IS1

Grade Two Instructional Segment 2: Landscape Materials

In IS2, students explore four key ideas about materials: (1) different materials have different properties; (2) material properties can change; (3) some of these changes can be easily reversed and some cannot; and (4) the properties of a material affect how it can be used by people and its role in the natural environment.

GRADE TWO INSTRUCTIONAL SEGMENT 2: LANDSCAPE MATERIALS

Guiding Questions

- How can we describe different materials?
- How are materials similar and different from one another?
- What sort of changes can happen to materials?
- How do the properties of the materials relate to their use?

Performance Expectations

Students who demonstrate understanding can do the following:

2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. [Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]

2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.* [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.] [*Assessment Boundary: Assessment of quantitative measurements is limited to length.*]

2-PS1-3. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object. [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]

2-PS1-4. Construct an argument with evidence that some changes in matter, caused by mixing, heating, or cooling can be reversed and some cannot. [Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and heating paper.]

K–2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a practice or disciplinary core idea.

GRADE TWO INSTRUCTIONAL SEGMENT 2: LANDSCAPE MATERIALS

The bundle of performance expectations above focuses on the following elements from the NRC document *A Framework for K–12 Science Education*:

Highlighted Science and Engineering Practices	Highlighted Disciplinary Core Ideas	Highlighted Crosscutting Concepts
[SEP-3] Planning and Carrying Out Investigations [SEP-4] Analyzing and Interpreting Data [SEP-6] Constructing Explanations (for science) and Designing Solutions (for engineering) [SEP-7] Engaging in Argument from Evidence	PS1.A: Structure and Properties of Matter PS1.B: Chemical Reactions	[CCC-1] Patterns [CCC-2] Cause and Effect: Mechanism and Explanation [CCC-5] Energy and Matter: Flows, Cycles, and Conservation

Highlighted California Environmental Principles and Concepts:

Principle I The continuation and health of individual human lives and of human communities and societies depend on the health of the natural systems that provide essential goods and ecosystem services.

Principle II The long-term functioning and health of terrestrial, freshwater, coastal and marine ecosystems are influenced by their relationships with human societies.

Principle III Natural systems proceed through cycles that humans depend upon, benefit from and can alter.

Principle IV The exchange of matter between natural systems and human societies affects the long-term functioning of both.

Principle V Decisions affecting resources and natural systems are complex and involve many factors.

CA CCSS for ELA/Literacy Connections: RI.2.3, 8; W.2.1, 8; L.2.6

CA ELD Standards Connections: ELD.PI.2.6, 10, 11, ELD.PII.2.5

One of the goals of playing with sand in IS1 was to give students first-hand experience with material properties and how they could change. When sand is wet, it holds together differently than when it is dry. To make a sand castle, which properties work best? To build on this prior experience, students explore their schoolyard with a specific focus on the materials that make it up. They make observations and record them in a table, noting what materials they find, words to describe the material (ELD.PII.2.5), and what the material is used for (table 3.6).

Table 3.6. Example Schoolyard Exploration Notes

MATERIAL	WORDS TO DESCRIBE IT	WHAT IS IT USED FOR?
Metal	Shiny, Silver	Chair
Wood	Splintery, White	Fence
Playground Pavement	Hot, Broken	Playing

When students return, the class discusses the different words/adjectives they used to describe each material. Does the adjective always apply to this material? For example, the metal of the chairs in the classroom is always fairly shiny, but the concrete of the playground is not always hot (especially on cold mornings). Students recognize that the playground is broken and has cracks in it this year, but it probably didn't when the school was first built. From this wide range of descriptions of objects and materials in the schoolyard, teachers help students focus on which are properties of the material itself and which are simply how the materials are put together. If you break off a piece of concrete, is it still concrete? Even though the concrete of the schoolyard is cracked, the relevant property that describes concrete as a material is that it is breakable (though not easily!). Classes can then come up with a list of properties of materials such as texture, hardness, absorbency, flexibility, and whether the material is a solid or liquid. Then they can use these properties to describe everyday materials during in-class explorations (2-PS1-1). The two properties that are most important for landscapes are the hardness/strength of the material (discussed more in IS3) and the ability to absorb water (discussed in IS4). To build knowledge for these future segments, additional activities can explore each of these properties. For example, to explore material strength, students make synthetic rocks using different materials and drop them from different heights to see which are strongest. To explore absorption, students can time how long it takes for a cup of water to soak into different surfaces in the schoolyard (students may have to be taught how to use or read a stopwatch).

While materials have certain properties when they are alone, those properties sometimes change when different materials are mixed together. Students conduct investigations to determine if objects mixed or fastened together can be separated into their original components. For example, students can mimic the sorting strategies of recycling facilities by separating metal and paper objects mixed together by using their unique properties (paper floats while many metals are magnetic). While these materials remain separate when mixed together, other materials change properties when they are mixed, such as flour and water in pancake batter, which students can explore with cooking activities.

Properties of some materials change when the temperature changes. Liquid water turns into a hard solid when cooled in the freezer. Butter and chocolate both soften when warm. Students can explore making sculptures out of beeswax, which begins as a rigid material but becomes more flexible as students warm it in their hands. Other materials also flow more easily when they become warmer, including corn syrup. Students can pour corn syrup at different temperatures down a cardboard ramp and see how long it takes to travel a certain distance. With corn syrup, its past history does not really affect its ability to flow—a cup of syrup that was once in the freezer but now returned to room temperature should flow identically to a cup that remained at room temperature the entire time. In other words, the effects of temperature on corn syrup are entirely reversible. Students explore the melting and freezing of ice cubes and find that it, too, is entirely reversible. Other changes, however, are not. A toaster oven uses heat to turn soft, flexible bread into a browned, rigid, and crispy toast. Cooling it back down does not make it soft again. Clay heated and fired in a kiln never becomes soft and pliable again. Using evidence from a variety of experiences, students should be able to construct an argument that some changes from heating, cooling, or mixing can be reversed while some cannot (2-PS1-4).

Material properties become important in some forms of engineering because each part must serve a specific function. Engineers try to design solutions that meet certain criteria. If a material is not strong enough, too heavy, or simply unattractive, it may not be the best choice for a particular solution. Would a jacket made out of paper keep you dry in the rain? Would a jacket made out of aluminum foil be comfortable? Students can reverse engineer different products by looking at the parts that make them up and their material properties. To assess if students can choose the appropriate material for different engineering challenges, teachers can present students with a series of design challenges, which they begin by **defining the problem [SEP-1]** (figuring out what criteria are most important). Then they select the appropriate materials to solve the problems (2-PS1-2). They would need to **perform tests [SEP 3]** to determine the material properties and **analyze [SEP-4]** the results.

Engineering Connection: Create a Better Soil

Students play the role of agricultural engineers, trying to create a soil that retains as much moisture as possible for plants to grow. They test sand, woody material (bark), and clay (vermiculite) to see which will absorb the most water. They place each ingredient in a plastic cup with holes in the bottom and pour in a fixed amount of water. How much water leaks out? (Be sure to catch the water in containers below to compare the amount that flowed through). They weigh each cup before and after to figure out how much water was retained. Over the next few days, they record how quickly the soil dries out (by measuring the weight). They get to blend ingredients together to get the optimum mixture and test it (2-PS1-2; K–2-ETS1–3). *(This engineering connection could be completed during IS4 when students explore the needs of plants in more detail.)*

Engineering Connection: Create a New Toy with Old Parts

Teachers can ask parents to bring in old electronics and appliances that students can disassemble. With a briefing about proper safety precautions for sharp edges (and with a few parent volunteers), the students use screwdrivers and pliers to dismantle the devices. In their engineering notebooks, students make a list of the different parts they find and their material properties. They **ask questions [SEP-1]** about what each part does. Then, they try to reassemble the parts to **design [SEP-6]** a new toy with the existing materials. They make a sketch of their toy and document why they chose particular materials (2-PS1-3).

IS3 Grade Two Instructional Segment 3: Landscape Changes

Students apply their understanding of material properties to figure out which natural forces affect landscapes. Every rock records a story. Earth scientists look out on a landscape and **ask questions [SEP-1]** about both the processes that are actively shaping it today and the specific sequence of events in the past that led up to the present-day. What makes the mountains tall? Why are some mountains steeper than others? How are mountains and volcanoes related? Scientists **plan and conduct investigations [SEP-3]** to answer those questions using what geologists often refer to as their natural laboratory—Earth's present-day landscape.