COBB TEACHING AND LEARNING STANDARDS

Earth Systems

COBB COUNTY SCHOOL DISTRICT

ONE TEAM
ONE GOAL
STUDENT SUCCESS

Earth Systems Standards

The Cobb Teaching and Learning Standards (CT & LS) for Science are designed to provide foundational knowledge and skills for all students to develop proficiency in science. The Project 2061's *Benchmarks for Science Literacy* and the follow up work, *A Framework for K-12 Science Education* were used as the core of the standards to determine appropriate content and process skills for students. The Cobb Teaching and Learning Standards focus on a limited number of core disciplinary ideas and crosscutting concepts which build from Kindergarten to high school. The standards are written with the core knowledge to be mastered integrated with the science and engineering practices needed to engage in scientific inquiry and engineering design. Crosscutting concepts are used to make connections across different science disciplines.

The Cobb Teaching and Learning Standards drive instruction for science. Hands-on, student-centered, and inquiry-based approaches should be the emphasis of instruction. The standards are a required minimum set of expectations that show proficiency in science. However, instruction can extend beyond these minimum expectations to meet student needs.

Science consists of a way of thinking and investigating, as well a growing body of knowledge about the natural world. To become literate in science, students need to possess sufficient understanding of fundamental science content knowledge, the ability to engage in the science and engineering practices, and to use scientific and technological information correctly. Technology should be infused into the curriculum and the safety of the student should always be foremost in instruction.

The Cobb Teaching and Learning Standards for Earth Systems are designed to continue student investigations that began in K-8 Earth Science and Life Science curricula on the connections among Earth's systems through Earth history. These systems – the atmosphere, hydrosphere, geosphere, and biosphere – interact through time to produce the Earth's landscapes, ecology, and resources. These standards engage the students in constructing explanations of phenomena fundamental to the sciences of geology and physical geography, including the early history of the Earth, plate tectonics, landform evolution, the Earth's geologic record, weather and climate, and the history of life on Earth. Instruction should focus on development of scientific explanations, rather than mere descriptions of phenomena. Case studies, laboratory exercises, maps, and data analysis should be integrated into units. Special attention should be paid to topics of current interest (e.g., recent earthquakes, tsunamis, global warming, price of resources) and to potential careers in the geosciences.

Unit 1 1 wk BL/2 wks YR	Unit 2 2 wks BL/4 wks YR	Unit 3 4 wks BL/8 wks YR	Unit 4 2 wks BL/4 wks YR	Unit 5: 1.5 wks BL/3 wks YR	Unit 6: 3 wks BL/6 wks YR	Unit 7: 3 wks BL/6wks YR	Unit 8: 1.5 wks BL/3 wks YR
Intro to Systems and Maps SES1	**Introduction to Earth's Beginnings SE1**	**Atmosphere and Meteorology SES5**	**Landscape Changes SES3**	**Minerals, Rocks, and the Rock Cycle SES2, SES3**	**Plate Tectonics, Earthquakes, and Landforms SES2, SES3**	**Geologic Time SES4**	**How Life Shapes the Earth SES6**
SES1 Obtain, evaluate, and communicate information to investigate the composition and formation of Earth systems, including the Earth's place in the solar system. b. Ask questions to evaluate evidence for the development and composition of Earth's early systems, including the geosphere (crust, mantle and core), hydrosphere and atmosphere. (Clarification statement: The differentiation by density of Earth into crust, mantle and core should be included in this element.)	**SES1. Obtain, evaluate, and communicate information to investigate the composition and formation of Earth systems, including the Earth's place in the solar system.** a. Construct an explanation of the origins of the solar system from scientific evidence including the composition, distribution and motion of solar system objects. (Clarification statement: The nebular hypothesis should be included in this element.) b. Ask questions to evaluate evidence for the development and composition of Earth's early systems, including the geosphere (crust, mantle and core), hydrosphere and atmosphere. (Clarification statement: The differentiation by density of Earth into crust, mantle and core should be included in this element.) c. Develop a model of the physical composition of Earth's layers using multiple types of evidence (e.g., Earth's magnetic field, composition of meteorites and seismic waves). (Clarification statement: Earth's layers should include crust, mantle, inner core and outer core.)	**SES5. Obtain, evaluate, and communicate information to investigate the interaction of solar energy and Earth's systems to produce weather and climate.** a. Develop and use models to explain how latitudinal variations in solar heating create differences in air pressure, global wind patterns, and ocean currents that redistribute heat globally. b. Analyze and interpret data (e.g., maps, meteograms, and weather apps) that demonstrate how the interaction and movement of air masses creates weather. c. Construct an argument that predicts weather patterns based on interactions among ocean currents, air masses, and topography. d. Analyze and interpret data to show how temperature and precipitation produce the pattern of climate regions (zones) on Earth. e. Construct an explanation that describes the conditions that generate extreme weather events (e.g., hurricanes, tornadoes, and thunderstorms) and the hazards associated with these events. f. Construct an argument relating changes in global climate to variation to Earth/sun relationships and atmospheric composition.	**SES3. Obtain, evaluate, and communicate information to explore the actions of water, wind, ice, and gravity as they relate to landscape change.** a. Plan and carry out an investigation that demonstrates how surface water and groundwater act as the major agents of physical and chemical weathering. c. Construct an explanation that relates the past and present actions of ice, wind, and water to landform distribution and landscape change. d. Construct an argument based on evidence that relates the characteristics of the sedimentary materials to the energy by which they were transported and deposited.	**SES2. Obtain, evaluate, and communicate information to understand how plate tectonics creates certain geologic features, landforms, Earth materials, and geologic hazards.** d. Ask questions to compare and contrast the relationship between transformation processes of all rock types (sedimentary, igneous, and metamorphic) and specific plate tectonic settings. **SES3. Obtain, evaluate, and communicate information to explore the actions of water, wind, ice, and gravity as they relate to landscape change.** d. Construct an argument based on evidence that relates the characteristics of the sedimentary materials to the energy by which they were transported and deposited.	**SES2. Obtain, evaluate, and communicate information to understand how plate tectonics creates certain geologic features, landforms, Earth materials, and geologic hazards**. a. Construct an explanation based on evidence that describes the mechanisms causing plate tectonic motion. b. Develop and use models for the different types of plate tectonic settings (convergent, divergent and transform boundaries). c. Construct an explanation that communicates the relationship of geologic features, landforms, Earth materials and geologic hazards to each plate tectonic setting. d. Ask questions to compare and contrast the relationship between transformation processes of all rock types (sedimentary, igneous, and metamorphic) and specific plate tectonic settings e. Construct an argument using multiple forms of evidence that supports the theory of plate tectonics (e.g., fossils, paleomagnetism, seafloor age, etc.). **SES3. Obtain, evaluate, and communicate information to explore the actions of water, wind, ice, and gravity as they relate to landscape change.** b. Develop a model of the processes and geologic hazards that result from both sudden and gradual mass wasting.	**SES4. Obtain, evaluate, and communicate information to understand how rock relationships and fossils are used to reconstruct the Earth's past.** a. Use mathematics and computational thinking to calculate the absolute age of rocks using a variety of methods (e.g., radiometric dating, rates of erosion, rates of deposition, and varve count). b. Construct an argument applying principles of relative age (superposition, original horizontality, cross-cutting relations, and original lateral continuity) to interpret a geologic cross-section and describe how unconformities form. c. Analyze and interpret data from rock and fossil succession in a rock sequence to interpret major events in Earth's history such as mass extinction, major climatic change, and tectonic events. d. Construct an explanation applying the principle of uniformitarianism to show the relationship between sedimentary rocks and their fossils to the environments in which they were formed. e. Construct an argument using spatial representations of Earth data that interprets major transitions in Earth's history from the fossil and rock record of geologically defined areas. (Clarification statement: Students should use maps and cross-sections with a focus on Georgia.)	**SES6. Obtain, evaluate, and communicate information about how life on Earth responds to and shapes Earth's systems.** a. Construct an argument from evidence that describes how life has responded to major events in Earth's history (e.g., major climatic change, tectonic events) through extinction, migration, and/or adaptation. b. Construct an explanation that describes how biological processes have caused major changes in Earth's systems through geologic time (e.g., nutrient cycling, atmospheric composition, and soil formation). c. Ask questions to investigate and communicate how humans depend on Earth's land and water resources, which are distributed unevenly around the planet as a result of past geological and environmental processes. d. Analyze and interpret data that relates changes in global climate to natural and anthropogenic modification of Earth's atmosphere and oceans.

Earth Systems

SES1. Obtain, evaluate, and communicate information to investigate the composition and formation of Earth systems, including the Earth's place in the solar system.

a. Construct an explanation of the origins of the solar system from scientific evidence including the composition, distribution and motion of solar system objects.
(*Clarification statement:* The nebular hypothesis should be included in this element.)

b. Ask questions to evaluate evidence for the development and composition of Earth's early systems, including the geosphere (crust, mantle and core), hydrosphere and atmosphere.
(*Clarification statement:* The differentiation by density of Earth into crust, mantle and core should be included in this element.)

c. Develop a model of the physical composition of Earth's layers using multiple types of evidence (e.g., Earth's magnetic field, composition of meteorites and seismic waves).
(*Clarification statement:* Earth's layers should include crust, mantle, inner core and outer core.)

SES2. Obtain, evaluate, and communicate information to understand how plate tectonics creates certain geologic features, landforms, Earth materials, and geologic hazards.

a. Construct an explanation based on evidence that describes the mechanisms causing plate tectonic motion.
(*Clarification statement:* The role of radioactive decay as the source of energy that drives the process of convection should be studied as part of this element).

b. Develop and use models for the different types of plate tectonic settings (convergent, divergent and transform boundaries).
(*Clarification statement:* Subduction zones, continental collisions, rift zones, and ocean basins should be included.)

c. Construct an explanation that communicates the relationship of geologic features, landforms, Earth materials and geologic hazards to each plate tectonic setting.

d. Ask questions to compare and contrast the relationship between transformation processes of all rock types (sedimentary, igneous, and metamorphic) and specific plate tectonic settings.
(*Clarification statement:* The plate tectonic settings to be considered here are continental collision, subduction zone, mid-ocean ridge, transformation fault, hot spot, and passive zone.)

e. Construct an argument using multiple forms of evidence that supports the theory of plate tectonics (e.g., fossils, paleomagnetism, seafloor age, etc.).

SES3. Obtain, evaluate, and communicate information to explore the actions of water, wind, ice, and gravity as they relate to landscape change.

a. Plan and carry out an investigation that demonstrates how surface water and groundwater act as the major agents of physical and chemical weathering.

b. Develop a model of the processes and geologic hazards that result from both sudden and gradual mass

c. Construct an explanation that relates the past and present actions of ice, wind, and water to landform distribution and landscape change.

d. Construct an argument based on evidence that relates the characteristics of the sedimentary materials to the energy by which they were transported and deposited.

SES4. Obtain, evaluate, and communicate information to understand how rock relationships and fossils are used to reconstruct the Earth's past.

a. Use mathematics and computational thinking to calculate the absolute age of rocks using a variety of methods (e.g., radiometric dating, rates of erosion, rates of deposition, and varve count).

b. Construct an argument applying principles of relative age (superposition, original horizontality, cross-cutting relations, and original lateral continuity) to interpret a geologic cross-section and describe how unconformities form.

c. Analyze and interpret data from rock and fossil succession in a rock sequence to interpret major events in Earth's history such as mass extinction, major climatic change, and tectonic events.

d. Construct an explanation applying the principle of uniformitarianism to show the relationship between sedimentary rocks and their fossils to the environments in which they were formed.

e. Construct an argument using spatial representations of Earth data that interprets major transitions in Earth's history from the fossil and rock record of geologically defined areas.

(*Clarification statement:* Students should use maps and cross-sections with a focus on Georgia.)

SES5. Obtain, evaluate, and communicate information to investigate the interaction of solar energy and Earth's systems to produce weather and climate.

a. Develop and use models to explain how latitudinal variations in solar heating create differences in air pressure, global wind patterns, and ocean currents that redistribute heat globally.

b. Analyze and interpret data (e.g., maps, meteograms, and weather apps) that demonstrate how the interaction and movement of air masses creates weather.

c. Construct an argument that predicts weather patterns based on interactions among ocean currents, air masses, and topography.

d. Analyze and interpret data to show how temperature and precipitation produce the pattern of climate regions (zones) on Earth.

e. Construct an explanation that describes the conditions that generate extreme weather events (e.g., hurricanes, tornadoes, and thunderstorms) and the hazards associated with these events.

f. Construct an argument relating changes in global climate to variation to Earth/sun relationships and atmospheric composition.

SES6. Obtain, evaluate, and communicate information about how life on Earth responds to and shapes Earth's systems.

a. Construct an argument from evidence that describes how life has responded to major events in Earth's history (e.g., major climatic change, tectonic events) through extinction, migration, and/or adaptation.

b. Construct an explanation that describes how biological processes have caused major changes in Earth's systems through geologic time (e.g., nutrient cycling, atmospheric composition, and soil formation).

c. Ask questions to investigate and communicate how humans depend on Earth's land and water resources, which are distributed unevenly around the planet as a result of past geological and environmental processes.

d. Analyze and interpret data that relates changes in global climate to natural and anthropogenic modification of Earth's atmosphere and oceans.