

6th Grade Science Curriculum

Unit 1: Forces and Motion

Number of Days: 30

Unit Focus	Essential Questions	Next Generation Standards	Disciplinary Core Ideas(DCI)
<p><i>How can we find solutions to problems and answer questions?</i> Students use the scientific method and engineering design to solve problems, answer questions, and to find truths about nature. They will act as true scientists and engineers as they pose issues,</p> <p><i>How can we predict the motion of an object?</i> Students use system and system models and stability and change to understanding ideas related to why some objects will keep moving and why objects fall to the ground. Students apply Newton’s third law of motion to related forces to explain the motion of objects. Students also apply an engineering practice and concept to solve a problem caused when objects collide. The crosscutting concepts of system and system models and stability and change provide a framework for understanding the disciplinary core ideas. Students demonstrate proficiency in asking questions, planning and carrying out investigations, designing solutions, engaging in argument from evidence, developing and using models, and constructing explanations and designing solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas.</p>	<ul style="list-style-type: none">• How do you use methods and the feed back loop to solve problems?• How vectors are used to analyze motion?• How vectors are used to analyze motion?• What is the difference between speed and velocity?	<p>MS-PS2-1 MS-PS2-2 MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4</p>	<ul style="list-style-type: none">• ETS1.A: Defining Problems• ETS1.B: Developing Solutions• PS2.A: Forces and Motion• ETS1.A: Defining and Delimiting Engineering Problems• ETS1.C: Optimizing the Design Solution• ETS1.B: Developing Possible Solutions

Camden City School District

**Link to Unit 1:
Forces and Motion**

[https://njctl.org/courses/
archived-courses-units/
8th-grade-science/](https://njctl.org/courses/archived-courses-units/8th-grade-science/)

***All teachers must
register at
[http://
www.NJCTL.org](http://www.NJCTL.org)**

Camden City School District

<i>NGSS Framework</i>		
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts

Camden City School District

<p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none"> Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS2-2) <p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1) <p>Asking Questions and Defining Problems</p> <ul style="list-style-type: none"> Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1) <p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2) 	<p>PS2.A: Forces and Motion</p> <ul style="list-style-type: none"> 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). (MS-PS2-1) 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. (MS-PS2-2) 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. (MS-PS2-2) <p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1) <p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2) A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) There are systematic processes for evaluating 	<p>Systems and System Models</p> <ul style="list-style-type: none"> Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. (MS-PS2-1) <p>Stability and Change</p> <ul style="list-style-type: none"> 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-PS2-2) <p>-----</p> <p><i>Connections to Engineering, Technology, and Applications of Science</i></p> <p>Influence of Science, Engineering, and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-PS2-1) All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1) The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)
---	---	---

Camden City School District

English Language Arts	Mathematics
<p>Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-PS2-1),(MS-ETS1-1),(MS-ETS1-2) RST.6-8.1</p> <p>Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-1),(MS-PS2-2) RST.6-8.3</p> <p>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. (MS-ETS1-1) WHST.6-8.8</p> <p>Draw evidence from informational texts to support analysis, reflection, and research. (MS-ETS1-2) WHST.6-8.9</p> <p>Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ETS1-2),(MS-ETS1-3) RST.6-8.9</p> <p>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. (MS-ETS1-2) WHST.6-8.7</p>	<p>Reason abstractly and quantitatively. (MS-PS2-1),(MS-PS2-2),(MS-PS2-3), (MS-ETS1-1),(MS-ETS1-2) MP.2</p> <p>Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-PS2-1) 6.NS.C.5</p> <p>Write, read, and evaluate expressions in which letters stand for numbers. (MS-PS2-1),(MS-PS2-2) 6.EE.A.2</p> <p>Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-PS2-1),(MS-PS2-2) 7.EE.B.3</p> <p><u>Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.</u> (MS-PS2-1),(MS-PS2-2) 7.EE.B.4</p> <p><u>Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.</u> (MS-ETS1-1),(MS-ETS1-2) 7.EE.3</p>

Camden City School District

Unit 1: Forces and Motion

Approximate Days: # 30

Standard(s):

PS2.A Forces and Motion

Student Outcomes	Inquiry Based Learning Activities	Materials/Resources
------------------	-----------------------------------	---------------------

Camden City School District

Students will know that:

- Problems can be solved using methodic testing and designing
- Reference points dictate if motion is noticeable
- 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

Students will be able to:

- **Design** experiments and engineering problems.
- **Analyze** data to **Infer** meaning of outcomes.
- **Communicate** findings.
- **Interpret** motion graphs.
- **Calculate** speed.
- **Calculate** Force.
- **Calculate** Weight.
- **Explain** any moving object using Newton's Laws.
- **Calculate** momentum.
- **Calculate** basic sum of force problems.

• **Introductory Simple Bubble Lab**

<https://www.thoughtco.com/bubble-life-and-temperature-project-609020>

• **Forces and Friction lab**

<https://njctl.org/courses/science/8th-grade-science/forces-motion/attachments/forces-and-friction-simulation/>

Newton's Third Law and Momentum Lab

<https://njctl.org/courses/science/8th-grade-science/forces-motion/attachments/newtons-third-law-and-momentum-lab/>

Newton's Laws of Motion Lab

<https://njctl.org/courses/science/8th-grade-science/forces-motion/attachments/newtons-laws-of-motion/>

Accelerated Motion Lab

<https://njctl.org/courses/science/8th-grade-science/forces-motion/attachments/accelerated-motion-on-an-inclined-plane/>

Sticky Sneakers Lab

Materials Needed:

Phet link:

<http://phet.colorado.edu/en/simulation/forces-and-motion-basics>

Directions:

- Go to the following website:
69. <http://www.mrmont.com/games/carcollision.html>

Materials:

- cup or beaker
- an index card
- a penny

Materials:

- Lab Sheet, Calculator
- Stop Watch
- Incline Plane Apparatus
- Car
- Meter stick
- Tape

Camden City School District

<https://njctl.org/courses/science/8th-grade-science/forces-motion/attachments/sticky-sneakers-lab/>

Graphing Motion Simulation

<https://njctl.org/courses/science/8th-grade-science/forces-motion/attachments/graphing-motion-simulation/>

Resources:

- www.NJCTL.org
 - www.nicerc.org
 - https://www.youtube.com/playlist?list=PLSzDiTp_K4OccO-3-Cpkeywhd8vlljmEH
 - <http://www.ck12.org/>
 - http://www.ck12.org<https://urldefense.proofpoint.com/v2/url?u=http-3A__www.ck12.org&d=CwMFaQ&c=uVBC5aaqdp04wbCmyXNuQqcI6-HHVF3q1DNb_Pgp7v8&r=sNJUdrLZ_tffMB5A06zIXFw0XW_5tS9haJqOoP6a318&m=pxqBwqiQg9FHOsDRGvWq4yKISNIVZAGgnFdvRehjUlc-ELL
related resource
 - <http://bpsscience.weebly.com/science-and-literacy-close-reading-cwa--more.html>
- **Technology Resources:**
1. *Explore Learning*
 2. *United Streaming*
 3. *YouTube*
 4. *Phet*
 5. *Teacher Tube*

Camden City School District

<p>Differentiated Instruction:</p> <p>Modifications / Extensions: How will I differentiate the curriculum for ESL, gifted, at-risk, etc?</p> <ul style="list-style-type: none">• All Learners: Guided Notes/ Graphic Organizers/ Study Guides Opportunities to rework and re-submit work• Assessments: Extra Time/ Use of notebook or reference cards/ Break into smaller tasks/ Word Banks/ Reduce choices on multiple choice questions	<p>What evidence will I collect that demonstrate that the students have achieved the objective?</p> <ul style="list-style-type: none">• Teacher Created: Tests Quizzes Lab Reports Mid Terms Final Exams• Alternate Assessments: Journal Responses OEQ/Short Responses grade using a 0-3 Rubric Lab Reports Oral Assessments Portfolio Projects
<p>Assessments:</p> <p>DOQ's on edConnect</p>	