

# CCPS Science Unit Plan

<b>Grade</b>	8th	<b>Subject</b>	HS Physical Science	<b>Unit #</b>	6
<b>Unit Name</b>	Force and Motion		<b>Timeline</b>	2 weeks	
<b>How to use the Framework</b>	<p style="color: red;">This Framework should be used to implement daily science instruction. The resources and instructional strategies reflected in the Framework will provide a foundation for effective implementation and student mastery of standards.</p> <p style="color: red;">Please see the hyperlinked <a href="#">abbreviation document</a> to ensure understanding of all abbreviations used with this framework.</p>				
Unit Overview	<p><b>In this unit, students will have opportunities to observe, measure, and discuss how matter and the forces that act upon it combine to create regularities and patterns that explain scientific phenomenon. Students will develop a conceptual understanding of force, motion and matter through inquiry and investigation. Newton's Laws of Motion, gravitational forces, and simple machines. The tasks suggested in this unit integrate the characteristics of science and habits of mind that extend students' critical and creative thinking abilities in the context of the science concepts being studied.</b></p> <p><b>Focus:</b></p> <ul style="list-style-type: none"> <li>● Motion: Distance, Displacement, Speed, Velocity, Time, and Acceleration</li> <li>● Newton's Three Laws: Inertia, Force, Mass, Acceleration, and Action-Reaction</li> <li>● Gravitational Force for falling objects: Gravity, Mass, Acceleration of Gravity, and Force</li> <li>● Simple Machines: Work and Mechanical Advantage</li> </ul>				
Lesson Plan guidance document and template	<p><a href="#">CCPS Lesson Plan Template Day View</a>  <a href="#">Lesson Plan Template Week View</a>  <a href="#">Department of Science Guidance Document</a></p>				
3Dimensional Instruction	<u>GSE</u>	<u>Science and Engineering Practices</u>	<u>Crosscutting Concepts</u>		
	<p><b>SPS8. Obtain, evaluate, and communicate information to explain the relationships among force, mass, and motion.</b></p> <p>a. Plan and carry out an investigation to analyze the motion of an object</p>	<ul style="list-style-type: none"> <li>● Developing and using models</li> <li>● Planning and carrying out investigations</li> <li>● Analyzing and interpreting data</li> </ul>	<ul style="list-style-type: none"> <li>● Cause and Effect: Mechanism and Prediction</li> <li>● Scale, Proportion, and Quantity</li> <li>● Systems and System Models</li> <li>● Stability and Change</li> </ul>		

	<p>using mathematical and graphical models.  <i>(Clarification statement: Mathematical and graphical models could include distance, displacement, speed, velocity, time and acceleration.)</i></p> <p>b. Construct an explanation based on experimental evidence to support the claims presented in Newton's three laws of motion.  <i>(Clarification statement: Evidence could demonstrate relationships among force, mass, velocity, and acceleration.)</i></p> <p>c. Analyze and interpret data to identify the relationship between mass and gravitational force for falling objects.</p> <p>d. Use mathematics and computational thinking to identify the relationships between work, mechanical advantage, and simple machines.</p>	<ul style="list-style-type: none"> <li>• Using mathematics and computational thinking</li> <li>• Engaging in argument from evidence</li> <li>• Obtaining, evaluating, and communicating information</li> </ul>	
<p><b>NGSS Alignment</b></p>	<p><a href="#">NGSS Alignment to Disciplinary Core Ideas</a></p>		

**Weekly Lesson Tasks**

**Week 1**

**GSE: SPS8. Obtain, evaluate, and communicate information to explain the relationships among force, mass, and motion.**

a. Plan and carry out an investigation to analyze the motion of an object using mathematical and graphical models.

*(Clarification statement: Mathematical and graphical models could include distance, displacement, speed, velocity, time and acceleration.)*

b. Construct an explanation based on experimental evidence to support the claims presented in Newton's three laws of motion.

*(Clarification statement: Evidence could demonstrate relationships among force, mass, velocity, and acceleration.)*

**Focused Concept:** Motion  
Force: Newton's Laws of Motion

**Phenomenon:**

Car stop - seatbelts and airbags

[Car Crash without Seatbelts](#)

<https://goo.gl/aiFnyY>

**DQ:** How do we describe motion?

What does force have to do with motion?

**SEP:**

- Ask Questions.
- Develop and Use Models.
- Plan and Carry out Investigations.
- Analyze and Interpret Data.
- Obtain, Evaluate, and Communicate Information.

**CCC:**

- Cause and Effect
- Systems and System Models
- Stability and Change
- Patterns

	Day 1	Day 2	Day 3	Day 4	Day 5
<b>Learning Target</b>	SWBAT describe motion.  SWBAT interpret distance/time graphs.	SWBAT interpret distance/time (speed) graphs and velocity/time (acceleration) graphs.	SWBAT explain what causes an object to move or stay still.	SWBAT explain why we wear seatbelts.	SWBAT apply the laws of motion in the Gizmo.
<b>Opening</b>	Show students the	<b>Inspire Physical Science</b>	Show students the	<b>Inspire Physical Science</b>	Introduce the Fan Cart

	<p>phenomenon and have them engage in a see-think-wonder</p> <p><b>Inspire Physical Science Module 2: Lesson 1: Motion</b></p> <p>Engage: Launch the Lesson: Describing Motion (from textbook)</p> <p>Go through the Teacher PowerPoint: Motion for this lesson in your textbook resources. As the teacher moves through the information students should be taking notes.</p> <p><b>Inspire Physical Science Module 2: Lesson 2: Velocity</b></p> <p>Go through the Teacher PowerPoint: Velocity for this lesson in your textbook resources. As the teacher moves through the information students should be taking notes.</p> <p><b>*Momentum is mentioned in the textbook, but is not in the language of the standard.</b></p>	<p><b>Module 2: Lesson 3: Acceleration</b></p> <p>Engage: Launch the Lesson: Acceleration (from textbook)</p> <p>Go through the Teacher PowerPoint: Acceleration for this lesson in your textbook resources. As the teacher moves through the information students should be taking notes.</p> <p><a href="#">Motion Graphs</a></p> <p>Take students through the following <a href="#">presentation</a>.</p> <p>It is recommended that students are given white boards with dry erase markers to write their responses to the questions in the presentation. This allows the teacher to immediately address misconceptions.</p>	<p>phenomenon and have them engage in a see-think-wonder</p> <p><b>Inspire Physical Science Module 3: Lesson 1: Forces</b></p> <p>Engage: Launch the Lesson: Forces (from textbook)</p> <p>Go through the Teacher PowerPoint: Forces for this lesson in your textbook resources. As the teacher moves through the information students should be taking note</p> <p><b>Inspire Physical Science Module 3: Lesson 2: Newton's Laws</b></p> <p>Engage: Launch the Lesson: Newton's Laws of Motion(from textbook)</p> <p>Go through the Teacher PowerPoint: Newton's Laws of Motion for this lesson in your textbook resources. As the teacher moves through the information students should be taking notes.</p>	<p><b>Module 3: Lesson 3: Using Newton's Laws</b></p> <p>Engage: Launch the Lesson: Using Newton's Laws(from textbook)</p> <p>Go through the Teacher PowerPoint: Using Newton's Laws for this lesson in your textbook resources. As the teacher moves through the information students should be taking notes.</p>	<p>Physics Gizmo and complete the first page of the student handout as a class.</p> <p>The teacher should model how to manipulate the Gizmo and have students manipulate the Gizmo. The teacher and students should follow each step from page one of the Gizmo handout.</p>
<p><b>Guided Practice/ Transition</b></p>	<p>Have students go through Explore and Explain: Graphing Motion from the textbook online resources.</p> <p>Have students examine the graph and determine which girl swam the farthest during the workout.</p>	<p>Have students go through Explore and Explain: Velocity and Acceleration from the textbook online resources.</p> <p>Have students describe three ways an object can accelerate.</p>	<p>Have students go through Explore and Explain: What is Force? from the textbook online resources.</p> <p>Students can work in pairs to identify additional balanced and unbalanced forces.</p>	<p>Have students go through Explore and Explain: What happens in a car crash? from the textbook online resources.</p> <p>Revisit the phenomenon with car crashes without seatbelts.</p>	<p>In pairs, students should complete activity A of the Fan Cart Physics Gizmo. After about 10 minutes the teacher should review Activity A as a whole class.</p>

	<p>Students can work in pairs and then share their responses with a justification.</p> <p>Have students go through Explore and Explain: Velocity from the textbook online resources.</p> <p>Have students describe the velocity of Earth's crust.</p> <p>Students can work in pairs and then share their responses with a justification.</p>	<p>Students can work in pairs and then share their responses with a justification.</p> <p>Whole class will briefly review pages 1 -3 and 6 - 8 of <a href="#">Motion Graphs</a>.</p> <p>-Pages 1 -3 focus on distance/time (speed) graphs -Pages 6 - 8 focus on velocity/time (acceleration) graphs. Sometimes velocity/time graphs are also written as speed/time graphs.</p> <p><b>It is very important for students to understand the differences between these graphs.</b></p>	<p>Have students go through Explore and Explain:</p> <ul style="list-style-type: none"> <li>• Newton's First Law of Motion</li> <li>• Newton's Second law of Motion</li> <li>• Newton's Third Law of Motion</li> </ul> <p><b>*It is important to go through all laws.</b></p>		
<b>Independent Practice</b>	<p>From the additional resources section of the online textbook have students complete the Teaching Activity: Distance-Time Graph.</p> <p>Students can work independently or in pairs.</p>	<p>From the additional resources section of the online textbook have students complete the Lab: Motion Graphs.</p> <p>The ideal group size for this task is 3 students.</p> <p>From the evaluate section of the online textbook have students complete Lesson Check: Acceleration independently.</p> <p>If time permits... In pairs, students should complete pages 4 - 5 and 9 - 11 from this <a href="#">document</a>.</p> <p><a href="#">Answer Key</a></p>	<p>Students access the <a href="#">force and motion phet</a>.</p> <p>Review the <a href="#">teacher notes</a> before assigning this phet.</p> <p>In pairs, students should complete this <a href="#">student activity</a> using the force and motion phet.</p> <p>Additional support for this phet can be found on <b>Pivot Activities: Balanced and Unbalanced Forces: Effect on motion (Includes a Phet)</b></p>	<p>Have students write a CER to answer the following question:</p> <p>Why do we wear seatbelts?</p> <p>Students should use their knowledge about motion and Newton's Laws.</p>	<p>Students can either continue working in pairs or work independently to complete activity B of the Fan Cart Physics Gizmo.</p>
<b>Assessment Summary</b>	Go over the Teaching	Go over student responses	Go over student responses	Have students trade papers	Independently, students

	Activity: Distance-Time Graph task and discuss any misconceptions.	from the Lab: Motion Graphs. Discuss any misconceptions that arise.  TOTD: Compare and contrast velocity and acceleration.	from the force and motion student activity sheet and address misconceptions.	and do a peer review of one another's work. They should ensure the other student has a clear claim, supported with evidence (using key vocabulary) and supporting that evidence with reasoning.	complete the Gizmo quiz.  Remind students they will have a quiz tomorrow over force and motion.
<b>Small Group Tasks (TBA)</b>					
<b>Teacher Notes</b>	<a href="#">Additional Supports for Struggling Learners</a>  <a href="#">DOE Teacher Notes</a>	.Students regularly mix up velocity and acceleration. Be as clear as possible when identifying the differences.  For additional support with this standard consider using the following practice from Pivot: <b>Activities: Practice: Position vs Time Motion Graphs</b>  <a href="#">Additional Supports for Struggling Learners</a>  <a href="#">DOE Teacher Notes</a>	.Students regularly mix up velocity and acceleration. Be as clear as possible when identifying the differences.  <a href="#">Additional Supports for Struggling Learners</a>  <a href="#">DOE Teacher Notes</a>	<a href="#">Additional Supports for Struggling Learners</a>  <a href="#">DOE Teacher Notes</a>	<a href="#">Additional Supports for Struggling Learners</a>  <a href="#">DOE Teacher Notes</a>

**Week 2**

**GSE:**  
**SPS8. Obtain, evaluate, and communicate information to explain the relationships among force, mass, and motion.**

c. Analyze and interpret data to identify the relationship between mass and gravitational force for falling objects.

**Focused Concept:**  
 Force, Mass and Gravity  
 Work and Simple Machines

d. Use mathematics and computational thinking to identify the relationships between work, mechanical advantage, and simple machines.

**Phenomenon:**  
Car stop - seatbelts and airbags  
[Car Crash without Seatbelts](#)  
<https://goo.gl/aiFnyY>

**DQ: What is the relationship between mass, distance and gravitational force? How do simple machines make work easier?**

- SEP:**
- Ask Questions.
  - Develop and Use Models.
  - Plan and Carry out Investigations.
  - Analyze and Interpret Data.
  - Use Mathematics and Computational Thinking.
  - Construct Explanations.
  - Obtain, Evaluate, and Communicate Information.

- CCC:**
- Cause and Effect
  - Systems and System Models
  - Stability and Change
  - Patterns

	Day 6	Day 7	Day 8	Day 9	Day 10
<b>Learning Target</b>	SWBAT calculate work and mechanical advantage.	SWBAT identify the impact a simple machine has on work.	SWBAT explain the relationship between mass and gravitational force.	SWBAT score a 75% or higher on unit review items (study guide, review games, etc.).	SWBAT score a 75% or higher on the unit assessment.
<b>Opening</b>	<p>Introduce Work, Simple Machines and Mechanical advantage using this <a href="#"><u>presentation</u></a>.</p> <p>Teachers will Check for understanding by: -Asking the embedded questions to ensure students are grasping the information.</p> <p>Students should take notes as the teacher shares the information.</p>	<p>Introduce the Ants on a Slant Gizmo and complete the first page of the student handout as a class.</p> <p>The teacher should model how to manipulate the Gizmo and have students manipulate the Gizmo. The teacher and students should follow each step from page one of the Gizmo handout.</p>	<p>Introduce the <a href="#"><u>Gravity Force Lab Phet</u></a></p> <p>Have all students access the Phet and walk students through the various controls (such as changing the mass of the objects).</p> <p>Also demonstrate decimal notation and scientific notation. If students are unfamiliar with scientific notation it is recommended they use decimal notation.</p>	<p>Review all <a href="#"><u>elements</u></a> from this unit as a guideline for what students should know.</p> <p>SPS8a, SPS8b, SPS8c, SPS8d</p>	<p>Review all <a href="#"><u>elements</u></a> from this unit as a guideline for what students should know.</p> <p>SPS8a, SPS8b, SPS8c, SPS8d</p> <p>Go over the study guide from the previous day.</p>

<p><b>Guided Practice/Transition</b></p>	<p>Go through the practice questions embedded in the presentation (whole class). Model the math concepts in the practice problems.</p>	<p>In pairs, students should complete activity A of the Ants On a Slant Gizmo. After about 10 minutes the teacher should review Activity A as a whole class.</p>	<p>In pairs, have students complete this <a href="#">worksheet</a> about the Gravity Force Lab Phet.</p> <p>*This is an inquiry activity where we want students to discover the relationship that exists between mass and gravitational force rather than telling students.</p>	<p>Present SPS8a, SPS8b, SPS8c, SPS8d and go over the <a href="#">annotation guide</a>.</p> <p>Read through the annotation guide and allow students to complete it in pairs.</p>	<p>Answer any final questions students may have prior to testing</p> <p>Do a few practice problems from <a href="#">Unit 6 Assessment Prep Presentation</a></p>
<p><b>Independent Practice</b></p>	<p>Have students complete this <a href="#">worksheet</a> to practice calculating work and mechanical advantage.</p>	<p>Students can either continue working in pairs or work independently to complete activity B of the Ants On a Slant Gizmo.</p>	<p>Students write a CER: what is the relationship between gravitational force and mass?</p> <p>The teacher will post the following <a href="#">presentation</a> on the law of universal gravitation on Canvas as a student reference to complete this task.</p> <p><a href="#">Resource</a>: What is a CER and why is it crucial to science instruction?</p>	<p>Students complete a <a href="#">Unit 6 Study Guide</a></p>	<p>Unit 6 Assessment</p>
<p><b>Assessment/Summary</b></p>	<p>Go over the worksheet and address any misconceptions.</p>	<p>Independently, students complete the Gizmo quiz.</p>	<p>TOTD: Present this <a href="#">image</a> to the class. Using the image have students interpret the math behind the law of universal gravitation.</p>	<p>Students complete the study guide for homework.</p>	<p>Review test data from Illuminate</p>
<p><b>Small Group Tasks (TBA)</b></p>					
<p><b>Teacher Notes</b></p>	<p><a href="#">Additional Supports for Struggling Learners</a></p> <p><a href="#">DOE Teacher Notes</a></p>	<p><a href="#">Additional Supports for Struggling Learners</a></p> <p><a href="#">DOE Teacher Notes</a></p>	<p>There are additional resources that correspond to this Phet on Pivot under: Activities: Applying Universal Law of Gravitation with PhET</p> <p><a href="#">Additional Supports for Struggling Learners</a></p>	<p><a href="#">Additional Supports for Struggling Learners</a></p> <p><a href="#">DOE Teacher Notes</a></p>	<p><a href="#">Additional Supports for Struggling Learners</a></p> <p><a href="#">DOE Teacher Notes</a></p>

**Assessment Prep**

Prepare students for assessment by reviewing the following Assessment Prep Presentation.

[Unit 6 Assessment Prep Presentation](#)

Provide the following guidance:

Ask the students to use what they know about the tasks completed to answer the provided assessment prep question.

- What is the question asking you?
- What do you know about the vocabulary or concept in the question?
- Is this question similar to any investigations or tasks we've completed?
- How can what you've done help you answer this question?
- Just view the assessment question: What is the question asking you?

Guide students to think about how their experience connects to the question.

Using the answer choices provided, ask the students the following:

- Identify a wrong answer: How do I know this answer is incorrect?
- Identify the right answer: How do we know this answer is correct?

Allow the students time to discuss in collaborative groups.

**TEACHER NOTE:** If students struggle with the question, review it the next day. Do not rush to the next question; instructional time is the only time they have to prepare for the end-of-year assessment.

### Labs / Investigations

Mandatory Labs	Explore Learning Gizmo	Pivot Interactives/Phet
	<b>Fan Cart Physics</b> <b>Ants on a Slant</b>	<b>Moving Man</b> <b>Force and Motion</b> <b>Gravity Force Lab</b>
<b>Supplemental Resources</b>	<b>Invent a Back Scratcher from Everyday Materials</b>	

[https://www.teachengineering.org/activities/view/invent\\_a\\_backscratcher](https://www.teachengineering.org/activities/view/invent_a_backscratcher)

**Balloon Cars:** <https://www.sciencebuddies.org/teacher-resources/lesson-plans/balloon-car?from=Blog>

**Paper Roller Coaster:**

<https://www.sciencebuddies.org/teacher-resources/lesson-plans/roller-coaster-kinetic-potential-energy?from=Blog>

**Push Harder (Newton's 2nd Law)**

<https://www.sciencebuddies.org/teacher-resources/lesson-plans/newtons-second-law?from=Blog>

**Two Stage Balloon Rocket**

<https://www.sciencebuddies.org/teacher-resources/lesson-plans/two-stage-balloon-rocket?from=Blog>

**Pivot**

Activities: Practice: Position vs Time Motion Graphs

Activities: Applying Universal Law of Gravitation with PhET

Activities: Balanced and Unbalanced Forces: Effect on motion (Includes a Phet)