Kindergarten Science Unit 2: Pushes and Pulls

Unit Summary: During this unit of study, students apply an understanding of the effects of different strengths or different directions of pushes and pulls on the motion of an object to analyze a design solution. The crosscutting concept of cause and effect is called out as the organizing concept for this disciplinary core idea. Students are expected to demonstrate grade-appropriate proficiency in planning and carrying out investigations and analyzing and interpreting data. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Concepts and Vocabulary:

- Pushes and Pulls can have different strengths and directions.
- When objects touch or collide, they push on one another and can change motion.

Stage 1 – Desired Results

Performance Expectations: (PE) (Established Goals / Content Standards)

(K-PS2-1) Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. [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. [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.]

(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.

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This unit is based on K-PS2-1, K-PS2-2, and K-2 ETS1-3.

Enduring Understandings	Essential Questions
Students will understand that: ● Pushing or pulling on an object can change the speed or direction of its motion and start or stop it. ● A larger push or pull makes things go faster.	● How does pulling or pushing on an object change the speed or direction of its motion and start or stop it? ● What tools can we use to increase the speed of an object or make the object turn?

Questions that guide lessons:

- Can pushes and pulls have different strengths and directions?
- What happens when objects touch or collide?
- What does a bigger push or pull do to an object?

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations ● With guidance, plan and conduct an investigation in collaboration with peers. (K-PS2- 1) **Analyzing and Interpreting Data** ● Analyze data from tests of an object or tool to determine if it works as intended. (K-PS2-2) **Asking Questions and Defining Problems** ● Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1) ● Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1) **Developing and Using Models** ● Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)	**PS2.A: Forces and Motion** ● Pushes and pulls can have different strengths and directions. (K-PS2-1), (K-PS2-2) ● Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. (K-PS2-1), (K-PS2-2) PS2.B: Types of Interactions ● When objects touch or collide, they push on one another and can change motion. (K-PS2-1) PS3.C: Relationship Between Energy and Forces ● A bigger push or pull makes things speed up or slow down more quickly. (secondary to K-PS2-1) ETS1.A: Defining Engineering Problems ● A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. (secondary to K-PS2-2) ETS1.A: Defining and Delimiting Engineering Problems ● A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1) ● Asking questions, making observations, and gathering information are helpful in thinking about problems.	**Cause and Effect** ● Simple tests can be designed to gather evidence to support or refute student ideas about causes. (K-PS2-1), (K-PS2-2) **Structure and Function** ● The shape and stability of structures of natural and designed objects are related to their function(s). (K-2-ETS1-1) **Connections to the Nature of Science Scientific Investigations Use a Variety of Methods** ● Scientists use different ways to study the world. (K-PS2-1)

	(K-2-ETS1-1) ● Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1)	
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Stage 2 – Assessment Evidence	
Summative Performance Task(s): ● Students will model the relationships between pushes and pulls. (drawing, model, etc.) to include at least three real life examples and demonstrate how pushing and pulling effects an object. Students will plan and conduct an investigation to compare the effects of different strengths or directions of pushes and pulls on the motion of an object. Students will determine if the design solution worked as intended. Colliding Balls Activity **Audience:** ● Peers, teacher, self-reflection **Criteria:** ● Teacher observation	**Formative Evidence:** Through what other evidence will students demonstrate achievement of the desired results? ● (Suggested) 2-4 question oral comprehension checks ● Teacher observation ● Class Discussion/ Anecdotal notes ● (possible) Mystery Science end-of-mystery assessment Mystery Science Pushes and Pulls Assessments Folder ● PBL activity (car tracks, roller coaster design) ● Standard K-PS2-1 Checklist Assessment ● Standard K-PS2-2 Checklist Assessment

Stage 3 – Learning Plan / Road Map (Design to make as student centered as possible)
Suggested Resources for Planning: **Mystery Science** **Unit 2 Pushes and Pulls Suggested Activities Folder** **Force and Motion Mentor Texts** **www.thewonderofscience.com** **Ollie-skateboarding Slow Motion Phenomena Video** **golf ball collision phenomena video** **Amazing Slinky Tricks Phenomena Video** **Giant Newtonś Cradle Phenomena Video** **Bed of Nails- Ellen Phenomena Video** **Force and Motion Anchor Chart** **Rube Goldberg Machines video** **Pushes and Pulls Vocabulary Sheet**

Learning Activities:
Mystery Science, njctl.org, Scholastic News, Teaching Engineering
Create a Backscratcher
Intro to Creating Inventions
Create a Crash Test Car and Test
STEAM: Creating Art Using Force and Motion
4 Simple Experiments to Introduce Physics
Marshmallow Shooter Experiment
Marble Painting using Force and Motion
Straw Rocket Launchers
Leprechaun Balloon Races
Slide as a Simple Machine

Suggested Methods: (The following methods anchor learning with a purpose, mitigating the "why do I need to know this" questions.)

- Phenomena based learningC
- Problem Based Learning (PBL)
- Inquiry Based Learning
- Case studies
- Engaging in Argument w/ evidence