Unit 7: Motion in One Dimension

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 builds foundational kinematic concepts through data interpretation and modeling:

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.4**: For a function that models a relationship between two quantities, interpret key features of graphs and tables.
- **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
- Scale, Proportion, and Quantity
- Systems and System Models

These standards support instructional objectives including:

- Differentiating between distance and displacement, speed and velocity

- Analyzing acceleration as the rate of change of velocity
- Interpreting position vs. time and velocity vs. time graphs
- Using kinematic equations to solve problems involving uniform acceleration
- Connecting real-world motion to graphical and mathematical representations

Unit Summary

This unit introduces students to the foundational concepts of motion and how objects move in one dimension. Students will explore speed, velocity, acceleration, and displacement through data collection, graphical analysis, and mathematical modeling. Using real-world phenomena and laboratory investigations, students will interpret motion graphs and apply kinematic equations to describe and predict the motion of objects. By the end of this unit, students will be able to represent motion both qualitatively and quantitatively and connect these concepts to broader engineering and physical science applications.

Learning Objectives

- How are speed, velocity and acceleration related?
- How can motion be described both qualitatively and quantitatively?
- How can real-world scenarios be modeled using motion graphs and equations?
- How can you distinguish between uniform motion and uniform acceleration?
- How does gravity affect the motion of an object?
- How does Newton's Second Law relate to changes in motion?
- How is the graphical representation of motion analyzed using equations?
- How is the motion of an object related to different graphs of the motion of an object.
- How will you be able to describe a change in position?
- In what ways do frame of reference and perspective affect motion analysis?
- What role does acceleration play in predicting future motion?

Essential Skills

- Analyze position-time and velocity-time graphs to describe an object's motion qualitatively.
- Calculate the velocity and the displacement of an object undergoing constant acceleration
- Communicate motion concepts using appropriate units, symbols, and graphical representations.
- Define velocity and acceleration operationally.

- Describe the difference between scalar and vector quantities and apply them to motion problems.
- Determine from the curves on a velocity-time graph both the constant and instantaneous acceleration.
- Distinguish between instantaneous and average velocity.
- Interpret a v-t graph to find the time at which an object has a specific velocity
- Interpret graphs for a moving object and describe in words the information presented in graphs.
- Justify the use of specific kinematic equations in solving motion problems.
- Model and solve real-world one-dimensional motion scenarios involving constant acceleration.
- Predict an object's future motion using motion equations and graph interpretation.
- Recognize the meaning of the acceleration due to gravity.
- Relate the direction and magnitude of velocity and acceleration to the motion of objects.
- Use the motion equations to solve problems involving freely falling objects.
- Write equations that describe the position of an object moving at constant velocity.

Standards

SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
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.

Instructional Tasks/Activities

- Common assessment chapter test
- Common assessment quiz
- Constructed response
- Do now's and/or exit slips
- Exit Cards (answer to daily objective questions)
- Graphic organizers or models
- Gravitational Acceleration
- Gravity between 2 objects
- Guided practice
- Homework
- Homework
- Individual, small, and large group work
- Intro to Physics and Newton's Laws
- Laboratory investigations within small groups
- Motion Virtual Lab
- Review Activity

- Section Review Questions
- Speed, Vel, Acc, Graphs and Practice
- Speed, Velocity, and Acceleration
- Using Newton's Laws of Motion
- Vocabulary flash cards or map (word, picture, sentence, example)

Assessment Procedure

- • Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly. This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all college prep students.)
- 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