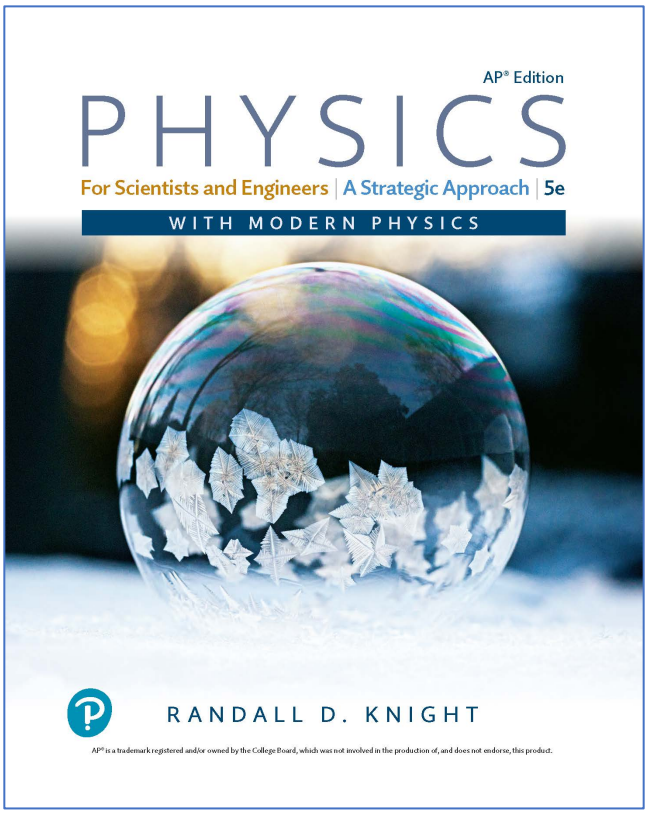
A Correlation of

Physics for Scientists and Engineers

A Strategic Approach

5th Edition, AP® Edition ©2022



To the

AP® Physics C: Mechanics

Course Framework (Fall 2024)

Pearson

Table of Contents

The units above reflect the College Board's AP® Physics C: Mechanics Course Framework.

Unit 1: Kinematics (5 topics)		
Topic	**Learning Objectives**	**Physics for Scientists and Engineers Chapters and Sections**
1.1 Scalars and Vectors	1.1.A Describe a scalar or vector quantity using magnitude and direction, as appropriate.	3.1 Scalars and Vectors 3.2 Using Vectors 3.3 Coordinate Systems and Vector Components 3.4 Unit Vectors and Vector Algebra
1.2 Displacement, Velocity, and Acceleration	1.2.A Describe a change in an object's position. 1.2.B Describe the average velocity and acceleration of an object. 1.2.C Describe the instantaneous position, velocity, and acceleration of an object as a function of time.	1.2 Models and Modeling 1.3 Position, Time, and Displacement 1.4 Velocity 1.5 Linear Acceleration 1.6 Motion in One Dimension 2.2 Instantaneous Velocity 2.7 Instantaneous Acceleration
1.3 Representing Motion	1.3.A Describe the position, velocity, and acceleration of an object using representations of that object's motion.	1.1 Motion Diagrams 1.7 Solving Problems in Physics 2.3 Finding Position from Velocity 2.4 Motion with Constant Acceleration 2.5 Free-Fall
1.4 Reference Frames and Relative Motion	1.4.A Describe the reference frame of a given observer. 1.4.B Describe the motion of objects as measured by observers in different inertial reference frames.	4.3 Relative Motion
1.5 Motion in Two or Three Dimensions	1.5.A Describe the motion of an object moving in two or three dimensions.	4.1 Motion in Two Dimensions 4.2 Projectile Motion

Unit 2: Force and Translational Dynamics (10 topics)		
Topic	**Learning Objectives**	**Physics for Scientists and Engineers Chapters and Sections**
2.1 Systems and Center of Mass	2.1.A Describe the properties and interactions of a system. 2.1.B Describe the location of a system's center of mass with respect to the system's constituent parts.	7.1 Interacting Objects 12.2 Rotation about the Center of Mass
2.2 Forces and Free-Body Diagrams	2.2.A Describe a force as an interaction between two objects or systems. 2.2.B Describe the forces exerted on an object or system using a free-body diagram.	5.1 Force 5.2 A Short Catalog of Forces 5.3 Identifying Forces 5.7 Free-Body Diagrams
2.3 Newton's Third Law	2.3.A Describe the interaction of two objects or systems using Newton's third law and a representation of paired forces exerted on each object or system.	7.1 Interacting Objects 7.2 Analyzing Interacting Objects 7.3 Newton's Third Law 7.4 Ropes and Pulleys 7.5 Examples of Interacting-Objects Problems
2.4 Newton's First Law	2.4.A Describe the conditions under which a system's velocity remains constant.	5.6 Newton's First Law 6.1 The Equilibrium Model
2.5 Newton's Second Law	2.5.A Describe the conditions under which a system's velocity changes.	5.4 What Do Forces Do? 5.5 Newton's Second Law 6.2 Using Newton's Second Law 6.6 More Examples of Newton's Second Law

Unit 2: Force and Translational Dynamics (10 topics)		
Topic	**Learning Objectives**	**Physics for Scientists and Engineers Chapters and Sections**
2.6 Gravitational Force	2.6.A Describe the gravitational interaction between two objects or systems with mass. 2.6.B Describe situations in which the gravitational force can be considered constant. 2.6.C Describe the conditions under which the magnitude of a system's apparent weight is different from the magnitude of the gravitational force exerted on that system. 2.6.D Describe inertial and gravitational mass. 2.6.E Describe the gravitational force exerted on an object by a uniform spherical distribution of mass.	6.3 Mass, Weight, and Gravity 13.3 Newton's Law of Gravity 13.4 Little g and Big G
2.7 Kinetic and Static Friction	2.7.A Describe kinetic friction between two surfaces.	6.4 Friction

	2.7.B Describe static friction between two surfaces.	

2.8 Spring Forces	2.8.A Describe the force exerted on an object by an ideal spring. 2.8.B Describe the equivalent spring constant of a combination of springs exerting forces on an object.	9.4 Restoring Forces and the Work Done by a Spring
2.9 Resistive Forces	2.9.A Describe the motion of an object subject to a resistive force.	6.5 Drag
2.10 Circular Motion	2.10.A Describe the motion of an object traveling in a circular path. 2.10.B Describe circular orbits using Kepler's third law.	4.4 Uniform Circular Motion 4.5 Centripetal Acceleration 8.2 Uniform Circular Motion 8.3 Circular Orbits 13.1 A Little History 13.6 Satellite Orbits and Energies

Unit 3: Work, Energy, and Power (5 topics)		
Topic	**Learning Objectives**	**Physics for Scientists and Engineers Chapters and Sections**
3.1 Translational Kinetic Energy	3.1.A Describe the translational kinetic energy of an object in terms of the object's mass and velocity.	9.2 Work and Kinetic Energy for a Single Particle
3.2 Work	3.2.A Describe the work done on an object or system by a given force or collection of forces.	9.2 Work and Kinetic Energy for a Single Particle 9.3 Calculating the Work Done 9.4 Restoring Forces and the Work Done by a Spring
3.3 Potential Energy	3.3.A Describe the potential energy of a system.	10.1 Potential Energy 10.2 Gravitational Potential Energy 10.3 Elastic Potential Energy 10.6 Force and Potential Energy 10.7 Conservative and Nonconservative Forces 13.5 Gravitational Potential Energy
3.4 Conservation of Energy	3.4.A Describe the energies present in a system. 3.4.B Describe the behavior of a system using conservation of mechanical energy principles.	9.1 Energy Overview 10.4 Conservation of Energy 10.5 Energy Diagrams 10.8 The Energy Principle Revisited

	3.4.C Describe how the selection of a system determines whether the energy of that system changes.	
3.5 Power	3.5.A Describe the transfer of energy into, out of, or within a system in terms of power.	9.6 Power

Unit 4: Linear Momentum (4 topics)		
Topic	**Learning Objectives**	**Physics for Scientists and Engineers Chapters and Sections**
4.1 Linear Momentum	4.1.A Describe the linear momentum of an object or system.	11.1 Momentum and Impulse
4.2 Change in Momentum and Impulse	4.2.A Describe the impulse delivered to an object or system. 4.2.B Describe the relationship between the impulse exerted on an object or a system and the change in momentum of the object or system.	11.1 Momentum and Impulse
4.3 Conservation of Linear Momentum	4.3.A Describe the behavior of a system	11.2 Conservation of Momentum 11.4 Explosions 11.5 Momentum in Two Dimensions

	using conservation of linear momentum. 4.3.B Describe how the selection of a system determines whether the momentum of that system changes.	
4.4 Elastic and Inelastic Collisions	4.4.A Describe whether an interaction between objects is elastic or inelastic.	11.3 Collisions

Unit 5: Torque and Rotational Dynamics (6 topics)		
Topic	**Learning Objectives**	**Physics for Scientists and Engineers Chapters and Sections**
5.1 Rotational Kinematics	5.1.A Describe the rotation of a system with respect to time using angular displacement, angular velocity, and angular acceleration.	12.1 Rotational Motion
5.2 Connecting Linear and Rotational Motion	5.2.A Describe the linear motion of a point on a rotating rigid system that corresponds to the rotational motion of that point, and vice versa.	4.4 Uniform Circular Motion 4.6 Nonuniform Circular Motion
5.3 Torque	5.3.A Identify the torques exerted on a rigid system. 5.3.B Describe the torques exerted on a rigid system.	12.5 Torque

5.4 Rotational Inertia	5.4.A Describe the rotational inertia of a rigid system relative to a given axis of rotation. 5.4.B Describe the rotational inertia of a rigid system rotating about an axis that does not pass through the system's center of mass.	12.3 Rotational Energy 12.4 Calculating Moment of Inertia
5.5 Rotational Equilibrium and Newton's First Law in Rotational Form	5.5.A Describe the conditions under which a system's angular velocity remains constant.	12.5 Torque 12.8 Static Equilibrium
5.6 Newton's Second Law in Rotational Form	5.6.A Describe the conditions under which a system's angular velocity changes.	12.5 Torque 12.6 Rotational Dynamics 12.7 Rotation About a Fixed Axis
Unit 6: Energy and Momentum of Rotating Systems (6 topics)		
Topic	**Learning Objectives**	**Physics for Scientists and Engineers Chapters and Sections**
6.1 Rotational Kinetic Energy	6.1.A Describe the rotational kinetic energy of a rigid system in terms of the rotational inertia and angular velocity of that rigid system.	12.3 Rotational Energy
6.2 Torque and Work	6.2.A Describe the work done on a rigid system by a given torque or collection of torques.	(none)
6.3 Angular Momentum and Angular Impulse	6.3.A Describe the angular momentum of an object or rigid system.	12.11 Angular Momentum

	6.3.B Describe the angular impulse delivered to an object or rigid system by a torque. 6.3.C Relate the change in angular momentum of an object or rigid system to the angular impulse given to that object or rigid system.	
6.4 Conservation of Angular Momentum	6.4.A Describe the behavior of a system using conservation of angular momentum. 6.4.B Describe how the selection of a system determines whether the angular momentum of that system changes.	12.11 Angular Momentum

Unit 6: Energy and Momentum of Rotating Systems (6 topics)		
Topic	**Learning Objectives**	**Physics for Scientists and Engineers Chapters and Sections**
6.5 Rolling	6.5.A Describe the kinetic energy of a system that has translational and rotational motion. 6.5.B Describe the motion of a system that is rolling without slipping. 6.5.C Describe the motion of a system that is rolling while slipping.	12.9 Rolling Motion

6.6 Motion of Orbiting Satellites	6.6.A Describe the motions of a system consisting of two objects interacting only via gravitational forces.	13.5 Gravitational Potential Energy 13.6 Satellite Orbits and Energies

Unit 7: Oscillations (5 topics)		
Topic	**Learning Objectives**	**Physics for Scientists and Engineers Chapters and Sections**
7.1 Defining Simple Harmonic Motion (SHM)	7.1.A Describe simple harmonic motion.	15.1 Simple Harmonic Motion
7.2 Frequency and Period of SHM	7.2.A Describe the frequency and period of an object exhibiting SHM.	15.1 Simple Harmonic Motion 15.3 Energy in Simple Harmonic Motion 15.6 The Pendulum

7.3 Representing and Analyzing SHM	7.3.A Describe the displacement, velocity, and acceleration of an object exhibiting SHM.	15.1 Simple Harmonic Motion 15.4 The Dynamics of SHM 15.8 Driven Oscillations and Resonance
7.4 Energy of Simple Harmonic Oscillators	7.4.A Describe the mechanical energy of a system exhibiting SHM.	15.3 Energy in Simple Harmonic Motion
7.5 Simple and Physical Pendulums	7.5.A Describe the properties of a physical pendulum.	15.6 The Pendulum