

Curriculum Standard for Physics (2013)

1. Objectives

- a. To help students further master relevant skills and competence based on their Junior Physics education;
- b. To arouse the interest of Physics learning and enhance logical deduction and problem solving competence and skills thus to consolidate the foundation of their physics education; and
- c. To deepen the understanding of scientific methodology and learning systematically through observation and experiments to eventually develop truth seeking attitude and to make learning relevant to life.

2. Time Allocation

Five periods on a weekly basis for all science stream classes; each period carries forty minutes in duration.

3. Curriculum Content

1. The Introduction of Physics

- 1.1 What is physics?
- 1.2 Research Method of Physics

2. Measurement of Physical quantities, Unit and Data Processing

- 2.1 Measurement of Physical Quantities and Unit
- 2.2 Error and Significant Digit
- 2.3 Scientific Notation and Order of Magnitude
- 2.4 Physics Formulas and Graphs

3. Rectilinear Motion

- 3.1 Mechanical Motion
- 3.2 Reference Body, Coordinate System and Reference System
- 3.3 Distance Travelled and Displacement
- 3.4 Rectilinear Motion with Uniform Velocity, Velocity and Speed
- 3.5 Graph of Rectilinear Motion with Uniform Velocity
- 3.6 Rectilinear Motion with Variable Velocity, Average Velocity and Instantaneous Velocity
- 3.7 Acceleration of Rectilinear Motion with Variable Velocity
- 3.8 Rectilinear Motion with Uniform Velocity
- 3.9 Free-fall Motion

4. Newton's Law of Motion

- 4.1 Force and Motion
- 4.2 Newton's First Law of Motion
- 4.3 Inertia and Mass
- 4.4 Momentum
- 4.5 Newton's Second Law of Motion
- 4.6 Newton's Third Law of Motion

5. Statics

- 5.1 Types of Forces
- 5.2 Resultant of Force System
- 5.3 Resolution of Forces

- 5.4 Balance of Concurrent Forces
- 5.5 Balance of Moment of Force, Balance of Planar Force System
- 5.6 Parallel Force System

6. Plane Motion

- 6.1 Curvilinear Motion
- 6.2 Projectile Motion
- 6.3 Circular Motion with Uniform Speed
- 6.4 Centripetal Force
- 6.5 Centrifugal Motion and its Application
- 6.6 Vertical Plane Circular Motion

7. Work and Energy

- 7.1 Work and Power
- 7.2 The Work of Conservative Force and Variable Force
- 7.3 Kinetic Energy
- 7.4 Potential Energy
- 7.5 Law of Conservation of Mechanical Energy

8. Law of Conservation of Momentum

- 8.1 The Relation between Impulse and Momentum
- 8.2 Law of Conservation of Momentum
- 8.3 Recoil Reaction
- 8.4 Collision

9. Rotation

- 9.1 Rigid body and Its Rotation
- 9.2 Moment of Inertia of Rigid Body
- 9.3 Function of Rolling Rigid Body
- 9.4 Law of Rigid Body Rotation
- 9.5 Angular Momentum
- 9.6 Law of Conservation of Angular Momentum

10. Vibration

- 10.1 Vibration Phenomenon
- 10.2 Simple Harmonic Motion
- 10.3 Equation of Simple Harmonic Motion
- 10.4 Graph of Simple Harmonic Motion
- 10.5 Energy of Simple Harmonic Motion
- 10.6 Angular Simple Harmonic Motion
- 10.7 Forced Vibration, Resonance

11. Hydromechanics

- 11.1 Preface
- 11.2 Liquid Pressure
- 11.3 Archimedes' Principle
- 11.4 Atmospheric Pressure
- 11.5 Steady Flow and Equation of Continuity
- 11.6 Bernoulli's Equation
- 11.7 Application of Bernoulli's Equation
- 11.8 Motion of Objects in Real Fluid

12. Properties of Matter (1)

- 12.1 Basic Unit of Matter—Molecule
- 12.2 Size, Distance and Mass of Molecule
- 12.3 Atomic Bond
- 12.4 Crystal and Non-Crystal
- 12.5 Solid Deformation
- 12.6 Properties of Liquid

13. Temperature and Heat

- 13.1 Temperature
- 13.2 Heat Measurement
- 13.3 Thermal Effect and Change of State
- 13.4 Solid Thermal Expansion
- 13.5 Liquid Thermal Expansion

14. Heat Transfer

- 14.1 Heat Conduction
- 14.2 Calculation of Heat Conduction
- 14.3 Heat Convection
- 14.4 Heat Radiation

15. Law of Gases

- 15.1 State Property of Gases
- 15.2 State Equation of Ideal Gas
- 15.3 Application of State Equation of Ideal Gas
- 15.4 Isothermal Change of State of Gas, Boyle's law
- 15.5 Isochoric Change of State of Gas, Law of Pressure
- 15.6 Isobaric Change of State of Gas, Charles's Law

16. Molecular Motion of Gases and Thermodynamics

- 16.1 Molecular Model of Gas
- 16.2 Gas Pressure
- 16.3 Root-mean-square Speed and Average Speed of Gas Molecule
- 16.4 The Relation between Molecular Kinetic Energy of Gas and Thermodynamic Temperature
- 16.5 Avogadro's Law
- 16.6 Internal Energy of Gas
- 16.7 The First Law of Thermodynamics
- 16.8 Four Application Processes for Ideal Gas in the First Law of Thermodynamics
- 16.9 Specific Heat and Molar Heat Capacity of Gas

17. Properties of Matter (2)

- 17.1 Five States of Matter
- 17.2 Gas-liquid Phase Transformation
- 17.3 Liquid-solid Phase Transformation

18. Mechanical Wave, Sound

- 18.1 Mechanical Wave
- 18.2 Sound Wave and Ultrasound Wave
- 18.3 Graph of Wave

- 18.4 Progressive Wave Equation
- 18.5 Reflection and Refraction of Wave
- 18.6 Superposition of Wave, Standing Wave
- 18.7 Doppler Effect
- 19. Reflection and Refraction of Light
 - 19.1 Reflection of Light, Plane Mirror Imaging
 - 19.2 Spherical Mirror Imaging
 - 19.3 Refraction of Light, Refractive Index
 - 19.4 Analysis of Several Refraction Phenomena
 - 19.5 Total Internal Reflection
- 20. Prism and Lens
 - 20.1 Prism
 - 20.2 Dispersion and Spectrum
 - 20.3 Lens and Lens Imaging
 - 20.4 Lens Focal Length Measurement
 - 20.5 Compound Mirror Imaging and Optical Instrument
- 21. Undulatory Property of Light
 - 21.1 Corpuscular Theory and Wave Theory of Light
 - 21.2 Interference Phenomenon of Light
 - 21.3 Diffraction Phenomenon of Light
 - 21.4 Transverse Wave of Light, Polarisation of Light
 - 21.5 Electromagnetic Nature of Light, Electromagnetic Spectrum
 - 21.6 Light Speed Measurement
- 22. Electric Field
 - 22.1 Two Types of Electric Charge, Law of Conservation of Charge
 - 22.2 Coulomb's Law
 - 22.3 Electric Field, Electric Field Force
 - 22.4 Electric Potential and Electric Potential Energy
 - 22.5 Electric Potential Difference, the Relation between Electric Potential Difference and Electric Field Force
 - 22.6 Millikan Experiment
 - 22.7 Movement of Charged Particles in a Uniform Electric Field
 - 22.8 Conductor in Electric Field
 - 22.9 Capacitor, Capacitance
 - 22.10 Linking of Capacitor
 - 22.11 The Energy Stored in Capacitor
- 23. Steady Current
 - 23.1 Current
 - 23.2 Ohm's Law
 - 23.3 Resistance and Electric Resistivity
 - 23.4 Electric Work and Electric Power
 - 23.5 Series Circuit
 - 23.6 Parallel Circuit
 - 23.7 Electromotive Force and Internal Resistance
 - 23.8 Battery Pack
 - 23.9 Electrical Bridge and Potentiometer

- 23.10 Kirchhoff's Rules
- 23.11 Superconducting
- 24. Electric Current and Magnetic Field
 - 24.1 Magnetic Field
 - 24.2 Magnetic Induction line of Magnetic Field
 - 24.3 Magnetic Induction
 - 24.4 Magnetic Field of Linear Current and Electrified Solenoid
 - 24.5 The Effect of Magnetic Field on Current
 - 24.6 Moving Coil Galvanometer
 - 24.7 The Effect of Magnetic Field on Electric Charge Movement
 - 24.8 Movement of Charged Particles in Magnetic Field
 - 24.9 Application of Lorentz Force
 - 24.10 Magnetic Properties of Matter and Magnetic Material
- 25. Electromagnetic Induction and Alternating Current
 - 25.1 Electromagnetic Induction Phenomenon
 - 25.2 Lenz's Law
 - 25.3 Faraday's Law of Electromagnetic Induction
 - 25.4 Direct Current Motor and Opposing Electromotive Force
 - 25.5 Self-induction
 - 25.6 Eddying
 - 25.7 Alternating Current
 - 25.8 Signature Parameters of Alternating Current
 - 25.9 AC Circuit Including Inductor and Capacitor
 - 25.10 Electromagnetic Oscillation and Electromagnetic Wave
 - 25.11 Radio Wave Transmission and Reception
 - 25.12 Transformer
 - 25.13 Electric Power Transmission
- 26. Quantum Physics
 - 26.1 Photoelectric Effect
 - 26.2 Photon Theory
 - 26.3 Compton Effect
 - 26.4 Rutherford Atomic Model
 - 26.5 Hypothesis of Bohr's Atomic Structure
 - 26.6 Wave-particle Duality of Matter Wave
 - 26.7 Laser
- 27. Physics of Atom and Atomic Nucleus
 - 27.1 X-ray
 - 27.2 Natural Radioactive Element
 - 27.3 Composition of Atomic Nucleus
 - 27.4 Decay
 - 27.5 Artificial Nuclear Reaction
 - 27.6 Nuclear Energy
- 28. Basic Knowledge of Electronic Technology
 - 28.1 Semiconductor and Its Electrical Conductivity
 - 28.2 Crystal Diode

- 28.3 Transistor Rectifier Circuit
- 28.4 Crystal Triode
- 28.5 Transistor Amplifier Circuit

29. Introduction of Relativity Theory

- 29.1 Two Basic Assumptions of Special Theory of Relativity
- 29.2 View of Time and Space of Special Theory of Relativity
- 29.3 Law of Mechanics of Special Theory of Relativity
- 29.4 General Theory of Relativity

30. Celestial Objects

- 30.1 The Shape, Motion and Structure of Earth
- 30.2 Law of Universal Gravitation
- 30.3 The Sun and Its Planets
- 30.4 Planetary Motion and Kepler's Law
- 30.5 A Lifetime of Star