

# MOTION: PUSHES & PULLS (K.PS.NGSS)

## UNIT AT A GLANCE

### ACTIVITY 1 - Playground Motion

**QUESTIONS:** How do we describe motion on the playground?

Time to Complete	Phenomena	Summary: Students Will...
Preparation: 15 minutes Activity: 3 classes Lesson 1A: 45–50 min. Lesson 1B: 75–80 min. Lesson 1C: 45–50 min.	A push and a pull change the motion of the equipment on the playground.	<ul style="list-style-type: none"> <li>Brainstorm ideas of the different kinds of motion on the playground.</li> <li>Make observations of motion on different equipment in the playground.</li> <li>Look for patterns in the forces to identify pushes and pulls.</li> </ul>
Students Figure Out How To:	Practices	Performance Expectations (PE) at Lesson Level and Assessment
<ul style="list-style-type: none"> <li>Construct explanations of the concept of force (pushes and pulls) through observation and investigation.</li> <li>Determine if the force is a push or a pull.</li> </ul>	Constructing Explanations Planning and Carrying Out Investigations Analyzing and Interpreting Data Cause and Effect	<b>PE at Lesson Level</b> Develop an initial understanding of weather conditions and instruments used to measure weather conditions. Evaluate students' initial understanding of patterns and ability to recognize patterns. <b>Formative Assessment</b> Science Talk Journal Entry/Weather Observation Log

### ACTIVITY 2 - Balls In Motion

**QUESTIONS:** What can we learn about motion by changing the strength of the force on a ball?

Time to Complete	Phenomena	Summary: Students Will...
Preparation: 15 minutes Activity: 5 classes Lesson 2A: 45 min. 2 class periods Lesson 2B: 45 min. 2 class periods Lesson 2C: 60 min.	The motion and direction of a rolling ball is related to the strength and direction of a push or a pull. Pushes and pulls have different strengths and directions. Pushes and pulls can change motion.	<ul style="list-style-type: none"> <li>Investigate motion related to force.</li> <li>Investigate the motion of different types of balls.</li> <li>Relate the angle of a ramp to the motion of the ball.</li> <li>Relate the size and weight of the balls to their motion.</li> </ul>

## ACTIVITY 2 - Balls In Motion - *Continued*

Students Figure Out How To:	Practices	Performance Expectations (PE) at Lesson Level and Assessment
<ul style="list-style-type: none"> <li>Design an investigation to collect information on the motion of a variety of balls.</li> <li>Determine the effects of different strengths of forces on the motion and direction of different balls.</li> <li>Make statements about forces and motion based on evidence.</li> </ul>	<p><b>Planning and Carrying Out Investigations</b></p> <p><b>Constructing Explanations</b></p> <p><b>Cause and Effect</b></p>	<p><b>PE at Lesson Level:</b> Collect data through observations of changes in motion due to pushes or pulls.</p> <p><b>Formative Assessment:</b> Facilitation of team activity 2A—design and conduct an investigation of how the motion of the balls is related to the strength and direction of the push.</p> <p><b>Summative Assessment:</b> Respond to text 2C—relate the strength of the push to a change in the motion of the vegetable cart. Journal Entry</p>

## ACTIVITY 3 - Collisions

**QUESTIONS:** How is the motion of objects affected by collisions?

Time to Complete	Phenomena	Summary: Students Will...
<p>Preparation: 10 minutes Activity: 3 classes Lesson 3A: 45–50 min. Lesson 3B: 45–50 min. Lesson 3C: 45–50 min.</p>	<p>When objects touch or collide, they push on one another and can change motion. Engineers use scientific understanding to solve problems. Engineers collect and use data to make improvements to designs.</p>	<ul style="list-style-type: none"> <li>Investigate the effect of a rolling ball hitting a barrier.</li> <li>Apply their knowledge of forces and collisions with barriers to collisions between objects of different weight.</li> <li>Design an apparatus that will allow a ball to travel from a specific starting point to a specific end point with a change in direction.</li> </ul>
Students Figure Out How To:	Practices	Performance Expectations (PE) at Lesson Level and Assessment
<ul style="list-style-type: none"> <li>Design an investigation to determine the effect of a collision between a moving object and a stationary object.</li> <li>Design an investigation to determine the effect of a collision between two moving objects.</li> <li>Construct explanations regarding the effect of collisions on motion.</li> </ul>	<p><b>Constructing Explanations</b></p> <p><b>Planning and Carrying Out Investigations</b></p> <p><b>Developing and Using Models</b></p> <p><b>Analyzing and Interpreting Data</b></p> <p><b>Patterns</b></p>	<p><b>PE at Lesson Level</b> Relate information from investigations to reading.</p> <p><b>Formative Assessment:</b> Class discussion</p> <p><b>Summative Assessment:</b> Student presentations Journal Entry</p>

## ACTIVITY 4 - Explaining Motion

**QUESTIONS:** What are the common characteristics of forces and motion?

<b>Time to Complete</b>	<b>Phenomena</b>	<b>Summary: Students Will...</b>
Preparation: 10 minutes Activity: 3 classes Lesson 4A: 45–50 min. 2 class periods Lesson 4B: 45–50 min.	A push or a pull is used to move a cart of vegetables from one place to another. A greater push is necessary to move the cart uphill. Gravity can pull the cart downhill. A force is needed to change the direction of the cart.	<ul style="list-style-type: none"> <li>Review and compare information recorded from initial thinking and investigations.</li> <li>Make connections among information gained through their investigations and information in written text.</li> </ul>
<b>Students Figure Out How To:</b>	<b>Practices</b>	<b>Performance Expectations (PE) at Lesson Level and Assessment</b>
<ul style="list-style-type: none"> <li>Determine changes in previous thinking based on observation and evidence.</li> <li>Compare evidence from investigation to evidence presented in text.</li> <li>Summarize their thinking about motion and forces based on new evidence.</li> </ul>	Constructing Explanations Develop and Using Models Analyzing and Interpreting Data	<b>PE at Lesson Level</b> Relate information from investigations to reading. <b>Formative Assessment:</b> Class discussion <b>Summative Assessment:</b> Student presentations Journal Entry

## ACTIVITY 5 - What Goes Up Must Come Down

**QUESTIONS:** How does the pull of gravity affect the motion of objects?

<b>Time to Complete</b>	<b>Phenomena</b>	<b>Summary: Students Will...</b>
Preparation: 10 minutes Activity 5: 2 classes Lesson 5A: 45–50 min. Lesson 5B: 45–50 min.	All objects, when dropped or thrown will fall to the earth.	<ul style="list-style-type: none"> <li>Gather evidence to demonstrate how all objects fall toward the earth.</li> <li>Design and conduct investigations into the force that pulls objects by dropping and rolling downhill.</li> </ul>
<b>Students Figure Out How To:</b>	<b>Practices</b>	<b>Performance Expectations (PE) at Lesson Level and Assessment</b>
<ul style="list-style-type: none"> <li>Provide evidence that objects fall down.</li> <li>Determine how predictions about motion can be determined by position and the force of gravity.</li> </ul>	Planning and Carrying Out Investigations. Constructing Explanations Analyzing and Interpreting Data Cause and Effect	<b>PE at Lesson Level:</b> Make observations to determine that all objects fall to the earth. <b>Formative Assessment:</b> Motion statement <b>Summative Assessment:</b> Journal Entries

## ACTIVITY 6 - Where Is It? Where Is It Going?

**QUESTIONS:** How does the description of motion change from different points of view?

Time to Complete	Phenomena	Summary: Students Will...
Preparation: 10 minutes Activity 6: 2 classes Lesson 6A: 45–50 min. Lesson 6B: 45–50 min.	The description of an object’s motion from one observer’s view may be different from that reported from a different observer’s view.	<ul style="list-style-type: none"> <li>Consider position of observer in relation to moving object when describing motion.</li> <li>Make observations of motion from different positions.</li> <li>Apply vocabulary related to the motion of different moving objects.</li> </ul>
Students Figure Out How To:	Practices	Performance Expectations (PE) at Lesson Level and Assessment
<ul style="list-style-type: none"> <li>Make observations of the motion and position of objects from different points of view.</li> <li>Compare and contrast the description of an object’s motion from different observers’ views.</li> <li>Collaborate to determine the best descriptions of motion and position.</li> </ul>	<b>Obtaining, Evaluating, and Communicating Information</b>	<b>Formative Assessment:</b> Summary Discussion 7A Activity Page 7A <b>Summative Assessment:</b> Summary Discussion 7B Journal Entry 7B

## ACTIVITY 7 - Setting Things In Motion

**QUESTIONS:** How can we build a device that will make a ball travel from one specific starting point to another specific end point?

Time to Complete	Phenomena	Summary: Students Will...
Preparation: 10 minutes Activity 7: 4-6 classes Designing and Building: 2-3 classes Presentations: 2-3 classes	Engineers make models to demonstrate how things move. They design, test, and refine devices to make improvements to their product. Engineers use scientific information to develop new material.	<ul style="list-style-type: none"> <li>Use information about forces, collisions, and motion to design a device that will make the ball move from point A to point B.</li> <li>Evaluate their own and each other’s devices to make improvements and adjustments.</li> </ul>
Students Figure Out How To:	Practices	Performance Expectations (PE) at Lesson Level and Assessment
<ul style="list-style-type: none"> <li>Make decisions as to material and design to accomplish the task.</li> <li>Evaluate the design and make adjustments based on evidence and feedback.</li> <li>Work as a team using the Engineering Design Process</li> </ul>	<b>Obtaining, Evaluating, and Communicating Information</b> <b>Constructing Explanations</b> <b>Developing and Using Models.</b>	<b>Summative Assessment:</b> Performance assessment of engineering device Journal Entry