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2018 Mississippi College- and Career-Readiness Standards for Science

Effective Date: 2018-2019 School Year

2018 Mississippi College- and Career-Readiness Standards for Science

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Introduction

Mission Statement

The Mississippi Department of Education is dedicated to student success, which includes improving student achievement in science, equipping citizens to solve complex problems, and establishing fluent communication skills within a technological environment. The Mississippi College- and Career-Readiness Standards provide a consistent, clear understanding of what students are expected to know and be able to do by the end of each grade level or course. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that students need for success in college and careers and allowing students to compete in the global economy.

Purpose

In an effort to closely align instruction for students who are progressing toward postsecondary study and the workforce, the *2018 Mississippi College- and Career-Readiness Standards for Science* includes grade- and course-specific standards for K-12 science.

This document is designed to provide K-12 science teachers with a basis for curriculum development. In order to prepare students for careers and college, it outlines what knowledge students should obtain, and the types of skills students must master upon successful completion of each grade level. The *2018 Mississippi College- and Career-Readiness Standards (MS CCRS) for Science* replaces the *2010 Mississippi Science Framework*. These new standards reflect national expectations while focusing on postsecondary success, but they are unique to Mississippi in addressing the needs of our students and teachers. The standards' content centers around three basic content strands of science: life science, physical science, and Earth and space science. Instruction in these areas is designed for a greater balance between content and process. Teachers are encouraged to transfer more ownership of the learning process to students, who can then direct their own learning and develop a deeper understanding of science and engineering practices, critical analysis, and knowledge. Doing so will produce students that will become more capable, independent, and scientifically literate adults.

Implementation

The *2018 Mississippi College- and Career-Readiness Standards (MS CCRS) for Science* will be implemented during the 2018-2019 school year.

2018 Mississippi College- and Career-Readiness Standards for Science Overview

Research and Background Information

In today's modern world and complex society, our students are required to possess sufficient knowledge of science and engineering to become vigilant consumers of scientific and technological information. To meet the growing challenges facing our future workforce, the National Research Council (NRC) published a research-based report on teaching and learning science in a 2012 document titled *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (NRC, 2012). This document proposes a new approach to K-12 science education through the integration of science and engineering practices (SEPs), crosscutting concepts, disciplinary core ideas, and engineering design within the context of science instruction.

Core Elements in the Use and Design of the *MS CCRS for Science*

The *MS CCRS for Science* are goals that reflect what a student should know and be able to do. This document does not dictate a manner or methods of teaching. The standards in this document are not sequenced for instruction and do not prescribe classroom activities, materials, or instruction strategies. These standards are end-of year expectations for each grade or course. The standards are intended to drive relevant and rigorous instruction that emphasizes student mastery of both disciplinary core ideas (concepts) and application of science and engineering practices (skills) to support student readiness for citizenship, college, and careers.

The *MS CCRS for Science* document was built by adapting and extending information from *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (NRC, 2012) and combining with Mississippi's previous science framework process strands (i.e., science as inquiry, unifying concepts and processes, science and technology, science in personal and social perspectives, and the history and nature of science). These concepts connect information across the science content strands (i.e., life science, physical science, and Earth and space science) with the disciplinary core ideas (e.g., ecology and interdependence, motions, forces, and energy, Earth systems and cycles) and are essential to both scientists and engineers because they identify common properties and processes found in practice.

The core elements are integrated across standards and performance objectives in each grade and course. A brief description of each core element is presented below.

1. Nature of Science: Science and Engineering Practices (SEPs) replaced the Inquiry Strand included in the *2010 Mississippi Science Framework*. Beyond integration within the standards, these practices must be mastered by students to produce a more scientifically literate citizenry and to develop students that are more excited about STEM (Science, Technology, Engineering, and Mathematics) topics and careers. Inquiry verbs, along with the SEPs, are woven throughout the standards, especially in the performance objectives. Each has a deliberate placement to indicate the depth of understanding expected of students.

   The practices describe the behaviors that scientists engage in as they investigate and build models and theories about the natural world. They also describe the key set of engineering practices that engineers use as they design and build models and systems. These practices work together (overlap and interconnect) and are not separated in the study and investigation of science concepts. For example, the practice of *mathematical and computational thinking* may include some aspects of *analyzing and interpreting data*. The data often come from *planning and carrying out an investigation*. The writing task force for the *MS CCRS for Science* incorporated this language into the

performance objectives to emphasize the importance of a student-centered science classroom and not a teacher-centered classroom. A list of these eight practices is listed below.

a. **Ask Questions (science) and Define Problems (engineering)**
b. **Develop and Use Models**
c. **Plan and Conduct Investigations**
d. **Analyze and Interpret Data**
e. **Use Mathematical and Computational Thinking**
f. **Construct Explanations (science) and Design Solutions (engineering)**
g. **Engage in Scientific Argument from Evidence**
h. **Obtain, Evaluate, and Communicate Information**

2. Crosscutting concepts: These seven, binding concepts were adopted directly from the National Research Council's *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (2012) and should be woven into instruction for every grade and course. Crosscutting concepts are designed to help students see the unity of the sciences. Students often are confused when they study ecosystems for three weeks, then weather for two weeks, and finally motion and forces for several weeks. A concept is crosscutting if it communicates a scientific way of thinking about a subject and it applies to many different disciplines of science and engineering. Crosscutting concepts are sometimes called "the ties that bind." The seven concepts are listed below.

   a. **Patterns**
   b. **Cause and effect: Mechanism and explanation**
   c. **Scale, proportion, and quantity**
   d. **Systems and system models**
   e. **Energy and matter: Flows, cycles, and conservation**
   f. **Structure and function**
   g. **Stability and change**

3. Technology: If Mississippi students are to compete on a global stage and exit high school prepared for college, career, and life, technology should be used in the classroom in a way that suits 21st-century learners and reflects the modern workplace. Technology is essential in teaching and learning of science; it influences and enhances students' learning. Flexible access, customized delivery, and increased convenience for the user are core tenets. K-12 learners have fundamentally changed over the past few decades, and our classrooms should adapt to accommodate them. Dr. Ruben Puentedura's SAMR (Substitution, Augmentation, Modification, and Redefinition) model is a resource that can be considered by teachers, administrators, and technology staff as they integrate meaningful and appropriate digital learning experiences into the classroom. At the basic level, technology enhances instruction.

4. Science and society: This core element assures exploration of science's impacts on society and the feedback loop that must be cultivated and sustained to continue improvement of systems.

5. History of science: Because most modern-day scientific advancement derives from past discoveries, it is essential that students understand the breakthroughs that make today's work possible.

6. Engineering design process (EDP) is the method of devising a system, component, or process to meet desired needs. Engineering standards are represented in some performance objectives with grade-banded, specific wording that prompts educators to approach learning and exploration using the engineering process. These performance objectives are marked with an *. It is important to

note that the EDP is flexible. Most students will approach the process in various ways. The EDP is also a cycle—there is no official start or end point. Students can begin at any step, focus on just one step, move back and forth between steps, or repeat the cycle. Professional development and teacher resources will be developed for Mississippi teachers as EDP is incorporated into Mississippi standards.

Students should be provided a safe environment for failure without consequence, which is one of the most powerful drivers in learning. Providing many opportunities for students to fail, learn, and try again, with appropriate levels of support, fosters a deeper level of understanding and greater student interest and engagement.

Other Important Core Elements

Mathematics is integrated throughout the science standards document because it is essential to the scientific process, requiring students to quantify, analyze, and present results. Students must be familiar with data analysis, critical thinking, and recording their own data; students must organize and analyze it before presenting their findings. Analysis of scientific studies and publications from a quantitative perspective is also very important.

English/language arts skills are also integrated into the science standards. Students will be required to read informational text for understanding as well as process and critique information. Students must be able to articulate a critical point of view using proper terminology. In addition, the K-4 science curriculum should be increasingly tied to language arts to lay the foundation for students to have access to science before fifth grade.

Content Strands and Disciplinary Core Ideas

Science (and engineering) fields can be divided into three content-strand domains based on relative content presented in strands, extending from kindergarten to eighth grade. Grouping content in this way allows for vertical alignment of competencies and objectives to better organize content distribution. Content strands are not included in the Grades 9-12 course organization, which allows for a more logical, sequential placement and flow of content. Content strands are subdivided into 10 disciplinary core ideas in which standards and performance objectives for science content can be placed in grades K-8.

K-8 content strands with the 10 disciplinary core ideas include:

Life Science

1. Hierarchical Organization
2. Reproduction and Heredity
3. Ecology and Interdependence
4. Adaptations and Diversity

Physical Science

5. Organization of Matter and Chemical Interactions
6. Motions, Forces, and Energy

Earth and Space Science

7. Earth's Structure and History
8. Earth and the Universe
9. Earth Systems and Cycles
10. Earth's Resources

Structure of the Standards Document

The organization and structure of this standards document are as follows:

- Grade-band overview: An overview that describes the general content and themes for the grade-level band or the high school courses. Outputs and outcomes are provided along with examples of, and references to, science and engineering practices and connecting concepts.

- Grade-level or course overview: An overview that describes the specific content and themes for each grade level and/or high school course. The K-8 standards are presented with each grade focused on a grade-level theme. High school courses provide an overview of the major ideas and strategies to use when planning instruction for the course.

- Content strand: Domains into which science fields can be divided based on relative content extending from kindergarten to eighth grade. In grades K through 8, the content strands are organized into three distinct areas: (1) life science, (2) physical science, and (3) Earth and space science. For the Grade 9-12 courses, the content areas are organized around the core ideas of each course.

- Disciplinary core ideas: Subdivision of the main content strands providing recurring ideas from the three content strands. The core ideas are the key organizing principles for the development of learning units. The K-8 vertical alignment is designed in a spiral arrangement, which places emphasis on one of the three content strands in each grade level. All content strands will be found in each grade level, but all disciplinary core ideas will not be found in every grade level in K-8 due to the spiral arrangement of content.

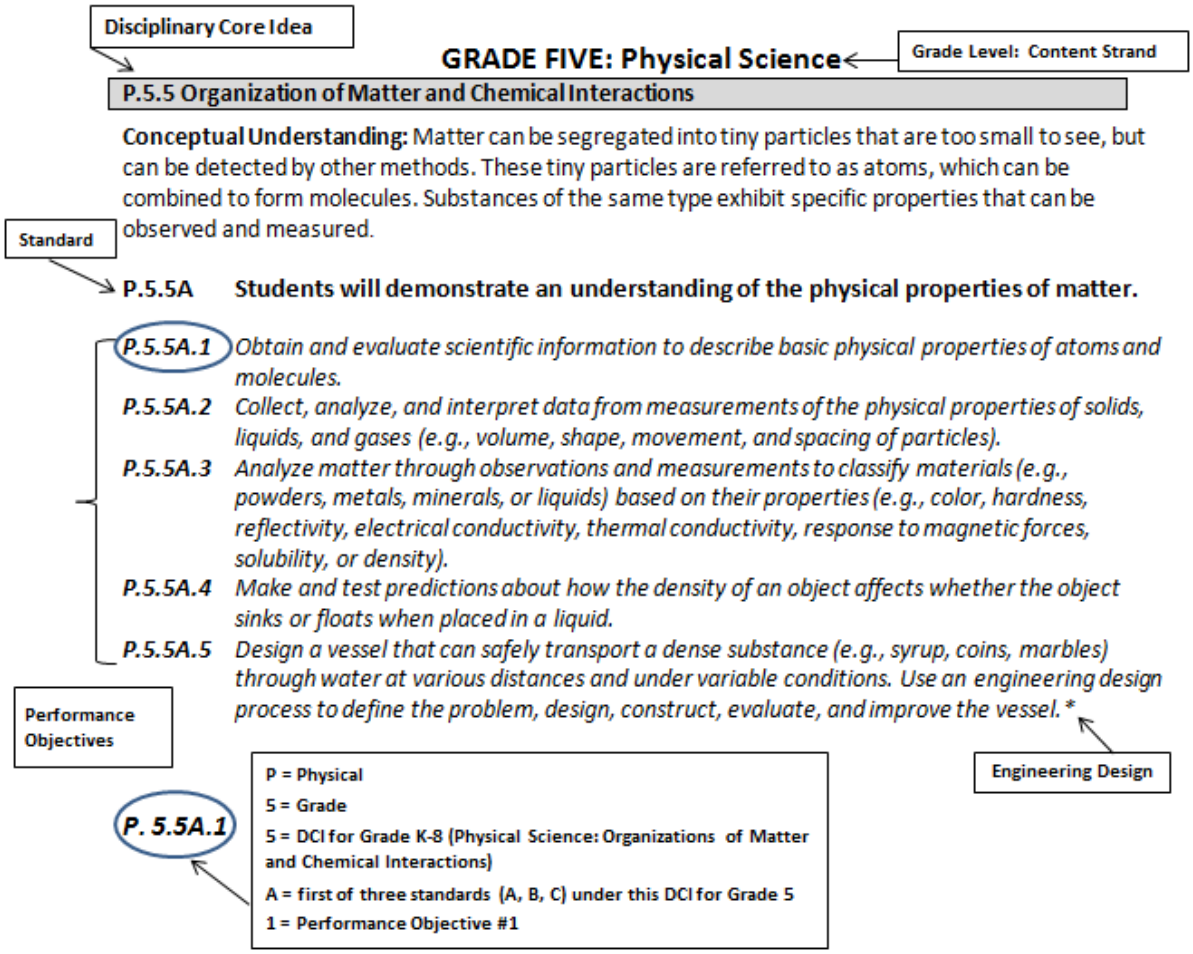
- Conceptual understanding: Statements of the core ideas for which student should demonstrate an understanding. Some grade level and/or course topics include more than one conceptual understanding with each guiding the intent of the standards.

- Content standards: Written below each disciplinary core ideas and conceptual understanding, the standards are a general statement of what students should know and be able to do because of instruction.

- Performance objectives: Detailed statements of content and skills to be mastered by the students. Performance objectives are specific statements of what students know and can do because of the science instruction at that level. These statements contain SEP and inquiry verb language.

Standards will appear in the following format:

Grade-Band Overview
Grade Level Theme (K-8)
Grade Level (K-8) or Course Overview (9-12)
Grade Level: Content Strand (K-8); Course Name (9-12)
    Disciplinary Core Idea (DCI)
    Conceptual Understanding
    Standard
    Performance Objectives



Safety in the Science Classroom

The National Science Teachers Association (NSTA) encourages K–12 school leaders and teachers to promote and support the use of science activities in science instruction and work to avoid and reduce injury. NSTA provides the following guidelines for school leaders and teachers to develop safety programs that include the effective management of chemicals, implement safety training for teachers and others, and create school environments that are as safe as possible (NSTA 2013).

1) National Science Teacher Association's *Safety in the Science Classroom*, accessible at http://www.nsta.org/docs/SafetyInTheScienceClassroom.pdf.
2) An extensive list of safety resources is available at http://www.nsta.org/safety/.

Support Documents and Resources

The MDE will develop support documents after these standards have been approved by the State Board of Education. Local districts, schools, and teachers may use these documents to construct standards-based science curriculum, allowing them to customize content to fit their students' needs and match available instructional materials. The support documents will include suggested resources, instructional strategies, essential knowledge, and detailed information about the core elements (e.g., SEPs, crosscutting concepts).

Professional development efforts will be aligned with the standards and delivered in accord with teacher resources to help expand expertise in delivering student-centered lessons (e.g., inquiry-based learning, 5-E instructional models, or other best practices in STEM teaching). The most successful national models and programs will be referenced for a capacity-building effort that can develop a more effective culture of science education in Mississippi.

Investigate, Apply, and Understand

It is important that the pedagogical paradigm of Mississippi's science classroom reflects the nature of the content being learned. The essence of science is natural to children and includes discovery, observation, questioning, design, testing, failure, iteration, and hands-on application. Research-based approaches such as inquiry-based (IB), project-based, and discovery learning are all pedagogical pathways that make sense, especially in the science classroom. Mississippi's science teachers are encouraged to embrace the growth mindset and constantly seek to upgrade classroom approaches by experimenting and adopting methods that excite students to learn and become functional, autonomous learners and contributors. Students should be provided increased maneuverability in the classroom to formulate their own ideas to investigate and understand the scientific and engineering design processes.

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GRADES K-2 OVERVIEW

Students in Grades K-2 are naturally curious about their world and learn best through hands-on experiences. Teachers must consider the students' developmental level to provide appropriate learning experiences so that students will understand the nature of science. Therefore, investigations using the five senses should be an integral part of scientific inquiry. Recognizing and observing patterns are also important, and students should be given experiences with living things to help them build their scientific understanding. Learning opportunities should also facilitate the development of language-process skills and mathematical concepts, while the students develop the ability to observe and then communicate observations. Students need to be supplied with the appropriate materials and equipment necessary to complete scientific investigations.

Each grade is developed around a theme:

- Kindergarten – Change in the Natural World
- Grade 1 – Discovering Patterns and Constructing Explanations
- Grade 2 – Systems, Order, and Organization

In kindergarten, students are introduced to the concept of change. They learn to generate questions, conduct structured experiments, sort, classify, sequence, and predict to communicate those findings. In first grade, students build on the knowledge gained from kindergarten and make deeper connections by examining evidence, observing patterns, and formulating explanations. By second grade, students learn to organize and categorize their findings, which establish a foundation for logical thinking. They also use abstract reasoning and interpretation of observations to draw conclusions from their investigations.

The core science content utilizes hands-on classroom instruction to reinforce the seven crosscutting concepts (i.e., patterns; cause and effect; scale, portion, and quantity; systems and system models; energy and matter; structure and function; and stability and change).

SEPs are in life science, physical science, and Earth and space science. The SEPs are designed so that students may develop skills and apply knowledge to solve real-life problems. While presented as distinct skill sets, the eight practices intentionally overlap and interconnect as students explore the science concepts. Some examples of specific skills students should develop in grades K-2 are listed below.

1. Generate questions and investigate the differences between liquids and solids and develop awareness that a liquid can become a solid and vice versa.
2. Develop and use models to predict weather conditions associated with seasonal patterns and changes.
3. Conduct an investigation to provide evidence that vibrations create sound (e.g., pluck a guitar string) and that sound can create vibrations (e.g., feeling sound through a speaker).
4. Analyze and interpret data from observations and measurements to describe local weather conditions (including temperature, wind, and forms of precipitation).
5. Compare and measure the length of solid objects using technology and mathematical representations. Analyze and communicate findings.
6. Construct an explanation for the general pattern of change in daily temperatures by measuring and calculating the difference between morning and afternoon temperatures.
7. Obtain and evaluate informational texts and other media to generate and answer questions about water sources and human uses of clean water.

Curricula and instructions that integrate science and engineering practices should reflect the skills outlined above.

The Engineering Design Process (EDP) is a step-by-step method of devising a system, component, or process to meet desired needs. This is similar to the "scientific method" which is taught to young scientists. However, the EDP is a flexible process. Students can begin at any step, focus on just one step, move back and forth between steps, or repeat the cycle. Engineering standards are represented in some performance objectives with grade-banded, specific wording that will prompt students to approach learning and exploration using the engineering process. **These performance objectives are marked with an * at the end of the statement.** Professional development and teacher resources will be developed for teachers as EDP is incorporated into Mississippi standards.

Each K-2 standard allows students to be active doers of science rather than passive observers. This approach creates an opportunity for student learning and engages the pupil in the scientific investigation process.

KINDERGARTEN

Theme: Change in the Natural World

In kindergarten, students observe the changes in the natural world and identify how animals use their senses to recognize the changes. As language and vocabulary develops, students recognize that plants and animals change and report findings about the changes throughout the life cycle. Students conduct an investigation to determine the needs of plants to grow and use quantitative measurement to chart growth over time. Students learn that change occurs when plants and animals do not get the food, water, and space needed for growth. Students develop and use models to describe the seasonal changes in the environment. Students develop questions and conduct a structured investigation to determine how sunlight affects the temperature of sand, soil, rocks, and water. Using an engineer design process, students then construct a structure to reduce the temperature of a play area. Students recognize that scientists observe changes in the natural world and use investigations, charts, drawings, sketches, and models to communicate these changes. Students need to recognize that scientists observe the natural world and use investigations, charts, drawings, sketches, and models to communicate ideas.

KINDERGARTEN: Life Science

L.K.1 Hierarchical Organization

Conceptual Understanding: Objects in the environment can be classified as living and nonliving. Living things include plants and animals. All living things reproduce, grow, develop, respond to stimuli, and die; and nonliving things do not. Living things require air, food, water, and an environment in which to live. Acting as scientists, students will observe the natural world and use investigations, charts, drawings, sketches, and models to communicate ideas.

L.K.1A Students will demonstrate an understanding of living and nonliving things.

L.K.1A.1 *With teacher guidance, conduct an investigation of living organisms and nonliving objects in various real-world environments to define characteristics of living organisms that distinguish them from nonliving things (e.g., playground, garden, school grounds).*

L.K.1A.2 *With teacher support, gain an understanding that scientists are humans who use observations to learn about the natural world. Obtain information from informational text or other media about scientists who have made important observations about living things (e.g. Carl Linnaeus, John James Audubon, Jane Goodall).*

Conceptual Understanding: All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air. Animals (including humans) use their senses to learn about the world around them.

L.K.1B Students will demonstrate an understanding of how animals (including humans) use their physical features and their senses to learn about their environment.

L.K.1B.1 *Develop and use models to exemplify how animals use their body parts to (a) obtain food and other resources, (b) protect themselves, and (c) move from place to place.*

L.K.1B.2 *Identify and describe examples of how animals use their sensory body parts (eyes to detect light and movement, ears to detect sound, skin to detect temperature and touch, tongue to taste, and nose to detect smell).*

KINDERGARTEN: Life Science

L.K.2 Reproduction and Heredity

Conceptual Understanding: Plants and animals change in form as they go through stages in the life cycle. Young plants and animals are very much like their parents and other plants and animals of the same kind, but they can also vary in many ways.

L.K.2 **Students will demonstrate an understanding of how living things change in form as they go through the general stages of a life cycle.**

L.K.2.1 *Use informational text or other media to make observations about plants as they change during the life cycle (e.g., germination, growth, reproduction, and death) and use models (e.g., drawing, writing, dramatization, or technology) to communicate findings.*

L.K.2.2 *Construct explanations using observations to describe and model the life cycle (birth, growth, adulthood, death) of a familiar mammal (e.g., dog, squirrel, rabbit, deer).*

L.K.2.3 *With teacher guidance, conduct a structured investigation to observe and measure (comparison of lengths) the changes in various individuals of a single plant species from seed germination to adult plant. Record observations using drawing or writing.*

L.K.2.4 *Use observations to explain that young plants and animals are like but not exactly like their parents (i.e., puppies look similar, but not exactly like their parents).*

KINDERGARTEN: Life Science

L.K.3 Ecology and Interdependence

Conceptual Understanding: The environment consists of many types of living things including plants and animals. Living things depend on the land, water, and air to live and grow.

L.K.3A **Students will demonstrate an understanding of what animals and plants need to live and grow.**

L.K.3A.1 *With teacher guidance, conduct a structured investigation to determine what plants need to live and grow (water, light, and a place to grow). Measure growth by directly comparing plants with other objects.*

L.K.3A.2 *Construct explanations using observations to describe and report what animals need to live and grow (food, water, shelter, and space).*

Conceptual Understanding: Interdependence exists between plants and animals within an environment. Living things can only survive in areas where their needs for air, water, food, and shelter are met.

L.K.3B **Students will demonstrate an understanding of the interdependence of living things and the environment in which they live.**

L.K.3B.1 *Observe and communicate that animals get food from plants or other animals. Plants make their own food and need light to live and grow.*

L.K.3B.2 *Create a model habitat which demonstrates interdependence of plants and animals using an engineering design process to define the problem, design, construct, evaluate, and improve the habitat.**

KINDERGARTEN: Life Science

L.K.4 Adaptations and Diversity

Conceptual Understanding: When animals do not get what they need to survive, they will die. Some types of plants and animals are now extinct because they were unable to adapt when the environment changed. There are similarities between some present-day animals and extinct animals.

L.K.4 **Students will demonstrate an understanding that some groups of plants and animals are no longer living (extinct) because they were unable to meet their needs for survival.**

L.K.4.1 *Obtain information from informational text or other media to document and report examples of different plants or animals that are extinct.*

L.K.4.2 *Observe and report how some present-day animals resemble extinct animals (i.e., elephants resemble wooly mammoths).*

KINDERGARTEN: Physical Science

P.K.5 Organization of Matter and Chemical Interactions

Conceptual Understanding: Matter exists in different states, including solid and liquid forms. Water can exist as a solid or a liquid. Solid objects can be described and sorted according to their attributes. Different properties are suited for different purposes.

P.K.5A **Students will demonstrate an understanding of the solid and liquid states of matter.**

P.K.5A.1 *Generate questions and investigate the differences between liquids and solids and develop awareness that a liquid can become a solid and vice versa.*

P.K.5A.2 *Describe and compare the properties of different materials (e.g., wood, plastic, metal, cloth, paper) and classify these materials by their observable characteristics (visual, aural, or natural textural) and by their physical properties (weight, volume, solid or liquid, and sink or float).*

Conceptual Understanding: Many objects can be built from a smaller set of pieces (e.g., blocks, construction sets). Most objects can be broken down into various component pieces and any piece of uniform matter (e.g., a sheet of paper, a block of wood,) can be subdivided into smaller pieces of the same material. If pieces of the original object are damaged or removed, the object may not have the same properties or work the same.

P.K.5B. **Students will demonstrate an understanding of how solid objects can be constructed from a smaller set.**

P.K.5B.1 *Use basic shapes and spatial reasoning to model large objects in the environment using a set of small objects (e.g., blocks, construction sets).*

P.K.5B.2 *Analyze a large composite structure to describe its smaller components using drawing and writing.*

P.K.5B.3 *Explain why things may not work the same if some of the parts are missing.*

KINDERGARTEN: Earth and Space Science

E.K.8 Earth and the Universe

Conceptual Understanding: Seasonal changes occur as the Earth orbits the sun. These seasonal changes repeat in a pattern. Patterns of sunrise and sunset can be described and predicted.

E.K.8A Students will demonstrate an understanding of the pattern of seasonal changes on the Earth.

E.K.8A.1 *Construct an explanation of the pattern of the Earth's seasonal changes in the environment using evidence from observations.*

Conceptual Understanding: The sun is the source of heat and light for the solar system. This heat can impact Earth's natural resources. Living things depend upon the effects of the sun (warms the land, air, water, and helps plants grow) to survive.

E.K.8B Students will demonstrate an understanding that the Sun provides the Earth with heat and light.

E.K.8B.1 *With teacher guidance, generate and answer questions to develop a simple model, which describes observable patterns of sunlight on the Earth's surface (day and night).*

E.K.8B.2 *With teacher guidance, develop questions to conduct a structured investigation to determine how sunlight affects the temperature of the Earth's natural resources (e.g., sand, soil, rocks, and water).*

E.K.8B.3 *Develop a device (i.e., umbrella, shade structure, or hat) which would reduce heat from the sun (temperature) using an engineering design process to define the problem, design, construct, evaluate, and improve the device.**

KINDERGARTEN: Earth and Space Science

E.K.10 Earth's Resources

Conceptual Understanding: Humans use Earth's resources for everything they do. Choices that humans make to live comfortably can affect the world around them. Recycling, reusing, and reducing consumption of natural resources is important in protecting our Earth's environment. Humans can make choices that reduce their impact on Earth's environment.

E.K.10 Students will demonstrate an understanding of how humans use Earth's resources.

E.K.10.1 *Participate in a teacher-led activity to gather, organize and record recyclable materials data on a chart or table using technology. Communicate results.*

E.K.10.2 *With teacher guidance, develop questions to conduct a structured investigation to determine ways to conserve Earth's resources (i.e., reduce, reuse, and recycle) and communicate results.*

E.K.10.3 *Create a product from the reused materials that will meet a human need (e.g., pencil holder, musical instrument, bird feeder). Use an engineering design process to define the problem, design, construct, evaluate, and improve the product.**