Unit 8: Newtons Law

Content Area: **Template**
Course(s):
Time Period:
Length:
Status: **Published**

State Mandated Topics Addressed in this Unit

This unit aligns with the following NJ Student Learning Standards for Science (NJSLS-S) and supports exploration of forces, equilibrium, and motion:

NJSLS-S Performance Expectations:

- **HS-PS2-1**: Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
- **HS-PS2-2**: Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

Integrated Mathematics Standards (NJSLS-M):

- **A-CED.A.1**: Create equations and inequalities in one variable and use them to solve problems.
- **F-IF.B.6**: Calculate and interpret the average rate of change of a function over a specified interval.

Science & Engineering Practices (SEPs):

- SEP 1: Asking Questions and Defining Problems
- SEP 2: Developing and Using Models
- SEP 4: Analyzing and Interpreting Data
- SEP 5: Using Mathematics and Computational Thinking
- SEP 6: Constructing Explanations and Designing Solutions

Crosscutting Concepts:

- Cause and Effect
- Systems and System Models
- Stability and Change

These standards support instructional objectives including:

- Applying Newton's Laws to explain real-world phenomena
- Solving problems involving net force, mass, and acceleration
- Investigating equilibrium conditions and motion

- Representing force interactions with diagrams and vector analysis
- Understanding the relationship between force and motion in engineering and everyday contexts

Unit Summary

In this unit, students will apply Newton's Laws of Motion to analyze and predict the behavior of objects in various physical situations. They will calculate net force and determine both magnitude and direction based on the relationship between force, mass, and acceleration. Students will also explore the concept of equilibrium and identify conditions under which objects remain at rest or in constant motion. Through hands-on investigations, data analysis, and mathematical modeling, students will develop a deeper understanding of how Newton's laws govern motion in the real world.

Learning Objectives

- How are action and reaction forces involved in everyday interactions?
- How do friction and air resistance influence motion?
- How do net force and mass affect an object's acceleration?
- How do Newton's Laws apply to real-world situations like driving, sports, or space travel?
- How does Newton's First Law explain the behavior of objects at rest and in motion?
- In what ways can force diagrams help us analyze motion?
- What conditions must be met for an object to be in equilibrium?
- What happens when multiple forces act on an object at once?

Essential Skills

- Apply Newton's laws to explain common phenomena (e.g., seatbelt safety, sports motion, falling objects).
- Construct and analyze free-body diagrams to represent forces acting on objects.
- Define the friction force and distinguish between static and kinetic friction.
- Describe how the weight and the mass of an object are related.
- Describe real-life examples of Newton's third law in action (e.g., walking, rocket propulsion).
- Determine force that produces equilibrium when three forces act on an object.
- Differentiate between mass and weight, and explain how each affects motion.
- Explain interaction pairs of forces and how they are related by Newton's third law
- Explain the meaning of Newton's first law and describe an object in equilibrium.

- Explain the tension in ropes and strings in terms of Newton's third law.
- Identify conditions for static and dynamic equilibrium and analyze systems accordingly.
- Predict motion outcomes based on changes in force and mass using Newton's second law.
- Recognize Newton's second law of motion and use it to solve motion problems.
- Solve problems involving frictional forces in real-world systems.

Standards

SCI.HS-PS2-1	Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
9-12.HS-PS2-1	Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
9-12.HS-PS2-1.PS2.A.1	Newton's second law accurately predicts changes in the motion of macroscopic objects.
9-12.HS-PS2-4.PS2.B	Types of Interactions
9-12.HS-PS2-4.PS2.B.1	Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects.

Instructional Tasks/Activities

- • Exit Cards (answer to daily objective questions)
- • Homework
- • Section Review Questions
- • Study Guide Packets
- • Vocabulary flash cards or map (word, picture, sentence, example)
- Common assessment chapter test
- Common assessment quiz
- Constructed response
- Do now's and/or exit slips
- Graphic organizers or models
- Guided practice
- Homework
- Individual, small, and large group work
- Laboratory investigations within small groups
- Review Activity

Assessment Procedure

- Flashcards and/or drill and practice

- Inquiry based activities with reflective discussion
- Laboratory groups
- Lecture with note taking or guided notes
- Online models and simulators
- Power point presentations
- Whole and small group discussions

Recommended Technology Activities

- Appropriate Content Specific Online Resource
- Chromebook
- Copy/Paste Content Specific Link Here
- Copy/Paste Content Specific Link Here
- Copy/Paste Content Specific Link Here
- Gimkit
- GoGuardian
- Google Classroom
- Google Docs
- Google Forms
- Google Slides
- Kahoot
- MagicSchool AI
- Other- Specified in Lesson
- Quiziz
- Screencastify

Accommodations & Modifications & Differentiation

Accommodations and Modifications should be used to meet individual needs. Their IEP and 504 plans should be used in addition to the following suggestions.

Gifted and Talented

- Compare & Contrast
- Conferencing
- Debates
- Jigsaw
- Peer Partner Learning

- Problem Solving
- Structured Controversy
- Think, Pair, Share
- Tutorial Groups

Instruction/Materials

- alter format of materials (type/highlight, etc.)
- color code materials
- eliminate answers
- extended time
- extended time
- large print
- modified quiz
- modified test
- Modify Assignments as Needed
- Modify/Repeat/Model directions
- necessary assignments only
- Other (specify in plans)
- other- named in lesson
- provide assistance and cues for transitions
- provide daily assignment list
- read class materials orally
- reduce work load
- shorten assignments
- study guide/outline
- utilize multi-sensory modes to reinforce instruction

Environment

- alter physical room environment
- assign peer tutors/work buddies/note takers
- assign preferential seating
- individualized instruction/small group
- modify student schedule (Describe)
- other- please specify in plans
- provide desktop list/formula

Honors Modifications

Resources

- Resource 1
- Resource 2
- Resource 3
- Resource 4
- Resource 5