Phoenixville Area School District UbD Science Unit Plan (Forces & Env Sci)

Grade: K **Unit:** Materials & Motion **Authors:** R. Lovelidge & L. Miller (PAELC)

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="3">Overarching NGSS & PA Standards:

3.2.K.B
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.

3.2.K.A
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.

3.2.K.C
Make observations to determine the effect of sunlight</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

• Ask questions and/or define problems.
• Develop and/or use models.
• Plan and/or carry out investigations.
• Analyze and interpret data using computational thinking.
• Obtain, evaluate, and communicate information (supported by evidence)
• Construct explanations and design solutions</td></tr>
<tr><td colspan="2">Meaning-Making</td></tr>
<tr><td>Students will understand that…
• Compare how different strengths and directions (of pushes and pulls) affect the motion of an object.
• Analyze data from two different objects designed to solve the same problem
o Compare the strengths and weaknesses of each design

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• The planet Earth requires sunlight for plants and animals to survive.
• Sunlight warms the Earth’s surface so that living things can live here.
• Different materials on Earth are warmed by sunlight in different ways.
• There are ways to reduce the effect of sunlight on the surfaces of the Earth.
o For example: some structures create shade and block sunlight.</td><td>ESSENTIAL QUESTIONS
Students will keep considering...
• What causes objects to move?
• What happens when you push or pull an object with various strengths?
• How can we change the motion of an object?
• How can we stop the motion of an object?
• What happens when objects collide?

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• Why does Earth need sunlight?</td></tr>
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on Earth's surface. **3.2.K.D** Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.* **3.3.K.E** Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment. STEM- K–2 ETS1-1,		• How does sunlight warm the earth? • How are Earth's materials affected by the presence or absence of sunlight? • How can the effects of sunlight on surfaces be reduced? • Observing the relative warming effect of sunlight on Earth's materials • Comparing the relative warmth of surfaces in and out of sunlight. • Safely using tools and materials to design and build a prototype. • Engaging in collaborative conversations to discuss their explorations, designs, and to generate and test explanations.
	Knowledge and Skills Acquisition	

K–2 ETS1-2,
K–2 ETS1-3

Which branch(es) of science apply:

E&SS & PS

UNDERSTANDINGS

Students will know…

- 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.
- Gravity pulls things down.
- A bigger push or pull makes things speed up or slow down more quickly.
- When objects touch or collide, they push on one another and can change motion.

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- Dark and light-colored surfaces are affected differently by sunlight.
- Some structures can create shade and reduce warming when they reduce sunlight.
- For any given surface, the longer amount of time it is exposed to sunlight, the warmer the surface will be.
- Earth materials (sand, soil, rocks, water) are affected by the presence or absence of sunlight.

KEY VOCABULARY

Direction	Warmer
Force	Cooler
Gravity	Dark
Mass	Light
Motion	Temperature
Position	Thermometer
Pull	Surface
Push	Sand

Students will be skilled at…

- Planning and conducting an investigation with peers to compare the effects of different strengths or directions (of pushes and pulls) on the motion of an object.
- Analyzing data from tests of an object or tool to determine if it works as intended (to change the speed or direction) of the object while it is being acted on (by a push or pull.)
- Analyzing 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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- Observing the relative warming effect of sunlight on Earth's materials
- Comparing the relative warmth of surfaces in and out of sunlight.
- Safely using tools and materials to design and build a prototype.

	Pull Ramp Slope Speed Collide Collision	Soil Water Rock Shade Sun Sunlight Earth's surface Prototype Structures	• Engaging in collaborative conversations to discuss their explorations, designs, and to generate and test explanations.

Stage 2 – Evidence

Evaluative Criteria	***Assessment Evidence***	
What criteria will be used in each assessment to evaluate attainment of the desired results? Rubrics related to each will be developed.	**PERFORMANCE TASK(S):** Investigations: I. **Tasks:** Students work with five different wood samples to observe their properties. They begin with free exploration, go on a hunt for matching samples, drop water on the samples, and float them in basins. They test the wood to find out how many paper clips it takes to sink it, then organize their results by making a concrete graph. Students use sandpaper to change the shape of wood. They compare sawdust and shavings and how they interact with water. They simulate the manufacture of two kinds of wood—particleboard and plywood. **Assessment:** Investigation 1 I-Check II. **Tasks:** Students observe and compare the properties of ten kinds of paper and go on a hunt for matching samples. They compare how well the papers fold and which has the best surface for writing. They test papers for absorption, then soak the samples overnight. Students learn how to recycle paper by making new paper from old and crafting papier-mâché bowls. **Assessment:** Investigation 2 I-Check III. **Tasks:** Students observe and compare the properties of ten kinds of fabric and search for different ways fabrics are used. They take apart fabrics to learn how they	**Differentiation Considerations:** For labs, consider that some students may wish to: • explain verbally instead of in a written format • draw their responses • write in their first language If challenges arise with the complexity of the task(s), some students may need: • more incremental steps • an alternative activity Other considerations: • When grouping students consider matching different skills sets

	are woven from threads. Students investigate how fabrics interact with water. They consider the properties of different fabrics and decide which fabric are good choices for clothing. Students plan how they can conserve, reuse, and recycle. They observe the warming effect of the sun and design a structure to reduce the effect of heating. **Assessment:** Investigation 3 I-Check IV. **Tasks:** Students investigate the strength of pushes and pulls needed to move objects. They use gravity to pull balls down slopes to investigate collisions. Students find ways to change the strength and direction of the pull on a rolling ball to meet design challenges. Students change the strength of the push on a balloon rocket flying on a line to explore cause and effect. **Assessment:** Investigation 4 I-Check Unit Activities: **1.** <u>School Yard Shelter</u> **GOAL:** Your goal is to create a prototype for the best structure or cover that can provide shade for students at recess. **ROLE:** You are a member of our school's maintenance team. **AUDIENCE:** The principal of the school. **SITUATION:** Students at our school are getting very hot when playing in the grassy areas and on the tennis courts during recess. Work with the other members of your maintenance team to create a prototype for the best structure or cover that can provide shade for our students who are hot. **PRODUCT/PERFORMANCE AND PURPOSE:** The performance task is to design a prototype for helping students stay cool in a certain area of the school yard. The product is a protype **STANDARDS & CRITERIA FOR SUCCESS:** Your prototype needs to be designed to be placed in an area in the school yard where students can stay cool. **2.** <u>Car Driver</u> **GOAL:** Your goal is to be able to control your car and be able to make it slow down, speed up, and change direction to avoid collision. **ROLE:** You are a trainer for racecar drivers. **AUDIENCE:** The audience is racecar drivers. **SITUATION:** Your drivers have their first race coming up! You will need to teach them how to make their cars move slow, fast, and change direction to avoid collisions.	• When asking students to describe a model, give them the opportunity to draw or write it, as well. • Teacher can scribe written responses for students

	PRODUCT/PERFORMANCE AND PURPOSE: The purpose is the "drivers" need to be able to control their cars to make them drive short and long distances and avoid collisions. The performance task is to effectively push/pull your car to be able to make your car go a long distance and a short distance. You need to create a way for your car to change direction to avoid colliding with the big block in the road. **STANDARDS & CRITERIA FOR SUCCESS:** You will need to reach a certain number on the racetrack. You must consider how strongly you must push your car to get closest to that spot. You will need to show and describe how your car will change direction to avoid collisions.	

What criteria will be used in each assessment to evaluate attainment of the desired results?
 	
Rubrics related to each will be developed.
	OTHER EVIDENCE:
	
	• Lab-**Investigating Car Motion**. This will consist of a group of students conducting a series of trials (and recording their findings) to observe their cars:
	  o Across long and short distances
	  o Across flat and inclined surfaces
	
	(Students will use the results from this activity to aid in the successful completion of the unit performance task)
	
	• Checklists of collaborative behaviors in labs and activities
	• Checklists of collaborative behaviors in class discussions
	• Journal entries: On an outdoor trip, students will observe and record the effects of the sun on three different surfaces: grass, black top, and playground rubberized surface. Students will record (by drawing or writing) which surfaces are the hottest and which are the coolest.
	
	What evidence will be collected to determine whether Stage 1 goals were achieved?)
		Differentiation Considerations:
		
		For journal entries, consider that some students may wish to:
		
		• draw instead of write entries
		• write in their first language
		
		For labs, consider that some students may wish to:
		
		• explain verbally instead of in a written format
		• write in their first language
		
		If challenges arise with complexity of the task(s):
		
		• smaller steps and/or
		• alternative activities will be provided.