Unit 02: Motion in 1 Dimension

Content Area: **Science**
Course(s):
Time Period: **Marking Period 1**
Length: **5-6 weeks**
Status: **Published**

Summary

The tools and terminology necessary for investigating and describing motion in one dimension are explored. The concepts of vectors and scalars are introduced as mathematical tools useful for analyzing motion. The physical quantities of displacement, velocity, and acceleration are used to understand and quantify motion. Graphical analysis of position, velocity, and time is employed to explore the intricacies of both constant velocity and constantly accelerated motion. The special case of uniformly accelerated motion is considered. The motion of freely falling objects is closely examined and Galileo's Law of Falling Bodies is discovered by students through inquiry and experimentation. Students are introduced to motion in 2D by the examination of projectile motion

Revised July 2022

Standards

CS.9-12.8.1.12.DA.5	Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.
SCI.HS-PS2	Motion and Stability: Forces and Interactions
TECH.8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
TECH.8.1.12.A.5	Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.

TECH.9.4.12.CI	Creativity and Innovation
TECH.9.4.12.TL.2	Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

Essential Questions/Enduring Understandings

Essential Questions

- What do the quantities of distance, displacement, speed, velocity and acceleration tell us about an objects state of motion?

- How can motion graphs be used to analyze the motion of an object?

- What are the general characteristics of constantly accelerated motion?

- What method of analysis did Galileo use to investigate the motion of falling bodies and what conclusions did he arrive at?

Enduring Understanding

- In a vacuum, all objects fall with a constant acceleration regardless of their mass.

- The quantities velocity and acceleration represent rates of change. The rates of change can be seen as the seen as the slopes of motion graphs

- In constantly accelerated motion an object's velocity changes by the same amount per unit time

Objectives

- Students will be skilled at experimentally measuring the velocity and acceleration of moving objects

- Students will be skilled at collecting data and producing position v time and velocity v time graphs

- Students will be skilled at drawing "dot diagrams" for moving objects

- Students will know Galileo's method of analysis for studying falling objects

- Students will know The Law of Odds numbers and it's consequences

- Students will be skilled at measuring the acceleration of a falling body

- Students will know the effect of air resistance on freely falling bodies

- Students will be skilled at analyzing a solving problems involving 1 dimensional motion

- Students will know the difference between distance and displacement; speed and velocity.

- Students will be skilled at predicting the stopping distance for a cart rolled down a ramp

- Students will know the difference between vector and scalar quantities

Learning Plan

- Class activity: "Establishing Position"

- Video Clip: "Frames of Reference"

- Socratic Questioning and Discussion: Developing the concepts of distance. displacement, speed and velocity.

- Mini Lab: "Speed and Velocity Explorations"

- Lab: "Position v Time Explorations"

- Socratic Questioning and Discussion: Developing the concept of acceleration

- Lab: "60m Dash"

- Teacher presentation: Using motion graphs to investigate motion

- Cooperative Problem Solving: Motion Graphs

- Teacher Presentation: Constantly Accelerated Motion and Galileo's method of analysis

- Demo: The Law of Odd Numbers

- Socratic Questioning and Discussion: Describing constantly accelerated motion mathematically

- Lab: "Measuring the acceleration of a ball rolling down a ramp"

- Teacher Presentation: Solving constantly accelerated motion problems

- Lab: "Stopping and Starting"

- Cooperative Problem Solving: Constantly Accelerated Motion

- Inquiry Activity: "Testing Aristotle's Law of Falling Bodies"

- Video: The Mechanical Universe: "The Law of Falling Bodies"

- Teacher Presentation: Analyzing Free Fall mathematically

- Lab: "Measuring g"

- Cooperative Problem Solving: Free Fall

Assessment

Formative:

Do Now Questions

Exit Ticket Questions

Whole Class Discussion Participation

Small Group Discussion Participation

Individual Student Questions/Responses

Cooperative Problem Solving *(Motion Graphs, Constantly Accelerated Motion)*

Lab Experiments *(Speed and Velocity Explorations, Position vs. Time Explorations, 60 m Dash, Measuring acceleration of a ball on ramp, Stopping and Starting, Measuring g)*

Quizzes

Summative:

Formal Lab Report

Unit Test

Benchmark:

Honors Physics Midterm Exam

Alternative Assessments:

Guided Formal Lab Report

Unit Study Guide

Materials

Textbook T PHYSICS: PRINCIPLES WITH APPLICATIONS 6th Edition GIANCOLI, PEARSON

Mechanical Universe Video Series

Video: 2004 Olympic Shot-put final

Equipment for free-fall and projectile demos

Chromebooks for PhET Simulation

Lab Equipment: ramps, ball bearings, stopwatches, slotted masses, meter sticks, bricks, ring stands, projectile launchers, iphones, 60m tape measure, photo gates

Computer / Smart board

¼ inch graph paper

Integrated Accommodation and Modifications

FOR SPECIAL EDUCATION STUDENTS , ELL, AT RISK AND STUDENTS GIFTED STUDENTS

https://docs.google.com/spreadsheets/d/1XVU7bji7iOgH8W9w9PLxDox44Da1R1oCxiSeoIztRGQ/edit?usp=sharing