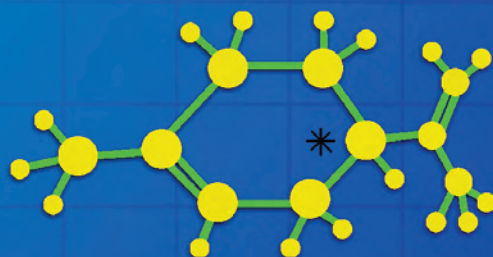
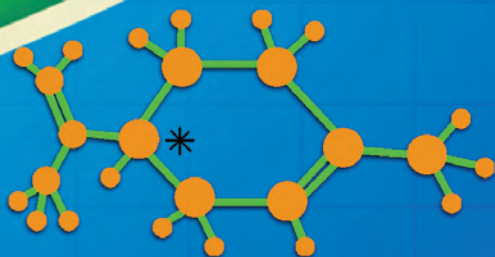
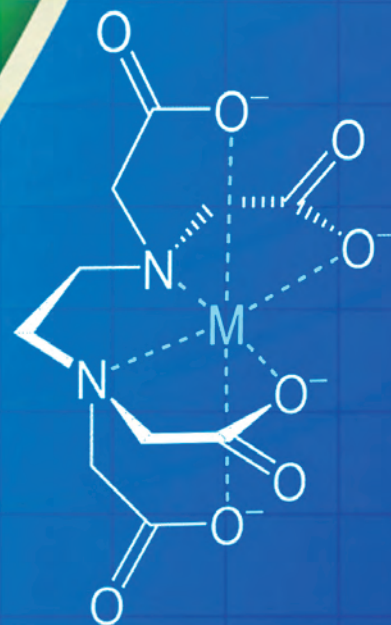




# CHEMISTRY

Standard XII



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 30.01.2020 and it has been decided to implement it from academic year 2020-21.

# CHEMISTRY

## STANDARD TWELVE



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2020

**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,

We welcome you all to std. XII. For the first time, you were introduced to the subject of chemistry discipline in std XI.

Chemistry is very vast subject that covers many aspects of our everyday experience. This textbook aims to create awareness and to understand certain essential aspects by the state curriculum framework (NCF) which was formulated in 2005, followed by the national curriculum framework (SCF) in 2010. Based on these two frameworks, reconstruction of the curriculum and partipation of a revised syllabus has been done and designed now.

Three major branches of chemistry, namely organic chemistry, inorganic chemistry and physical chemistry are presented in separate units in this book. Care is taken to have an integrated approach in deliberation of their contents. Chemistry is highly applied subject. In the unit "applied chemistry" along with the application of chemistry in life science and materials in everyday life, the upcoming applied branches, namely nanochemistry and green chemistry are also introduced. You can learn basic principles, understand facts and put them into practice by learning in the classroom and laboratory. The textbook is presented in a simple language with relevant diagrams, graphs, tables, photographs. This will help you to understand various terminology, concepts with more clarity. All the illustrations are in colour form. The new syllabus focuses on the basic principles, concepts, laws based on precise observations, their applications in everyday life and ability to solve different types of problems. The general teaching - learning objectives of the revised syllabus are further determined on the basis of the 'Principle of constructivism' i.e. self learning.

The curriculum and syllabus is designed to make the students to think independently. The students are encouraged to read, study more through the additional information given in the colored boxes. Activities have been introduced in each chapter. These activities will help to understand the content knowledge on your own efforts. QR code has been introduced for gaining the additional information, abstracts of chapters and practice questions/ activities.

The efforts taken to prepare the text book will help the students think about more than just the content of the chemical concepts. Teachers, parents as well as the aspiring condidates preparing for the competitive examinations will be benefited.

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

Our best wishes to all !



(Vivek Gosavi)

**Director**

Pune

Date : 21 February 2020

Bharatiya Saur : 2 Phalguna 1941

Maharashtra State Bureau of Textbook  
Production and Curriculum Research, Pune 4

## - For Teachers -

### Dear Teachers,

We are happy to introduce the revised textbook of chemistry for std. XII. This book is a sincere attempt in continuation with the standard XI book 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 time. The present curriculum has been restructured so as to bridge the credibility gap that exists in the 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.
- The present book has been prepared for constructivism and activity based learning.
- Teachers must skilfully plan and organize the activities provided in each chapter to develop interest as well as to stimulate the thought process among the students.
- Always teach with proper planning.
- Use teaching aids as required for the 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.
- Each unit is structured in a definite manner. It starts from the basic concepts of general chemistry

required for each branch of chemistry. Application of this knowledge will help students to understand further chapters in each unit.

- Each chapter provides solved problems on each and every concept and various laws. The solved problems are put into boxes. Teachers should explain each step of the problems to the student and give them practice.
- Invite students' participation by making use of the boxes like 'Can You Recall', 'Do you know?'
- Encourage the students to collect related information by providing them the websites.
- Teaching- learning interactions, processes and participation of all students are necessary and so is your active guidance.
- Do not use the content of the boxes titled 'Do you know?' for evaluation.
- Exercises include parameters such as co-relation, critical thinking, analytical reasoning etc. Evaluation pattern should be based on the given parameters. Equal weightage should be assigned to all the topics. Use different combinations of questions.
- Illustrative figures are included to help assimilation of new concepts. Teachers should note that students are not expected to draw all the figures included in this book. As a part of evaluation students can be asked to draw schematic diagrams/structures and interpret or label other complicated figures.

Can you recall ?



Remember...



Do you know ?



Observe and discuss...



Use your brain power



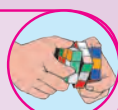
Can you tell ?



Internet my friend



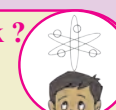
Try this...



Activity :



Can you think ?



#### Cover page :

- (+) - **Limonene** and (-) **Limonene** : major contributors to the characteristic flavours of peelings of oranges and lemons respectively.
- **Image of gold surface** : Au (111), obtained by Scanning Tunneling Microscope (STM).
- **Structures of coordination complexes** : haemoglobin, chlorophyll and metal -EDTA complex.

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## Competency Statements - Standard XII

Area/ Unit/ Lesson	After studying the contents in Textbook students.....
<b>Physical Chemistry</b>	<ul style="list-style-type: none"> <li>• Distinguish crystal structures illustrating unit cell and packing efficiency in cubic systems.</li> <li>• Gain information on point defects and band theory in relation to electric and magnetic behavior.</li> <li>• Define solubility and rationalise its dependence on various factors.</li> <li>• Explain Henry and Raoult's laws.</li> <li>• Derive expressions for colligative properties.</li> <li>• Learn van't Hoff factor and its correlation with dissociation constant.</li> <li>• Categorize strong and weak acid bases.</li> <li>• Learn Ostwald's dilution law.</li> <li>• Derive Henderson Balch Hassel equation.</li> <li>• Explain the role of buffer solutions in controlling of pH.</li> <li>• Understand spontaneity of reactions.</li> <li>• Know reversible/irreversible processes and PV work.</li> <li>• Understand first and second laws of thermodynamics.</li> <li>• Work out change in enthalpy, entropy and Gibbs' functions in physical and chemical transformations.</li> <li>• Apply Hess's Law in thermochemical equations.</li> <li>• State what are strong and weak electrolytes.</li> <li>• Define Kohlrausch law and state its importance.</li> <li>• Understand functioning of electrolytic and galvanic cells. Write half cell reactions there in.</li> <li>• Describe type of electrodes.</li> <li>• Derive Nernst equation and understand its importance.</li> <li>• Know what are dry cell, lead strong batteries and fuel cells.</li> <li>• Describe the electrochemical series and its implications.</li> <li>• Define average and instantaneous rate, order and molecularity in kinetics</li> <li>• Formulate differential and integral rate laws for zero and first order reactions.</li> <li>• Understand basis of collision theory of reaction rates</li> <li>• Sketch qualitatively potential energy curve. Understand acceleration of reactions in the presence of catalyst.</li> <li>• Solve relevant numerical problems.</li> </ul>
<b>Inorganic chemistry</b>	<ul style="list-style-type: none"> <li>• Write electronic configuration of groups 16, 17, 18 and those of d and f blocks.</li> <li>• Correlate atomic properties of elements with electron configuration.</li> <li>• Explain the anomalous behaviour of 'O' and 'F'.</li> <li>• Understand allotropy in 'O' and 'S'.</li> <li>• Draw structures of oxyacids of 'sulfur' and 'halogens'.</li> <li>• Write reactions for preparation, chemical properties of O<sub>2</sub>, O<sub>3</sub>, SO<sub>2</sub>, H<sub>2</sub>SO<sub>4</sub>, Cl<sub>2</sub>, HCl, KMnO<sub>4</sub>, K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>.</li> <li>• Draw structures of interhalogen and xenon compounds and illustrate their properties. State the methods of preparation with reaction.</li> <li>• Know chemistry of the elements belonging to groups 16, 17, 18.</li> <li>• Understand the principles of metallurgy in extraction of iron.</li> <li>• Compare lanthanoides and actinoides.</li> <li>• Enlist properties of the manmade post actinoide elements.</li> <li>• Understand Werner theory of coordination compounds.</li> <li>• Understand and apply EAN rule for stability of coordination compounds.</li> <li>• Understand diverse isomerism in coordination compounds.</li> <li>• Use the concept of hybridization for predicting structures and magnetic behaviour of complexes based on the V.B.T.</li> <li>• Understand C.F.T. Sketch qualitatively d-orbital splitting diagrams in octahedral and tetrahedral ligand field environments.</li> <li>• Distinguish between high spin and low spin complexes.</li> <li>• Predict structure, colour and magnetic properties of the complexes based on the C.F.T.</li> </ul>

<b>Organic Chemistry</b>	<ul style="list-style-type: none"> <li>• State common and IUPAC names of compounds and methods of preparation of halogen derivatives, alcohols, phenols, ethers, aldehydes, ketones, carboxylic acid and amines.</li> <li>• Understand structure, chemical properties, laboratory tests and reactions of the above functional groups.</li> <li>• Explain acid or base strength of alcohols, phenols, carboxylic acids and amines.</li> <li>• Explain trends in boiling point and solubility of compounds of above functional groups in terms of intermolecular forces.</li> <li>• Understand optical activity, recognize chiral molecules and represent with Fischer projection and wedge formulae.</li> <li>• Understand mechanism of nucleophilic substitution reactions and influencing factors.</li> </ul>
<b>Applied Chemistry</b>	<ul style="list-style-type: none"> <li>• Classify carbohydrates, amino acids, nucleic acids.</li> <li>• Represent monosaccharides using the Fischer projection formula.</li> <li>• Represent monosaccharides, disaccharides and polysaccharides using the Haworth formula.</li> <li>• Correlate properties of carbohydrates to the presence or absence of potential aldehyde group.</li> <li>• Learn four level structure of proteins and primary structures nucleic acid.</li> <li>• Represent primary structure of dipeptide and tripeptide from data on the terminals.</li> <li>• Understand enzyme catalysis and double strand DNA structure.</li> <li>• Understand classification of polymers on the basis of source, structure, intermolecular forces, polymerization, number of monomers and biodegradability.</li> <li>• Understand addition and condensation polymerization.</li> <li>• Know properties, structure and preparation of natural rubber, vulcanized rubber, Buna-S, viscose, LDP, HDP, teflon, polyacrylo nitrile, polyamide, polyesters, phenol-formaldehyde resin and PHBV.</li> <li>• Understand scope of green chemistry with reference to sustainable development.</li> <li>• Recognize twelve principles of green chemistry and their implementation.</li> <li>• Correlate the Chemistry knowledge gained so far as pro or counter to the principles of green chemistry.</li> <li>• Understand scope and applications of nanochemistry.</li> <li>• Gain knowledge of a synthetic method and properties of nanoparticles.</li> <li>• Know instrumental techniques for characterization of nanomaterials.</li> </ul>

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