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Unit Synopsis

In this unit, students will take on the role of pinball engineers to explore how pinball machines allow people to control the direction and strength of forces on a ball, which serves as the anchor phenomenon of the unit. They conduct tests on their own prototypes of a pinball machine (called Box Models) and use what they learn to solve the design problem of creating a Class Pinball Machine. Regular circle-time discussions facilitate students’ growing understanding of ideas related to force and motion, as well as their ability to use language to describe these fundamental ideas. In the process, students learn about how engineers design and test solutions to problems. Students each contribute evidence from the tests they conduct using their Box Models to help make decisions about how to design the Class Pinball Machine, something that can remain in the classroom even after the unit is complete. At the end of the unit, students use their new understanding of the phenomena of force and motion to identify pushes and pulls more broadly in their lives.

Amplify Unit Level 3D Statement

Students plan and carry out investigations to determine **how force affects the movement of an object, its direction, and its distance**, and **use observations of movement to provide evidence** about forces (**cause and effect; scale, proportion, and quantity; structure and function**). They assume the role of engineer as they engage in the design process to develop models that test ideas and construct solutions with the goal of designing a Class Pinball Machi

Key: Targeted 3D Learning Objectives

Science and Engineering Practices

Disciplinary Core Ideas

Crosscutting Concepts

***Reference your Scope and Sequence on Curriculum Corner to create your Long-Term Plan to determine your time frame for teaching the unit.**

Depending on your Long-Term Plan, you could have 1-3 flex days during the unit. Flex Days are recommended:

- After a Critical Juncture in lessons 1.5, 2.3, 3.3 and 4.3
- Campus based activities day
- Review centers for the End of Unit Exam

DISCIPLINARY LITERACY

In science, disciplinary literacy is synonymous with the science and engineering practices (SEPs). The SEPs are the context through which all science concepts should be taught. In the lessons, you will find the Science and Engineering practices icons when the SEPs are being explicitly used by students. The two focus SEPs for this unit are Constructing Explanations and Designing Solutions and Obtaining, Evaluating, and Communicating Information.

**Focus on
Disciplinary
Literacy**



Practice 1



Asking
Questions
Defining
Problems

Practice 2



Developing
and Using
Models

Practice 3



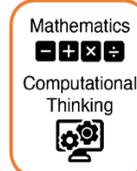
Planning and
Carrying Out
Investigations

Practice 4



Analyzing and
Interpreting
Data

Practice 5



Mathematics
Computational
Thinking

Practice 6



Constructing
Explanations
Designing
Solutions

Practice 7



Engaging in
Argument
from Evidence

Practice 8



Obtaining,
Evaluating, and
Communicating
Information

UNIT 1: ADVANCED TEACHER PREPARATION

Step	Action	Resource
1	Internalize the unit by following steps on the Unit Internalization Protocol	Unit Internalization Protocol Curriculum Corner > State > Early Childhood > Grade > Instructional Resources
	Watch the Unit Overview Video/ TIPS	Kindergarten Unit 2 Overview Video
	Review the visual flow of the unit	Coherence Flowchart
	Gain science background knowledge and identify student and teacher preconceptions	Amplify Science Background Knowledge
2	Prepare for each day of instruction by following the Lesson Internalization Protocol for each lesson	Lesson Internalization Protocol Curriculum Corner > State > Early Childhood > Grade > Instructional Resources

PROGRESS BUILD

Below describes the way in which students' explanations of the central phenomenon should develop and deepen over the course of this unit.

Pushes and Pulls Progress Build	
In the <i>Pushes and Pulls</i> unit, students will learn to construct scientific explanations that describe the different ways that an object moves as caused by different forces exerted on the object. In particular, students will focus on investigating and explaining the different distances and directions that a pinball can be made to move in a pinball machine.	
Prior knowledge (preconceptions): There is no significant prior knowledge assumed. Students will certainly have experience with observing moving objects, including rolling balls, as well as making objects move in different ways. Students will have experience moving objects by pushing or pulling, but they likely have not thought carefully about how those objects do so. Students will have opportunities to explore these kinds of actions more carefully over the course of the unit.	
Level 1	
An object starts moving when a force is exerted on it.	When an unmoving object starts to move, it is because another object exerted a force on it.
Level 2	
Stronger force causes an object to move a longer distance.	When an unmoving object starts to move, it is because another object exerted a force on it. A strong force will cause the object to move a long distance, while a gentle force will cause the object to move a short distance.
Level 3	
An object starts to move in the direction of the force exerted on it.	When an unmoving object starts to move, it is because another object exerted a force on it. A strong force will cause the object to move a long distance, while a gentle force will cause the object to move a short distance. The object starts moving in the same direction as the force that was exerted on it.
Level 4	
Moving objects can change direction because of a force from a moving or still object.	When an unmoving object starts to move, it is because another object exerted a force on it. A strong force will cause the object to move a long distance, while a gentle force will cause the object to move a short distance. The object starts moving in the same direction as the force that was exerted on it. If the object changes the direction it is moving, it is because a moving or still object exerted a force on it.

CONTENT STANDARDS

Below are the standards **taught** and **assessed** in this unit.

Standards
<p>Next Generation Science Standards (NGSS)</p> <p>Focal Performance Expectations</p> <p>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. <i>[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.]</i></p> <p>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. <i>[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.]</i></p> <p>K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.</p> <p>K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.</p> <p>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.</p>
<p>Texas Alignment (TEKS)</p> <p>1.7.A explain how pushes and pulls can start, stop, or change the speed or direction of an object's motion; and</p> <p>1.7.B Plan and conduct a descriptive investigation that predicts how pushes and pulls can start, stop, or change the speed or direction of an object's motion.</p> <p>2.7.A Explain how objects push on each other and may change shape when they touch or collide; and</p> <p>2.7.B plan and conduct a descriptive investigation to demonstrate how the strength of a push and pull changes an object's motion.</p>
<p>Ohio Alignment (Ohio's Learning Standards)</p> <p>1.PS.2: Objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth.</p> <p>2.PS.1: Forces change the motion of an object.</p>
<p>Florida Alignment (NGSSS)</p> <p>K.P.12.1 Investigate that things move in different ways, such as fast, slow, etc.</p> <p>K.P.13.1 Observe that a push or a pull can change the way an object is moving.</p>

ROADMAP

Below is the recommended sequence of instruction for this unit.

At a Glance Unit 2: Pushes and Pulls								
Day	Lesson	Date	Day	Lesson	Date	Day	Lesson	Date
1	1.1		16	Optional Flex Day		31	4.2 B	
2	1.2		17	3.1 A		32	4.3 A	
3	1.3 A		18	3.1 B		33	4.3 B*	
4	1.3 B		19	3.2 A		34	Optional Flex Day	
5	1.4 A		20	3.2 B		35	5.1	
6	1.4 B		21	3.3 A		36	5.2	
7	1.4 C		22	3.3 B*		37	5.3	
8	1.5 A*		23	Optional Flex Day		38	6.1	
9	Optional Flex Day		24	3.4 A		39	6.2	
10	1.5 B		25	3.4 B		40	Review	
11	2.1		26	3.5 A		41	Review	
12	2.2 A		27	3.5 B		42	6.3 A	
13	2.2 B		28	4.1 A		43	6.3 B	
14	2.3 A*		29	4.1 B		44	6.3 C	
15	2.3 B*		30	4.2 A				
<p>* Critical Juncture in lesson</p> <p><u>Formative Checks:</u> Each lesson includes a formative check to gauge student progress, using varied, differentiated methods. Examples include: anecdotal records, oral and written explanations with evidence, illustrations with labels, physical models, presentations. Notice that we are moving away from exit tickets and multiple-choice questions. As you review responses, you will need to look for patterns of strength and areas that the teacher needs to make adjustments and provide more support.</p>						 <ul style="list-style-type: none"> • See Scope and Sequence for Scanning Deadline, Link • Allow 5 business days BEFORE the scanning deadline for grading responses and entering grades. 		