

ELEMENTARY STANDARDS
(GRADES Pre-K - 3)
Science and Technology and Engineering Education

Physical Sciences: Chemistry and Physics 3.2.

A. Chemistry

- 1. Properties of Matter*
- 2. Structure of Matter*
- 3. Matter & Energy*
- 4. Reactions*
- 5. Unifying Themes*
- 6. Science as Inquiry*

B. Physics

- 1. Force & Motion of Particles and Rigid Bodies*
- 2. Energy Storage and Transformations: Conservation Laws*
- 3. Heat / Heat Transfer*
- 4. Electrical and Magnetic Energy*
- 5. Nature of Waves (Sound and Light Energy)*
- 6. Unifying Themes*
- 7. Science as Inquiry*

Earth and Space Sciences 3.3.

A. Earth Structures, Processes and Cycles

- 1. Earth Features and the Processes that Change It*
- 2. Earth's Resources / Materials*
- 3. Earth's History*
- 4. Sciences and Transfer of Energy*
- 5. Water*
- 6. Weather and Climate*
- 7. Unifying Themes*
- 8. Science as Inquiry*

B. Origin and Evolution of the Universe

- 1. Composition and Structure*
- 2. Unifying Themes*
- 3. Science as Inquiry*

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3.4.

Technology and Engineering Education

A. Scope of Technology

1. *Characteristics of Technology*
2. *Core Concepts of Technology*
3. *Technology Connections*

B. Technology and Society

1. *Effects of Technology*
2. *Technology and Environment*
3. *Society and Development of Technology*
4. *Technology and History*

C. Technology and Engineering Design

1. *Design Attributes*
2. *Engineering Design*
3. *Research & Development, Invention & Innovation, Experimentation/problem Solving and Troubleshooting*

D. Abilities for a Technological World

1. *Applying the Design Process*
2. *Using and Maintaining Technological Systems*
3. *Assessing Impact of Products and Systems*

E. The Designed World

1. *Medical Technologies*
2. *Agricultural and Related Biotechnologies*
3. *Energy and Power Technologies*
4. *Information and Communication Technologies*
5. *Transportation Technologies*
6. *Manufacturing Technologies*
7. *Construction Technologies*

Glossary

IX.

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VIII. INTRODUCTION

Learning about science and technology is vitally important in today's increasingly complicated world. The rate of new discoveries and the development of increasingly sophisticated tools make science and technology rapidly changing subjects. As stated in Content Standard E of the National Science Education Standards, "the relationship between science and technology is so close that any presentation of science without developing an understanding of technology would portray an inaccurate picture of science."

In the near future, society will benefit from basic research discoveries that will lead to new tools, materials, and medical treatments. Learning about the world around us, by observing and experimenting, is the core of science and technology and is strongly reflected in Pennsylvania's Academic Standards for Science and Technology.

This document describes what students should know and be able to do in the following four standard categories:

- ◇ 3.1. Biological Sciences
- ◇ 3.2. Physical Sciences: Chemistry and Physics
- ◇ 3.3. Earth and Space Sciences
- ◇ 3.4. Technology and Engineering Education

These standards describe what students should know and be able to do at each grade level. In addition, these standards reflect the increasing complexity and sophistication that students are expected to achieve as they progress through school. Additionally, Science as Inquiry is logically embedded in the Science and Technology standards as inquiry is the process through which students develop a key understanding of sciences. Unifying Themes in the sciences capture the big ideas of science. Teachers shall expect that students know and apply the concepts and skills expressed at the preceding level. Consequently, previous learning is reinforced but not re-taught.

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Engineering	The profession of or work performed by an engineer. Engineering involves the knowledge of the mathematical and natural sciences (biological and physical) gained by study, experience, and practice that are applied with judgment and creativity to develop ways to utilize the materials and forces of nature for the benefit of mankind.
Engineering Design Process:	The seven step process or method used by engineers to solve a problem. (See 3.4.4.C2.)
Enzymes:	Protein that catalyzes chemical reactions in cells.
Equilibrium:	A condition in which all acting influences are cancelled by others, resulting in a stable, balanced or unchanging system.
Evolution:	The change in genetic composition of a population over successive generations leading to the formation of a new species.
Exothermic:	A process or reaction that releases energy usually in the form of heat, but it can also release energy in form of light (e.g. explosions), sound or electricity (e.g., a battery).
Extinction:	The cessation of existence of a species.
Families:	A taxonomic rank; a way of classifying organisms into groups based on similarities.
Food Chain:	A relationship of who eats whom.
Food Web:	A complex relationship where most organisms are eaten by more than one type of consumer.
Forensics:	The use of DNA for identification. Some examples of DNA use are to establish paternity in child support cases; establish the presence of a suspect at a crime scene, and identify accident victims.
Frequency:	The number of repeated wave cycles per second.
Galaxy:	A massive, gravitationally bound system consisting of stars, an interstellar medium of gas and dust and dark matter.
Gamete:	A sex cell containing one set of chromosomes, sperm or egg.

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Gene Expression:	The process by which inheritable information from a gene, such as the DNA sequence, is made into a functional gene product, such as protein or RNA.
Gene Recombination:	The process by which a strand of genetic material (usually DNA but can also be RNA) is broken and then joined to a different DNA molecule.
Genetic Engineering:	The technology entailing all processes of altering the genetic material of a cell to make it capable of performing the desired functions, such as mass-producing substances like insulin.
Genetic(s):	The study of inheritance.
Genotypic:	Referring to the actual genetic composition of an organism.
Geochemical Cycles:	The Earth is a containing essentially a fixed amount of each stable chemical atom or element. Each element can exist in several different chemical reservoirs in the solid earth, oceans, atmosphere and organisms.
Geologic Time:	A chronologic schema to describe the timing and relationships between events that have occurred during the history of Earth.
Geology:	The science and study of the solid matter that constitutes the Earth.
Gradualism:	Evolution model stating that mutations and phenotypic changes leading to the formation of new species are gradual and explain the fossil record gaps as simply missing because fossils are hard to find.
Gravity:	The fundamental force of attraction that all objects with mass have for each other.
Hydrogen Bonds:	A special type of dipole-dipole force that exists between an electronegative atom and a hydrogen atom bonded to Nitrogen, Oxygen or Fluorine.
Hydrologic Cycle:	Describes the continuous movement of water on, above and below the surface of the Earth.
Hydrosphere:	The water on or surrounding the surface of the globe, including the water of the oceans and the water in the atmosphere.
Igneous:	Rock produced under conditions involving intense heat, as rocks of volcanic origin or rocks crystallized from molten magma.

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Inertia:	The resistance an object has to a change in its state of motion.
Innovation:	The introduction of something new or a new idea, method or device. An innovation can be clearly complex or seemingly simple. Innovation is the process of modifying an existing product, process, or system, or system to improve it.
Intermodalism:	The use of more than one form of transportation.
Invention:	Invention is the process of turning ideas and imagination into new products, processes, or systems.
Kinetic Molecular Theory:	Explains the forces between molecules and the energy that they possess; explains macroscopic properties of gases, such as pressure, temperature or volume, by considering their molecular composition and motion.
Law of Superposition:	A general law stating that in any sequence of sediments or rocks that has not been overturned, the youngest sediments or rocks are at the top of the sequence and the oldest are at the bottom.
Life Cycles:	The lifetime of an organism from birth to death.
Lithosphere:	The outer part of the Earth, consisting of the crust and upper mantle.
Lymphocytes:	White blood cells.
Magnets:	A material that attracts or repels the same material and attracts iron and steel.
Mass:	How much matter there is in an object.
Meiosis	A type of cell division consisting or two rounds of nuclear and cellular division.
Mendelian Patterns of Inheritance:	Predicting the inheritance of offspring traits.
Metamorphic:	Rock that was once one form of rock but has changed to another under the influence of heat, pressure or some other agent without passing through a liquid phase.
Meteorology:	The interdisciplinary scientific study of the atmosphere that focuses on weather processes and forecasting.

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Strains:	Groups sharing common ancestry with clear-cut physiological distinctions but usually not structural distinctions.
Subsystem:	A set of elements, which is a system itself, and a part of a larger system.
System:	A set of interacting or interdependent entities, real or abstract, forming an integrated whole. An open system usually interacts with some entities in their environment. A closed system is isolated from its environment.
Technology:	Technology is how people modify the natural world to suit their own purposes... generally it refers to the diverse collection of processes and knowledge that people use to extend human abilities and to satisfy human needs and wants.
Technology Transfer:	Technology transfer is the process of sharing of skills, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities among governments and other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services
Telemedicine:	The use of telecommunications and information technologies for the provision of health care at a distance.
Theory of Evolution:	Theory that explains the process of change in the inherited traits of a population of organisms from one generation to the next. There are two major mechanisms driving evolution: natural selection and genetic drift.
Topography:	The three-dimensional arrangement of physical attributes (such as shape, height, and depth) of a land surface in a place or region; physical features that make up the topography of an area include mountains, valleys, plains, and bodies of water; human-made features such as roads, railroads and landfills are also often considered part of a region's topography.
Torque:	A force applied at right angles to an object's center of rotation that cause rotation.
Unicellular:	An organism made up of a single cell.
Velocity:	The speed and direction of an object or wave.
Voltage:	The difference of electrical potential between two points that cause current to flow.

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VSEPR:

A model which is used for predicting the shapes of individual molecules based upon their extent of electron-pair electrostatic repulsion.

Wavelength:

The physical length of one cycle or period of a wave.