

Revised Edition

S. Chand's  
Principles of  
**Physics**

(As per NCERT/CBSE Syllabus)

**FOR CLASS XI**

V.K. MEHTA  
ROHIT MEHTA



*S. Chand's*  
Principles of  
**Physics**

**For**  
**CLASS XI**

*As per the New CBSE Course Structure and New NCERT Guidelines.*

---

*S. Chand's*  
**Principles of**  
**Physics**

**For**  
**CLASS XI**

**Senior Secondary Certificate Examinations of CBSE and  
Other State Boards of School Education**

---

**V.K. MEHTA**  
**ROHIT MEHTA**



**S. CHAND & COMPANY PVT. LTD.**

**(AN ISO 9001 : 2008 COMPANY)**

**RAM NAGAR, NEW DELHI-110 055**



# S. CHAND & COMPANY PVT. LTD.

(An ISO 9001 : 2008 Company)

Head Office: 7361, RAM NAGAR, NEW DELHI - 110 055

Phone: 23672080-81-82, 9899107446, 9911310888

Fax: 91-11-23677446

Shop at: [schandgroup.com](http://schandgroup.com); e-mail: [info@schandgroup.com](mailto:info@schandgroup.com)

## Branches:

- AHMEDABAD** : 1st Floor, Heritage, Near Gujarat Vidhyapeeth, Ashram Road, **Ahmedabad** - 380 014, Ph: 27541965, 27542369, [ahmedabad@schandgroup.com](mailto:ahmedabad@schandgroup.com)
- BENGALURU** : No. 6, Ahuja Chambers, 1st Cross, Kumara Krupa Road, **Bengaluru** - 560 001, Ph: 22268048, 22354008, [bangalore@schandgroup.com](mailto:bangalore@schandgroup.com)
- BHOPAL** : Bajaj Tower, Plot No. 2&3, Lala Lajpat Rai Colony, Raisen Road, **Bhopal** - 462 011, Ph: 4274723, 4209587. [bhopal@schandgroup.com](mailto:bhopal@schandgroup.com)
- CHANDIGARH** : S.C.O. 2419-20, First Floor, Sector - 22-C (Near Aroma Hotel), **Chandigarh** -160 022, Ph: 2725443, 2725446, [chandigarh@schandgroup.com](mailto:chandigarh@schandgroup.com)
- CHENNAI** : No.1, Whites Road, Opposite Express Avenue, Royapettah, **Chennai** - 600014 Ph. 28410027, 28410058, [chennai@schandgroup.com](mailto:chennai@schandgroup.com)
- COIMBATORE** : 1790, Trichy Road, LGB Colony, Ramanathapuram, **Coimbatore** -6410045, Ph: 2323620, 4217136 [coimbatore@schandgroup.com](mailto:coimbatore@schandgroup.com) (**Marketing Office**)
- CUTTACK** : 1st Floor, Bhartia Tower, Badambadi, **Cuttack** - 753 009, Ph: 2332580; 2332581, [cuttack@schandgroup.com](mailto:cuttack@schandgroup.com)
- DEHRADUN** : 1st Floor, 20, New Road, Near Dwarka Store, **Dehradun** - 248 001, Ph: 27111101, 2710861, [dehradun@schandgroup.com](mailto:dehradun@schandgroup.com)
- GUWAHATI** : Dilip Commercial (1st floor), M.N. Road, Pan Bazar, **Guwahati** - 781 001, Ph: 2738811, 2735640 [guwahati@schandgroup.com](mailto:guwahati@schandgroup.com)
- HYDERABAD** : Padma Plaza, H.No. 3-4-630, Opp. Ratna College, Narayanaguda, **Hyderabad** - 500 029, Ph: 27550194, 27550195, [hyderabad@schandgroup.com](mailto:hyderabad@schandgroup.com)
- JAIPUR** : 1st Floor, Nand Plaza, Hawa Sadak, Ajmer Road, **Jaipur** - 302 006, Ph: 2219175, 2219176, [jaipur@schandgroup.com](mailto:jaipur@schandgroup.com)
- JALANDHAR** : Mai Hiran Gate, **Jalandhar** - 144 008, Ph: 2401630, 5000630, [jalandhar@schandgroup.com](mailto:jalandhar@schandgroup.com)
- KOCHI** : Kachapilly Square, Mullassery Canal Road, Ernakulam, **Kochi** - 682 011, Ph: 2378740, 2378207-08, [cochin@schandgroup.com](mailto:cochin@schandgroup.com)
- KOLKATA** : 285/J, Bipin Bihari Ganguli Street, **Kolkata** - 700 012, Ph: 22367459, 22373914, [kolkata@schandgroup.com](mailto:kolkata@schandgroup.com)
- LUCKNOW** : Mahabeer Market, 25 Gwynne Road, Aminabad, **Lucknow** - 226 018, Ph: 4076971, 4026791, 4065646, 4027188, [lucknow@schandgroup.com](mailto:lucknow@schandgroup.com)
- MUMBAI** : Blackie House, IInd Floor, 103/5, Walchand Hirachand Marg, Opp. G.P.O., **Mumbai** - 400 001, Ph: 22690881, 22610885, [mumbai@schandgroup.com](mailto:mumbai@schandgroup.com)
- NAGPUR** : Karnal Bagh, Near Model Mill Chowk, **Nagpur** - 440 032, Ph: 2720523, 2777666 [nagpur@schandgroup.com](mailto:nagpur@schandgroup.com)
- PATNA** : 104, Citicentre Ashok, Mahima Palace, Govind Mitra Road, **Patna** - 800 004, Ph: 2300489, 2302100, [patna@schandgroup.com](mailto:patna@schandgroup.com)
- PUNE** : 291, Flat No.-16, Ganesh Gayatri Complex, IInd Floor, Somwarpeth, Near Jain Mandir, **Pune** - 411 011, Ph: 64017298, [pune@schandgroup.com](mailto:pune@schandgroup.com) (**Marketing Office**)
- RAIPUR** : Kailash Residency, Plot No. 4B, Bottle House Road, Shankar Nagar, **Raipur** - 492 007, Ph: 2443142, Mb. : 09981200834, [raipur@schandgroup.com](mailto:raipur@schandgroup.com) (**Marketing Office**)
- RANCHI** : Flat No. 104, Sri Draupadi Smriti Apartments, (Near of Jaipal Singh Stadium) Neel Ratan Street, Upper Bazar, **Ranchi** - 834 001, Ph: 2208761, [ranchi@schandgroup.com](mailto:ranchi@schandgroup.com) (**Marketing Office**)
- SILIGURI** : 122, Raja Ram Mohan Roy Road, East Vivekanandapally, P.O., Siliguri, **Siliguri**-734001, Dist., Jalpaiguri, (W.B.) Ph. 0353-2520750 (**Marketing Office**) [siliguri@schandgroup.com](mailto:siliguri@schandgroup.com)
- VISAKHAPATNAM** : No. 49-54-15/53/8, Plot No. 7, 1st Floor, Opp. Radhakrishna Towers, Seethammadhara North Extn., **Visakhapatnam** - 530 013, Ph-2782609 (M) 09440100555, [visakhapatnam@schandgroup.com](mailto:visakhapatnam@schandgroup.com) (**Marketing Office**)

© 1999, V.K. Mehta, Rohit Mehta

All rights reserved. No part of this publication may be reproduced or copied in any material form (including photo copying or storing it in any medium in form of graphics, electronic or mechanical means and whether or not transient or incidental to some other use of this publication) without written permission of the copyright owner. Any breach of this will entail legal action and prosecution without further notice.

**Jurisdiction** : All disputes with respect to this publication shall be subject to the jurisdiction of the Courts, tribunals and forums of New Delhi, India only.

First Edition 1999

Subsequent Editions and Reprints 2001, 2002, 2003, 2004, 2006 (Twice), 2007 (Twice), 2008, 2009, 2010, 2011, 2012 (Twice), 2013,

Reprint with corrections, 2013 (as per new syllabus)

ISBN : 81-219-1934-7

Code : 16B 260

PRINTED IN INDIA

By Rajendra Ravindra Printers Pvt. Ltd., 7361, Ram Nagar, New Delhi -110 055  
and published by S. Chand & Company Pvt. Ltd., 7361, Ram Nagar, New Delhi -110 055.

## PREFACE TO THE SEVENTH EDITION

---

The general response to the fifth edition of the book was very encouraging. The authors feel that their work has been amply rewarded and wish to express their deep sense of gratitude to the large number of readers who have used it and in particular to those of them who have sent helpful suggestions from time to time for the improvement of the book.

In the present edition, authors have made sincere efforts to make the book up-to-date. There are many notable features of this edition including **Answers to very short answer questions, Answers to short answer questions and solution of NCERT Textbook exercises**. Keeping in view the growing demands of fast developing science and technology, a large number of practical problems have been added to make the book practically oriented. It is hoped that these features will make the book more useful to the students.

We are thankful to the Management Team and the Editorial Department of S. Chand & Company Pvt. Ltd., New Delhi for all help and support in the publication of this book.

Errors might have crept in despite utmost care to avoid them and authors shall be grateful if these are pointed out along with other suggestions for the improvement of the book.

**V.K. MEHTA**  
**ROHIT MEHTA**

**Disclaimer :** While the authors of this book have made every effort to avoid any mistake or omission and have used their skill, expertise and knowledge to the best of their capacity to provide accurate and updated information. The authors and S. Chand does not give any representation or warranty with respect to the accuracy or completeness of the contents of this publication and are selling this publication on the condition and understanding that they shall not be made liable in any manner whatsoever. S.Chand and the author expressly disclaim all and any liability/responsibility to any person, whether a purchaser or reader of this publication or not, in respect of anything and everything forming part of the contents of this publication. S. Chand shall not be responsible for any errors, omissions or damages arising out of the use of the information contained in this publication.

Further, the appearance of the personal name, location, place and incidence, if any; in the illustrations used herein is purely coincidental and work of imagination. Thus the same should in no manner be termed as defamatory to any individual.

# SYLLABUS

## Class–XI

---

### Unit I: Physical World and Measurement

(Periods 10)

Physics - scope and excitement; nature of physical laws; Physics, technology and society.

Need for measurement: Units of measurement; systems of units; SI units, fundamental and derived units. Length, mass and time measurements; accuracy and precision of measuring instruments; errors in measurement; significant figures.

Dimensions of physical quantities, dimensional analysis and its applications.

### Unit II: Kinematics

(Periods 30)

Frame of reference, Motion in a straight line: Position-time graph, speed and velocity.

Elementary concepts of differentiation and integration for describing motion. Uniform and nonuniform motion, average speed and instantaneous velocity. Uniformly accelerated motion, velocity-time and position-time graphs.

Relations for uniformly accelerated motion (graphical treatment).

Scalar and vector quantities; Position and displacement vectors, general vectors and their notations; equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors. Relative velocity.

Unit vector; Resolution of a vector in a plane - rectangular components. Scalar and Vector product of vectors.

Motion in a plane. Cases of uniform velocity and uniform acceleration-projectile motion. Uniform circular motion.

### Unit III: Laws of Motion

(Periods 16)

Intuitive concept of force. Inertia, Newton's first law of motion; momentum and Newton's second law of motion; impulse; Newton's third law of motion.

Law of conservation of linear momentum and its applications.

Equilibrium of concurrent forces. Static and kinetic friction, laws of friction, rolling friction, lubrication.

Dynamics of uniform circular motion: Centripetal force, examples of circular motion (vehicle on a level circular road, vehicle on banked road).

### Unit IV: Work, Energy and Power

(Periods 16)

Work done by a constant force and a variable force; kinetic energy, work-energy theorem, power.

Notion of potential energy, potential energy of a spring, conservative forces: conservation of mechanical energy (kinetic and potential energies); non-conservative forces: motion in a vertical circle; elastic and inelastic collisions in one and two dimensions.

### Unit V: Motion of System of Particles and Rigid Body

(Periods 18)

Centre of mass of a two-particle system, momentum conservation and centre of mass motion.

Centre of mass of a rigid body; centre of mass of a uniform rod.

Moment of a force, torque, angular momentum, laws of conservation of angular momentum and its applications.

Equilibrium of rigid bodies, rigid body rotation and equations of rotational motion, comparison of linear and rotational motions.

Moment of inertia, radius of gyration. Values of moments of inertia, for simple geometrical objects (no derivation). Statement of parallel and perpendicular axes theorems and their applications.

## **Unit VI: Gravitation**

**(Periods 14)**

Keplar's laws of planetary motion. The universal law of gravitation.

Acceleration due to gravity and its variation with altitude and depth.

Gravitational potential energy and gravitational potential. Escape velocity. Orbital velocity of a satellite. Geo-stationary satellites.

## **Unit VII: Properties of Bulk Matter**

**(Periods 28)**

Elastic behaviour, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear modulus of rigidity, Poisson's ratio; elastic energy.

Pressure due to a fluid column; Pascal's law and its applications (hydraulic lift and hydraulic brakes).

Effect of gravity on fluid pressure.

Viscosity, Stokes' law, terminal velocity, Reynold's number, streamline and turbulent flow, critical velocity. Bernoulli's theorem and its applications.

Surface energy and surface tension, angle of contact, excess of pressure across a curved surface, application of surface tension ideas to drops, bubbles and capillary rise.

Heat, temperature, Thermal expansion; thermal expansion of solids, liquids and gases, anomalous expansion of water; specific heat capacity;  $C_p$ ,  $C_v$  - calorimetry; change of state - latent heat capacity.

Heat transfer-conduction, convection and radiation, thermal conductivity, Newton's law of cooling, Qualitative ideas of Blackbody radiation, Wein's displacement Law, Stefan's law Green house effect.

## **Unit VIII: Thermodynamics**

**(Periods 12)**

Thermal equilibrium and definition of temperature (zeroth law of thermodynamics). Heat, work and internal energy. First law of thermodynamics. Isothermal and adiabatic processes.

Second law of thermodynamics: reversible and irreversible processes. Heat engine and refrigerator.

## **Unit IX: Behaviour of Perfect Gases and Kinetic Theory of Gases**

**(Periods 8)**

Equation of state of a perfect gas, work done in compressing a gas.

Kinetic theory of gases - assumptions, concept of pressure. Kinetic interpretation of temperature; rms speed of gas molecules; degrees of freedom, law of equipartition of energy (statement only)

and application to specific heat capacities of gases; concept of mean free path, Avogadro's number.

## **Unit X: Oscillations and Waves**

**(Periods 28)**

Periodic motion - time period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion (S.H.M) and its equation; phase; oscillations of a spring-restoring force and force constant; energy in S.H.M. Kinetic and potential energies; simple pendulum-derivation of expression for its time period.

Free, forced and damped oscillations (qualitative ideas only), resonance.

Wave motion. Transverse and longitudinal waves, speed of wave motion. Displacement relation for a progressive wave. Principle of superposition of waves, reflection of waves, standing waves in strings and organ pipes, fundamental mode and harmonics, Beats, Doppler effect.

# CONTENTS

---

## UNIT I PHYSICAL WORLD AND MEASUREMENT

- 1. INTRODUCTION** 3 – 13

Physics — Some Scientific Notions — Scope and Excitement of Physics — Fields of Physics — The Simplicity of Physics — Physics is Basic Science — Physics and Technology — Physics and Society — Some Discoveries and Inventions — Basic Forces in Nature — Towards Unification of Forces — Conservation Laws — System, Environment and Isolated System
  - 2. SYSTEMS OF UNITS** 14 – 24

Measurement — Need for Measurement — Unit — Fundamental Units and Derived Units — Characteristics of a Standard Unit — Old Systems of Fundamental Units — SI Units — Definitions of SI Base Units — Some derived SI Units — Advantages of SI Units — Practical Units for Large Distances — Practical Units for Very Small Distances — Practical Units for Heavy Masses — Practical Units for Large Time — Multiples and Sub-multiples of SI Units — Conversions
  - 3. MEASUREMENT OF LENGTH, MASS AND TIME** 25 – 42

Order of Magnitude — Measurement of Physical Quantities — Indirect Methods for Measuring Large Distances — Measurement of Very Small (Atomic) Distances — Measurement of Mass — Measurement of Inertial Mass — Measurement of Gravitational Mass — Spring Balance — Measurement of Time Intervals
  - 4. DIMENSIONS AND DIMENSIONAL ANALYSIS** 43 – 76

Dimensions of Physical Quantities — Dimensional Formula — Dimensional Equation — Dimensional Formulas of Physical Quantities — Four Categories of Physical Quantities — Principle of Homogeneity of Dimensions — Uses of Dimensional Equations — To check the correctness of a Physical Relation — To Recapitulate the Forgotten Formula — Derivation of Formulas — To Convert One System of Unit to Another — To Find Dimensions of Constants in a Relation — Limitations of Dimensional Analysis — **Competititon Success Material**
  - 5. ERROR ANALYSIS** 77 – 102

Accuracy of Measuring Instrument — Limit of Precision of Measuring Instrument — Significant Figures — Rules for Significant Figures — Significant Figures in Calculations — Rounding Off — Errors in Measurement — Commonly Used Terms in Error Analysis — Propagation of Errors — Competition Success Material
- NCERT Textbook Exercises** 103 – 115

**UNIT II**  
**KINEMATICS**  
**(Description of Motion in One Dimension)**

**6. MOTION IN A STRAIGHT LINE** **119 – 161**

Mechanics — Rest and Motion — Types of Motion — Concept of Point Object or Particle — Location of Point in Space — Motion in three, Two and One Dimensions — Scalar and Vector Quantities — Motion in a Straight Line — Description of Motion — Distance and Displacement — Speed — Velocity — Speed Versus Velocity — Graphical Representation of Uniform Motion — Displacement Time ( $x - t$ ) Graph for Uniform Motion — Velocity — Time ( $v - t$ ) Graph for Uniform Motion — Summary of Uniform Motion in Straight Line — Graphical Analysis of Variable Velocity — Relative Velocity in One Dimension — Mathematical treatment of Relative Velocity — Position-Time graph of Relative Velocity — Acceleration — Graphical Analysis of Variable Acceleration — Graphical Representation of Acceleration — **Competition Success Material**

**7. UNIFORMLY ACCELERATED LINEAR MOTION** **162 – 203**

Equations for Uniformly Accelerated linear motion — Summary of Equations of Uniform Motion — Displacement in  $n$ th second in Uniform Acceleration — Equation of Uniform Acceleration from  $v - t$  Graph — Position-Time Graph for Constant +ve Acceleration — Vertical Motion under Gravity — Equations for Uniformly Accelerated Linear Motion (Calculus Method) — **Competition Success Material**

**NCERT Textbook Exercises** **204 – 215**

**UNIT III**  
**KINEMATICS**  
**(Description of Motion in Two and Three Dimensions)**

**8. VECTORS** **219 – 274**

Vector — Some Definitions in Vector Algebra — Position Vector and Displacement Vector in a Plane — Addition of Vectors — Addition of more than Two Vectors Graphically — Analytical Method of Vector Addition — Some Properties of Vectors — Subtraction of Vectors — Relative Velocity in two Dimensions — Magnitude and Direction of relative Velocity — Applications of Relative Velocity — Resolution of a vector in a Plane — Rectangular Components of a Vector in a Plane — Vector Addition by Angular Components — Rectangular Components in Three Dimensions — Multiplication of Vectors — Scalar Product of Two Vectors — Properties of Scalar (or Dot) Product — Unit Vectors and the Dot Product — Dot Product — Properties of Vector Product — Unit Vectors and the Cross Product — **Competition Success Material**

**9. MOTION IN A PLANE** **275 – 323**

Motion in a Plane — Motion in uniform Velocity in a Plane — Motion in Uniform Acceleration in a Plane — Projectile — Mathematical Analysis of Projectile Motion — Parameters of Projectile Motion — Velocity of Projectile at

any Time — Special Cases of Projectile Motion — Non-Uniform Motion in a Plane — Terms Relating to Circular Motion — Relation between Linear and Angular Quantities — Uniform Circular Motion — Centripetal Acceleration — Projectile Motion versus Uniform Circular Motion — Motion of An Object in Three Dimensional Space — **Competition Success Material**

NCERT Textbook Exercises

324 – 336

## UNIT IV LAWS OF MOTION

### 10. FORCE

339 – 397

Force — Inertia — Newton's First Law of Motion — Types of Inertia — Examples of Law of Inertia — Linear Momentum — Newton's Second Law of Motion — Basic Forces in Nature — Impulsive Force and Impulse — Impulse — Linear Momentum Theorem — Examples of Impulse-Linear Momentum Relationship — Newton's Third Law of Motion - Examples of Newton's Third Law of Motion — Newton's Second Law is the Real law of Motion — Some Applications of Newton's Laws of Motion — Law of Conservation of Linear Momentum — Examples of Conservation of Linear Momentum — Rocket Propulsion — Changing Mass in Motion — Another Example of Changing Mass in Motion — Equilibrium of Concurrent Forces — Connected Motion — Solving Problems in Mechanics — Inertial Frames of Reference — Accelerated Frames of Reference — **Competition Success Material**

### 11. FRICTION AND DYNAMICS OF CIRCULAR MOTION

398 – 448

Friction — Cause of Friction — Types of Friction — Laws of Friction — Magnitude of Limiting Friction - Magnitude of Kinetic Friction — Angle of Friction — Measurement of  $\mu_s$  and  $\mu_k$  — Acceleration of a Body Down Rough Inclined Plane — Rolling Friction — Advantages and Disadvantages of Friction — Methods of Reducing Friction — Centripetal Force — Centrifugal Force — Motion of a Vehicle on a Level Circular Road — Banking of Roads — Bending of a Cyclist — Motion in a Vertical Circle — Practical Examples of Motion in a Vertical Circle — **Competition Success Material**

NCERT Textbook Exercises

449 – 463

## UNIT V WORK, ENERGY AND POWER

### 12. WORK, ENERGY AND POWER

467 – 530

Work — Work done by a Constant Force — Work and the Scalar Product — Nature of Work Done — Work Done against Friction — Work done by a Variable Force—Power — Mechanical Energy — Expression for Kinetic Energy — Kinetic Energy and Linear Momentum — Work- Energy Theorem — Gravitational Potential Energy (G.P.E.) — Conservative and Non-Conservative Forces — Elastic Potential Energy of a Spring — Elastic Potential Energy stored in a Spring — Spring Force is a Conservative Force — Different Forms of Energy — Transformation of Energy — Law of Conservation of Energy — Mass- Energy Relation — Types of

Collisions — Elastic Collision in One Dimension — Coefficient of Restitution — Inelastic Collision in one Dimension — Elastic Collision in Two Dimensions — Inelastic Collision in Two Dimensions — Perfectly Inelastic Collision in Two Dimensions — **Competition Success Material**

NCERT Textbook Exercises

531 – 541

**UNIT VI**  
**MOTION OF SYSTEM OF**  
**PARTICLES AND RIGID BODY**

**13. CENTER OF MASS AND ROTATIONAL MOTION**

**545 – 587**

Extended Bodies — Center of Mass — Concept of Center of Mass — Center of Mass of Two Particle System – Center of Mass – Generalisation to N Particles — Motion of Center of Mass of a System — Momentum of the System — Momentum Conservation and Center of Mass — Examples of Motion of Center of Mass — Rigid Body — Center of Mass of Rigid Bodies — Center of Mass of Solid Objects — Center of Mass of Uniform Rod — Center of Mass of Semicircular Loop — Center of Mass of Uniform Cone — Center of Mass of Symmetrically Bodies (Uniform Composition) — Center of Mass and Center of Gravity — The General Motion of a Rigid Body — Rotational Motion — Equations for Uniformly Accelerated Rotational Motion — Derivation of Equations of Rotational Motion — Torque (or Moment of Force) — Torque on a Particle in a Plane (Rotational Motion of Particle) — Expression for Torque in Polar Coordinates — General Definition of Torque — Rectangular Components of Torque — Power associated with Torque — Angular Momentum — Expression for Angular Momentum — Angular Momentum in Polar Co-ordinates — General Definition of Angular Momentum — Torque and Angular Momentum for a System of Particles — Geometrical Meaning of Angular Momentum — Angular Momentum and Kepler’s Second Law — Law of Conservation of Angular Momentum — Simple Momentum — **Competition Success Material**

**14. MOMENT OF INERTIA**

**588 – 644**

Concept of Moment of Inertia - Moment of Inertia of a Rigid Body — Radius of Gyration — Rotational Kinetic Energy — Torque and Moment of inertia — Angular Momentum and Moment of Inertia — Relation between Torque and Angular Momentum — Work-Energy Theorem in Rotational Motion — Power in Rotational Motion — M.I. of some Commonly used Bodies — Law of conservation of Angular Momentum — Examples of conservation of Angular Momentum — Theorems on Moment of Inertia — Theorem of Parallel Axes — Theorem of Perpendicular Axes — Calculation of Moment of Inertia of Rigid bodies — M.I. of Thin Circular Ring About its Axes — M.I. of Uniform Circular Disc — M.I. of a Thin Uniform Rod — M.I. of Thin hollow Cylinder about its Axes - M.I. of Uniform Solid Cylinder about its Axes - M.I. of a Uniform Hollow Sphere about a Diameter — M.I. of a Uniform Solid Sphere about a Diameter — Combined Rotation and Translation — Rolling Cylinder (without Slipping) on an Inclined Plane — Laws of Rotational Motion — Linear and Angular Quantities — Equilibrium of Rigid Bodies — Binary System — **Competition Success Material**

NCERT Textbook Exercises

645 – 655

## UNIT VII GRAVITATION

### 15. ACCELERATION DUE TO GRAVITY 659 – 690

Acceleration due to Gravity — Newton's Law of Universal Gravitation — Vector form of Newton's Law of Gravitation — Difference between Gravitation and Gravity — Expression for Acceleration due to Gravity — Mass and Density of earth — Variation in the Value of  $g$  — Variation of  $g$  with Altitude — Variation of  $g$  with Depth — Variation of  $g$  due to Shape of Earth - Variation of  $g$  due to Rotation of Earth — Torque due to Gravity — **Competition Success Material**

### 16. SATELLITE AND PLANETARY MOTION 691 – 729

Natural and Artificial Satellites — Principle of Launching Earth Satellite — Orbital Velocity of Satellite — Time Period of Satellite — Height of Satellite above Earth's Surface — Energy of Satellite — Angular Momentum of Satellite — Geostationary Satellites — Polar Satellite — Uses of Artificial Satellites — Weightlessness — Weightlessness in Satellites — Escape Velocity — Expression for Escape Velocity — Planetary Motion and Kepler's Laws — Deduction of Kepler's Third Law — Law of Gravitation from Kepler's Third Law — **Competition Success Material**

### 17. GRAVITATIONAL FIELD, ENERGY AND POTENTIAL 730 – 753

Gravitational Field — Intensity of Gravitational Field — Intensity of Gravitational Field Due to Earth — Gravitational Potential Energy — General Expression for Gravitational Potential Energy — Gravitational P.E. near Earth's Surface — Escape Velocity from Energy Principle — Gravitational Potential — Relation between Gravitational Field and Potential — **Competition Success Material**

NCERT Textbook Exercises

754 – 760

## UNIT VIII PROPERTIES OF BULK MATTER

### 18. ELASTICITY 763 – 801

Interatomic and Intermolecular Forces — States of Matter — Classification of Solids — Difference between Crystalline and Amorphous Solids — Elastic Behavior of Solids — Elasticity — Types of Solid Deformation — Stress — Strain — Elastic Limit — Hook's Law and Modulus of Elasticity — Types of Moduli of Elasticity — Young's Modulus (or Elasticity in Length) — Stress-Strain Curve for an Ideal gas — Stress-Strain Curve for Rubber — Classification of Materials on Elastic Properties — Elastic Fatigue — Creep — Bulk Modulus (or Elasticity in Volume) — Shear Modulus (or Elasticity of Shape) — Strain Energy — Poisson's ratio — Relation among Elastic Constants — Applications of Elasticity — **Competition Success Material**

### 19. HYDROSTATICS (FLUIDS AT REST) 802 – 867

Ideal Fluid — Liquid at Rest — Thrust of the Liquid — Pressure of the Liquid — Practical Applications of Pressure — Pressure Exerted by a Liquid column —

Pascal's Law — Hydraulic Lift — Hydraulic Breaking System — Hydraulic Paradox — Effect of Gravity on Liquid Pressure — Important Properties of Liquids at Rest — Absolute and Gauge Pressure — Atmosphere and Atmospheric Pressure — Mercury Barometer — Height of Atmosphere — Manometer — Buoyant Force — Archimedes' Principle — Proof of Archimedes' Principle — Principle of Floatation — Fraction of Volume Submerged of a Floating Body — Terms Concerning Surface Tension — Surface Tension — Measurement of Surface Tension — Surface Energy — Relation between Surface Tension and Surface Energy — Some Surface Tension Phenomena — Excess Pressure on Curved Liquid Surface — Excess Pressure Inside a Bubble and Liquid Drop — Angle of Contact — Capillarity — Capillary Rise (Ascent Formula) — Practical applications of Capillarity — Alternative Proof for Formula of Capillary Rise Factors Affecting Surface Tension — Action of Detergents — **Competition Success Material**

**20. HYDRODYNAMICS (FLUIDS IN MOTION) 868 – 916**

Viscosity — Cause of Viscosity — Coefficient of Viscosity — Fluid Friction (Viscosity) Versus Solid Friction — Stokes' Law — Importance of Stokes' Law — Terminal Velocity — Importance of Viscosity — Fluid Flow — Types of Liquid Flow — Rate of Flow — Reynolds Number — Critical Velocity — Equation of Continuity — Total Energy of a Liquid — Bernoulli's Theorem — Proof of Bernoulli's Theorem — Different Forms of Bernoulli's Theorem — Limitations of Bernoulli's Theorem — Applications of Bernoulli's Theorem — Venturimeter — Torricelli's Theorem — Poiseuille's Formula — Derivation of Poiseuille's Formula (by Dimensional Analysis) — **Competition Success Material**

**21. THERMAL PROPERTIES OF MATTER 917 – 963**

Concept of Heat — Concept of Temperature — Measurement of Temperature — Scales of Temperature — Kelvin or Absolute scale of Temperature — Triple Point of Water — Thermal Expansion of Solids — Relation between Coefficients of Expansion — Thermal Expansion from Molecular Theory — Thermal Stresses — Applications of Thermal Expansions of Solids — Thermal Expansion of Liquids — Variation of Density of Solids and Liquids With Temperature — Specific Heat or Specific Heat Capacity — Molar Specific Heat — Dulong and Petit law — Specific Heat of Water — Heat Capacity and Water Equivalent — Different States of a Substance — Latent Heat — Law of heat Exchange — Calorimetry — Specific Heat of a Gas — Two Principal Specific Heats of a Gas —  $C_p$  is Greater than  $C_v$  —  $PV$  Diagram of a Real Substance — Phase Diagram — Gas and Vapour — **Competition Success Material**

**22. TRANSFER OF HEAT 964 – 998**

Conduction — Thermal Conductivity — Coefficient of Thermal Conductivity — Thermal Resistance — Applications of Thermal Conductivity — Convection — Applications of Convection — Radiation — Thermal Radiation — Reflection, Transmission and Absorption — Perfectly Black Body — Terminology Concerning Thermal Radiation — Energy Distribution of Black Body Radiation — Wien's Displacement Law — Stefan's Law — Kirchhoff's Law — Newton's Law of Cooling — Sun — Comparison of Conduction, Convection and Radiation - **Competition Success Material**

**NCERT Textbook Exercises**

**999 – 1022**

## UNIT IX THERMODYNAMICS

### 23. THERMODYNAMICS

1025 – 1082

Thermodynamics — Laws of Thermodynamics at a Glance — Commonly used Terms in Thermodynamics —  $P$ - $V$  Diagram — Types of Thermodynamic Process — Work Done During Expansion — Non-Cyclic and Cyclic Processes — Work Done in a Cyclic Process — Internal Energy of a Gas — First Law of Thermodynamics — Applications of First Law of Thermodynamics — Isothermal Process — Work Done During Isothermal Process — Adiabatic Process — Work Done During Adiabatic Process — Isothermal and Adiabatic Process Compared — Reversible and Irreversible Processes — Limitations of First Law of Thermodynamics — Second Law of Thermodynamics — Entropy — Entropy and Second Law of Thermodynamics - Principle of a Heat Engine — Heat and Mechanical Work in Engines — The Carnot Cycle — Efficiency of Carnot Engine — Carnot's Theorem — Types of Heat Engines — Refrigerator — **Competition**

**Success Material**

NCERT Textbook Exercises

1083 – 1085

## UNIT X BEHAVIOUR OF PERFECT GAS AND KINETIC THEORY

### 24. BEHAVIOUR OF PERFECT GAS AND KINETIC THEORY

1089 – 1133

Ideal Gas or Perfect Gas — Gas Laws — Boyle's Law — Charles' Law — Gay Lussac's Law (Pressure Law) — Perfect Gas Equation — Universal Gas Constant — Kinetic Theory of Gases — Pressure Exerted by a Gas — Expression for Pressure in Alternate Forms — Average Kinetic Energy of a Gas Molecule — Kinetic-Theory Interpretation of Temperature — Mean Velocity of Gas Molecules — Root Mean Square Velocity of Gas Molecules — Most Probable Velocity of Gas Molecules — Derivation of Gas Laws from Kinetic Theory — Monoatomic, Diatomic and Polyatomic Gases — Degrees of Freedom — Law of Equipartition of Energy — Molar Specific Heats of an Ideal Monoatomic Gas — Calculation of  $C_p/C_v$  for Gases — Relation Between  $\gamma$  and Degrees of Freedom — Mean Free Path — Avogadro's Number — The Mole — Significance of Avogadro's Number — **Competition Success Material**

NCERT Textbook Exercises

1134 – 1139

## UNIT XI OSCILLATIONS AND WAVES

### 25. OSCILLATIONS

1143 – 1206

Periodic and Oscillatory Motion — Simple Harmonic Motion (S.H.M.) — Periodic Functions — Analysis of S.H.M. in terms of Uniform Circular Motion — General Displacement Equation of S.H.M. — Characteristics of Simple Harmonic Motion — Graphical Representation of S.H.M. — Total Energy in S.H.M. — Dynamics of Simple Harmonic Motion — Typical Examples of S.H.M. — Oscillations of

a Loaded Spring — Springs in Series and Parallel — Simple Pendulum — Oscillations of a Liquid in a U-Tube — Oscillations of a Floated Cylinder — Body Dropped in a Tunnel Along Earth Diameter — Undamped and Damped Oscillations — Free, Forced and Resonant Oscillations — Demonstration of Free, Forced and Resonant Vibrations — Coupled Oscillations — **Competition Success Material**

## 26. WAVES

1207 – 1298

Types of Waves — Mechanical Waves — Types of Mechanical Waves — Comparison of Transverse and Longitudinal Waves — Wave Terminology — Relation between wave Velocity, Frequency and Wavelength — Characteristics of Wave motion — Speed of Transverse Waves — Speed of Longitudinal Waves — Sound Waves — Sound Waves in Air — Newton's Formula for Velocity of Sound — Laplace's Correction — Factors Affecting Velocity of Sound in a Gas — Wave Function — Periodic Wave Function — Harmonic Wave Function — Harmonic Wave Function is Periodic in  $x$  and  $t$  — Equation of Simple Harmonic Travelling Wave — Particle Velocity and Acceleration — Phase and Phase Difference — Reflection of Waves — Superposition Principle — Behavior of Waves in a Medium — Stationary Waves or Standing Waves — Types of Stationary Waves — Formation of Stationary Waves (Graphical Method) — Characteristics of Stationary Waves — Equation of a Stationary Wave — Standing Waves in a String Fixed at Both Ends — Standing Waves in Air Columns — Standing Waves in a Pipe Closed at One End — Standing Waves in an Open Pipe — Closed and Open Pipes Compared — Beats — Formation of Beats — Mathematical Treatment of Beats — Uses of the Phenomenon of Beats — Doppler Effect — Calculation of Apparent Frequency — Musical Sound and Noise — Characteristics of a Musical Sound — Intensity and Intensity Level of Sound — Acoustics of Buildings — Sound Waves in a Hall — Absorbing Power of a Surface — Reverberation — Standard Reverberation Time — Methods of Reducing Reverberation Time — Factors Affecting acoustics of Building — **Competition Success Material**

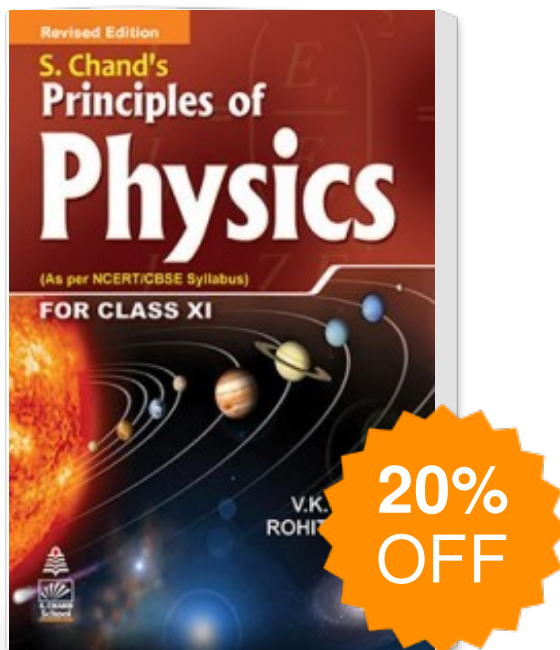
**NCERT Textbook Exercises**

1299 – 1320

**INDEX**

1321 – 1325

# S. Chand's Principles Of Physics For XI



Publisher : SChand Publications ISBN : 9788121919340

Author : V K Mehta And  
Rohit Mehta

Type the URL : <http://www.kopykitab.com/product/12009>



Get this eBook