May 6B Gr. 8: Newton's Laws

Content Area: **Science**
Course(s):
Time Period: **May**
Length: **2 Weeks**
Status: **Published**

Unit Overview

The English mathematician Isaac Newton didn't play baseball in the 17th century, but the laws of motion he developed explain why a ball can move in a straight line at a constant speed. In this concept, you will learn more about Newton's laws.

Enduring Understandings

Lesson Objectives

By the end of the lesson, students should be able to:

- Explain and apply Newton's first law of motion.
- Explain and apply Newton's second law of motion.
- Explain and apply Newton's third law of motion.

Essential Questions

- **Overarching Question**
    - How can one explain and predict interactions between objects and within systems of objects?
- **Focus Question**
    - How can one predict an object's continued motion, changes in motion, or stability?
- **Lesson Questions**
    - How does an object behave when no unbalanced force is applied to it, and why?
    - How are force, mass, and acceleration related?
    - How can a force pushing in one direction cause movement in the opposite direction?
- **Can You Explain?**

- How do objects at rest and in motion respond in the presence of an external, unbalanced force?

Instructional Strategies & Learning Activities

- The Five E Instructional Model

  Science Techbook follows the 5E instructional model. As you plan your lesson, the provided Model Lesson includes strategies for each of the 5Es.

- Engage (45–90 minutes)

  Students are asked to consider the amount of force a small object would have if it fell from a great height. Students begin to formulate ideas around the Can You Explain? (CYE) question.

- Explore (135 minutes)

  Students investigate questions about Newton's laws by using evidence from text and media assets. Students complete Hands-On Activities to explore how forces affect the motion of objects and how they affect colliding objects.

- Explain (45–90 minutes)

  Students construct scientific explanations to the CYE question by including evidence of how Newton's laws explain how objects behave when forces act on them.

- Elaborate with STEM (45–90 minutes)

  Students apply their understanding of Newton's laws as they explore how engineers apply these laws to space travel. In the STEM projects, students apply Newton's laws to calculate their weight on other planets or design a robot that travels

- Evaluate (45–90 minutes)

  Students are evaluated on the state science standards as well as Standards in ELA/Literacy and Standards in Math standards using Board Builder and the provided concept summative assessments.

Integration of Career Readiness, Life Literacies and Key Skills

Students will work in small groups or partnerships to conduct investigations, build models or prototypes and present findings.

Students will explore the engineering careers in space travel.

TECH.9.4.8.CI.4	Explore the role of creativity and innovation in career pathways and industries.
	An individual's strengths, lifestyle goals, choices, and interests affect employment and income.
WRK.9.2.8.CAP.10	Evaluate how careers have evolved regionally, nationally, and globally.
TECH.9.4.8.GCA.2	Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
	Multiple solutions often exist to solve a problem.
WRK.9.2.8.CAP.12	Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.
WRK.9.2.8.CAP.3	Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.
	Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others.
TECH.9.4.8.GCA.1	Model how to navigate cultural differences with sensitivity and respect (e.g., 1.5.8.C1a).
TECH.9.4.8.TL.3	Select appropriate tools to organize and present information digitally.
WRK.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.
TECH.9.4.8.DC.2	Provide appropriate citation and attribution elements when creating media products (e.g., W.6.8).
TECH.9.4.8.DC.1	Analyze the resource citations in online materials for proper use.

Technology and Design Integration

Technology is fully integrated using Discovery Techbook.

	Computer models can be used to simulate events, examine theories and inferences, or make predictions.
CS.6-8.8.1.8.DA.1	Organize and transform data collected using computational tools to make it usable for a specific purpose.
	People use digital devices and tools to automate the collection, use, and transformation of data. The manner in which data is collected and transformed is influenced by the type of digital device(s) available and the intended use of the data.
CS.6-8.8.1.8.DA.5	Test, analyze, and refine computational models.

Interdisciplinary Connections

LA.SL.8.4	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.
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.W.8.1	Write arguments to support claims with clear reasons and relevant evidence.
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.W.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.
MA.6.EE.A.2	Write, read, and evaluate expressions in which letters stand for numbers.
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.
MA.6.EE.A.2a	Write expressions that record operations with numbers and with letters standing for numbers.
LA.W.8.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
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.8.10	By the end of the year read and comprehend literary nonfiction at grade level text-complexity or above, with scaffolding as needed.
LA.SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
MA.7.EE.B.3	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.
MA.7.EE.B.4	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.
MA.6.NS.C.5	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

Differentiation

Struggling Students

1. Using a two-column chart, ask students to compare and contrast the terms *velocity* and *speed*, *mass* and *weight*, and *law* and *theory*.
2. Working in pairs, have students develop diagrams or demonstrations of

ELL

1. Assist students in identifying familiar prefixes and/or words within words for each glossary term (e.g., *inertia* is a Latin word that means "unskilled, inactive, or idle").
2. Encourage students to demonstrate their understanding by drawing concepts. For example, they can draw a ball rolling down a hill or a book sitting on a table and indicate all of the different forces acting on those

Accelerated Students

1. Before they read the Core Interactive Text, have students use their previous knowledge of Newton's laws to give examples of balanced and unbalanced forces.
2. Challenge students to describe how consideration of Newton's laws would

each of Newton's laws, explaining or labeling all of the forces at work.	objects.	affect the design of deep-sea vehicles.

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.

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Benchmark Assessments

Benchmark Assessments are given periodically (e.g., at the end of every quarter or as frequently as once per month) throughout a school year to establish baseline achievement data and measure progress toward a standard or set of academic standards and goals.

Schoolwide Benchmark assessments:

Aimsweb benchmarks 3X a year

Linkit Benchmarks 3X a year

Additional Benchmarks used in this unit:

See above

Formative Assessments

See assessments located in links 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:

See assessments located in links above.

Instructional Materials

See materials located in links above.

Discovery Techbook

Teacher made materials

Additional labs are available through NJCTL on-line curriculum

Standards

SCI.MS.PS3.A	Definitions of Energy
SCI.MS-PS3-3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
SCI.MS.PS3.B	Conservation of Energy and Energy Transfer
SCI.MS-PS3	Energy
SCI.MS.ETS1.B	Developing Possible Solutions
SCI.MS-PS3-4	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
SCI.MS-PS3-2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
	Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.
SCI.MS.ETS1.A	Defining and Delimiting an Engineering Problem