Physics, Part 1
Course Outline & Objectives

Course Description:

In Physics Part 1, students explore the fundamentals of motion, forces, and energy. They begin with one-dimensional motion and acceleration, applying kinematic equations to analyze position and time. The course covers Newton's laws, force diagrams, and the effects of friction and air resistance. Students examine two-dimensional motion, including vectors, projectile motion, and inclined planes. Topics also include circular motion, torque, simple machines, work, energy, and momentum. Real-world applications, such as roller coasters and collisions, help connect physics concepts to everyday life.

Credits - One Semester (0.5 Carnegie unit / CA: 5 credits)
Prerequisites: Algebra 1; Geometry; and Algebra 2 (co-requisite)
OR Integrated Math 1; Integrated Math 2; and Integrated Math 3 (co-requisite)

Course Outline

Unit 1: Kinematics

1.1 Distance and Displacement
1.2 Speed and Velocity
1.3 Acceleration
1.4 Position vs Time Graphs
1.5 Velocity vs Time Graphs
1.6 Introduction to Kinematic Equations
1.7 Introduction to Free Fall
1.8 Problem Solving with Kinematic Equations

Unit 2: Force

2.1 Newton's First Law of Motion
2.2 What is a Force?
2.3 Free-Body Diagrams and Net Force
2.4 Friction
2.5 Newton's Second Law of Motion (F=ma)
2.6 Finding Forces Using the Second Law
2.7 Newton's Third Law of Motion

Unit 3: Motion and Force in Two Dimensions

3.1 An Introduction to Vectors
3.2 Vector Components and More Vector Addition
3.3 What is Projectile Motion?
3.4 Horizontal Projectiles
3.5 Non-Horizontal Projectiles
3.6 Forces in Two Dimensions and Static Equilibrium
3.7 Newton's 2nd Law in Two Dimensions

Next Generation Science Standards

In Unit 1 students will:
Explore one-dimensional motion and the key differences between: distance and displacement; speed and velocity; average and instantaneous rates
Examine both positive and negative acceleration, including free fall
Apply kinematic equations to analyze and model the relationship between position and time
[HS-PS2-1, HS-PS3-1, HS-PS3-2]

In Unit 2 students will:
Study Newton's three laws of motion
Investigate the relationship between force, mass, and acceleration
Explore the effects of friction and air resistance
Learn to create and interpret free-body diagrams to solve problems
Focus on motion described in one dimension
[HS-PS2-1, HS-PS2-3, HS-PS2-4, HS-PS3-1]

In Unit 3 students will:
Deepen their understanding of vectors and learn to resolve them into components
Explore projectile motion and horizontal motion
Analyze forces applied at angles using vector components
Calculate various types of forces, including normal force, friction, and gravity
Horizontal and vertical components of angled forces
Study forces in two dimensions and static equilibrium
Analyze motion and forces on an inclined plane
[HS-PS2-1, HS-PS2-2, HS-PS2-4, HS-PS3-1]

Course Outline

Unit 4: Circular Motion & Gravitation

4.1 Circular Velocity and Acceleration
4.2 Centripetal Force
4.3 Mathematics of Circular Motion
4.4 Applications of Circular Motion
4.5 Newton's Law of Universal Gravitation
4.6 Kepler's Laws of Planetary Motion
4.7 Torque
4.8 Simple Machines

Unit 5: Work, Energy, and Power

5.1 Work and Power
5.2 Mechanical Energy
5.3 Work/Energy Relationship
5.4 Conservation of Energy
5.5 Other Forms of Energy

Unit 6: Momentum

6.1 Momentum and Impulse
6.2 Conservation of Momentum
6.3 Elastic and Inelastic Collisions
6.4 Conserving Momentum in Explosions
6.5 Angular Momentum

Next Generation Science Standards

In Unit 4 students will:

Explore circular motion and its real-world applications
Examine key concepts including centripetal force, circular velocity, and circular acceleration
Learn about Newton's law of universal gravitation
Study Kepler's laws of planetary motion
Investigate torque and the mechanics of simple machines
[HS-PS2-1, HS-PS2-4, HS-PS3-2]

In Unit 5 students will:

Explore the concepts of work, energy, and power
Define and calculate work, and understand its relationship to energy and power
Examine various forms of energy, including potential, kinetic, chemical, thermal, and electrical
Study the law of conservation of energy in closed and open systems
Analyze energy transfers between potential and kinetic energy
Apply concepts to real-world scenarios such as roller coasters, skiing, and braking a car
[HS-PS3-1, HS-PS3-2, HS-PS3-3, HS-PS3-4]

In Unit 6 students will:

Explore momentum, impulse, collisions, and explosions
Examine how mass and velocity affect momentum
Investigate the differences between elastic and inelastic collisions
Apply the law of conservation of momentum
Analyze whether kinetic energy is conserved in different collision scenarios
Be introduced to the concept of angular momentum
[HS-PS2-2, HS-PS2-3, HS-PS3-1]

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