Chemistry

Part II

Textbook for Class XII

12086

विद्यया ऽमृतमश्नुते

एन सी ई आर टी
NCERT

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

2019-20

ISBN 81-7450-648-9 (Part I)
81-7450-716-7 (Part II)

First Edition
April 2007 Chaitra 1929

Reprinted
November 2007 Kartika 1929
December 2008 Pausa 1930
January 2010 Magha 1931
January 2011 Magha 1932
January 2012 Magha 1933
November 2012 Kartika 1934
November 2013 Kartika 1935
December 2014 Pausa 1936
December 2015 Pausa 1937
February 2017 Magha 1938
February 2018 Magha 1939
January 2019 Pausa 1940

PD 400T RPS

OFFICES OF THE PUBLICATION DIVISION, NCERT

NCERT Campus
Sri Aurobindo Marg
New Delhi 110 016 **Phone : 011-26562708**

108, 100 Feet Road
Hosdakere Halli Extension
Banashankari III Stage
Bengaluru 560 085 **Phone : 080-26725740**

Navjivan Trust Building
P.O.Navjivan
Ahmedabad 380 014 **Phone : 079-27541446**

CWC Campus
Opp. Dhankal Bus Stop
Panihati
Kolkata 700 114 **Phone : 033-25530454**

CWC Complex
Maligaon
Guwahati 781 021 **Phone : 0361-2674869**

₹ 130.00

Publication Team

Head, Publication Division	:	*M. Siraj Anwar*
Chief Editor	:	*Shveta Uppal*
Chief Business Manager	:	*Gautam Ganguly*
Chief Production Officer	:	*Arun Chitkara*
Assistant Editor	:	*R.N. Bhardwaj*
Production Assistant	:	*Sunil Kumar*

Cover and Layout
Blue Fish

Printed on 80 GSM paper with NCERT watermark

Published at the Publication Division by the Secretary, National Council of Educational Research and Training, Sri Aurobindo Marg, New Delhi 110 016 and printed at Arun Packers & Printers, C-36, Lawrence Road Industrial Area, Delhi - 110 035

FOREWORD

The National Curriculum Framework (NCF), 2005 recommends that children's life at school must be linked to their life outside the school. This principle marks a departure from the legacy of bookish learning which continues to shape our system and causes a gap between the school, home and community. The syllabi and textbooks developed on the basis of NCF signify an attempt to implement this basic idea. They also attempt to discourage rote learning and the maintenance of sharp boundaries between different subject areas. We hope these measures will take us significantly further in the direction of a child-centred system of education outlined in the National Policy on Education (1986).

The success of this effort depends on the steps that school principals and teachers will take to encourage children to reflect on their own learning and to pursue imaginative activities and questions. We must recognise that, given space, time and freedom, children generate new knowledge by engaging with the information passed on to them by adults. Treating the prescribed textbook as the sole basis of examination is one of the key reasons why other resources and sites of learning are ignored. Inculcating creativity and initiative is possible if we perceive and treat children as participants in learning, not as receivers of a fixed body of knowledge.

These aims imply considerable change in school routines and mode of functioning. Flexibility in the daily time-table is as necessary as rigour in implementing the annual calender so that the required number of teaching days are actually devoted to teaching. The methods used for teaching and evaluation will also determine how effective this textbook proves for making children's life at school a happy experience, rather than a source of stress or boredom. Syllabus designers have tried to address the problem of curricular burden by restructuring and reorienting knowledge at different stages with greater consideration for child psychology and the time available for teaching. The textbook attempts to enhance this endeavour by giving higher priority and space to opportunities for contemplation and wondering, discussion in small groups, and activities requiring hands-on experience.

The National Council of Educational Research and Training (NCERT) appreciates the hard work done by the textbook development committee responsible for this book. We wish to thank the Chairperson of the advisory group in science and mathematics, Professor J.V. Narlikar and the Chief Advisor for this book, Professor B. L. Khandelwal for guiding the work of this committee.

Several teachers contributed to the development of this textbook; we are grateful to their principals for making this possible. We are indebted to the institutions and organisations which have generously permitted us to draw upon their resources, material and personnel. As an organisation committed to systemic reform and continuous improvement in the quality of its products, NCERT welcomes comments and suggestions which will enable us to undertake further revision and refinement.

Director
National Council of Educational
Research and Training

New Delhi
20 November 2006

PREFACE

Chemistry has made a profound impact on the society. It is intimately linked to the well-being of human kind. The rate of advancements in chemistry is so high that curriculum developers continuously look for strategies to cope with these advancements. Also, the students have to be inspired to be the future leaders who would make fundamental contributions. The present textbook is a sincere effort in this direction.

The textbook, presented in two parts, comprises of sixteen Units. Although the titles of various Units indicate a sort of compartmentalisation into physical, inorganic and organic chemistry, readers will find that these sub-disciplines have been intermingled, at least to a certain extent, to have a unified approach to the subject. First nine Units covering physical and inorganic chemistry portions are included in Part I while organic chemistry portion comprising of seven Units is included in Part II of the book. The approach of presentation of the subject matter discourages students from rote memorisation. The subject has in fact, been organised around the laws and principles of chemistry. As students master these laws and principles, they will soon get to the point where they can predict much of what will come.

Efforts have been directed towards making the subject stimulating and exciting by references to the historical developments and its usefulness to our lives, wherever appropriate. The text is well illustrated with examples from surrounding environment to facilitate grasping of the qualitative and quantitative aspects of the concept easily. Physical data are given in SI units throughout the book to make comparison of various properties easier. IUPAC system of nomenclature has been followed along with the common names. Structural formulae of chemical compounds showing functional/coordinating groups in different colours are drawn using electronic system. Each Unit has a good number of examples, as illustrations, with their solutions and some intext questions, the answers of some of which are given at the end of the Unit. The end of Unit exercises are designed to apply important principles and provoke thinking process to solve them. Answers of some of these exercises are given at the end of the book.

A variety of materials, e.g., biographical sketches of some scientists, additional information related to a particular topic, etc., is given in boxes with a deep yellow coloured bar. This boxed material with a 'deep yellow bar' is to bring additional life to the topic. However, it is non-evaluative. The structures of some of the more complex compounds incorporated in the book are for understanding their chemistry. As their reproduction would lead to memorisation, it is also a non-evaluative portion of the text.

The information part has been significantly reduced and, wherever possible, it has been substantiated with facts. However, it is necessary for students to be aware of commercially important chemicals, their processes of manufacture and sources of raw materials. This leads to descriptive material in the book. Attempts have been made to make descriptions of such compounds interesting by considering their structures and reactivity. Thermodynamics, kinetics and electrochemical aspects have been applied to a few chemical reactions which should be beneficial to students for understanding why a particular reaction happened and why a particular property is exhibited by the product. There is currently great awareness of environmental and energy issues which are directly related to chemistry. Such issues have been highlighted and dealt with at appropriate places in the book.

A team of experts constituted by the NCERT has developed the manuscript of the book. It gives me great pleasure to acknowledge the valuable contribution of all the members of this team. I also acknowledge the valuable and relentless contribution of the editors in bringing the book to the present shape. I also acknowledge with thanks the dedicated efforts and valuable contribution of Professor Brahm Parkash, who not only coordinated the entire programme but also actively involved in writing and editing of this book. Thanks are also due to the participating teachers and subject experts of the review workshop for their contribution, which has helped us to make the book learner friendly. Also, I thank the technical and administrative staff of the NCERT for their support in the entire process.

The team of this textbook development programme hopes that the book stimulates its readers and makes them feel the excitement and fascination for this subject. Efforts have been made to bring out this book error-free. Nevertheless, it is recognised that in a book of this complexity, there could inevitably be occasional errors. It will always be a pleasure to hear about them from readers to take necessary steps to rectify them.

B.L. KHANDELWAL

TEXTBOOK DEVELOPMENT COMMITTEE

CHAIRMAN, ADVISORY GROUP FOR TEXTBOOKS IN SCIENCE AND MATHEMATICS

J.V. Narlikar, *Professor Emeritus*, *Chairman*, Advisory Committee, Inter University Centre for Astronomy and Astrophysics (IUCAA), Ganeshkhind, Pune University Campus, Pune

CHIEF ADVISOR

B.L. Khandelwal, *Professor*, *Director*, Disha Institute of Management and Technology, Raipur, Chhattisgarh. Formerly *Chairman*, Department of Chemistry, Indian Institute of Technology, New Delhi

MEMBERS

A.S. Brar, *Professor*, Department of Chemistry, Indian Institute of Technology, New Delhi

A.Q. Contractor, *Professor*, Department of Chemistry, Indian Institute of Technology, Powai, Mumbai

Alka Mehrotra, *Reader*, DESM, NCERT, New Delhi

Anjni Koul, *Lecturer*, DESM, NCERT, New Delhi

Brahm Parkash, *Professor*, DESM, NCERT, New Delhi

I.P. Agarwal, *Professor*, DESM, Regional Institute of Education, NCERT, Bhopal, M.P.

K.K. Arora, *Reader*, Department of Chemistry, Zakir Hussain College, University of Delhi, New Delhi

K.N. Upadhayaya, *Head* (Retired), Department of Chemistry, Ramjas College, Delhi University, Delhi

Kavita Sharma, *Lecturer*, DEE, NCERT, New Delhi

M.P. Mahajan, *Professor*, Department of Chemistry, Guru Nanak Dev University, Amritsar, Punjab

M.L. Agarwal, *Principal* (Retired), Kendriya Vidyalaya, Jaipur, Rajasthan

Puran Chand, *Professor*, *Joint Director* (Retired), CIET, NCERT, New Delhi

R.A. Verma, *Vice Principal*, Shaheed Basant Kumar Biswas Sarvodaya Vidyalaya, Civil Lines, New Delhi

R.K. Verma, *Professor*, Department of Chemistry, Magadh University, Bihar

R.K. Prashar, *Lecturer*, DESM, NCERT, New Delhi

R.S. Sindhu, *Professor*, DESM, NCERT, New Delhi

S.K. Gupta, *Reader*, School of Studies in Chemistry, Jiwaji University, Gwalior, M.P.

S.K. Dogra, *Professor*, Dr B.R. Ambedkar Centre for Biomedical Research, University of Delhi, Delhi

Sarabjeet Sachdeva, *PGT*, (Chemistry), St. Columbas School, New Delhi

S. Badhwar, *Lecturer*, The Daly College, Indore, M.P.

V.N. Pathak, *Professor*, Department of Chemistry, University of Rajasthan, Jaipur, Rajasthan

Vijay Sarda, *Reader*, Department of Chemistry, Zakir Hussain College, University of Delhi, New Delhi

V.K. Verma, *Professor*, (Retired), Institute of Technology, Banaras Hindu University, Varanasi, U.P.

V.P. Gupta, *Professor*, DESM, Regional Institute of Education, NCERT, Bhopal, M.P.

MEMBER-COORDINATOR

Brahm Parkash, *Professor*, DESM, NCERT, New Delhi

ACKNOWLEDGMENTS

The National Council of Educational Research and Training (NCERT) gratefully acknowledges the valuable contributions of the individuals and organisations involved in the development of Chemistry textbook for Class XII. The acknowledgements are also due to the following practicing teachers and subject experts for reviewing the draft manuscript and giving useful suggestions for its improvement in a workshop: Dr D.S. Rawat, Department of Chemistry, University of Delhi, Delhi; Dr Mahendra Nath, *Reader,* Chemistry Department, University of Delhi, Delhi; Dr Sulekh Chandra, *Reader,* Zakir Hussain College, New Delhi; Ms Ameeta K., *PGT* (Chemistry), Vidyalaya No. 3, Patiala Cantt (Pb.); Dr G.T. Bhandge, *Professor* and *Head,* DESM, Regional Institute of Education, Mysore; Dr Neeti Misra, *Senior Lecturer,* Department of Chemistry, Acharya Narendra Dev College, New Delhi; Dr S.P.S. Mehta, Department of Chemistry, Kumaun University, Nainital (UA); Dr N.V.S. Naidu, *Assistant Professor* (Chemistry), SVU College of Mathematics and Physical Sciences, S.V. University, Tirupati (A.P.); Dr A.C. Handa, Hindu College, Delhi University, Delhi; Dr A.K. Vashishtha, G.B.S.S.S. Jafrabad, Delhi; Dr Charanjit Kaur, *Head,* Department of Chemistry, Sri Sathya Sai College for Women, Bhopal, P.O. Habibganj; Ms Alka Sharma, *PGT* (Chemistry), S.L.S. DAV Public School, Mausam Vihar, Delhi; Dr H.H. Tripathy, *Reader* (Retired), Regional Institute of Education, Bhubaneswar; Shri C.B. Singh, *PGT* (Chemistry), Kendriya Vidyalaya No. 2, Delhi Cantt, Delhi; and Dr Sunita Hooda, Acharya Narendra Dev College, Delhi University, New Delhi.

The Council also thanks Professor B.L. Khandelwal, Professor Brahm Parkash, Dr K.K. Arora, Dr Vijay Sarda and Professor R.S. Sindhu, members of the Textbook Development Committee for editing the manuscript and bringing it to the present shape.

The Council also acknowledges the contributions of Shri Vijay Singh, Narender Verma and Vijay Kaushal *DTP Operators and* Dr K.T. Chitralekha, *Copy Editor* in shaping this book. The efforts of the Publication Department, NCERT are also duly acknowledged.

Contents of Chemistry Part I

CONTENTS