## Geology Curriculum

The Georgia Performance Standards are designed to provide students with the knowledge and skills for proficiency in science. The Project 2061's *Benchmarks for Science Literacy* is used as the core of the curriculum to determine appropriate content and process skills for students. The GPS is also aligned to the National Research Council's *National Science Education Standards*. Technology is infused into the curriculum. The relationship between science, our environment, and our everyday world is crucial to each student's success and should be emphasized.

The performance standards should drive instruction. Hands-on, student-centered, and inquiry-based approaches should be the emphasis of instruction. This curriculum is intended as a required curriculum that would show proficiency in science, and instruction should extend beyond the curriculum to meet the student needs.

The hands-on nature of the science curriculum standards increases the need for teachers to use appropriate precautions in the laboratory and field. The guidelines for the safe use, storage, and disposal of chemicals must be observed. Safety of the student should always be foremost in science instruction.

Science consists of a way of thinking and investigating, and includes a growing body of knowledge about the natural world. To become literate in science, therefore, students need to acquire understandings of both the **Characteristics of Science** and its **Content**. The Georgia Performance Standards for Science require that instruction be organized so that these are treated together. Therefore, **A CONTENT STANDARD IS NOT MET UNLESS APPLICABLE CHARACTERISTICS OF SCIENCE ARE ALSO ADDRESSED AT THE SAME TIME.** For this reason they are presented as co-requisites.

An explanation of the coding of the science GPS is attached.

This Performance Standards document includes four major components. They are:

**The Standards for Georgia Science Courses.** The Characteristics of Science co-requisite standards are listed first followed by the Content co-requisite standards. Each Standard is followed by elements that indicate the specific learning goals associated with it.

**Tasks that students should be able to perform during or by the end of the course.** These tasks are keyed to the relevant Standards. Some of these can serve as activities that will help students achieve the learning goals of the Standard while others can be used to assess student learning. Many of these tasks can serve both purposes.

**Samples of student work.** As a way of indicating what it takes to meet a Standard, examples of successful student work are provided. Many of these illustrate how student work can bridge the Content and Characteristics of Science Standards. The Georgia DOE Standards web site will continue to add samples as they are identified and teachers are encouraged to submit examples from their own classroom experiences.

**Teacher Commentary.** Teacher commentary is meant to open the pathways of communication between students and the classroom teacher. Showing students why they did or did not meet a standard enables them to take ownership of their own learning.

Georgia Performance Science Standards-- Explanation of Coding

## Characteristics of Science Standards

**SKCS1**
**S**cience **K**indergarten **C**haracteristics of **S**cience Standard #**1**

**S8CS2**
**S**cience Grade **8** **C**haracteristics of **S**cience Standard #**2**

**SCSh8**
**S**cience **C**haracteristics of **S**cience **h**igh school Standard #**8**

## Content Standards

**S5P3**
**S**cience Grade **5** **P**hysical Science Standard #**3**

**S4E2**
**S**cience Grade **4** **E**arth Science Standard #**2**

**S7L4**
**S**cience Grade **7** **L**ife Science Standard #**4**

**SC1**
**S**cience **C**hemistry Standard #**1**

**SB4**
**S**cience **B**iology Standard #**4**

**SPS6**
**S**cience **P**hysical **S**cience Standard #**6**

**SP3**
**S**cience **P**hysics Standard #**3**

**SAST2**
**S**cience **AST**ronomy **S**tandard #**2**

**SG3**
**S**cience **G**eology Standard #**3**

## Geology

The Geology course is designed to lead the student toward a successful understanding of introductory Geologic science. Geology can serve students who have both science and non-science emphasis in their course work. The goal of this course is to provide students with a basic understanding of geology, geologic processes and how geology impacts our society. The curriculum investigates the Earth's formation, Earth materials and processes, available and important resources, changing landscapes and climate, catastrophic events, and society's attempt to deal with our ever changing world. Students can make real-world connections by examining our role in the solar system, man's effect upon our mineral and rock resources, seismic events, landforms and how a changing climate has the ability to alter life as we know it, thus applying their knowledge to these real-world situations.

# Co-Requisite – Characteristics of Science

## Habits of Mind

**SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.**

a. Exhibit the above traits in their own scientific activities.
b. Recognize that different explanations often can be given for the same evidence.
c. Explain that further understanding of scientific problems relies on the design and execution of new experiments which may reinforce or weaken opposing explanations.

**SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.**

a. Follow correct procedures for use of scientific apparatus.
b. Demonstrate appropriate technique in all laboratory situations.
c. Follow correct protocol for identifying and reporting safety problems and violations.

**SCSh3. Students will identify and investigate problems scientifically.**

a. Suggest reasonable hypotheses for identified problems.
b. Develop procedures for solving scientific problems.
c. Collect, organize and record appropriate data.
d. Graphically compare and analyze data points and/or summary statistics.
e. Develop reasonable conclusions based on data collected.
f. Evaluate whether conclusions are reasonable by reviewing the process and checking against other available information.

**SCSh4. Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.**

a. Develop and use systematic procedures for recording and organizing information.
b. Use technology to produce tables and graphs.
c. Use technology to develop, test, and revise experimental or mathematical models.

**SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.**

a. Trace the source on any large disparity between estimated and calculated answers to problems.
b. Consider possible effects of measurement errors on calculations.
c. Recognize the relationship between accuracy and precision.
d. Express appropriate numbers of significant figures for calculated data, using scientific notation where appropriate.
e. Solve scientific problems by substituting quantitative values, using dimensional analysis and/or simple algebraic formulas as appropriate.

**SCSh6. Students will communicate scientific investigations and information clearly.**

a. Write clear, coherent laboratory reports related to scientific investigations.
b. Write clear, coherent accounts of current scientific issues, including possible alternative interpretations of the data.
c. Use data as evidence to support scientific arguments and claims in written or oral presentations.
d. Participate in group discussions of scientific investigation and current scientific issues.

## The Nature of Science

**SCSh7. Students analyze how scientific knowledge is developed.**

Students recognize that:

a. The universe is a vast single system in which the basic principles are the same everywhere.
b. Universal principles are discovered through observation and experimental verification.
c. From time to time, major shifts occur in the scientific view of how the world works. More often, however, the changes that take place in the body of scientific knowledge are small modifications of prior knowledge. Major shifts in scientific views typically occur after the observation of a new phenomenon or an insightful interpretation of existing data by an individual or research group.
d. Hypotheses often cause scientists to develop new experiments that produce additional data.
e. Testing, revising, and occasionally rejecting new and old theories never ends.

**SCSh8. Students will understand important features of the process of scientific inquiry.**
Students will apply the following to inquiry learning practices:

a. Scientific investigators control the conditions of their experiments in order to produce valuable data.
b. Scientific researchers are expected to critically assess the quality of data including possible sources of bias in their investigations' hypotheses, observations, data analyses, and interpretations.
c. Scientists use practices such as peer review and publication to reinforce the integrity of scientific activity and reporting.
d. The merit of a new theory is judged by how well scientific data are explained by the new theory.
e. The ultimate goal of science is to develop an understanding of the natural universe which is free of biases.
f. Science disciplines and traditions differ from one another in what is studied, techniques used, and outcomes sought.

**Reading Standard Comment**
After the elementary years, students are seriously engaged in reading for learning. This process sweeps across all disciplinary domains, extending even to the area of personal learning. Students encounter a variety of informational as well as fictional texts, and they experience text in all genres and modes of discourse. In the study of various disciplines of learning (language arts, mathematics, science, social studies), students must learn through reading the communities of discourse of each of those disciplines. Each subject has its own specific vocabulary, and for students to excel in all subjects, they must learn the specific vocabulary of those subject areas *in context.*

Beginning with the middle grades years, students begin to self-select reading materials based on personal interests established through classroom learning. Students become curious about science, mathematics, history, and literature as they form contexts for those subjects related to their personal and classroom experiences. As students explore academic areas through reading, they develop favorite subjects and become confident in their verbal discourse about those subjects.

Reading across curriculum content develops both academic and personal interests in students. As students read, they develop both content and contextual vocabulary. They also build good habits for reading, researching, and learning. The Reading Across the Curriculum standard focuses on the academic and personal skills students acquire as they read in all areas of learning.

**SCSh9. Students will enhance reading in all curriculum areas by:**

a. Reading in all curriculum areas
- Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas.
- Read both informational and fictional texts in a variety of genres and modes of discourse.
- Read technical texts related to various subject areas.

b. Discussing books
- Discuss messages and themes from books in all subject areas.
- Respond to a variety of texts in multiple modes of discourse.
- Relate messages and themes from one subject area to messages and themes in another area.
- Evaluate the merit of texts in every subject discipline.
- Examine author's purpose in writing.
- Recognize the features of disciplinary texts.

c. Building vocabulary knowledge
- Demonstrate an understanding of contextual vocabulary in various subjects.
- Use content vocabulary in writing and speaking.
- Explore understanding of new words found in subject area texts.

d. Establishing context
- Explore life experiences related to subject area content.

- Discuss in both writing and speaking how certain words are subject area related.
- Determine strategies for finding content and contextual meaning for unknown words.

# Co- Requisite -Content

**SG1. Students will interpret the geologic history of the Earth.**

a. Describe the formation and evolution of the Earth including the lithosphere, hydrosphere, and atmosphere as driven by internal/external energy sources (i.e. solar, radioactive, gravitational).
b. Use fossils, radiometric dating and stratigraphic relationships and geologic maps (e.g. cross cutting, superposition, uniformitarianism) to interpret Earth's history.
c. Explain how catastrophic and long-term events have impacted the evolution of life on Earth.
d. Relate the geologic history of Georgia to that of surrounding regions.

**SG2. Students will interpret the geologic conditions and processes that form different rocks and minerals.**

a. Describe how minerals form under diverse geological conditions.
b. Distinguish between the processes that form plutonic (intrusive) and volcanic (extrusive) igneous rocks of differing compositions, including magmatic differentiation.
c. Differentiate between processes that form various types of sedimentary rocks.
d. Interpret the changes in common sedimentary and igneous rocks under a variety of metamorphic conditions.

**SG3. Students will investigate the evidence for plate tectonics; evaluate the importance of Earth's internal processes and assess the relationship between plate tectonic boundary type and certain disasters such as earthquakes and volcanic eruptions.**

a. Analyze the mechanisms that drive plate motion, the different types of plate boundaries, and how boundary type relates to mountain building, earthquakes, volcanism, and features such as island arcs, hot spots, and mid ocean ridges.
b. Compare and contrast folded, fault-block, and volcanic mountains and analyze their relationship to plate tectonic setting.
c. Analyze cross-sectional diagrams to differentiate between types of folds and faults and the landforms they produce.
d. Classify volcanoes, using their interior/exterior features, magma composition and their plate tectonic settings and assess current volcanic hazards in the United States.

e. Research current technology that improves our ability to predict natural disasters and mitigate their effects.
f. Evaluate the differences in seismic activity at plate margins versus mid-plate areas and assess the degree of seismic risk in different parts of the United States including Georgia.

**SG4. Students will evaluate how climate systems affect landforms on the surface of the Earth.**

a. Analyze the effects of climate on weathering processes and soil formation.
b. Characterize the geologic processes and resulting landforms of desert and glacial areas.
c. Distinguish specific landforms and geologic features on topographic maps.
d. Examine the features of various coastal systems in different areas; erosion and depositional features, barrier islands, coastal management, and tides as an energy resource.
e. Investigate the characteristics, geologic processes, and human impacts associated with surface and groundwater as a natural resource in Georgia.
f. Discuss how changes in greenhouse gases have affected Earth's climate history.

**SG5. Students will apply geologic knowledge to the use of resources in the Earth and the control of human impacts on Earth's systems.**

a. Investigate the geologic origin, distribution, limitations, and economic importance of mineral resources, including those obtained in Georgia.
b. Compare and contrast the types and origins of gemstones and their occurrence in Georgia.
c. Research current controversies regarding the extraction and use of geologic resources (e.g. causes of global warming, drilling for oil, safety and environmental impact of mining).
d. Compare and contrast the impacts of using energy resources obtained from the Earth, with those of energy alternatives.