April 6A Gr.8: Interaction of Force and Mass

Content Area: **Science**
Course(s):
Time Period: **April**
Length: **1 Weeks**
Status: **Published**

Unit Overview

A game of tug-of-war illustrates why the rope moves toward the stronger team: The force of pull is stronger on that side. In this concept, you will learn about the interaction of force and mass.

Enduring Understandings

Lesson Objectives

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

- Describe and identify an unbalanced force.
- Predict how an object will move when it is acted on by an unbalanced force.
- Describe and classify forces that can act on an object.

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**
    - What happens when two unbalanced forces act on an object?
    - What kinds of forces can act on an object?
- **Can You Explain?**
    - How does the mass of an object affect the outcome when an unbalanced force acts on it?

Instructional Strategies & Learning Activities

Science 8th grade Periods 2,3,4

Scientific Method and Lab report rubric

Four Frictions -Static, fluid, rolling sliding

Newton's Laws of Motion

Model Rocket Project

Objective(s)

Students will review in great detail the scientific method and all the sections of the lab report rubric

Goal(s)

Students will observe and gather data in support of Newtons Laws of Motion while building, launching and recovering an Estes Wizard Model Rocket.

The scientific method is often considered passe but the validity of its sequential, linear thought which streamlines the discovery process while identifying conceptual bias is undeniable. We will have a discussion about each section of the rubric and write practice pieces to gain experience in each section.

Procedures

Students will participate in various demonstrations, experiments and simulations to investigate different frictions and Newton's Laws of Motion.

Students have been given a 21 page manual on the correct procedures and format to write a lab report. Additionally, online instructions and tech support is provided via the Estes Rocket site.

Assessment

class discussion
review of assignments
quizzes
tests
projects/ labs

Differentiation

<u>Change the Pace:</u>

pre-testing

curriculum compacting

tiered activities (start with more difficult activities and skip the easier ones)

independent study

learning centers (skip centers that student has mastered)

Change the Delivery/Content:

mini-lessons for small groups

use different resources (higher level books, higher level response questions, open ended questions/problems…)

curriculum compacting

independent study

open-ended questions

teacher conferences

reading journals

Change the Product:

choice boards or Tic Tack Toe menus

student choice options

game creation

technology-based products/presentations

Change the Process - Add Depth:

tiered activities

open-ended activities

higher-level questions

student experts

increase complexity, decrease structure

Change the Process - Add Breadth:

choice boards or Tic Tack Toe menus

interdisciplinary units

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 learn about careers in engineering cars and spacecraft.

9.2.8.CAP	Career Awareness and Planning
9.4.8.CI	Creativity and Innovation
	An individual's strengths, lifestyle goals, choices, and interests affect employment and income.
	Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking.
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.
9.4.8.CI.4	Explore the role of creativity and innovation in career pathways and industries.
9.4.8.CT	Critical Thinking and Problem-solving
	Multiple solutions often exist to solve a problem.
	An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful.
9.4.8.CT.3	Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
9.2.8.CAP.15	Present how the demand for certain skills, the job market, and credentials can determine an individual's earning power.
	Increases in the quantity of information available through electronic means have heightened the need to check sources for possible distortion, exaggeration, or misrepresentation.
9.4.8.IML.1	Critically curate multiple resources to assess the credibility of sources when searching for information.
	Digital tools make it possible to analyze and interpret data, including text, images, and sound. These tools allow for broad concepts and data to be more effectively communicated.
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).

Technology Integration

Technology is fully integrated using Discovery Techbook.

ED	Engineering Design
	Engineering design is a systematic, creative, and iterative process used to address local and global problems. The process includes generating ideas, choosing the best solution, and making, testing, and redesigning models or prototypes.
8.2.8.ED.2	Identify the steps in the design process that could be used to solve a problem.
8.2.8.ED.3	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
8.2.8.ED.4	Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team.
	Engineering design requirements and specifications involve making trade-offs between competing requirements and desired design features.
8.2.8.ITH.1	Explain how the development and use of technology influences economic, political, social, and cultural issues.
8.2.8.ITH.2	Compare how technologies have influenced society over time.

Interdisciplinary Connections

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.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.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.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.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.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.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.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
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.WHST.6-8	Writing History, Science and Technical Subjects
LA.W.8.1	Write arguments to support claims with clear reasons and relevant evidence.
LA.WHST.6-8.1	Write arguments focused on discipline-specific content.
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.WHST.6-8.2	Write informative/explanatory texts, including the narration of historical events, scientific 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.6-8.6	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.
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.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research.
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.
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.
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.

Differentiation

Struggling Students

1. Using a two-column chart, ask students to compare and contrast mass and weight, balanced and unbalanced forces, and velocity and acceleration.
2. Have students pause each

ELL

1. Have students write down the mathematical representation of the terms *mass, gravity, weight, force*, and *inertia* to help distinguish these terms and the relationships among

Accelerated Students

1. Before they read the Core Interactive Text, have students use their previous knowledge of force and mass to predict how the mass of an object affects what happens when it is struck by another

video when a key vocabulary word, such as *inertia*, *action*, or *balance* is mentioned, and have them record how the word is used in the video's context.	them. 2. Encourage students to demonstrate their understanding by drawing concepts. For example, they can illustrate what happens when a heavy truck and light car hit each other at different speeds.	object. 2. Challenge students to identify instances of inertia at work in their daily lives.

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:

Pre and post assessments to measure growth.

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:

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

MS-PS2	Motion and Stability: Forces and Interactions
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.
PS2.A	Forces and Motion 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. 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. 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-PS2-4	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
PS2.B	Types of Interactions