# March  Grade 7 Unit 5A: Forces and Motion

Content Area: **Science**
Course(s):
Time Period: **March**
Length: **6-8 Weeks**
Status: **Published**

## Unit Overview

This unit covers:

Forces and motion

interaction of forces and mass

Newton's Laws

gravity

friction

straight line motion

## Enduring Understandings

By the end of this unit, students will know:

- The causes of motion.
- The difference between speed and velocity.
- Unbalanced forces cause acceleration.
- The larger the force the larger the acceleration.
- The inverse relationship between mass and acceleration.
- Newton’s 3$^{rd}$ law acts in force pairs.

## Essential Questions

- What causes motion to occur?
- What do motion graphs look like for objects moving with constant velocity?
- What do graphs look like for objects that are accelerating?
- How is the speed of an object calculated?
- How is velocity similar / different from velocity?
- How is acceleration calculated?
- How do unbalanced forces affect the motion of an object?
- How does friction affect an object when at rest or in motion?

- What are the biggest factors that affect the force of gravity?
- How is weight calculated?
- What does Newton's 1st law state about objects at rest or in motion?
- How does the mass of an object and the force acting on that object affect the object's acceleration?
- How can Newton's 3rd law of motion be used to explain the motion of a rocket?
- What factors affect the momentum of an object?
- How is momentum different from inertia?

## Instructional Strategies & Learning Activities

**INTERACTIONS OF FORCES AND MASS**

### The Five Es

**The Five E Instructional Model**

Science Techbook follows the 5E instructional model. The provided Model Lesson: Interaction of Force and Mass includes strategies for each of the 5Es (click link to download PDF). As you design the inquiry-based learning experience for students, be sure to collect data during instruction to drive your instructional decisions. Point-of-use teacher notes are also provided within each E-tab.

**Engage (45–90 minutes)**

Core Interactive Text: What Happens When Force Meets Mass?

Video: Demonstrations of Inertia: Tricks with a Sledgehammer
Caption: How does the demonstration in this video illustrate the concept of inertia?

Video: Principles of Motion: The Law of Inertia
Caption: The law of inertia comes from Newton's First Law of Motion. What is the law of inertia?

Video: Inertia in Action
Caption: Inertia explains why people get injured in car accidents. Why does the driver appear to move backward when the car is struck from behind?

Video: Coasting Through Physics
Caption: Roller coaster design must account for inertia. How does inertia apply to roller coasters?

**Explore (90 minutes)**

Core Interactive Text: What Happens When Two Unbalanced Forces Act on an Object?

Image: Net Force
Caption: The net force is the sum of all the forces acting on an object. In this case, what forces are acting on the ball? What is the dominant force?

Interactive: Monster Truck Pull
Caption: Powerful forces are in action at this monster truck pull. Which truck produces the greatest pulling force? What happens when two forces pull in opposite directions?

Image: Tug of War
Caption: This political cartoon from 1898 shows people involved in a tug of war. When the forces are balanced, an object will remain stationary if it was stationary to begin with or continue moving if it was already moving. What will happen to the rope if both sides exert the same force on it but in opposite directions?

Video: Sir Isaac's Apple
Caption: Newton's laws of motion can be used to explain the behavior of objects in motion. How are Newton's laws affected when two forces act on an object?

Core Interactive Text: What Kinds of Forces Can Act on an Object?

Video: Facts about Forces
Caption: Forces are interactions that can move an object if they are unopposed by another force. What types of forces can you name?

Video: Friction on the Ground and in the Air
Caption: Friction is a force between two bodies that affects the movement of objects on the ground and in the air. How does friction make it possible for you to walk across a floor?

**Explain (45–90 minutes)**

Core Interactive Text: Explaining Interaction of Force and Mass (balanced and unbalanced forces)

Image: Scientific Explanation

Video: Student Scientific Explanations

**Elaborate with STEM (45–135 minutes)**

Core Interactive Text: Force, Mass, and Transportation

Video: Extreme Driving
Caption: A car designed to climb a vertical slope is not your average commuter car. Why does this car not flip backward off an almost vertical cliff?

Video: Train Smashes into Car
Caption: When a train crashes into a car, the car always comes off worst. How does calculation of G-force help engineers design an airbag to limit the damage from a train crashing into a car?

Video: Other Applications of Gravity
Caption: How does a planet's mass affect the speed of a spacecraft in orbit around the planet?

STEM Project Starter: Marble Madness

STEM Project Starter: Mars or Bust! What's the Deal with Wheels in Exploring the Red Planet?

**Evaluate (45–90 minutes)**

Core Interactive Text: Review Interaction of Force and Mass

Constructed Response: Interaction of Force and Mass

NEWTON'S LAWS

## he Five Es

**The Five E Instructional Model**

Science Techbook follows the 5E instructional model. The provided Model Lesson: Newton's Laws includes strategies for each of the 5Es (click link to download PDF). As you design the inquiry-based learning experience for students, be sure to collect data during instruction to drive your instructional decisions. Point-of-use teacher notes are also provided within each E-tab.

**Engage (45–90 minutes)**

Core Interactive Text: Should You Fear a Penny Dropped Off of the Empire State Building?

Video: The Penny Myth
Caption: Could a penny dropped off the Empire State Building kill you?

Video: Dynamite Jail Break
Caption: How could dynamite cause a wall to break open?

Video: Paper Strength: Newton's Laws: Explanation
Caption: How do Newton's laws apply to different systems all around us?

Video: G Whiz: The Physics of a Stunt Pilot
Caption: What is a g-force, and what can it do to your body?

**Explore (135 minutes)**

Core Interactive Text: How Does an Object Behave When No Unbalanced Force Is Applied to It, and Why?

Video: Newton's First Law of Motion
Caption: Inertia explains why objects remain in their current state of motion unless an unbalanced force acts on them. What are some examples of unbalanced forces and their results in everyday life?

Exploration: Monster Truck Pull
Caption: In a monster truck pull, the most powerful truck is the victor. How does a monster truck pull demonstrate balanced and unbalanced forces?

Video: Newton's First Law Demonstrated
Caption: There are a few techniques for performing the tablecloth trick. How does Newton's first law of motion explain these techniques?

Core Interactive Text: How Are Force, Mass, and Acceleration Related?

Song: The Law of Inertia and Newton's Second Law of Motion
Caption: Applying a force to an object can cause it to accelerate. What role does mass play in determining the rate of acceleration of an object?

Hands-On Activity: Newton's Laws in Action
Caption: Together, Newton's three laws of motion describe the properties of motion. How do Newton's laws help people understand and predict the results of their actions?

Core Interactive Text: How Can a Force Pushing in One Direction Cause Movement in the Opposite Direction?

Video: Newton's Third Law of Motion
Caption: For every action, there is an equal and opposite reaction. Can you explain why a rowboat moves one way when you use the oars to push water the other way?

Video: Hydrofoiling with Kites
Caption: A hydrofoil works like an airplane's wing. How do hydrofoils demonstrate Newton's third law?

Reading Passage: Rocket Launch Demonstrates Energy, Force, and Motion
Caption: Before a rocket is launched, it is at rest. What force is applied to the rocket to launch it?

Hands-On Activity: Applying Newton's Third Law to Collisions
Caption: When two objects collide, the forces of the objects balance each other. What is the relationship between the mass of objects and the results of a collision?

**Explain (45–90 minutes)**

Core Interactive Text: Explaining Newton's Laws

Image: Scientific Explanation

Video: Student Scientific Explanations

**Elaborate with STEM (45–90 minutes)**

Core Interactive Text: Rocket Science Curiosity

Video: The Curiosity Landing: Seven Minutes of Terror
Caption: How does Newton's second law describe the motion of a rocket slowing?

Video: Landing the Curiosity Rover
Caption: What are some challenges that engineers faced in landing the rover on Mars?

STEM Project Starter: Weight on Different Planets

STEM Project Starter: Designing an Ice Robot

**Evaluate (45–90 minutes)**

Core Interactive Text: Review Newton's Laws

Constructed Response: Newton's Laws

GAVITY:

## The Five Es

### The Five E Instructional Model

Science Techbook follows the 5E Instructional Model. The provided Model Lesson: Gravityincludes strategies for each of the 5Es (click link to download PDF). As you design the inquiry-based learning experience for students, be sure to collect data during instruction to drive your instructional decisions. Point-of-use teacher notes are also provided within each E-tab.

**Engage (45–90 minutes)**

Core Interactive Text: Thinking About Gravity

Video: Gravity All Around Us
Caption: How does gravity affect our lives?

Video: The Physics of Falling
Caption: What affects Adriane's falling speed?

Video: Forces and Motion
Caption: What kinds of forces can you feel operating on you?

Video: Galactic Collisions
Caption: What does gravity do in outer space?

**Explore (180 minutes)**

Core Interactive Text: What Is Gravity and How Does It Work?

Video: Cancelling Out Gravity
Caption: When a person is in free fall, they experience weightlessness. Does this mean that they are not feeling the effects of gravity?

Image: Weight and Gravity
Caption: Astronauts weigh about one-sixth as much on the moon as on Earth. What would you weigh on the moon?

Core Interactive Text: How Does the Force of Gravity Affect Objects on Earth and in Our Solar System?

Exploration: Lose Weight Without Dieting
Caption: In this exploration, you will weigh a bowling ball in different locations. In some locations, it weighs more than it does on Earth. In others, it weighs less. The bowling ball has different weights even though it has not changed! How is that possible?

Core Interactive Text: How Does the Acceleration Due to Gravity Relate to the Mass of an Object and Its Distance from Earth?

Hands-On Activity: Massive Motion
Caption: Gravity affects all massive objects. Does gravity affect objects of different masses differently?

Video: The Law of Falling Bodies
Caption: A feather falls more slowly than a golf ball. Why is that?

**Explain (45–90 minutes)**

Core Interactive Text: Explaining Gravity

Image: Scientific Explanation

Video: Student Scientific Explanations

**Elaborate with STEM (45–135 minutes)**

Core Interactive Text: Careers and Gravity

Video: Gravity: Making Waves
Caption: How can scientists detect gravitational waves?

STEM Project Starter: Falling Objects

STEM Project Starter: Gravity on Other Planets

STEM Project Starter: Wingsuit Flying

**Evaluate (45–90 minutes)**

Core Interactive Text: Review Gravity

Constructed Response: Gravity

FRICTION:

## The Five Es

**The Five E Instructional Model**

Science Techbook follows the 5E instructional model. The provided Model Lesson: Frictionincludes strategies for each of the 5Es (click link to download PDF). As you design the inquiry-based learning experience for students, be sure to collect data during instruction to drive your instructional decisions. Point-of-use teacher notes are also provided within each E-tab.

**Engage (45–90 minutes)**

Core Interactive Text: How Does Friction Affect a Stopping Car?

Image: Bicycle Racers Making a Turn

Caption: These cyclists depend on friction to help them control their bicycles. In what ways does friction act on a bicycle?

Video: Braking Physics: Demonstrating the Science of Stopping a Car
Caption: How does the frictional force on a road help to bring a car to a stop?

Video: Card Throwing: Friction and Tension
Caption: How does friction play a role in high-speed card throwing?

Video: Friction: Book Pages
Caption: If you were to interlace the pages of two books, could you pull them apart?

Video: Friction: Jeans on Fire
Caption: If you were to drag a pair of jeans fast enough, would the force of friction catch them on fire?

**Explore (90 minutes)**

Core Interactive Text: How Does Friction Relate to Kinetic Energy and the Transfer of Energy between Objects?

Video: The Science of Broomball or How Not to Fall Down on Ice
Caption: What makes broomball shoes different from running shoes?

Hands-On Activity: Investigating Kinetic Friction
Caption: What is the relationship between the type of surface and the amount of kinetic friction? Explore this activity to learn more about the factors that affect kinetic friction.

Reading Passage: Tires on a Road
Caption: What properties contribute to the amount of friction between tires and a road?

Core Interactive Text: How Does Friction Affect the Motion of an Object?

Image: Surface and Motion
Caption: Different surfaces have different amounts of friction. Can you correctly match each surface based on how far the ball rolls?

Exploration: Slippery Slope
Caption: What happens when a block slides down a ramp?

Video: Thermal Tiles and Rocket Problems
Caption: NASA designed thermal tiles to cover the outside of the space shuttle. Why were these tiles necessary? What role does friction play in space shuttle reentry?

**Explain (45–90 minutes)**

Core Interactive Text: Explaining Friction

Image: Scientific Explanation

Video: Student Scientific Explanations

**Elaborate with STEM (45–135 minutes)**

Core Interactive Text: Heat Shields on Rocket Ships

Video: The Problem of Reentry
Caption: Why is friction a challenge for astronauts as they reenter Earth's atmosphere?

Video: Thermal Protection
Caption: How do engineers protect a spaceship from the heat of reentry into the atmosphere?

STEM Project Starter: Galileo's Friction Experiment

STEM Project Starter: Engineering a Shoe

**Evaluate (45–90 minutes)**

Core Interactive Text: Review Friction

Constructed Response: Friction

STRAIGHT LINE MOTION

## the Five Es

**The Five E Instructional Model**

Science Techbook follows the 5E instructional model. The provided Model Lesson: Straight Line Motion includes strategies for each of the 5Es (click link to download PDF). As you design the inquiry-based learning experience for students, be sure to collect data during instruction to drive your instructional decisions. Point-of-use teacher notes are also provided within each E-tab.

**Engage (45–90 minutes)**

Core Interactive Text: Force It! The Science of Motion

Video: Making a Faster Toy Car
Caption: The MythBusters team works to design a faster toy race car. How does the car move without an engine?

Video: The Toy Car Myth
Caption: Will a toy car coasting downhill outrace a much heavier real car? Which factors affect the motion of each object?

Video: Underwater Shooting
Caption: Does a bullet fired underwater move differently that a bullet fired through the air? How can you explain these differences in motion?

Video: Force and Motion
Caption: Several important forces affect objects in motion. How do forces affect you every day as you move through your life?

**Explore (90 minutes)**

Core Interactive Text: What Is Speed?

Image: Billiard Balls
Caption: Motion describes a change in position. How can you describe the motion of this billiard ball?

Image: Distance vs. Time Graph
Caption: This graph shows how an object's position changed over time. Was the object stationary at any time period shown in the graph? How can you tell?

Exploration: On the Move
Caption: An object is in motion, yet this motion appears different depending on where the observer is standing. How can the position of the observer make a difference in the observed motion of an object?

Video: Uniform and Non-Uniform Motion
Caption: An object with uniform motion has a constant speed. How does an object with non-uniform motion compare?

Core Interactive Text: What Are Velocity and Acceleration?

Video: Speed, Velocity, and Acceleration
Caption: Speed and velocity both describe an object's motion. How are speed and velocity different?

Video: Acceleration
Caption: Acceleration is another way to describe the movement of an object. What does acceleration measure?

Core Interactive Text: When and Why Does the Motion of an Object Change?

Image: Net Force
Caption: Two forces act in opposite directions on an object at rest. What is the overall force on the object, and how will this affect the object's motion?

Video: Reviewing Newton's First Law of Motion
Caption: According to Newton's first law of motion, an object at rest stays at rest unless an unbalanced force is applied to it. What happens to an object already in motion if all forces acting on it are balanced?

Animation: Balanced Forces
Caption: Two people pulling equally on a rope remain stationary. How does this demonstrate Newton's discovery about balanced forces and motion?

Hands-On Activity: Measuring Changes of Motion
Caption: What forces act upon the ball to cause changes in its motion?

Video: Inertia in Action
Caption: Inertia is the resistance of an object to a change in motion. How can a seatbelt protect you from the effects of inertia in a car crash?

Reading Passage: Seatbelt Science and Safety
Caption: A big threat to a person's safety during an automobile accident is their inertia. How do seatbelts protect people from being harmed by their own inertia?

**Explain (45–90 minutes)**

Core Interactive Text: Explaining Straight Line Motion

Image: Scientific Explanation

Video: Student Scientific Explanations

**Elaborate with STEM (45–135 minutes)**

Core Interactive Text: Careers in Motion: Demolition Engineer

Video: Tools of Destruction
Caption: Demolition engineers have developed many machines to demolish buildings safely and quickly. What machine is most popular for demolition today?

Video: The Art of Demolition
Caption: Demolition engineers must be masters of physics. How can the laws of motion be used to predict how buildings will fall?

STEM Project Starter: Classroom Olympics

STEM Project Starter: Vicious Cycle: Balanced and Unbalanced Forces

STEM Project Starter: The Gravity of the Situation: Parachuting Forces

**Evaluate (45–90 minutes)**

Core Interactive Text: Review Straight Line Motion

Constructed Response: Straight Line Motion

THE UNITS BELOW ARE FROM THE NJCTL AND WILL BE USED AS NEEDED. CURRICULUM WILL BE CONSOLIDATED THROUGHOUT THE 2017-2018 SCHOOL YEAR.

Forces and Motion Unit webpage

This webpage link contains all the materials needed to teach this unit.

| | | | |
|---|---|---|---|
| | **Unit Lesson Plan - Forces and Motion** | | |
| **Teacher:** | | **Time Frame:** | **20 days** |
| **Grade:** | **8th Grade** | **School:** | |
| **Subject:** | **PSI Middle School Science** | | |

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| **NGSS/DCI** | **For any pair of interacting objects, the force exerted by the fi object is equal in strength to the force that the second object e** |

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| **MS-PS2:**<br><br>**Forces and Interactions** | **the opposite direction (Newton's third law). (MS-PS2-1)**<br><br>**The motion of an object is determined by the sum of the force force on the object is not zero, its motion will change. The gre object, the greater the force needed to achieve the same chang given object, a larger force causes a larger change in motion.**<br><br>**All positions of objects and the directions of forces and motio an arbitrarily chosen reference frame and arbitrarily chosen share information with other people, these choices must also b**<br><br>http://www.nextgenscience.org/msps2-motion-stability-forces-int |
| **Instructional Objective:**<br><br>**MS-PS2-1.** | **Apply Newton's Third Law to design a solution to a problem two colliding objects.** |
| **Instructional Objective:**<br><br>**MS-PS2-2.** | **Plan an investigation to provide evidence that the change in a depends on the sum of the forces on the object and the mass o** |

# Essential Questions

**(What questions will the student be able to answer as a result of the instruction?)**

- What causes motion to occur?
- What do motion graphs look like for objects moving with constant velocity?
- What do graphs look like for objects that are accelerating?
- How is the speed of an object calculated?
- How is velocity similar / different from velocity?
- How is acceleration calculated?
- How do unbalanced forces affect the motion of an object?
- How does friction affect an object when at rest or in motion?
- What are the biggest factors that affect the force of gravity?
- How is weight calculated?
- What does Newton's 1st law state about objects at rest or in motion?
- How does the mass of an object and the force acting on that object affect the object's acceleration?
- How can Newton's 3rd law of motion be used to explain the motion of a rocket?
- What factors affect the momentum of an object?
- How is momentum different from inertia?

# Knowledge & Skills

**(What skills are needed to achieve the desired results?)**

| By the end of this unit, students will know: | By the end of this unit, students will be abl |
|---|---|
| • The causes of motion.<br>• The difference between speed and velocity.<br>• Unbalanced forces cause acceleration.<br>• The larger the force the larger the acceleration.<br>• The inverse relationship between mass and acceleration.<br>• Newton's 3rd law acts in force pairs. | • Interpret motion graphs<br>• Calculate speed.<br>• Calculate Weight.<br>• Calculate Force.<br>• Explain any moving object using N<br>• Calculate momentum.<br>• Calculate basic sum of force proble |

# Assessment

**(What is acceptable evidence to show desired results (rubrics, exam, etc.)? Attach Copy**

During the Smart Notebook lesson designed to introduce concepts, students will be continually questioned on th combination of class work/homework questions and the SMART Response system. Classwork and Homework discussed as a class and misconceptions will be addressed by the teacher prior to the formal evaluations listed be

Quiz 1: Motion

Lab 1: Graphing Motion Simulation Lab

Lab 2: Constant Speed Graphical Analysis Lab

Lab 3: Accelerated Motion Lab

Quiz 2: Graphing Motion

Lab 4: Sticky Sneakers

Quiz 3: Forces

Lab 5: Forces and Friction Simulation Lab

Quiz 4: Newton's Laws

Lab 6: Newton's 3rd Law and Momentum Lab

Quiz 5: Newton's 3rd Law & Momentum

Lab 7: Newton's Laws of Motion

Unit Test

**(What is the sequence of activities, learning experiences, etc, that will lead to desired results (the plan)?**

| Day | Topic | Classwork | |
|---|---|---|---|
| 1 | Motion, Speed, and Velocity | Slides 1-26;<br><br>Questions #1-7 | |
| 2 | Average vs. Instantaneous Speed | Questions #14- 23 | |
| 3 | Motion Quiz<br><br>Motion Graphs | Motion Quiz;<br><br>Slides 27-36; | |
| 4 | Graphing Motion | Graphing Motion Simulation Lab<br><br>Slide 37 | Fi |
| 5 | Acceleration | Slides 35-50;<br><br>Questions #34-41 | |
| 6 | Constant Speed Graphical Analysis | Constant Speed Graphical Analysis Lab<br><br>Slide 51 | |
| 7 | Accelerated Motion Using the Inclined Plane | Slides 52-54;<br><br>Accelerated Motion on an | |

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|---|---|---|---|
| | | Inclined Plane Lab<br><br>Slide 55 | |
| 8 | Graphing Motion Quiz<br><br>Forces and Friction | Graphing Motion Quiz;<br><br>Slides 56-76;<br><br>Questions #48-54 | |
| 9 | Gravity and Equilibrium | Slides 77-100;<br><br>Questions #58-64 | |
| 10 | Friction & Equilibrium | Sticky Sneakers Lab<br><br>Slide 101 | |
| 11 | Forces Quiz<br><br>Newton's First Law | Forces Quiz;<br><br>Slides 102-119;<br><br>Questions #72-75 | |
| 12 | Newton's Second Law | Slides 120-129; Questions #79-84 | |
| 13 | Forces & Friction | Forces and Friction Simulation Lab<br><br>Slide 130 | |
| 14 | Newton's Laws Quiz<br><br>Forces & Friction | Newton's Laws Quiz;<br><br>Complete Forces & Friction Simulation | Fi<br>S |
| 15 | Newton's 3rd Law & Momentum | Slides 131- 156 | |
| 16 | Newton's 3rd Law & Momentum | Newton's 3rd Law & Momentum Lab<br><br>Slide 157 | |
| 17 | 3rd Law & Momentum Quiz<br><br>Newton's Laws | 3rd Law & Momentum Quiz;<br><br>Newton's Laws Lab Stations 1-3 | Finish |

| | | | |
|---|---|---|---|
| | | Slide 158 | |
| 18 | Newton's Laws Lab | Newton's Laws Lab Stations 4-8 | C |
| 19 | Test Review using Notebook | Study Guide Review | |
| 20 | Unit Test | Testing | |
| | | | |

*HW Problems are currently not scaffolded from least to most difficult, but are instead listed in order of topic. Teacher should pay special attention at the end of each class period when assigning HW so that only problems related to the topic that was taught are being assigned.

**Pacing guide is based on 40minute class periods, you will need to adjust based on your school's schedule.

## Integration of Career Readiness, Life Literacies and Key Skills

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| 9.2.8.CAP.1 | Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest. |
| 9.2.8.CAP.2 | Develop a plan that includes information about career areas of interest. |
| 9.2.8.CAP.3 | Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income. |
| 9.2.8.CAP.4 | Explain how an individual's online behavior (e.g., social networking, photo exchanges, video postings) may impact opportunities for employment or advancement. |
| | Multiple solutions often exist to solve a problem. |
| 9.4.8.CT.1 | Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2). |
| 9.4.8.DC.1 | Analyze the resource citations in online materials for proper use. |
| 9.4.8.DC.2 | Provide appropriate citation and attribution elements when creating media products (e.g., W.6.8). |
| 9.4.8.IML.1 | Critically curate multiple resources to assess the credibility of sources when searching for information. |
| 9.4.8.IML.3 | Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b). |
| 9.4.8.TL.3 | Select appropriate tools to organize and present information digitally. |

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| 9.4.8.TL.4 | Synthesize and publish information about a local or global issue or event (e.g., MSLS4-5, 6.1.8.CivicsPI.3). |

## Interdisciplinary Connections

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|---|---|
| LA.RST.6-8 | Reading Science and Technical Subjects |
| LA.RST.6-8.1 | Cite specific textual evidence to support analysis of science and technical texts. |
| LA.RI.8.1 | Cite the textual evidence and make relevant connections that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text. |
| LA.RST.6-8.2 | Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. |
| LA.RI.8.2 | Determine a central idea of a text and analyze its development over the course of the text, including its relationship to supporting ideas; provide an objective summary of the text. |
| LA.RI.8.3 | Analyze how a text makes connections among and distinctions between individuals, ideas, or events (e.g., through comparisons, analogies, or categories). |
| LA.RST.6-8.3 | Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. |
| LA.RI.8.4 | Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts. |
| LA.RST.6-8.4 | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics. |
| LA.RI.8.5 | Analyze the structure an author uses to organize a specific paragraph in a text, including the role of particular sentences, to develop and to refine a key concept. |
| LA.RST.6-8.5 | Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic. |
| LA.RST.6-8.6 | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text. |
| LA.RI.8.6 | Determine an author’s point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints. |
| LA.RI.8.7 | Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea. |
| LA.RST.6-8.7 | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). |
| LA.RST.6-8.8 | Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. |
| LA.RI.8.8 | Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced. |
| LA.RI.8.9 | Analyze and reflect on (e.g., practical knowledge, historical/cultural context, and background knowledge) two or more texts that provide conflicting information on the same topic and identify where the texts disagree on matters of fact or interpretation. |
| LA.RST.6-8.9 | Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. |
| LA.WHST.6-8.2 | Write informative/explanatory texts, including the narration of historical events, scientific |

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| | procedures/experiments, or technical processes. |
| LA.WHST.6-8.4 | Produce clear and coherent writing in which the development, organization, voice, and style are appropriate to task, purpose, and audience. |
| LA.WHST.6-8.5 | With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed. |
| LA.WHST.6-8.7 | Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. |
| LA.WHST.6-8.8 | Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. |
| LA.WHST.6-8.10 | Write routinely over extended time frames (time for research, reflection, metacognition/self correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| MA.8.SP.A.3 | Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. |

## Differentiation

See differentiation suggestions in Discovery Techbook lessons.

Differentiation in science can be accomplished in several ways. Once you have given a pre-test to students, you know what information has already been mastered and what they still need to work on. Next, you design activities, discussions, lectures, and so on to teach information to students. The best way is to have two or three groups of students divided by ability level.

While you are instructing one group, the other groups are working on activities to further their knowledge of the concepts. For example, while you are helping one group learn the planet names in order, another group is researching climate, size, and distance from the moon of each planet. Then the groups switch, and you instruct the second group on another objective from the space unit. The first group practices writing the order of the planets and drawing a diagram of them.

Here are some ideas for the classroom when you are using differentiation in science:

- Create a tic-tac-toe board that lists different activities at different ability levels. When students aren't involved in direct instruction with you, they can work on activities from their tic-tac-toe board. These boards have nine squares, like a tic-tac-toe board; and each square lists an activity that corresponds with the science unit. For example, one solar system activity for advanced science students might be to create a power point presentation about eclipses. For beginning students, an activity might be to make a poster for one of the planets and include important data such as size, order from the sun, whether it has moons, and so on.

- Find websites on the current science unit that students can explore on their own.

- Allow students to work in small groups to create a project throughout the entire unit. For example, one group might create a solar system model to scale. Another group might write a play about the solar system. This is an activity these groups can work on while they are not working directly with you.

Differentiation in science gets students excited to learn because it challenges them to expand their knowledge

and skills, instead of teaching the whole group concepts they have already mastered.

## Modifications & Accommodations

Refer to QSAC EXCEL SMALL SPED ACCOMMOCATIONS spreadsheet in this discipline.

**Modifications and Accommodations used in this unit:**

In addition to differentiated instruction, IEP's and 504 accommocations will be utilized.

## Formative Assessments

Assessment allows both instructor and student to monitor progress towards achieving learning objectives, and can be approached in a variety of ways. **Formative assessment** refers to tools that identify misconceptions, struggles, and learning gaps along the way and assess how to close those gaps. It includes effective tools for helping to shape learning, and can even bolster students' abilities to take ownership of their learning when they understand that the goal is to improve learning, not apply final marks (Trumbull and Lash, 2013). It can include students assessing themselves, peers, or even the instructor, through writing, quizzes, conversation, and more. In short, formative assessment occurs throughout a class or course, and seeks to improve student achievement of learning objectives through approaches that can support specific student needs (Theal and Franklin, 2010, p. 151).

**Formative Assessments used in this unit:**

Formative assessments as listed in unit.

See assessments located in the unit link above

## Summative Assessments

**Summative assessments** evaluate student learning, knowledge, proficiency, or success at the conclusion of an instructional period, like a unit, course, or program. Summative assessments are almost always formally graded and often heavily weighted (though they do not need to be). Summative assessment can be used to

great effect in conjunction and alignment with formative assessment, and instructors can consider a variety of ways to combine these approaches.

**Summative assessments for this unit:**

Summative assessments as listed in unit.

See assessments located in the unit link above

## Instructional Materials

See materials located in Unit above.

## Standards

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|---|---|
| MS-PS2 | Motion and Stability: Forces and Interactions |
| MS-PS2-1 | Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. |
| | Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle. |
| | Assessment is limited to vertical or horizontal interactions in one dimension. |
| PS2.A | Forces and Motion |
| | For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). |
| | Systems and System Models |
| | Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. |
| MS-PS2-2 | Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. |
| | Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units. |
| | Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry. |
| | The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, |

| | |
|---|---|
| | the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.<br><br>All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.<br><br>Stability and Change<br><br>Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. |
| MS-PS2-3 | Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.<br><br>Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.<br><br>Asking Questions and Defining Problems<br><br>Asking questions and defining problems in grades 6–8 builds from grades K–5 experiences and progresses to specifying relationships between variables and clarifying arguments and models.<br><br>Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. |
| PS2.B | Types of Interactions<br><br>Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.<br><br>Cause and effect relationships may be used to predict phenomena in natural or designed systems.<br><br>Engaging in argument from evidence in 6–8 builds from grades K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world.<br><br>Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. |
| PS2.B | Types of Interactions<br><br>Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. |