SOUTH CAROLINA
DEPARTMENT OF EDUCATION

Bundling Guide for Grade 5 Science

Purpose and Use

This document is intended to be a guide to provide examples of ways Performance Expectations (PEs) could be bundled. For this purpose, a bundle as defined by Pruit (2014), is, "a set of PEs that provide students with coherent connections among concepts within and across disciplines." This document is not intended to be read from cover to cover, but to be used, when needed, to support teacher professional learning and curriculum decisions. This is not intended for student use, and thus is not written in student-friendly language. This is not a curriculum or a means to limit instruction in the classroom. The bundles presented in this guide are not ordered for instruction. Although each PE states a dedicated Science and Engineering Practice (SEP) and Crosscutting Concept (CCC), students will need to use the full range of SEPs and CCCs to achieve success by the end of instruction.

The bundles in this document do not represent the only way the PEs can be bundled. PEs bundled together may change depending upon the selected anchoring phenomenon that students are working to explain. The bundles presented in this guide were developed using an iterative process informed by the work of Krajick and colleagues (2014). This process is summarized in the steps below:

- Review bundles that already exist.
- Build bundles around an anchoring phenomenon.
- The "Example anchoring phenomena to support 3D instruction" provided in this resource is just that, an example. There are myriad phenomena to support 3D instruction, and different phenomena may be more appropriate for different learning contexts.
- Explore and look for unexpected relationships among the PEs, including bundling across disciplines (Earth and Space Science, Life Science, Physical Science) when appropriate. This can include identification of PEs that are only partially met in the bundle.
- PEs within a bundle marked with an asterisk (*) share an authentic connection with the bundle but may not fully met.
- Make sure each PE in the grade/course is found in at least one bundle.

Properties of Matter

Matter is anything that has mass[†] and takes up space, and it typically exists in one of three states: solid, liquid, or gas. In all states, matter is made of particles that are too small to be visible, but their presence and behavior can be observed through their effects. For example, the inflation and shape of a balloon shows that gas particles are moving freely and exerting pressure. When matter changes state, such as melting, freezing, or evaporating, the total amount of matter (mass) stays the same. This principle, known as the conservation of matter, means that heating or cooling a substance does not create or destroy particles. Materials can also be identified and compared using physical properties like color, hardness, reflectivity, conductivity, and density[‡]. These properties remain consistent even when the material changes state.

PEs aligned to this bundle:

- 5-PS1-1. Develop a model to describe that matter is made up of particles too small to be seen.
- 5-PS1-2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.
- 5-PS1-3. Make observations and measurements to identify materials based on their properties. *
- 5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances. *

Example anchoring phenomena to support 3D instruction:

- Ice melting blocks
- Strong scent (like vinegar) from across the room

[†]Mass is the more appropriate measurement of the amount of matter in an object. Weight is a measurement of the gravitational force acting on an object's matter. Although distinguishing between the two measurements is beyond the State Assessment boundary for 5-PS1-2, the underlying scientific concept here is the Law of Conservation of Matter (The Law of Conservation of Mass).

[‡]Density is the primary property used to distinguish materials by property. Although using density conflicts with the State Assessment Boundary for 5-PS1-3, exposure to this property in the classroom can only enhance students' ability to use properties to identify materials.

Changes in Matter

When two or more different substances are mixed, their particles may interact and rearrange to form a new substance. If this results in a chemical change, the new substance(s) will have different properties from the original materials, such as a change in color, temperature, hardness, reflectivity, or density[‡]. A chemical change may also produce a gas or solid. For example, when vinegar is mixed with baking soda, the reaction produces a gas (carbon dioxide), a new substance with different properties. Although the materials have changed, the total mass[†] remains the same because matter is conserved during chemical changes. This means that the combined mass of the original substances equals the mass of the resulting substance(s). Understanding that matter is made of particles, even when they are too small to be visible, helps explain how these changes occur and why the properties of substances can be used to identify and compare substances.

PEs aligned to this bundle:

- 5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
- 5-PS1-1. Develop a model to describe that matter is made up of particles too small to be seen. *
- 5-PS1-2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. *
- 5-PS1-3. Make observations and measurements to identify materials based on their properties. *

Example anchoring phenomena to support 3D instruction:

- Rusting iron
- Mixing soap and milk
- Borax slime

[†]Mass is the more appropriate measurement of the amount of matter in an object. Weight is a measurement of the gravitational force acting on an object's matter. Although distinguishing between the two measurements is beyond the State Assessment boundary for 5-PS1-2, the underlying scientific concept here is the Law of Conservation of Matter (The Law of Conservation of Mass).

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Solar Energy and the Biosphere

Solar energy is the primary energy input for all Earth systems, including the biosphere. The biosphere is the collection of all living organisms on Earth, including producers, consumers, and decomposers. Producers, organisms that make their own food, use sunlight and matter (primarily carbon dioxide from the air and water) to carry out photosynthesis and grow. Photosynthesis captures energy from sunlight and stores it in producers, making that energy available to other organisms in the ecosystem. Consumers are organisms that meet their energy needs by eating other organisms. Decomposers, such as fungi and bacteria, break down dead organisms and return materials to the environment, where producers can use them for growth. These relationships are often represented in food webs, which operate within ecosystems. Matter cycles between the air, soil and living organisms as producers, consumers, and decomposers grow, interact, and die. Organisms obtain gases and water from the environment and release waste matter, including solids, liquids, and gases, back into the environment, continuing the cycle.

PEs aligned to this bundle:

- 5-PS3-1. Use models to describe that energy in animals' food (used for body, repair, growth, motion, and to maintain body warmth) was once energy from the sun.
- 5-LS1-1. Support an argument with evidence that plants obtain materials they need for growth mainly from air and water.
- 5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
- 5-PS1-1. Develop a model to describe that matter is made of particles that are too small to be seen.*
- 5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances. *
- 5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. *

Example anchoring phenomena to support 3D instruction:

- Composting
- Caterpillar to butterfly

Earth's Spheres

Earth's sphere, including the atmosphere, geosphere, hydrosphere, and biosphere, interact in complex ways that shape the planet and support life. The atmosphere is the layer of gases surrounding Earth, which influences weather, climate, and the movement of materials like dust and water vapor. The geosphere includes Earth's solid features like rocks, mountains, and soil, which are shaped by forces such as wind, water, and gravity. The hydrosphere includes all of Earth's water, found in oceans, rivers, lakes, groundwater, ice, and the atmosphere. Water is unevenly distributed across the planet, and its movement through landscapes affects erosion, nutrient transport, and the availability of fresh water for living organisms. The biosphere includes all living things, which depend on and influence the other spheres. For example, plants help stabilize soil, animals move nutrients, and microorganisms break down organic matter. Human activities, such as agriculture, construction, and energy use, can disrupt these interactions by altering landforms, polluting water and air, or changing how resources are distributed. Gravity plays a key role in Earth processes by pulling water down, including downhill and as rainfall, guiding sediment flow, and helping shape landforms. Understanding how Earth's spheres interact, and how human actions influence them, can aid in recognizing the importance of natural resources and planning sustainable solutions.

PEs aligned to this bundle:

- 5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
- 5-ESS2-2. Describe and graph the amounts of saltwater and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.
- 5-ESS3-1. Evaluate potential solutions to problems that individual communities face in protecting the Earth's resources and environment.
- 5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down. *

Examples of anchoring phenomena to support 3D instruction:

- Corn sweat
- Drought and dry riverbeds
- Urban heat islands and stormwater runoff

The Sun and Stars

The Sun appears much brighter than other stars because it is significantly closer to Earth. Although many stars are larger or more luminous than the Sun, their great distances make them appear dimmer in the night sky. This difference in apparent brightness can be explained by comparing the relative distances of stars from Earth. Earth's changing position in space causes daily changes in the position of the Sun, resulting in predictable patterns such as day and night, the length and direction of shadows, and the seasonal appearance of stars in the night sky. As Earth rotates, the position of specific places relative to the Sun changes, resulting in sunrise, sunset, and the transition between day and night. As Earth orbits around the Sun, held in place by gravity, different constellations and stars become visible during different seasons. These patterns can be recorded and represented to reveal consistent trends over time.

PEs aligned to this bundle:

- 5-ESS1-1. Support an argument with evidence that the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.
- 5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.
- 5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down. *

Examples of anchoring phenomena to support 3D instruction:

- Appearance of the star, Sirus
- Betelgeuse appears dimmer than the Sun but is much larger
- Year-long shadow tracking