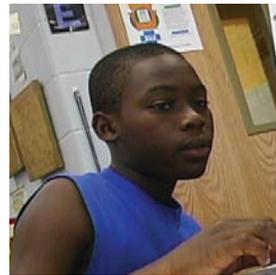
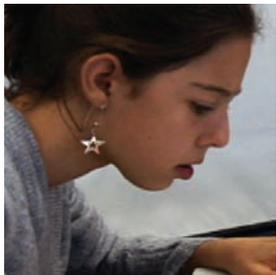


SCIENCE

FLORIDA



Sunshine State Standards



# Table of Contents

## Overview

|  |    |
|--|----|
| History.....   | 6  |
| A Commitment to Excellence.....  | 6  |
| Science Standards Revision Process.....                                | 8  |
| Access Points for Students for Significant Cognitive Disabilities..... | 9  |
| Structure of Standards Documents.....                                  | 9  |
| Acknowledgements.....  | 10 |
| Science Standards Framers Committee.....                               | 10 |
| National Experts Who Presented Research to the Framers.....            | 11 |
| Science Standards Writing Committee.....                               | 11 |
| Science Access Point Writing Team.....                                 | 13 |
| Science Standards Expert Review Panelists.....                         | 15 |
| Other Reviewers.....   | 16 |

## K-8 Science Standards

|   |           |
|---|-----------|
| <b>Definitions/Codes .....</b>                                      | <b>17</b> |
| <b>Grade K.....</b>   | <b>19</b> |
| Big Idea 1 – The Practice of Science.....                           | 19        |
| Big Idea 5 – Earth in Space and Time.....                           | 19        |
| Big Idea 8 – Properties of Matter.....                              | 20        |
| Big Idea 9 – Changes in Matter.....                                 | 20        |
| Big Idea 10 – Forms of Energy.....                                  | 20        |
| Big Idea 12 – Motion of Objects.....                                | 20        |
| Big Idea 13 – Forces and Changes in Motion.....                     | 20        |
| Big Idea 14 – Organization and Development of Living Organisms..... | 21        |
| <b>Grade 1.....</b>   | <b>22</b> |
| Big Idea 1 – The Practice of Science.....                           | 22        |
| Big Idea 5 – Earth in Space and Time.....                           | 22        |
| Big Idea 6 – Earth Structure.....                                   | 22        |
| Big Idea 8 – Properties of Matter.....                              | 23        |
| Big Idea 12 – Motion of Objects.....                                | 23        |
| Big Idea 13 – Forces and Changes in Motion.....                     | 23        |
| Big Idea 14 – Organization and Development of Living Organisms..... | 23        |
| Big Idea 16 – Heredity and Reproduction.....                        | 24        |
| Big Idea 17 – Interdependence.....                                  | 24        |

**Grade 2..... 25**

Big Idea 1 – The Practice of Science..... 25  
Big Idea 6 – Earth Structures..... 25  
Big Idea 7 – Earth Systems and Patterns..... 25  
Big Idea 8 – Properties of Matter..... 26  
Big Idea 9 – Changes in Matter..... 26  
Big Idea 10 – Forms of Energy..... 26  
Big Idea 13 – Forces and Changes in Motion..... 27  
Big Idea 14 – Organization and Development of Living Organisms..... 27  
Big Idea 16 – Heredity and Reproduction..... 27  
Big Idea 17 – Interdependence..... 27

**Grade 3..... 28**

Big Idea 1 – The Practice of Science..... 28  
Big Idea 3 – The Role of Theories, Laws, Hypotheses, and Models..... 28  
Big Idea 5 – Earth in Space and Time..... 29  
Big Idea 6 – Earth Structures..... 29  
Big Idea 8 – Properties of Matter..... 29  
Big Idea 9 – Changes in Matter..... 30  
Big Idea 10 – Forms of Energy..... 30  
Big Idea 11 – Energy Transfer and Transformations..... 30  
Big Idea 14 – Organization and Development of Living Organisms..... 30  
Big Idea 15 – Diversity and Evolution of Living Organisms..... 30  
Big Idea 17 – Interdependence..... 31

**Grade 4..... 32**

Big Idea 1 – The Practice of Science..... 32  
Big Idea 2 – The Characteristics of Scientific Knowledge..... 32  
Big Idea 3 – The Role of Theories, Laws, Hypotheses, and Models..... 33  
Big Idea 5 – Earth in Space and Time..... 33  
Big Idea 6 – Earth Structures..... 33  
Big Idea 8 – Properties of Matter..... 34  
Big Idea 9 – Changes in Matter..... 34  
Big Idea 10 – Forms of Energy..... 34  
Big Idea 11 – Energy Transfer and Transformations..... 35  
Big Idea 12 – Motion of Objects..... 35  
Big Idea 16 – Heredity and Reproduction..... 35  
Big Idea 17 – Interdependence..... 35

**Grade 5..... 37**

Big Idea 1 – The Practice of Science..... 37  
Big Idea 2 – The Characteristics of Scientific Knowledge..... 37

|   |    |
|---|----|
| Big Idea 5 – Earth in Space and Time.....                           | 38 |
| Big Idea 7 – Earth Systems and Patterns.....                        | 38 |
| Big Idea 8 – Properties of Matter.....                              | 38 |
| Big Idea 9 – Changes in Matter.....                                 | 39 |
| Big Idea 10 – Forms of Energy.....                                  | 39 |
| Big Idea 11 – Energy Transfer and Transformations.....              | 39 |
| Big Idea 13 – Forces and Changes in Motion.....                     | 40 |
| Big Idea 14 – Organization and Development of Living Organisms..... | 40 |
| Big Idea 15 – Diversity and Evolution of Living Organisms.....      | 40 |
| Big Idea 17 – Interdependence.....                                  | 41 |

**Grade 6..... 42**

|  |    |
|--|----|
| Big Idea 1 – The Practice of Science.....                            | 42 |
| Big Idea 2 – The Characteristics of Scientific Knowledge.....        | 42 |
| Big Idea 3 – The Role of Theories, Laws, Hypotheses, and Models..... | 43 |
| Big Idea 6 – Earth Structures.....                                   | 43 |
| Big Idea 7 – Earth Systems and Patterns.....                         | 43 |
| Big Idea 11 – Energy Transfer and Transformations.....               | 44 |
| Big Idea 12 – Motion of Objects.....                                 | 44 |
| Big Idea 13 – Forces and Changes in Motion.....                      | 44 |
| Big Idea 14 – Organization and Development of Living Organisms.....  | 44 |
| Big Idea 15 – Diversity and Evolution of Living Organisms.....       | 45 |

**Grade 7..... 46**

|  |    |
|--|----|
| Big Idea 1 – The Practice of Science.....                            | 46 |
| Big Idea 2 – The Characteristics of Scientific Knowledge.....        | 46 |
| Big Idea 3 – The Role of Theories, Laws, Hypotheses, and Models..... | 47 |
| Big Idea 6 – Earth Structures.....                                   | 47 |
| Big Idea 10 – Forms of Energy.....                                   | 47 |
| Big Idea 11 – Energy Transfer and Transformations.....               | 48 |
| Big Idea 15 – Diversity and Evolution of Living Organisms.....       | 48 |
| Big Idea 16 – Heredity and Reproduction.....                         | 48 |
| Big Idea 17 – Interdependence.....                                   | 49 |

**Grade 8..... 50**

|  |    |
|--|----|
| Big Idea 1 – The Practice of Science.....                            | 50 |
| Big Idea 2 – The Characteristics of Scientific Knowledge.....        | 50 |
| Big Idea 3 – The Role of Theories, Laws, Hypotheses, and Models..... | 51 |
| Big Idea 4 – Science and Society.....                                | 51 |
| Big Idea 5 – Earth in Space and Time.....                            | 51 |
| Big Idea 8 – Properties of Matter.....                               | 52 |
| Big Idea 9 – Changes in Matter.....                                  | 53 |
| Big Idea 18 – Matter and Energy Transformations.....                 | 53 |

## **9-12 Science Standards: Bodies of Knowledge**

|  |           |
|--|-----------|
| <b>Introduction.....</b>   | <b>54</b> |
| <b>Nature of Science.....</b>  | <b>55</b> |
| Standard 1 – The Practice of Science.....                            | 55        |
| Standard 2 – The Characteristics of Scientific Knowledge.....        | 56        |
| Standard 3 – The Role of Theories, Laws, Hypotheses, and Models..... | 56        |
| Standard 4 – Science and Society.....                                | 57        |
| <b>Earth and Space Science.....</b>                                  | <b>58</b> |
| Standard 5 – Earth in Space and Time.....                            | 58        |
| Standard 6 – Earth Structures.....                                   | 59        |
| Standard 7 – Earth Systems and Patterns.....                         | 59        |
| <b>Physical Science.....</b>   | <b>60</b> |
| Standard 8 – Matter.....   | 60        |
| Standard 10 – Energy.....  | 61        |
| Standard 12 – Motion.....  | 63        |
| <b>Life Science.....</b>   | <b>64</b> |
| Standard 14 – Organization and Development of Living Organisms.....  | 64        |
| Standard 15 – Diversity and Evolution of Living Organisms.....       | 68        |
| Standard 16 – Heredity and Reproduction.....                         | 69        |
| Standard 17 – Interdependence.....                                   | 70        |
| Standard 18 – Matter and Energy Transformations.....                 | 72        |

# Overview

# Sunshine State Standards: Science

## History

The Sunshine State Standards were first approved by the State Board of Education in 1996 as a means of identifying academic expectations for student achievement in Florida. These original standards were written in several subject areas and were divided into four separate grade clusters (PreK-2, 3-5, 6-8, 9-12). This format was chosen to provide flexibility to school districts in designing curriculum based on local needs.

As Florida moved toward greater accountability for student achievement at each grade level, the Sunshine State Standards were further defined with specific “Grade Level Expectations” added over time. As time went on, two realities appeared that magnified the need to increase the level of rigor, coherence, and clarity in Florida’s academic standards. First, it was recognized that the level of rigor in the 1996 standards was inadequate to address the increased levels of achievement attained by our students. Second, ample evidence from both national and international measures of student achievement indicated the urgent need for higher levels of challenge for all students. This could not occur without a serious effort to increase the level of rigor and expectations across the board for all Florida students.

The Department of Education recognized the need for a systematic approach to review and revise all of the academic standards, and on January 17, 2006, the State Board of Education adopted a six-year cycle that set forth a schedule for the regular review and revision of all K-12 content standards. This action went beyond increasing the rigor of the standards; it included this alignment of the new standards with assessments, instructional materials, professional development, and teacher licensure exams. This way, the new standards and their higher levels of rigor will be fully integrated into the entire culture of K-12 instruction. This move sets the stage for higher levels of rigor and higher academic achievement for years to come.

## A Commitment to Excellence

In 2006, the Florida legislature boldly stated its commitment to higher and more challenging standards for Florida’s children by passing HB 7087. Florida law now reads:

*§1001.03(1) ...The state board shall establish a schedule to facilitate the periodic review of the standards to ensure adequate rigor, relevance, logical student progression, and integration of reading, writing, and mathematics across all subject areas.*

This is a commitment that is shared by educators across Florida, as evidenced by the overwhelming level of public feedback for this revision process. Our goal is to move forward with confidence and a sense of purpose as we begin implementing these revised rigorous science content standards.

Many people were involved in the review and revision of the science standards. We extend our thanks to all of the educators and members of the public for their active interest in this important work. We look forward to continuing to work with all stakeholders as partners in implementing these higher expectations for all Florida students.

Dr. Eric J. Smith  
Commissioner of Education

## Science Standards Revision Process

In May 2007, the Office of Mathematics and Science convened a committee of framers to consider the framework for the revision of the Sunshine State Standards for science content. Taking into account research in science and science education, a major goal of the revision of the Sunshine State Standards was to strive for consensus among content experts, educational experts, researchers, parents, teachers, and members of the business and workforce community.

Experts in national and international science curriculum provided their analyses of the 1996 Sunshine State Standards for science benchmarks and grade level expectations to the framers. These experts also presented research on the content standards used by other states and countries that lead the world in student achievement for science. There was agreement by all reviewers that Florida's standards fit the description of "a mile wide and an inch deep" and lacked coherence. The content of these presentations can be found online at [www.flstandards.org](http://www.flstandards.org). Combined with their own expertise in science and science education, the framers used the research presented to define the structure and provide recommendations that would become the guiding principles for the writers of the science content standards to follow.

From June 2007 to October 2007, the writers committee met to write the new standards and benchmarks according to the structure set by the framers. This was an iterative process, with the framers reviewing the work and providing comments back to the writers. Responding to calls for clarity, coherence, and minimal redundancy, the number of K-8 grade level expectations was reduced from an average of more than 65 per grade to an average of about 30 benchmarks per grade. High school benchmarks went from a 9-12 grade band in the 1996 standards to specific benchmarks for content in four Bodies of Knowledge: Nature of Science, Life Science, Earth Science, and Physical Science.

From October 2007 to January 2008, the drafts of the standards were provided to the public via online sources and through public forums in various locations around the state. Online reviewers were able to rate the benchmarks and provide comment. Online reviewers provided 262,524 ratings of 480 draft standards and benchmarks. Of these reviewers, 10,017 interested persons completed the visitor profile. These reviewers identified themselves, in descending order of numbers of reviewers, as teachers, parents, other interested persons, district staff, and administrators. Additionally, experts in science and science education provided an in-depth review of the drafts and made comments and proposed revisions.

In January 2008, the benchmarks were revised based on the considerable input from the committees and other reviewers. The names of the framers, speakers, writers, and expert review panelists are included in the Acknowledgment section of this document.

## **Access Points for Students with Significant Cognitive Disabilities**

As part of the revision to the Sunshine State Standards, Access Points for students with significant cognitive disabilities have been developed. These Access Points are expectations written for students with significant cognitive disabilities to access the general education curriculum. Embedded in the Sunshine State Standards, access points reflect the core intent of the standards with reduced levels of complexity. The three levels of complexity include participatory, supported, and independent with the participatory level being the least complex. The new Florida Alternate Assessment will measure achievement on the Access Points.

The Access Points for the Science Sunshine State Standards were developed through the cooperative efforts of writing teams composed of Florida educators and parents under the direction of staff from the Accommodations and Modifications for Students with Disabilities Project, the Accountability and Assessment for Students with Disabilities Project, and the Florida Department of Education

## **Structure of the Standards Documents**

The new world-class Sunshine State Standards for science are organized by grade level for grades K-8 and by Bodies of Knowledge for grades 9-12. This structure was determined by the Framers Committee based on review of the issues presented by experts and research in curriculum standards. The Bodies of Knowledge do not comprise courses. Standards and benchmarks will be used from the various Bodies of Knowledge to write specific science courses at the secondary level.

Several documents were used by the writers in drafting the new science content standards including: 2009 Framework for the Science portion of the National Assessment for Educational Progress (NAEP); the Atlas of Science Literacy from the American Association for the Advancement of Science (AAAS); the Science Benchmarks from Project 2061 of the AAAS; the National Research Council's National Science Education Standards; and Science Curriculum Standards from Massachusetts, Singapore, South Carolina, and Indiana (K-8).

Eighteen Big Ideas thread throughout all grade levels and build in rigor and depth as students advance. Each grade level includes benchmarks from the four Bodies of Knowledge (Nature of Science, Life Science, Earth Science, and Physical Science).

With people from many aspects of the education, business, and research communities involved with writing, reviewing, and revising the science content standards, this 2008 revision is truly the work of Florida stakeholders. The Office of Mathematics and Science is incredibly grateful for the intensity of the work that was performed in writing these content standards.

Mary Jane Tappen  
Executive Director, Florida Department of Education's Office of Mathematics and Science

## Acknowledgments

The Office of Mathematics and Science gratefully acknowledges the cooperation and assistance received from individuals and groups throughout Florida during this revision process. Without such cooperation, these revisions would not have been possible.

We would like to express special thanks to the many local educators, parents, and business people who participated in the current revision process by serving on curriculum committees and reacting to draft documents, as well as those who took the time to review and rate the drafts online. These people include, but are not limited to, the following:

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# FLORIDA SCIENCE STANDARDS

## K-8 GRADE-LEVEL STANDARDS

### Big Ideas

The revised science standards include big ideas that flow throughout all grade levels and build in rigor as students move to higher grade levels. The eighteen big ideas used throughout this document are organized as follows:

#### Body of Knowledge: The Nature of Science

Big Idea 1: The Practice of Science

Big Idea 2: The Characteristics of Scientific Knowledge

Big Idea 3: The Role of Theories, Laws, Hypotheses, and Models

Big Idea 4: Science and Society

#### Body of Knowledge: Earth and Space Science

Big Idea 5: Earth in Space in Time

Big Idea 6: Earth Structures

Big Idea 7: Earth Systems and Patterns

#### Body of Knowledge: Physical Science

Big Idea 8: Properties of Matter

Big Idea 9: Changes in Matter

Big Idea 10: Forms of Energy

Big Idea 11: Energy Transfer and Transformations

Big Idea 12: Motion of Objects

Big Idea 13: Forces and Changes in Motion

#### Body of Knowledge: Life Science

Big Idea 14: Organization and Development of Living Organisms

Big Idea 15: Diversity and Evolution of Living Organisms

Big Idea 16: Heredity and Reproduction

Big Idea 17: Interdependence

Big Idea 18: Matter and Energy Transformations

The numbering for the big ideas is consistent throughout the document. Not all big ideas are addressed at each grade level, so the numbering scheme is not consecutive for each grade level.

## Benchmark Coding Scheme

|            |             |                   |           |           |
|------------|-------------|-------------------|-----------|-----------|
| <b>SC.</b> | <b>5.</b>   | <b>N.</b>         | <b>1.</b> | <b>1</b>  |
| Subject    | Grade Level | Body of Knowledge | Big Idea  | Benchmark |

Body of Knowledge Key:

N ~ Nature of Science

E ~ Earth and Space Science

P ~ Physical Science

L ~ Life Science

## GRADE: K

### Big Idea 1:

**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.K.N.1.1     | Collaborate with a partner to collect information.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |
| SC.K.N.1.2     | Make observations of the natural world and know that they are descriptors collected using the five senses.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.K.N.1.3     | Keep records as appropriate -- such as pictorial records -- of investigations conducted.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                   |
| SC.K.N.1.4     | Observe and create a visual representation of an object which includes its major features.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                     |
| SC.K.N.1.5     | Recognize that learning can come from careful observation.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

**Big Idea 5: Humans continue to explore Earth's place in space. Gravity and energy influence the formation of galaxies, including our own Milky Way Galaxy, stars, the Solar System, and Earth. Humankind's need to explore continues to lead to the development of knowledge and understanding of our Solar System.**

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.K.E.5.1     | Explore the Law of Gravity by investigating how objects are pulled toward the ground unless something holds them up.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.K.E.5.2     | Recognize the repeating pattern of day and night.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.K.E.5.3     | Recognize that the Sun can only be seen in the daytime.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.K.E.5.4     | Observe that sometimes the Moon can be seen at night and sometimes during the day.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                                   |
| SC.K.E.5.5     | Observe that things can be big and things can be small as seen from Earth.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.K.E.5.6     | Observe that some objects are far away and some are nearby as seen from Earth.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |

**Big Idea 8:**

A. All objects and substances in the world are made of matter. Matter has two fundamental properties: matter takes up space and matter has mass.

B. Objects and substances can be classified by their physical and chemical properties.

Mass is the amount of matter (or "stuff") in an object. Weight, on the other hand, is the measure of force of attraction (gravitational force) between an object and Earth.

The concepts of mass and weight are complicated and potentially confusing to elementary students. Hence, the more familiar term of "weight" is recommended for use to stand for both mass and weight in grades K-5. By grades 6-8, students are expected to understand the distinction between mass and weight, and use them appropriately.

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.K.P.8.1     | Sort objects by observable properties, such as size, shape, color, temperature (hot or cold), weight (heavy or light) and texture.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 9:**

A. Matter can undergo a variety of changes.

B. Matter can be changed physically or chemically.

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.K.P.9.1     | Recognize that the shape of materials such as paper and clay can be changed by cutting, tearing, crumpling, smashing, or rolling.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |

**Big Idea 10:**

A. Energy is involved in all physical processes and is a unifying concept in many areas of science.

B. Energy exists in many forms and has the ability to do work or cause a change.

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.K.P.10.1    | Observe that things that make sound vibrate.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |

**Big Idea 12:**

A. Motion is a key characteristic of all matter that can be observed, described, and measured.

B. The motion of objects can be changed by forces.

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.K.P.12.1    | Investigate that things move in different ways, such as fast, slow, etc.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |

**Big Idea 13:**

A. It takes energy to change the motion of objects.

B. Energy change is understood in terms of forces--pushes or pulls.

C. Some forces act through physical contact, while others act at a distance.

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.K.P.13.1    | Observe that a push or a pull can change the way an object is moving.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |

**Big Idea 14:**

**A. All plants and animals, including humans, are alike in some ways and different in others.**

**B. All plants and animals, including humans, have internal parts and external structures that function to keep them alive and help them grow and reproduce.**

**C. Humans can better understand the natural world through careful observation.**

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.K.L.14.1    | Recognize the five senses and related body parts.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.K.L.14.2    | Recognize that some books and other media portray animals and plants with characteristics and behaviors they do not have in real life.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.K.L.14.3    | Observe plants and animals, describe how they are alike and how they are different in the way they look and in the things they do.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>     |

# GRADE: 1

## Big Idea 1:

**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.1.N.1.1     | Raise questions about the natural world, investigate them in teams through free exploration, and generate appropriate explanations based on those explorations.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                                  |
| SC.1.N.1.2     | Using the five senses as tools, make careful observations, describe objects in terms of number, shape, texture, size, weight, color, and motion, and compare their observations with others.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.1.N.1.3     | Keep records as appropriate - such as pictorial and written records - of investigations conducted.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.1.N.1.4     | Ask "how do you know?" in appropriate situations.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |

**Big Idea 5: Humans continue to explore Earth's place in space. Gravity and energy influence the formation of galaxies, including our own Milky Way Galaxy, stars, the Solar System, and Earth. Humankind's need to explore continues to lead to the development of knowledge and understanding of our Solar System.**

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.1.E.5.1     | Observe and discuss that there are more stars in the sky than anyone can easily count and that they are not scattered evenly in the sky.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                 |
| SC.1.E.5.2     | Explore the Law of Gravity by demonstrating that Earth's gravity pulls any object on or near Earth toward it even though nothing is touching the object.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.1.E.5.3     | Investigate how magnifiers make things appear bigger and help people see things they could not see without them.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.1.E.5.4     | Identify the beneficial and harmful properties of the Sun.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

**Big Idea 6: Humans continue to explore the composition and structure of the surface of the Earth. 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 water and natural resources.**

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.1.E.6.1     | Recognize that water, rocks, soil, and living organisms are found on Earth's surface.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |
| SC.1.E.6.2     | Describe the need for water and how to be safe around water.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                      |
| SC.1.E.6.3     | Recognize that some things in the world around us happen fast and some happen slowly.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |

**Big Idea 8:**

A. All objects and substances in the world are made of matter. Matter has two fundamental properties: matter takes up space and matter has mass.

B. Objects and substances can be classified by their physical and chemical properties. Mass is the amount of matter (or "stuff") in an object. Weight, on the other hand, is the measure of force of attraction (gravitational force) between an object and Earth.

The concepts of mass and weight are complicated and potentially confusing to elementary students. Hence, the more familiar term of "weight" is recommended for use to stand for both mass and weight in grades K-5. By grades 6-8, students are expected to understand the distinction between mass and weight, and use them appropriately.

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.1.P.8.1     | Sort objects by observable properties, such as size, shape, color, temperature (hot or cold), weight (heavy or light), texture, and whether objects sink or float.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 12:**

A. Motion is a key characteristic of all matter that can be observed, described, and measured.

B. The motion of objects can be changed by forces.

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.1.P.12.1    | Demonstrate and describe the various ways that objects can move, such as in a straight line, zigzag, back-and-forth, round-and-round, fast, and slow.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 13:**

A. It takes energy to change the motion of objects.

B. Energy change is understood in terms of forces--pushes or pulls.

C. Some forces act through physical contact, while others act at a distance.

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.1.P.13.1    | Demonstrate that the way to change the motion of an object is by applying a push or a pull.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 14:**

A. All plants and animals, including humans, are alike in some ways and different in others.

B. All plants and animals, including humans, have internal parts and external structures that function to keep them alive and help them grow and reproduce.

C. Humans can better understand the natural world through careful observation.

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.1.L.14.1    | Make observations of living things and their environment using the five senses.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |
| SC.1.L.14.2    | Identify the major parts of plants, including stem, roots, leaves, and flowers.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |
| SC.1.L.14.3    | Differentiate between living and nonliving things.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                             |

**Big Idea 16:**

**A. Offspring of plants and animals are similar to, but not exactly like, their parents or each other.**

**B. Life cycles vary among organisms, but reproduction is a major stage in the life cycle of all organisms.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>  |
|-----------------------|---|
| SC.1.L.16.1           | Make observations that plants and animals closely resemble their parents, but variations exist among individuals within a population.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |

**Big Idea 17:**

**A. Plants and animals, including humans, interact with and depend upon each other and their environment to satisfy their basic needs.**

**B. Both human activities and natural events can have major impacts on the environment.**

**C. Energy flows from the sun through producers to consumers.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>   |
|-----------------------|--|
| SC.1.L.17.1           | Through observation, recognize that all plants and animals, including humans, need the basic necessities of air, water, food, and space.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |

## GRADE: 2

### Big Idea 1:

**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.2.N.1.1     | Raise questions about the natural world, investigate them in teams through free exploration and systematic observations, and generate appropriate explanations based on those explorations.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.2.N.1.2     | Compare the observations made by different groups using the same tools.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.2.N.1.3     | Ask "how do you know?" in appropriate situations and attempt reasonable answers when asked the same question by others.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.2.N.1.4     | Explain how particular scientific investigations should yield similar conclusions when repeated.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| SC.2.N.1.5     | Distinguish between empirical observation (what you see, hear, feel, smell, or taste) and ideas or inferences (what you think).<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.2.N.1.6     | Explain how scientists alone or in groups are always investigating new ways to solve problems.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |

**Big Idea 6: Humans continue to explore the composition and structure of the surface of Earth. 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 water and natural resources.**

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.2.E.6.1     | Recognize that Earth is made up of rocks. Rocks come in many sizes and shapes.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.2.E.6.2     | Describe how small pieces of rock and dead plant and animal parts can be the basis of soil and explain the process by which soil is formed.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>    |
| SC.2.E.6.3     | Classify soil types based on color, texture (size of particles), the ability to retain water, and the ability to support the growth of plants.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |

**Big Idea 7: Humans continue to explore the interactions among water, air, and land. Air and water are in constant motion that results in changing conditions that can be observed over time.**

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.2.E.7.1     | Compare and describe changing patterns in nature that repeat themselves, such as weather conditions including temperature and precipitation, day to day and season to season.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.2.E.7.2     | Investigate by observing and measuring, that the Sun's energy directly and indirectly warms the water, land, and air.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |

|            |   |
|------------|---|
| SC.2.E.7.3 | Investigate, observe and describe how water left in an open container disappears (evaporates), but water in a closed container does not disappear (evaporate).<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.2.E.7.4 | Investigate that air is all around us and that moving air is wind.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.2.E.7.5 | State the importance of preparing for severe weather, lightning, and other weather related events.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |

**Big Idea 8: A. All objects and substances in the world are made of matter. Matter has two fundamental properties: matter takes up space and matter has mass.**

**B. Objects and substances can be classified by their physical and chemical properties.**

Mass is the amount of matter (or "stuff") in an object. Weight, on the other hand, is the measure of force of attraction (gravitational force) between an object and Earth.

The concepts of mass and weight are complicated and potentially confusing to elementary students. Hence, the more familiar term of "weight" is recommended for use to stand for both mass and weight in grades K-5. By grades 6-8, students are expected to understand the distinction between mass and weight, and use them appropriately.

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.2.P.8.1     | Observe and measure objects in terms of their properties, including size, shape, color, temperature, weight, texture, sinking or floating in water, and attraction and repulsion of magnets.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |
| SC.2.P.8.2     | Identify objects and materials as solid, liquid, or gas.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.2.P.8.3     | Recognize that solids have a definite shape and that liquids and gases take the shape of their container.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |
| SC.2.P.8.4     | Observe and describe water in its solid, liquid, and gaseous states.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.2.P.8.5     | Measure and compare temperatures taken every day at the same time.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.2.P.8.6     | Measure and compare the volume of liquids using containers of various shapes and sizes.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

**Big Idea 9:**

**A. Matter can undergo a variety of changes.**

**B. Matter can be changed physically or chemically.**

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.2.P.9.1     | Investigate that materials can be altered to change some of their properties, but not all materials respond the same way to any one alteration.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |

**Big Idea 10:**

**A. Energy is involved in all physical processes and is a unifying concept in many areas of science.**

**B. Energy exists in many forms and has the ability to do work or cause a change.**

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.2.P.10.1    | Discuss that people use electricity or other forms of energy to cook their food, cool or warm their homes, and power their cars.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |

**Big Idea 13:**

A. It takes energy to change the motion of objects.

B. Energy change is understood in terms of forces--pushes or pulls.

C. Some forces act through physical contact, while others act at a distance.

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.2.P.13.1    | Investigate the effect of applying various pushes and pulls on different objects.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.2.P.13.2    | Demonstrate that magnets can be used to make some things move without touching them.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.2.P.13.3    | Recognize that objects are pulled toward the ground unless something holds them up.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |
| SC.2.P.13.4    | Demonstrate that the greater the force (push or pull) applied to an object, the greater the change in motion of the object.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 14:**

A. All plants and animals, including humans, are alike in some ways and different in others.

B. All plants and animals, including humans, have internal parts and external structures that function to keep them alive and help them grow and reproduce.

C. Humans can better understand the natural world through careful observation.

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.2.L.14.1    | Distinguish human body parts (brain, heart, lungs, stomach, muscles, and skeleton) and their basic functions.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 16:**

A. Offspring of plants and animals are similar to, but not exactly like, their parents or each other.

B. Life cycles vary among organisms, but reproduction is a major stage in the life cycle of all organisms.

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.2.L.16.1    | Observe and describe major stages in the life cycles of plants and animals, including beans and butterflies.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 17:**

A. Plants and animals, including humans, interact with and depend upon each other and their environment to satisfy their basic needs.

B. Both human activities and natural events can have major impacts on the environment.

C. Energy flows from the sun through producers to consumers.

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.2.L.17.1    | Compare and contrast the basic needs that all living things, including humans, have for survival.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                                       |
| SC.2.L.17.2    | Recognize and explain that living things are found all over Earth, but each is only able to live in habitats that meet its basic needs.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

## GRADE: 3

### Big Idea 1:

**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.3.N.1.1     | Raise questions about the natural world, investigate them individually and in teams through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.3.N.1.2     | Compare the observations made by different groups using the same tools and seek reasons to explain the differences across groups.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| SC.3.N.1.3     | Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.3.N.1.4     | Recognize the importance of communication among scientists.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.3.N.1.5     | Recognize that scientists question, discuss, and check each others' evidence and explanations.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.3.N.1.6     | Infer based on observation.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| SC.3.N.1.7     | Explain that empirical evidence is information, such as observations or measurements, that is used to help validate explanations of natural phenomena.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |

**Big Idea 3: 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.3.N.3.1     | Recognize that words in science can have different or more specific meanings than their use in everyday language; for example, energy, cell, heat/cold, and evidence.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.3.N.3.2     | Recognize that scientists use models to help understand and explain how things work.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.3.N.3.3     | Recognize that all models are approximations of natural phenomena; as such, they do not perfectly account for all observations.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                                       |

**Big Idea 5: Humans continue to explore Earth's place in space. Gravity and energy influence the formation of galaxies, including our own Milky Way Galaxy, stars, the Solar System, and Earth. Humankind's need to explore continues to lead to the development of knowledge and understanding of our Solar System.**

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.3.E.5.1     | Explain that stars can be different; some are smaller, some are larger, and some appear brighter than others; all except the Sun are so far away that they look like points of light.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.3.E.5.2     | Identify the Sun as a star that emits energy; some of it in the form of light.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.3.E.5.3     | Recognize that the Sun appears large and bright because it is the closest star to Earth.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| SC.3.E.5.4     | Explore the Law of Gravity by demonstrating that gravity is a force that can be overcome.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.3.E.5.5     | Investigate that the number of stars that can be seen through telescopes is dramatically greater than those seen by the unaided eye.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |

**Big Idea 6: Humans continue to explore the composition and structure of the surface of Earth. 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 water and natural resources.**

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.3.E.6.1     | Demonstrate that radiant energy from the Sun can heat objects and when the Sun is not present, heat may be lost.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |

**Big Idea 8:**

**A. All objects and substances in the world are made of matter. Matter has two fundamental properties: matter takes up space and matter has mass.**

**B. Objects and substances can be classified by their physical and chemical properties. Mass is the amount of matter (or "stuff") in an object. Weight, on the other hand, is the measure of force of attraction (gravitational force) between an object and Earth.**

**The concepts of mass and weight are complicated and potentially confusing to elementary students. Hence, the more familiar term of "weight" is recommended for use to stand for both mass and weight in grades K-5. By grades 6-8, students are expected to understand the distinction between mass and weight, and use them appropriately.**

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.3.P.8.1     | Measure and compare temperatures of various samples of solids and liquids.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                               |
| SC.3.P.8.2     | Measure and compare the mass and volume of solids and liquids.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.3.P.8.3     | Compare materials and objects according to properties such as size, shape, color, texture, and hardness.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 9:**

**A. Matter can undergo a variety of changes.**

**B. Matter can be changed physically or chemically.**

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.3.P.9.1     | Describe the changes water undergoes when it changes state through heating and cooling by using familiar scientific terms such as melting, freezing, boiling, evaporation, and condensation.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 10:****A. Energy is involved in all physical processes and is a unifying concept in many areas of science.****B. Energy exists in many forms and has the ability to do work or cause a change.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>   |
|-----------------------|--|
| SC.3.P.10.1           | Identify some basic forms of energy such as light, heat, sound, electrical, and mechanical.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>                              |
| SC.3.P.10.2           | Recognize that energy has the ability to cause motion or create change.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |
| SC.3.P.10.3           | Demonstrate that light travels in a straight line until it strikes an object or travels from one medium to another.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.3.P.10.4           | Demonstrate that light can be reflected, refracted, and absorbed.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

**Big Idea 11:****A. Waves involve a transfer of energy without a transfer of matter.****B. Water and sound waves transfer energy through a material.****C. Light waves can travel through a vacuum and through matter.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>   |
|-----------------------|--|
| SC.3.P.11.1           | Investigate, observe, and explain that things that give off light often also give off heat.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.3.P.11.2           | Investigate, observe, and explain that heat is produced when one object rubs against another, such as rubbing one's hands together.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |

**Big Idea 14:****A. All plants and animals, including humans, are alike in some ways and different in others.****B. All plants and animals, including humans, have internal parts and external structures that function to keep them alive and help them grow and reproduce.****C. Humans can better understand the natural world through careful observation.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>  |
|-----------------------|---|
| SC.3.L.14.1           | Describe structures in plants and their roles in food production, support, water and nutrient transport, and reproduction.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.3.L.14.2           | Investigate and describe how plants respond to stimuli (heat, light, gravity), such as the way plant stems grow toward light and their roots grow downward in response to gravity.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |

**Big Idea 15:****A. Earth is home to a great diversity of living things, but changes in the environment can affect their survival.****B. Individuals of the same kind often differ in their characteristics and sometimes the differences give individuals an advantage in surviving and reproducing.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>  |
|-----------------------|---|
| SC.3.L.15.1           | Classify animals into major groups (mammals, birds, reptiles, amphibians, fish, arthropods, vertebrates and invertebrates, those having live births and those which lay eggs) according to their physical characteristics and behaviors.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

|             |  |
|-------------|--|
| SC.3.L.15.2 | Classify flowering and nonflowering plants into major groups such as those that produce seeds, or those like ferns and mosses that produce spores, according to their physical characteristics.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
|-------------|--|

**Big Idea 17:**

**A. Plants and animals, including humans, interact with and depend upon each other and their environment to satisfy their basic needs.**

**B. Both human activities and natural events can have major impacts on the environment.**

**C. Energy flows from the sun through producers to consumers.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>  |
|-----------------------|---|
| SC.3.L.17.1           | Describe how animals and plants respond to changing seasons.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                     |
| SC.3.L.17.2           | Recognize that plants use energy from the Sun, air, and water to make their own food.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |

## GRADE: 4

### Big Idea 1:

**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.4.N.1.1     | Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both individual and team investigations through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.4.N.1.2     | Compare the observations made by different groups using multiple tools and seek reasons to explain the differences across groups.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| SC.4.N.1.3     | Explain that science does not always follow a rigidly defined method ("the scientific method") but that science does involve the use of observations and empirical evidence.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.4.N.1.4     | Attempt reasonable answers to scientific questions and cite evidence in support.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.4.N.1.5     | Compare the methods and results of investigations done by other classmates.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.4.N.1.6     | Keep records that describe observations made, carefully distinguishing actual observations from ideas and inferences about the observations.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.4.N.1.7     | Recognize and explain that scientists base their explanations on evidence.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.4.N.1.8     | Recognize that science involves creativity in designing experiments.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

### Big Idea 2:

**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.4.N.2.1     | Explain that science focuses solely on the natural world.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 3: The terms that describe examples of scientific knowledge, for example; "theory," "law," "hypothesis," and "model" have very specific meanings and functions within science.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>   |
|-----------------------|--|
| SC.4.N.3.1            | <p>Explain that models can be three dimensional, two dimensional, an explanation in your mind, or a computer model.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p> |

**Big Idea 5: Humans continue to explore Earth's place in space. Gravity and energy influence the formation of galaxies, including our own Milky Way Galaxy, stars, the Solar System, and Earth. Humankind's need to explore continues to lead to the development of knowledge and understanding of our Solar System.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>  |
|-----------------------|---|
| SC.4.E.5.1            | <p>Observe that the patterns of stars in the sky stay the same although they appear to shift across the sky nightly, and different stars can be seen in different seasons.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p> |
| SC.4.E.5.2            | <p>Describe the changes in the observable shape of the moon over the course of about a month.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>  |
| SC.4.E.5.3            | <p>Recognize that Earth revolves around the Sun in a year and rotates on its axis in a 24-hour day.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>  |
| SC.4.E.5.4            | <p>Relate that the rotation of Earth (day and night) and apparent movements of the Sun, Moon, and stars are connected.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>   |
| SC.4.E.5.5            | <p>Investigate and report the effects of space research and exploration on the economy and culture of Florida.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>   |

**Big Idea 6: Humans continue to explore the composition and structure of the surface of Earth. 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 water and natural resources.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>  |
|-----------------------|---|
| SC.4.E.6.1            | <p>Identify the three categories of rocks: igneous, (formed from molten rock); sedimentary (pieces of other rocks and fossilized organisms); and metamorphic (formed from heat and pressure).</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i></p>                   |
| SC.4.E.6.2            | <p>Identify the physical properties of common earth-forming minerals, including hardness, color, luster, cleavage, and streak color, and recognize the role of minerals in the formation of rocks.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>         |
| SC.4.E.6.3            | <p>Recognize that humans need resources found on Earth and that these are either renewable or nonrenewable.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>  |
| SC.4.E.6.4            | <p>Describe the basic differences between physical weathering (breaking down of rock by wind, water, ice, temperature change, and plants) and erosion (movement of rock by gravity, wind, water, and ice).</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p> |
| SC.4.E.6.5            | <p>Investigate how technology and tools help to extend the ability of humans to observe very small things and very large things.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>   |
| SC.4.E.6.6            | <p>Identify resources available in Florida (water, phosphate, oil, limestone, silicon, wind, and solar energy).</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i></p>   |

**Big Idea 8:**

A. All objects and substances in the world are made of matter. Matter has two fundamental properties: matter takes up space and matter has mass.

B. Objects and substances can be classified by their physical and chemical properties. Mass is the amount of matter (or "stuff") in an object. Weight, on the other hand, is the measure of force of attraction (gravitational force) between an object and Earth.

The concepts of mass and weight are complicated and potentially confusing to elementary students. Hence, the more familiar term of "weight" is recommended for use to stand for both mass and weight in grades K-5. By grades 6-8, students are expected to understand the distinction between mass and weight, and use them appropriately.

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.4.P.8.1     | Measure and compare objects and materials based on their physical properties including: mass, shape, volume, color, hardness, texture, odor, taste, attraction to magnets.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.4.P.8.2     | Identify properties and common uses of water in each of its states.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.4.P.8.3     | Explore the Law of Conservation of Mass by demonstrating that the mass of a whole object is always the same as the sum of the masses of its parts.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                         |
| SC.4.P.8.4     | Investigate and describe that magnets can attract magnetic materials and attract and repel other magnets.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |

**Big Idea 9:**

A. Matter can undergo a variety of changes.

B. Matter can be changed physically or chemically.

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.4.P.9.1     | Identify some familiar changes in materials that result in other materials with different characteristics, such as decaying animal or plant matter, burning, rusting, and cooking.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |

**Big Idea 10:**

A. Energy is involved in all physical processes and is a unifying concept in many areas of science.

B. Energy exists in many forms and has the ability to do work or cause a change.

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.4.P.10.1    | Observe and describe some basic forms of energy, including light, heat, sound, electrical, and the energy of motion.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>            |
| SC.4.P.10.2    | Investigate and describe that energy has the ability to cause motion or create change.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.4.P.10.3    | Investigate and explain that sound is produced by vibrating objects and that pitch depends on how fast or slow the object vibrates.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.4.P.10.4    | Describe how moving water and air are sources of energy and can be used to move things.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

**Big Idea 11:****A. Waves involve a transfer of energy without a transfer of matter.****B. Water and sound waves transfer energy through a material.****C. Light waves can travel through a vacuum and through matter.**

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.4.P.11.1    | Recognize that heat flows from a hot object to a cold object and that heat flow may cause materials to change temperature.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |
| SC.4.P.11.2    | Identify common materials that conduct heat well or poorly.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |

**Big Idea 12:****A. Motion is a key characteristic of all matter that can be observed, described, and measured.****B. The motion of objects can be changed by forces.**

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.4.P.12.1    | Recognize that an object in motion always changes its position and may change its direction.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |
| SC.4.P.12.2    | Investigate and describe that the speed of an object is determined by the distance it travels in a unit of time and that objects can move at different speeds.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 16:****A. Offspring of plants and animals are similar to, but not exactly like, their parents or each other.****B. Life cycles vary among organisms, but reproduction is a major stage in the life cycle of all organisms.**

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.4.L.16.1    | Identify processes of sexual reproduction in flowering plants, including pollination, fertilization (seed production), seed dispersal, and germination.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.4.L.16.2    | Explain that although characteristics of plants and animals are inherited, some characteristics can be affected by the environment.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.4.L.16.3    | Recognize that animal behaviors may be shaped by heredity and learning.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.4.L.16.4    | Compare and contrast the major stages in the life cycles of Florida plants and animals, such as those that undergo incomplete and complete metamorphosis, and flowering and nonflowering seed-bearing plants.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 17:****A. Plants and animals, including humans, interact with and depend upon each other and their environment to satisfy their basic needs.****B. Both human activities and natural events can have major impacts on the environment.****C. Energy flows from the sun through producers to consumers.**

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.4.L.17.1    | Compare the seasonal changes in Florida plants and animals to those in other regions of the country.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.4.L.17.2    | Explain that animals, including humans, cannot make their own food and that when animals eat plants or other animals, the energy stored in the food source is passed to them.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

|             |  |
|-------------|--|
| SC.4.L.17.3 | Trace the flow of energy from the Sun as it is transferred along the food chain through the producers to the consumers.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.4.L.17.4 | Recognize ways plants and animals, including humans, can impact the environment.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |

## GRADE: 5

### Big Idea 1:

**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.5.N.1.1     | Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.5.N.1.2     | Explain the difference between an experiment and other types of scientific investigation.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.5.N.1.3     | Recognize and explain the need for repeated experimental trials.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.5.N.1.4     | Identify a control group and explain its importance in an experiment.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.5.N.1.5     | Recognize and explain that authentic scientific investigation frequently does not parallel the steps of "the scientific method."<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.5.N.1.6     | Recognize and explain the difference between personal opinion/interpretation and verified observation.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |

### Big Idea 2:

**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.5.N.2.1     | Recognize and explain that science is grounded in empirical observations that are testable; explanation must always be linked with evidence.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>             |
| SC.5.N.2.2     | Recognize and explain that when scientific investigations are carried out, the evidence produced by those investigations should be replicable by others.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 5: Humans continue to explore Earth's place in space. Gravity and energy influence the formation of galaxies, including our own Milky Way Galaxy, stars, the Solar System, and Earth. Humankind's need to explore continues to lead to the development of knowledge and understanding of our Solar System.**

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.5.E.5.1     | Recognize that a galaxy consists of gas, dust, and many stars, including any objects orbiting the stars. Identify our home galaxy as the Milky Way.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |
| SC.5.E.5.2     | Recognize the major common characteristics of all planets and compare/contrast the properties of inner and outer planets.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                      |
| SC.5.E.5.3     | Distinguish among the following objects of the Solar System -- Sun, planets, moons, asteroids, comets -- and identify Earth's position in it.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>      |

**Big Idea 7: Humans continue to explore the interactions among water, air, and land. Air and water are in constant motion that results in changing conditions that can be observed over time.**

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.5.E.7.1     | Create a model to explain the parts of the water cycle. Water can be a gas, a liquid, or a solid and can go back and forth from one state to another.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                         |
| SC.5.E.7.2     | Recognize that the ocean is an integral part of the water cycle and is connected to all of Earth's water reservoirs via evaporation and precipitation processes.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>          |
| SC.5.E.7.3     | Recognize how air temperature, barometric pressure, humidity, wind speed and direction, and precipitation determine the weather in a particular place and time.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>           |
| SC.5.E.7.4     | Distinguish among the various forms of precipitation (rain, snow, sleet, and hail), making connections to the weather in a particular place and time.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                         |
| SC.5.E.7.5     | Recognize that some of the weather-related differences, such as temperature and humidity, are found among different environments, such as swamps, deserts, and mountains.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.5.E.7.6     | Describe characteristics (temperature and precipitation) of different climate zones as they relate to latitude, elevation, and proximity to bodies of water.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                  |
| SC.5.E.7.7     | Design a family preparedness plan for natural disasters and identify the reasons for having such a plan.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |

**Big Idea 8:**

**A. All objects and substances in the world are made of matter. Matter has two fundamental properties: matter takes up space and matter has mass.**

**B. Objects and substances can be classified by their physical and chemical properties. Mass is the amount of matter (or "stuff") in an object. Weight, on the other hand, is the measure of force of attraction (gravitational force) between an object and Earth.**

**The concepts of mass and weight are complicated and potentially confusing to elementary students. Hence, the more familiar term of "weight" is recommended for use to stand for both mass and weight in grades K-5. By grades 6-8, students are expected to understand the distinction between mass and weight, and use them appropriately.**

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.5.P.8.1     | Compare and contrast the basic properties of solids, liquids, and gases, such as mass, volume, color, texture, and temperature.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

|            |   |
|------------|---|
| SC.5.P.8.2 | Investigate and identify materials that will dissolve in water and those that will not and identify the conditions that will speed up or slow down the dissolving process.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>       |
| SC.5.P.8.3 | Demonstrate and explain that mixtures of solids can be separated based on observable properties of their parts such as particle size, shape, color, and magnetic attraction.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.5.P.8.4 | Explore the scientific theory of atoms (also called atomic theory) by recognizing that all matter is composed of parts that are too small to be seen without magnification.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>       |

**Big Idea 9:**

**A. Matter can undergo a variety of changes.**

**B. Matter can be changed physically or chemically.**

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.5.P.9.1     | Investigate and describe that many physical and chemical changes are affected by temperature.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |

**Big Idea 10:**

**A. Energy is involved in all physical processes and is a unifying concept in many areas of science.**

**B. Energy exists in many forms and has the ability to do work or cause a change.**

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.5.P.10.1    | Investigate and describe some basic forms of energy, including light, heat, sound, electrical, chemical, and mechanical.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.5.P.10.2    | Investigate and explain that energy has the ability to cause motion or create change.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.5.P.10.3    | Investigate and explain that an electrically-charged object can attract an uncharged object and can either attract or repel another charged object without any contact between the objects.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.5.P.10.4    | Investigate and explain that electrical energy can be transformed into heat, light, and sound energy, as well as the energy of motion.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |

**Big Idea 11:**

**A. Waves involve a transfer of energy without a transfer of matter.**

**B. Water and sound waves transfer energy through a material.**

**C. Light waves can travel through a vacuum and through matter.**

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.5.P.11.1    | Investigate and illustrate the fact that the flow of electricity requires a closed circuit (a complete loop).<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.5.P.11.2    | Identify and classify materials that conduct electricity and materials that do not.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                           |

**Big Idea 13:****A. It takes energy to change the motion of objects.****B. Energy change is understood in terms of forces--pushes or pulls.****C. Some forces act through physical contact, while others act at a distance.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>  |
|-----------------------|---|
| SC.5.P.13.1           | Identify familiar forces that cause objects to move, such as pushes or pulls, including gravity acting on falling objects.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |
| SC.5.P.13.2           | Investigate and describe that the greater the force applied to it, the greater the change in motion of a given object.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.5.P.13.3           | Investigate and describe that the more mass an object has, the less effect a given force will have on the object's motion.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.5.P.13.4           | Investigate and explain that when a force is applied to an object but it does not move, it is because another opposing force is being applied by something in the environment so that the forces are balanced.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |

**Big Idea 14:****A. All plants and animals, including humans, are alike in some ways and different in others.****B. All plants and animals, including humans, have internal parts and external structures that function to keep them alive and help them grow and reproduce.****C. Humans can better understand the natural world through careful observation.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>   |
|-----------------------|--|
| SC.5.L.14.1           | Identify the organs in the human body and describe their functions, including the skin, brain, heart, lungs, stomach, liver, intestines, pancreas, muscles and skeleton, reproductive organs, kidneys, bladder, and sensory organs.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.5.L.14.2           | Compare and contrast the function of organs and other physical structures of plants and animals, including humans, for example: some animals have skeletons for support -- some with internal skeletons others with exoskeletons -- while some plants have stems for support.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 15:****A. Earth is home to a great diversity of living things, but changes in the environment can affect their survival.****B. Individuals of the same kind often differ in their characteristics and sometimes the differences give individuals an advantage in surviving and reproducing.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>   |
|-----------------------|--|
| SC.5.L.15.1           | Describe how, when the environment changes, differences between individuals allow some plants and animals to survive and reproduce while others die or move to new locations.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |

**Big Idea 17:**

**A. Plants and animals, including humans, interact with and depend upon each other and their environment to satisfy their basic needs.**

**B. Both human activities and natural events can have major impacts on the environment.**

**C. Energy flows from the sun through producers to consumers.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>   |
|-----------------------|--|
| SC.5.L.17.1           | Compare and contrast adaptations displayed by animals and plants that enable them to survive in different environments such as life cycles variations, animal behaviors and physical characteristics.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

## GRADE: 6

### Big Idea 1:

**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.6.N.1.1     | Define a problem from the sixth grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.6.N.1.2     | Explain why scientific investigations should be replicable.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| SC.6.N.1.3     | Explain the difference between an experiment and other types of scientific investigation, and explain the relative benefits and limitations of each.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.6.N.1.4     | Discuss, compare, and negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.6.N.1.5     | Recognize that science involves creativity, not just in designing experiments, but also in creating explanations that fit evidence.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |

### Big Idea 2:

**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.6.N.2.1     | Distinguish science from other activities involving thought.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.6.N.2.2     | Explain that scientific knowledge is durable because it is open to change as new evidence or interpretations are encountered.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                            |
| SC.6.N.2.3     | Recognize that scientists who make contributions to scientific knowledge come from all kinds of backgrounds and possess varied talents, interests, and goals.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |

**Big Idea 3: The terms that describe examples of scientific knowledge, for example; "theory," "law," "hypothesis," and "model" have very specific meanings and functions within science.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>  |
|-----------------------|---|
| SC.6.N.3.1            | Recognize and explain that a scientific theory is a well-supported and widely accepted explanation of nature and is not simply a claim posed by an individual. Thus, the use of the term theory in science is very different than how it is used in everyday life.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.6.N.3.2            | Recognize and explain that a scientific law is a description of a specific relationship under given conditions in the natural world. Thus, scientific laws are different from societal laws.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.6.N.3.3            | Give several examples of scientific laws.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.6.N.3.4            | Identify the role of models in the context of the sixth grade science benchmarks.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |

**Big Idea 6: 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.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>   |
|-----------------------|--|
| SC.6.E.6.1            | Describe and give examples of ways in which Earth's surface is built up and torn down by physical and chemical weathering, erosion, and deposition.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.6.E.6.2            | Recognize that there are a variety of different landforms on Earth's surface such as coastlines, dunes, rivers, mountains, glaciers, deltas, and lakes and relate these landforms as they apply to Florida.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 7: 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.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>   |
|-----------------------|--|
| SC.6.E.7.1            | Differentiate among radiation, conduction, and convection, the three mechanisms by which heat is transferred through Earth's system.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.6.E.7.2            | Investigate and apply how the cycling of water between the atmosphere and hydrosphere has an effect on weather patterns and climate.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| SC.6.E.7.3            | Describe how global patterns such as the jet stream and ocean currents influence local weather in measurable terms such as temperature, air pressure, wind direction and speed, and humidity and precipitation.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.6.E.7.4            | Differentiate and show interactions among the geosphere, hydrosphere, cryosphere, atmosphere, and biosphere.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| SC.6.E.7.5            | Explain how energy provided by the sun influences global patterns of atmospheric movement and the temperature differences between air, water, and land.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.6.E.7.6            | Differentiate between weather and climate.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.6.E.7.7            | Investigate how natural disasters have affected human life in Florida.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| SC.6.E.7.8            | Describe ways human beings protect themselves from hazardous weather and sun exposure.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |

|  |   |
|--|---|
| SC.6.E.7.9   | Describe how the composition and structure of the atmosphere protects life and insulates the planet.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| <b>Big Idea 11:</b>  |   |
| A. Waves involve a transfer of energy without a transfer of matter.  |   |
| B. Water and sound waves transfer energy through a material.   |   |
| C. Light waves can travel through a vacuum and through matter.   |   |
| D. The Law of Conservation of Energy: Energy is conserved as it transfers from one object to another and from one form to another. |   |
| <b>BENCHMARK CODE</b>  | <b>BENCHMARK</b>  |
| SC.6.P.11.1  | Explore the Law of Conservation of Energy by differentiating between potential and kinetic energy. Identify situations where kinetic energy is transformed into potential energy and vice versa.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| <b>Big Idea 12:</b>  |   |
| A. Motion is a key characteristic of all matter that can be observed, described, and measured.                                     |   |
| B. The motion of objects can be changed by forces.   |   |
| <b>BENCHMARK CODE</b>  | <b>BENCHMARK</b>  |
| SC.6.P.12.1  | Measure and graph distance versus time for an object moving at a constant speed. Interpret this relationship.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| <b>Big Idea 13:</b>  |   |
| A. It takes energy to change the motion of objects.  |   |
| B. Energy change is understood in terms of forces--pushes or pulls.  |   |
| C. Some forces act through physical contact, while others act at a distance.   |   |
| <b>BENCHMARK CODE</b>  | <b>BENCHMARK</b>  |
| SC.6.P.13.1  | Investigate and describe types of forces including contact forces and forces acting at a distance, such as electrical, magnetic, and gravitational.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.6.P.13.2  | Explore the Law of Gravity by recognizing that every object exerts gravitational force on every other object and that the force depends on how much mass the objects have and how far apart they are.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |
| SC.6.P.13.3  | Investigate and describe that an unbalanced force acting on an object changes its speed, or direction of motion, or both.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| <b>Big Idea 14:</b>  |   |
| A. All living things share certain characteristics.  |   |
| B. The scientific theory of cells, also called cell theory, is a fundamental organizing principle of life on Earth.                |   |
| C. Life can be organized in a functional and structural hierarchy.   |   |
| D. Life is maintained by various physiological functions essential for growth, reproduction, and homeostasis.                      |   |
| <b>BENCHMARK CODE</b>  | <b>BENCHMARK</b>  |
| SC.6.L.14.1  | Describe and identify patterns in the hierarchical organization of organisms from atoms to molecules and cells to tissues to organs to organ systems to organisms.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>                                    |

|  |   |
|--|---|
| SC.6.L.14.2  | Investigate and explain the components of the scientific theory of cells (cell theory): all organisms are composed of cells (single-celled or multi-cellular), all cells come from pre-existing cells, and cells are the basic unit of life.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                             |
| SC.6.L.14.3  | Recognize and explore how cells of all organisms undergo similar processes to maintain homeostasis, including extracting energy from food, getting rid of waste, and reproducing.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.6.L.14.4  | Compare and contrast the structure and function of major organelles of plant and animal cells, including cell wall, cell membrane, nucleus, cytoplasm, chloroplasts, mitochondria, and vacuoles.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.6.L.14.5  | Identify and investigate the general functions of the major systems of the human body (digestive, respiratory, circulatory, reproductive, excretory, immune, nervous, and musculoskeletal) and describe ways these systems interact with each other to maintain homeostasis.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.6.L.14.6  | Compare and contrast types of infectious agents that may infect the human body, including viruses, bacteria, fungi, and parasites.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| <b>Big Idea 15:</b>  |   |
| <b>A. The scientific theory of evolution is the organizing principle of life science.</b>    |   |
| <b>B. The scientific theory of evolution is supported by multiple forms of evidence.</b>     |   |
| <b>C. Natural Selection is a primary mechanism leading to change over time in organisms.</b> |   |
| <b>BENCHMARK CODE</b>  | <b>BENCHMARK</b>  |
| SC.6.L.15.1  | Analyze and describe how and why organisms are classified according to shared characteristics with emphasis on the Linnaean system combined with the concept of Domains.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |

## GRADE: 7

### Big Idea 1:

**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.7.N.1.1     | Define a problem from the seventh grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.7.N.1.2     | Differentiate replication (by others) from repetition (multiple trials).<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.7.N.1.3     | Distinguish between an experiment (which must involve the identification and control of variables) and other forms of scientific investigation and explain that not all scientific knowledge is derived from experimentation.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.7.N.1.4     | Identify test variables (independent variables) and outcome variables (dependent variables) in an experiment.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.7.N.1.5     | Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.7.N.1.6     | Explain that empirical evidence is the cumulative body of observations of a natural phenomenon on which scientific explanations are based.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.7.N.1.7     | Explain that scientific knowledge is the result of a great deal of debate and confirmation within the science community.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

### Big Idea 2:

**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.7.N.2.1     | Identify an instance from the history of science in which scientific knowledge has changed when new evidence or new interpretations are encountered.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |

**Big Idea 3: 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.7.N.3.1     | Recognize and explain the difference between theories and laws and give several examples of scientific theories and the evidence that supports them.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.7.N.3.2     | Identify the benefits and limitations of the use of scientific models.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

**Big Idea 6: 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.7.E.6.1     | Describe the layers of the solid Earth, including the lithosphere, the hot convecting mantle, and the dense metallic liquid and solid cores.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.7.E.6.2     | Identify the patterns within the rock cycle and relate them to surface events (weathering and erosion) and sub-surface events (plate tectonics and mountain building).<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.7.E.6.3     | Identify current methods for measuring the age of Earth and its parts, including the law of superposition and radioactive dating.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.7.E.6.4     | Explain and give examples of how physical evidence supports scientific theories that Earth has evolved over geologic time due to natural processes.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| SC.7.E.6.5     | Explore the scientific theory of plate tectonics by describing how the movement of Earth's crustal plates causes both slow and rapid changes in Earth's surface, including volcanic eruptions, earthquakes, and mountain building.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.7.E.6.6     | Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.7.E.6.7     | Recognize that heat flow and movement of material within Earth causes earthquakes and volcanic eruptions, and creates mountains and ocean basins.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |

**Big Idea 10: A. Energy is involved in all physical processes and is a unifying concept in many areas of science. B. Energy exists in many forms and has the ability to do work or cause a change.**

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| SC.7.P.10.1    | Illustrate that the sun's energy arrives as radiation with a wide range of wavelengths, including infrared, visible, and ultraviolet, and that white light is made up of a spectrum of many different colors.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |
| SC.7.P.10.2    | Observe and explain that light can be reflected, refracted, and/or absorbed.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.7.P.10.3    | Recognize that light waves, sound waves, and other waves move at different speeds in different materials.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |

**Big Idea 11:****A. Waves involve a transfer of energy without a transfer of matter.****B. Water and sound waves transfer energy through a material.****C. Light waves can travel through a vacuum and through matter.****D. The Law of Conservation of Energy: Energy is conserved as it transfers from one object to another and from one form to another.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>  |
|-----------------------|---|
| SC.7.P.11.1           | Recognize that adding heat to or removing heat from a system may result in a temperature change and possibly a change of state.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>                 |
| SC.7.P.11.2           | Investigate and describe the transformation of energy from one form to another.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.7.P.11.3           | Cite evidence to explain that energy cannot be created nor destroyed, only changed from one form to another.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                                   |
| SC.7.P.11.4           | Observe and describe that heat flows in predictable ways, moving from warmer objects to cooler ones until they reach the same temperature.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |

**Big Idea 15:****A. The scientific theory of evolution is the organizing principle of life science.****B. The scientific theory of evolution is supported by multiple forms of evidence.****C. Natural Selection is a primary mechanism leading to change over time in organisms.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>   |
|-----------------------|--|
| SC.7.L.15.1           | Recognize that fossil evidence is consistent with the scientific theory of evolution that living things evolved from earlier species.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.7.L.15.2           | Explore the scientific theory of evolution by recognizing and explaining ways in which genetic variation and environmental factors contribute to evolution by natural selection and diversity of organisms.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.7.L.15.3           | Explore the scientific theory of evolution by relating how the inability of a species to adapt within a changing environment may contribute to the extinction of that species.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                              |

**Big Idea 16:****A. Reproduction is characteristic of living things and is essential for the survival of species.****B. Genetic information is passed from generation to generation by DNA; DNA controls the traits of an organism.****C. Changes in the DNA of an organism can cause changes in traits, and manipulation of DNA in organisms has led to genetically modified organisms.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>  |
|-----------------------|---|
| SC.7.L.16.1           | Understand and explain that every organism requires a set of instructions that specifies its traits, that this hereditary information (DNA) contains genes located in the chromosomes of each cell, and that heredity is the passage of these instructions from one generation to another.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.7.L.16.2           | Determine the probabilities for genotype and phenotype combinations using Punnett Squares and pedigrees.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

|             |   |
|-------------|---|
| SC.7.L.16.3 | Compare and contrast the general processes of sexual reproduction requiring meiosis and asexual reproduction requiring mitosis.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                    |
| SC.7.L.16.4 | Recognize and explore the impact of biotechnology (cloning, genetic engineering, artificial selection) on the individual, society and the environment.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |

**Big Idea 17:**

**A. Plants and animals, including humans, interact with and depend upon each other and their environment to satisfy their basic needs.**

**B. Both human activities and natural events can have major impacts on the environment.**

**C. Energy flows from the sun through producers to consumers.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>  |
|-----------------------|---|
| SC.7.L.17.1           | Explain and illustrate the roles of and relationships among producers, consumers, and decomposers in the process of energy transfer in a food web.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.7.L.17.2           | Compare and contrast the relationships among organisms such as mutualism, predation, parasitism, competition, and commensalism.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.7.L.17.3           | Describe and investigate various limiting factors in the local ecosystem and their impact on native populations, including food, shelter, water, space, disease, parasitism, predation, and nesting sites.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |

## GRADE: 8

### Big Idea 1:

**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.8.N.1.1     | Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.8.N.1.2     | Design and conduct a study using repeated trials and replication.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.8.N.1.3     | Use phrases such as "results support" or "fail to support" in science, understanding that science does not offer conclusive 'proof' of a knowledge claim.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.8.N.1.4     | Explain how hypotheses are valuable if they lead to further investigations, even if they turn out not to be supported by the data.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| SC.8.N.1.5     | Analyze the methods used to develop a scientific explanation as seen in different fields of science.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| SC.8.N.1.6     | Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

### Big Idea 2:

**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.8.N.2.1     | Distinguish between scientific and pseudoscientific ideas.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.8.N.2.2     | Discuss what characterizes science and its methods.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>        |

**Big Idea 3: 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.8.N.3.1     | Select models useful in relating the results of their own investigations.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.8.N.3.2     | Explain why theories may be modified but are rarely discarded.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>            |

**Big Idea 4: As tomorrows 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.8.N.4.1     | Explain that science is one of the processes that can be used to inform decision making at the community, state, national, and international levels.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.8.N.4.2     | Explain how political, social, and economic concerns can affect science, and vice versa.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |

**Big Idea 5: The origin and eventual fate of the Universe still remains one of the greatest questions in science. Gravity and energy influence the formation of galaxies, including our own Milky Way Galaxy, stars, the planetary systems, and Earth. 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.8.E.5.1     | Recognize that there are enormous distances between objects in space and apply our knowledge of light and space travel to understand this distance.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.8.E.5.2     | Recognize that the universe contains many billions of galaxies and that each galaxy contains many billions of stars.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.8.E.5.3     | Distinguish the hierarchical relationships between planets and other astronomical bodies relative to solar system, galaxy, and universe, including distance, size, and composition.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| SC.8.E.5.4     | Explore the Law of Universal Gravitation by explaining the role that gravity plays in the formation of planets, stars, and solar systems and in determining their motions.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| SC.8.E.5.5     | Describe and classify specific physical properties of stars: apparent magnitude (brightness), temperature (color), size, and luminosity (absolute brightness).<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.8.E.5.6     | Create models of solar properties including: rotation, structure of the Sun, convection, sunspots, solar flares, and prominences.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |
| SC.8.E.5.7     | Compare and contrast the properties of objects in the Solar System including the Sun, planets, and moons to those of Earth, such as gravitational force, distance from the Sun, speed, movement, temperature, and atmospheric conditions.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.8.E.5.8     | Compare various historical models of the Solar System, including geocentric and heliocentric.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

|             |   |
|-------------|---|
| SC.8.E.5.9  | Explain the impact of objects in space on each other including: 1 )the Sun on the Earth including seasons and gravitational attraction; AND 2) the Moon on the Earth, including phases, tides, and eclipses, and the relative position of each body.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.8.E.5.10 | Assess how technology is essential to science for such purposes as access to outer space and other remote locations, sample collection, measurement, data collection and storage, computation, and communication of information.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                     |
| SC.8.E.5.11 | Identify and compare characteristics of the electromagnetic spectrum such as wavelength, frequency, use, and hazards and recognize its application to an understanding of planetary images and satellite photographs.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                                |
| SC.8.E.5.12 | Summarize the effects of space exploration on the economy and culture of Florida.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |

**Big Idea 8:**

**A. All objects and substances in the world are made of matter. Matter has two fundamental properties: matter takes up space and matter has mass which gives it inertia.**

**B. Objects and substances can be classified by their physical and chemical properties. Mass is the amount of matter (or "stuff") in an object. Weight, on the other hand, is the measure of force of attraction (gravitational force) between an object and Earth.**

The concepts of mass and weight are complicated and potentially confusing to elementary students. Hence, the more familiar term of "weight" is recommended for use to stand for both mass and weight in grades K-5. By grades 6-8, students are expected to understand the distinction between mass and weight, and use them appropriately.

| BENCHMARK CODE | BENCHMARK  |
|----------------|--|
| SC.8.P.8.1     | Explore the scientific theory of atoms (also known as atomic theory) by using models to explain the motion of particles in solids, liquids, and gases.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.8.P.8.2     | Differentiate between weight and mass recognizing that weight is the amount of gravitational pull on an object and is distinct from, though proportional to, mass.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.8.P.8.3     | Explore and describe the densities of various materials through measurement of their masses and volumes.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.8.P.8.4     | Classify and compare substances on the basis of characteristic physical properties that can be demonstrated or measured; for example, density, thermal or electrical conductivity, solubility, magnetic properties, melting and boiling points, and know that these properties are independent of the amount of the sample.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.8.P.8.5     | Recognize that there are a finite number of elements and that their atoms combine in a multitude of ways to produce compounds that make up all of the living and nonliving things that we encounter.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.8.P.8.6     | Recognize that elements are grouped in the periodic table according to similarities of their properties.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.8.P.8.7     | Explore the scientific theory of atoms (also known as atomic theory) by recognizing that atoms are the smallest unit of an element and are composed of sub-atomic particles (electrons surrounding a nucleus containing protons and neutrons).<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.8.P.8.8     | Identify basic examples of and compare and classify the properties of compounds, including acids, bases, and salts.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.8.P.8.9     | Distinguish among mixtures (including solutions) and pure substances.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

**Big Idea 9:**

**A. Matter can undergo a variety of changes.**

**B. When matter is changed physically, generally no changes occur in the structure of the atoms or molecules composing the matter.**

**C. When matter changes chemically, a rearrangement of bonds between the atoms occurs. This results in new substances with new properties.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>   |
|-----------------------|--|
| SC.8.P.9.1            | Explore the Law of Conservation of Mass by demonstrating and concluding that mass is conserved when substances undergo physical and chemical changes.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.8.P.9.2            | Differentiate between physical changes and chemical changes.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.8.P.9.3            | Investigate and describe how temperature influences chemical changes.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |

**Big Idea 18:**

**A. Living things all share basic needs for life.**

**B. Living organisms acquire the energy they need for life processes through various metabolic pathways (photosynthesis and cellular respiration).**

**C. Matter and energy are recycled through cycles such as the carbon cycle.**

| <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>  |
|-----------------------|---|
| SC.8.L.18.1           | Describe and investigate the process of photosynthesis, such as the roles of light, carbon dioxide, water and chlorophyll; production of food; release of oxygen.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>        |
| SC.8.L.18.2           | Describe and investigate how cellular respiration breaks down food to provide energy and releases carbon dioxide.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| SC.8.L.18.3           | Construct a scientific model of the carbon cycle to show how matter and energy are continuously transferred within and between organisms and their physical environment.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| SC.8.L.18.4           | Cite evidence that living systems follow the Laws of Conservation of Mass and Energy.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |

**FLORIDA SCIENCE STANDARDS  
SECONDARY BODIES OF KNOWLEDGE**

These Bodies of Knowledge (BOK) do not represent courses. Courses such as Physics, Chemistry, or Biology will be developed from these standards, and individual courses may have standards from more than one BOK. The \* (sunbursts) denote benchmarks that include content that all students should know and be able to do. These benchmarks are considered to be appropriate for statewide assessment or end of course exams. There are some Florida science courses with curriculum defined by other organizations (such as College Board for Advanced Placement Physics or International Baccalaureate science courses). Access points have been developed for the sunburst benchmarks in the BOK's of Nature of Science, Earth and Space Science, Physical Science, and Life Science.

|            |             |                   |                            |           |
|------------|-------------|-------------------|----------------------------|-----------|
| <b>SC.</b> | <b>912.</b> | <b>E.</b>         | <b>1.</b>                  | <b>1</b>  |
| Subject    | Grade Level | Body of Knowledge | Big Idea / Supporting Idea | Benchmark |

**Body of Knowledge Key:**  
**N ~ Nature of Science**  
**E ~ Earth and Space Science**  
**P ~ Physical Science**  
**L ~ Life Science**

## GRADE 9 - 12

### NATURE OF SCIENCE BODY OF KNOWLEDGE

#### 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: 1. pose questions about the natural world, 2. conduct systematic observations, 3. examine books and other sources of information to see what is already known, 4. review what is known in light of empirical evidence, 5. plan investigations, 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), 7. pose answers, explanations, or descriptions of events, 8. generate explanations that explicate or describe natural phenomena (inferences), 9. use appropriate evidence and reasoning to justify these explanations to others, 10. communicate results of scientific investigations, and 11. evaluate the merits of the explanations produced by others.</p> <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   | <p>Identify sources of information and assess their reliability according to the strict standards of scientific investigation.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>   |
| * | SC.912.N.1.5   | <p>Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>  |
| * | SC.912.N.1.6   | <p>Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>  |
| * | SC.912.N.1.7   | <p>Recognize the role of creativity in constructing scientific questions, methods and explanations.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i></p>   |

## GRADE 9 - 12

### 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).<br><br><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.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| *  | SC.912.N.2.3   | Identify examples of pseudoscience (such as astrology, phrenology) in society.<br><br><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.<br><br><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.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| <b>Standard 3: The Role of Theories, Laws, Hypotheses, and Models</b><br><b>The terms that describe examples of scientific knowledge, for example: "theory," "law," "hypothesis" and "model" have very specific meanings and functions within science.</b> |                |  |
| *  | 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.<br><br><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.<br><br><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.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |

## GRADE 9 - 12

|  |              |  |
|--|--------------|--|
| *  | 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.<br><br><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.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| <p><b>Standard 4: Science and Society</b><br/> <b><i>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.</i></b></p> |              |  |
| *  | SC.912.N.4.1 | Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.<br><br><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.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |

## GRADE 9 - 12

### EARTH AND SPACE SCIENCE BODY OF KNOWLEDGE

#### 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   | <p>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.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>                            |
| * | SC.912.E.5.2   | <p>Identify patterns in the organization and distribution of matter in the universe and the forces that determine them.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>   |
| * | SC.912.E.5.3   | <p>Describe and predict how the initial mass of a star determines its evolution.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>  |
| * | SC.912.E.5.4   | <p>Explain the physical properties of the Sun and its dynamic nature and connect them to conditions and events on Earth.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>  |
| * | SC.912.E.5.5   | <p>Explain the formation of planetary systems based on our knowledge of our Solar System and apply this knowledge to newly discovered planetary systems.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>                        |
| * | SC.912.E.5.6   | <p>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.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p> |
| * | SC.912.E.5.7   | <p>Relate the history of and explain the justification for future space exploration and continuing technology development.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>  |
| * | SC.912.E.5.8   | <p>Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed observational tools.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>   |
| * | SC.912.E.5.9   | <p>Analyze the broad effects of space exploration on the economy and culture of Florida.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>  |
|   | SC.912.E.5.10  | <p>Describe and apply the coordinate system used to locate objects in the sky.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>  |
|   | SC.912.E.5.11  | <p>Distinguish the various methods of measuring astronomical distances and apply each in appropriate situations.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>  |

## GRADE 9 - 12

### 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.<br><br><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.<br><br><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.<br><br><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.<br><br><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.<br><br><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.<br><br><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.<br><br><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.<br><br><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.<br><br><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.<br><br><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.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                    |

## GRADE 9 - 12

|   |              |   |
|---|--------------|---|
| * | SC.912.E.7.6 | Cite evidence that the ocean has had a significant influence on climate change by absorbing, storing, and moving heat, carbon, and water.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                            |
| * | SC.912.E.7.7 | Identify, analyze, and relate the internal (Earth system) and external (astronomical) conditions that contribute to global climate change.<br><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.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| * | SC.912.E.7.9 | Relate the formation of severe weather to the various physical factors.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |

## GRADE 9 - 12

### PHYSICAL SCIENCE BODY OF KNOWLEDGE

**Standard 8: Matter**

**A. A working definition of matter is that it takes up space, has mass, and has measurable properties. Matter is comprised of atomic, subatomic, and elementary particles.**

**B. Electrons are key to defining chemical and some physical properties, reactivity, and molecular structures. Repeating (periodic) patterns of physical and chemical properties occur among elements that define groups of elements with similar properties. The periodic table displays the repeating patterns, which are related to the atom's outermost electrons. Atoms bond with each other to form compounds.**

**C. In a chemical reaction, one or more reactants are transformed into one or more new products. Many factors shape the nature of products and the rates of reaction.**

**D. Carbon-based compounds are building-blocks of known life forms on earth and numerous useful natural and synthetic products.**

|   | BENCHMARK CODE | BENCHMARK   |
|---|----------------|---|
| * | SC.912.P.8.1   | Differentiate among the four states of matter.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| * | SC.912.P.8.2   | Differentiate between physical and chemical properties and physical and chemical changes of matter.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| * | SC.912.P.8.3   | Explore the scientific theory of atoms (also known as atomic theory) by describing changes in the atomic model over time and why those changes were necessitated by experimental evidence.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| * | SC.912.P.8.4   | Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| * | SC.912.P.8.5   | Relate properties of atoms and their position in the periodic table to the arrangement of their electrons.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| * | SC.912.P.8.6   | Distinguish between bonding forces holding compounds together and other attractive forces, including hydrogen bonding and van der Waals forces.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| * | SC.912.P.8.7   | Interpret formula representations of molecules and compounds in terms of composition and structure.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| * | SC.912.P.8.8   | Characterize types of chemical reactions, for example: redox, acid-base, synthesis, and single and double replacement reactions.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| * | SC.912.P.8.9   | Apply the mole concept and the law of conservation of mass to calculate quantities of chemicals participating in reactions.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| * | SC.912.P.8.10  | Describe oxidation-reduction reactions in living and non-living systems.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| * | SC.912.P.8.11  | Identify selected functional groups and relate how they contribute to properties of carbon compounds.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |

|   |               |   |
|---|---------------|---|
| * | SC.912.P.8.12 | Describe the properties of the carbon atom that make the diversity of carbon compounds possible.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| * | SC.912.P.8.13 | Relate acidity and basicity to hydronium and hydroxyl ion concentration and pH.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                  |

**Standard 10: Energy**

**A. Energy is involved in all physical and chemical processes. It is conserved, and can be transformed from one form to another and into work. At the atomic and nuclear levels energy is not continuous but exists in discrete amounts. Energy and mass are related through Einstein's equation  $E=mc^2$ .**

**B. The properties of atomic nuclei are responsible for energy-related phenomena such as radioactivity, fission and fusion.**

**C. Changes in entropy and energy that accompany chemical reactions influence reaction paths. Chemical reactions result in the release or absorption of energy.**

**D. The theory of electromagnetism explains that electricity and magnetism are closely related. Electric charges are the source of electric fields. Moving charges generate magnetic fields. E. Waves are the propagation of a disturbance. They transport energy and momentum but do not transport matter.**

|   | BENCHMARK CODE | BENCHMARK   |
|---|----------------|---|
| * | SC.912.P.10.1  | Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| * | SC.912.P.10.2  | Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| * | SC.912.P.10.3  | Compare and contrast work and power qualitatively and quantitatively.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| * | SC.912.P.10.4  | Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                     |
| * | SC.912.P.10.5  | Relate temperature to the average molecular kinetic energy.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| * | SC.912.P.10.6  | Create and interpret potential energy diagrams, for example: chemical reactions, orbits around a central body, motion of a pendulum.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| * | SC.912.P.10.7  | Distinguish between endothermic and exothermic chemical processes.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
|   | SC.912.P.10.8  | Explain entropy's role in determining the efficiency of processes that convert energy to work.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| * | SC.912.P.10.9  | Describe the quantization of energy at the atomic level.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| * | SC.912.P.10.10 | Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear).<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| * | SC.912.P.10.11 | Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                             |
| * | SC.912.P.10.12 | Differentiate between chemical and nuclear reactions.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |

|  |                       |  |
|--|-----------------------|--|
|  | SC.912.P.10.13        | Relate the configuration of static charges to the electric field, electric force, electric potential, and electric potential energy.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| *  | SC.912.P.10.14        | Differentiate among conductors, semiconductors, and insulators.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| *  | SC.912.P.10.15        | Investigate and explain the relationships among current, voltage, resistance, and power.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| *  | SC.912.P.10.16        | Explain the relationship between moving charges and magnetic fields, as well as changing magnetic fields and electric fields, and their application to modern technologies.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
|  | SC.912.P.10.17        | Explore the theory of electromagnetism by explaining electromagnetic waves in terms of oscillating electric and magnetic fields.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| *  | SC.912.P.10.18        | Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
|  | SC.912.P.10.19        | Explain that all objects emit and absorb electromagnetic radiation and distinguish between objects that are blackbody radiators and those that are not.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| *  | SC.912.P.10.20        | Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| *  | SC.912.P.10.21        | Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
|  | SC.912.P.10.22        | Construct ray diagrams and use thin lens and mirror equations to locate the images formed by lenses and mirrors.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| <b>Standard 12: Motion</b><br><b>A. Motion can be measured and described qualitatively and quantitatively. Net forces create a change in motion. When objects travel at speeds comparable to the speed of light, Einstein's special theory of relativity applies.</b><br><b>B. Momentum is conserved under well-defined conditions. A change in momentum occurs when a net force is applied to an object over a time interval.</b><br><b>C. The Law of Universal Gravitation states that gravitational forces act on all objects irrespective of their size and position.</b><br><b>D. Gases consist of great numbers of molecules moving in all directions. The behavior of gases can be modeled by the kinetic molecular theory.</b><br><b>E. Chemical reaction rates change with conditions under which they occur. Chemical equilibrium is a dynamic state in which forward and reverse processes occur at the same rates.</b> |                       |  |
|  | <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>   |
| *  | SC.912.P.12.1         | Distinguish between scalar and vector quantities and assess which should be used to describe an event.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| *  | SC.912.P.12.2         | Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| *  | SC.912.P.12.3         | Interpret and apply Newton's three laws of motion.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| *  | SC.912.P.12.4         | Describe how the gravitational force between two objects depends on their masses and the distance between them.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

## GRADE 9 - 12

|   |                |  |
|---|----------------|--|
| * | SC.912.P.12.5  | Apply the law of conservation of linear momentum to interactions, such as collisions between objects.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| * | SC.912.P.12.6  | Qualitatively apply the concept of angular momentum.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| * | SC.912.P.12.7  | Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i> |
|   | SC.912.P.12.8  | Recognize that Newton's Laws are a limiting case of Einstein's Special Theory of Relativity at speeds that are much smaller than the speed of light.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>           |
|   | SC.912.P.12.9  | Recognize that time, length, and energy depend on the frame of reference.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |
| * | SC.912.P.12.10 | Interpret the behavior of ideal gases in terms of kinetic molecular theory.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
|   | SC.912.P.12.11 | Describe phase transitions in terms of kinetic molecular theory.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
|   | SC.912.P.12.12 | Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                           |
|   | SC.912.P.12.13 | Explain the concept of dynamic equilibrium in terms of reversible processes occurring at the same rates.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |

## GRADE 9 - 12

### LIFE SCIENCE BODY OF KNOWLEDGE

#### Standard 14: Organization and Development of Living Organisms

**A. Cells have characteristic structures and functions that make them distinctive.**

**B. Processes in a cell can be classified broadly as growth, maintenance, reproduction, and homeostasis.**

**C. Life can be organized in a functional and structural hierarchy ranging from cells to the biosphere.**

**D. Most multicellular organisms are composed of organ systems whose structures reflect their particular function.**

| BENCHMARK CODE | BENCHMARK   |
|----------------|---|
| *              | SC.912.L.14.1<br>Describe the scientific theory of cells (cell theory) and relate the history of its discovery to the process of science.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| *              | SC.912.L.14.2<br>Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| *              | SC.912.L.14.3<br>Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                     |
|                | SC.912.L.14.4<br>Compare and contrast structure and function of various types of microscopes.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| *              | SC.912.L.14.5<br>Explain the evidence supporting the scientific theory of the origin of eukaryotic cells (endosymbiosis).<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| *              | SC.912.L.14.6<br>Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>                 |
| *              | SC.912.L.14.7<br>Relate the major structure of fungi to their functions.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
|                | SC.912.L.14.8<br>Explain alternation of generations in plants.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
|                | SC.912.L.14.9<br>Relate the structure of each of the major plant organs and tissues to physiological processes.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
|                | SC.912.L.14.10<br>Discuss the relationship between the evolution of land plants and their anatomy.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
|                | SC.912.L.14.11<br>Classify and state the defining characteristics of epithelial tissue, connective tissue, muscle tissue, and nervous tissue.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
|                | SC.912.L.14.12<br>Describe the anatomy and histology of bone tissue.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |
|                | SC.912.L.14.13<br>Distinguish between bones of the axial skeleton and the appendicular skeleton.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |
|                | SC.912.L.14.14<br>Identify the major bones of the axial and appendicular skeleton.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |

## GRADE 9 - 12

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|  | SC.912.L.14.15 | Identify major markings (such as foramina, fossae, tubercles, etc.) on a skeleton. Explain why these markings are important.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                      |
|  | SC.912.L.14.16 | Describe the anatomy and histology, including ultrastructure, of muscle tissue.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
|  | SC.912.L.14.17 | List the steps involved in the sliding filament of muscle contraction.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
|  | SC.912.L.14.18 | Describe signal transmission across a myoneural junction.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
|  | SC.912.L.14.19 | Explain the physiology of skeletal muscle.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
|  | SC.912.L.14.20 | Identify the major muscles of the human on a model or diagram.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
|  | SC.912.L.14.21 | Describe the anatomy, histology, and physiology of the central and peripheral nervous systems and name the major divisions of the nervous system.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
|  | SC.912.L.14.22 | Describe the physiology of nerve conduction, including the generator potential, action potential, and the synapse.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                                |
|  | SC.912.L.14.23 | Identify the parts of a reflex arc.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |
|  | SC.912.L.14.24 | Identify the general parts of a synapse and describe the physiology of signal transmission across a synapse.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                                      |
|  | SC.912.L.14.25 | Identify the major parts of a cross section through the spinal cord.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |

## GRADE 9 - 12

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|----------------|--|
| SC.912.L.14.26 | Identify the major parts of the brain on diagrams or models.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.912.L.14.27 | Identify the functions of the major parts of the brain, including the meninges, medulla, pons, midbrain, hypothalamus, thalamus, cerebellum and cerebrum.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>                            |
| SC.912.L.14.28 | Identify the major functions of the spinal cord.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.912.L.14.29 | Define the terms endocrine and exocrine.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
| SC.912.L.14.30 | Compare endocrine and neural controls of physiology.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.912.L.14.31 | Describe the physiology of hormones including the different types and the mechanisms of their action.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.912.L.14.32 | Describe the anatomy and physiology of the endocrine system.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.912.L.14.33 | Describe the basic anatomy and physiology of the reproductive system.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.912.L.14.34 | Describe the composition and physiology of blood, including that of the plasma and the formed elements.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.912.L.14.35 | Describe the steps in hemostasis, including the mechanism of coagulation. Include the basis for blood typing and transfusion reactions.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.912.L.14.36 | Describe the factors affecting blood flow through the cardiovascular system.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.912.L.14.37 | Explain the components of an electrocardiogram.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>  |
| SC.912.L.14.38 | Describe normal heart sounds and what they mean.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.912.L.14.39 | Describe hypertension and some of the factors that produce it.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.912.L.14.40 | Describe the histology of the major arteries and veins of systemic, pulmonary, hepatic portal, and coronary circulation.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.912.L.14.41 | Describe fetal circulation and changes that occur to the circulatory system at birth.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.912.L.14.42 | Describe the anatomy and the physiology of the lymph system.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| SC.912.L.14.43 | Describe the histology of the respiratory system.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| SC.912.L.14.44 | Describe the physiology of the respiratory system including the mechanisms of ventilation, gas exchange, gas transport and the mechanisms that control the rate of ventilation.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| SC.912.L.14.45 | Describe the histology of the alimentary canal and its associated accessory organs.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

## GRADE 9 - 12

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|--|----------------|---|
|  | SC.912.L.14.46 | Describe the physiology of the digestive system, including mechanical digestion, chemical digestion, absorption and the neural and hormonal mechanisms of control.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
|  | SC.912.L.14.47 | Describe the physiology of urine formation by the kidney.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
|  | SC.912.L.14.48 | Describe the anatomy, histology, and physiology of the ureters, the urinary bladder and the urethra.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
|  | SC.912.L.14.49 | Identify the major functions associated with the sympathetic and parasympathetic nervous systems.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
|  | SC.912.L.14.50 | Describe the structure of vertebrate sensory organs. Relate structure to function in vertebrate sensory systems.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
|  | SC.912.L.14.51 | Describe the function of the vertebrate integumentary system.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>   |
|  | SC.912.L.14.52 | Explain the basic functions of the human immune system, including specific and nonspecific immune response, vaccines, and antibiotics.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                             |
|  | SC.912.L.14.53 | Discuss basic classification and characteristics of plants. Identify bryophytes, pteridophytes, gymnosperms, and angiosperms.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                                      |

### Standard 15: Diversity and Evolution of Living Organisms

**A. The scientific theory of evolution is the fundamental concept underlying all of biology.**

**B. The scientific theory of evolution is supported by multiple forms of scientific evidence.**

**C. Organisms are classified based on their evolutionary history.**

**D. Natural selection is a primary mechanism leading to evolutionary change.**

|   | BENCHMARK CODE | BENCHMARK  |
|---|----------------|--|
| * | SC.912.L.15.1  | Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
|   | SC.912.L.15.2  | Discuss the use of molecular clocks to estimate how long ago various groups of organisms diverged evolutionarily from one another.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
|   | SC.912.L.15.3  | Describe how biological diversity is increased by the origin of new species and how it is decreased by the natural process of extinction.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| * | SC.912.L.15.4  | Describe how and why organisms are hierarchically classified and based on evolutionary relationships.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
|   | SC.912.L.15.5  | Explain the reasons for changes in how organisms are classified.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| * | SC.912.L.15.6  | Discuss distinguishing characteristics of the domains and kingdoms of living organisms.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |

## GRADE 9 - 12

|  |                       |   |
|--|-----------------------|---|
|  | SC.912.L.15.7         | Discuss distinguishing characteristics of vertebrate and representative invertebrate phyla, and chordate classes using typical examples.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| *  | SC.912.L.15.8         | Describe the scientific explanations of the origin of life on Earth.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
|  | SC.912.L.15.9         | Explain the role of reproductive isolation in the process of speciation.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| *  | SC.912.L.15.10        | Identify basic trends in hominid evolution from early ancestors six million years ago to modern humans, including brain size, jaw size, language, and manufacture of tools.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
|  | SC.912.L.15.11        | Discuss specific fossil hominids and what they show about human evolution.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
|  | SC.912.L.15.12        | List the conditions for Hardy-Weinberg equilibrium in a population and why these conditions are not likely to appear in nature. Use the Hardy-Weinberg equation to predict genotypes in a population from observed phenotypes.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
| *  | SC.912.L.15.13        | Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle to survive, which result in differential reproductive success.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                       |
| *  | SC.912.L.15.14        | Discuss mechanisms of evolutionary change other than natural selection such as genetic drift and gene flow.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| *  | SC.912.L.15.15        | Describe how mutation and genetic recombination increase genetic variation.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| <b>Standard 16: Heredity and Reproduction</b><br><b>A. DNA stores and transmits genetic information. Genes are sets of instructions encoded in the structure of DNA.</b><br><b>B. Genetic information is passed from generation to generation by DNA in all organisms and accounts for similarities in related individuals.</b><br><b>C. Manipulation of DNA in organisms has led to commercial production of biological molecules on a large scale and genetically modified organisms.</b><br><b>D. Reproduction is characteristic of living things and is essential for the survival of species.</b> |                       |   |
|  | <b>BENCHMARK CODE</b> | <b>BENCHMARK</b>  |
| *  | SC.912.L.16.1         | Use Mendel's laws of segregation and independent assortment to analyze patterns of inheritance.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| *  | SC.912.L.16.2         | Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, codominant, sex-linked, polygenic, and multiple alleles.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
| *  | SC.912.L.16.3         | Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |

## GRADE 9 - 12

|   | BENCHMARK CODE | BENCHMARK  |
|---|----------------|--|
| * | SC.912.L.16.4  | <p>Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>  |
| * | SC.912.L.16.5  | <p>Explain the basic processes of transcription and translation, and how they result in the expression of genes.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>  |
|   | SC.912.L.16.6  | <p>Discuss the mechanisms for regulation of gene expression in prokaryotes and eukaryotes at transcription and translation level.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>   |
|   | SC.912.L.16.7  | <p>Describe how viruses and bacteria transfer genetic material between cells and the role of this process in biotechnology.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>   |
| * | SC.912.L.16.8  | <p>Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>   |
| * | SC.912.L.16.9  | <p>Explain how and why the genetic code is universal and is common to almost all organisms.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>   |
| * | SC.912.L.16.10 | <p>Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>   |
|   | SC.912.L.16.11 | <p>Discuss the technologies associated with forensic medicine and DNA identification, including restriction fragment length polymorphism (RFLP) analysis.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>   |
|   | SC.912.L.16.12 | <p>Describe how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, polymerase chain reaction, ligation, and transformation) is used to construct recombinant DNA molecules (DNA cloning).</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p> |
| * | SC.912.L.16.13 | <p>Describe the basic anatomy and physiology of the human reproductive system. Describe the process of human development from fertilization to birth and major changes that occur in each trimester of pregnancy.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>         |
| * | SC.912.L.16.14 | <p>Describe the cell cycle, including the process of mitosis. Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>                  |
|   | SC.912.L.16.15 | <p>Compare and contrast binary fission and mitotic cell division.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>   |
| * | SC.912.L.16.16 | <p>Describe the process of meiosis, including independent assortment and crossing over. Explain how reduction division results in the formation of haploid gametes or spores.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>   |
| * | SC.912.L.16.17 | <p>Compare and contrast mitosis and meiosis and relate to the processes of sexual and asexual reproduction and their consequences for genetic variation.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>  |

## GRADE 9 - 12

### Standard 17: Interdependence

**A. The distribution and abundance of organisms is determined by the interactions between organisms, and between organisms and the non-living environment.**

**B. Energy and nutrients move within and between biotic and abiotic components of ecosystems via physical, chemical and biological processes.**

**C. Human activities and natural events can have profound effects on populations, biodiversity and ecosystem processes.**

|   | BENCHMARK CODE | BENCHMARK  |
|---|----------------|--|
|   | SC.912.L.17.1  | Discuss the characteristics of populations, such as number of individuals, age structure, density, and pattern of distribution.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| * | SC.912.L.17.2  | Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| * | SC.912.L.17.3  | Discuss how various oceanic and freshwater processes, such as currents, tides, and waves, affect the abundance of aquatic organisms.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| * | SC.912.L.17.4  | Describe changes in ecosystems resulting from seasonal variations, climate change and succession.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| * | SC.912.L.17.5  | Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| * | SC.912.L.17.6  | Compare and contrast the relationships among organisms, including predation, parasitism, competition, commensalism, and mutualism.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
|   | SC.912.L.17.7  | Characterize the biotic and abiotic components that define freshwater systems, marine systems and terrestrial systems.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| * | SC.912.L.17.8  | Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| * | SC.912.L.17.9  | Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
| * | SC.912.L.17.10 | Diagram and explain the biogeochemical cycles of an ecosystem, including water, carbon, and nitrogen cycle.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| * | SC.912.L.17.11 | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests.<br><br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |

## GRADE 9 - 12

|   | BENCHMARK CODE | BENCHMARK   |
|---|----------------|---|
|   | SC.912.L.17.12 | Discuss the political, social, and environmental consequences of sustainable use of land.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
|   | SC.912.L.17.13 | Discuss the need for adequate monitoring of environmental parameters when making policy decisions.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
|   | SC.912.L.17.14 | Assess the need for adequate waste management strategies.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
|   | SC.912.L.17.15 | Discuss the effects of technology on environmental quality.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
|   | SC.912.L.17.16 | Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i> |
|   | SC.912.L.17.17 | Assess the effectiveness of innovative methods of protecting the environment.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>  |
|   | SC.912.L.17.18 | Describe how human population size and resource use relate to environmental quality.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
|   | SC.912.L.17.19 | Describe how different natural resources are produced and how their rates of use and renewal limit availability.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| * | SC.912.L.17.20 | Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |

### Standard 18: Matter and Energy Transformations

**A. All living things are composed of four basic categories of macromolecules and share the same basic needs for life.**

**B. Living organisms acquire the energy they need for life processes through various metabolic pathways (primarily photosynthesis and cellular respiration).**

**C. Chemical reactions in living things follow basic rules of chemistry and are usually regulated by enzymes.**

**D. The unique chemical properties of carbon and water make life on Earth possible.**

|   | BENCHMARK CODE | BENCHMARK  |
|---|----------------|--|
| * | SC.912.L.18.1  | Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
|   | SC.912.L.18.2  | Describe the important structural characteristics of monosaccharides, disaccharides, and polysaccharides and explain the functions of carbohydrates in living things.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
|   | SC.912.L.18.3  | Describe the structures of fatty acids, triglycerides, phospholipids, and steroids. Explain the functions of lipids in living organisms. Identify some reactions that fatty acids undergo. Relate the structure and function of cell membranes.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |
|   | SC.912.L.18.4  | Describe the structures of proteins and amino acids. Explain the functions of proteins in living organisms. Identify some reactions that amino acids undergo. Relate the structure and function of enzymes.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                                     |

## GRADE 9 - 12

|   |                |  |
|---|----------------|--|
|   | SC.912.L.18.5  | Discuss the use of chemiosmotic gradients for ATP production in chloroplasts and mitochondria.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
|   | SC.912.L.18.6  | Discuss the role of anaerobic respiration in living things and in human society.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| * | SC.912.L.18.7  | Identify the reactants, products, and basic functions of photosynthesis.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| * | SC.912.L.18.8  | Identify the reactants, products, and basic functions of aerobic and anaerobic cellular respiration.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>  |
| * | SC.912.L.18.9  | Explain the interrelated nature of photosynthesis and cellular respiration.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>   |
| * | SC.912.L.18.10 | Connect the role of adenosine triphosphate (ATP) to energy transfers within a cell.<br><i>Cognitive Complexity/Depth of Knowledge Rating: High</i>   |
| * | SC.912.L.18.11 | Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>                                |
| * | SC.912.L.18.12 | Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.<br><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i> |