NORTH CAROLINA STANDARD COURSE OF STUDY
K-12 Science, Sixth Grade

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Engaging in science encourages students' curiosity, interests, and prepares them for the broadest range of postsecondary opportunities, be it college, career, or military service. The 2023 K-12 Science Standards are designed to allow students to become active participants in science - building their understanding of the natural world through observations and investigations.

The scientific method provides a common framework for introducing the traditional experimental design and hypothesis-testing process. The methodologies or approaches utilized by scientists can vary depending on the nature of their research questions and available tools. Steps that all scientists follow when conducting scientific investigations usually involve asking questions, the collection and analysis of relevant data, the use of logical reasoning, opportunities to communicate and collaborate with others, and the development of explanations.

The Science and Engineering Practices (SEP) are embedded in the standards to support a greater emphasis on how students develop science knowledge and the durable skills within the NC Portrait of a Graduate. While one practice is identified in each objective, teachers should utilize other practices to support students' progress towards mastering the standards.

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Sixth Grade	
Strand: Matter and its Interactions	
Standard	**Objectives**
PS.6.1 Understand the structure, states, and physical properties of matter.	PS.6.1.1 Use models to illustrate that matter is made of atoms and elements, and are distinguished from each other by the types of atoms that compose them.
	PS.6.1.2 Use models to explain the relationship between changes in thermal energy in a substance and the motion of its particles (including phase changes).
	PS.6.1.3 Carry out investigations to compare the physical properties of pure substances that are independent of the amount of matter present including density, melting point, boiling point and solubility to properties that are dependent on the amount of matter present to include volume, mass and weight.

Strand: Energy	
Standard	**Objectives**
PS.6.2 Understand characteristics of thermal and electrical energy transfer and interactions of matter and energy.	PS.6.2.1 Use models to compare the directional transfer of heat energy of matter through convection, radiation, and conduction.
	PS.6.2.2 Use models to explain how the transfer of heat and resulting change of temperature impacts the behavior of matter to include expansion, and contraction.
	PS.6.2.3 Carry out investigations to compare the transfer of thermal energy in insulated and non-insulated materials (examples could include insulated box, solar cooker, or styrofoam cup).
	PS.6.2.4 Engage in argument from evidence to classify materials as conductors and insulators of energy (both thermal and electrical).
	PS.6.2.5 Carry out investigations to explain the transfer of electrical energy in electrical circuits, to include how a circuit requires a complete loop through which an electrical current can pass.

Strand: Waves and Their Applications in Technologies for Information Transfer	
Standard	**Objectives**
PS.6.3 Understand the properties of waves and the wavelike property of energy in seismic, electromagnetic (including visible light), and sound waves.	PS.6.3.1 Use models of a simple wave to explain wave properties in seismic, light, and sound waves that include: waves having a repeating pattern with a specific amplitude, frequency, and wavelength, and the amplitude of a wave is related to the energy of the wave.
	PS.6.3.2 Carry out investigations to conclude the relationship between the electromagnetic spectrum (including visible light) and sight.
	PS.6.3.3 Carry out investigations to conclude the relationship between sound waves (including rate of vibration, the medium through which vibrations travel) and hearing.
	PS.6.3.4 Use models to explain that various waves (seismic, sound, electromagnetic, including visible light) are reflected, absorbed or transmitted through various materials.

Strand: From Molecules to Organisms- Structures and Processes	
Standard	**Objectives**
LS.6.1 Understand the structures, processes, and behaviors of plants that enable them to survive and reproduce.	LS.6.1.1 Use models to explain how the processes of photosynthesis, respiration, and transpiration work together to meet the needs of plants.
	LS.6.1.2 Construct an explanation to compare how vascular and nonvascular plants obtain, transport, and use nutrients and water necessary for survival.
	LS.6.1.3 Use models to summarize structural adaptations, processes, and responses that flowering plants use for defense, survival and reproduction.

Strand: Ecosystems- Interactions, Energy, and Dynamics	
Standard	**Objectives**
LS.6.2 Understand the flow of energy through ecosystems and the responses of populations to the biotic and abiotic factors in their environment.	LS.6.2.1 Use models to summarize how energy derived from the sun is used by plants to produce sugars (photosynthesis) and is transferred to consumers and decomposers.
	LS.6.2.2 Analyze and interpret data to predict how the abiotic factors (such as temperature, water, sunlight, and soil quality) and biotic factors affect the ability of organisms to grow and survive in different biomes (freshwater, marine, temperate forest, rainforest, grassland, desert, taiga, tundra).

Strand: Earth's Place in the Universe	
Standard	**Objectives**
ESS.6.1 Understand the earth/moon/sun system, and the properties, structures and predictable motions of celestial bodies in the Universe.	ESS.6.1.1 Use models to explain how the relative motion and relative position of the Sun, Earth and moon affect the seasons, tides, phases of the moon, and eclipses.
	ESS.6.1.2 Analyze and interpret data to compare the planets in our solar system in terms of: size and gravitational force relative to Earth, surface and atmospheric features, relative distance from the sun, and ability to support life.
	ESS.6.1.3 Use models to explain how the gravitational forces of the Sun and planets impact the structure of our solar system.
	ESS.6.1.4 Analyze and interpret data from historical and ongoing space exploration to illustrate the size and scale of the components of our solar system, galaxy, and universe.

Strand: Earth's Systems	
Standard	**Objectives**
ESS.6.2 Understand the lithosphere and how interactions of constructive and destructive forces have resulted in changes in the surface of the earth over time.	ESS.6.2.1 Use models to summarize the structure of the earth, including the layers, the mantle and core based on the relative position, composition and density.
	ESS.6.2.2 Construct an explanation to illustrate how the movement of lithospheric plates can create geologic landforms and cause major geologic events such as earthquakes and volcanic eruptions.
	ESS.6.2.3 Use models to explain the rock cycle and its relationship to the formation of soil (including how different types of soil come from different types of rocks).

Strand: Earth and Human Activity	
Standard	**Objectives**
ESS.6.3 Understand the reciprocal relationship between the lithosphere and humans.	ESS.6.3.1 Engage in argument from evidence to explain that the good health of humans and the environment requires: monitoring of the lithosphere, maintaining soil quality and stewardship.
	ESS.6.3.2 Obtain, evaluate, and communicate information to compare the implications of sustainable and unsustainable land use practices (including agriculture and deforestation) and the importance of stewardship.

NORTH CAROLINA STANDARD COURSE OF STUDY
K-12 Science, Seventh Grade

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Seventh Grade	
Strand: Motion and Stability: Forces and Interactions	
Standard	**Objectives**
PS.7.1 Understand motion, the effects of forces on motion, and the graphical representations of motion.	PS.7.1.1 Construct an explanation to summarize the motion of an object by its position, direction of motion, and speed in respect to some other object.
	PS.7.1.2 Use models to illustrate the effects of balanced and unbalanced forces acting on an object (including friction, gravity, and magnetism).
	PS.7.1.3 Analyze and interpret graphical data to summarize the motion of an object to show a change in position over a period of time.
	PS.7.1.4 Analyze and interpret graphical data to summarize the motion of an object to show a change in distance over a period of time for constant speed and variable motion.

Strand: Energy	
Standard	**Objectives**
PS.7.2 Understand forms of energy, energy transfer and transformation, and conservation in mechanical systems.	PS.7.2.1 Construct an explanation to summarize how kinetic and potential energy contribute to the mechanical energy of an object.
	PS.7.2.2 Engage in argument from evidence to explain how energy can be transformed from one form to another, specifically potential energy and kinetic energy (models could include roller coasters, pendulums, or cars on ramps as examples).
	PS.7.2.3 Carry out investigations to conclude that energy can be transferred from one system to another when two objects push or pull on each other over a distance (work) in a mechanical system using qualitative data.
	PS.7.2.4 Carry out investigations to compare the efficiency of simple machines in relation to their advantages for particular purposes (to include inclined planes, pulleys, levers and wheel and axles) using qualitative data.

Strand: From Molecules to Organisms- Structures and Processes	
Standard	**Objectives**
LS.7.1 Understand the processes, structures and functions of living organisms that enable them to survive, reproduce and carry out the basic functions of life.	LS.7.1.1 Construct an explanation to conclude how the structures of single-celled organisms carry out all of the basic functions of life including: Euglena, Amoeba, Paramecium, Volvox.
	LS.7.1.2 Use models to explain how the relevant structures within cells (including cell membrane, cell wall, nucleus, mitochondria, chloroplasts, and vacuoles) function to support the life of plant, animal, and bacterial cells.
	LS.7.1.3 Use models to explain how the hierarchical organization of multicellular organisms from cells to tissues to organs to systems to organisms functions to support life.
	LS.7.1.4 Construct an explanation to summarize how the major systems of the human body interact with each other to support life (including digestion, respiration, reproduction, circulation, excretion, nervous).

Strand: Heredity- Inheritance and Variation of Traits	
Standard	**Objectives**
LS.7.2 Understand the relationship of the mechanisms of reproduction, patterns of inheritance, and potential variation among offspring.	LS.7.2.1 Construct an explanation supported with scientific evidence to summarize the role of genes on chromosomes as inherited cellular structures which contribute to an organism's traits (not to include the structure of DNA).
	LS.7.2.2 Use models to explain how asexual reproduction results in offspring with identical genetic information while sexual reproduction results in offspring with genetic variation (not to include specific phases of mitosis and meiosis).
	LS.7.2.3 Use models (Punnett squares) to infer and predict patterns of the inheritance of single genetic traits from parent to offspring (including dominant and recessive traits).

Strand: Earth's Systems	
Standard	**Objectives**
ESS.7.1 Understand the atmosphere and how the cycling of water relates to Earth's weather and climate.	ESS.7.1.1 Analyze and interpret data to compare the composition, properties and structure of Earth's atmosphere to include: mixtures of gases and differences in temperature and pressure within layers.
	ESS.7.1.2 Use models to explain how the energy of the Sun and Earth's gravity drive the cycling of water, including changes of state, as it moves through multiple pathways in Earth's systems and relates to weather patterns on Earth.
	ESS.7.1.3 Analyze and interpret data to explain the relationship between the movement of air masses, high and low pressure systems, frontal boundaries and weather conditions that may result.
	ESS.7.1.4 Use models to predict weather conditions based on observations (including clouds, air masses, fronts), measurements (wind speed and direction, air temperature, humidity and air pressure), weather maps, satellites and radar.
	ESS.7.1.5 Use models to explain the influence of convection, global winds, and the jet stream on weather and climatic conditions.

Strand: Earth and Human Activity	
Standard	**Objectives**
ESS.7.2 Understand the reciprocal relationship between the atmosphere and humans.	ESS.7.2.1 Engage in argument from evidence to explain that the good health of humans and environment requires: monitoring of the atmosphere, maintaining air quality and stewardship.
	ESS.7.2.2 Analyze and interpret data to explain how changes in the structure and composition of the atmosphere affects the greenhouse effect and global temperatures.
	ESS.7.2.3 Obtain, evaluate, and communicate information to explain the impacts on humans and mitigation strategies of potentially hazardous environmental factors (including air quality index, UV index, Heat Index, Wildfires) and storms (hurricanes, blizzards, tornadoes, severe thunderstorms, floods).

NORTH CAROLINA STANDARD COURSE OF STUDY
K-12 Science, Eighth Grade

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Eighth Grade	
Strand: Matter and its Interactions	
Standard	**Objectives**
PS.8.1 Understand the properties of matter and changes that occur when matter interacts in open and closed systems.	PS.8.1.1 Construct an explanation to classify matter as elements, compounds, or mixtures based on how the atoms are arranged in various substances.
	PS.8.1.2 Use models to illustrate the structure of atoms in terms of the protons, electrons, and neutrons (using the location, charges and comparative size of these subatomic particles), without consideration of isotopes, ions, and energy levels.
	PS.8.1.3 Analyze and interpret data to explain how the physical properties of elements and their reactivity have been used to produce the current model of the Periodic Table of Elements.
	PS.8.1.4 Construct an explanation to classify changes in matter as physical changes (including changes in size, shape, and state) or chemical changes that are the result of a chemical reaction (including changes in energy, color, formation of a gas or precipitate).
	PS.8.1.5 Use models to illustrate how atoms are rearranged during a chemical reaction so that balanced chemical equations support the Law of Conservation of Mass (in both open and closed systems).

Strand: From Molecules to Organisms- Structures and Processes	
Standard	**Objectives**
LS.8.1 Understand the hazards caused by agents of diseases that affect living organisms.	LS.8.1.1 Construct an explanation to compare the basic characteristics of viruses, bacteria, fungi and parasites relating to the spread, treatment and prevention of disease.
	LS.8.1.2 Analyze and interpret data to explain the difference between epidemic and pandemic as it relates to the spread, treatment and prevention of disease.

Strand: Ecosystems- Interactions, Energy, and Dynamics	
Standard	**Objectives**
LS.8.2 Understand how organisms interact with and respond to the biotic and abiotic factors in their environment.	LS.8.2.1 Carry out investigations to explain how changing biotic and abiotic factors such as food, water, shelter, and space affect populations in an ecosystem.
	LS.8.2.2 Construct an explanation to summarize the relationships among producers, consumers, and decomposers including the positive and negative consequences of such interactions including: coexistence and cooperation, competition (predator/prey), parasitism, and mutualism.
	LS.8.2.3 Construct an explanation to summarize how food provides the energy and the building materials required for the growth and survival of all organisms (to include plants).
	LS.8.2.4 Use models to explain how the flow of energy within food webs is interconnected with the cycling of matter (water and carbon).

Strand: Biological Evolution- Unity and Diversity	
Standard	**Objectives**
LS.8.3 Understand the evolution of organisms over time based on evidence and processes.	LS.8.3.1 Analyze and interpret data to infer evolutionary relationships by using evidence drawn from fossils and comparative anatomy.
	LS.8.3.2 Use models to explain the process of natural selection, in which genetic variations in a population affect individuals' likelihood of surviving and reproducing in its environment.

Strand: Earth's Place in the Universe	
Standard	**Objectives**
ESS.8.1 Understand the history of Earth and its life forms based on evidence of change recorded in fossil records and landforms.	ESS.8.1.1 Analyze and interpret data to conclude the relative age of Earth and relative age of rocks and fossils from index fossils and ordering of rock layers.
	ESS.8.1.2 Engage in argument from evidence to explain the use of fossils, composition of sedimentary rocks, faults, and igneous rock formations found in rock layers as evidence of the history of the Earth and its life forms.

Strand: Earth's Systems	
Standard	**Objectives**
ESS.8.2 Understand the hydrosphere including freshwater, estuarine, ocean systems.	ESS.8.2.1 Use models to explain the structure of the hydrosphere including: water distribution on earth, local river basins, estuaries, and water availability.
	ESS.8.2.2 Use models to explain how temperature and salinity drive major ocean currents and how these currents impact climate, ecosystems, and the distribution of nutrients, minerals, dissolved gases, and life forms.

Strand: Earth and Human Activity	
Standard	**Objectives**
ESS.8.3 Understand the reciprocal relationship between the hydrosphere and humans.	ESS.8.3.1 Analyze and interpret data to predict the safety and potability of water supplies in North Carolina based on physical and biological factors, including: temperature, dissolved oxygen, pH, nitrates and phosphates, turbidity, and bio-indicators.
	ESS.8.3.2 Engage in argument from evidence to explain that the good health of humans and the environment requires: monitoring of the hydrosphere, water quality standards, methods of water treatment, maintaining safe water quality, and stewardship.
Standard	**Objectives**
ESS.8.4 Understand the environmental implications associated with the various methods of obtaining, managing, and using energy resources.	ESS.8.4.1 Construct an explanation to classify the primary sources of energy as either renewable (Geothermal, Biomass, Solar, Wind, Hydroelectric) or nonrenewable (Coal, Petroleum, Natural Gas, Nuclear).
	ESS.8.4.2 Engage in argument from evidence to explain the environmental consequences of the various methods of obtaining, transforming, and distributing energy.
	ESS.8.4.3 Analyze and interpret data to illustrate the relationship between human activities and global temperatures since industrialization.
	ESS.8.4.4 Obtain, evaluate, and communicate information to compare the long term implications of the use of renewable and nonrenewable energy resources and the importance of stewardship and conservation.