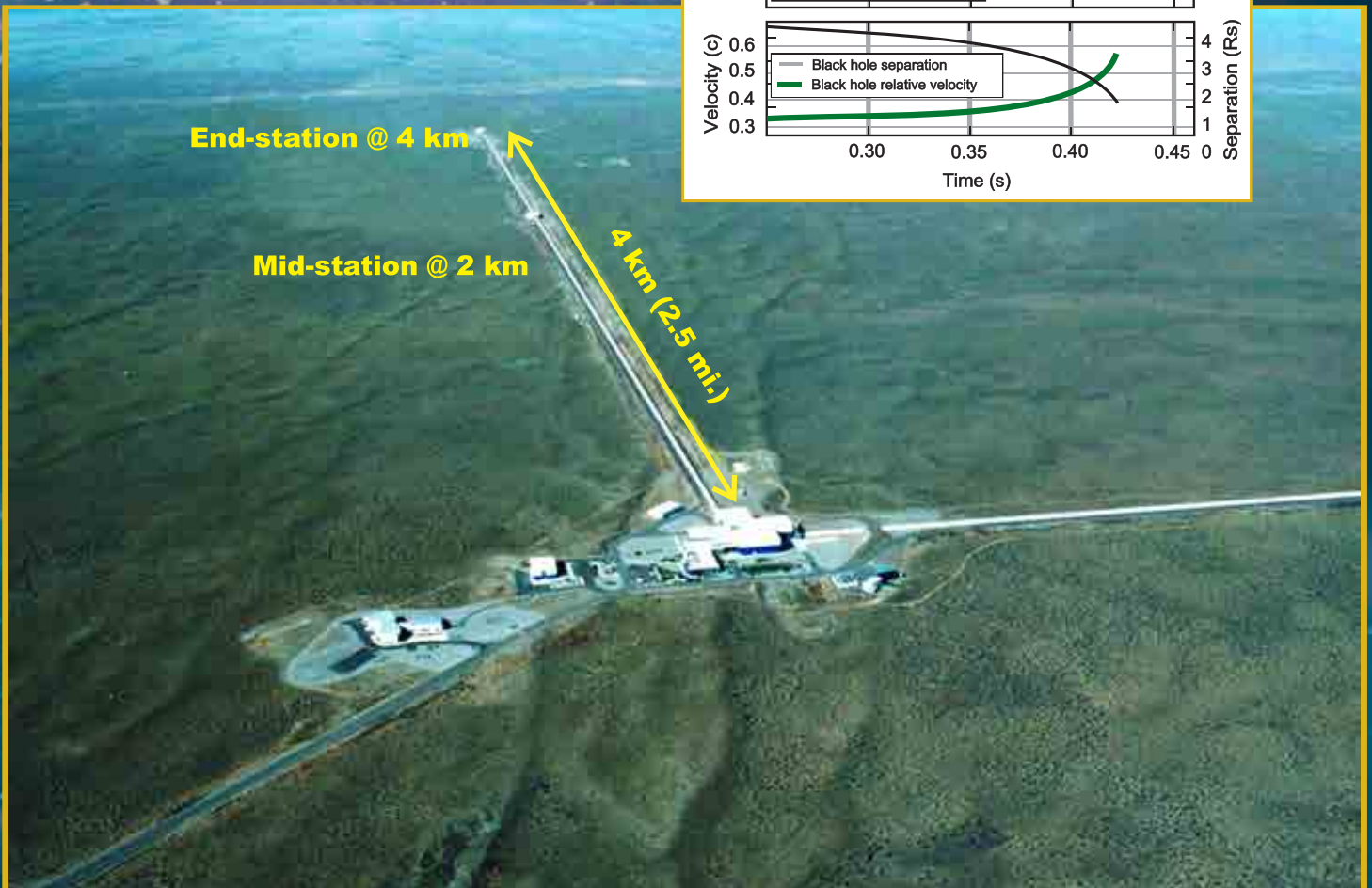
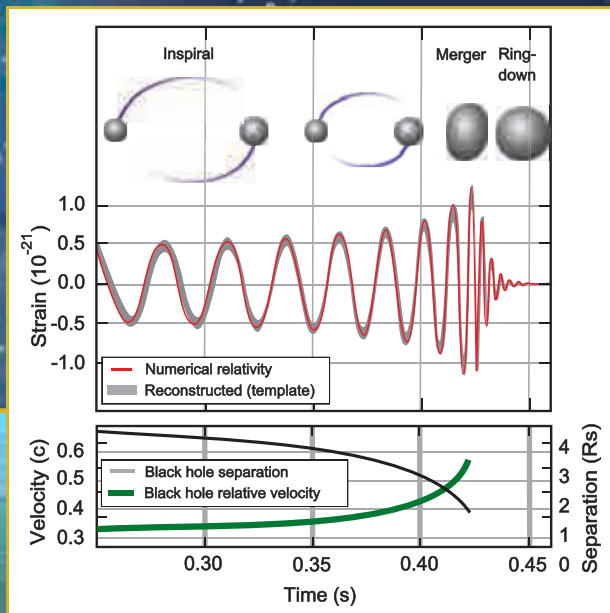




# PHYSICS

## Standard XI



The Coordination Committee formed by GR No. Abhyas - 2116/(Pra.Kra.43/16) SD - 4 Dated 25.4.2016 has given approval to prescribe this textbook in its meeting held on 20.06.2019 and it has been decided to implement it from academic year 2019-20.

# PHYSICS

**Standard XI**



**T8P5A8**

Download DIKSHA App on your smartphone. If you scan the Q.R.Code on this page of your textbook, you will be able to access full text. If you scan the Q.R.Code provided, you will be able to access audio-visual study material relevant to each lesson, provided as teaching and learning aids.



2019

**Maharashtra State Bureau of Textbook Production and  
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## **The Constitution of India**

### **Preamble**

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC and to secure to all its citizens:

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the unity and integrity of the Nation;

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949, do HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.

## NATIONAL ANTHEM

Jana-gana-mana-adhināyaka jaya hē  
Bhārata-bhāgya-vidhātā,

Panjāba-Sindhu-Gujarāta-Marāthā  
Drāvida-Utkala-Banga

Vindhya-Himāchala-Yamunā-Gangā  
uchchala-jaladhi-taranga

Tava subha nāmē jāgē, tava subha āsisa māgē,  
gāhē tava jaya-gāthā,

Jana-gana-mangala-dāyaka jaya hē  
Bhārata-bhāgya-vidhātā,

Jaya hē, Jaya hē, Jaya hē,  
Jaya jaya jaya, jaya hē.

## PLEDGE

India is my country. All Indians  
are my brothers and sisters.

I love my country, and I am proud  
of its rich and varied heritage. I shall  
always strive to be worthy of it.

I shall give my parents, teachers  
and all elders respect, and treat  
everyone with courtesy.

To my country and my people,  
I pledge my devotion. In their  
well-being and prosperity alone lies  
my happiness.

## Preface

**Dear Students,**

It is a matter of pleasure and pride to place this exposition on basic physics in the hands of the young generation. This is not only textbook of physics for standard XI class, but embodies material which will be useful for self-study.

This textbook aims to create awareness about Physics. The National Curriculum Framework (NCF) was formulated in the year 2005, followed by the State Curriculum Framework (SCF) in 2010. Based on the given two frameworks, reconstruction of the curriculum and preparation of a revised syllabus has been undertaken which will be introduced from the academic year 2019-20. The textbook incorporating the revised syllabus has been prepared and designed by the Maharashtra State Bureau of Textbook Production and Curriculum Research, (Balharati), Pune.

The purpose of the book is to prepare a solid foundation for further studies in physics at the standard XII class. Proficiency in science in general and physics in particular is a basic requirement for the professional courses such as engineering and medicine etc., apart from the graduation courses in science itself. With this point of view, each chapter is prepared with elementary level and encompassing the secondary school level physics to the higher secondary level. Most of the topics are explained lucidly and in sufficient details, so that the students understand them well. A number of illustrative examples and figures are included to enlighten the student proficiency. With this background, the student is expected to solve the exercises given at the end of the chapters. For students who want more, Internet sites for many topics have been provided. They can enjoy further reading.

After all, physics is a conceptual subject. Knowledge about physical phenomena is gained as a natural consequence of observation, experience and revelation upon problem solving.

The book is written with this mind-set. The curriculum and syllabus conforms to the maxims of teaching such as moving from concrete to abstract, known to unknown and from part to the whole. For the first time, in this textbook of Physics, various activities have been introduced. These activities will not only help to develop understanding the content but also provide scope of the for gaining relevant and additional knowledge on your own efforts. A detailed information of all concepts is also given for a better understanding of the subject. QR Codes have been introduced for gaining additional information, abstracts of chapters and practice questions/ activities.

The efforts taken to prepare the textbook will not only enrich the learning experiences of the students, but also benefit other stakeholders such as teachers, parents as well as candidates aspiring for the competitive examinations.

We look forward to a positive response from the teachers and students.

Our best wishes to all!



(Dr. Sunil Magar)

**Director**

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Pune

Date : 20 June 2019

Bhartiya Saur : 30 Jyeshtha 1941



## - For Teachers -

### Dear Teachers,

We are happy to introduce the revised textbook of Physics for Std XI. This book is a sincere attempt to follow the maxims of teaching as well as develop a 'constructivist' approach to enhance the quality of learning. The demand for more activity based, experiential and innovative learning opportunities is the need of the hour. The present curriculum has been restructured so as to bridge the credibility gap that exists between what is taught and what students learn from direct experience in the outside world. Guidelines provided below will help to enrich the teaching-learning process and achieve the desired learning outcomes.

- ✓ To begin with, get familiar with the textbook yourself, and encourage the students to read each chapter carefully.
- ✓ The present book has been prepared for constructivist and activity-based teaching, including problem solving exercises.
- ✓ Use teaching aids as required for proper understanding of the subject.
- ✓ Do not finish the chapter in short.
- ✓ Follow the order of the chapters strictly as listed in the contents because the units are introduced in a graded manner to facilitate knowledge building.

- ✓ 'Error in measurements' is an important topic in physics. Please ask the students to use this in estimating errors in their measurements. This must become an integral part of laboratory practices.
  - ✓ Major concepts of physics have a scientific base. Encourage group work, learning through each other's help etc. Facilitate peer learning as much as possible by reorganizing the class structure frequently.
  - ✓ Do not use the boxes titled 'Do you know?' for evaluation. However, teachers must ensure that students read this extra information.
  - ✓ For evaluation, equal weightage should be assigned to all the topics. Use different combinations of questions. Stereotype questions should be avoided.
  - ✓ Use QR Code given in the textbook. Keep checking the QR Code for updated information. Certain important links, websites have been given for references. Also a list of reference books is given. Teachers as well as the students can use these references for extra reading and in-depth understanding of the subject.
- Best wishes for a wonderful teaching experience!

### References:

1. Fundamentals of Physics - Halliday, Resnick, Walker; John Wiley (sixth ed.).
2. Sears and Zeemansky's University Physics - Young and Freedman, Pearson Education (12<sup>th</sup> ed.)
3. Physics for Scientists and Engineers - Lawrence S. Lerner; Jones and Bartlett Publishers, UK.

**Front Page :** Figure shows the LIGO laboratory in the United States of America and the inset shows the trace of gravity waves detected upon the merger of two black holes. In the background is the artist's impression of planets and galaxies.

Since ages, mankind is awed by the sheer scale of the universe and is trying to understand the laws governing the same. Today we observe the events in the universe with highly sophisticated instruments and laboratories such as the LIGO project seen on the cover. Picture Credit: Caltech/ MIT/ LIGO laboratory.

Figure Credit : B. P. Abott et al. Physical Review Lett 116, 061102, 2016

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## Competency Statements Standard XI

Area/ Unit/ Lesson	Competency Statements After studying the content in Textbook student ...
Units and Mathematical Tools	<ul style="list-style-type: none"> <li>Distinguish between fundamental and derived quantities.</li> <li>Distinguish between different system of units and their use.</li> <li>Identify methods to be used for measuring lengths and distances of varying magnitudes.</li> <li>Check correctness of physical equations using dimensional analysis.</li> <li>Establish the relation between related physical quantities using dimensional analysis.</li> <li>Find conversion factors between the units of the same physical quantity in two different sets of units.</li> <li>Identify different types of errors in measurement of physical quantities and estimate them.</li> <li>Identify the order of magnitude of a given quantity and the significant figures in them.</li> <li>Distinguish between scalar and vector quantities.</li> <li>Perform addition, subtraction and multiplication (scalar and vector product) of vectors.</li> <li>Determine the relative velocity between two objects.</li> <li>Obtain derivatives and integrals of simple functions.</li> <li>Obtain components of vectors.</li> <li>Apply mathematical tools to analyze physics problems.</li> </ul>
Motion and Gravitation	<ul style="list-style-type: none"> <li>Visualize motions in daily life in one, two and three dimensions.</li> <li>Explain the necessity of Newton's first law of motion.</li> <li>Categorize various forces of nature into four fundamental forces.</li> <li>State various conservation principles and use these in daily life situations.</li> <li>Derive expressions and evaluate work done by a constant force and variable force.</li> <li>Organize/categorize the common principles between collisions and explosions.</li> <li>Explain the necessity of defining impulse and apply it to collisions, etc.</li> <li>Elaborate the limitations of Newton's laws of motion.</li> <li>Elaborate different types of mechanical equilibria with suitable examples.</li> <li>Apply the Kepler's laws of planetary motion to solar system.</li> <li>Elaborate Newton's law of gravitation.</li> <li>Calculate the values of acceleration due to gravity at any height above and depth below the earth's surface.</li> <li>Distinguish between different orbits of earth's satellite.</li> <li>Explain how escape velocity varies from planet.</li> <li>Explain weightlessness in a satellite.</li> </ul>
Properties of Matter	<ul style="list-style-type: none"> <li>Explain the difference between elasticity and plasticity</li> <li>Identify elastic limit for a given material.</li> <li>Differentiate between different types of elasticity modules.</li> <li>Judge the suitability of materials for specific applications in daily life appliances.</li> <li>Identify the role of force of friction in daily life.</li> <li>Differentiate between good and bad conductors of heat.</li> <li>Relate underlying physics for use of specific materials for use in thermometers for specific applications.</li> </ul>
Sound and Optics	<ul style="list-style-type: none"> <li>Apply and relate various parameters related to wave motion.</li> <li>Compare various types of waves with common features and distinguishing features.</li> <li>Analytically relate the factors on which the speed of sound and speed of light depends.</li> <li>Explain the essential factor to describe wave propagation and relate it with phase angle.</li> <li>Apply the laws of reflection to light.</li> <li>Mathematically describe the Doppler effect for sound waves.</li> <li>Apply the laws of refraction to common phenomena in daily life like, a mirage or a rainbow.</li> <li>Identify the defects in images obtained by mirrors and lenses, with their cause and ways of reducing or eliminating them.</li> <li>Explain the construction and use of various optical instruments such as a microscope, a telescope, etc.</li> <li>Relate dispersion of light with colour and apply it analytically with the help of prisms.</li> </ul>



	<ul style="list-style-type: none"> <li>Describe dispersive power as a basic property of transparent materials and relate it with their refractive indices.</li> <li>Analyze the time taken to receive an echo and calculate distance to the reflecting object.</li> <li>Explain reverberation and acoustics.</li> </ul>
Electricity and Magnetism	<ul style="list-style-type: none"> <li>Distinguish between conductors and insulators.</li> <li>Apply coulomb's law and obtain the electric field due to a certain distribution of charges.</li> <li>Define dipole, obtain the dipolar field.</li> <li>Relate the drift of electrons in a conductor to resistivity</li> <li>Calculate resistivity at various temperature.</li> <li>Connect resistors in series and parallel combination.</li> <li>Compare electric and magnetic fields.</li> <li>Draw electric and magnetic lines of force.</li> <li>Obtain magnetic parameters of the Earth.</li> <li>Solve numerical and analytical problems.</li> </ul>
Communication and Semiconductors	<ul style="list-style-type: none"> <li>Explain the properties of an electromagnetic wave.</li> <li>Distinguish between mechanical waves and electromagnetic waves.</li> <li>Identify different types of electromagnetic radiations from <math>\gamma</math>- rays to radio waves.</li> <li>Distinguish between different modes of propagation of EM waves through earth's atmosphere.</li> <li>Identify different elements of a communication system.</li> <li>Explain different types of modulation and identify the types of modulation needed in given situation.</li> <li>Distinguish between conductors, insulators and semiconductors based on band structure.</li> <li>Differentiate between p type and n type semiconductors and their uses.</li> <li>Explain working of forward and reverse biased junction.</li> <li>Explain the working of semiconductor diode.</li> </ul>

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