

TABLE OF CONTENTS

Licensing

Introduction

- Chapter 0: Introduction
 - 0.1: Science and the Realm of Physics, Physical Quantities, and Units
 - 0.2: Physics - An Introduction
 - 0.3: Physical Quantities and Units
 - 0.E: Introduction (Exercise)

Unit 1: Mechanics I - Motion and Forces

- Chapter 1: Kinematics
 - 1.1: Introduction to One-Dimensional Kinematics
 - 1.2: Displacement
 - 1.3: Vectors, Scalars, and Coordinate Systems
 - 1.4: Time, Velocity, and Speed
 - 1.5: Acceleration
 - 1.6: Motion Equations for Constant Acceleration in One Dimension
 - 1.7: Falling Objects
 - 1.8: Projectile Motion
 - 1.9: Centripetal Acceleration
 - 1.E: Kinematics (Exercise)
- Chapter 2: Dynamics
 - 2.1: Introduction to Dynamics- Newton's Laws of Motion
 - 2.2: Development of Force Concept
 - 2.3: Newton's First Law of Motion- Inertia
 - 2.4: Newton's Second Law of Motion- Force and Acceleration
 - 2.5: Newton's Third Law of Motion- Symmetry in Forces
 - 2.6: Normal Force and Tension
 - 2.7: Spring Force- Hooke's Law
 - 2.8: Friction
 - 2.9: Newton's Universal Law of Gravitation
 - 2.10: Centripetal Force
 - 2.E: Dynamics (Exercise)

Unit 2: Mechanics I - Energy and Momentum, Oscillations and Waves, Rotation, and Fluids

- Chapter 3: Work and Energy
 - 3.1: Introduction to Work and Energy
 - 3.2: Work- The Scientific Definition
 - 3.3: Kinetic Energy and the Work-Energy Theorem
 - 3.4: Gravitational Potential Energy
 - 3.5: Conservative Forces, Potential Energy, and Conservation of Energy
 - 3.6: Spring Potential Energy
 - 3.7: Power
 - 3.E: Work and Energy (Exercise)

- Chapter 4: Impulse and Momentum
 - 4.1: Introduction to Linear Momentum and Collisions
 - 4.2: Linear Momentum and Force
 - 4.3: Impulse
 - 4.4: Conservation of Momentum
 - 4.5: Elastic Collisions in One Dimension
 - 4.6: Inelastic Collisions in One Dimension
 - 4.E: Impulse and Momentum (Exercise)
- Chapter 5: Oscillations and Waves
 - 5.1: Introduction to Oscillatory Motion and Waves
 - 5.2: Period and Frequency in Oscillations
 - 5.3: Simple Harmonic Motion- A Special Periodic Motion
 - 5.4: Forced Oscillations and Resonance
 - 5.5: Waves
 - 5.6: Wave Interference- Standing Waves and Beats
 - 5.7: Sound
 - 5.8: Speed of Sound, Frequency, and Wavelength
 - 5.9: Doppler Effect and Sonic Booms
 - 5.E: Oscillations and Waves (Exercise)
- Chapter 6: Rotation
 - 6.1: Introduction to Rotational Motion and Angular Momentum
 - 6.2: Angular Acceleration
 - 6.3: Dynamics of Rotational Motion- Rotational Inertia
 - 6.4: Rotational Kinetic Energy
 - 6.5: Angular Momentum and Its Conservation
 - 6.6: Gyroscopic Effects- Vector Aspects of Angular Momentum
 - 6.E: Rotation (Exercise)
- Chapter 7: Fluids
 - 7.1: Introduction to Fluids
 - 7.2: What Is a Fluid?
 - 7.3: Density
 - 7.4: Pressure
 - 7.5: Pressure Due to the Weight of Fluid
 - 7.6: Archimedes' Principle
 - 7.7: Flow Rate and Its Relation to Velocity
 - 7.8: Bernoulli's Equation
 - 7.E: Fluids (Exercise)

Unit 3: Classical Physics - Thermodynamics, Electricity and Magnetism, and Light

- Chapter 8: Thermal Physics
 - 8.1: Introduction to Thermal Physics
 - 8.2: Temperature
 - 8.3: The Ideal Gas Law
 - 8.4: Heat
 - 8.5: Heat Transfer Methods
 - 8.6: Temperature Change and Heat Capacity
 - 8.7: Phase Change and Latent Heat
 - 8.8: The First Law of Thermodynamics
 - 8.9: The First Law of Thermodynamics and Heat Engine Processes

- 8.10: Introduction to the Second Law of Thermodynamics- Heat Engines and Their Efficiency
- 8.11: Carnot's Perfect Heat Engine- The Second Law of Thermodynamics Restated
- 8.12: Applications of Thermodynamics- Heat Pumps and Refrigerators
- 8.13: Entropy and the Second Law of Thermodynamics- Disorder and the Unavailability of Energy
- 8.14: Statistical Interpretation of Entropy and the Second Law of Thermodynamics- The Underlying Explanation
- 8.E: Thermal Physics (Exercises)
- Chapter 9: Electricity
 - 9.1: Introduction to Electricity
 - 9.2: Static Electricity and Charge- Conservation of Charge
 - 9.3: Coulomb's Law
 - 9.4: Electric Field- Concept of a Field Revisited
 - 9.5: Electric Field Lines
 - 9.6: Electric Potential and Potential Energy
 - 9.7: Conductors and Applications of Electrostatics
 - 9.8: Current
 - 9.9: Ohm's Law- Resistance and Simple Circuits
 - 9.10: Electric Power and Energy
 - 9.11: Resistors in Series and Parallel
 - 9.12: Electric Hazards and the Human Body
 - 9.E: Electricity (Exercise)
- Chapter 10: Magnetism
 - 10.1: Introduction to Magnetism
 - 10.2: Magnets
 - 10.3: Ferromagnets and Electromagnets
 - 10.4: Magnetic Fields and Magnetic Field Lines
 - 10.5: Magnetic Field Strength- Force on a Moving Charge in a Magnetic Field
 - 10.6: Magnetic Force on a Current-Carrying Conductor
 - 10.7: Motors and Meters
 - 10.8: Magnetic Fields Produced by Currents- Ampere's Law
 - 10.9: Induced Voltage and Magnetic Flux
 - 10.10: Faraday's Law of Induction- Lenz's Law
 - 10.11: Transformers
 - 10.12: Alternating Current versus Direct Current
 - 10.E: Magnetism (Exercise)
- Chapter 11: Light
 - 11.1: Introduction to Light
 - 11.2: Maxwell's Equations- Electromagnetic Waves Predicted and Observed
 - 11.3: Production and Properties of Electromagnetic Waves
 - 11.4: The Electromagnetic Spectrum- an Overview
 - 11.5: The Electromagnetic Spectrum- Application Notes
 - 11.6: Reflection
 - 11.7: Refraction
 - 11.8: Dispersion- The Rainbow and Prisms
 - 11.9: Image Formation by Lenses
 - 11.10: Image Formation by Mirrors
 - 11.11: Polarization
 - 11.E: Light (Exercises)

Unit 4: Modern Physics - Quantum Mechanics, Special Relativity, and Nuclear and Particle Physics

- Chapter 12: Quantum Mechanics
 - 12.1: Introduction to Quantum Mechanics
 - 12.2: Blackbody Radiation
 - 12.3: The Photoelectric Effect
 - 12.4: The Wave Nature of Matter
 - 12.5: Uncertainty Principle
 - 12.6: Discovery of the Atomic Nucleus
 - 12.7: Bohr's Theory of the Hydrogen Atom
 - 12.8: The Wave Nature of Matter Causes Quantization
 - 12.E: Quantum Mechanics (Exercise)
- Chapter 13: Special Relativity
 - 13.1: Prelude to Special Relativity
 - 13.2: Einstein's Postulates
 - 13.3: Simultaneity and Time Dilation
 - 13.4: Length Contraction
 - 13.5: Relativistic Addition of Velocities
 - 13.6: Relativistic Momentum
 - 13.7: Relativistic Energy
 - 13.E: Special Relativity (Exercise)
- Chapter 14: Nuclear and Particle Physics
 - 14.1: Introduction to Nuclear and Particle Physics
 - 14.2: Nuclear Radioactivity
 - 14.3: Radiation Detection and Detectors
 - 14.4: Substructure of the Nucleus
 - 14.5: Nuclear Decay and Conservation Laws
 - 14.6: Half-Life and Activity
 - 14.7: Medical Imaging and Diagnostics
 - 14.8: Biological Effects of Ionizing Radiation
 - 14.9: Fusion
 - 14.10: Fission
 - 14.11: Nuclear Weapons
 - 14.12: The Four Basic Forces
 - 14.13: Particles, Patterns, and Conservation Laws
 - 14.14: GUTs- The Unification of Forces
 - 14.E: Nuclear and Particle Physics (Exercise)

6: Appendix

- Chapter 15: Atomic Masses
- Chapter 16: Selected Radioactive Isotopes
- Chapter 17: Useful Information
- Chapter 18: Glossary of Key Symbols and Notation

Index

Glossary

