KINDERGARTEN: PUSH AND PULL

Standards Bundle
Standards are listed within the bundle. Bundles are created with potential instructional use in mind, based upon potential for related phenomena that can be used throughout a unit.

K-PS2-1 Plan and carry out an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. (SEP: 3; DCI: PS2.A, PS2.B, PS3.C; CCC: Cause/Effect) [Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.] [*Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.*]

K-PS2-2 Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.* (SEP: 4; DCI: PS2.A, ETS1.A; CCC: Cause/Effect) [Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.] [*Assessment Boundary: Assessment does not include friction as a mechanism for change in speed.*]

Content Overview
This section provides a generic overview of the content or disciplinary core ideas as an entry point to the standards.

Pushing and pulling an object will change how it moves. The direction and speed can be affected by the way it is pushed or pulled.

Phenomena
Phenomena can be used at varying levels of instruction. One could be used to anchor an entire unit, while another might be more supplemental for anchoring just a unit. Please remember that phenomena should allow students to engage in the SEP and use the CCC/DCI to understand and explain the phenomenon.

- When I play with my toy cars, sometimes the cars will roll across the room and sometimes they don't.
- In baseball, the pitcher throws the ball one direction but if the batter hits the ball, the ball goes a different direction.
- At the fair, my kids and I went on the bumper cars. It was hard to go straight, especially when someone else hit us with their car.

Storyline
This section aims to decode not only the DCI connections, but also the SEP and CCC in a detailed account of how they possibly fit together in a progression for student learning, including both rationale and context for the bundle.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations • With guidance, plan and conduct an investigation in collaboration with peers. **Analyzing and Interpreting Data** • Analyze data from tests of an object or tool to determine if it works as intended.	**PS2.A: Forces and Motion** • Pushes and pulls can have different strengths and directions. • Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. **PS2.B: Types of Interactions** • When objects touch or collide, they push on one another and can change motion. **PS3.C: Relationship Between Energy and Forces** • A bigger push or pull makes things speed up or slow down more quickly. *(secondary)*	**Cause and Effect** • Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Students can compare the effects of pushes and pulls on an object's motion, and then determine a way to change the object's speed or direction. In order to compare how pushes and pulls have an effect on motion, students must first observe objects in motion (themselves, doors, fans, swings, etc.) They can record their findings using notes or by drawing pictures. These observations will raise questions such as, "Why do you have to push some objects harder to get them to move? How do you get objects to change the direction that they move?" Through investigations and classroom discussions, students at this grade can begin to formulate explanations for these questions.

From the earliest grades, students should have a variety of opportunities to carry out investigations that will help develop their ability to observe, measure, and analyze data from experiences they have while interacting with the world around them. This can occur through everyday experiences or through intentional small group investigations set up by the teacher. By conducting small group investigations associated with pushes and pulls, students can recognize the cause and effect relationship between the strength of the push of an object and the distance it travels. Through investigation and observation, students will discover that pushes and pulls have different strengths and directions, and that by pushing or pulling on the object, they can change the object's speed or direction. Using the information they observe, students can answer their initial questions and construct explanations for the observations they made.

During their investigations, students may naturally desire to design a structure or tool that will change the direction or speed of a moving object or stop it all together. In either case, students should be prompted to consider how well the design works to change the direction or speed of an object. Students should be prompted to use data to support their claim for how well the design worked as they intended.

Formative Assessment

Formative assessment is crucial because all learners benefit from timely and focused feedback from others. It promotes self-reflection, self-explanation, and social learning. It can also make learning more relevant. Each of the questions below might be used throughout the formative assessment process. Specific prompts may focus on individual practices, core ideas, or crosscutting concepts, but, together, the components need to support inferences about students' three-dimensional science learning as described in a given bundle, standard or lesson-level performance expectation.

SEP Planning and Carrying Out Investigations
- Compare the effects of different strengths of pushes and pulls on the motion of an object.
- Compare the effects of different directions of pushes and pulls on the motion of an object.

SEP Analyzing and Interpreting Data
- Determine if your solution moves the marble the specified distance.

CCC Cause and Effect
- Does your toy car travel farther when you push it lightly or harder?
- What happens to the direction the toy car is traveling when another toy car collides with it?

Performance Outcomes

These are statements of how students use knowledge and are similar to the standards in how they blend DCI, SEP, and CCC, but at a smaller grain-size. These are potential outcomes for instruction as it plays out in lessons and activities in the classroom. It is important to also think of these as smaller outcomes that build toward the larger goal of mastering the standards.

- **Communicate** that pushing or pulling on an object can *change* its speed or direction, or can start or stop it.
- **Communicate from observation** that when objects collide, they push on one another and *change* motion.
- **Communicate from observation** that a *bigger* push or pull makes things *speed up or slow down* more quickly.
- **Plan and carry out a simple investigation** to determine whether something designed to push or pull an object *makes it move* the way it was intended.
- **Use data** to determine how well a design works *to change* the speed or direction of a moving object.