

Wethersfield Public Schools
NGSS Unit Overview
Forces & Interactions
Approved 2019
Updated to NGSS 2022

Grade: 4th	Topic: Forces & Interactions	Time Frame/Duration: 15-18 days
Brief Unit Description: In this unit, students will be seeking to answer the question “What makes objects move the way they do?” Lessons focus on types of forces, interaction of force and motion, work, as well as potential and kinetic energy. Students participate in hands-on activities during lessons to solidify understanding, as well as afterwards for assessments and learning extensions. Students are also learning about the importance of and ways to develop an evidence-based explanatory model. Students learn that the success of a product depends on the scientific characteristics of its design, and apply this in their design of experiments and models.		
Primary Performance Expectation(s) 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. 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. 3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. 3-PS2-4. Define a simple design problem that can be solved by applying scientific ideas about magnets.*		
Supporting/Additional Performance Expectations(s): 4-PS3-1 Use evidence to construct an explanation relating the speed of an object to the energy of that object. 4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. 4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide. 4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.		

Looking back: 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.	Looking Forward: MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. MS-PS2-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. MS-PS2-3 Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. MS-PS2-5 Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
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Learning Outcomes/ Hinge Ideas: Enduring Understandings: ~The size of the change in an object's motion is related to the strength of the push or pull. ~The more massive an object is, the less effect a given force will have on its motion. ~Forces cause objects to move, change position or direction, or stop. Essential Questions: ~What makes objects move the way they do? ~What is the effect of friction on motion? ~How do force and mass influence the speed of an object?		
Science & Engineering Practices: 1. Asking questions 2. Developing and using models 3. Planning and carrying out investigations 4. Analyzing and interpreting	Disciplinary Core Ideas: 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	Crosscutting Concepts: Patterns • Patterns of change can be used to make predictions. (3-PS2-2) Cause and Effect • Cause and effect relationships are routinely identified. (3-PS2-1) • Cause and effect relationships are routinely identified, tested,

data	speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3-PS2-1) • 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.) (3-PS2-2) PS2.B: Types of Interactions • Objects in contact exert forces on each other. (3-PS2-1) • Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3),(3-PS2-4)	and used to explain change. (3-PS2-3) Interdependence of Science, Engineering, and Technology • Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. (3-PS2-4)
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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),(3-PS2-3)

RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-PS2-3)

RI.3.8 Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence). (3-PS2-3)

W.3.7 Conduct short research projects that build knowledge about a topic. (3-PS2-1),(3-PS2-2)

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),(3-PS2-2)

SL.3.3 Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. (3-PS2-3)

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)

Suggested Resources/Lessons

Vocabulary:

motion, force, speed, gravity, friction, mass

Links:

Anchoring Phenomenon Video
NGSS Science

Phenomenon:

This unit is anchored by a skateboard jump phenomenon containing an successful jump and an epic fail.

Lessons 1-2:Developing Models to Explain the Skateboarder's Motion

Lesson 3a: Pulling a Vehicle Looking at Force

Lesson 3b: Tug-of-War

Lesson 4: Testing the Motion of Vehicles Carrying a Load

Lesson 5: Testing How Varying Pulling Force Affects Motion of Loaded Vehicle

Lesson 6: Looking at Friction

Lesson 7: Looking at Rubber Band Energy

Lesson 8: Testing the Effects of Rubber Band Energy

Lesson 9: Adding to Models Using Evidence from Activities

Lesson 10: Writing the Evidence Based Explanation