

Midterm Major Project: Engineering Design Challenge Coleman

The Big Concept: Laws of Motion

Standards:

3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.)

PS2.B: Types of Interactions

- Objects in contact exert forces on each other.

3-PS2-2 Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

PS2.A: Forces and Motion

- The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)

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Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.</p> <ul style="list-style-type: none">Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. <hr/> <p><i>Connections to Nature of Science</i></p> <p>Scientific Investigations Use a Variety of Methods</p> <ul style="list-style-type: none">Science investigations use a variety of methods, tools, and techniques.	<p>PS2.A: Forces and Motion</p> <ul style="list-style-type: none"><u>Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.)</u> <p>PS2.B: Types of Interactions</p> <ul style="list-style-type: none">Objects in contact exert forces on each other.	<p>Cause and Effect</p> <ul style="list-style-type: none">Cause and effect relationships are routinely identified.

Declarative Knowledge Needed: gravity pulls things down, everything has mass and can be moved with the appropriate amount of force, different materials react differently to various stimuli, weight variances can cause different reactions, potential to kinetic energy, weight distribution affects rolling, shapes matter, importance of bracing when constructing

Procedural Knowledge Needed: how to fold, cut, and tape cardstock to create track pieces, working on a foundation plan first, working in an engineering/STEM notebook creating drawings and various iterations, reading and using a ruler properly, comfort with the process of failing forward...learning from the mistakes, creating tests and documenting the results, proper usage of tools used in the activity

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Ancillary Concepts. Standards Covered:

Common Core State Standards Connections:

ELA/Literacy -

- RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-PS2-1)
- W.3.7 Conduct short research projects that build knowledge about a topic. (3-PS2-1)
- W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-PS2-1)

Mathematics -

- MP.2 Reason abstractly and quantitatively. (3-PS2-1)
- MP.5 Use appropriate tools strategically. (3-PS2-1)
- 3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. (3-PS2-1)

Possible Activities:

- Rube Goldberg Machines
- Paper Roller Coasters
- Marble Runs
- Newton's Cradles
- Remote-controlled/programmed "bumper cars" using small robots(Ozobots, LEGO, Sphero, etc.)

Best Activity for my classroom:

I tend to give choices, to get more voice from the learners. I find the dedication, persistence and follow through are much higher when students feel they have a say. The joy in their learning tends to shine through, as well as the excitement to share their new-found knowledge.

If I had to choose (1)one, I would guess that beginning with or combining **Paper Roller Coasters and the Marble Run.**