward centripetal force.

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.4. Physical Science, Chemistry and Physics			
3.4.8. GRADE 8	3.4.9. GRADE 9	3.4.10. GRADE 10	3.4.11. GRADE 11
<ul style="list-style-type: none"> • Recognize that a moving electric charge is the source of a magnetic field and that a moving magnet (changing magnetic field) is the source of an electric field. • <i>Identify the relationship of electricity and magnetism as two aspects of a single electromagnetic force.</i> <p>D. Identify essential ideas about the composition and structure of the universe.</p> <ul style="list-style-type: none"> • <i>Compare the basic structures of the universe (e.g., galaxy types, nova, black holes, neutron stars).</i> • <i>Describe the structure and life cycle of star, using the Hertzsprung-Russell diagram.</i> • <i>Describe the nuclear processes involved in energy production in a star.</i> • <i>Explain the “red-shift” and Hubble’s use of it to determine stellar distance and movement.</i> 	<ul style="list-style-type: none"> • <i>Know Newton’s laws of motion (including inertia, action and reaction) and gravity and apply them to solve problems related to forces and mass.</i> 	<ul style="list-style-type: none"> • <i>Describe light effects (e.g., Doppler effect, dispersion, absorption, emission spectra, polarization, interference).</i> • <i>Describe and measure the motion of sound, light and other objects.</i> • Know Newton’s laws of motion (including inertia, action and reaction) and gravity and apply them to solve problems related to forces and mass. • Determine the efficiency of mechanical systems by applying mathematical formulas. <p>D. Explain essential ideas about the composition and structure of the universe.</p> <ul style="list-style-type: none"> • Compare the basic structures of the universe (e.g., galaxy types, nova, black holes, neutron stars). • Describe the structure and life cycle of star, using the Hertzsprung-Russell diagram. • Describe the nuclear processes involved in energy production in a star. • Explain the “red-shift” and Hubble’s use of it to determine stellar distance and movement. 	<ul style="list-style-type: none"> • <i>Evaluate wave properties of frequency, wavelength, and speed as applied to sound and light through different media.</i> <p>D. Explain essential ideas about the composition and structure of the universe.</p> <ul style="list-style-type: none"> • <i>Compare the use of visual, radio, and x-ray telescopes to collect data regarding the structure and evolution of the universe.</i> • Use the constancy of the speed of light to discuss the relationship between the distance to a stellar source and the time at which the collected data originated.

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.4. Physical Science, Chemistry and Physics			
3.4.8. GRADE 8	3.4.9. GRADE 9	3.4.10. GRADE 10	3.4.11. GRADE 11
<ul style="list-style-type: none"> • <i>Compare absolute versus apparent star magnitude and their relation to stellar distance.</i> • <i>Explain the impact of the Copernican and Newtonian thinking on man’s view of the universe.</i> • <i>Identify and analyze the findings of several space instruments in regards to the extent and composition of the solar system and universe.</i> 		<ul style="list-style-type: none"> • Compare absolute versus apparent star magnitude and their relation to stellar distance. • Explain the impact of the Copernican and Newtonian thinking on man’s view of the universe. • Identify and analyze the findings of several space instruments in regards to the extent and composition of the solar system and universe. 	

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.4. Physical Science, Chemistry and Physics			
3.4.12. GRADE 12			
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. .</i>			
<p>A. Apply concepts about the structure and properties of matter.</p> <ul style="list-style-type: none"> • Apply rules of systematic nomenclature and formula writing to chemical substances. • Classify and describe, in equation form, types of chemical and nuclear reactions. • Explain how radioactive isotopes that are subject to decay can be used to estimate the age of materials. • Explain how the forces that bind solids, liquids and gases affect their properties. • Characterize and identify important classes of compounds (e.g., acids, bases, salts). • Apply the conservation of energy concept to fields as diverse as mechanics, nuclear particles and studies of the origin of the universe. • Apply the predictability of nuclear decay to estimate the age of materials that contain radioactive isotopes. • Quantify the properties of matter (e.g., density, solubility coefficients) by applying mathematical formulas. 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.4. Physical Science, Chemistry and Physics			
3.4.12. GRADE 12			
<p>B. Apply and analyze energy sources and conversions and their relationship to heat and temperature.</p> <ul style="list-style-type: none"> • <i>Determine the heat involved in illustrative chemical reactions.</i> • Evaluate mathematical formulas that calculate the efficiency of specific chemical and mechanical systems. • Use knowledge of oxidation and reduction to balance complex reactions • Apply appropriate thermodynamic concepts (e.g., conservation, entropy) to solve problems relating to energy and heat. <p>C. Apply the principles of motion and force.</p> <ul style="list-style-type: none"> • Evaluate wave properties of frequency, wavelength and speed as applied to sound and light through different media. • <i>Propose and produce modifications to specific mechanical power systems that will improve their efficiency.</i> • <i>Analyze the principles of translational motion, velocity and acceleration as they relate to free fall and projectile motion.</i> 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.4. Physical Science, Chemistry and Physics			
3.4.12. GRADE 12			
<ul style="list-style-type: none"> • <i>Analyze the principles of rotational motion to solve problems relating to angular momentum, and torque.</i> • <i>Interpret a model that illustrates circular motion and acceleration.</i> • <i>Describe inertia, motion, equilibrium, and action/reaction concepts through words, models and mathematical symbols.</i> <p>D. Analyze the essential ideas about the composition and structure of the universe.</p> <ul style="list-style-type: none"> • <i>Analyze the Big Bang Theory's use of gravitation and nuclear reaction to explain a possible origin of the universe.</i> • Compare the use of visual, radio and x-ray telescopes to collect data regarding the structure and evolution of the universe. • <i>Correlate the use of the special theory of relativity and the life of a star.</i> 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.5. Earth Sciences			
3.5.K. GRADE K	3.5.1. GRADE 1	3.5.2. GRADE 2	3.5.3. GRADE 3
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to.</i>			
	<p>A. Develop an awareness of prehistoric life.</p> <ul style="list-style-type: none"> • Recognize that fossils provide information about the past. • Identify basic life forms that existed in the history of the Earth. <p>B. Develop an awareness of common Earth materials in the environment.</p> <ul style="list-style-type: none"> • Identify and explore soil and rocks in a local environmental setting. 	<p>A. Recognize basic landforms.</p> <ul style="list-style-type: none"> • Identify basic Earth structures through the use of models. 	<p>A. Describe basic landforms and how they are formed.</p> <ul style="list-style-type: none"> • <i>Describe Earth processes (e.g. rusting, weathering, erosion) that have affected selected physical features in students' neighborhoods.</i> • <i>Identify various Earth structures (e.g. mountains, faults, and drainage basins) through the use of models.</i> <p>B. Classify common Earth materials using resources.</p> <ul style="list-style-type: none"> • Describe characteristics of different Earth materials. • <i>Identify and sort Earth materials according to a classification key (e.g., soil/rock type).</i> • <i>Identify uses of various Earth materials (e.g. buildings, highways, fuels, growing plants).</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.5. Earth Sciences			
3.5.K. GRADE K	3.5.1. GRADE 1	3.5.2. GRADE 2	3.5.3. GRADE 3
<p>C. Develop an awareness of basic weather elements.</p> <ul style="list-style-type: none"> • Observe and describe weather. • Construct simple graphs (i.e., pictographs) of daily weather. 	<p>C. Develop an awareness of basic seasonal weather patterns.</p> <ul style="list-style-type: none"> • Describe and compare seasonal characteristics. • <i>Explain how the different seasons affect plants, animals, food availability, and daily human life.</i> 	<p>C. Identify basic weather elements.</p> <ul style="list-style-type: none"> • Identify and describe different types of precipitation. • Identify weather information, sources (e.g. newspaper, radio, and television, Internet). • Interpret basic data from weather charts and graphs. <p>D. Identify the basic types of water on the Earth’s surface.</p> <ul style="list-style-type: none"> • <i>Know that approximately 3 quarters of the Earth is covered by water.</i> • <i>Describe locations of fresh and salt water in or near the state of Pennsylvania.</i> • Create models demonstrating that the majority of Earth is covered with water. • Label different bodies of water on the Earth. 	<p>D. Describe the water cycle.</p> <ul style="list-style-type: none"> • <i>Identify examples of water in the form of solid, liquid, and gas on or near the surface of the Earth.</i> • <i>Explain and illustrate evaporation and condensation.</i> • Describe the stages of the water cycle.

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.5. Earth Sciences			
3.5.4. GRADE 4	3.5.5. GRADE 5	3.5.6. GRADE 6	3.5.7. GRADE 7
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>A. Know basic landforms and Earth history.</p> <ul style="list-style-type: none"> • Describe earth processes (e.g. rusting, weathering, erosion) that have affected selected physical features in students' neighborhoods. • Identify various Earth structures (e.g. mountains, faults, and drainage basins) through the use of models. • <i>Identify the composition of soil as weathered rock and decomposed organic remains.</i> • <i>Describe fossils and the type of environment they lived in (e.g. tropical, aquatic, desert).</i> 	<p>A. Describe Earth's structure.</p> <ul style="list-style-type: none"> • <i>Describe major layers of the Earth.</i> • Describe and illustrate the rock cycle. • <i>Explain how the rock cycle affected rock formations in the state of Pennsylvania.</i> • <i>Identify living plants and animals that are similar to fossil forms.</i> 	<p>A. Describe the processes involved in the formation of landforms.</p> <ul style="list-style-type: none"> • <i>Describe the processes involved in the creation of geologic features (e.g. folding, faulting, volcanism, sedimentation) and these processes seen today (e.g. erosion, weathering, crustal plate movement) are similar to those in the past.</i> • <i>Describe the processes that formed Pennsylvania geologic structures and resources including mountains, glacial formations, water gaps and ridges.</i> • <i>Distinguish between examples of rapid surface changes (e.g. landslides, earthquakes) and slow surface changes (e.g. weathering).</i> 	<p>A. Describe Earth features and processes.</p> <ul style="list-style-type: none"> • Describe major layers of the Earth. • Describe the processes involved in the creation of geologic features (e.g. folding, faulting, volcanism, sedimentation) and that these processes seen today (e.g. erosion, weathering, crustal plate movement) are similar to those in the past. • Describe the processes that formed Pennsylvania geologic structures and resources including mountains, glacial formations, water gaps and ridges. • Explain how the rock cycle affected rock formations in the state of Pennsylvania. • Distinguish between examples of rapid surface changes (e.g. landslides, earthquakes) and slow surface changes (e.g. weathering). • Identify living plants and animals that are similar to fossil forms.

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.5. Earth Sciences			
3.5.4. GRADE 4	3.5.5. GRADE 5	3.5.6. GRADE 6	3.5.7. GRADE 7
<p>B. Know types and uses of Earth materials.</p> <ul style="list-style-type: none"> • Identify uses of various Earth materials (e.g. buildings, highways, fuels, growing plants). • Identify and sort Earth materials according to a classification key (e.g. soil/rock type). <p>B. Know basic weather elements.</p> <ul style="list-style-type: none"> • <i>Identify weather patterns from data charts (including temperature, wind direction and speed, and precipitation) and graphs of the data.</i> • Explain how the different seasons affect plants, animals, food availability, and daily human life. 	<p>B. Describe Earth’s resources.</p> <ul style="list-style-type: none"> • <i>Identify and locate significant earth resources (e.g. rock types, oil, gas, coal deposits) in Pennsylvania.</i> • Describe the processes involved in creating Earth’s resources. • <i>Explain the processes involved in the formation of oil and coal in Pennsylvania.</i> • Describe and locate significant Earth’s resources (e.g. fossil fuels, water, timber, rock types). • <i>Identify and locate significant earth resources (e.g. rock types, oil, gas, coal deposits) in Pennsylvania.</i> • <i>Explain the value and uses of different Earth resources (e.g., selected minerals, ores, fuel sources, agricultural uses).</i> 	<p>B. Examine how Earth’s resources affect everyday life.</p> <ul style="list-style-type: none"> • List examples of how Earth’s resources affect modern life (e.g. settlement, economics, uses of resources). • Explain how Earth’s resources affected early human settlement. • <i>Compare the locations of human settlements as related to available resources.</i> 	<p>B. Recognize Earth resources and how they affect everyday life.</p> <ul style="list-style-type: none"> • Identify and locate significant Earth resources (e.g. rock types, oil, gas, coal deposits) in Pennsylvania. • Explain the processes involved in the formation of oil and coal in Pennsylvania. • Explain the value and uses of different Earth resources (e.g. selected minerals, ores, fuel sources, agricultural uses). • Compare the locations of human settlements as related to available resources. <p>C. Describe basic elements of meteorology.</p> <ul style="list-style-type: none"> • <i>Explain weather forecasts by interpreting weather data and symbols.</i> • <i>Explain the oceans’ impact on local weather and the climate of a region.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.5. Earth Sciences			
3.5.4. GRADE 4	3.5.5. GRADE 5	3.5.6. GRADE 6	3.5.7. GRADE 7
<p>C. Recognize the Earth’s different water resources.</p> <ul style="list-style-type: none"> • Know that approximately $\frac{3}{4}$th of the Earth is covered by water. • Describe locations of fresh and salt water in or near the state of Pennsylvania. • Identify examples of water in the form of solid, liquid, and gas on or near the surface of the Earth. • Explain and illustrate evaporation and condensation. • <i>Recognize other resources available from water (e.g. energy, transportation, minerals, food).</i> 	<p>D. Explain the behavior of the Earth’s water systems.</p> <ul style="list-style-type: none"> • <i>Explain the water cycle using the processes of evaporation and condensation.</i> • <i>Describe factors that affect evaporation and condensation.</i> • Describe how water systems are connected. 		<ul style="list-style-type: none"> • <i>Identify how cloud types, wind directions, and barometric pressure changes are associated with weather patterns in different regions of the country.</i> • <i>Explain and illustrate the processes of cloud formation and precipitation.</i> • <i>Describe and illustrate the major layers of the Earth’s atmosphere.</i> • <i>Identify different air masses and global wind patterns and how they relate to the weather patterns in different regions of the U.S.</i> <p>D. Explain the behavior and impact of the Earth’s water systems.</p> <ul style="list-style-type: none"> • Explain the water cycle using the processes of evaporation and condensation. • Describe factors that affect evaporation and condensation. • <i>Distinguish salt from fresh water (e.g. density, electrical conduction).</i> • <i>Compare the effect of water type (e.g. polluted, fresh, salt water) and the life contained in them.</i> • <i>Identify ocean and shoreline features (e.g. bays, inlets, spit, tidal marshes).</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.5. Earth Science			
3.5.8. GRADE 8	3.5.9. GRADE 9	3.5.10. GRADE 10	3.5.11. GRADE 11
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>A. Explain the events and processes that have changed the Earth.</p> <ul style="list-style-type: none"> • Explain processes of geologic change and the similarities of past and present changes (as indicated by geological evidence). • <i>Explain several methods of dating earth materials and structures.</i> • Compare and contrast geologic time periods. • <i>Correlate general geologic time periods to the historical development of the Earth.</i> • <i>Describe and identify major types of rocks and minerals.</i> 	<p>A. Compare Earth features with the processes of change.</p> <ul style="list-style-type: none"> • <i>Illustrate and explain plate tectonics as the mechanism of continental movement and sea floor changes.</i> • <i>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).</i> • <i>Interpret topographic maps to identify and describe significant geologic history/structures in Pennsylvania.</i> • <i>Evaluate, interpret, and predict geologic history using geologic maps.</i> 	<p>A. Relate earth features and processes that change the Earth.</p> <ul style="list-style-type: none"> • Illustrate and explain plate tectonics as the mechanism of continental movement and sea floor changes. • 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). • Interpret topographic maps to identify and describe significant geologic history/structures in Pennsylvania. • Evaluate, interpret, and predict geologic history using geologic maps. • Explain several methods of dating Earth's materials and structures. • Correlate general geologic time periods in the history of the Earth. • Describe and identify major types of rocks and minerals. 	<p>A. Explain the relationship between Earth features and processes of change.</p> <ul style="list-style-type: none"> • <i>Apply knowledge of geophysical processes to explain the formation and degradation of Earth structures (e.g. mineral deposition coal formation, soil composition).</i> • <i>Interpret geological evidence supporting evolution.</i> • <i>Apply knowledge of radioactive decay to assess the age of various Earth features and objects.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.5. Earth Science			
3.5.8. GRADE 8	3.5.9. GRADE 9	3.5.10. GRADE 10	3.5.11. GRADE 11
<p>B. Describe the relationship between humans and resources.</p> <ul style="list-style-type: none"> • <i>Evaluate the impact of geologic activities/hazards (e.g. earthquakes, sinkholes, landslides).</i> • <i>Evaluate land use (e.g. agricultural, recreational, residential, and commercial) in Pennsylvania based on soil composition.</i> • <i>Demonstrate the effects of sedimentation and erosion before and after a conservation plan is implemented.</i> <p>C. Explain the impact of meteorology on living things.</p> <ul style="list-style-type: none"> • Explain the formation of climatic zones and their effects on the physical environment. • <i>Evaluate specific adaptations plants and animals have made that enable them to survive in different climates.</i> • <i>Describe weather and climate patterns on global levels.</i> 	<p>B. Identify the sources and locations of Earth’s resources.</p> <ul style="list-style-type: none"> • Explain the formation of important minerals and Earth resources as found in their locations.. • <i>Compare the locations of strategic minerals and Earth resources in the world with their geologic history using maps and global information systems.</i> <p>C. Recognize the importance of meteorological data on weather forecasting.</p> <ul style="list-style-type: none"> • Evaluate various methods of gathering meteorological data and their value for weather forecasting. • <i>Analyze information from meteorological instruments and online sources to predict weather patterns.</i> 	<p>B. Explain sources and uses of Earth resources.</p> <ul style="list-style-type: none"> • Compare the locations of strategic minerals and Earth resources in the world with their geologic history using maps and global information systems. • Evaluate land use (e.g. agricultural, recreational, residential and commercial) in Pennsylvania based upon soil composition. • Evaluate the impact of geologic activities/hazards (e.g. earthquakes, sinkholes, landslides). • Demonstrate the effects of sedimentation and erosion before and after a conservation plan is implemented. <p>C. Interpret meteorological data.</p> <ul style="list-style-type: none"> • Analyze information from meteorological instruments and online sources to predict weather patterns. • Describe weather and climate patterns on global levels. • Evaluate specific adaptations plants and animals have made that enable them to survive in different climates. 	<p>B. Explain the relationship between humans and resources.</p> <ul style="list-style-type: none"> • <i>Describe how the location of Earth’s major resources has affected a country’s strategic decisions.</i> • <i>Compare locations of Earth features and country boundaries.</i> • <i>Analyze the impact of Pennsylvania coal deposits and rivers on the life of Pennsylvania’s settlements and cities.</i> <p>C. Analyze atmosphere energy transfers.</p> <ul style="list-style-type: none"> • <i>Describe how weather and climate involve the transfer of energy in and out of the atmosphere.</i> • <i>Explain how unequal heating of the air, ocean, and land produces wind and ocean currents.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.5. Earth Science			
3.5.8. GRADE 8	3.5.9. GRADE 9	3.5.10. GRADE 10	3.5.11. GRADE 11
<p>D. Explain the impact of the Earth’s water systems as a resource for living things.</p> <ul style="list-style-type: none"> • <i>Compare specific sources of potable water (e.g. wells, public systems, rivers) used by people in Pennsylvania.</i> • <i>Identify the components of a municipal/agricultural water supply system and a wastewater treatment system.</i> • <i>Relate aquatic life to water conditions (e.g. turbidity, temperature, salinity, dissolved oxygen, nitrogen levels, pressure).</i> • <i>Compare commercially important aquatic species in or near Pennsylvania.</i> 	<p>D. Analyze the ocean as an economic source.</p> <ul style="list-style-type: none"> • Describe the formation of ocean floor and shoreline features (e.g. bays, spits, riptides, continental shelf, and slope). • Compare and contrast the formation of ocean floor and shoreline features of the Atlantic and Pacific coastlines. • <i>Identify economic resources found in marine areas.</i> • Compare commercially important aquatic species in or near Pennsylvania. 	<p>D. Assess the value of water as a resource.</p> <ul style="list-style-type: none"> • Compare specific sources of potable water (e.g. wells, public systems, rivers) used by people in Pennsylvania. • Identify the components of a municipal/agricultural water supply system and a wastewater treatment system. • Relate aquatic life to water conditions (e.g. turbidity, temperature, salinity, dissolved oxygen, nitrogen levels, pressure). • Compare commercially important aquatic species in or near Pennsylvania. • Identify economic resources found in marine areas. 	<ul style="list-style-type: none"> • <i>Analyze the energy transformations that occur during the greenhouse effect and predict the long-term effects of increased pollutant levels in the atmosphere.</i> • <i>Analyze the mechanisms that drive a weather phenomena (e.g. El Nino, hurricane, tornado) using the correlation of three methods of heat energy transfer.</i> <p>D. Describe the principles and history of hydrology.</p> <ul style="list-style-type: none"> • Identify the various commercial and electrical uses of water. • Compare and contrast various systems of water purification and desalination. • <i>Analyze the historical development of water use in Pennsylvania (e.g. recovery of Lake Erie).</i> • <i>Analyze the operation and effectiveness of a water purification and desalination system.</i> • <i>Compare the marine life and type of water found in the intertidal, neritic, and bathyal zones.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.5. Earth Science			
3.5.8. GRADE 8	3.5.9. GRADE 9	3.5.10. GRADE 10	3.5.11. GRADE 11
<ul style="list-style-type: none"> • <i>Assess the natural and man-made factors that affect the availability of clean water (e.g. rock and mineral deposits, man-made pollution).</i> 		<ul style="list-style-type: none"> • <i>Assess the natural and man-made factors that affect the availability of clean water (e.g. rock and mineral deposits, man-made pollution).</i> 	

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.5. Earth Science			
3.5.12. GRADE 12			
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>A. Analyze and evaluate Earth features and processes that change the Earth.</p> <ul style="list-style-type: none"> • Apply knowledge of geophysical processes to explain the formation and degradation of Earth structures (e.g. mineral deposition, cave formations, soil composition). • Interpret geological evidence supporting evolution. • Apply knowledge of radioactive decay to assess the age of various Earth features and objects. <p>B. Analyze the availability, location and extraction of Earth resources.</p> <ul style="list-style-type: none"> • Describe how the location of Earth’s major resources has affected a country’s strategic decisions. • Compare locations of Earth features and country boundaries. • Analyze the impact of Pennsylvania coal deposits and rivers on the life of Pennsylvania’s settlements and cities. 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.5. Earth Science			
3.5.12. GRADE 12			
<p>C. Analyze atmospheric energy transfers.</p> <ul style="list-style-type: none"> • Describe how weather and climate involve the transfer of energy in and out of the atmosphere. • Explain how unequal heating of the air, ocean, and land produces wind and ocean currents. • Analyze the energy transformations that occur during the greenhouse effect and predict the long-term effects of increased pollutant levels in the atmosphere. • Analyze the mechanisms that drive a weather phenomena (e.g. El Nino, hurricane, tornado) using the correlation of three methods of heat energy transfer. <p>D. Analyze the principles and history of hydrology.</p> <ul style="list-style-type: none"> • Analyze the operation and effectiveness of a water purification and desalination system. • <i>Evaluate the pros and cons of surface water appropriation for commercial and electrical use.</i> • Analyze the historical development of water use in Pennsylvania (e.g. recovery of Lake Erie). 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.5. Earth Science			
3.5.12. GRADE 12			
<ul style="list-style-type: none"> • Compare the marine life and type of water found in the intertidal, neritic, and bathyal zones. 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.6. Technology			
3.6.K. GRADE K	3.6.1. GRADE 1	3.6.2. GRADE 2	3.6.3. GRADE 3
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>B. Develop an awareness of different ways to communicate information.</p> <ul style="list-style-type: none"> • Identify conventional methods of communication (e.g. talking, writing, and drawing). • Be aware of commonly used forms of electronic communication (e.g. telephone, e-mail, television). 	<p>A. Identify biotechnologies used to produce food and provide health services.</p> <ul style="list-style-type: none"> • Identify agricultural and industrial production processes that evaluate plants and animals. • Identify common plants used as food. • Recognize that farms raise animals and plants as food sources. <p>(See Biology 3.3.)</p>	<p>A. Identify biotechnologies used to treat and convert waste.</p> <ul style="list-style-type: none"> • Identify waste management methods (e.g. landfills, compost piles, worm bins). • Identify materials that can be recycled. • Identify different recycling processes. 	<p>A. Describe how different biotechnologies contribute to the well being of humans.</p> <ul style="list-style-type: none"> • Identify different uses of drugs and explain their effects on humans. • Recognize a variety of assistive devices used by humans and explain their purposes (e.g. wheelchairs, canes, artificial limbs). <p>B. Identify information technologies that involve encoding, transmitting, receiving, storing, retrieving and decoding.</p> <ul style="list-style-type: none"> • <i>Identify electronic communication methods that exist in the community (e.g., digital cameras, telephone, internet, television, fiber optics).</i> • Compare the effectiveness of a variety of different forms of communication including electronic means. • <i>Demonstrate the ability to communicate an idea by applying basic sketching and drawing techniques.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.6. Technology			
3.6.K. GRADE K	3.6.1. GRADE 1	3.6.2. GRADE 2	3.6.3. GRADE 3
<p>C. Develop an awareness that humans construct and transport products.</p> <ul style="list-style-type: none"> • Be aware of a variety of construction tools. • Recognize a variety of transportation methods. 	<p>C. Develop an awareness of how humans manufacture and transport products.</p> <ul style="list-style-type: none"> • Examine the concept of transportation systems. • Recognize the difference between natural and manufactured items. 		<ul style="list-style-type: none"> • <i>Identify graphic reproduction methods.</i> • <i>Describe appropriate image generating techniques (e.g., photography, video).</i> <p>C. Identify the ways humans manufacture materials and goods.</p> <ul style="list-style-type: none"> • <i>Identify and group a variety of construction tasks.</i> • <i>Identify the major construction systems present in a specific local building.</i> • <i>Identify specific construction systems that depend on each other in order to complete a project.</i> • <i>Know skills used in construction.</i> • <i>Identify examples of manufactured goods present in the home and school.</i> • <i>Identify basic resources needed to produce a manufactured item.</i> • <i>Identify basic component operations in a specific manufacturing enterprise (e.g., cutting, shaping, attaching).</i> • <i>Identify waste and pollution resulting from a manufacturing enterprise.</i> • <i>Explain and demonstrate the concept of manufacturing (e.g.,</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.6. Technology			
3.6.K. GRADE K	3.6.1. GRADE 1	3.6.2. GRADE 2	3.6.3. GRADE 3
			<p style="text-align: center;"><i>assemble a set of papers or ball point pens sequentially, mass produce an object).</i> (See 3.8.)</p>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.6. Technology			
3.6.4. GRADE 4	3.6.5. GRADE 5	3.6.6. GRADE 6	3.6.7. GRADE 7
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>A. Know that biotechnologies relate to propagating, growing, maintaining, adapting, treating and converting.</p> <ul style="list-style-type: none"> • Identify agricultural and industrial production processes that involve plants and animals. • Identify waste management treatment processes. • <i>Describe how knowledge of the human body influences or impacts ergonomic design.</i> • <i>Describe how biotechnology has impacted various aspects of daily life (e.g., health care, agriculture, waste treatment).</i> <p>B. Know that technologies involve encoding, transmitting, receiving, storing, retrieving and decoding.</p> <ul style="list-style-type: none"> • Identify electronic communication methods that exist in the community (e.g., digital cameras, telephone, internet, television, fiber optics). 	<p>A. Explain biotechnologies that relate to propagating, growing, maintaining, adapting, treating, and converting.</p> <ul style="list-style-type: none"> • <i>Identify and explain the impact that a specific medical advancement has had on society.</i> • <i>Explain the factors that were taken into consideration when a specific object was designed.</i> 	<p>A. Explain biotechnologies that relate to related technologies of propagating, growing, maintaining, adapting, treating and converting.</p> <ul style="list-style-type: none"> • <i>Identify the environmental, societal and economic impacts that waste has in the environment.</i> • <i>Define and describe how fuels and energy can be generated through the process of biomass conversion.</i> • <i>Identify and group basic plant and animal production processes.</i> <p>B. Identify and use information technologies used for encoding transmitting, receiving, storing, receiving and decoding information.</p> <ul style="list-style-type: none"> • Produce a graphic object. • <i>Demonstrate the effectiveness of image generating technique to communicate a story (e.g., photography, video).</i> 	<p>A. Explain biotechnologies that relate to related technologies of propagating, growing, maintaining, adapting, treating and converting.</p> <ul style="list-style-type: none"> • Identify the environmental, societal and economic impacts that waste has in the environment. • Identify and explain the impact that a specific medical advancement has had on society. • Explain the factors that were taken into consideration when a specific object was designed. • Define and describe how fuels and energy can be generated through the process of biomass conversion. • Identify and group basic plant and animal production processes. <p>B. Explain information technologies of encoding, transmitting, receiving, storing, retrieving and decoding.</p> <ul style="list-style-type: none"> • Demonstrate the effectiveness of image generating technique to communicate a story (e.g., photography, video).

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.6. Technology			
3.6.4. GRADE 4	3.6.5. GRADE 5	3.6.6. GRADE 6	3.6.7. GRADE 7
<ul style="list-style-type: none"> • Identify graphic reproduction methods. • Describe appropriate image generating techniques (e.g., photography, video). • Demonstrate the ability to communicate an idea by applying basic sketching and drawing techniques. <p>C. Know physical technologies of structural design, analysis and engineering, finance, production, marketing, research and design.</p> <ul style="list-style-type: none"> • Identify and group a variety of construction tasks. • Identify the major construction systems present in a specific local building. • Identify specific construction systems that depend on each other in order to complete a project. • Know skills used in construction. • Identify examples of manufactured goods present in the home and school. 	<p>C. Identify physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and design.</p> <ul style="list-style-type: none"> • <i>Use knowledge of material effectiveness to solve specific construction problems (e.g., steel vs. wood bridges).</i> • <i>Differentiate among the different types of construction applications (e.g., microwave tower, power plants, aircrafts).</i> • <i>Evaluate a construction activity by specifying task analyses and necessary resources.</i> 	<ul style="list-style-type: none"> • <i>Analyze and evaluate the effectiveness of a graphic object designed and produced to communicate a thought or concept.</i> • Identify and use basic technical drawing techniques. • <i>Apply basic technical drawing techniques to communicate an idea or solution to a problem.</i> • <i>Apply the appropriate method of communications technology to communicate a thought.</i> <p>C. Describe physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and design.</p> <ul style="list-style-type: none"> • <i>Explain basic material processes that manufactured objects undergo during production. (e.g., separating, forming, combining).</i> • <i>Explain the relationships among the basic resources needed in the production process for a specific manufactured object.</i> • <i>Analyze manufacturing steps that affect waste and pollutants.</i> 	<ul style="list-style-type: none"> • Analyze and evaluate the effectiveness of a graphic object designed and produced to communicate a thought or concept. • Apply basic technical drawing techniques to communicate an idea or solution to a problem. • Apply the appropriate method of communications technology to communicate a thought. <p>C. Explain physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and design.</p> <ul style="list-style-type: none"> • Use knowledge of material effectiveness to solve specific construction problems (e.g., steel vs wood bridges). • Differentiate among the different types of construction applications (e.g., microwave tower, power plants, aircrafts). • Explain basic material processes that manufactured objects undergo during production. (e.g., separating, forming, combining).

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.6. Technology			
3.6.4. GRADE 4	3.6.5. GRADE 5	3.6.6. GRADE 6	3.6.7. GRADE 7
<ul style="list-style-type: none"> • Identify basic resources needed to produce a manufactured item. • Identify basic component operation in a specific manufacturing enterprise (e.g., cutting, shaping, attaching). • Identify waste and pollution resulting from a manufacturing enterprise. • Explain and demonstrate the concept of manufacturing (e.g., assemble a set of papers or ball point pens sequentially, mass produce an object). • Identify transportation technologies of propelling, structuring, suspending, guiding, controlling and supporting. • Identify and experiment with simple machines used in transportation systems. • Explain how improved transportation systems have changed society. <p>(See Earth Science 3.5.)</p>	<ul style="list-style-type: none"> • <i>Explain the difference between design engineering and production engineering processes</i> • <i>Explain transportation technologies of propelling, structuring, suspending, guiding, controlling and supporting.</i> • <i>Identify and explain the workings of several mechanical power systems.</i> • <i>Model and explain examples of vehicular propulsion, control, guidance, structure and suspension systems.</i> • <i>Explain the limitations of land, marine, air and space transportation systems.</i> 		<ul style="list-style-type: none"> • Evaluate a construction activity by specifying task analyses and necessary resources. • Explain the relationships among the basic resources needed in the production process for a specific manufactured object. • Explain the difference between design engineering and production engineering processes. • Analyze manufacturing steps that affect waste and pollutants. • Explain transportation technologies of propelling, structuring, suspending, guiding, controlling and supporting. • Identify and explain the workings of several mechanical power systems. • Model and explain examples of vehicular propulsion, control, guidance, structure and suspension systems. • Explain the limitations of land, marine, air and space transportation systems.
Refer to Physical Science Standard Category 3.4 for concepts that deal with Technology Standards.			

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3.6. Technology			
3.6.8. GRADE 8	3.6.9. GRADE 9	3.6.10. GRADE 10	3.6.11. GRADE 11
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>A. Apply biotechnologies that relate to propagating, growing, maintaining, adapting, treating and converting.</p> <ul style="list-style-type: none"> • Research areas to improve existing plant and animal production processes. • <i>Apply knowledge of plant and animal production processes in designing an improvement to existing processes.</i> • <i>Analyze and solve a complex production process problem using biotechnologies (e.g., hydroponics, fish farming, crop propagation).</i> • <i>Evaluate and apply biotechnical processes to complex plant and animal production methods.</i> • <i>Apply knowledge of biochemical-related technologies to propose alternatives to hazardous waste treatment.</i> 	<p>A. Apply biotechnologies that relate to propagating, growing, maintaining, adapting, treating and converting.</p> <ul style="list-style-type: none"> • Research biomedical technology applications. • <i>Apply knowledge of biomedical technology applications in designing a solution to a simple medical problem (e.g., wheel chair design, artificial arteries).</i> • <i>Apply knowledge of how biomedical technology affects waste products in designing a solution that will result in reduced waste.</i> • <i>Apply ergonomic engineering factors when devising a solution to a specific problem.</i> • Describe various methods of biochemical conversion. 	<p>A. Apply biotechnologies that relate to propagating, growing, maintaining, adapting, treating and converting.</p> <ul style="list-style-type: none"> • 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. 	<p>A. Analyze biotechnologies that relate to propagating, growing, maintaining, adapting, treating and converting.</p> <ul style="list-style-type: none"> • <i>Analyze specific examples where engineering has impacted society in protection, personal health application or physical enhancement.</i> • <i>Appraise and evaluate the cause and effect and subsequent environmental, economic and societal impacts that result from biomass and biochemical conversion.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.6. Technology			
3.6.8. GRADE 8	3.6.9. GRADE 9	3.6.10. GRADE 10	3.6.11. GRADE 11
<p>B. Investigate information technologies of encoding, transmitting, receiving, storing, retrieving and decoding.</p> <ul style="list-style-type: none"> • <i>Illustrate an understanding of a computer network system by modeling, constructing or assembling its components.</i> • Investigate advanced communication techniques. <p>C. Examine physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and design.</p> <ul style="list-style-type: none"> • <i>Describe and classify common construction by their characteristics and composition.</i> 	<p>B. Examine information technologies of encoding, transmitting, receiving, storing, retrieving, and decoding.</p> <ul style="list-style-type: none"> • <i>Describe the proper use of graphic and electronic communication systems.</i> • <i>Apply and analyze advanced communication techniques to produce an image that effectively conveys a message (e.g., desktop publishing, audio and/or video production).</i> • <i>Apply a variety of advanced mechanical and electronic drafting methods to communicate a solution to a specific problem.</i> <p>C. Illustrate physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and design to real world problems.</p> <ul style="list-style-type: none"> • <i>Evaluate material failure common to specific applications.</i> • <i>Select and apply the necessary resources to successfully conduct a manufacturing enterprise.</i> 	<p>B. Apply knowledge of information technologies of encoding, transmitting, receiving, storing, retrieving and decoding.</p> <ul style="list-style-type: none"> • Describe the proper use of graphic and electronic communication systems. • 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). • Illustrate an understanding of a computer network system by modeling, constructing or assembling its components. <p>C. Apply physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and design to real world problems.</p> <ul style="list-style-type: none"> • Describe and classify common construction by their characteristics and composition. 	<p>B. Analyze knowledge of information technologies of encoding, transmitting, receiving, storing, retrieving and decoding.</p> <ul style="list-style-type: none"> • <i>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).</i> • <i>Describe the operation of fiber optic, microwave and satellite informational systems.</i> • Identify and use various graphic and electronic information techniques to solve basic problems. <p>C. Analyze physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and design to real world problems.</p> <ul style="list-style-type: none"> • <i>Apply knowledge of construction technology by designing, planning and applying all the necessary resources to successfully solve a construction</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.6. Technology			
3.6.8. GRADE 8	3.6.9. GRADE 9	3.6.10. GRADE 10	3.6.11. GRADE 11
<ul style="list-style-type: none"> • <i>Compare and contrast specific construction systems that depend on each other in order to complete a project.</i> • <i>Demonstrate knowledge of various construction systems by building or interpreting models.</i> 	<ul style="list-style-type: none"> • <i>Apply concepts of design engineering and production engineering in the organization and application of a manufacturing activity.</i> • Apply the concepts of manufacturing by redesigning an enterprise to improve productivity or reduce or eliminate waste and/or pollution. 	<ul style="list-style-type: none"> • Compare and contrast specific construction systems that depend on each other in order to complete a project. • Evaluate material failure common to specific applications. • Demonstrate knowledge of various construction systems by building or interpreting models. • Select and apply the necessary resources to successfully conduct a manufacturing enterprise. • Apply concepts of design engineering and production engineering in the organization and application of a manufacturing activity. • Apply the concepts of manufacturing by redesigning an enterprise to improve productivity or reduce or eliminate waste and/or pollution. • Evaluate the interrelationship of various transportation systems in the community. • Analyze the impacts that transportation systems have on a community. 	<p><i>problem.</i></p> <ul style="list-style-type: none"> • <i>Apply advanced information collection and communication techniques to successfully convey solutions to specific construction problems.</i> • <i>Assess the importance of capital on specific construction applications.</i> • <i>Analyze transportation technologies of propelling, structuring, suspending, guiding, controlling and supporting.</i> • <i>Analyze the concepts of vehicular propulsion, guidance, control, suspension and structural systems while designing and producing specific complex transportation systems.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.6. Technology			
3.6.12 GRADE 12			
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>A. Analyze biotechnologies that relate to propagating, growing, maintaining, adapting, treating and converting.</p> <ul style="list-style-type: none"> • 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. • Appraise and evaluate the cause and effect and subsequent environmental, economic and societal impacts that result from biomass and biochemical conversion. • 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. 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.6. Technology			
3.6.12 GRADE 12			
<p>B. Analyze knowledge of information technologies of processes encoding, transmitting, receiving, storing, retrieving and decoding.</p> <ul style="list-style-type: none"> • 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). • <i>Analyze and evaluate a message designed and produced using still, motion and animated communication techniques.</i> • Describe the operation of fiber optic, microwave and satellite informational systems. • <i>Apply various graphic and electronic information techniques to solve real world problems (e.g., data organization and analysis, forecasting, interpolation).</i> 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.6. Technology			
3.6.12 GRADE 12			
<p>C. Analyze physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and design to real world problems.</p> <ul style="list-style-type: none"> • Apply knowledge of construction technology by designing, planning and applying all the necessary resources to successfully solve a construction problem. • Compare resource options in solving a specific manufacturing problem. • Analyze and apply complex skills needed to process materials in complex manufacturing enterprises. • Apply advanced information collection and communication techniques to successfully convey solutions to specific construction problems. • Assess the importance of capital on specific construction applications. • Analyze the positive and negative qualities of several different types of materials as they would relate to specific construction applications. • Analyze transportation 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.6. Technology			
3.6.12 GRADE 12			
<p>technologies of propelling, structuring, suspending, guiding, controlling and supporting.</p> <ul style="list-style-type: none"> • Analyze the concepts of vehicular propulsion, guidance, control, suspension and structural systems while designing and producing specific complex transportation systems. <p>(See 3.4. Physical Science, Chemistry and Physics)</p>			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.7. Technological Devices			
3.7.K. GRADE K	3.7.1. GRADE 1	3.7.2. GRADE 2	3.7.3. GRADE 3
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>A. Develop an awareness of basic tools that help us do work.</p> <ul style="list-style-type: none"> • Identify simple tools and their functions. • Be aware of how to handle tools safely. <p>(See Science, Technology 3.8.)</p>	<p>B. Use instruments to study materials.</p> <ul style="list-style-type: none"> • Demonstrate ability to measure materials (e.g. length, width, weight). • Demonstrate the function of various tools and their functions (e.g. stapler, straw, scissors). <p>C. Demonstrate the basic use of the computer.</p> <ul style="list-style-type: none"> • Use the keyboard, monitor, CPU, and mouse to perform basic computer functions. 	<p>A. Demonstrate the use of basic tools, simple materials, and techniques to safely solve problems.</p> <ul style="list-style-type: none"> • Demonstrate the use of simple machines. • Select appropriate tools and materials to solve simple problems. <p>B. Use instruments to study materials.</p> <ul style="list-style-type: none"> • Choose an instrument for an assigned task (e.g. metric rulers for length). • Demonstrate simple skills of measuring, recording, and cutting. <p>C. Demonstrate the basic use of the computer and printer.</p> <ul style="list-style-type: none"> • Use the keyboard, monitor, CPU, and mouse to perform basic computer functions. • Produce and print a simple document. • Recognize the major parts necessary for a computer to input and output data. 	<p>C. Identify basic computer operations and concepts.</p> <ul style="list-style-type: none"> • <i>Identify the major parts necessary for a computer to input and output data.</i> • <i>Demonstrate the basic use of input and output devices.</i> • <i>Explain and demonstrate the use of external and internal storage devices (e.g., disk drive and CD drive).</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.7. Technological Devices			
3.7.K. GRADE K	3.7.1. GRADE 1	3.7.2. GRADE 2	3.7.3. GRADE 3
<p>D. Use basic computer software.</p> <ul style="list-style-type: none"> • Apply operating skills to perform basic computer tasks using grade-level appropriate software. 	<p>D. Use basic computer software.</p> <ul style="list-style-type: none"> • Apply operating skills to perform basic computer tasks using grade-level appropriate software. 	<p>D. Use basic computer software.</p> <ul style="list-style-type: none"> • Apply operating skills to perform basic computer tasks using grade-level appropriate software. • Produce simple graphics. 	<ul style="list-style-type: none"> • <i>Explain and demonstrate the basic use of input and output devices (e.g., keyboard, monitor, printer, mouse).</i> <p>D. Use basic computer software.</p> <ul style="list-style-type: none"> • <i>Apply operating skills to perform basic computer tasks using grade-level appropriate software.</i> • <i>Apply basic word processing skills.</i> • <i>Produce simple documents containing text and graphics.</i> • <i>Identify and use simple graphic and presentation graphic materials generated by the computer.</i> • <i>Apply specific instructional software.</i> <p>E. Develop knowledge of basic communications systems.</p> <ul style="list-style-type: none"> • <i>Explain basic e-mail functions.</i> • <i>Apply a web browser.</i> • <i>Use on-line searches to answer age appropriate questions.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.7. Technological Devices			
3.7.4. GRADE 4	3.7.5. GRADE 5	3.7.6. GRADE 6	3.7.7. GRADE 7
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>A. Explore the use of basic tools, simple materials and techniques to safely solve problems.</p> <ul style="list-style-type: none"> • <i>Describe the scientific principles on which various tools are based.</i> • <i>Group tools and machines by their function.</i> • <i>Select and safely apply appropriate tools and materials to solve simple problems.</i> <p>B. Select appropriate instruments to study materials.</p> <ul style="list-style-type: none"> • <i>Develop simple skills to measure, record, cut and fasten.</i> • <i>Explain appropriate instrument selection for specific tasks.</i> 		<p>A. <i>Demonstrate the safe and appropriate use of tools to solve problems.</i></p> <ul style="list-style-type: none"> • <i>Describe safe procedures for using tools and materials.</i> • <i>Assess materials for appropriateness of use.</i> <p>B. Demonstrate the proper use of instruments and apparatus to study materials.</p> <ul style="list-style-type: none"> • <i>Select appropriate instruments to measure the size, weight, shape and temperature of living and non-living objects.</i> • <i>Apply knowledge of different measurement systems to measure and record objects’ properties.</i> 	<p>A. Describe the safe and appropriate use of tools, materials and techniques to answer questions and solve problems.</p> <ul style="list-style-type: none"> • Identify uses of tools, machines, materials, information, people, money, energy and time that meet specific design criteria. • Describe safe procedures for using tools and materials. • Assess materials for appropriateness of use. <p>B. Use appropriate instruments and apparatus to study materials.</p> <ul style="list-style-type: none"> • Select appropriate instruments to measure the size, weight, shape and temperature of living and non-living objects. • Apply knowledge of different measurement systems to measure and record objects’ properties.

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.7. Technological Devices			
3.7.4. GRADE 4	3.7.5. GRADE 5	3.7.6. GRADE 6	3.7.7. GRADE 7
<p>C. Identify basic computer operations and concepts.</p> <ul style="list-style-type: none"> • Identify the major parts necessary for a computer to input and output data. • Explain and demonstrate the basic use of input and output devices (e.g., keyboard, monitor, printer, mouse). • Explain and demonstrate the use of external and internal storage devices (e.g., disk drive, CD drive). <p>D. Use basic computer software.</p> <ul style="list-style-type: none"> • Apply operating system skills to perform basic computer tasks. • Apply basic word processing skills. • Identify and use simple graphic and presentation graphic materials generated by the computer. • Apply specific instructional software. 		<p>C. Explain the use of advanced input and output devices.</p> <ul style="list-style-type: none"> • <i>Know specialized computer applications used in the community.</i> • <i>Describe the function of advanced input and output devices (e.g., scanners, video images, plotters, projectors) and demonstrate their use.</i> • <i>Demonstrate age appropriate keyboarding skills and techniques</i> <p>D. Apply computer software to solve specific problems.</p> <ul style="list-style-type: none"> • <i>Identify software designed to meet specific needs (e.g., Computer Aided Drafting, design software, tutorial, financial, presentation software).</i> • <i>Identify and solve basic software problems relevant to specific software applications.</i> • <i>Identify basic multimedia applications.</i> • <i>Demonstrate a basic knowledge of desktop publishing applications.</i> • <i>Apply intermediate skills in utilizing word processing, database and spreadsheet software.</i> 	<p>C. Explain and demonstrate basic computer operations and concepts.</p> <ul style="list-style-type: none"> • Know specialized computer applications used in the community. • Describe the function of advanced input and output devices (e.g., scanners, video images, plotters, projectors) and demonstrate their use. • Demonstrate age appropriate keyboarding skills and techniques. <p>D. Apply computer software to solve specific problems.</p> <ul style="list-style-type: none"> • Identify software designed to meet specific needs (e.g., Computer Aided Drafting, design software, tutorial, financial, presentation software). • Identify and solve basic software problems relevant to specific software applications. • Identify basic multimedia applications. • Demonstrate a basic knowledge of desktop publishing applications. • Apply intermediate skills in utilizing word processing, database and spreadsheet software.

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.7. Technological Devices			
3.7.4. GRADE 4	3.7.5. GRADE 5	3.7.6. GRADE 6	3.7.7. GRADE 7
<p>E. Identify basic computer communications systems.</p> <ul style="list-style-type: none"> • Apply a web browser. • Apply basic electronic mail functions. • Use on-line searches to answer age appropriate questions. 	<p>E. Apply basic computer communications systems.</p> <ul style="list-style-type: none"> • Apply basic e-mail functions. • <i>Apply basic on-line research techniques to solve a specific problem.</i> 	<p>E. Apply basic computer communications systems.</p> <ul style="list-style-type: none"> • Apply intermediate e-mail functions. • Apply intermediate on-line research techniques. 	<ul style="list-style-type: none"> • Apply basic graphic manipulation techniques. <p>E. Explain basic computer communications systems.</p> <ul style="list-style-type: none"> • Describe the organization and functions of the basic parts that make up the World Wide Web. • Apply advanced electronic mail functions. • Apply basic on-line research techniques to solve a specific problem.

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.7. Technological Devices			
3.7.8. GRADE 8	3.7.9. GRADE 9	3.7.10. GRADE 10	3.7.11. GRADE 11
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. .</i>			
	<p>A. Identify and safely use a variety of tools, basic machines, materials, and techniques to solve problems and answer questions.</p> <ul style="list-style-type: none"> • <i>Select and safely apply appropriate tools, materials and processes necessary to solve complex problems.</i> • <i>Apply advanced tool and equipment manipulation techniques to solve problems.</i> <p>B. Demonstrate the use of appropriate instruments to study processes.</p> <ul style="list-style-type: none"> • <i>Describe and use appropriate instruments to gather and analyze data.</i> • <i>Compare and contrast different scientific measurement system for a specific situation.</i> • <i>Explain the need to estimate measurements within error of various instruments.</i> • <i>Apply accurate measurement knowledge to solve everyday problems.</i> 	<p>A. Identify and safely use a variety of tools, basic machines, materials and techniques to solve problems and answer questions.</p> <ul style="list-style-type: none"> • Select and safely apply appropriate tools, materials and processes necessary to solve complex problems. • Apply advanced tool and equipment manipulation techniques to solve problems. <p>B. Apply appropriate instruments and apparatus to examine a variety of objects and processes.</p> <ul style="list-style-type: none"> • Describe and use appropriate instruments to gather and analyze data. • Compare and contrast different scientific measurement system for a specific situation. • Explain the need to estimate measurements within error of various instruments. 	<p>A. Apply advanced tools, materials and techniques to answer complex questions.</p> <ul style="list-style-type: none"> • <i>Demonstrate the safe use of complex tools and machines within their specifications.</i> • <i>Select and safely apply appropriate tools, materials and processes necessary to solve complex problems that could result in more than one solution.</i> • <i>Evaluate and use technological resources to solve complex multi-step problems.</i> <p>B. Evaluate appropriate instruments and apparatus to accurately measure materials and processes.</p> <ul style="list-style-type: none"> • <i>Apply and evaluate the use of appropriate instruments to accurately measure scientific and technological phenomena within the error limits of the equipment.</i> • <i>Evaluate the appropriate use of different measurement scales (macro and micro).</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.7. Technological Devices			
3.7.8. GRADE 8	3.7.9. GRADE 9	3.7.10. GRADE 10	3.7.11. GRADE 11
	<ul style="list-style-type: none"> • <i>Describe and demonstrate the operation and use of advanced instrumentation in evaluating materials and chemical properties (e.g., scanning electron microscope, nuclear magnetic resonance machines).</i> 	<ul style="list-style-type: none"> • Apply accurate measurement knowledge to solve everyday problems. • Describe and demonstrate the operation and use of advanced instrumentation in evaluating materials and chemical properties (e.g., scanning electron microscope, nuclear magnetic resonance machines). 	<ul style="list-style-type: none"> • <i>Evaluate the utility and advantages of a variety of absolute and relative measurement scales for their appropriate application.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.7. Technological Devices			
3.7.8. GRADE 8	3.7.9. GRADE 9	3.7.10. GRADE 10	3.7.11. GRADE 11
	<p>C. Apply basic computer operations and concepts.</p> <ul style="list-style-type: none"> • <i>Identify solutions to basic hardware and software problems.</i> • <i>Apply knowledge of advanced input devices.</i> • <i>Apply knowledge of hardware setup.</i> • <i>Describe the process for basic software installation and demonstrate it.</i> • <i>Analyze and solve basic operating systems problems.</i> • <i>Apply touch keyboarding skills and techniques at acceptable speed and accuracy.</i> • <i>Demonstrate the ability to perform basic software installation.</i> <p>D. Utilize computer software to solve specific problems.</p> <ul style="list-style-type: none"> • <i>Apply intermediate graphic manipulation and desktop publishing techniques.</i> • <i>Apply basic multimedia applications.</i> • <i>Apply intermediate word processing, database, and spreadsheet skills.</i> • <i>Develop an awareness that data can be shared between application</i> 	<p>C. Apply basic computer operations and concepts.</p> <ul style="list-style-type: none"> • 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 acceptable speed and accuracy. • Demonstrate the ability to perform basic software installation. <p>D. Utilize computer software to solve specific problems.</p> <ul style="list-style-type: none"> • Identify legal restrictions in the use of software and the output of data. • Apply advanced graphic manipulation and desktop publishing techniques. • Apply basic multimedia applications. • Apply advanced word processing, database and spreadsheet skills. 	<p>C. Evaluate computer operations and concepts as to their effectiveness to solve specific problems.</p> <ul style="list-style-type: none"> • <i>Describe and demonstrate atypical software installation.</i> • <i>Analyze and solve hardware and advanced software problems.</i> • <i>Assess and apply multiple input and output devices to solve specific problems.</i> <p>D. Evaluate the effectiveness of computer software to solve specific problems.</p> <ul style="list-style-type: none"> • Evaluate the effectiveness of the computer as a presentation tool. • Design and apply intermediate multimedia applications. • Understand the legal responsibilities of computer users.

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.7. Technological Devices			
3.7.8. GRADE 8	3.7.9. GRADE 9	3.7.10. GRADE 10	3.7.11. GRADE 11
<p>E. Apply basic computer communications systems.</p> <ul style="list-style-type: none"> • Identify the parts of a basic network. • Identify the components of a web page. • Recognize file transfer within and outside of a computer network. • Identify, describe and complete intermediate on-line research. 	<p><i>software.</i></p> <ul style="list-style-type: none"> • <i>Describe and demonstrate how two or more software applications can be used to produce an output.</i> • <i>Select and apply software designed to meet specific needs.</i> <p>E. Apply basic computer communications systems.</p> <ul style="list-style-type: none"> • Describe the function and parts of a basic network. • Describe the components of a web page and their functions. • Explain file transfer within and outside of a computer network. • <i>Identify, describe and complete intermediate on-line research.</i> 	<ul style="list-style-type: none"> • Describe and demonstrate how two or more software applications that can be used to produce an output. • Select and apply software designed to meet specific needs. <p>E. Apply basic computer communications systems.</p> <ul style="list-style-type: none"> • <i>Identify and explain various types of on-line services.</i> • <i>Identify and explain the function of the parts of a basic network.</i> • <i>Describe and apply the components of a web page and their function.</i> • <i>Explain and demonstrate file transfer within and outside of a computer network.</i> • Identify, describe and complete advanced on-line research. 	<p>E. Assess the effectiveness of computer communications systems.</p> <ul style="list-style-type: none"> • <i>Assess the effectiveness of a computer based communications system.</i> • <i>Transfer files among different computer platforms.</i> • <i>Analyze the effectiveness of on-line information resources to meet the needs for collaboration, research, publications, communications and productivity.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.7. Technological Devices			
3.7.12. GRADE 12			
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. .</i>			
<p>A. Apply advanced tools, materials and techniques to answer complex questions.</p> <ul style="list-style-type: none"> • Demonstrate the safe use of complex tools and machines within their specifications. • Select and safely apply appropriate tools, materials and processes necessary to solve complex problems that could result in more than one solution. • Evaluate and use technological resources to solve complex multi-step problems. <p>B. Evaluate appropriate instruments and apparatus to accurately measure materials and processes.</p> <ul style="list-style-type: none"> • Apply and evaluate the use of appropriate instruments to accurately measure scientific and technologic phenomena within the error limits of the equipment. • Evaluate the appropriate use of different measurement scales (macro and micro). • Evaluate the utility and advantages of a variety of absolute and relative measurement scales for their appropriate application. 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.7. Technological Devices			
3.7.12. GRADE 12			
<p>C. Evaluate computer operations and concepts as to their effectiveness to solve specific problems.</p> <ul style="list-style-type: none"> • 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. <p>D. Evaluate the effectiveness of computer software to solve specific problems.</p> <ul style="list-style-type: none"> • <i>Evaluate the effectiveness of software to produce an output and demonstrate the process.</i> • <i>Design and apply advanced multimedia techniques.</i> • <i>Analyze, select and apply the appropriate software to solve complex problems.</i> • <i>Evaluate the effectiveness of the computer as a presentation tool.</i> • <i>Analyze the legal responsibilities of computer users.</i> 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.7. Technological Devices			
3.7.12. GRADE 12			
<p>E. Assess the effectiveness of computer communications systems.</p> <ul style="list-style-type: none"> • Assess the effectiveness of a computer based communications system. • Transfer files among different computer platforms. • Analyze the effectiveness of on-line information resources to meet the needs for collaboration, research, publications, communications and productivity. • <i>Apply knowledge of protocol standards to solve connectivity problems.</i> 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.8. Science, Technology and Human Endeavors			
3.8.K. GRADE K	3.8.1. GRADE 1	3.8.2. GRADE 2	3.8.3. GRADE 3
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to...</i>			
<p>A. Develop an awareness of the use of technology.</p> <ul style="list-style-type: none"> • Develop an awareness of basic tools (i.e., hammer, shovel, computer, telephone). • Develop an awareness of different types of transportation. <p>B. Know the basic human needs (food, clothes, shelter, air, water).</p>	<p>A. Identify how science and technology affect people.</p> <ul style="list-style-type: none"> • Explore the use of problem solving in science. 	<p>A. Recognize that people select, create, and use science and technology.</p> <ul style="list-style-type: none"> • Develop an awareness of how technology affects people and their world. • Develop an awareness of health and sanitation services community. <p>B. Identify the basic human needs.</p> <ul style="list-style-type: none"> • Develop an awareness of a simple invention used daily (i.e., velcro, post-its). 	<p>A. Recognize that people select, create and use science and technology.</p> <ul style="list-style-type: none"> • Compare past and present inventions. • Develop an awareness of interrelationships among people and technology. • Discuss recent advances in communication technology. • <i>Identify how physical technology (e.g., construction, manufacturing, transportation), informational technology and biotechnology are used to meet human needs and improve the quality of life.</i> • <i>Describe how scientific discoveries and technological advancements are related.</i> <p>B. Describe how technological resources serve specific human needs and improve the quality of life.</p> <ul style="list-style-type: none"> • <i>Describe a technological invention and the resources that were used to develop it.</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.8. Science, Technology and Human Endeavors			
3.8.K. GRADE K	3.8.1. GRADE 1	3.8.2. GRADE 2	3.8.3. GRADE 3
<p>C. Define a problem.</p> <ul style="list-style-type: none"> • Identify classroom problems. 	<p>C. Identify the term “solution” as an answer to a problem.</p> <ul style="list-style-type: none"> • Discuss solutions to everyday problems in the classroom. 	<p>C. Explore ways to find a solution to a problem.</p> <ul style="list-style-type: none"> • Discuss solutions to community problems. 	<p>C. Identify scientific and technological problems in society.</p> <ul style="list-style-type: none"> • Identify results of technological changes in your community.

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3.8. Science, Technology and Human Endeavors			
3.8.4. GRADE 4	3.8.5. GRADE 5	3.8.6. GRADE 6	3.8.7. GRADE 7
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>A. Know that people select, create and use science and technology and is limited by social and physical restraints.</p> <ul style="list-style-type: none"> • <i>Identify and describe positive and negative impacts that influence or result from new tools and techniques.</i> • Identify how physical technology (e.g., construction, manufacturing, transportation), informational technology and biotechnology are used to meet human needs. • Describe how scientific discoveries and technological advancements are related. • <i>Identify interrelationships among technology, people and their world.</i> • <i>Apply the technological design process to solve a simple problem.</i> <p>B. Know how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.</p> <ul style="list-style-type: none"> • Identify and distinguish between human needs and improving the quality of life. 	<p>A. Describe how people select, create, and use science and technology.</p> <ul style="list-style-type: none"> • Create an invention and explain its usefulness. • <i>Identify changes in society as a result of a technological development.</i> • Describe how scientific discoveries and technological advancements are related. 	<p>A. Identify alternative solutions to problems.</p> <ul style="list-style-type: none"> • <i>Identify and describe the unavoidable constraints of technological design.</i> • <i>Identify and explain improvements in transportation, health, sanitation and communications as a result of advancements in science and technology and how they affect our lives.</i> <p>B. Illustrate how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.</p> <ul style="list-style-type: none"> • <i>Describe the workings of a system.</i> 	<p>A. Explain how sciences and technologies are limited in their effects and influences on society.</p> <ul style="list-style-type: none"> • Identify and describe the unavoidable constraints of technological design. • Identify changes in society as a result of a technological development. • Identify and explain improvements in transportation, health, sanitation and communications as a result of advancements in science and technology and how they affect our lives. <p>B. Explain how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.</p> <ul style="list-style-type: none"> • Identify interrelationships between systems and resources.

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.8. Science, Technology and Human Endeavors			
3.8.4. GRADE 4	3.8.5. GRADE 5	3.8.6. GRADE 6	3.8.7. GRADE 7
<ul style="list-style-type: none"> • Identify and distinguish between natural and human-made resources. • Describe a technological invention and the resources that were used to develop it. <p>C. Know the pros and cons of possible solutions to scientific and technological problems in society.</p> <ul style="list-style-type: none"> • <i>Compare the positive and negative expected and unexpected impacts of technological change.</i> • <i>Identify and discuss examples of technological change in the community that have both positive and negative impacts.</i> 	<p>C. Know the pros and cons of possible solutions to scientific and technological problems in society.</p> <ul style="list-style-type: none"> • <i>Compare and contrast the impacts of technological change (positive and negative).</i> 	<ul style="list-style-type: none"> • <i>List resources available to a system.</i> • <i>Identify problems in a community and their effects on the quality of life.</i> <p>C. Examine the solutions to scientific and technological problems in society.</p> <ul style="list-style-type: none"> • <i>Describe ways technology extends and enhances human abilities.</i> 	<ul style="list-style-type: none"> • Identify and describe the resources necessary to solve a selected problem in a community and improve the quality of life. <p>C. Identify the pros and cons of applying technological and scientific solutions to address problems and the effect upon society.</p> <ul style="list-style-type: none"> • Describe the positive and negative expected and unexpected effects of specific technological developments. • Describe ways technology extends and enhances human abilities.

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3.8. Science, Technology and Human Endeavors			
3.8.8. GRADE 8	3.8.9. GRADE 9	3.8.10. GRADE 10	3.8.11. GRADE 11
<i>Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to . . .</i>			
<p>A. Identify the development of technological enterprises as society changes.</p> <ul style="list-style-type: none"> • Explain the results of constraints on technological design. • Explore different cultures and their technologies. 	<p>A. Explain how societal demands affect scientific and technological enterprises.</p> <ul style="list-style-type: none"> • <i>Explain the effects of increased production on society and the environment.</i> • <i>Describe and evaluate societal change as a result of technological developments.</i> • <i>Explain how society has influenced international environmental problems.</i> • <i>Examine solutions used to rectify international environmental problems (e.g., global warming, erosion).</i> • <i>Assess the social impacts of a specific international environmental problem by designing a solution that applies the appropriate technologies and resources.</i> 	<p>A. Analyze the relationship between societal demands and scientific and technological enterprises.</p> <ul style="list-style-type: none"> • Identify past and current tradeoffs between increased production, environmental harm and social values (e.g., increased energy needs, power plants, automobiles). • Compare technologies that are applied and accepted differently in various cultures (e.g., factory farming, nuclear power). • Describe and evaluate social change as a result of technological developments. • Assess the social impacts of a specific international environmental problem by designing a solution that applies the appropriate technologies and resources. 	<p>A. Analyze the interactions and constraints of science and technology in society.</p> <ul style="list-style-type: none"> • <i>Classify scientific and technological knowledge (e.g., robotics, nuclear energy, and nuclear weapons).</i> • Evaluate technological developments that have changed the way humans do work and discuss their impacts (e.g., genetically engineered crops). • Evaluate socially proposed limitations of scientific research and technological application.

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.8. Science, Technology and Human Endeavors			
3.8.8. GRADE 8	3.8.9. GRADE 9	3.8.10. GRADE 10	3.8.11. GRADE 11
<p>B. Examine how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.</p> <ul style="list-style-type: none"> • Explain problem-solving procedures and methods for evaluating these procedures. <p>C. Explain the consequences and impacts of scientific and technological solutions.</p> <ul style="list-style-type: none"> • <i>Relate scientific and technological advancements in terms of cause and effect.</i> 	<p>B. Compare how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.</p> <ul style="list-style-type: none"> • <i>Identify several problems and opportunities that exist in your community, apply various problem-solving methods to design and evaluate possible solutions.</i> • <i>Examine the impact of 20th century interventions on our society.</i> • <i>Identify variables necessary for the construction of homes and business in different US locations.</i> <p>C. Predict the consequences and impacts of scientific and technological solutions.</p> <ul style="list-style-type: none"> • <i>Compare and contrast potential solutions to technological, social, economic and environmental problems.</i> 	<p>B. Analyze how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.</p> <ul style="list-style-type: none"> • Identify several problems and opportunities that exist in your community, apply various problem-solving methods to design and evaluate possible solutions. • Analyze a recently invented item, describing the human need that prompted its invention and the current and potential social impacts of the specific invention. • 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. <p>C. Evaluate possibilities, consequences and impacts of scientific and technological solutions.</p> <ul style="list-style-type: none"> • Relate scientific and technological advancements in terms of cause and effect. 	<p>B. Create a use of a technological resource to solve specific societal needs and improve the quality of life.</p> <ul style="list-style-type: none"> • <i>Apply appropriate tools that extend and enhance human abilities.</i> • <i>Use knowledge of human abilities to design or modify technologies that extend and enhance human abilities.</i> • <i>Apply appropriate tools, materials and processes.</i> • <i>Use knowledge of human abilities to design or modify technologies that extend and enhance human abilities.</i> • <i>Apply appropriate tools, materials and processes to physical, informational or biotechnological systems to identify and recommend solutions to international problems.</i> <p>C. Evaluate the consequences and impacts of scientific and technological solutions.</p> <ul style="list-style-type: none"> • <i>Review solutions to specific scientific and technological applications.</i>

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3.8. Science, Technology and Human Endeavors			
3.8.8. GRADE 8	3.8.9. GRADE 9	3.8.10. GRADE 10	3.8.11. GRADE 11
<ul style="list-style-type: none"> • Analyze technological enhancements on human abilities. 		<ul style="list-style-type: none"> • Describe and evaluate the impacts that financial considerations have had on specific scientific and technological applications. • Compare and contrast potential solutions to technological, social, economic and environmental problems. • Analyze the impacts on society of accepting or rejecting scientific and technological advances. 	<ul style="list-style-type: none"> • <i>Explain risk-benefit analysis.</i> • <i>Analyze the impacts on society of accepting or rejecting scientific and technological advances.</i> • <i>Analyze and communicate the positive or negative impacts that a recent technological invention had on society.</i> • <i>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).</i>

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.8. Science, Technology and Human Endeavors			
3.8.12. GRADE 12			
<i>. Pennsylvania’s public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to. . .</i>			
<p>A. Synthesize and evaluate the interactions and constraints of science and technology on society.</p> <ul style="list-style-type: none"> • Compare and contrast how scientific and technological knowledge is both shared and protected. • Evaluate technological developments that have changed the way humans do work and discuss their impacts (e.g., genetically engineered crops). • Evaluate socially proposed limitations of scientific research and technological application. <p>B. Apply the use of ingenuity and technological resources to solve specific societal needs and improve the quality of life.</p> <ul style="list-style-type: none"> • Apply appropriate tools, materials and processes to solve complex problems. • Use knowledge of human abilities to design or modify technologies that extend and enhance human abilities. 			

Berks County Intermediate Unit K-12 Benchmarks for *Science and Technology*

3.8. Science, Technology and Human Endeavors			
3.8.12. GRADE 12			
<ul style="list-style-type: none"> • Apply appropriate tools, materials and processes to physical, informational or biotechnological systems to identify and recommend solutions to international problems. <p>C. Evaluate the consequences and impacts of scientific and technological solutions.</p> <ul style="list-style-type: none"> • Propose solutions to specific scientific and technological applications, identifying possible financial considerations. • Analyze scientific and technological solutions through the use of risk/benefit analysis. • Analyze and communicate the positive or negative impacts that a recent technological invention had on society. • 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). 			