SC DEPARTMENT OF EDUCATION

Bundling Guide for Grade 7 Science

Office of Assessment and Standards

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 whole 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:

1. Review bundles that already exist.
2. Build bundles around an anchoring phenomenon.
    a. 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.
3. 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.
    a. PEs within a bundle marked with an asterisk (*) share an authentic connection with the bundle but may not fully met.
4. Make sure each PE in the grade/course is found in at least one bundle.

Matter and Its Interactions

Different substances are made up of tiny particles called atoms. These atoms bond in various combinations to form molecules, which can be very small or quite large. Solids can be made of individual molecules, or they can have repeating patterns, like crystals. Each substance has its own unique set of characteristics—both physical (for example: color, shape, and density) and chemical (how it behaves when it combines with other substances)—that can help identify it. During a chemical reaction, the atoms in the original substances rearrange to form new molecules with different properties. However, the total number of atoms in the reaction stays the same, conserving mass. Some chemical reactions release energy, while others absorb it.

PEs aligned to this bundle:

- 7-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.
- 7-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- 7-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
- 7-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
- 7-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.*

Example anchoring phenomena to support 3D instruction:

- Hidenburg explosion
- Why does cutting an onion make you cry?

Applications of Chemical Reactions

Every pure substance possesses specific physical and chemical properties that remain consistent under certain conditions. These properties can be used to identify pure substances When substances undergo chemical reactions, they react in characteristic ways. During these reactions, the atoms composing the original substances rearrange to form new molecules with distinct properties compared to the starting materials. Some chemical reactions result in the release of energy, while others absorb it.

PEs aligned to this bundle:

- 7-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
- 7-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
- 7-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.*
- 7-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.*
- 7-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.*

Example anchoring phenomena to support 3D instruction:

- Thermal energy device (warming device, cooling device)
- Production of synthetic materials (plastics, medicines, fuels [Connection to Natural Resources])

Energy Storage and Transfer in Physical Systems

Motion energy is called kinetic energy. It depends on both the mass and the velocity of an object. The faster an object moves, and the more massive it is, the more kinetic energy it has. In a group of objects, there can also be stored energy, known as potential energy, based on their positions relative to each other. When two objects interact, they exert forces on each other. This can lead to the transfer of energy between them. When one object's motion energy changes, there are also changes in other types of energy in the system.

PEs aligned to this bundle:

- 7-PS3-1. Construct and interpret graphical displays of data to describe the proportional relationships of kinetic energy to the mass of an object and to the speed [sic] of an object.
- 7-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
- 7-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Example anchoring phenomena to support 3D instruction:

- Rollercoasters
- Siege engines (for example: catapult, lithobolo, trebuchet, etc.)

Energy and Matter in Living Systems

Plants, algae (like phytoplankton), and many tiny organisms use sunlight to turn carbon dioxide from the air and water into sugars through photosynthesis. This process also releases oxygen into the air. These sugars can be used right away or stored for later. Inside living things, food goes through chemical reactions to make new molecules for growth or to release energy. Most animals and plants use oxygen to break down sugars and release energy with carbon dioxide as a byproduct, but some bacteria can do this without oxygen. Food webs show how energy and matter move between different parts of an ecosystem, like producers (plants), consumers (animals), and decomposers (like bacteria and fungi). Nutrients from dead plants or animals are recycled back into the soil or water by decomposers, keeping the cycle going. This means that the same atoms get used over and over again, moving between living and nonliving parts of the ecosystem.

PEs aligned to this bundle:

- 7-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms
- 7-LS1-7. Develop a model to describe how food molecules in plants and animals are rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
- 7-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
- 7-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.*
- 7-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.*
- 7-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.*

Example anchoring phenomena to support 3D instruction:

- Photosynthesis and respiration
- Compost
- Vermiculture

Ecosystem Dynamics

Ecosystems are always changing, with their characteristics shifting over time. Any disruption to a part of an ecosystem—whether it's a physical change or something affecting living organisms—can cause ripples throughout the whole system. Living things, as well as groups of them, rely on their interactions with each other and with the environment around them. In any ecosystem, organisms that need the same resources, like food or water, may end up competing. This competition can put limits on how much organisms can grow and reproduce. Predators can reduce the numbers of certain species, while mutually beneficial interactions can develop between different organisms. Human activities have changed many ecosystems, often damaging or destroying habitats and leading to the extinction of species. However, these changes can have different effects on different living things. Generally, as human populations grow and use more resources, the negative impacts on the environment tend to increase. Humans can actively work to minimize them through technology and better practices.

PEs aligned to this bundle:

- 7-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- 7-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- 7-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- 7-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- 7-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Example anchoring phenomena to support 3D instruction:

- Invasive species
- Habitat loss and restoration

Human Impacts and Natural Resources

Humans rely on Earth's geosphere, hydrosphere, atmosphere, and biosphere for a wide range of resources. However, many of these resources, such as minerals, fresh water, and elements of the biosphere, are limited and not renewable within human lifetimes. Their distribution across the planet is uneven due to past geological processes. As human populations grow and consumption of natural resources increases, the negative impacts on Earth tend to rise unless humans actively employ different approaches and technologies. Addressing the effects of climate change and minimizing human vulnerability to its effects requires a comprehensive understanding of climate science. Additionally, insights into human behavior are crucial for making informed decisions and taking appropriate actions to mitigate the impacts of climate change.

PEs aligned to this bundle:

- 7-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
- 7-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
- 7-ESS3-5. Ask questions to clarify evidence of the factors that have impacted global temperatures over the past century.

Example anchoring phenomena to support 3D instruction:

- Use of copper in devices
- Mineral mining for electric vehicles

References

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