

Big Idea: <i>How do equal and unequal forces on an object affect the object?</i>							
Guiding Questions: Part A: <i>How do scientists play soccer?</i> Part B: <i>Can we use patterns that we observed to predict the future?</i>							
21st Century Themes/Skills:							
<i>DCI (Disciplinary Core Ideas)</i>	<i>Science and Engineering Practices</i>	<i>Crosscutting Concepts</i>	<i>Student Learning Objectives</i>	<i>Differentiated Activities (Consider the 5 Es)</i>	<i>Resources/Technology</i>	<i>Formative Assessments</i>	<i>Benchmark Assessment</i>
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.) (3-PS2-1) PS2.B: Types of Interactions Objects in contact exert forces on each other.	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. -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. 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 -Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.	Cause and Effect Cause and effect relationships are routinely identified. (3-PS2-1) Patterns Patterns of change can be used to make predictions. (3-PS2-2)	Students will observe and explain that an object will move in the direction of the largest force as well as an object will not be in motion if the forces are equal.	Engage students by with a large rope laying in the middle of an area where all students are able to see the rope from the same angle. Pose the questions: "Is the rope moving?" (No.) "How can we make the rope move?" (Have students brainstorm ideas of how to make the rope move. They should record their ideas in their science journal.) Facilitate a discussion about the ways we can move the rope.	<i>Adapted from McCracken School District</i>	-Activity Student Sheets of Responses (see links in Resources/Technology for each lesson) -Class discussion -Science journal entries -Predictions -Questions -Observations -Group collaboration -Planned and conducted experiments -Exit Slips (paper-based, Google Forms, Google Classroom post, etc.)	
				Explore the concept of force using the game "Tug of War." Students will create testable scientific questions of teams they wish to have compete in "Tug of War." Examples: girls vs boys (Who is stronger, boys or girls?), tall vs short, etc. Have students test their questions.	Discovery Education About Force Interactive Tug of War		
				Explain the concepts of forces (balanced and unbalanced) through a class discussion. The main focus of the discussion should be that the rope moved in the direction that had the largest force upon it. Create a definition of Newton's First Law of Motion.			
				To illustrate more than one force is acting on it, students will play a class game of "Four Way Tug of War." To create this game, the teacher will attach the additional rope by tying a knot in the middle of the rope. Through this activity, students could discover that the merging and combining of teams could help create unbalanced forces and allow the rope to move in the direction of the greater force.			
				Evaluate students through their science journals predictions, observations, and questions and through class discussion.			
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				Explore the concept of gravity through planning and conducting an investigation centered on the question "If you drop a ping pong ball and golf ball at the same time from the same height, which one will hit the ground first? Why?"			
				Explain the cause and effect relationship of gravity and mass of each ball based upon the findings from the experiment.			
				Elaborate with the discussion of the question "When Neil Armstrong dropped the hammer and the feather, why did they hit the moon at the same time?"			
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				Explore the question "What effect does the force of the same strength have on objects of different weights?" through student planned investigation using ping pong ball, golf ball, and ruler.			

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				<p>Explain by comparing data from investigation and draw conclusions about force applied to objects and it's outcome in distance and direction the object traveled. Use other balls to continue investigating. Create a definition of Newton's Second Law of Motion.</p> <p>Elaborate by making a list of forces they see every day and how those forces effect the motion of the objects. (examples could include batting or kicking a ball, strong winds and breezes blowing, flowing water)</p>	<p>Further Elaboration Resources:</p> <ul style="list-style-type: none"> Ask students to make a model of force applied to an object and its outcome to demonstrate for the class. Knowing what we now know about force and outcome, design and draw a paddle you would use to win a ping pong tournament. Watch Bill Nye the Science Guy The Law of Inertia: https://www.youtube.com/watch?v=ZFoG7HRE2mE 		
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				United Streaming: TEAMS: Force and Motion: Measuring Forces Segment 5 "How do Pendulums Work?"			
				Explore: Students will be building a machine to make observations of an object's motion to provide evidence that a pattern can be used to predict future motion and further explore the effects of force on an object in motion. Each group is responsible for building a machine and using it to experiment with applying force to an object in motion.	Materials Needed: For each group: • Ruler • 2 pieces of masking tape • 2 feet of string • 2" ping pong ball • Lesson 4-Building a Pendulum Paper • Large straw		
				Explain: Justify (evidence) and clarify to provide evidence that a pattern can be used to predict future motion. Formally create definitions, explanations, and new labels for the vocabulary pendulum, fulcrum point, Inertia, balanced force and unbalanced force Elaborate and Evaluate: draw and label pendulum creation while in motion; observe these concepts in real world applications and explain them using support from their recorded observations.			
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				Explore: Predict what will happen if two balloons are rubbed together against and interacting with various sources. Plan and conduct experiment.	Materials Needed: Two balloons per group One tin can per group One piece of woolen fabric per group		
				Explain the creation of static electricity and the concepts through analyze the results of the investigation			
				Elaborate by regrouping and discussing any other examples of the transfer of static electricity students can think of.			
PS2.B: Types of Interactions 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	Asking Questions and Defining Problems Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying	Cause and Effect Cause and effect relationships are routinely identified, tested, and used to explain change.	Students will ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.	Engage: demonstration of attraction and repulsion using two bar magnets.			
				Explore: Stations of magnetic explorations	See page 21 for materials per station		

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properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.	qualitative relationships. -Ask questions that can be investigated based on patterns such as cause and effect relationships.		Students will investigate and confirm their understanding of how magnets attract and repel other magnets.	Explain: discussion about the results the students discovered in regards to magnets to ensure they are prepared for the next lessons.	Magnets Song		
				Elaborate: Discuss and introduce students to what we will be doing further in investigation of magnets			