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	Understandings about scientific inquiry	Different kinds of questions suggest different kinds of scientific investigations.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Current scientific knowledge and understanding guide scientific investigations. Different scientific domains employ different methods, core theories, and standards to advance scientific knowledge and understanding.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Mathematics is important in all aspects of scientific inquiry.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Scientific explanations emphasize evidence, have logically consistent arguments, and use scientific principles, models, and theories. The scientific community accepts and uses such explanations until displaced by better scientific ones.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Science advances through legitimate skepticism. Asking questions and querying other scientists' explanations is part of scientific inquiry.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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		Scientific investigations sometimes result in new ideas and phenomena for study, generate new methods or procedures for an investigation, or develop new technologies to improve the collection of data. All of these results can lead to new investigations.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PHYSICAL SCIENCE	**Properties and changes of properties in matter**	A substance has characteristic properties, such as density, a boiling point, and solubility, all of which are independent of the amount of the sample. A mixture of substances often can be separated into the original substances using one or more of the characteristic properties.				X													
		Substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties.				X												X	
		Chemical elements do not break down…There are more than 100 known elements that combine in a multitude of ways to produce compounds, which account for the living and nonliving substances that we encounter.																X	

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	Motions and forces	The motion of an object can be described by its position, direction of motion, and speed. That motion can be measured and represented on a graph.		X															X
		An object that is not being subjected to a force will continue to move at a constant speed and in a straight line.																	X
		If more than one force acts on an object along a straight line, then the forces will reinforce or cancel one another, depending on their direction and magnitude. Unbalanced forces will cause changes in the speed or direction of an object's motion.			X														X
	Transfer of Energy	Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.					X				X		X	X		X	X	X	X
		Heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature.					X						X					X	

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		Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from that object—emitted by or scattered from it—must enter the eye.					X							X					
		Electrical circuits provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced.	X														X		
		In most chemical or nuclear reactions, energy is transferred into or out of a system. Heat, light, mechanical motion, or electricity might all be involved in such transfers.														X		X	
		The Sun is a major source of energy for changes on the Earth's surface. The Sun loses energy by emitting light. A tiny fraction of that light reaches the Earth, transferring energy from the Sun to the Earth. The Sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.					X						X			X			

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LIFE SCIENCE	**Structure and function in living systems**	Living systems at all levels of organization demonstrate the complementary nature of structure and function. Important levels of organization for structure and function include cells, organs, tissues, organ systems, whole organisms, and ecosystems.												X	X	X			
		All organisms are composed of cells—the fundamental unit of life. Most organisms are single cells; other organisms, including humans, are multicellular.													X				
		Cells carry on the many functions needed to sustain life. They grow and divide, thereby producing more cells. This requires that they take in nutrients, which they use to provide energy for the work that cells do and to make the materials that a cell or an organism needs.													X				

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		Specialized cells perform specialized functions in multicellular organisms. Groups of specialized cells cooperate to form a tissue, such as a muscle. Different tissues are in turn grouped together to form larger functional units, called organs. Each type of cell, tissue, and organ has a distinct structure and set of functions that serve the organism as a whole.												X	X				
		The human organism has systems for digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease. These systems interact with one another.							X					X					
		Disease is a breakdown in structures or functions of an organism. Some diseases are the result of intrinsic failures of the system. Others are the result of damage by infection by other organisms.							X					X					

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	Reproduction and Heredity	Reproduction is a characteristic of all living systems; because no individual organism lives forever, reproduction is essential to the continuation of every species. Some organisms reproduce asexually. Other organisms produce sexually.													X	X			
		In many species, … Sexually produced offspring never are identical to either of their parents.													X	X			
		Every organism requires a set of instructions for specifying its traits. Heredity is the passage of these instructions from one generation to another.														X			
		Hereditary information is contained in genes, located in the chromosomes of each cell. Each gene carries a single unit of information. An inherited trait of an individual can be determined by one or by many genes, and a single gene can influence more than one trait. A human cell contains many thousands of different genes.														X			

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		The characteristics of an organism can be described in terms of a combination of traits. Some traits are inherited and others result from interactions with the environment.														X			
	Regulation and Behavior	All organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment.								X					X	X			
		Regulation of an organism's internal environment involves sensing the internal environment and changing physiological activities to keep conditions within the range required to survive.																	
		Behavior is one kind of response an organism can make to an internal or environmental stimulus. A behavioral response requires coordination and communication at many levels, including cells, organ systems, and whole organisms. Behavioral response is a set of actions determined in part by heredity and in part from experience.								X				X	X	X			

CATEGORY	STANDARD	CONCEPTS AND PRINCIPLES	MODELS AND DESIGNS	VARIABLES	LEVERS AND PULLEYS	MIXTURES AND SOLUTIONS	SOLAR ENERGY	LANDFORMS	FOOD AND NUTRITION	ENVIRONMENTS	PLANETARY SCIENCE	EARTH HISTORY	WEATHER AND WATER	HUMAN BRAIN AND SENSES	DIVERSITY OF LIFE	POPULATIONS AND ECOSYSTEMS	ELECTRONICS	CHEMICAL INTERACTIONS	FORCE AND MOTION
		An organism's behavior evolves through adaptation to its environment. How a species moves, obtains food, reproduces, and responds to danger are based in the species evolutionary history.														X			
	POPULATIONS AND ECOSYSTEMS	A population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose an ecosystem.														X			
		Populations of organisms can be categorized by the function they serve in an ecosystem…Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.														X			

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		For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organism in food webs.								X						X			
		The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition…														X			
	Diversity and Adaptations of Organisms	Millions of species of animals, plants, and microorganisms are alive today. Although different species might look dissimilar, the unity among organisms becomes apparent from an analysis of internal structures, the similarity of their chemical processes, and the evidence of common ancestry.													X				

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		Biological evolution accounts for the diversity of species developed through gradual processes over many generations. Species acquire many of their unique characteristics through biological adaptation, which involves the selection of naturally-occurring variations in populations…														X			
		Extinction of species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of species is common; most of the species that have lived on the Earth no longer exist.										X				X			

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Earth Science	**Structure of the Earth System**	The solid Earth is layered with a lithosphere; hot, convecting mantle; and dense, metallic core.										X							
		Lithospheric plates on the scales of continents and oceans constantly move at rates of centimeters per year in response to movements in the mantle. Major geologic events, such as earthquakes, volcanic eruptions, and mountain building, result from these plate motions.										X							
		Landforms are the result of a combination of constructive and destructive forces. Constructive forces include crustal deformation, volcanic eruption, and deposition of sediment, while destructive forces include weathering and erosion.						X				X							
		Some changes in the solid Earth can be described as the “rock cycle.” Old rocks at the Earth’s surface weather, forming sediments that are buried, then compacted, heated, and often recrystallized into new rock. Eventually, new rocks may be brought to the surface by forces that drive plate motions, and the rock cycle continues.										X							

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SCIENCE AND TECHNOLOGY	ABILITIES OF TECHNOLOGICAL DESIGN	Identify appropriate problems for technological design.	X																
		Design a solution or a product.	X	X	X	X	X										X		
		Implement a proposed design.	X	X	X		X										X		
		Evaluate completed technological designs or products.	X	X	X	X	X										X		
		Communicate the process of technological design.	X	X	X	X	X										X		
	UNDERSTANDINGS ABOUT SCIENCE AND TECHNOLOGY	Scientific inquiry and technological design have similarities and differences. Scientists propose explanations for questions about the natural world, and engineers propose solutions relating to human problems, needs, and aspirations.	X	X	X		X	X			X	X	X	X			X		X
		Many different people in different cultures have made and continue to make contributions to science and technology.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Science and technology are reciprocal.	X	X			X				X			X			X		
		Perfectly designed solutions do not exist.																	
		Technological designs have constraints.	X														X		

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		Technological solutions have intended benefits and unintended consequences. Some consequences can be predicted, others cannot.	X														X		
Science in Personal and Social Perspectives	**Personal health**	Regular exercise is important to the maintenance and improvement of health.																	
		The potential for accidents and the existence of hazards imposes the need for injury prevention.																	
		The use of tobacco increases the risk of illness.																	
		Alcohol and other drugs are often abused substances. Such drugs change how the body functions and can lead to addiction.												X					
		Food provides energy and nutrients for growth and development.							X							X			
		Sex drive is a natural human function that requires understanding.																	

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		Natural environments may contain substances (for example, radon and lead) that are harmful to human beings. Maintaining environmental health involves establishing or monitoring quality standards of soil, water, and air use.																	
	Populations, resources, and Environments	When an area becomes overpopulated, the environment will become degraded due to the increased use of resources.														X			
		Causes of environmental degradation and resource depletion vary from region to region and from country to country.								X									
	Natural Hazards	Internal and external processes of the earth system cause natural hazards, events that change or destroy human and wildlife habitats, damage property, and harm or kill humans. Natural hazards include earthquakes, landslides, wildfires, volcanic eruptions, floods, storms, and even possible impacts of asteroids.									X	X	X			X			

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		Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal. Such activities can accelerate many natural changes.						X								X			
		Natural hazards can present personal and societal challenges because misidentifying the change or incorrectly estimating the rate and scale of change may result in either too little attention and significant human costs or too much cost for unneeded preventive measures.																	
	Risks and Benefits	Risk analysis considers the type of hazard and estimates the number of people that might be exposed and the number likely to suffer consequences. The results are used to determine the options for reducing or eliminating risks.																	
		Students should understand the risks associated with natural hazards (fires, floods, tornadoes, etc.), with chemical hazards (pollutants in air, water, soil, and food), with biological hazards (pollen, viruses, bacteria, and parasites), social hazards, and with personal hazards.										X	X			X			

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		Individuals can use a systematic approach to thinking critically about risks and benefits.														X			
		Important personal and social decisions are made based on perceptions of benefits and risks.																	
	Science and technology in Society	Science influences society through its knowledge and world view.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Societal challenges often inspire questions for scientific research, and social priorities often influence research priorities through the availability of funding for research.																	
		Technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact. Technological changes are often accompanied by social, political, and economic changes that can be beneficial or detrimental to individuals and to society. etc.															X		
		Science and technology have advanced through contributions of many different people, in different cultures, at different times in history.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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		Scientists and engineers work in many different settings, including colleges and universities, businesses and industries, specific research institutes, and government agencies.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Scientists and engineers have ethical codes requiring that human subjects involved with research be fully informed about risks and benefits associated with the research before the individuals choose to participate. etc.																	
		Science cannot answer all questions and technology cannot solve all human problems or meet all human needs. Students should understand the difference between scientific and other questions. They should appreciate what science and technology can reasonably contribute to society and what they cannot do.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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HISTORY AND NATURE OF SCIENCE	**SCIENCE AS A HUMAN ENDEAVOR**	Women and men of various social and ethnic backgrounds—and with diverse interests, talents, qualities, and motivations—engage in the activities of science, engineering, and related fields such as the health professions. Some scientists work in teams, and some work alone, but all communicate extensively with others.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Science requires different abilities, depending on such factors as the field of study and type of inquiry. Science is very much a human endeavor...etc.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	NATURE OF SCIENCE	Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models. Etc.		X						X	X					X			X
		In areas where active research is being pursued and in which there is not a great deal of experimental or observational evidence and understanding, it is normal for scientists to differ with one another about the interpretation of the evidence or theory being considered. etc.									X	X							

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		It is part of scientific inquiry to evaluate the results of scientific investigations, experiments, observations, theoretical models, and the explanations proposed by other scientists [or students]. etc.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	History of Science	Many individuals have contributed to the traditions of science. Studying some of these individuals provides further understanding of scientific inquiry, science as a human endeavor, the nature of science, and the relationships between science and society.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		In historical perspective, science has been practiced by different individuals in different cultures. In looking at the history of many peoples, one finds that the scientists and engineers of high achievement are considered to be among the most valued contributors to their culture.	X	X		X		X			X								
		Tracing the history of science can show how difficult it was for scientific innovators to break through the accepted ideas of their time to reach the conclusions that we currently take for granted.	X	X						X	X	X	X	X	X	X	X	X	X