

Unit 2: Motion and Stability

8th Grade Science

10 Class Meetings

Revised June 2022

Essential Questions

- How do Newton's Laws explain how objects interact with one another?

Enduring Understandings with Unit Goals

EU 1: There are balanced and unbalanced forces that act upon objects due to their mass and motion as defined by Newton's Laws.

- Develop the procedure of the experiment, which includes providing evidence as to why the object is in motion.
- Compare and contrast the balanced or unbalanced forces acting on the object.
- Interpret which factors will serve as independent and dependent variables in the experiment

EU 2: The force that will be exerted by one object onto another object is equal in strength to the force the second object exerts onto the first, but in the opposite direction.

- Identify the components within the system that are involved in the collision.
- Predict the force that will be exerted by the first object on the second object.
- Apply Newton's third law to design the solution to a problem.

Standards

Next Generation Science Standards:

- **MS-PS2-1:** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- **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.

Common Core State Standards:

- **RST.6-8.1:** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- **RST.6-8.3:** Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- **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.
- **6.NS.C.5:** 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.
- **6.EE.A.2:** Write, read, and evaluate expressions in which letters stand for numbers.
- **7.EE.B.3:** 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.
- **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.

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ISAAC Vision of the Graduate Competencies

Competency 1: Write effectively for a variety of purposes.

Competency 2: Speak to diverse audiences in an accountable manner.

Competency 3: Develop the behaviors needed to interact and contribute with others on a team.

Competency 4: Analyze and solve problems independently and collaboratively.

Competency 5: Be responsible, creative, and empathetic members of the community.

Unit Content Overview

1. Newton's First Law

- Proves that a body at rest will remain at rest and a body in motion will remain in motion unless acted upon by an outside force
- Define balanced and unbalanced forces (EU1)

2. Newton's Second Law

- Review the second law
- Understand that the force acting on an object is equal to the mass of that object times its acceleration. $F = ma$

3. Newton's Third Law

- Investigate that every action has an equal and opposite reaction.
- Create a solution to a problem involving a collision of two objects (EU2).

4. Newton's Law of Gravitation

- Compare and contrast the gravitational forces that planets exert on each other.
- Calculate the force of gravity between different planets and objects in the solar system.

Interdisciplinary Connection:

- Language Arts– Cite textual evidence to support analysis of science and technical texts, attending to the precise details of explanation of description
- Math – Reason abstractly and quantitatively, positive versus negative numbers, and using variables to represent real-world quantities
- Art – Multimedia art

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Daily Learning Objectives with *Do Now Activities*

Students will be able to...

- Compare and contrast Newton's Laws
 - Predict what will happen to the washers that are on the roof of a toy car when you run it into a stack of books. Write down observations.
- Distinguish between examples of each of Newton's Laws
 - What do you know about Sir Isaac Newton?
- Design an investigation that tests Newton's First Law
 - What is inertia? Can you think of how you experience inertia?
- Evaluate the most effective ways to validate Newton's First Law
 - What does the term "mass" mean? Are there other meanings?
- Design an investigation that tests Newton's Third Law
 - Compare and contrast Newton's 1ST and 2nd Laws
- Evaluate the most effective ways to validate Newton's Third Law
 - Write down an activity that uses all three Laws and explain where they are taking place in that activity.
- Create a project detailing each of Newton's Laws
 - Draw an example of each of Newton's Laws using different scenarios
- Critique the project of others
 - What does it mean to give constructive criticism? Give an example of saying the same thing (in a nice and then rude way).
- Demonstrate content knowledge for success on the unit exam
 - What Law are you most confused about? Discuss it with your partner.

Instructional Strategies/Differentiated Instruction

- Whole group instruction
- Guided notes
- Student-led instruction
- Independent problem-solving
- Collaborative problem-solving
- Graphic Organizer
- Cross-curricular problem solving (independent and collaborative)
- Accountable Talk
- Homework
- Word walls with visuals
- Small group instruction
- Manipulatives

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Assessments

FORMATIVE ASSESSMENTS:

- Warm-ups (NGSS)
- IABs (PS2-2)
- Whiteboards
- Mid-class check-ins
- Exit Slips
- Accountable Talk Discussions
- Do Now
- Student-led instruction
- Homework
- Performance Task- *Who Wants to be a Scientist?*
 - Problem-Solving Rubric

SUMMATIVE ASSESSMENTS:

- Quiz – EU 1 & EU 2
- Performance Task- *Who Wants to be a Scientist?*
- Unit 2 Test

Unit Task

Unit Task Name: *Who Wants to be a Scientist?*

Description: Students will select one of Newton’s three laws and explain how it can be correlated to real-world scenarios. Students will first illustrate an example of how the law can be applied in different scenarios. Afterwards students will create a video or graphic design of themselves demonstrating the law. Finally, students will write a summary of the law and present it to the class like they are on a game show. Students will be awarded points based on a rubric.

- **Evaluation:** Summative Assessment and Problem-Solving Rubric

Unit Resources

- Flipped Google Classroom Videos
- Worksheets
- Laptops
- NGSS Prep Online
- Teach Engineering
- PALS