

Appendix A
Pennsylvania Academic Standards for Science and Technology
Grade 7

3.1.7

- A. Explain the parts of a simple system and their relationship to each other.
 - 1. Describe a system as a group of related parts that work together to achieve a desired result (e.g., digestive system).
 - 2. Explain the importance of order in a system.
 - 3. Distinguish between system inputs, system processes, and system outputs.
 - 4. Distinguish between open loop and closed loop systems.
 - 5. Apply systems analysis to solve problems.

- B. Describe the use of models as an application of scientific or technological concepts.
 - 1. Identify and describe different types of models and their functions.
 - 2. Apply models to predict specific results and observations (e.g., population growth, effects of infectious organisms).
 - 3. Explain systems by outlining a system's relevant parts and its purpose and/or designing a model that illustrates its function.

- C. Identify patterns as repeated processes or recurring elements in science and technology.
 - 1. Identify different forms of patterns and use them to group and classify specific objects.
 - 2. Identify repeating structure patterns.
 - 3. Identify and describe patterns that occur in physical systems (e.g., construction, manufacturing, transportation), informational systems, and biochemically related systems.
 - 4. Explain scale as a way of relating concepts and ideas to one another by some measure.
 - 6. Apply various applications of size and dimensions of scale to scientific, mathematical, and technological applications.
 - 7. Describe scale as a form of ratio and apply to a life situation.
 - 8. Identify change as a variable in describing natural and physical systems.
 - 9. Describe fundamental science and technology concepts that could solve practical problems.
 - 10. Explain how ratio is used to describe change.
 - 11. Describe the effect of making a change in one part of a system on the system as a whole.

3.2.7

- A. Explain and apply scientific and technological knowledge.
 - 1. Distinguish between a scientific theory and a belief.
 - 2. Answer "What if" questions based on observation, inference or prior knowledge or experience.

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3. Explain how skepticism about an accepted scientific explanation has led to a new understanding.
 4. Explain how new information may change existing theories and practice.
- B. Apply process knowledge to make and interpret observations.
1. Measure materials using a variety of scales.
 2. Describe relationships by making inferences and predictions.
 3. Communicate, use space/time relationships, define operationally, raise questions, formulate hypotheses, test, and experiment,
 4. Design controlled experiments, recognize variables, and manipulate variables.
 5. Interpret data, formulate models, design models, and produce solutions.
- C. Identify and use the elements of scientific inquiry to solve problems.
1. Generate questions about objects, organisms and/or events that can be answered through scientific investigations.
 2. Evaluate the appropriateness of questions.
 3. Design an investigation with limited variables to investigate a question.
 4. Conduct a two-part experiment.
 5. Judge the significance of experimental information in answering the question.
 6. Communicate appropriate conclusions from an experiment.
 7. Know and use the technological design process to solve problems.
 8. Define different types of problems.
 9. Define all aspects of the problem, necessary information, and questions that must be answered.
 10. Propose the best solution.
 11. Design and propose alternative methods to achieve solutions.
 12. Apply a solution.
 13. Explain the results, present improvements, identify and infer the impacts of the solution.

3.3.7

- A. Describe the similarities and differences that characterize diverse living things.
1. Describe how the structures of living things help them function in unique ways.
 2. Explain how to use a dichotomous key to identify plants and animals.
 3. Account for adaptations among organisms that live in a particular environment.
 4. Describe the cell as the basic structural and functional unit of living things.
 5. Identify the levels of organization from cell to organism.
 6. Compare life processes at the organism level with life processes at the cell level.
 7. Explain that cells and organisms have particular structures that underlie their functions.
 8. Describe and distinguish among cell cycles, reproductive cycles, and life cycles.

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9. Explain disease effects on structures or functions of an organism.
- C. Know that every organism has a set of genetic instructions that determines its inherited traits.
1. Identify and explain inheritable characteristics.
 2. Identify that the gene is the basic unit of inheritance.
 3. Identify basic patterns of inheritance (e.g., dominance, recessive, co-dominance).
 4. Describe how traits are inherited.
 5. Distinguish how different living things reproduce (e.g., vegetative budding, sexual).
 6. Recognize that mutations can alter a gene.
 7. Describe how selective breeding, natural selection, and genetic technologies can change the genetic makeup of organisms.
- D. Explain basic concepts of natural selection.
1. Identify adaptations that allow organisms to survive in their environment.
 2. Describe how an environmental change can affect the survival of organisms and entire species.
 3. Know that differences in individuals of the same species may give some advantage in surviving and reproducing.
 4. Recognize that populations of organisms can increase rapidly.
 5. Describe the role that fossils play in studying the past.
 6. Explain how biologic extinction is a natural process.

3.4.7

- A. Describe concepts about the structure and properties of matter.
1. Identify elements as basic building blocks of matter that cannot be broken down chemically.
 2. Distinguish compounds from mixtures.
 3. Describe and conduct experiments that identify chemical and physical properties.
 4. Describe reactants and products of simple chemical reactions.
- B. Relate energy sources and transfers to heat and temperature.
1. Identify and describe sound changes in moving objects.
 2. Know that the sun is a major source of energy that emits wavelengths of visible light, infrared, and ultraviolet radiation.
 3. Explain the conversion of one form of energy to another by applying knowledge of each form of energy.
 4. Explain the parts and functions in an electrical circuit.
- C. Identify and explain the principles of force and motion.
1. Describe the motion of an object based on its position, direction, and speed.
 2. Classify fluid power systems according to fluid used or mode of power transmission (e.g., air, oil).

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3. Explain various motions using models.
 4. Explain how convex and concave mirrors and lens change light images.
 5. Explain how sound and light travel in waves of differing speeds, sizes and frequencies.
- D. Describe essential ideas about the composition and structure of the universe and the earth's place in it.
1. Compare various planets' characteristics.
 2. Describe basic star types and identify the sun as a star type.
 3. Describe and differentiate comets, asteroids and meteors.
 4. 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.
 5. Illustrate how the positions of stars and constellations change in relation to the Earth during an evening and from month to month.
 6. Identify equipment and instruments that explore the universe.
 7. Identify the accomplishments and contributions provided by selected past and present scientists in the field of astronomy.
 8. Identify and articulate space program efforts to investigate possibilities of living in space and on other planets.

3.5.7

- A. Describe earth features and processes.
1. Describe major layers of the earth.
 2. 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, and crustal plate movement) are similar to those in the past.
 3. Describe the processes that formed Pennsylvania geologic structures and resources including mountains, glacial formations, water gaps, and ridges.
 4. Explain how the rock cycle affected rock formations in the state of Pennsylvania.
 5. Distinguish between examples of rapid surface changes (e.g., landslides, earthquakes) and slow surface changes (e.g., weathering).
 6. Identify living plants and animals that are similar to fossil forms.
- B. Recognize earth resources and how they affect everyday life.
1. Identify and locate significant earth resources (e.g., rock types, oil, gas, coal deposits) in Pennsylvania.
 2. Explain the processes involved in the formation of oil and coal in Pennsylvania.
 3. Explain the value and uses of different earth resources (e.g., selected minerals, ores, fuel sources, and agricultural uses).
 4. Compare the locations of human settlements as related to available resources.
- C. Describe basic elements of meteorology.

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1. Explain weather forecasts by interpreting weather data and symbols.
2. Explain the oceans' impact on local weather and the climate of a region.
3. Identify how cloud types, wind directions, and barometric pressure changes are associated with weather patterns in different regions of the country.
4. Explain and illustrate the processes of cloud formation and precipitation.
5. Describe and illustrate the major layers of the earth's atmosphere.
6. Identify different air masses and global wind patterns and how they relate to the weather patterns in different regions of the U.S.

- D. Explain the behavior and impact of the earth's water systems.
1. Explain the water cycle using the processes of evaporation and condensation.
 2. Describe factors that affect evaporation and condensation.
 3. Distinguish salt from fresh water (e.g., density, electrical conduction).
 4. Compare the effect of water type (e.g., polluted, fresh, salt water) and the life contained in them.
 5. Identify ocean and shoreline features, (e.g., bays, inlets, spit, tidal marshes).

3.6.7

- A. Explain biotechnologies that relate to related technologies of propagating, growing, maintaining, adapting, treating, and converting.
1. Identify the environmental, societal, and economic impacts that waste has in the environment.
 2. Identify and explain the impact that a specific medical advancement has had on society.
 3. Explain the factors that were taken into consideration when a specific object was designed.
 4. Define and describe how fuels and energy can be generated through the process of biomass conversion.
 5. Identify and group basic plant and animal production processes.
 6. Explain the impact that agricultural science has had on biotechnology.
- B. Explain information technologies of encoding, transmitting, receiving, storing, retrieving, and decoding.
1. Demonstrate the effectiveness of an image generating technique to communicate a story (e.g., photography, video).
 2. Analyze and evaluate the effectiveness of a graphic object designed and produced to communicate a thought or concept.
 3. Apply basic technical drawing techniques to communicate an idea or solution to a problem.
 4. Apply the appropriate method of communications technology to communicate a thought.
- C. Explain physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research, and design.

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1. Use knowledge of material effectiveness to solve specific construction problems (e.g., steel vs. wood bridges).
2. Differentiate among the different types of construction applications (e.g., microwave tower, power plants, and aircrafts).
3. Explain basic material processes that manufactured objects undergo during production. (e.g., separating, forming, and combining).
4. Evaluate a construction activity by specifying task analyses and necessary resources.
5. Explain the relationships among the basic resources needed in the production process for a specific manufactured object.
6. Explain the difference between design engineering and production engineering processes.
7. Analyze manufacturing steps that affect waste and pollutants.
8. Explain transportation technologies of propelling, structuring, suspending, guiding, controlling, and supporting.
9. Identify and explain the workings of several mechanical power systems.
10. Model and explain examples of vehicular propulsion, control, guidance, structure, and suspension systems.
11. Explain the limitations of land, marine, air, and space transportation systems.

3.7.7

- A. Describe the safe and appropriate use of tools, materials, and techniques to answer questions and solve problems.
 1. Identify uses of tools, machines, materials, information, people, money, energy, and time that meet specific design criteria.
 2. Describe safe procedures for using tools and materials.
 3. Assess materials for appropriateness of use.
- B. Use appropriate instruments and apparatus to study materials.
 1. Select appropriate instruments to measure the size, weight, shape, and temperature of living and non-living objects.
 2. Apply knowledge of different measurement systems to measure and record objects' properties.
- C. Explain and demonstrate basic computer operations and concepts.
 1. Know specialized computer applications used in the community.
 2. Describe the function of advanced input and output devices (e.g., scanners, video images, plotters, projectors) and demonstrate their use.
 3. Demonstrate age appropriate keyboarding skills and techniques.
- D. Apply computer software to solve specific problems.
 1. Identify software designed to meet specific needs (e.g., Computer Aided Drafting, design software, tutorial, financial, presentation software).
 2. Identify and solve basic software problems relevant to specific software applications.
 3. Identify basic multimedia applications.

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4. Demonstrate a basic knowledge of desktop publishing applications.
5. Apply intermediate skills in utilizing word processing, database, and spreadsheet software.
6. Apply basic graphic manipulation techniques.

D. Explain basic computer communications systems.

1. Describe the organization and functions of the basic parts that make up the World Wide Web.
2. Apply advanced electronic mail functions.
3. Apply basic on-line research techniques to solve a specific problem.

3.8.7

- A. Explain how sciences and technologies are limited in their effects and influences on society.
 1. Identify and describe the unavoidable constraints of technological design.
 2. Identify changes in society as a result of a technological development.
 3. Identify and explain improvements in transportation, health, sanitation, and communications as a result of advancements in science and technology and how they effect our lives.
- B. Explain how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.
 1. Identify interrelationships between systems and resources.
 2. Identify and describe the resources necessary to solve a selected problem in a community and improve the quality of life.
 3. identify and explain specific examples of how agricultural science has met human needs and has improved the quality of life.
- C. Identify the pros and cons of applying technological and scientific solutions to address problems and the effect upon society.
 1. Describe the positive and negative expected and unexpected effects of specific technological developments.
 2. Describe ways technology extends and enhances human abilities.