

**Unit Lesson**

**Objectives**

**Nature of Science**

Accuracy and Precision

Differentiate between accuracy and precision.

Apply rules for using significant figures.

Identify causes and effects of uncertainty in data.

Using Math to Analyze Data

Use mathematical error analysis to analyze data points.

Explain the difference and relationship between accuracy and precision.

Create graphs and compare data points graphically.

Science Practice: Make measurements with accuracy and precision.

Data Analysis

Read and interpret graphs.

Distinguish between direct and inverse relationships.

Calculate percent error.

Analyzing Data and Drawing  
Conclusions

Analyze data to determine validity.

Create charts and graphs to analyze trends in data.

Formulate a conclusion based on observations, data, and inferences.

Science Practice: Describe various ways evidence can be interpreted or explained.

Tools, Technology, and  
Measurement

**Unit Lesson****Objectives**

Select and use appropriate tools to perform tests and collect data.

Select and use appropriate technology such as computers and graphing calculators to gather, analyze, interpret, and display data.

Use the SI system of measurement to convert between standard and metric, and metric and metric, and to recognize approximate representations of measurement.

Science Practice: Use technology to display data in tables and graphs, and use the graphical representations to interpret the data.

## Test

**Motion**

## Speed and Velocity

Differentiate between speed and velocity.

Describe the motion of an object using different reference frames.

Use graphs and equations to solve speed and velocity problems.

Interpret motion maps to describe linear motion.

## Acceleration

Distinguish between constant velocity and constant acceleration.

Use graphs to analyze motion with constant acceleration.

Solve problems involving distance, time, velocity, and acceleration.

Interpret motion maps to describe linear motion.

Lab: Motion with Constant  
Acceleration

Recognize the relationships between position, time, velocity, and acceleration.

Calculate the average velocity of a moving object.

Use graphs to determine acceleration.

**Unit Lesson****Objectives**

## Vectors

Use vector diagrams to determine the resultant vector.

Resolve a vector into horizontal and vertical components.

## Projectile Motion

Recognize that the horizontal and vertical motions of a projectile are independent.

Identify examples of projectile motion.

Solve problems involving projectile motion.

## Unit Test

**Forces**

## Introduction to Forces

Identify and describe various forces.

Analyze free-body diagrams.

Determine how net force affects the motion of an object.

Newton's First and Third  
Laws

Describe Newton's first law of motion and how it relates to inertia.

Explain Newton's third law of motion and how it relates to action and reaction forces.

Use vectors to calculate the effect of forces on objects.

## Newton's Second Law

Describe Newton's second law of motion.

Calculate force, mass, or acceleration given the other two quantities.

**Unit Lesson****Objectives**

Interpret free-body diagrams for accelerating objects.

Lab: Newton's Second Law

Determine how force and mass affect acceleration.

Calculate the acceleration of a moving object.

Impulse and Momentum

Calculate mass, velocity, or momentum given the other two quantities.

Describe impulse and how it relates to momentum.

Solve problems involving impulse.

Analyze and compare the momentum and impulse of different objects.

Conservation of Momentum

Describe the law of conservation of momentum.

Apply the law of conservation of momentum to analyze collisions between objects.

Solve problems involving the conservation of momentum.

Use mathematical representations to show that the total momentum of a system of objects is conserved when there is no net force on the system.

Lab: Conservation of Linear  
Momentum

Calculate the momentum of a moving object before and after a collision.

Demonstrate that momentum is conserved during a collision.

Unit Test

**Gravity**

Universal Law of Gravitation

**Unit Lesson****Objectives**

Explain the relationships among gravitational force, mass, and distance.

Solve problems that involve the universal law of gravitation.

Describe the effect of gravity on an object.

Use mathematical representations to predict the gravitational and electrostatic forces between objects.

## Centripetal Acceleration

Describe and calculate tangential speed.

Define and identify examples of centripetal acceleration.

Solve problems involving centripetal acceleration.

## Circular Motion

Describe how circular motion is caused by centripetal force.

Explain the relationship between centripetal force and inertia.

Use centripetal force concepts to solve problems.

Interpret motion maps to describe circular motion.

## Orbital Motion

Explain how Newton's universal law of gravitation affects orbital motion.

Identify the forces acting on an object in orbit.

Solve problems involving the orbital speed and period of an object in orbit.

## Simple Harmonic Motion

Describe simple harmonic motion.

Explain how position, velocity, and acceleration change during simple harmonic motion.

Solve problems using Hooke's law.

## Unit Test

**Unit Lesson****Objectives****Work and Energy**

## Work and Power

Define and describe work.

Compare the work done in different situations.

Explain how work and power are related.

Calculate work and power.

## Kinetic Energy

Define kinetic energy and identify situations in which it's present.

Calculate kinetic energy, mass, or velocity given the other two quantities.

Describe the work-energy theorem and use it to solve problems.

## Potential Energy

Identify and describe different types of potential energy.

Solve problems involving the potential energy of an object.

## Energy Transformations

Explain how energy changes form.

Identify and describe examples of energy transformations.

Solve problems involving energy transformations.

Analyze and interpret energy transfer diagrams.

## Conservation of Energy

Explain the law of conservation of energy.

Apply the law of conservation of energy to solve problems.

Use energy transfer diagrams to illustrate that energy is conserved.

**Unit Lesson****Objectives**

Unit Test

**Thermodynamics**

## Temperature and Heat

Distinguish between temperature, thermal energy, and heat.

Explain how temperature relates to kinetic energy.

Describe specific heat and explain why it differs from one substance to another.

Solve problems involving specific heat.

## Heat Transfer

Explain how molecular movement transfers thermal energy by conduction.

Describe how fluid movement transfers thermal energy by convection.

Explain how electromagnetic waves transfer energy by radiation.

## Lab: Mechanical Equivalent of Heat

Describe the conversion of gravitational potential energy to thermal energy in a system.

Calculate gravitational potential energy and heat.

Relate the potential energy of an object to the temperature change of water.

## States of Matter

Differentiate among the four states of matter.

Identify the properties of the fourth state of matter: plasma.

## Changes of State

Identify and describe the six changes of state.

Explain and interpret heating curves.

**Unit Lesson****Objectives**

Solve problems involving latent heat of fusion and latent heat of vaporization.

## First Law of Thermodynamics

Explain the first law of thermodynamics.

Solve problems using the first law of thermodynamics.

Apply the first law of thermodynamics to describe how heat engines work.

Second Law of  
Thermodynamics

Describe how the first and second laws of thermodynamics are related.

Explain why entropy increases over time.

Apply the second law of thermodynamics to describe how heat engines work.

## Unit Test

**Cumulative Exam**

## Cumulative Exam Review

## Cumulative Exam