CCPS Science Unit Plan

Grade	4	Subject	Science	Unit #	5
Unit Name	Unit 5: Force and Motion		Timeline	6 Weeks	
How to use the Framework	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. Please see the hyperlinked abbreviation document to ensure understanding of all abbreviations used with this framework. CCPS Department of Science Website for access to all unit frameworks				
Unit Overview	*All resources related to this Framework are embedded in this document or can be located via the Science Department website. **Background Information:** Students will have begun to study physical science through the light and sound unit. In this unit, students will make sense of everyday activities like throwing a ball, or riding a bike in relation to their force and motion. Forces are needed to move objects. Students will learn that unbalanced forces are what changes an objects motion, while balance forces will keep an object in a constant state. Gravity is a force that is constantly at work on all objects. Gravity is the force of attraction that objects have to one another. Students will investigate earth's gravitational force on various objects by observing an object's weight and it's motion. Students should get the experience of designing investigations, analyzing data, and constructing arguments to support the claim that gravity affects the motion of objects. Students will build on their understanding of motion and force by understanding how simple machines impact the motion of an object. Simple machines make the work of moving object easier by changing the direction of a force or the amount of force needed to do something. Students will gather information about 6 simple machines to ask questions about how they impact or change force. **Prerequisites:** Kindergarten - Unit 2: Motion (Standards: SKP2a/b) First Grade - Unit 4: Magnets (Standards: S1P2a/b) Second Grade - Unit 4: Magnets (Standards: S1P2a/b) **By the end of this unit the student will be able to**: p • investigate the effects of forces on various objects • identify the difference between balanced and unbalanced forces • communicate the effects of balanced and unbalanced forces on various objects • construct an argument for the claim that gravitational force affects the motion of an object • inquire of simple machines • identify 6 simple machines and explain their uses • describe how simple machines change forces of objects when used to complete a task **By the end of this unit the teacher should:** • *guide* students in planning and executing investigations to answer questions or test solutions, advancing from basic to more controlled inquiries. • *advise* students in the practice of constructing and utilizing models, encouraging the use of various tools such as diagrams, physical replicas, and computer simulations to represent scientific concepts or engineering solutions. **Science-4th-Teacher-Notes.pdf**				

Lesson Plan guidance document and template	Link the following : https://drive.google.com/file/d/1dDFitw1NesctodMZ9XAr7zc0-S5GZKPB/view?usp=drive_link

Standards

GSE	Science and Engineering Practices	Crosscutting Concepts
S4P3. Obtain, evaluate, and communicate information about the relationship between balanced and unbalanced forces. **a.** Plan and carry out an investigation on the effects of balanced and unbalanced forces on an object and communicate the results. **b.** Construct an argument to support the claim that gravitational force affects the motion of an object. **c.** Ask questions to identify and explain the uses of simple machines (lever, pulley, wedge, inclined plane, wheel and axle, and screw) and how forces are changed when simple machines are used to complete tasks. (Clarification statement: The use of mathematical formulas is not expected.)	**Ask Questions** A practice of science is to ask and refine questions that lead to descriptions and explanations of how the natural and designed world works and which can be empirically tested. **Plan and Carry Out Investigations** Scientists and engineers plan and carry out investigations in the field or laboratory, working collaboratively as well as individually. Their investigations are systematic and require clarifying what counts as data and identifying variables or parameters. **Construct Explanations** The products of science are explanations and the products of engineering are solutions. **Develop and Use Models** A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations. **Analyzing and Interpreting Data** Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Modern technology	**Patterns** Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them. **Cause and Effect** Mechanism and explanation. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts. **Systems and System Models** Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering. **Scale, proportion, and quantity:** In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance. **Energy and matter:** Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

		makes the collection of large data sets much easier, providing secondary sources for analysis.	

NGSS Alignment	NGSS Alignment to Disciplinary Core Ideas

The Phenomenon Protocol

Anchoring Phenomena	Learning Targets
S4P3a - **Dad pushing a baby on a swing (video link)**	The students will plan and carry out investigations to observe the effects of balanced and unbalanced forces on objects.
S4P3b - **Galileo on the Moon (video link)**	The students will develop models to illustrate how gravitational forces affect an object.
S4P3c - **Wheelchair Ramp**	Students will be able to construct an explanation of how simple machines are used and how are forces changed when utilized to complete a task.

Weekly Lesson Tasks

Navigation: Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Additional Resources

Week 1

Standards | Phenomenon | Weekly Lessons

GSE: S4P3b	**Focused Concept:** • Effects of gravity on an object
Learning Target:	Students will construct an argument to support the claim that gravitational force affects the motion of an object.
Lab Safety Protocol: • Do not eat or drink in the science lab when working on investigations • Use all tools and materials appropriately • Do not horseplay, hit, or throw materials • Computers should be shared where appropriate • Do not throw the materials • All investigations should be completed without any obstruction from other materials • General Safety Practices for the Elementary Science Classroom- TOC.docx	**Materials:** PhET Sim: Energy Skate Park - Basics ball pencil rock balance gram cubes
Phenomenon: S4P3b - Galileo on the Moon (video link)	**DQ: How can gravitational force affect the motion of an object?**

Day 1: Opening	Day 2 : Guided Practice/ Transition	Day 3: Independent Practice	Day 4: Independent Practice	Day 5: Assessment / Summary
Phenomena Introduction	**Introduce the Driving**	**Graphic Organizer**	**Text Annotation Strategy**	**Claim-Evidence-Reasoning**

Show students the phenomenon card **S4P3b - Galileo on the Moon (video link)**

Use the See-Think-Wonder protocol to guide student thinking.

Teachers should provide students opportunities to share observations and develop questions. The teacher should record students' observations and questions on chart paper for referencing throughout this week's lesson.

Inquiry Activity

PhET Simulation
"How can gravitational force affect the motion of an object?"

Objective : Students will investigate the changing motion of different objects impacted by gravitational and frictional force

SEP TEACHER TIP:
To support students with the Science & Engineering Practices for this week, follow the guidance in this protocol:

Construct Explanatio…

The lab for this week's lesson can be found by accessing: **PhET**

Question:

Have students review the driving question:
How can gravitational force affect the motion of an object?

Use the strategy to support students with making connections and understanding the driving question (DQ).

Visualizing the Driving Question

Click here to access question words reference chart
The process can be recorded on chart paper with the students or the teacher can complete the graphic organizer.
Be sure to create a reference for students to have throughout the week.

**TEACHER NOTE: Students should not answer the driving question at this time. Students will need to collect information, data and understanding from the phenomenon strategy, inquiry activity, investigation, text or video protocol and vocabulary strategy to develop a response in the claim-evidence-reasoning format.

(3-5 teachers and students should focus on developing claim, evidence, and reasoning)

Claim-Evidence-Reasoning (CER)

Objective: Expose students to claim-evidence-reasoning (CER) student samples below to review and understand their peers'

Students will need and use the student lab sheet for How long do objects take to fall?

Materials
ball
pencil
rock
balance
gram cubes
meter stick

Investigation Facilitation
uInvestigate Lab: How long do objects take to fall?

Objective: Students will observe the effects of gravity on an object

SEP TEACHER TIP:
To support students with the Science & Engineering Practices for this week, follow the guidance in this protocol:

Construct Explanations and…

Students will need to work in groups of 4 or 5. The teacher should assign partners prior to the beginning of the lesson.

Have students follow the procedure provided in the lab.

The lab for this week's lesson can be found by accessing **SAVVAS Grade 5, Unit: Patterns in Space, Lesson 1: Earth's Gravitational Forces**

**TEACHER NOTE:
The teacher should ensure that students use all materials

Have students read and annotate the following text: Forces & Motion

The teacher should facilitate the following process. Have the students follow the text protocol facilitation directions provided in the following strategy:

3-5 Text Annotation Prot…

Students should complete the following student handout as they work through the text annotation protocol:

3-5 Information Analysis Student Organizer (editable)

3-5 Information Analysis…

During the teacher-led discussion, the teacher should ask the following questions:

1. What does it look like when gravity acts on an object?
2. Does gravity act on all objects in the same way? Why or why not? How do you know?
3. What forces act upon an object?

**TEACHER NOTE: Read and review the annotation protocol prior to providing this lesson to students. Students will need to be placed in groups or have an understanding of how the groups will change to limit time used for transitioning.

Vocabulary Strategy

Vocabulary Words:

Students will write a response to the following driving question in the CER format.

How can gravitational force affect the motion of an object?

Review the claim-evidence-reasoning poster with the students

**TEACHER NOTE: Provide students with sentence starters by sharing on the board:

3-5 Claim-Evidence-Rea…

Have students write their claim-evidence-reasoning

writing a claim
Have students develop a claim which is their answer to the driving question, claim. Students should use all their knowledge from the phenomenon, inquiry activity, investigation, and information analysis protocol to develop an answer to the question.

writing evidence
Students should provide observational or numerical data as their evidence from their investigation and write a short caption or brief description of the data they provide to support their claim.

writing the reasoning
Students will use textual evidence from the "text annotation graphic organizer" to generate the reasoning or justification in the CER format.

Simulations, Physics: Motion, Energy Skate Park: Basics (link)

**TEACHER NOTE:
Students will work on computers to investigate this physical phenomenon; The teacher may assign student pairs to complete the assignment in order to ensure that students are able to discuss answers

Note that students will see the impact of various friction levels that act upon gravity. The teacher will not need to explicitly teach about friction but can ask the students: *What is friction? How does friction work compared to gravity? How does friction impact motion?*

The teacher will actively monitor students progress through the investigation and record student ideas on chart paper.

Materials:
PhET Sim: Energy Skate Park - Basics

thoughts on the topic, initiating the process of developing skills for effective argumentation.

The teacher should state the following to students:

"Claim-Evidence-Reasoning or CER is a way of writing that helps students understand and explain what they learn in science investigations and science ideas."

Review the claim-evidence-reasoning poster with students.

As a class or in student groups, provide students with this week's claim- evidence-reasoning sample.

Balanced and Unbalanced …
This CER will introduce a concept that students will learn later in the unit. However, the goal of unit is to ensure that students know how to analyze a CER correctly

The teacher or students should read over student sample(s) to analyze
claim-evidence-reasoning protocol. Ask students to use the CER observations chart to complete the following analysis protocol:

Claim-Evidence-Reasoning Record Observations Document (google doc)

Claim-Evidence-Reasonin… (PDF)

1. Identify the student's claim in

including the scale. The teacher can guide students thinking with the following questions: *How do we know something is falling? What would make something fall faster than another object? How can we measure features of objects that make them fall faster?*

The teacher should be sure to assess the student's proposed plans ensuring that all materials are put to use.

To guide students in the development of their plans by guiding them through the following steps:
Have the students weigh their objects in a balance with the gram cubes and record the data.
Students should then use the meter stick to measure one meter up from the ground. The student groups should then work together to hold all three objects one meter above the ground. With one student using the timer, the other students should drop the object at the same time. Then record what they observe. Students can repeat the investigation to take note of any changes. Students can also drop one object at a time and record the amount of time that each object takes to hit the floor then compare their data.

gravity
mass
weight
force
motion
friction

Vocabulary Strategy:
Four Square
Provide students with the graphic organizer (editable) or pdf handout, explaining its four sections: word, meaning, picture, and sentence.

Use a Think Aloud to demonstrate how to use the graphic organizer with one of the provided vocabulary words.

Allow students to work in collaborative groups. Actively monitor and facilitate small group discussions and review various artifacts (pictures, images, primary sources, charts) to build knowledge of the term.

Have students collaborate to complete the four square strategy for the other vocabulary terms.

Monitor student progress, sharing new ideas for class discussion, and help students distinguish essential from non-essential characteristics.

Allow groups to share their thinking through academic dialogue and compare their completed task with members of other groups.

Have students use the following template to write their claim-evidence-reasoning (CER)

3-5 Student Writing Template (editable)
3-5 Student Writing Template (pdf)

**TEACHER NOTE: Have students review the student sample(s) of claim-evidence-reasoning on Day 2. Have students compare their writing to those students' samples. Ask the following questions:

How are your thoughts or understanding similar to another writer on the topic? How are your thoughts or understanding different to another writer on the topic? What would you like to learn more about? Why?

Assessment for Learning:

S4P3b Gravity

	the sample and have the teacher or students write their observations or questions. *2. Identify the student's evidence in the sample and have the teacher or students write their observations or questions.* *3. Identify the student's reasoning in the sample and have the teacher or students write their observations or questions.* Ask the following questions to students as they analyze the student samples: Claim-Evidence-Reasonin… **TEACHER NOTE: As students review the student samples, they will begin to see or read vocabulary. Begin or continue a reference chart of questions or observations about vocabulary. Students will explicitly learn vocabulary on Day 4.			

Week 2

Standards | Phenomenon | Weekly Lessons

GSE: S4P3b	**Focused Concept:** • The effects of gravitational force on an object
Learning Target	Students will construct an argument to support the idea that gravity affects an object's motion

Lab Safety Protocol

- Do not eat or drink in the science lab when working on investigations
- Use all tools and materials appropriately
- Do not horseplay, hit, or throw materials
- Computers should be shared where appropriate
- Do not throw the materials

Materials

golf balls large marbles	toy ball meter stick

- All investigations should be completed without any obstruction from other materials

ruler balance with gram cubes pan fine sand safety goggles	stopwatch masking tape ramp or smooth flat board several books (for height)

Phenomenon: S4P3b - Galileo on the Moon (video link)

DQ: How can gravitational force affect the motion of an object?

Day 1: Opening	Day 2 : Guided Practice/ Transition	Day 3: Independent Practice	Day 4: Independent Practice	Day 5: Assessment / Summary
Phenomena Introduction Show students the phenomenon card **S4P3b - Galileo on the Moon (video link)** Use the See-Think-Wonder protocol to guide student thinking. Teachers should provide students opportunities to share observations and develop questions. The teacher should record students' observations and questions on chart paper for referencing throughout this week's lesson. **Inquiry Activity** **Savvas uInvestigate Lab** **"How can you compare the energy of objects?"** **Objective** : Students will investigate and compare the energy of different sized objects **SEP TEACHER TIP:** To support students with the Science & Engineering	**Introduce the Driving Question:** Have students review the driving question: *How can gravitational force affect the motion of an object??* Use the strategy to support students with making connections and understanding the driving question (DQ). Visualizing the Driving Question Click here to access question words reference chart The process can be recorded on chart paper with the students or the teacher can complete the graphic organizer. Be sure to create a reference for students to have throughout the week. ****Teacher Note:** Students should not answer the driving question at this time. Students will need to collect information,	**Graphic Organizer** Students will need and use the student lab sheet for uInvestigate Lab: How d… **Materials** toy ball meter stick stopwatch masking tape ramp or smooth flat board several books (for height) **Investigation Facilitation** **uInvestigate: How does starting height affect an object's energy?** **Objective**: Students will investigate how the height of a ramp affects the energy of an object in motion as it moves down the ramp. **SEP TEACHER TIP:** To support students with the Science & Engineering Practices for this week, follow	**Text Annotation Strategy** Have students read and annotate the following text: "Energy Speed and Moving Objects" The lab for this week's lesson can be found by accessing **SAVVAS Grade 4 Unit: Energy and Motion Topic 1: Energy, Speed, and Moving Objects** The teacher should facilitate the following process. Have the students follow the text protocol facilitation directions provided in the following strategy: 3-5 Text Annotation Prot… Students should complete the following student handout as they work through the text annotation protocol: 3-5 Information Analysis Student Organizer (editable) 3-5 Information Analysis… During the teacher-led	**Claim-Evidence-Reasoning** Students will write a response to the following driving question in the CER format. ***How can gravitational force affect the motion of an object?*** Review the claim-evidence-reasoning poster with the students **TEACHER NOTE: Provide students with sentence starters by sharing on the board: 3-5 Claim-Evidence-Rea… Have students write their claim-evidence-reasoning **writing a claim** Have students develop a claim which is their answer to the driving question, claim. Students should use all their knowledge from the phenomenon, inquiry activity, investigation, and information analysis protocol to develop an answer to the question.

Practices for this week, follow the guidance in this protocol:
Construct Explanations a…

Have students follow the procedure provided in the lab and answer the Analyze and Interpret question.

Students can use the graphic organizer for
How can we compare the…

The lab for this week's lesson can be found by accessing **SAVVAS Grade 4 Unit: Energy and Motion Topic Launch.**

**TEACHER NOTE:
By this unit, students have been guided through inquiry steps and have been supported to develop their own plans to investigate phenomena. The teacher should encourage students to use ALL materials in their plan and ensure that there is enough data to support their idea.

In this activity, students will view the impact that objects make when falling. Students may consider planning to cause the object to collide, however, the teacher can guide their ideas by asking such questions as: how will you use all of the materials? how will you ensure that the objects hit each other directly? What will guide the collision?

If students require additional scaffolded support the teacher data and understanding from the phenomenon strategy, inquiry activity, investigation, text or video protocol and vocabulary strategy to develop a response in the claim-evidence-reasoning format.

(3-5 teachers and students should focus on developing claim, evidence, and reasoning)

Claim-Evidence-Reasoning (CER)

Objective: Expose students to claim-evidence-reasoning (CER) student samples below to review and understand their peers' thoughts on the topic, initiating the process of developing skills for effective argumentation.

The teacher should state the following to students:

"Claim-Evidence-Reasoning or CER is a way of writing that helps students understand and explain what they learn in science investigations and science ideas."

Review the claim-evidence-reasoning poster with students.

As a class or in student groups, provide students with this week's claim-evidence-reasoning sample.

Simple Machines Studen…
This CER will introduce a concept that students will learn later in the unit. However, the guidance in this protocol:
Construct Explanations a…

Students should work in groups to perform this investigation. The teacher should organize groups prior to.

Have students follow the procedure provided in the lab.

The lab for this week's lesson can be found by accessing **SAVVAS Grade 4, Unit: Energy and Motion, Lesson 1: Energy, Speed, and Moving Objects**

**TEACHER NOTE:
Reminder: By this unit students have been guided through inquiry steps and have been supported to develop their own procedures. The teacher should encourage students to use ALL materials in their plan and ensure that there is enough data to support their idea.

In this activity, students will be observing the effect of gravity as a ball rolls from various ramp heights. Students may consider planning to calculate the speed of the ball to compare, HOWEVER calculating speed is not required in the standard. Instead, students will compare the distance and the time. The teacher should help guide students through what factors to consider when planning their procedure including:

- Ramp Height
- *What to measure: with the* discussion, the teacher should ask the following questions:

1. If a baseball is thrown forward from a pitcher's hand, will it stay in the air forever? Why not?
2. Is everything on earth impacted by gravity? Why? How does a plane stay in the air then?
3. What force would slow gravity down?

**TEACHER NOTE: Read and review the annotation protocol prior to providing this lesson to students. Students will need to be placed in groups or have an understanding of how the groups will change to limit time used for transitioning.

Vocabulary Strategy

Vocabulary Words:
friction
gravity
mass
weight
force
motion

Vocabulary Strategy:
Vocabulary Terms Chart
Provide students with the graphic organizer (editable) or pdf handout, explaining its sections: word, *What did it look like in the investigation?*, meaning, image/drawing, connection

writing evidence
Students should provide observational or numerical data as their evidence from their investigation and write a short caption or brief description of the data they provide to support their claim.

writing the reasoning
Students will use textual evidence from the "text annotation graphic organizer" to generate the reasoning or justification in the CER format.

Have students use the following template to write their claim-evidence-reasoning (CER)

3-5 Student Writing Template (editable)
3-5 Student Writing Template (pdf)

**TEACHER NOTE: Have students review the student sample(s) of claim-evidence-reasoning on Day 2. Have students compare their writing to those students' samples. Ask the following questions:

How are your thoughts or understanding similar to another writer on the topic? How are your thoughts or understanding different to another writer on the topic? What would you like to learn more about? Why?

Assessment for Learning:

can provide one or all of the following: - pan of even sand - Data chart - Slow Motion Ball Drop Video **Materials:** golf balls large marbles ruler balance with gram cubes pan fine sand safety goggles	goal of unit is to ensure that students know how to analyze a CER correctly The teacher or students should read over student sample(s) to analyze claim-evidence-reasoning protocol. Ask students to use the CER observations chart to complete the following analysis protocol: Claim-Evidence-Reasoning Record Observations Document (google doc) Claim-Evidence-Reasoni… (PDF) *1. Identify the student's claim in the sample and have the teacher or students write their observations or questions.* *2. Identify the student's evidence in the sample and have the teacher or students write their observations or questions.* *3. Identify the student's reasoning in the sample and have the teacher or students write their observations or questions.* Ask the following questions to students as they analyze the student samples: Claim-Evidence-Reasoni… **Teacher Note: As students review the student samples, they will begin to see or read	*meter stick, with the stopwatch* - *How will you collect your data?* - *What will you compare?* - *How will you answer the question?* If students require additional scaffolded support the teacher can provide one or all of the following: - ramp set up visual - Data chart - Ramp Height trials video If the students require guided instructions for the investigation the teacher should model the following for the students: 1. Place one book under the ramp. Tape the bottom of the ramp to the floor or to the desk to prevent it from slipping. Measure and record the height of the ramp in centimeters. 2. Roll the ball down the ramp. Record the time it takes to reach the end of the ramp in seconds. 3. Repeat steps 1 and 2 but increase the ramp's height with one additional book following each trial. Record your observations.	Use a Think Aloud to demonstrate how to use the graphic organizer with one of the provided vocabulary words. The teacher should provide the meaning of the word to the students and ask students to provide examples of how the word was represented during the investigation, phenomenon and/or inquiry activity. In the connection column, students should write how the word connects to concepts or observations they gathered during their classroom tasks. Allow students to work in collaborative groups. Actively monitor and facilitate small group discussions and review various artifacts (pictures, images, primary sources, charts) to build knowledge of the term. Have students collaborate, in groups, to complete the vocabulary terms chart for the other vocabulary terms. Allow groups to share their thinking through academic dialogue and compare their completed task with members of other groups.	**S4P3b Energy Force Mot…**

	vocabulary. Begin or continue a reference chart of questions or observations about vocabulary. Students will explicitly learn vocabulary on Day 4.			

Week 3

Standards | Phenomenon | Weekly Lessons

GSE: S4P3a	**Focused Concept:** • Balanced and unbalanced forces effects on objects.
Learning Target	Students will plan and carry out investigations to observe the effects of balanced and unbalanced forces on objects.

Lab Safety Protocol

- Do not eat or drink in the science lab when working on investigations
- Use all tools and materials appropriately
- Do not horseplay, hit, or throw materials
- Computers should be shared where appropriate
- Do not throw the materials
- All investigations should be completed without any obstruction from other materials

Materials

Bumper Jumper Game Tracker Collision Track Landing Zone Bumper Jumper w/ Foil Scissors Scotch Tape Scrap Paper Aluminum Foil	18oz Solo Cup 3ox Dixie Cups Pencils (w/ Erasers) Sticker Labels Marbles (2 per group) marbles (or balls) of different sizes and masses small ramp or chute

Phenomenon: S4P3a - Baby on a swing (video link)

DQ: What effect does balanced and unbalanced forces have on an object?

Day 1: Opening	Day 2 : Guided Practice/ Transition	Day 3: Independent Practice	Day 4: Independent Practice	Day 5: Assessment / Summary
Phenomena Introduction Show students the phenomenon card **S4P3a - Dad pushing a baby on a swing (video link)** Use the See-Think-Wonder protocol to guide student thinking. Teachers should provide students opportunities to	**Introduce the Driving Question:** Have students review the driving question: *What effect does balanced and unbalanced forces have on an object?* Use the strategy to support students with making	**Graphic Organizer** Students will need and use the student lab sheet for uInvestigate: How does e… **Materials** marbles (or balls) of different sizes and masses small ramp or chute	**Text Annotation Strategy** Have students read and annotate the following text: "Collisions" The lab for this week's lesson can be found by accessing **SAVVAS Grade 4, Energy and Motion Unit, Lesson 2: Collision**	**Claim-Evidence-Reasoning** Students will write a response to the following driving question in the CER format. ***How can gravitational force affect the motion of an object?*** Review the claim-evidence-reasoning poster with the students

share observations and develop questions. The teacher should record students' observations and questions on chart paper for referencing throughout this week's lesson.

Inquiry Activity

Mystery Science
"How can the marbles save the world?"

Objective : Students will investigate how energy transfers when objects collide

SEP TEACHER TIP:
To support students with the Science & Engineering Practices for this week, follow the guidance in this protocol:
Plan and Carry Out Inves…

Have students follow the procedure provided in the lab.

The lab for this week's lesson can be found by accessing **Mystery Science, Energizing Everything Unit, Lesson 3 Hands On Activity ONLY**

**TEACHER NOTE:
By this activity, the teacher should only present the Hands-On Activity and NOT the exploration.

Students should work in student groups or with a partner. The teacher should assign partners before the task.

connections and understanding the driving question (DQ).

Visualizing the Driving Question

Click here to access question words reference chart

The process can be recorded on chart paper with the students or the teacher can complete the graphic organizer.

Be sure to create a reference for students to have throughout the week.
****Teacher Note:** Students should not answer the driving question at this time. Students will need to collect information, data and understanding from the phenomenon strategy, inquiry activity, investigation, text or video protocol and vocabulary strategy to develop a response in the claim-evidence-reasoning format.

(3-5 teachers and students should focus on developing claim, evidence, and reasoning)

Claim-Evidence-Reasoning (CER)

Objective: Expose students to claim-evidence-reasoning (CER) student samples below to review and understand their peers' thoughts on the topic, initiating the process of developing skills for effective argumentation.

The teacher should state the following to students:

Investigation Facilitation
uInvestigate: How does energy transfer between objects?

Objective: Students will use marbles to test the effects of mass, speed, motion, and height when observing collisions.

SEP TEACHER TIP:
To support students with the Science & Engineering Practices for this week, follow the guidance in this protocol:
Plan and Carry Out Inves…

Students should work in groups to perform this investigation. The teacher should organize groups prior to.

Have students follow the procedure provided in the lab.

The lab for this week's lesson can be found by accessing **SAVVAS Grade 4, Unit: Energy and Motion, Lesson 2: Collisions**

**TEACHER NOTE:
Students will be testing what happens when two objects collide. The investigation requires that students choose one variable to measure: speed, mass, motion, or height.
This means that students will cause collisions between objects with different speeds, variables, motion, or height.

Students should choose what

The teacher should facilitate the following process. Have the students follow the text protocol facilitation directions provided in the following strategy:

3-5 Text Annotation Prot…

Students should complete the following student handout as they work through the text annotation protocol:

3-5 Information Analysis Student Organizer (editable)
3-5 Information Analysis…

During the teacher-led discussion, the teacher should ask the following questions:

1. What are the components of a collision?
2. What is the difference between kinetic and potential energy?
3. What is the difference between transferring energy or transforming energy?

**TEACHER NOTE: Read and review the annotation protocol prior to providing this lesson to students. Students will need to be placed in groups or have an understanding of how the groups will change to limit time used for transitioning.

Vocabulary Strategy

Vocabulary Words:
height
mass
speed
motion

**TEACHER NOTE: Provide students with sentence starters by sharing on the board:

3-5 Claim-Evidence-Rea…

Have students write their claim-evidence-reasoning

writing a claim
Have students develop a claim which is their answer to the driving question, claim. Students should use all their knowledge from the phenomenon, inquiry activity, investigation, and information analysis protocol to develop an answer to the question.

writing evidence
Students should provide observational or numerical data as their evidence from their investigation and write a short caption or brief description of the data they provide to support their claim.

writing the reasoning
Students will use textual evidence from the "text annotation graphic organizer" to generate the reasoning or justification in the CER format.

Have students use the following template to write their claim-evidence-reasoning (CER)

3-5 Student Writing Template (editable)
3-5 Student Writing Template (pdf)

The teacher needs to precut the cups ahead of time to ensure efficiency and accuracy

Through the investigation the teacher should ask the following questions while actively monitoring student progress:
- how will the cup ramp impact the motion of the marble? What does the ramp have to do with where the marble will land?
- what changes do you have to make to get the marble to zone 3? Why?
- what force brings the ball down to the table after it flies off the ramp?

Materials:
Bumper Jumper Game Tracker
Collision Track
Landing Zone
Bumper Jumper w/ Foil
Scissors
Scotch Tape
Scrap Paper
Aluminum Foil
18oz Solo Cup
3ox Dixie Cups
Pencils (w/ Erasers)
Sticker Labels
Marbles (2 per group)

"Claim-Evidence-Reasoning or CER is a way of writing that helps students understand and explain what they learn in science investigations and science ideas."

Review the claim-evidence-reasoning poster with students.

As a class or in student groups, provide students with this week's claim-evidence-reasoning sample.

The teacher will pull students samples from earlier in the unit for peer review. Be sure to hide student names.

The teacher or students should read over student sample(s) to analyze claim-evidence-reasoning protocol. Ask students to use the CER observations chart to complete the following analysis protocol:

Claim-Evidence-Reasoning Record Observations Document (google doc)

Claim-Evidence-Reasoni… (PDF)

1. Identify the student's claim in the sample and have the teacher or students write their observations or questions.

2. Identify the student's evidence in the sample and have the teacher or students write their

variable to test and create a plan for testing the objects using their chosen variable. The teacher should support students plan development by guiding their thinking using the following questions: *How will you make the objects collide? When they collide what will happen and how do you know? How can you change their collisions? What does the mass, speed, height, or motion mean in a collision?*

If students need additional support with the investigation, the teacher can provide the following steps:
1. Choose two marbles of different sizes and masses
2. Place one marble on a smooth, flat surface. Roll the second marble so that it collides with the first marble. Record your observations.
3. Roll one marble slowly across the surface, and then roll the second marble faster from behind the first marble in the same direction so that they collide. Observe and record.
4. Roll the marbles toward each other at about the same speed so that they collide. Observe and record.
Make sure students choose only one variable to change. For example, if students are testing how speed affects collisions, the same size (mass) marbles should be used in each trial.

collision

Vocabulary Strategy: Vocabulary Terms Chart
Provide students with the graphic organizer (editable) or pdf handout, explaining its sections: word, *What did it look like in the investigation?*, meaning, image/drawing, connection

Use a Think Aloud to demonstrate how to use the graphic organizer with one of the provided vocabulary words. The teacher should provide the meaning of the word to the students and ask students to provide examples of how the word was represented during the investigation, phenomenon and/or inquiry activity. In the connection column, students should write how the word connects to concepts or observations they gathered during their classroom tasks. Allow students to work in collaborative groups. Actively monitor and facilitate small group discussions and review various artifacts (pictures, images, primary sources, charts) to build knowledge of the term.

Have students collaborate, in groups, to complete the vocabulary terms chart for the other vocabulary terms.

Allow groups to share their thinking through academic dialogue and compare their completed task with members of other groups.

**TEACHER NOTE: Have students review the student sample(s) of claim-evidence-reasoning on Day 2. Have students compare their writing to those students' samples. Ask the following questions:

How are your thoughts or understanding similar to another writer on the topic? How are your thoughts or understanding different to another writer on the topic? What would you like to learn more about? Why?

Assessment for Learning:

S4P3a Collisions.pdf

	observations or questions. *3. Identify the student's reasoning in the sample and have the teacher or students write their observations or questions.* Ask the following questions to students as they analyze the student samples: Claim-Evidence-Reasoni… ****Teacher Note:** As students review the student samples, they will begin to see or read vocabulary. Begin or continue a reference chart of questions or observations about vocabulary. Students will explicitly learn vocabulary on Day 4.			

Week 4

Standards | Phenomenon | Weekly Lessons

GSE: S4P3a	**Focused Concept:** • Develop models to demonstrate the effects of balanced and unbalanced forces on objects.
Learning Target	Students will plan and carry out investigations to observe the effects of balanced and unbalanced forces on objects.

Lab Safety Protocol

- Do not eat or drink in the science lab when working on investigations
- Use all tools and materials appropriately
- Do not horseplay, hit, or throw materials
- Computers should be shared where appropriate
- Do not throw the materials
- All investigations should be completed without any obstruction from other materials

Materials:

1 25 foot Rope (per class) 1 Bandana (per class) 1 Marking material (per class) *Could be chalk, masking tape, string, etc. 1 Video recording device (per class) *Could be a tablet, cell phone, etc.	Bridge Challenge Worksheet Bridge Designer's Notebook Blank Paper Hardcover books Rulers Scissors Pennies

Phenomenon: S4P3a - Baby on a swing (video link)	**DQ: What effect does balanced and unbalanced forces have on an object?**

Day 1: Opening	Day 2 : Guided Practice/ Transition	Day 3: Independent Practice	Day 4: Independent Practice	Day 5: Assessment / Summary
Phenomena Introduction Show students the phenomenon card **S4P3b - Galileo on the Moon (video link)** Use the See-Think-Wonder protocol to guide student thinking. Teachers should provide students opportunities to share observations and develop questions. The teacher should record students' observations and questions on chart paper for referencing throughout this week's lesson. **Inquiry Activity** **Tug of War** **"How do we know which side will win?"** **Objective** : Students will play tug of war determining how to determine which side will win and why **SEP TEACHER TIP:** To support students with the Science & Engineering Practices for this week, follow the guidance in this protocol: Plan and Carry Out Inves… Students will use the PhET Simulation: Forces & Motion Basics, Net Forces	**Introduce the Driving Question:** Have students review the driving question: *What effect does balanced and unbalanced forces have on an object* Use the strategy to support students with making connections and understanding the driving question (DQ). Visualizing the Driving Question Click here to access question words reference chart The process can be recorded on chart paper with the students or the teacher can complete the graphic organizer. Be sure to create a reference for students to have throughout the week. **Teacher Note:** Students should not answer the driving question at this time. Students will need to collect information, data and understanding from the phenomenon strategy, inquiry activity, investigation, text or video protocol and vocabulary strategy to develop a response in the claim-evidence-reasoning format. (3-5 teachers and students should focus on developing claim, evidence, and reasoning)	**Graphic Organizer** Students will need and use the student lab sheet for the Bridge Challenge Worksheet **Materials** Bridge Challenge Worksheet Bridge Designer's Notebook Blank Paper Hardcover books Rulers Scissors Pennies (some bridges can be very strong) **Investigation Facilitation** **Mystery Science: What makes bridges so strong?** **Objective**: Students will use their knowledge of forces to build a strong bridge that supports as many pennies as possible -- using only paper. **SEP TEACHER TIP:** To support students with the Science & Engineering Practices for this week, follow the guidance in this protocol: Plan and Carry Out Inves… Students should work in partners or groups to perform this investigation. The teacher should organize groups prior to. Have students follow the procedure provided in the lab.	**Text Annotation Strategy** Have students read and annotate the following text: Balanced and Unbalanced Forces The teacher should facilitate the following process. Have the students follow the text protocol facilitation directions provided in the following strategy: 3-5 Text Annotation Prot… Students should complete the following student handout as they work through the text annotation protocol: 3-5 Information Analysis Student Organizer (editable) 3-5 Information Analysis… During the teacher-led discussion, the teacher should ask the following questions: 1. How can you change the motion of an object? 2. How do we measure forces? 3. How could you make an object move faster or go farther? **TEACHER NOTE: Read and review the annotation protocol prior to providing this lesson to students. Students will need to be placed in groups or have an understanding of how the groups will change to limit time used for transitioning.	**Claim-Evidence-Reasoning** Students will write a response to the following driving question in the CER format. ***What effect does balanced and unbalanced forces have on an object*** Review the claim-evidence-reasoning poster with the students **TEACHER NOTE: Provide students with sentence starters by sharing on the board: 3-5 Claim-Evidence-Rea… Have students write their claim-evidence-reasoning **writing a claim** Have students develop a claim which is their answer to the driving question, claim. Students should use all their knowledge from the phenomenon, inquiry activity, investigation, and information analysis protocol to develop an answer to the question. **writing evidence** Students should provide observational or numerical data as their evidence from their investigation and write a short caption or brief description of the data they provide to support their claim. **writing the reasoning**

The teacher should put students in partner pairs where they will share a computer. They will open the simulation to the "Net Force" page.

Students will complete the Graphic Organizer for the Tug of War Simulation: PhET Forces & Motion Data Sheet

Procedure::
1. Tell the students that they will be playing tug of war and will need to build the best strategy for winning
2. Allow students to play rock, paper, scissors to determine two team captains
3. Tell the class that they will be determining the best strategy to win the game by collecting data; we will play four matches

Final discussion:
If the cart was not moving at some point during the game, were you actually pulling?
If both sides were pulling, why wasn't the cart moving? Explain how this is an example of balanced forces.
What happened to make the cart accelerate to the right?

Explain that the cart changed speed (accelerated) while moving toward the team that was pulling with the most force, and that is an example of unbalanced forces. Unbalanced forces will cause an object's motion to change.
Why would the cart move slowly?
Can you think of other examples

Claim-Evidence-Reasoning (CER)

Objective: Expose students to claim-evidence-reasoning (CER) student samples below to review and understand their peers' thoughts on the topic, initiating the process of developing skills for effective argumentation.

The teacher should state the following to students:

"Claim-Evidence-Reasoning or CER is a way of writing that helps students understand and explain what they learn in science investigations and science ideas."

Review the claim-evidence-reasoning poster with students.

As a class or in student groups, provide students with this week's claim-evidence-reasoning sample.

The teacher will pull students samples from earlier in the unit for peer review. Be sure to hide student names.

The teacher or students should read over student sample(s) to analyze claim-evidence-reasoning protocol. Ask students to use the CER observations chart to complete the following analysis protocol:

Mystery Science - What …

The lab for this week's lesson can be found by accessing **Mystery Science, Invisible Forces Unit, Lesson 2 Hands On Activity ONLY**

**TEACHER NOTE:
The teacher will only present the "Hands-On Activity" from Mystery Science.

Students will complete the following task: "Using only two sheets of paper, build a strong bridge that will reach across a 6-inch gap. The bridge must be at least 3 inches wide"

The activity is guided for students to think through how to solve the problem.

The teacher should provide students with the following questions :
CHECK FOR UNDERSTANDING
Strong Bridge Assessment

Vocabulary Strategy

Vocabulary Words:
balanced forces, unbalanced forces, force, motion

Vocabulary Strategy:
Vocabulary Terms Chart
Provide students with the graphic organizer (editable) or pdf handout, explaining its sections: word, *What did it look like in the investigation?*, meaning, image/drawing, connection

Use a Think Aloud to demonstrate how to use the graphic organizer with one of the provided vocabulary words. The teacher should provide the meaning of the word to the students and ask students to provide examples of how the word was represented during the investigation, phenomenon and/or inquiry activity. In the connection column, students should write how the word connects to concepts or observations they gathered during their classroom tasks. Allow students to work in collaborative groups. Actively monitor and facilitate small group discussions and review various artifacts (pictures, images, primary sources, charts) to build knowledge of the term.

Have students collaborate, in groups, to complete the vocabulary terms chart for the other vocabulary terms.

Students will use textual evidence from the "text annotation graphic organizer" to generate the reasoning or justification in the CER format.

Have students use the following template to write their claim-evidence-reasoning (CER)

3-5 Student Writing Template (editable)
3-5 Student Writing Template (pdf)

**TEACHER NOTE: Have students review the student sample(s) of claim-evidence-reasoning on Day 2. Have students compare their writing to those students' samples. Ask the following questions:

How are your thoughts or understanding similar to another writer on the topic?
How are your thoughts or understanding different to another writer on the topic?
What would you like to learn more about? Why?

Assessment for Learning:

S4P3a Balanced and Unb…

of unbalanced forces? **TEACHER NOTE: Students may need to see a setup that causes one side to win and another to lose. So the teacher may need to pull "a wildcard" in some matches. Students can be given time to create different scenarios in the simulation. The teacher should ask the following closing discussion questions: 1. What has to happen to cause the blue team to win? 2. What has to happen to cause the red team to win? 3. What happened to cause neither team to win? 4. When we put all eight characters in the simulation, what happened? Why? 5. A push or a pull is a ____ 6. What force is keeping the bucket of candy on the ground? a. Force b. Gravity c. Balance d. Unbalanced force 7. When things are equal on both sides it is ___ 8. Looking at the photo below based on the values given, why isn't there any motion? **Materials:** PhET Forces & Motion Data Sheet	Claim-Evidence-Reasoning Record Observations Document (google doc) Claim-Evidence-Reasoni… (PDF) *1. Identify the student's claim in the sample and have the teacher or students write their observations or questions.* *2. Identify the student's evidence in the sample and have the teacher or students write their observations or questions.* *3. Identify the student's reasoning in the sample and have the teacher or students write their observations or questions.* Ask the following questions to students as they analyze the student samples: Claim-Evidence-Reasoni… ****Teacher Note:** As students review the student samples, they will begin to see or read vocabulary. Begin or continue a reference chart of questions or observations about vocabulary. Students will explicitly learn vocabulary on Day 4.		Allow groups to share their thinking through academic dialogue and compare their completed task with members of other groups.	

Week 5

Standards | Phenomenon | Weekly Lessons

GSE: S4P3c	**Focused Concept:** • Identify simple machines and explain their function
Learning Target	Students will be able to construct an explanation of how simple machines are used and how forces are changed when utilized to complete a task.
Lab Safety Protocol • Do not eat or drink in the science lab when working on investigations • Use all tools and materials appropriately • Do not horseplay, hit, or throw materials • Computers should be shared where appropriate • Do not throw the materials • All investigations should be completed without any obstruction from other materials	**Materials:** SEE LISTS UNDER EACH ACTIVITY
Phenomenon: S4P3c - Wheelchair Ramp	**DQ: How are simple machines used and how are forces changed when they are used to complete a simple task?**

Day 1: Opening	Day 2 : Guided Practice/ Transition	Day 3: Independent Practice	Day 4: Independent Practice	Day 5: Assessment / Summary
Phenomena Introduction Show students the phenomenon card **S4P3c - Wheelchair Ramp** Use the See-Think-Wonder protocol to guide student thinking. Teachers should provide students opportunities to share observations and develop questions. The teacher should record students' observations and questions on chart paper for referencing throughout this week's lesson. **Inquiry Activity** **Mystery Science**	**Introduce the Driving Question:** Have students review the driving question: *How are simple machines used and how are forces changed when they are used to complete a simple task?* Use the strategy to support students with making connections and understanding the driving question (DQ). Visualizing the Driving Question Click here to access question words reference chart The process can be recorded on chart paper with the students or	**Graphic Organizer** Simple Machines Student Instructions Simple Machines Student Journal **Materials** (Materials for this lab can be found in STEMscopes kit) 1 Wax paper strip, 65 cm length *optional (per group) 1 Eye hook screw (per group) 1 8 oz Paper cup (per group) 1 Single hole punch (per class) 1 Black permanent marker (per group) 1 Large paperclip (per group) 1 Small paper cup (per group) 3 Pencils taped together (per group) 1 1 g Weight (per group) 10-20 Pennies (per group) 1 Pair of scissors (per group)	**Text Annotation Strategy** Have students watch and take notes on the following **video**: Could you knock down a building using only dominoes? EXPLORATION The video for this week's lesson can be found by accessing **Mystery Science, Energizing Everything Unit, Lesson 4 EXPLORATION Video** **OR** Have student read and annotate the following text: Rube Goldberg, The Engineer The teacher should facilitate the following process. Have the students follow the text protocol facilitation directions provided	**Claim-Evidence-Reasoning** Students will write a response to the following driving question in the CER format. ***How are simple machines used and how are forces changed when they are used to complete a simple task?*** Review the claim-evidence-reasoning poster with the students **TEACHER NOTE: Provide students with sentence starters by sharing on the board: 3-5 Claim-Evidence-Rea… Have students write their claim-evidence-reasoning

"Could you knock down a building using only dominoes?"

Objective : Students will construct an explanation of how energy is stored, released, and transferred in chain reactions

SEP TEACHER TIP:
To support students with the Science & Engineering Practices for this week, follow the guidance in this protocol:
Construct Explanations a…

The teacher should put students in groups of 2 to 3 prior to the investigation.

The students will follow the guided procedures to set up what is actually known as a Rube Goldberg Machine.

Students will use their data from their data sheet will consider questions posed by the teacher at the end of the activity

The lab for this week's lesson can be found by accessing **Mystery Science, Energizing Everything Unit, Lesson 4 HANDS ON ACTIVITY ONLY**

**TEACHER NOTE:
The teacher should access the **Hands-On Activity ONLY** in the Mystery Science Lesson. Upon accessing the video, the teacher should **SKIP THE VIDEO** as it provides too much information up front for an inquiry activity. The teacher the teacher can complete the graphic organizer.

Be sure to create a reference for students to have throughout the week.
****Teacher Note:** Students should not answer the driving question at this time. Students will need to collect information, data and understanding from the phenomenon strategy, inquiry activity, investigation, text or video protocol and vocabulary strategy to develop a response in the claim-evidence-reasoning format.

(3-5 teachers and students should focus on developing claim, evidence, and reasoning)

Claim-Evidence-Reasoning (CER)

Objective: Expose students to claim-evidence-reasoning (CER) student samples below to review and understand their peers' thoughts on the topic, initiating the process of developing skills for effective argumentation.

The teacher should state the following to students:

"Claim-Evidence-Reasoning or CER is a way of writing that helps students understand and explain what they learn in science investigations and science ideas."

Review the claim-evidence-reasoning poster with students.

1 Meter stick (per group)
1 Textbook (per group)
500 g Sand (per group)
(voucher)
5 Books (per group)
2 Resealable sandwich bags (per group)
1 Protractor (per group)
1 Meter stick (per group)
2 Strings (30 cm and 150 cm) (per group)
1 Ruler (per group)
2 Spring scale (500 g/5 N) (per group)
1 Medium binder clip (per group)
1 Fixed pulley (per group)
1 Movable pulley (per group)
1 Wooden board (1 m x 15 cm x 2 cm) (per group)
1 Wooden board (2 x 2, 30 cm length) (per group)

Investigation Facilitation
"How do simple machines make work easier?"

Objective : Students will measure how helpful simple machines can be when moving objects.

SEP TEACHER TIP:
To support students with the Science & Engineering Practices for this week, follow the guidance in this protocol:
Construct Explanations a…

**TEACHER NOTE:
READ THE TEACHER INSTRUCTIONS PRIOR TO THE INVESTIGATION. This investigation requires the teacher to prepare ahead of time in the following strategy:

3-5 Text Annotation Prot…

FOR THE VIDEO:
Students should complete the following discussion questions as they watch the video. The teacher should pause where necessary to allow students to respond. Once all questions are completed the teacher should walk the class through the Annotation Discussion Protocol above.

Video Discussion Questions

FOR THE TEXT:
Students should complete the following student handout as they work through the text annotation protocol:

3-5 Information Analysis Student Organizer (editable)
3-5 Information Analysis…

During the teacher-led discussion, the teacher should ask the following questions:

(Insert three questions here for the teacher to ask to check for student comprehension and understanding, unhighlight this area when done)

**TEACHER NOTE: Read and review the annotation protocol prior to providing this lesson to students. Students will need to be placed in groups or have an understanding of how the groups will change to limit time used for transitioning.

writing a claim
Have students develop a claim which is their answer to the driving question, claim. Students should use all their knowledge from the phenomenon, inquiry activity, investigation, and information analysis protocol to develop an answer to the question.

writing evidence
Students should provide observational or numerical data as their evidence from their investigation and write a short caption or brief description of the data they provide to support their claim.

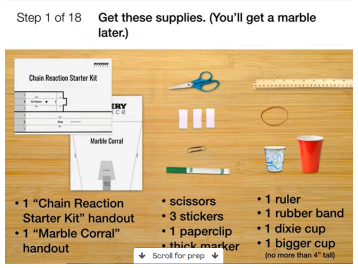
writing the reasoning
Students will use textual evidence from the "text annotation graphic organizer" to generate the reasoning or justification in the CER format.

Have students use the following template to write their claim-evidence-reasoning (CER)

3-5 Student Writing Template (editable)
3-5 Student Writing Template (pdf)

**TEACHER NOTE: Have students review the student sample(s) of claim-evidence-reasoning on Day 2. Have students compare their writing to those students' samples. Ask the following questions:

should start the students on this page:



With guidance, students will build a simple Rube Goldberg Machine.

By following the Guided Instructions provided by Mystery Science, students will have all of the information that they need to build a machine. This will be the first activity in a set of 2 that they will complete in week 6.

After students have tested their machine the teacher should have the following discussion with students:
How did moving the marker change the force of the lever? WHY did moving the marker change the force of the lever? What type of force acted upon the marble and how do you know? Where did the energy come from to make the marble move? Where did that energy come from… and that energy?

Materials:
Chain Reaction Starter Kit
Marble Corral
Markers
Rulers
Scissors

As a class or in student groups, provide students with this week's claim-evidence-reasoning sample.

The teacher will pull students samples from earlier in the unit for peer review. Be sure to hide student names.

The teacher or students should read over student sample(s) to analyze claim-evidence-reasoning protocol. Ask students to use the CER observations chart to complete the following analysis protocol:

Claim-Evidence-Reasoning Record Observations Document (google doc)

Claim-Evidence-Reasoni… (PDF)

1. Identify the student's claim in the sample and have the teacher or students write their observations or questions.

2. Identify the student's evidence in the sample and have the teacher or students write their observations or questions.

3. Identify the student's reasoning in the sample and have the teacher or students write their observations or questions.

Ask the following questions to students as they analyze the student samples:

as there are many parts and materials to assemble. It would also be best to walk through the student instructions ahead of time in order to understand what the students may need help with.

There are 4 parts to this investigation. The teacher will only facilitate parts one and two today and the following parts the next week.

This activity will require preparation. Please follow the teacher instructions here:
4P3C Simple Machines …

The students will explore inclined planes using a spring scale. They will compare the effort needed to lift an object with and without an inclined plane.
They will also compare how lifting objects is made easier with a pulley system. The students can create the pulley system or the teacher can create it ahead of time.
The teachers should ask the following questions throughout the investigation: *how do inclined planes work? how do pulleys work? how did the simple machine make doing the work easier?*

ALTERNATIVE ACTIVITY
If the teacher does not have access to the materials needed above, teachers can access the Gizmos below and walk with students through the accompanying activities.

Vocabulary Strategy

Vocabulary Words:
energy
transfer (of energy)
lever
stored energy

Vocabulary Strategy: Vocabulary Connect Two Strategy
Provide students with the graphic organizer (editable) or pdf handout.

Use a Think Aloud to demonstrate how to use the graphic organizer with one of the provided vocabulary words. Allow students to research the word using reference tools (google, research options, peer discussion, etc.). The teacher should model researching the word and using the information gathered to decide on another term that creates connections between the vocabulary word and another term/word.

Allow students to work in collaborative groups to discuss and research the other provided vocabulary terms and repeat the modeled instructional strategy.

Have students collaborate, in groups, to complete the strategy for the other vocabulary terms.

Allow groups to share their thinking through academic dialogue and compare their completed task with members of other groups.

How are your thoughts or understanding similar to another writer on the topic? How are your thoughts or understanding different to another writer on the topic? What would you like to learn more about? Why?

Assessment for Learning:

S4P3c Simple Machine Assessment

3 oz Dixie Cups (1 per group) Tape or File Folder Stickers Paper Clips (1 per group) 8oz Paper Cups (1 per group) #32 Rubber bands (1 per group) Small Marble (1 per group)	Claim-Evidence-Reasoni… **Teacher Note:** As students review the student samples, they will begin to see or read vocabulary. Begin or continue a reference chart of questions or observations about vocabulary. Students will explicitly learn vocabulary on Day 4.	Inclined Plane Inclined Plane Student Exploration Pulleys Pulleys Student Exploration The teacher and students should only complete Activity B. Activity A and C can be completed after both simple machines have been reviewed. The teacher should pause to review the questions in the investigations with the students		

Week 6

Standards | Phenomenon | Weekly Lessons

GSE: S4P3c		**Focused Concept:** • Construct an explanation of how simple machines are used and how forces are changed when utilized to complete a task.		
Learning Target	Students will be able to construct an explanation of how simple machines are used and how forces are changed when utilized to complete a task.			
Lab Safety Protocol • Do not eat or drink in the science lab when working on investigations • Use all tools and materials appropriately • Do not horseplay, hit, or throw materials • Computers should be shared where appropriate • Do not throw the materials • All investigations should be completed without any obstruction from other materials			**Materials:** SEE LISTS UNDER EACH ACTIVITY	
Phenomenon: S4P3c - Wheelchair Ramp			**DQ: How are simple machines used and how are forces changed when they are used to complete a simple task?**	
Day 1: Opening	**Day 2 : Guided Practice/ Transition**	**Day 3: Independent Practice**	**Day 4: Independent Practice**	**Day 5: Assessment / Summary**
Phenomena Introduction Show students the phenomenon card **S4P3c - Wheelchair**	**Introduce the Driving Question:** Have students review the	**Graphic Organizer** Simple Machines Student Instructions Simple Machines Student	**Text Annotation Strategy** Have students read and annotate the following text:	**Claim-Evidence-Reasoning** Students will write a response to the following driving question

Ramp

Use the See-Think-Wonder protocol to guide student thinking.

Teachers should provide students opportunities to share observations and develop questions. The teacher should record students' observations and questions on chart paper for referencing throughout this week's lesson.

Inquiry Activity
Mystery Science
"Can you build a chain reaction machine (Rube Goldberg Machine)?"

Objective : Students will explore how simple machines are used to store, release, and transfer energy

SEP TEACHER TIP:
To support students with the Science & Engineering Practices for this week, follow the guidance in this protocol:
Construct Explanations a…

The students will follow the guided procedures to set up what is actually known as a Rube Goldberg Machine.

Students will not use a graphic organizer for this activity but will consider questions posed by the teacher at the end of the activity

driving question:

How are simple machines used and how are forces changed when they are used to complete a simple task?

Use the strategy to support students with making connections and understanding the driving question (DQ).

Visualizing the Driving Question

Click here to access question words reference chart

The process can be recorded on chart paper with the students or the teacher can complete the graphic organizer.

Be sure to create a reference for students to have throughout the week.
****Teacher Note:** Students should not answer the driving question at this time. Students will need to collect information, data and understanding from the phenomenon strategy, inquiry activity, investigation, text or video protocol and vocabulary strategy to develop a response in the claim-evidence-reasoning format.

(3-5 teachers and students should focus on developing claim, evidence, and reasoning)

Claim-Evidence-Reasoning (CER)

Objective: Expose students to claim-evidence-reasoning

Journal

Materials
1 Wax paper strip, 65 cm length *optional (per group)
1 Eye hook screw (per group)
1 8 oz Paper cup (per group)
1 Single hole punch (per class)
1 Black permanent marker (per group)
1 Large paperclip (per group)
1 Small paper cup (per group)
3 Pencils taped together (per group)
1 1 g Weight (per group)
10-20 Pennies (per group)
1 Pair of scissors (per group)
1 Meter stick (per group)
1 Textbook (per group)
500 g Sand (per group)
(voucher)
5 Books (per group)
2 Resealable sandwich bags (per group)
1 Protractor (per group)
1 Meter stick (per group)
2 Strings (30 cm and 150 cm) (per group)
1 Ruler (per group)
2 Spring scale (500 g/5 N) (per group)
1 Medium binder clip (per group)
1 Fixed pulley (per group)
1 Movable pulley (per group)
1 Wooden board (1 m x 15 cm x 2 cm) (per group)
1 Wooden board (2 x 2, 30 cm length) (per group)

Investigation Facilitation
"How do simple machines make work easier?"

Objective : Students will measure how helpful simple

Simple Machines Reading Passage

The teacher should facilitate the following process. Have the students follow the text protocol facilitation directions provided in the following strategy:

3-5 Text Annotation Prot…

Students should complete the following student handout as they work through the text annotation protocol:

3-5 Information Analysis Student Organizer (editable)
3-5 Information Analysis…

During the teacher-led discussion, the teacher should ask the following questions:

1. Name four simple machines and describe their functions.
2. How do you think the amount of force needed to chop a log in half would change using a wedge?
3. How do pulleys compare with wheel and axles?
4. How would you justify how simple machines change the amount of force required to lift or move a load?

****TEACHER NOTE:** Read and review the annotation protocol prior to providing this lesson to students. Students will need to be placed in groups or have an understanding of how the groups will change to limit time used for transitioning.

in the CER format.

How are simple machines used and how are forces changed when they are used to complete a simple task?

Review the claim-evidence-reasoning poster with the students

****TEACHER NOTE:** Provide students with sentence starters by sharing on the board:

3-5 Claim-Evidence-Rea…

Have students write their claim-evidence-reasoning

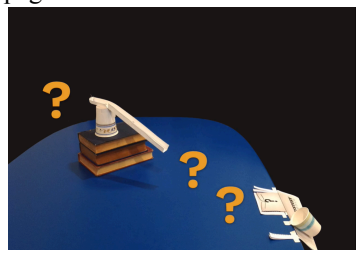
writing a claim
Have students develop a claim which is their answer to the driving question, claim. Students should use all their knowledge from the phenomenon, inquiry activity, investigation, and information analysis protocol to develop an answer to the question.

writing evidence
Students should provide observational or numerical data as their evidence from their investigation and write a short caption or brief description of the data they provide to support their claim.

writing the reasoning
Students will use textual evidence from the "text annotation graphic organizer" to generate the reasoning or justification in the CER format.

The lab for this week's lesson can be found by accessing **Mystery Science, Energizing Everything Unit, Lesson 5 HANDS ON ACTIVITY ONLY**

**TEACHER NOTE:
The teacher should access the **Hands-On Activity ONLY** in the Mystery Science Lesson. Upon accessing the video, the teacher should **SKIP THE VIDEO** as it provides too much information up front for an inquiry activity. The teacher should start the students on this page:



With guidance, students will build a simple Rube Goldberg Machine.
By following the Guided Instructions provided by Mystery Science, students will have all of the information that they need to build a machine. This will be the first activity in a set of 2 that they will complete in week 6.

After students have tested their machine the teacher should have the following discussion with students:
what simple machines did you use in your chain reaction? how did your simple machines transfer energy?

(CER) student samples below to review and understand their peers' thoughts on the topic, initiating the process of developing skills for effective argumentation.

The teacher should state the following to students:

"Claim-Evidence-Reasoning or CER is a way of writing that helps students understand and explain what they learn in science investigations and science ideas."

Review the claim-evidence-reasoning poster with students.

As a class or in student groups, provide students with this week's claim-evidence-reasoning sample.

The teacher will pull students samples from earlier in the unit for peer review. Be sure to hide student names.

The teacher or students should read over student sample(s) to analyze claim-evidence-reasoning protocol. Ask students to use the CER observations chart to complete the following analysis protocol:

Claim-Evidence-Reasoning Record Observations Document (google doc)

Claim-Evidence-Reasoni… (PDF)

machines can be when moving objects.

SEP TEACHER TIP:
To support students with the Science & Engineering Practices for this week, follow the guidance in this protocol:

Construct Explanations a…

**TEACHER NOTE:
READ THE TEACHER INSTRUCTIONS PRIOR TO THE INVESTIGATION.
This investigation requires the teacher to prepare ahead of time as there are many parts and materials to assemble. It would also be best to walk through the student instructions ahead of time in order to understand what the students may need help with.

There are 4 parts to this investigation. The teacher will only facilitate parts three and four. Parts one and two should have been complete the week prior

This activity will require preparation. Please follow the teacher instructions here:

4P3C Simple Machines …

The students will explore levers and wheel and axles comparing how lifting objects is made easier with a those systems.

ALTERNATIVE ACTIVITY
If the teacher does not have access to the materials needed above, teachers can access the Gizmos below and walk with

Vocabulary Strategy

Vocabulary Words:
Pulley
Lever
Wedge
Screw
Inclined Plane

Vocabulary Strategy:
Vocabulary Connect Two Strategy
Provide students with the graphic organizer (editable) or pdf handout.

Use a Think Aloud to demonstrate how to use the graphic organizer with one of the provided vocabulary words. Allow students to research the word using reference tools (google, research options, peer discussion, etc.). The teacher should model researching the word and using the information gathered to decide on another term that creates connections between the vocabulary word and another term/word.

Allow students to work in collaborative groups to discuss and research the other provided vocabulary terms and repeat the modeled instructional strategy.

Have students collaborate, in groups, to complete the strategy for the other vocabulary terms.

Allow groups to share their thinking through academic dialogue and compare their completed task with members of other groups.

Have students use the following template to write their claim-evidence-reasoning (CER)

3-5 Student Writing Template (editable)
3-5 Student Writing Template (pdf)

**TEACHER NOTE: Have students review the student sample(s) of claim-evidence-reasoning on Day 2. Have students compare their writing to those students' samples. Ask the following questions:

How are your thoughts or understanding similar to another writer on the topic?
How are your thoughts or understanding different to another writer on the topic?
What would you like to learn more about? Why?

Assessment for Learning:

S4P3c Simple Machines.…

	1. Identify the student's claim in the sample and have the teacher or students write their observations or questions. *2. Identify the student's evidence in the sample and have the teacher or students write their observations or questions.* *3. Identify the student's reasoning in the sample and have the teacher or students write their observations or questions.* Ask the following questions to students as they analyze the student samples: Claim-Evidence-Reasoni… ****Teacher Note:** As students review the student samples, they will begin to see or read vocabulary. Begin or continue a reference chart of questions or observations about vocabulary. Students will explicitly learn vocabulary on Day 4.	students through the accompanying activities. Levers Levers Student Exploration Wheel and Axle Wheel and Axle Student Exploration The teacher and students should only complete Activity B. Activity A and C can be complete if time permits after both simple machines have been reviewed. The teacher should pause to review the questions in the investigations with the students		

Assessment Prep

Prepare students for assessment by reviewing the following 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**	**Mystery Science/PhET**
uInvestigate Lab: How long do objects take to fall? **Savvas uInvestigate Lab** **"How can you compare the energy of objects?"** **uInvestigate: How does starting height affect an object's energy?** **uInvestigate: How does energy transfer between objects?**	**Pulleys** **Ants on A Slant** **Levers** **Wheel & Axle**	**Mystery Science: What makes bridges so strong?** **How do simple machines make work easier?** **PhET Physics: Motion, Energy Skate Park: Basics** **How can the marbles save the world?** **PhET: Tug of War**

Additional- Resources/Tasks Return to Top	
Supplemental Labs	Simple Machines
Culminating Performance Task	CER Task: How can gravitational force affect the motion of an object? CER Task: How can gravitational force affect the motion of an object? CER Task: What effect does balanced and unbalanced forces have on an object? CER Task: What effect does balanced and unbalanced forces have on an object? CER Task: How are simple machines used and how are forces changed when they are used to complete a simple task? CER Task: How are simple machines used and how are forces changed when they are used to complete a simple task?
STEM Activities	