

## Grade 9-12 Science Standards

### BODY OF KNOWLEDGE: NATURE OF SCIENCE

#### Standard 1: The Practice of Science

A: Scientific inquiry is a multifaceted activity; The processes of science include the formulation of scientifically investigable questions, construction of investigations into those questions, the collection of appropriate data, the evaluation of the meaning of those data, and the communication of this evaluation.

B: The processes of science frequently do not correspond to the traditional portrayal of "the scientific method."

C: Scientific argumentation is a necessary part of scientific inquiry and plays an important role in the generation and validation of scientific knowledge.

D: Scientific knowledge is based on observation and inference; it is important to recognize that these are very different things. Not only does science require creativity in its methods and processes, but also in its questions and explanations.

BENCHMARK CODE	BENCHMARK
SC.912.N.1.1	<p>Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:</p> <ol style="list-style-type: none"> <li>1. pose questions about the natural world,</li> <li>2. conduct systematic observations,</li> <li>3. examine books and other sources of information to see what is already known,</li> <li>4. review what is known in light of empirical evidence,</li> <li>5. plan investigations,</li> <li>6. use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),</li> <li>7. pose answers, explanations, or descriptions of events,</li> <li>8. generate explanations that explicate or describe natural phenomena (inferences),</li> <li>9. use appropriate evidence and reasoning to justify these explanations to others,</li> <li>10. communicate results of scientific investigations, and</li> <li>11. evaluate the merits of the explanations produced by others.</li> </ol> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>
SC.912.N.1.2	<p>Describe and explain what characterizes science and its methods.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>
SC.912.N.1.3	<p>Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i></p>

SC.912.N.1.4	Identify sources of information and assess their reliability according to the strict standards of scientific investigation.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.N.1.5	Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.  <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
SC.912.N.1.6	Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.  <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
SC.912.N.1.7	Recognize the role of creativity in constructing scientific questions, methods and explanations.  <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>

## Standard 2: The Characteristics of Scientific Knowledge

A: Scientific knowledge is based on empirical evidence, and is appropriate for understanding the natural world, but it provides only a limited understanding of the supernatural, aesthetic, or other ways of knowing, such as art, philosophy, or religion.

B: Scientific knowledge is durable and robust, but open to change.

C: Because science is based on empirical evidence it strives for objectivity, but as it is a human endeavor the processes, methods, and knowledge of science include subjectivity, as well as creativity and discovery.

BENCHMARK CODE	BENCHMARK
SC.912.N.2.1	Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science).  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.N.2.2	Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.N.2.3	Identify examples of pseudoscience (such as astrology, phrenology) in society.  <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
SC.912.N.2.4	Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.N.2.5	Describe instances in which scientists' varied backgrounds, talents, interests, and goals influence the inferences and thus the explanations that they make about observations of natural phenomena and describe that competing interpretations (explanations) of scientists are a strength of science as they are a source of new, testable ideas that have the potential to add new evidence to support one or another of the explanations.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

### Standard 3: The Role of Theories, Laws, Hypotheses, and Models

The terms that describe examples of scientific knowledge, for example: "theory," "law," "hypothesis" and "model" have very specific meanings and functions within science.

BENCHMARK CODE	BENCHMARK
SC.912.N.3.1	Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.N.3.2	Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science.  <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
SC.912.N.3.3	Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships.  <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
SC.912.N.3.4	Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.  <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
SC.912.N.3.5	Describe the function of models in science, and identify the wide range of models used in science.  <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

### Standard 4: Science and Society

As tomorrow's citizens, students should be able to identify issues about which society could provide input, formulate scientifically investigable questions about those issues, construct investigations of their questions, collect and evaluate data from their investigations, and develop scientific recommendations based upon their findings.

BENCHMARK CODE	BENCHMARK
SC.912.N.4.1	Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.  <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
SC.912.N.4.2	Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

## BODY OF KNOWLEDGE: EARTH AND SPACE SCIENCE

### Standard 5: Earth in Space and Time

The origin and eventual fate of the Universe still remains one of the greatest questions in science. Gravity and energy influence the development and life cycles of galaxies, including our own Milky Way Galaxy, stars, the planetary systems, Earth, and residual material left from the formation of the Solar System. Humankind's need to explore continues to lead to the development of knowledge and understanding of the nature of the Universe.

BENCHMARK CODE	BENCHMARK
SC.912.E.5.1	Cite evidence used to develop and verify the scientific theory of the Big Bang (also known as the Big Bang Theory) of the origin of the universe.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.E.5.2	Identify patterns in the organization and distribution of matter in the universe and the forces that determine them.  <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
SC.912.E.5.3	Describe and predict how the initial mass of a star determines its evolution.  <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
SC.912.E.5.4	Explain the physical properties of the Sun and its dynamic nature and connect them to conditions and events on Earth.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.E.5.5	Explain the formation of planetary systems based on our knowledge of our Solar System and apply this knowledge to newly discovered planetary systems.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.E.5.6	Develop logical connections through physical principles, including Kepler's and Newton's Laws about the relationships and the effects of Earth, Moon, and Sun on each other.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.E.5.7	Relate the history of and explain the justification for future space exploration and continuing technology development.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.E.5.8	Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed observational tools.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.E.5.9	Analyze the broad effects of space exploration on the economy and culture of Florida.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.E.5.10	Describe and apply the coordinate system used to locate objects in the sky.  <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
SC.912.E.5.11	Distinguish the various methods of measuring astronomical distances and apply each in appropriate situations.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

## Standard 6: Earth Structures

The scientific theory of plate tectonics provides the framework for much of modern geology. Over geologic time, internal and external sources of energy have continuously altered the features of Earth by means of both constructive and destructive forces. All life, including human civilization, is dependent on Earth's internal and external energy and material resources.

BENCHMARK CODE	BENCHMARK
SC.912.E.6.1	Describe and differentiate the layers of Earth and the interactions among them. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
SC.912.E.6.2	Connect surface features to surface processes that are responsible for their formation. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
SC.912.E.6.3	Analyze the scientific theory of plate tectonics and identify related major processes and features as a result of moving plates. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.E.6.4	Analyze how specific geologic processes and features are expressed in Florida and elsewhere. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.E.6.5	Describe the geologic development of the present day oceans and identify commonly found features. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
SC.912.E.6.6	Analyze past, present, and potential future consequences to the environment resulting from various energy production technologies. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

## Standard 7: Earth Systems and Patterns

The scientific theory of the evolution of Earth states that changes in our planet are driven by the flow of energy and the cycling of matter through dynamic interactions among the atmosphere, hydrosphere, cryosphere, geosphere, and biosphere, and the resources used to sustain human civilization on Earth.

BENCHMARK CODE	BENCHMARK
SC.912.E.7.1	Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.E.7.2	Analyze the causes of the various kinds of surface and deep water motion within the oceans and their impacts on the transfer of energy between the poles and the equator. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.E.7.3	Differentiate and describe the various interactions among Earth systems, including: atmosphere, hydrosphere, cryosphere, geosphere, and biosphere. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

SC.912.E.7.4	Summarize the conditions that contribute to the climate of a geographic area, including the relationships to lakes and oceans.  <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
SC.912.E.7.5	Predict future weather conditions based on present observations and conceptual models and recognize limitations and uncertainties of such predictions.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.E.7.6	Relate the formation of severe weather to the various physical factors.  <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
SC.912.E.7.7	Identify, analyze, and relate the internal (Earth system) and external (astronomical) conditions that contribute to global climate change.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.E.7.8	Explain how various atmospheric, oceanic, and hydrologic conditions in Florida have influenced and can influence human behavior, both individually and collectively.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
SC.912.E.7.9	Cite evidence that the ocean has had a significant influence on climate change by absorbing, storing, and moving heat, carbon, and water.  <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>