Instructional Implications for Grade 4

To meet the goals of *Each Child, Our Future*, Ohio's strategic plan for education, schools and districts will find it essential to have appropriate local curricula supported by high-quality instructional materials. Science is part of providing well-rounded content for students, as well-rounded content is one of the four learning domains listed in the strategic plan.

Science is an essential subject for students in grades K-12. It is important to build a strong foundation in science in early elementary years so students are prepared for understanding more complex material in intermediate and middle grades. It is equally important to continue students' science instruction by offering more advanced courses at the high school level. This allows students to better compete for admission to college or other postsecondary programs, as well as jobs. Advanced science courses in high schools also help produce a more scientifically literate public.

This document outlines the most notable changes from the 2010 standards to the 2018 standards and offers insight into how teachers can best prepare their students using the revised content. **The document is merely an overview; it does not provide a comprehensive treatment of changes or take the place of the model curriculum or instructional resources.**

The document consists of tables containing three columns that show the 2010 standard, the 2018 standard and the implications of any significant shifts from 2010 to 2018. The document addresses only areas in which the focus of instruction has changed. Standards that say "No change to content focus" should continue to be taught with the same goals as the corresponding 2010 standards. For standards in which the instructional focus has shifted, only the changed content is included in the third column of the table. Portions of the standard unaffected by the changes may not appear here but should continue to be taught.

Educators should teach all content in the standards incorporating the science and engineering practices, and they should engage students in scientific thought processes. Where possible, instructors should use real-world data and both problem-based and project-based experiences. *Ohio's Cognitive Demands*, which Ohio initiated in the 2010 standards, are clarified in the 2018 standards, featuring additional *Visions into Practice* examples categorized by cognitive demand. These levels of knowledge relate to current understanding and research about the ways people learn, and they are important aspects of an overall understanding of science concepts. Educators should give their students opportunities to practice all four types of thinking. Please note, the *Visions into Practice* section of the Model Curriculum suggests ways to incorporate these levels into instruction, but the examples are not mandatory; they are simply ideas educators could implement or adapt to suit local curriculum.

Also, educators need to design lessons to incorporate the concepts described in the *Nature of Science* sections. The *Nature of Science* provides a way for increasing students' understanding of science as more than a body of knowledge about how the natural world works. It also is a process for gathering information and gaining deeper knowledge about the world. These concepts of science should not form a standalone unit or be additional course materials. They should be embedded in each area of the science classroom experience, including lessons, laboratory or field studies, and assessments.

GRADE BAND THEME: INTERCONNECTIONS WITHIN SYSTEMS

This theme focuses on helping students explore the components of various systems and then investigate dynamic and sustainable relationships within systems using scientific inquiry.

Strand Connections: Heat and electrical energy are forms of energy that can be transferred from one location to another. Matter has properties that allow the transfer of heat and electrical energy. Heating and cooling affect the weathering of Earth's surface and Earth's past environments. The processes that shape Earth's surface and the fossil evidence found can help decode Earth's history.

2010 Content Statement	2018 Content Statement	Instructional implications of revisions
Earth and Space Science (ESS)	**Earth and Space Science (ESS)**	
Earth's surface has specific characteristics and landforms that can be identified. About 70 percent of the Earth's surface is covered with water and most of that is the ocean. Only a small portion of the Earth's water is freshwater, which is found in rivers, lakes and groundwater. Earth's surface can change due to erosion and deposition of soil, rock or sediment. Catastrophic events such as flooding, volcanoes and earthquakes can create landforms.	**4.ESS.1: Earth's surface has specific characteristics and landforms that can be identified.** About 70 percent of the Earth's surface is covered with water and most of that is the ocean. Only a small portion of the Earth's water is freshwater, which is found in rivers, lakes, groundwater and glaciers. Earth's surface can change due to erosion and deposition of soil, rock or sediment. Catastrophic events such as flooding, volcanoes and earthquakes can create landforms.	Glaciers were added as a freshwater location. Glaciers contain the largest portion (nearly 70 percent) of the freshwater on Earth. Students should develop an understanding of the important role glaciers play as an agent of weathering and erosion, specifically emphasizing the creation of the current landforms in and around Ohio. This content can be connected to the role of glaciers in environmental changes, which is covered in 4.LS.1.
The surface of Earth changes due to weathering. Rocks change shape, size and/or form due to water or ice movement, freeze and thaw, wind, plant growth, gases in the air, pollution and catastrophic events such as earthquakes, mass wasting, flooding and volcanic activity. **Note:** The ice movement (above) refers to large bodies of ice, such as glaciers that can break large rocks into small ones.	**4.ESS.2: The surface of Earth changes due to weathering.** Rocks change shape, size and/or form due to water or glacial movement, freeze and thaw, wind, plant growth, acid rain, pollution and catastrophic events such as earthquakes, flooding, and volcanic activity. **Note:** *Differentiating between chemical and physical weathering is not the focus at this grade level.*	No change to content focus, but be sure instruction reflects the strong emphasis on the *Nature of Science* and the *Cognitive Demands* included in the 2018 standards.
The surface of Earth changes due to erosion and deposition. Water, wind and ice physically remove and carry (erosion) rock, soil and sediment and deposit the material in a new location. Gravitational force affects movements of water, rock and soil.	**4.ESS.3: The surface of Earth changes due to erosion and deposition.** Liquid water, wind and ice physically remove and carry rock, soil and sediment (erosion) and deposit the material in a new location (deposition). Gravitational force affects movements of water, rock and soil.	No change to content focus, but be sure instruction reflects the strong emphasis on the *Nature of Science* and the *Cognitive Demands* included in the 2018 standards.

2010 Content Statement	2018 Content Statement	Instructional implications of revisions
Physical Science (PS)	**Physical Science (PS)**	
The total amount of matter is conserved when it undergoes a change. When an object is broken into smaller pieces, when a solid is dissolved in a liquid or when matter changes state (solid, liquid, gas), the total amount of matter remains constant. **Note 1:** At this grade, the discussion of conversation of matter should be limited to a macroscopic, observable level. **Note 2:** States of matter are found in PS grade 3. Heating and cooling is one way to change the state of matter.	**4.PS.1: When objects break into smaller pieces, dissolve, or change state, the total amount of matter is conserved.** When an object is broken into smaller pieces, when a solid is dissolved in a liquid or when matter changes state (solid, liquid, gas), the total amount of matter remains constant. **Note:** *Differentiation between mass and weight is not necessary at this grade level.*	No change to content focus, but be sure instruction reflects the strong emphasis on the *Nature of Science* and the *Cognitive Demands* included in the 2018 standards.
Energy can be transformed from one form to another or can be transferred from one location to another. Energy transfers from hot objects to cold objects as heat, resulting in a temperature change. Electric circuits require a complete loop of conducting materials through which an electrical energy can be transferred. Electrical energy in circuits can be transformed to other forms of energy, including light, heat, sound and motion. Electricity and magnetism are closely related.	**4.PS.2: Energy can be transferred from one location to another or can be transformed from one form to another.** Energy transfers from hot objects to cold objects as heat, resulting in a temperature change. Electric circuits require a complete loop of conducting materials through which electrical energy can be transferred. Electrical energy in circuits can be transformed to other forms of energy, including light, heat, sound and motion. Electricity and magnetism are closely related.	This grade level sets the stage for a more complete understanding of energy in later grades. It is important to distinguish between energy changing location (transfer) and energy changing from one type to another (transformation). Provide experiences with a variety of each of these processes. Teachers should carefully choose the words they use when teaching to foster an emerging understanding of energy terms. At this level, there is no need to distinguish between heat and thermal energy; however, proper use of these terms provides the foundation for making that distinction explicit in middle school.

2010 Content Statement	2018 Content Statement	Instructional implications of revisions
Life Science (LS)	**Life Science (LS)**	
Changes in an organism's environment are sometimes beneficial to its survival and sometimes harmful. Ecosystems can change gradually or dramatically. When the environment changes, some plants and animals survive and reproduce and others die or move to new locations. An animal's patterns of behavior are related to the environment. This includes the kinds and numbers of other organisms present, the availability of food and resources, and the physical attributes of the environment.	**4.LS.1: Changes in an organism's environment are sometimes beneficial to its survival and sometimes harmful.** Ecosystems can change gradually or dramatically. When the environment changes, some plants and animals survive and reproduce and others die or move to new locations. Ecosystems are based on interrelationships among and between biotic and abiotic factors. These include the diversity of other organisms present, the availability of food and other resources, and the physical attributes of the environment.	The focus of this standard is on the relationships within ecosystems, including how components interact and the effects that changing conditions within an ecosystem have on the components of the ecosystem. Provide opportunities for observations of the local environment (schoolyard, parks) and the interactions of biotic and abiotic factors to reinforce this content.
Fossils can be compared to one another and to present-day organisms according to their similarities and differences. The concept of biodiversity is expanded to include different classification schemes based upon shared internal and external characteristics of organisms. Most types of organisms that have lived on Earth no longer exist. Fossils provide a point of comparison between the types of organisms that lived long ago and those existing today.	**4.LS.2: Fossils can be compared to one another and to present-day organisms according to their similarities and differences.** The concept of biodiversity is expanded to include different classification schemes based upon shared internal and external characteristics of organisms. Most species that have lived on Earth are extinct. Fossils provide a point of comparison between the types of organisms that lived long ago and those existing today.	No change to content focus, but be sure instruction reflects the strong emphasis on the *Nature of Science* and the *Cognitive Demands* included in the 2018 standards.