2005 South Carolina Earth Science Standards

(extensively edited from original document which can be downloaded from: *http://www.myscschools.com/*)

Kindergarten: Earth Science

Units of Study: Rocks, Soil, and Water; Seasonal Changes

Properties of Earth Materials: Solid rocks, soils and water are earth materials.

- Describe earth materials using the senses.
- Explore the natural flow of water downhill.
- Describe a way to conserve water at home or at school. (P)
- Soils have properties of color and texture.
- Compare a variety of soil samples.
- Sort soil samples by a single attribute.

Changes in Earth and Sky: Weather changes from day to day and over the seasons.

- Record weather observations pictorially.
- Name and describe the seasons.
- Describe how seasonal changes may affect plants and animals.

Grade 1: Earth Science

Unit of Study: Things in the Sky

Objects in the Sky: The sun, moon, and stars have properties, locations and movements that can be observed and described.

- Observe and describe the basic relationships between the sun, moon, and Earth.
- Identify that the sun is a star and is the source of heat and light for Earth.

Changes in the Earth and Sky: The sun and moon appear to move across the sky on a daily basis.

- Observe and compare the day and the night sky.
- Observe and describe changes in shadows over time.
- Observe and describe the phases of the moon over time looking for patterns.

Grade 2: Earth Science

Unit of Study: Weather

Changes in the Earth and Sky: Weather changes from day to day and over the seasons.

- Define components of weather, including temperature, wind, and precipitation (rain, sleet, snow, and hail).
- Observe and identify weather conditions and patterns.
- Create and use symbols to represent weather conditions.
- Describe and sequence the seasons.
- Identify safety precautions to use during severe weather conditions. (P)
- Weather can be described by measurable quantities, such as temperature, wind direction, and precipitation.
- Measure and record temperature in both degrees Fahrenheit and Celsius.
- Measure and record precipitation.
- Investigate and describe changes in wind direction and the motion of objects due to the wind.
- Make simple charts and graphs of observed weather data.
- Identify the importance of measuring and recording weather data. (T)
- Compare drought and flood conditions.
- Investigate and describe how weather affects water supply and water conservation. (P)

Grade 3: Earth Science

Unit of Study: Earth Materials

Properties of Earth Materials: The varied earth materials have different physical properties and uses.

- Describe earth materials (rocks, minerals, water, soil, and fossils) by their physical properties.
- State similarities and differences among earth materials.
- Classify similar earth materials (e.g., types of rocks/soils) according to their physical properties.
- Recognize that rock, clay, silt, sand, and humus are components of soils.
- Describe and show that soils are layered (topsoil, subsoil and bedrock).
- Identify that soil provides support and nutrients for plant growth.

Observe and describe the unique physical characteristics of a variety of rock types.
Give examples of how humans obtain and use earth materials as resources. (P, T)
Explain how fossils provide evidence about prehistoric life and environments.
Explore careers in earth science. (N)
The sun provides the heat necessary to maintain the temperature of the Earth.
Compare the effects of heat from the sun on various earth materials (rocks, soils, and water).

Changes in the Earth: The surface of the Earth changes.

Describe surface features of the Earth (mountains, hills, valleys, plateaus, plains, oceans, lakes and rivers).
Construct and interpret models that illustrate features of the Earth.
Compare some changes in the Earth's surface that are due to slow processes, such as erosion and weathering, with some changes that are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.
Infer how human behavior, such as farming, mining, and construction, changes the Earth's surface. (P, N)
Predict and explain the consequences of natural events, such as fire, flood, drought, erosion, earthquake, and volcanic eruption. (P)
Explore how technologies are used to help predict some natural events. (T)

Grade 4: Earth Science

Units of Study: Sky Patterns; Weather and Climate

Objects in the Sky: The sun, moon, and stars and planets, asteroids and comets all have properties, locations, and movements that can be observed and described.

State that the sun produces its own light, while the moon reflects light from the sun.
Describe the positional relationship between the Earth and the moon and their positional relationship to the sun.
Observe and record phase changes of the moon over time.
Observe and recognize the location and apparent movement of constellations throughout the seasons.
Compare the properties, locations, and movements of the Earth with other planets.
Research and describe the historical/cultural significance of astronomy, such as navigation and exploration. (P, H, T, N)
Explore and identify careers in space science. (P)

Objects in the sky have patterns of movement. The sun, for example, appears to move across the sky in the same way every day, but its path changes slowly over the seasons.

Model and describe how the Earth's rotation on its axis produces day and night.
Model and describe how the tilt of the Earth on its axis and its revolution around the sun produce seasonal changes.
Describe how sunrise/sunset patterns change over time.
Investigate, describe, and predict the sun's apparent movement related to the shadows of objects throughout the day.
Identify safe ways to observe the sun.
Research and compare the technology humans have used to measure time throughout history. (T, H)

Changes in the Earth and Sky: Weather changes from day to day and over the seasons.

Observe daily and seasonal weather patterns.
Describe how clouds form.
Record and identify various cloud formations (such as, cirrus, stratus, and cumulus).
Predict weather based on observations.
Research and describe severe weather phenomena, technological advances, and related safety concerns. (T, P)

Weather can be described by measurable quantities, such as temperature, wind direction, speed, and precipitation.

Measure and collect daily weather data using meteorological tools (such as, Fahrenheit/Celsius thermometer, barometer, weather vane, anemometer, and rain gauge).
Interpret weather data from a variety of sources.

Grade 5: Earth Science

Unit of Study: Changes in the Earth's Surface: Landforms and Oceans

Structure of the Earth System: Land forms are the result of a combination of constructive and destructive forces.

Define constructive forces, which include crustal deformation (folding and faulting), volcanic eruptions and deposition of sediment.
Describe how landforms are created as a result of constructive forces.
Locate and describe the characteristics of South Carolina landform regions such as Blue Ridge, Piedmont, Sandhills, Coastal Plains, and Coastal Zone.
Model how constructive forces change the surface of the Earth.
Define destructive forces, which include weathering and erosion.
Describe how landforms change as a result of destructive forces.
Model how destructive forces change the surface of the Earth.
Investigate and describe how the Earth's surface is constantly changing by weathering, erosion, deposition and human impact. (P)
Identify technological advances developed as a result of major geological events such as earthquakes. (T)

Infer how waves, currents, tides, and storms affect the geological features of the ocean shore zone (e.g., beaches, barrier islands, inlets, estuaries, and harbors, etc.)

Discuss safety concerns associated with major geological events. (P)

The ocean floor is a part of the Earth's lithosphere. Lithospheric plates on the ocean floor move.

Identify that the lithosphere includes the crust and parts of the upper mantle, and is broken into large sections known as plates.

Recognize how plate movement produces volcanoes, earthquakes, and mountains on the ocean floor.

Identify and create a model of the geological features of the ocean floor (continental shelf/rise/slope, mid-Atlantic ridges, rifts, and trenches).

Water, which covers the majority of the Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle."

Diagram, label, and describe evaporation, condensation and precipitation as components of the water cycle.

Explain how the water cycle affects the salinity of the ocean's water.

Gravity is the force that explains the phenomena of the tides.

Describe the relationship of the positions of the sun and the moon on the ocean's tides.

Grade 6: Earth Science

Unit of Study: Energy Transfer in the Atmosphere

Structure of the Earth System: Water, which covers the majority of the Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the Earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow and falls to the surface, where it collects in lakes, oceans, soil, and rocks underground.

Identify, investigate and explain the processes of condensation, evaporation, precipitation, and runoff using a model or diagram.

Relate the occurrence of water in the Earth's crust, oceans, and atmosphere to the water cycle processes.

Analyze why precipitation occurs in the form of rain, sleet, hail, or snow.

Water is a solvent. As it passes through the water cycle, it dissolves minerals and gases and carries them to the oceans.

Classify different substances based on their solubility in water.

Infer the effects of water on the weathering of the Earth's surface in terms of solubility.

Describe how minerals (and salts) accumulate in lakes and oceans. [Concept has been taught at a previous grade level]

Explain how acid rain forms from gases (carbon dioxide, sulfur and nitrogen oxides from burning fossil fuels) dissolved in the water in the atmosphere.

The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor.

Identify the gas composition of the atmosphere.

Operationally define humidity and relative humidity and relate these to weather conditions

The atmosphere has different properties at different elevations.

Compare and contrast the physical characteristics of the different layers of the atmosphere (e.g., troposphere, stratosphere, mesosphere, thermosphere, exosphere).

Relate the characteristics of the layers of the atmosphere (e.g., temperature, pressure, composition of gases) to different altitudes.

Explain the effect of air pressure at different elevations (e.g., effects on cooking, on our ears popping).

Clouds, formed by the condensation of water vapor, affect weather and climate.

Demonstrate and explain the formation of clouds.

Classify shapes and types of clouds according to elevation.

Relate cloud types to weather events and patterns.

Use weather maps, Internet sites with satellite images, and other weather data to identify and predict weather conditions.

Global patterns of atmospheric movement influence local weather.

Relate heat transfer to the movement of air masses, high and low pressure areas, and fronts in the atmosphere.

Compare characteristics and locations of global wind patterns (e.g., trade winds and the jet stream), and give examples of how these global patterns can affect local weather.

Describe how satellites and computers provide information on local and worldwide weather patterns. (T)

Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.

Relate heat transfer to the circulation of ocean currents.

Compare the characteristics of the Gulf Stream with other large ocean currents and their effects on climate in Eastern North America and Western Europe.

Infer why air temperatures are more moderate in areas near large bodies of water.

Describe where hurricanes form and their movement across the oceans.

Describe what happens when hurricanes move over land.

Grade 7: Earth Science

Unit of Study: Ecology — The Abiotic Environment

Structure of the Earth System: Landforms are the result of a combination of constructive forces (e.g., deposition of sediments) and destructive forces (e.g., weathering and erosion).

Distinguish among weathering, erosion, and deposition.
Examine how physical weathering and chemical weathering break rocks into fragments.
Investigate and examine how the earth's surface is constantly changed by weathering, erosion, deposition and human impact. (P)
Examine the effects of weathering, erosion, and deposition on the formation of major landform regions in South Carolina.
Relate the fertility of floodplains to deposition of sediments.
Discuss the benefits and hazards of living on a floodplain. (P)

Soil consists of weathered rocks and decomposed organic material from dead plants, animals, and bacteria. Soils are often found in layers, with each having a different chemical composition. Living organisms have played many roles in the Earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.

Discuss how climatic conditions affect the development of soils.
Analyze soil properties that can be observed (soil profile, composition, texture, particle size) and measured (permeability, temperature, pH, moisture) to predict soil quality.
Explain why soil (sediments) can be a major pollutant of streams. (P)
Evaluate ways in which human activities have affected soil and the measures taken to control the impact (silt fences, ground cover, farming, land use, nutrient balance). (P)

Water, which covers the majority of the Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the Earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.

Define groundwater, runoff, drainage divide and drainage basin (watershed).
Infer what happens to water that does not soak into the ground or evaporate.
Analyze the factors that affect runoff.
Differentiate between drainage divides and drainage basins using maps or aerial photography and illustrate the relationships between groundwater and surface water in a watershed. (T)
Identify and illustrate groundwater zones including water table, zone of saturation, and zone of aeration.
Identify technologies designed to reduce sources of point and non-point water pollution. (T, P)

The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor.

Infer how air pollution affects people and the environment.
Infer how air pollution affects the human body.
Analyze ways air pollution can be reduced.
Analyze how chemical hazards (pollutants in air, water, soil, and food) affect populations and ecological succession. (P)

The sun is a major source of energy for changes on the Earth's surface. Energy is transferred in many ways.

Analyze the greenhouse effect and its consequences. (P)
Describe ways that humans may be influencing or contributing to global warming. (P)

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.

Describe how sunlight, through photosynthesis, is transferred by producers into chemical energy.
Trace the path of solar energy through a simple food chain and through food webs that include humans.
Examine how energy is transferred through an ecosystem.
Examine how energy is distributed in an energy pyramid.

The number of organisms an ecosystem can support depends upon the abiotic factors. Given adequate abiotic resources and no disease or predators, populations (including humans) increase at a rapid rate. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

Compare and contrast the abiotic factors that affect population growth and size (quantity of light, water, range of temperatures, soil compositions).
Diagram the cycles of water, carbon, oxygen, and nitrogen in the environment.
Analyze the vital role of single-celled organisms (e.g., phytoplankton) in the carbon, oxygen cycles.
Examine how materials are reused in a continuous cycle in ecosystems.
Distinguish between renewable and nonrenewable resources and examine the importance of their conservation. (P)
Evaluate the effects of human population on air, water, and land. (P)
Analyze the benefits of solid waste management (reduce, reuse, recycle). (T, P)

Grade 8: Earth Science

Unit of Study: Earth and Space Systems

Earth in the Solar System: The Earth is the third planet from the sun in the system that includes the moon, the sun, eight other planets and their moons, and smaller objects, such as asteroids and comets (solar system).

Describe the features of the planets in terms of size, composition, relative distance from the sun, and ability to support life.
Compare and contrast the Earth to other planets in terms of size, composition, and relative distance from the sun, and ability to support life.
Describe the features and explain the origins of asteroids, comets, and meteors.

The sun, an average star, is central and largest body in the solar system.

Describe and classify the main layers of the sun's atmosphere (corona, chromosphere, photosphere) and core.
Evaluate how phenomena on the sun's surface (e.g., sunspots, prominences, and solar flares) affect earth.
Describe how the solar wind affects Earth (e.g., auroras, interference in radio, television communication).

Energy is a property of many substances and is associated with nuclei.

Explain the process by which the sun produces energy (fusion).
Compare and contrast nuclear fusion and nuclear fission.

Most objects in the solar system are in regular and predictable motion which explains such phenomena as the day, the year, phases of the moon, and eclipses.

Compare and contrast the Earth's rotation and revolution as they relate to daily and annual changes.
Sequence and predict the phases of the moon (e.g., waxing, waning, crescent, new, and full).
Demonstrate the arrangement of the sun, the moon, and the Earth during solar and lunar eclipses (include partial eclipses).

Gravity alone holds us to the Earth's surface and explains the phenomena of the tides.

Compare and contrast the contributions of Copernicus and Galileo. (H)
Diagram the relative position of the sun, the moon, and the Earth during tides.
Examine the effect of the sun and moon on tides.

Seasons result from variations in the amount of the sun's energy hitting the surface, due to the tilt of the Earth's rotation on its axis and the length of the day.

Analyze how the parallel rays of the sun effect the temperature of Earth and produce different amounts of heating on Earth's surface.
Diagram how the tilt of Earth's axis affects the seasons and the length of day.
Relate the seasons to the tilt of the Earth and the angle of the sun's rays.

Gravity is the force that keeps planets in orbit around the sun and governs the rest of the motion in the solar system.

Examine the role of gravity in keeping the components of the solar system in orbit.
Describe the relationship among gravity, distance and mass on orbiting bodies.

Unit of Study: Earth Processes

Structure of the Earth System: The solid Earth is layered with a lithosphere; hot, convecting asthenosphere within the mantle; and dense metallic core.

Describe how seismic wave velocities support the existence of a layered Earth.
Explain the relative position, density, and composition of Earth's crust, mantle, and core.
Differentiate among composition, density, and location of continental crust and oceanic crust.
Identify the lithosphere as comprised of crust and upper mantle.
Identify the asthenosphere as the hot convecting mantle below the lithosphere.
Compare the physical nature of the lithosphere (brittle and rigid) with the asthenosphere (plastic and flowing).
Examine how the lithosphere responds to tectonic forces (faulting and folding).

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, those new rocks may be brought to the surface by the forces that drive plate motions, and the rock cycle continues.

Identify and classify minerals that form rocks and explain how recrystallization of these minerals can take place.
Distinguish minerals by their physical properties with a dichotomous key.
Identify and classify common rock types based on physical characteristics (such as minerals present, grain size, banding or layering, presence of organic material).
Compare and contrast intrusive and extrusive igneous rocks; clastic and chemical sedimentary rocks; and foliated and nonfoliated metamorphic rocks.
Explain how igneous, metamorphic, and sedimentary rocks are related in a rock cycle.

Major geologic events such as earthquakes, volcanic eruptions, and mountain building result from lithospheric plate motions. Landforms and sea-floor features are the result of a combination of constructive (crustal deformation, volcanic eruptions, deposition of sediment) and destructive (weathering, erosion) processes.

Illustrate and summarize what causes a volcano to erupt.
Compare and contrast how volcanoes are formed at mid ocean ridges, within intra-plate regions, at island arcs, and along some continental edges.
Examine how earthquakes result from forces inside Earth (tension, shearing, and compression).

Compare and contrast the three major types of seismic waves (primary, secondary, and surface waves).
Identify and investigate longitudinal and transverse waves.
Describe how the seismograph measures seismic activity (size and type of wave).(T)
Demonstrate how an earthquake's epicenter is located by using seismic wave information.
Explain the hazards that earthquakes pose to structures. (P)
Identify ways architectural engineers design and construct buildings in earthquake prone areas (e.g., buildings use shock absorbers and are designed to bend). (T)

Relate the occurrence of earthquakes and volcanoes to lithospheric plate boundaries using seismic data.

Compare and contrast constructive and destructive forces in volcanic and folded mountain building.
Identify and interpret geological features using imagery (aerial photography and satellite) and topographic maps. (T)
Describe the geologic history of South Carolina including the formation of the major landform regions (Blue Ridge, Piedmont, Sandhills, Coastal Plains and Coastal Zone) according to the geologic time scale.
Explain the modern distribution of continents to the movement of lithospheric plates since the formation of Pangaea.

Lithospheric plates on the scales of continents and oceans move at rates of centimeters per year in response to movement in the asthenosphere.

Explain how plate tectonics accounts for the motion of lithospheric plates and the break-up of Pangaea.
Compare and contrast the characteristics and interactions of the three types of plate boundaries (divergent, convergent, and transform plate boundaries).
Explain how the age of rocks and magnetic data on opposite sides of a divergent boundary are used to estimate the rates at which plates move.
Explain how paleoclimate evidence of fossil records supports the theory of plate tectonics.
Infer how subduction supports the theory of plate tectonics
Examine how the movement of a lithospheric plate over a hot spot formed the Hawaiian Islands.