Learning Architecture: 3D Specifications

Performance Expectation Theme

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.

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.*

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.

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.

Disciplinary Core Ideas (DCIs)

PS2.A: Forces and Motion

• Pushes and pulls can have different strengths and directions. (KPS2-1), (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)

Concepts:
Push, Pull
Strength
Direction

Speed
Motion
Changing speed/motion

PS2.B: Types of Interactions

• When objects touch or collide, they push on one another and can change motion. (K-PS2-1)

Concepts:
Touch vs Collide
Motion
Changing motion

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)

Concepts:
Bigger (vs. smaller) push

Speed up vs. slow down

More quickly

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 KPS2-2)

Science & Engineering Practices (SEPs)

Planning & Carrying Out Investigations

- plan and conduct an investigation in collaboration with peers (for K)…to produce data to serve as the basis for evidence to answer a question.
- Evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question.
- Make observations and/or measurements to collect data that can be used to make comparisons.

Analyzing & Interpreting Data

- Record information
- Use and share pictures, drawings, and/or writings of observations.
- patterns and/or relationships in oUse observations to describe rder to answer questions and solve problems.
- Compare predictions (based on prior experiences) to what occurred (observable events)
- Analyze data from tests of an object/tool to determine if it works as intended

Constructing Explanations (for science) & **Designing Solutions** (for engineering)

- Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.
- Use tools and/or materials to design and/or build a device that solves a specific problem or a solution to a specific problem.
- Generate and/or compare multiple solutions to a problem.

Asking Questions (for science) & **Defining Problems** (for engineering)

- based on observations to find more information
- that can be answered by an investigation
- a simple problem that can be solved through the development of a new or improved object or tool

Engaging in Argument from Evidence

- Identify arguments that are supported by evidence.
- Distinguish between explanations that account for all gathered evidence and those that do not.
- Analyze why some evidence is relevant to a scientific question and some is not.
- Distinguish between opinions and evidence in one's own explanations.
- Listen actively to arguments to indicate agreement or disagreement based on evidence, and/or to retell the main points of the argument.
- Construct an argument with evidence to support a claim.
- Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence.

NGSS appendix F SEP
K-2 Condensed Practices

Developing & Using Models

- Distinguish between a model and the actual object, process, and/or events the model represents.
- Compare models to identify common features and differences.
- Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).
- Develop a simple model based on evidence to represent a proposed object or tool.

Obtaining Evaluating & Communicating Information

- Read grade-appropriate texts and/or use media to obtain scientific and/or technical information to determine patterns in and/or evidence
- Describe how specific images (e.g., a diagram showing how a machine works) support a scientific or engineering idea.
- Obtain information using various texts, text features…
- Communicate information or design ideas and/or solutions in oral /written forms using models, drawings, …

Using Mathematical & Computational Thinking

- Decide when to use qualitative vs. quantitative data.
- Use counting and numbers to identify and describe patterns in the natural and designed world(s).
- Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs.
- Use quantitative data to compare two alternative solutions to a problem.

Crosscutting Concepts (CCs)

Cause & Effect

- Events have causes that generate observable patterns.
- Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Structure & Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

Scale, Proportion & Quantity

- Relative scales allow objects and events to be compared and described (e.g., bigger and smaller; hotter and colder; faster and slower).
- Standard units are used to measure length.

Patterns

- Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

Stability & Change

- Some things stay the same while other things change.
- Things may change slowly or rapidly.

Systems & System Models

- Objects and organisms can be described in terms of their parts.
- Systems in the natural and designed world have parts that work together.

Energy & Matter

- Objects may break into smaller pieces, be put together into larger pieces, or change shapes.

Phenomena & Questions

Phenomena:

Playgrounds

Questions:

- What kinds of motion do I experience on the playground?
- Why do I go higher when my mom/dad pushes me?
- Why do I pull the swing back to start, but have to be pushed to keep going?

Phenomena:

Daily Life

Questions:

- What kinds of things do I push/pull - why?
- How do things speed up/slow down?
- How do things change direction?
- Why do I get in trouble for pushing

Phenomena:

Cars & Ramps

Questions:

- Why does her car go farther than mine
- How can I make may car go fast/slow/stop?
- What if we add more ramps?
- How can I get my car to place X, y, or Z? (stops along the track)

Phenomena:

Pinball

Questions:

- Why does the ball bounce around so much?
- What can I do to change the way the ball moves?
- How does my pull push the ball?
- What happens when the ball hits the different parts

Learning Performances

Continued on next page…

Students will | ask questions | about | The cause & effect relationships | they experience | Playing on the playground | to learn about | Forces & Motion
- Push/pull
- Speed, direction, changes

Students will | construct explanations | about | the structure and function | of everyday objects/life experiences | to help make sense of | Forces & Motion
- Push/pull
- Speed, direction, changes

Students will | ask questions | about | The cause & effect relationships | they experience | Playing with cars and ramps | to prime their thinking about | Types of Interactions

And… | Relationship Between Energy and Forces

Students will | Define problems | related to the | the causes & effects | the Relationship Between Energy and Forces | **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 KPS2-2) | have on their ability to compare | how far their cars can go

Continued on next page…

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Learning Performances

Students will
Using concepts of

Design solutions
Scale, proportion & quantity

To effect the
Students will

the structure and function
Analyze & interpret data

Of their
From their

Car ramps
Car tracks

Using the properties of
To explore

Types of Interactions

And…

Forces & Motion
- Push/pull
- Speed, direction, changes

Relationship Between Energy and Forces

Types of Interactions

And…

Relationship Between Energy and Forces

Engaging in argument from evidence
Students will discuss

the causes & effects
that different

Structures in their pinball machines
Will have on

Types of Interactions

Students will
Analyze & interpret data

To explore
Forces & Motion
- Push/pull
- Speed, direction, changes

Related to the
Structure & function

Of their
Pinball machines