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MISSISSIPPI DEPARTMENT OF EDUCATION
Ensuring a bright future for every child

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.

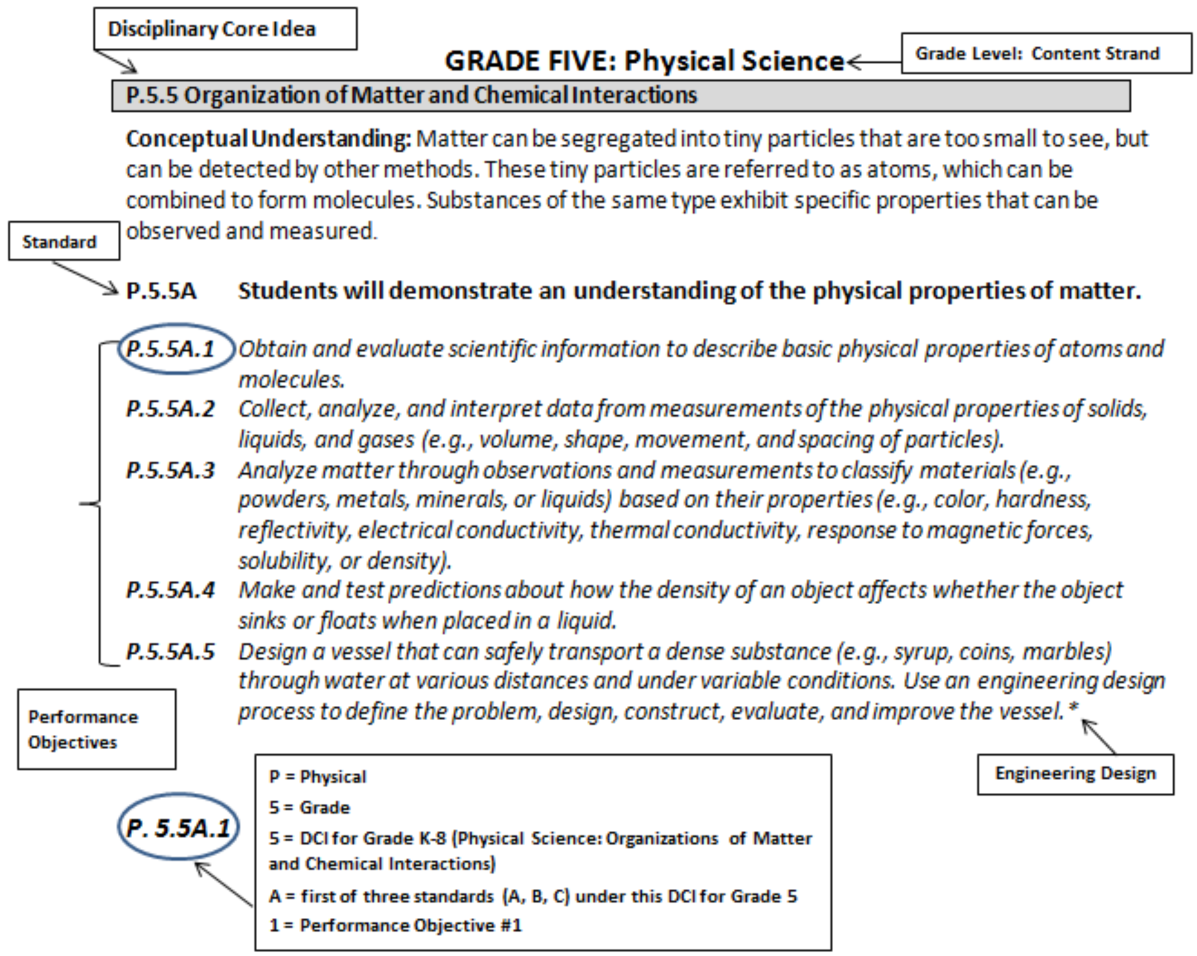
- Conceptual understanding: Statements of the core ideas for which student should demonstrate an understanding. Some grade level and/or course topics include more than one conceptual understanding with each guiding the intent of the standards.

- 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 6-8 OVERVIEW

Critical to middle school students is the foundation needed to be successful in high school science. In Grades 6-8, students use an integrated science curriculum to develop and plan controlled investigations and create more explicit and detailed models and explanations. Students must have opportunities to develop the skills necessary to engage in scientific and technical reasoning that are necessary for success in college, careers, and citizenship.

Because of using an integrated science model, the development of themes for each grade became necessary to assure continuity of thought processes.

- Grade 6 – Structure and Function
- Grade 7 – Systems and Cycles
- Grade 8 – Cause and Effect

In Grade 6, students need more tangible concepts, but by Grade 8, the complexity of the content increases to abstract cause and effect relationships. Explaining patterns and making predictions based on an understanding of cause and effect allows students to conceptualize and describe the relationships among natural phenomena. By building complexity into the standards, student skill sets are further strengthened as they prepare for high school courses.

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 6-8 are listed below.

1. Ask questions to explain how density of matter (observable in various objects) is affected by a change in heat and/or pressure.
2. Develop and use models to show relationships among the increasing complexity of multicellular organisms (cells, tissues, organs, organ systems, organisms) and how they serve the needs of the organism.
3. Conduct simple investigations about the performance of waves to describe their behavior (e.g., refraction, reflection, transmission, and absorption) as they interact with various materials (e.g., lenses, mirrors, and prisms).
4. Analyze and interpret data to explain how the processes of photosynthesis, and cellular respiration (aerobic and anaerobic) work together to meet the needs of plants and animals.
5. Use mathematical computation and diagrams to calculate the sum of forces acting on various objects.
6. Construct an explanation for how climate is determined in an area using global and surface features (e.g. latitude, elevation, shape of the land, distance from water, global winds, and ocean currents).
7. Engage in scientific argument based on current evidence to determine whether climate change happens naturally or is being accelerated through the influence of man.
8. Obtain and evaluate scientific information to explain the relationship between seeing color and the transmission, absorption, or reflection of light waves by various materials.

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.

The use of science and engineering practices and crosscutting concepts will actively engage students in science, building on their natural curiosity and encouraging further study in science and engineering fields. As science also requires the ability to think and reason, students will therefore also develop the skills necessary to be successful in college, career, and society.

GRADE SEVEN

Theme: Systems and Cycles

Students relate systems and cycles through analyzing various small scale and large scale phenomena. Using scientific methods, students can connect Earth's systems with the flow of energy in supporting living and nonliving organisms and specific interactions of matter. Students use multiple investigative methods to discover evidence, make claims, and generate explanations about systems and cycles that take place on Earth. A focus on organization and cycles of matter requires students to apply skills and make connections across genres of science since most complex cycles have multiple interactions.

GRADE SEVEN: Life Science

L.7.3 Ecology and Interdependence

Conceptual Understanding: The emphasis is on predicting consistent patterns of interactions among different cycling systems in terms of the relationships between organisms and abiotic components within ecosystems. Rearrangement of food molecules through chemical processes in cellular respiration and photosynthesis is an important part of energy cycling in all life systems. Preservation of biodiversity and consideration of human impacts are themes in maintaining ecosystem services.

L.7.3 Students will demonstrate an understanding of the importance that matter cycles between living and nonliving parts of the ecosystem to sustain life on Earth.

L.7.3.1 *Analyze diagrams to provide evidence of the importance of the cycling of water, oxygen, carbon, and nitrogen through ecosystems to organisms.*
L.7.3.2 *Analyze and interpret data to explain how the processes of photosynthesis, and cellular respiration (aerobic and anaerobic) work together to meet the needs of plants and animals.*
L.7.3.3 *Use models to describe how food molecules (carbohydrates, lipids, proteins) are processed through chemical reactions using oxygen (aerobic) to form new molecules.*
L.7.3.4 *Explain how disruptions in cycles (e.g., water, oxygen, carbon, and nitrogen) affect biodiversity and ecosystem services (e.g., water, food, and medications) which are needed to sustain human life on Earth.*
L.7.3.5 *Design solutions for sustaining the health of ecosystems to maintain biodiversity and the resources needed by humans for survival (e.g., water purification, nutrient recycling, prevention of soil erosion, and prevention or management of invasive species).**

GRADE SEVEN: Physical Science

P.7.5 Organization of Matter and Chemical Interactions

Conceptual Understanding: Matter and its interactions can be distinguished by investigating physical properties (e.g., mass, density, solubility) using chemical processes and experimentation. Changes to substances can either be physical or chemical.

P.7.5A Students will demonstrate an understanding of the physical and chemical properties of matter.

P.7.5A.1 *Collect and evaluate qualitative data to describe substances using physical properties (state, boiling/melting point, density, heat/electrical conductivity, color, and magnetic properties).*
P.7.5A.2 *Analyze and interpret qualitative data to describe substances using chemical properties (the ability to burn or rust).*

P.7.5A.3 *Compare and contrast chemical and physical properties (e.g., combustion, oxidation, pH, solubility, reaction with water).*

Conceptual Understanding: Matter is made of atoms and/or molecules that are in constant motion. The movement of the atoms and molecules depends on the amount of energy in the system at the time. The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.

P.7.5B Students will demonstrate an understanding about the effects of temperature and pressure on physical state, molecular motion, and molecular interactions.

P.7.5B.1 *Make predictions about the effect of temperature and pressure on the relative motion of atoms and molecules (speed, expansion, and condensation) relative to recent breakthroughs in polymer and materials science (e.g. self-healing protective films, silicone computer processors, pervious/porous concrete).*

P.7.5B.2 *Use evidence from multiple scientific investigations to communicate the relationships between pressure, volume, density, and temperature of a gas.*

P.7.5B.3 *Ask questions to explain how density of matter (observable in various objects) is affected by a change in heat and/or pressure.*

Conceptual Understanding: Atoms are the basic building blocks of ordinary elements. Compounds are substances composed of two or more elements. Chemical formulas can be used to describe compounds. The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The element position on the periodic table can also be used to predict the type of bonding that most commonly occurs between the elements.

P.7.5C Students will demonstrate an understanding of the proper use of the periodic table to predict and identify elemental properties and how elements interact.

P.7.5C.1 *Develop and use models that explain the structure of an atom.*

P.7.5C.2 *Use informational text to sequence the major discoveries leading to the current atomic model.*

P.7.5C.3 *Collect, organize, and interpret data from investigations to identify and analyze the relationships between the physical and chemical properties of elements, atoms, molecules, compounds, solutions, and mixtures.*

P.7.5C.4 *Predict the properties and interactions of elements using the periodic table (metals, non-metals, reactivity, and conductors).*

P.7.5C.5 *Describe concepts used to construct chemical formulas (e.g. CH_4, H_20) to determine the number of atoms in a chemical formula.*

P.7.5C.6 *Using the periodic table, make predictions to explain how bonds (ionic and covalent) form between groups of elements (e.g., oxygen gas, ozone, water, table salt, and methane).*

Conceptual Understanding: Changes to substances can either be physical or chemical. Many substances react chemically with other substances to form new substances with different properties. Substances (such as metals or acids) are identified according to their physical or chemical properties. Some chemical reactions release energy and others store energy.

P.7.5D Students will demonstrate an understanding of chemical formulas and common chemical substances to predict the types of reactions and possible outcomes of the reactions.

P.7.5D.1 *Analyze evidence from scientific investigations to predict likely outcomes of chemical reactions.*

P.7.5D.2 *Design and conduct scientific investigations to support evidence that chemical reactions (e.g., cooking, combustion, rusting, decomposition, photosynthesis, and cellular respiration) have occurred.*

P.7.5D.3 *Collect, organize, and interpret data using various tools (e.g., litmus paper, pH paper, cabbage juice) regarding neutralization of acids and bases using common substances.*

P.7.5D.4 *Build a model to explain that chemical reactions can store (formation of bonds) or release energy (breaking of bonds).*

Conceptual Understanding: In a chemical process, the atoms that make up original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. The total number of each type of atom is conserved, and the mass does not change. As these chemical combinations take place, substances react in various ways, yet matter is always conserved in a reaction.

P.7.5E Students will demonstrate an understanding of the law of conservation of mass.

P.7.5E.1 *Conduct simple scientific investigations to show that total mass is not altered during a chemical reaction in a closed system. Compare results of investigations to Antoine-Laurent Lavoisier's discovery of the law of conservation of mass.*

P.7.5E.2 *Analyze data from investigations to explain why the total mass of the product in an open system appears to be less than the mass of reactants.*

P.7.5E.3 *Compare and contrast balanced and unbalanced chemical equations to demonstrate the number of atoms does not change in the reaction.*

GRADE SEVEN: Earth and Space Science

E.7.9 Earth's Systems and Cycles

Conceptual Understanding: Complex patterns in the movement of air and water in the atmosphere are major determinants of local weather. Global movements of water and its changes in form are propelled by sunlight and gravity. Variations in temperature drive a global pattern of interconnected currents. Interactions between sunlight, oceans, atmosphere, ice, landforms, and living things vary with latitude, altitude, and local and regional geography. Weather is difficult to predict; however, large scale patterns and trends in global climate, such as the gradual increase in average temperature, are more easily observed and predicted.

E.7.9A Students will demonstrate an understanding of how complex changes in the movement and patterns of air and water molecules caused by the sun, winds, landforms, ocean temperatures, and currents in the atmosphere are major determinants of local and global weather patterns.

E.7.9A.1 *Analyze and interpret weather patterns from various regions to differentiate between weather and climate.*

E.7.9A.2 *Analyze evidence to explain the weather conditions that result from the relationship between the movement of water and air masses.*

E.7.9A.3 *Interpret atmospheric data from satellites, radar, and weather maps to predict weather patterns and conditions.*

E.7.9A.4 *Construct an explanation for how climate is determined in an area using global and surface features (e.g. latitude, elevation, shape of the land, distance from water, global winds and ocean currents).*

E.7.9A.5 *Analyze models to explain the cause and effect relationship between solar energy and convection and the resulting weather patterns and climate conditions.*

E.7.9A.6 *Research and use models to explain what type of weather (thunderstorms, hurricanes, and tornadoes) results from the movement and interactions of air masses, high and low pressure systems, and frontal boundaries.*

E.7.9A.7 *Interpret topographic maps to predict how local and regional geography affect weather patterns and make them difficult to predict.*

Conceptual Understanding: Climate changes are defined as significant and persistent changes in an area's average or extreme weather conditions. Changes can occur if any of Earth's systems change (e.g., composition of the atmosphere, reflectivity of Earth's surface). The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. Greenhouse gases in the atmosphere absorb and retain the energy radiated from land and ocean surfaces, thereby regulating Earth's average surface temperature and keeping it habitable. Excess greenhouse gases could cause a detrimental impact on climate over time.

E.7.9B Students will demonstrate an understanding of the relationship between natural phenomena, human activity, and global climate change.

E.7.9B.1 *Read and evaluate scientific or technical information assessing the evidence and bias of each source to explain the causes and effects of climate change.*

E.7.9B.2 *Interpret data about the relationship between the release of carbon dioxide from burning fossil fuels into the atmosphere and the presence of greenhouse gases.*

E.7.9B.3 *Engage in scientific argument based on current evidence to determine whether climate change happens naturally or is being accelerated through the influence of man.*

Conceptual Understanding: The tilt of Earth's spin axis with respect to the plane of its orbit around the sun is important for a habitable Earth. The Earth's spin axis is tilted 23.5 degrees. Earth's axis points in the same direction in space no matter where Earth is in relation to the sun. The seasons are a result of this tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.

E.7.9C Students will demonstrate an understanding that the seasons are the direct result of the Earth's tilt and the intensity of sunlight on the Earth's hemispheres.

E.7.9C.1 *Construct models and diagrams to illustrate how the tilt of Earth's axis results in differences in intensity of sunlight on the Earth's hemispheres throughout the course of one full revolution around the Sun.*

E.7.9C.2 *Investigate how variations of sunlight intensity experienced by each hemisphere (to include the equator and poles) create the four seasons.*