ACAP
Alabama Comprehensive Assessment Program
SUMMATIVE

Grade 6
Science

Alabama Educator Instructional Supports

Alabama Course of Study Standards

DATA RECOGNITION CORPORATION

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Introduction

The *Alabama Course of Study Instructional Supports: Science* is a companion manual to the 2015 *Alabama Course of Study: Science*. Instructional supports are foundational tools teachers may use to help students become independent learners as they build toward mastery of the *Alabama Course of Study* content standards.

- The purpose of the instructional supports found in this manual is to help teachers engage their students in exploring, explaining, and expanding their understanding of the content standards.

The content standards contained within the course of study may be accessed on the Alabama State Department of Education (ALSDE) website at https://www.alsde.edu/. On the home page, hover over "College- & Career-Ready Standards" and select "CCRS Website."

Educators are reminded that content standards indicate minimum content—what all students should know and be able to do by the end of each grade level or course. Local school systems may have additional instructional or achievement expectations and may provide instructional guidelines that address content sequence, review, and remediation.

Organization

The organizational components of this manual include standards, guiding questions, connections to instructional supports, key academic terms, and examples of activities. The definition of each component is provided below:

Content Standard:	The content standard is the statement that defines what all students should know and be able to do at the conclusion of a given grade level or course. Content standards contain minimum required content and complete the phrase "Students will."
Guiding Questions:	Each guiding question is designed to create a framework for the given standard. Therefore, each question is written to help teachers convey important concepts within the standard. By utilizing guiding questions, teachers are engaging students in investigating, analyzing, and demonstrating knowledge of the underlying concepts reflected in the standard.

Connections to the Three Dimensions:

The purpose of each instructional support is to engage students in exploring, explaining, and expanding their understanding of the content standards provided in the 2015 *Alabama Course of Study: Science*. An emphasis is placed on the integration of three-dimensional learning as described in the 2012 National Research Council (NRC) publication, *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*.

Each content standard in the 2015 *Alabama Course of Study: Science* blends knowledge and skills linked to science and engineering that all students should know and be able to do by the end of high school.

1. Scientific and Engineering Practices are skills and tools used by students to investigate phenomena, develop and use models, design and build systems, and construct arguments based on evidence to solve problems in the world in which they live.
2. Crosscutting Concepts are unifying conceptual threads that encourage students to connect scientific and engineering ideas across the domains of science.
3. Disciplinary Core Ideas in the four domains of Physical Science, Life Science, Earth and Space Sciences, and Engineering Technology include relevant content that provides students with foundational scientific knowledge.

Key Academic Terms:

The academic terms included in each instructional support. These academic terms are derived from the standards and are to be incorporated into instruction by the teacher and used by the students.

Instructional Activities:

A representative set of sample activities and examples that can be used in the classroom. The set of activities and examples is not intended to include all the activities and examples defined by the standard. These will be available in Fall 2020.

Additional Resources:

Additional resources include resources that are aligned to the standard and may provide additional instructional strategies to help students build toward mastery of the designated standard. These will be available in Fall 2020.

Grade 6
Earth's Place in the Universe
6.ESS.1 Create and manipulate models (e.g., physical, graphical, conceptual) to explain the occurrences of day/night cycles, length of year, seasons, tides, eclipses, and lunar phases based on patterns of the observed motions of celestial bodies.

Guiding Questions:

- How can models be used to demonstrate the rotation and revolution within the Sun-Earth-moon system?
- What is responsible for the day/night cycle on Earth?
- What cyclic motion corresponds to one year on Earth?
- What is the relationship between Earth's tilted axis of rotation and the seasons?
- How can a model be manipulated to show different seasons in the northern and southern hemispheres?
- What is the relationship between the orbital and rotational periods of the moon and Earth?
- What are the four main lunar phases?
- What patterns can be used to explain the lunar phases?
- What are tides and how are they formed?
- How could a model show tidal patterns (e.g., low tides, high tides, tidal bulges)?
- What is an eclipse?
- How can a model be manipulated to show the alignment of Earth, the moon, and the Sun during an eclipse (lunar and solar)?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Developing and Using Models

Focus for Crosscutting Concept(s):

- Patterns
- Cause and Effect

Focus for Disciplinary Core Idea(s):

- The Universe and Its Stars
- Earth and the Solar System

Key Academic Terms:

orbit, rotation, revolution, tilted axis, high tide, low tide, gravity, tidal bulge, lunar eclipse, solar eclipse, full moon, new moon, Earth/moon alignment, Sun-Earth-moon system, physical model, graphical model, conceptual model, waxing, waning, crescent, celestial

Grade 6
Earth's Place in the Universe
6.ESS.2 Construct models and use simulations (e.g., diagrams of the relationship between Earth and man-made satellites, rocket launches, the International Space Station, elliptical orbits, black holes, life cycles of stars, orbital periods of objects within the solar system, astronomical units and light years) to explain the role of gravity in affecting the motions of celestial bodies (e.g., planets, moons, comets, asteroids, meteors) within galaxies and the solar system.

Guiding Questions:

- How is the gravitational pull between two objects affected by changes in mass or distance?
- What is the relationship between gravity and the orbital pattern of an object?
- How can orbits, orbital periods, and orbital motion be explained using models?
- If an object was orbiting Earth and gravity ceased, how would the motion of that object change?
- What is the relationship between the orbital period of an object in our solar system and the distance of that object from the Sun?
- How does gravity affect the locations and movements of planets, moons, comets, meteors, and asteroids?
- What is a black hole?
- How can models and simulations describe black holes and explain what happens to an object as it approaches a black hole?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Developing and Using Models
- Constructing Explanations and Designing Solutions

Focus for Crosscutting Concept(s):

- Systems and System Models
- Patterns

Focus for Disciplinary Core Idea(s):

- The Universe and Its Stars
- Earth and the Solar System

Key Academic Terms:

gravity, orbit, satellite, black hole, elliptical orbit, orbital period, celestial body, solar system, galaxy, universe, asteroid, comet, meteor

Grade 6
Earth's Place in the Universe
6.ESS.3 Develop and use models to determine scale properties of objects in the solar system (e.g., scale model representing sizes and distances of the Sun, Earth, moon system based on a one-meter diameter Sun).

Guiding Questions:

- What is a solar system?
- What is the arrangement of planets in our solar system?
- How can a scale model be used to represent the relative sizes of celestial bodies in the solar system?
- How can a scale model be used to represent the relative distances between celestial bodies in the solar system?
- How are astronomical units and light years used to represent large distances in space?
- What are the benefits and drawbacks of modeling large-scale systems, like the ones present in space?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Developing and Using Models
- Analyzing and Interpreting Data

Focus for Crosscutting Concept(s):

- Scale, Proportion, and Quantity

Focus for Disciplinary Core Idea(s):

- Earth and the Solar System

Key Academic Terms:

scale model, celestial body, solar system, ratio, distance, proportion, astronomical unit, light year

Grade 6
Earth's Systems
6.ESS.4 Construct explanations from geologic evidence (e.g., change or extinction of particular living organisms; field evidence or representations, including models of geologic cross sections; sedimentary layering) to identify patterns of Earth's major historical events (e.g., formation of mountain chains and ocean basins, significant volcanic eruptions, fossilization, folding, faulting, igneous intrusion, erosion).

Guiding Questions:

- What are examples of Earth's major historical events?
- How can the patterns in Earth's major historical events be explained using geologic evidence?
- What is a geologic profile?
- How can a geologic profile be used to explain the relative ages of rocks?
- What happens to a geologic profile when the ground is overturned?
- How can geologic profiles be used to demonstrate the changes in a species over time?
- What characteristics of ocean basins are reflected in geologic profiles?
- How can geologic faulting and folding explain changes in landscapes?
- What is an igneous intrusion and how is it demonstrated within a geologic profile?
- What is a geologic cross section?
- How is the formation of mountain building reflected in geologic cross sections?
- How does erosion alter a geologic cross-section?
- What processes occur during fossilization?
- Why are most fossils found in sedimentary rock layers and not in igneous or metamorphic rock layers?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Constructing Explanations

Focus for Crosscutting Concept(s):

- Scale, Proportion, and Quantity

Focus for Disciplinary Core Idea(s):

- The History of Planet Earth

Key Academic Terms:

geologic cross section, geologic profile, igneous rock, sedimentary rock, metamorphic rock, intrusion, marine fossils, terrestrial fossil, extinction, ocean basin characteristics, erosion, deposition, compaction, sedimentation, mineral replacement, tar pit, law of superposition

Grade 6
Earth's Systems
6.ESS.5 Use evidence to explain how different geologic processes shape Earth's history over widely varying scales of space and time (e.g., chemical and physical erosion; tectonic plate processes; volcanic eruptions; meteor impacts; regional geographical features, including Alabama fault lines, Rickwood Caverns, and Wetumpka Impact Crater).

Guiding Questions:

- What are common geologic features and processes?
- What is physical erosion?
- What is chemical erosion?
- How does tectonic activity affect the weathering and erosion of Earth's surface?
- What are the mechanisms of plate tectonics?
- What geologic features are common at tectonic plate boundaries?
- How do different types of tectonic plate boundaries (divergent, convergent, subduction) affect Earth's surface?
- How do volcanic eruptions affect the geologic history of Earth?
- What are the signs of a meteorite impact on Earth?
- Is there evidence of a meteorite impact in Alabama?
- What geologic evidence can be observed of faulting and folding in Alabama?
- What is a cavern and how does it form?
- What are some features of Rickwood Caverns?
- What is karst topography?
- Which features of Earth formed over short or long periods of time?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Constructing Explanations and Designing Solutions

Focus for Crosscutting Concept(s):

- Scale, Proportion, and Quantity
- Patterns
- Cause and Effect

Focus for Disciplinary Core Idea(s):

- Earth's Materials and Systems
- The Roles of Water in Earth's Surface Processes

Key Academic Terms:

faulting, folding, normal fault, reverse fault, strike-slip fault, karst, cavern, physical erosion, chemical erosion, subduction, divergent, convergent, uplift, meteorite impact

Grade 6
Earth's Systems
6.ESS.6 Provide evidence from data of the distribution of fossils and rocks, continental shapes, and seafloor structures to explain past plate motions.

Guiding Questions:

- What is tectonic plate movement?
- What is Pangaea and how is it used to describe tectonic plate movement?
- How do fossils, continental shapes, seafloor structures, and rocks provide evidence for tectonic plate movement?
- What is magnetic striping and how is it used to describe tectonic plate movement?
- What geologic evidence is present in Alabama that indicates past tectonic plate movement?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Analyzing and Interpreting Data
- Constructing Explanations and Designing Solutions

Focus for Crosscutting Concept(s):

- Patterns
- Cause and Effect

Focus for Disciplinary Core Idea(s):

- The History of Planet Earth
- Plate Tectonics and Large-Scale System Interactions

Key Academic Terms:

Pangaea, tectonic plate, Alfred Wegener, continental drift, magnetic striping, polarity, magnetite, fossil

Grade 6
Earth's Systems
6.ESS.7 Use models to construct explanations of the various biogeochemical cycles of Earth (e.g., water, carbon, nitrogen) and the flow of energy that drives these processes.

Guiding Questions:

- What are the basic components and processes involved in each of the major biogeochemical cycles (water, carbon, nitrogen)?
- Where does energy enter or leave the water cycle (input vs. output)?
- How are plants and animals essential to the carbon cycle?
- Where in the carbon cycle is carbon stored for long periods of time?
- What is an example of a long-term sink for carbon?
- What is the role of bacteria in the recycling of carbon?
- How is atmospheric nitrogen used by organisms?
- How is energy essential to Earth cycles?
- How can the flow of energy and matter be modeled in each of the major biogeochemical cycles?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Developing and Using Models

Focus for Crosscutting Concept(s):

- Stability and Change
- Patterns
- Energy and Matter

Focus for Disciplinary Core Idea(s):

- Earth’s Materials and Systems
- The Roles of Water in Earth's Surface Processes

Key Academic Terms:

ammonia, nitrification, denitrification, water cycle, carbon cycle, nitrogen cycle, energy, recycling, carbon sink, biogeochemical cycle

Grade 6
Earth's Systems
6.ESS.8 Plan and carry out investigations that demonstrate the chemical and physical processes that form rocks and cycle Earth's materials (e.g., processes of crystallization, heating and cooling, weathering, deformation, and sedimentation).

Guiding Questions:

- What are the chemical and physical processes that form rocks?
- What is crystallization?
- What types of rocks commonly form crystals?
- Given an investigation plan, how can students experimentally determine what environmental factors affect the rate of crystallization?
- How does extreme heat and pressure affect rocks?
- What type of rock is formed from cooled magma?
- What type of rock is formed by erosion and compaction?
- How can the four processes of sedimentary rock formation (erosion, sedimentation, compaction, cementation) be demonstrated in an investigation?
- How can weathering be demonstrated in an investigation?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Planning and Carrying Out Investigations

Focus for Crosscutting Concept(s):

- Energy and Matter
- Stability and Change
- Cause and Effect

Focus for Disciplinary Core Idea(s):

- Earth's Materials and Systems

Key Academic Terms:

crystallization, sediment, sedimentation, compaction, cementation, igneous rock, metamorphic rock, sedimentary rock, magma, molten rock, lava, mineralization, weathering, erosion, deformation

Grade 6
Earth's Systems
6.ESS.9 Use models to explain how the flow of Earth's internal energy drives a cycling of matter between Earth's surface and deep interior causing plate movements (e.g., mid-ocean ridges, ocean trenches, volcanoes, earthquakes, mountains, rift valleys, volcanic islands).

Guiding Questions:

- What are the major layers of Earth's interior?
- How can the main layers of Earth be modeled?
- What is responsible for the internal thermal energy of Earth?
- What is convection and how can it be modeled?
- What is responsible for the movement of Earths tectonic plates?
- What are the three types of plate interactions?
- How can the three types of plate interactions be modeled?
- What Earth features are the result of tectonic plate interactions?
- What is the relationship between Earths internal heat and mid-ocean ridges?
- How can students use models to describe subduction and its result on Earth's features?
- What are hot spots and what are their effects on Earth's features?
- What event is defined by a sudden release of stored energy within Earth?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Developing and Using Models

Focus for Crosscutting Concept(s):

- Energy and Matter
- Stability and Change

Focus for Disciplinary Core Idea(s):

- Earth's Materials and Systems

Key Academic Terms:

convection, mid-ocean ridge, hot spot, subduction, trench, internal energy, magma, molten rock, rift valley, convergence, divergence, potential energy, kinetic energy, radioactive decay, gravity, magma plume, transform plate boundary, earthquake, volcano

Grade 6
Earth's Systems
6.ESS.10 Use research-based evidence to propose a scientific explanation regarding how the distribution of Earth's resources such as minerals, fossil fuels, and groundwater are the result of ongoing geoscience processes (e.g., past volcanic and hydrothermal activity, burial of organic sediments, active weathering of rock).

Guiding Questions:

- What is a natural resource?
- What is the link between past environments and the availability of natural resources today?
- Why are some natural resources found in very limited areas?
- Which natural resources are considered renewable or nonrenewable?
- How are fossil fuels (coal, natural gas, petroleum) formed?
- What past environments were essential for the production of fossil fuel deposits?
- How are fossil fuels used for energy?
- What are minerals and how are they formed?
- What process in rock formation is associated with mineral formation?
- What process or processes lead to the formation of groundwater?
- Where is groundwater located on Earth and how is it accessed?
- Which natural resources can be replaced within a human life span?
- How can the extraction and use of resources by humans affect or change the distribution of these resources?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Constructing Explanations and Designing Solutions

Focus for Crosscutting Concept(s):

- Cause and Effect
- Energy and Matter

Focus for Disciplinary Core Idea(s):

- Natural Resources

Key Academic Terms:

organic, natural resource, renewable, nonrenewable, fossil fuel, coal, geothermal heat, mineral, gold, diamond, groundwater, karst, limestone, calcium carbonate, aquifer, sinkhole, geyser, hot spring, extraction, depletion, research-based evidence, natural gas, petroleum, deposit, ore

Grade 6
Earth's Systems
6.ESS.11 Develop and use models of Earth's interior composition to illustrate the resulting magnetic field (e.g., magnetic poles) and to explain its measurable effects (e.g., protection from cosmic radiation).

Guiding Questions:

- How can a model illustrate layers of Earth?
- What is the cause of the electric current responsible for Earth's magnetic field?
- How do the locations of Earth's magnetic poles compare to the locations of the geographic poles?
- How can Earth's magnetic field, magnetic poles, and geographic poles be illustrated and described using a model?
- What is the magnetosphere?
- What is solar wind and how is it produced?
- How can a model describe what happens when solar winds encounter the magnetosphere?
- What is cosmic radiation?
- How would Earth change if all cosmic radiation entered the atmosphere?
- What happens to cosmic radiation when it interacts with Earth's magnetic field?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Developing and Using Models
- Constructing Explanations

Focus for Crosscutting Concept(s):

- Cause and Effect
- Energy and Matter

Focus for Disciplinary Core Idea(s):

- Earth Materials and Systems
- Types of Interactions

Key Academic Terms:

cosmic radiation, magnetosphere, solar wind, magnetic pole, geographic pole, electric current of Earth, core composition, solar radiation, ion

Grade 6
Earth's Systems
6.ESS.12 Integrate qualitative scientific and technical information (e.g., weather maps; diagrams; other visualizations, including radar and computer simulations) to support the claim that motions and complex interactions of air masses result in changes in weather conditions. a. Use various instruments (e.g., thermometers, barometers, anemometers, wet bulbs) to monitor local weather and examine weather patterns to predict various weather events, especially the impact of severe weather (e.g., fronts, hurricanes, tornados, blizzards, ice storms, droughts).

Guiding Questions:

- What is weather?
- What is the difference between weather and climate?
- What environmental factors are used to describe the weather in an area?
- What type of weather is most commonly associated with warm and cold fronts?
- How can diagrams and descriptions represent air motion in both cold and warm air masses?
- What type of weather is typically associated with low- and high-pressure zones?
- What symbols are commonly included on a weather map and how are they used?
- How is a weather map used to describe and predict weather patterns?
- How is regional weather affected by environmental factors (e.g., altitude, location, surface material)?
- What are some identifying features of a front, a hurricane, a tornado, a blizzard, an ice storm, and a drought?
- How are different instruments used to gather data and examine patterns used to predict weather events?
- What are the following tools used for: a thermometer, a barometer, an anemometer, and a wet bulb?
- What type of scientific data could be analyzed to predict weather conditions?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Engaging in Arguments from Evidence
- Analyzing and Interpreting Data

Focus for Crosscutting Concept(s):

- Energy and Matter
- Patterns
- Cause and Effect

Focus for Disciplinary Core Idea(s):

- The Roles of Water in Earth's Surface Processes
- Weather and Climate

Key Academic Terms:

weather, climate, anemometer, thermometer, wet-bulb thermometer, barometer, air mass, ascending, descending, weather map symbols, front, humidity, hurricane, tornado, blizzard, ice storm, drought, pressure zone, altitude, atmosphere

Grade 6
Earth's Systems
6.ESS.13 Use models (e.g., diagrams, maps, globes, digital representations) to explain how the rotation of Earth and unequal heating of its surface create patterns of atmospheric and oceanic circulation that determine regional climates. a. Use experiments to investigate how energy from the Sun is distributed between Earth's surface and its atmosphere by convection and radiation (e.g., warmer water in a pan rising as cooler water sinks, warming one's hands by a campfire).

Guiding Questions:

- What is density?
- How does density change in the atmosphere with increasing altitude?
- How does density change in the ocean with increasing depth?
- How can a model be used to explain how temperature and density affect circulating air and water?
- How does energy from the Sun affect patterns of atmospheric and oceanic circulation?
- How does the circulation of air near the poles differ from the circulation of air near the equator?
- How are radiation, convection, and conduction involved in the distribution of heat in Earth's atmosphere?
- How can convection currents be demonstrated using a model?
- How can a model be used to illustrate the distribution of water temperature in the oceans?
- How does salinity affect ocean circulation?
- What is the great ocean conveyor belt?
- How can a model be used to explain how Earth's rotation affects air and water circulation (Coriolis effect)?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Developing and Using Models
- Planning and Carrying Out Investigations

Focus for Crosscutting Concept(s):

- Systems and System Models
- Energy and Matter
- Patterns
- Cause and Effect

Focus for Disciplinary Core Idea(s):

- The Roles of Water in Earth's Surface Processes
- Weather and Climate

Key Academic Terms:

circulation, density, salinity, Coriolis effect, Hadley cell, climate, thermal layering, radiation, conduction, convection, great ocean conveyer belt, altitude, depth, atmosphere

Grade 6
Earth's Systems
6.ESS.14 Analyze and interpret data (e.g., tables, graphs, maps of global and regional temperatures; atmospheric levels of gases such as carbon dioxide and methane; rates of human activities) to describe how various human activities (e.g., use of fossil fuels, creation of urban heat islands, agricultural practices) and natural processes (e.g., solar radiation, greenhouse effect, volcanic activity) may cause changes in local and global temperatures over time.

Guiding Questions:

- What is the composition of Earth's atmosphere?
- What gases affect the temperature of Earth's atmosphere and the surface of Earth?
- What is ozone and how does it affect the global climate?
- How do natural processes affect regional and global climates?
- What is the greenhouse effect?
- What human activities are associated with increasing average global temperatures?
- How do human activities affect regional and global climates?
- How can data be used to show atmospheric changes related to increased global temperatures?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Analyzing and Interpreting Data

Focus for Crosscutting Concept(s):

- Stability and Change
- Patterns
- Cause and Effect

Focus for Disciplinary Core Idea(s):

- Global Climate Change

Key Academic Terms:

global climate change, carbon dioxide, oxygen, water, energy, methane, methane sources, ozone, greenhouse effect

Grade 6
Earth and Human Activity
6.ESS.15 Analyze evidence (e.g., databases on human populations, rates of consumption of food and other natural resources) to explain how changes in human population, per capita consumption of natural resources, and other human activities (e.g., land use, resource development, water and air pollution, urbanization) affect Earth's systems.

Guiding Questions:

- What Earth systems are affected by human activities?
- How can data explain how human populations are changing and what factors affect human populations?
- How can data be used as evidence to show a relationship between land use, resource access, development, and human population?
- What is meant by per capita consumption of a resource?
- What actions can reduce the effect of human consumption of natural resources?
- What is urbanization?
- What is the relationship between changes in human population and changes in water and air pollution?
- How might engineered solutions alter the effects of human activities on Earth's systems?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Analyzing and Interpreting Data
- Constructing Explanations

Focus for Crosscutting Concept(s):

- Cause and Effect
- Patterns

Focus for Disciplinary Core Idea(s):

- Human Impacts on Earth Systems

Key Academic Terms:

per capita, consumption, urbanization, pollution, engineered solution

Grade 6
Earth and Human Activity
6.ESS.16 Implement scientific principles to design processes for monitoring and minimizing human impact on the environment (e.g., water usage, including withdrawal of water from streams and aquifers or construction of dams and levees; land usage, including urban development, agriculture, or removal of wetlands; pollution of air, water, and land).

Guiding Questions:

- How do dams affect the natural environment?
- How are groundwater sources depleted and what are the impacts?
- How can humans reduce water consumption and their effect on water supplies?
- What is the relationship between wetlands and the quality of fresh water?
- What is land pollution and how can it be minimized?
- How does urbanization affect human life quality?
- How can humans reduce their land usage?
- What technical advances have enabled farmers to increase harvests?
- How can air quality be monitored?
- What purpose do wetland areas serve?
- How can air quality be improved by factories and electricity production facilities?
- How can human consumption of natural resources be monitored?

Connections to *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*:

Focus for Scientific and Engineering Practice(s):

- Constructing Explanations and Designing Solutions

Focus for Crosscutting Concept(s):

- Cause and Effect
- Influence of Science, Engineering, and Technology on Society and the Natural World

Focus for Disciplinary Core Idea(s):

- Human Impacts on Earth Systems

Key Academic Terms:

human impact, consumption, pollution, urbanization, natural resource, wetland