Mini-Map for SCI.EE.5.PS.Forces-1

Subject: Science
Physical Science (PS)
Grade band: 3–5

Grade-Level Expectation

DLM Essential Element	DLM Disciplinary Core Idea Family[1]	Framework Disciplinary Core Ideas
SCI.EE.5.PS.Forces-1 Make observations to determine the effects of balanced and unbalanced forces on the motion (i.e., speed and direction) of an object.	Physical Science – Interacting Forces	PS2.A: Forces and Motion PS2.B: Types of Interactions PS2.C: Stability and Instability in Physical Systems PS3.C: Relationship Between Energy and Forces

[1] DLM Science Essential Elements organize Disciplinary Core Ideas (defined in the *Framework for K-12 Science Education*) into DCI families. By combining similar concepts within a domain, science content from the general education standards is reduced in depth, breadth, and complexity to provide access for students that qualify for the DLM alternate assessment.

Linkage Level Descriptions

Initial Precursor	Distal Precursor	Proximal Precursor	Target[2]
Anticipate the consequences of actions and intentionally act to achieve a specific goal.	Participate in making observations to recognize the causal relationship between a force (i.e., push or pull) applied to a stationary object and its resulting motion.	Use observations to identify that forces (i.e., pushes or pulls) of different magnitudes (i.e., strengths) acting on a stationary object cause the object to move and travel different distances.	Use observations to describe the relationships between balanced and unbalanced forces (i.e., pushes and/or pulls) acting on an object and any resulting change in the object's motion (i.e., change in speed or direction).

[2] The target linkage level description is a measurement target that describes the expectations (content and performance) of the Essential Element for assessment purposes.

Essential Element Three Dimensions

Each Essential Element is defined in the three dimensions described in the *Framework for K-12 Science Education*: disciplinary core ideas (DCIs), science and engineering practices (SEPs), and crosscutting concepts (CCCs). The table below lists the details of each dimension from the individual DLM Essential Element descriptions, with color-coding of dimensions corresponding to the Next Generation Science Standards (NGSS). The first row (in blue) lists the SEP(s) used to construct the Essential Element and describes ways each SEP could be incorporated. The second row (in orange) describes the science concepts within the DCI family related to this Essential Element. The third row (in green) lists the CCC(s) associated with the Essential Element and explains how each might be incorporated in the grade band (quoted from NSTA, 2013, matrix of CCCs). Note that the SEP is presented first here (rather than second, as it is in the full list of Essential Elements) to reflect the emphasis on practices in instruction and across the linkage levels. The final row (in white) includes examples of how the three dimensions could work together to support instruction for the Essential Element. These examples provide ideas for integrating the dimensions and are not exhaustive, nor are they intended to limit instruction.

Science and Engineering Practices	**Planning and Carrying Out Investigations:** Planning and carrying out investigations to answer questions or test solutions to problems in grades 3–5 builds on K–2 experiences and progresses to using tools and observations in investigations to record data and support claims. • Collect and record data using tools to determine and support an explanation of a phenomenon. • Use observations and measurements to determine and describe relationships. **Using Mathematics and Computational Thinking:** Mathematical and computational thinking in grades 3–5 builds on K–2 experiences and progresses to using data and mathematical concepts to describe the natural and designed world. • Use simple data tables and graphs to determine and describe relationships in the natural world. • Use measurements and simple mathematical representations to describe characteristics of the natural world. **Constructing Explanations and Designing Solutions:** Constructing explanations and designing solutions in grades 3–5 builds on K–2 experiences and progresses to describing and explaining processes or relationships in the natural or designed world. • Identify observations, information, data, or models to describe and explain processes or relationships in the natural world. • Use information to determine and explain relationships in the designed world.
Disciplinary Core Ideas	**Interacting Forces** • Each force acts on one particular object and has both strength and direction. • Objects in contact exert forces on each other. One object applies a force on the other and vice versa (i.e., they push on each other).

	• A change in the forces acting on an object can cause changes in the motion of that object.
	• An object typically has multiple forces acting on it. The motion of an object depends on the total forces acting on that object.
	  o When the multiple forces acting on an object balance each other out (i.e., balanced forces have zero net force on the object), there is no change in that object's motion.
	  o An object at rest has balanced forces acting on it.
	  o An object moving at a constant speed has balanced forces acting on it.
	  o Forces acting on an object that are not balanced (i.e., do not sum to zero) can change the object's motion (i.e., speed it up, slow it down, stop it, and change direction).

Crosscutting Concepts	**Patterns**: Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them. • Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena and designed products. • Patterns of change can be used to make predictions. • Patterns can be used as evidence to support explanation. **Cause and Effect: Mechanism and Explanation**: Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering. • Cause and effect relationships are routinely identified, tested, and used to explain change. • Events that occur together with regularity might or might not be a cause and effect relationship. **Scale, Proportion, and Quantity**: In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change. • Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long time periods. • Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

How three dimensions support instruction for this Essential Element	Through investigations, students can observe patterns in how pushes or pulls on an object result in different speeds and directions of movement. Patterns can be observed in both the strength and direction of forces on an object. Students can identify mathematical relationships to understand the connections between causes of unequal or equal forces on objects and effects on the motion of those objects. For example, students can recognize that applying balanced forces on an object causes no change in the motion of the object, but unbalanced forces result in a change in motion. The concepts of proportion and quantity come through students learning about relationships between the magnitude of forces and their resulting motions. Students learn to quantify forces (i.e., the strength of a push or pull) and motion (i.e., speed and direction of movement).

Instructional Resources

Resources
Learning modules and additional science instructional resources can be found at https://www.dlmpd.com/science/
A glossary defining key science terms found in the Essential Elements can be found at DLM Glossary for Science Learning Maps.

Link to Text-Only Map

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