



SCIENCE

TEXTBOOK FOR CLASS X



1064

विद्यया ऽ मृतमश्नुते



एन सी ई आर टी
NCERT

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

1064 – SCIENCE

Textbook for Class X

ISBN 81-7450-636-5

First Edition

December 2006 *Agrahayana 1928*

Reprinted

November 2007 *Kartika 1929*

January 2009 *Pausa 1930*

December 2009 *Pausa 1931*

November 2010 *Kartika 1932*

January 2012 *Magha 1933*

November 2012 *Kartika 1934*

October 2013 *Asvina 1935*

December 2014 *Pausa 1936*

December 2015 *Agrahayana 1937*

February 2017 *Magha 1938*

January 2018 *Pausa 1939*

January 2019 *Pausa 1940*

August 2019 *Bhadrapada 1941*

January 2021 *Pausa 1942*

November 2021 *Agrahayana 1943*

PD 610T RSP

© **National Council of Educational
Research and Training, 2006**

₹ **190.00**

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 India
Offset Printers Pvt. Ltd., B-20/1, Okhla
Industrial Area, Phase-II, New Delhi 110020

ALL RIGHTS RESERVED

- No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior permission of the publisher.
- This book is sold subject to the condition that it shall not, by way of trade, be lent, re-sold, hired out or otherwise disposed of without the publisher's consent, in any form of binding or cover other than that in which it is published.
- The correct price of this publication is the price printed on this page. Any revised price indicated by a rubber stamp or by a sticker or by any other means is incorrect and should be unacceptable.

**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

Publication Team

Head, Publication Division : *Anup Kumar Rajput*

Chief Editor : *Shveta Uppal*

Chief Production Officer : *Arun Chitkara*

Chief Business Manager : *Vipin Dewan*

Production Assistant : *Sunil Kumar*

Cover, Layout and Illustrations

Digital Expressions

F O R E W O R D

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 calendar 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 team responsible for this book. We wish to thank the Chairman of the advisory group in science and mathematics, Professor J.V. Narlikar and the Chief Advisor for this book, Professor Rupamanjari Ghosh, School of Physical Sciences, Jawaharlal Nehru University, New Delhi, for guiding the work of this committee. Several teachers contributed to the development of this textbook; we are grateful to them and 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. We are especially grateful to the members of

the National Monitoring Committee, appointed by the Department of Secondary and Higher Education, Ministry of Human Resource Development under the Chairmanship of Professor Mrinal Miri and Professor G.P. Deshpande, for their valuable time and contribution. 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.

New Delhi
20 November 2006

Director
National Council of Educational
Research and Training

© NCERT
not to be republished

P R E F A C E

This textbook of Science for Class X is a continuation of our attempt in the Class IX Science textbook to comply with the guidelines of the National Curriculum Framework-2005. We had to work within a limited time frame and also had our own constraints coming in the way of this radical change. The revised and re-structured syllabus for Class X covers selected topics in the broad themes of — Materials, The World of the Living, How Things Work, Natural Phenomena and Natural Resources. We have interpreted the syllabus to present a coherent coverage of scientific concepts related to our daily life on the select topics. It is an integrated approach to science at this level, with no sharp divisions into disciplines such as Physics, Chemistry, Biology and Environmental Science.

There has been a conscious attempt to address the relevant social concerns in this science textbook wherever possible — the concerns for people with special needs, the issues of gender discrimination, energy and environment have found their natural place in this book. Students have been encouraged to get into the debates on some of the management concerns (for sustainable development, for example) so that they can arrive at their own decisions after a scientific analysis of all the facts.

This book has some features which are meant to enhance its effectiveness. The theme of each chapter has been introduced with examples from daily life, and if possible, by a relevant activity that the students have to perform. The entire approach of the book is, in fact, activity-based, i.e., the students are required to construct knowledge themselves from these activities. The emphasis is not on definitions and technical terms, but on the concepts involved. Special care has been taken so that the rigour of science is not lost while simplifying the language. Difficult and challenging ideas, which are not to be covered at this stage, have often been placed as extra material in the boxes in light orange. The excitement of doing science comes from pursuing the unknown — the students would have the opportunity to think and explore somewhat beyond the syllabus and may feel the urge to continue their scientific expedition at higher levels. All such box items, including brief biography of scientists, are, of course, non-evaluative.

Solved examples are provided, wherever felt necessary, to clarify a concept. The in-text questions after a main section are for the students to check their understanding of the topic. At the end of each chapter, there is a quick review of the important points covered in the chapter. We have introduced some multiple choice questions in the exercises. There are problems of different difficulty levels answers to the multiple-choice questions and numericals, and hints for the difficult questions are included at the end of the book.

This book has been made possible because of the active participation of many people. I wish to thank Professor Krishna Kumar, *Director*, NCERT, Prof. G. Ravindra, *Joint Director*, NCERT, and Professor Hukum Singh, Head, Department of Education in Science and Mathematics, NCERT, specially for their keen interest in the development of the book and for all the administrative support. I wish to put on record my sincere appreciation for Dr Anjni Koul, the member-coordinator of the textbook development committee, for her extraordinary commitment and efficiency. It has been a real pleasure working with my textbook development team and the review committee. The chosen editorial team worked extremely hard, on tight deadlines, to bring the book close to the shape that we dreamt of. Fruitful discussions with some members of the MHRD Monitoring Committee helped in providing the final touches to the book. I do not have the words to acknowledge the professional and personal inputs I received from some of my close friends during the preparation of this book. We warmly welcome comments and suggestions for improvement from our readers.

RUPAMANJARI GHOSH
Professor of Physics
School of Physical Sciences
Jawaharlal Nehru University
New Delhi

TEXTBOOK DEVELOPMENT COMMITTEE

CHAIRMAN, ADVISORY GROUP FOR TEXTBOOKS IN SCIENCE AND MATHEMATICS

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

CHIEF ADVISOR

Rupamanjari Ghosh, *Professor*, School of Physical Sciences, Jawaharlal Nehru University, New Delhi

MEMBERS

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

Animesh K. Mohapatra, *Reader*, Regional Institute of Education, Ajmer

B.B. Swain, *Professor (Retd.)*, Department of Physics, Utkal University, Orissa

B.K. Sharma, *Professor*, DESM, NCERT, New Delhi

B.K. Tripathi, *Reader*, DESM, NCERT, New Delhi

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

Charu Maini, *PGT*, Salwan Public School, Gurgaon, Haryana

Dinesh Kumar, *Reader*, DESM, NCERT, New Delhi

Gagan Gupta, *Reader*, DESM, NCERT, New Delhi

H.L. Satheesh, *TGT*, DM School, Regional Institute of Education, Mysore

Ishwant Kaur, *PGT*, DM School, Regional Institute of Education, Bhopal

J.D. Arora, *Reader*, Hindu College, Moradabad, Uttar Pradesh

Meenambika Menon, *TGT*, Cambridge School, Noida, Uttar Pradesh

Puran Chand, *Professor and Jt. Director (Retd.)*, Central Institute of Educational Technology
NCERT, New Delhi

Reeta Sharma, *Reader*, Regional Institute of Education, Bhopal

R.P. Singh, *Lecturer*, Rajkiya Pratibha Vikas Vidyalaya, Kishan Ganj, Delhi

Satyajit Rath, *Scientist*, National Institute of Immunology, JNU Campus, New Delhi

S.K. Dash, *Reader*, Regional Institute of Education, Bhubaneswar

Sunita Ramrakhiani, *PGT*, Ahlcon Public School, Delhi

Uma Sudhir, *Eklavya*, Indore, Madhya Pradesh

Vandana Saxena, *TGT*, Kendriya Vidyalaya-4, Kandhar Lines, Delhi Cantt., New Delhi

Vinod Kumar, *Reader*, Hans Raj College, Delhi University, Delhi

MEMBER-COORDINATOR

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

ACKNOWLEDGEMENTS

The National Council of Educational Research and Training (NCERT), besides expressing its gratefulness towards the members of the Textbook Development Committee for their contribution in the development of the Science Textbook for Class X, also acknowledges the contribution of the following members for reviewing, editing, refining, and finalisation of the manuscript of the book. Kanhiya Lal, *Principal* (Retd.), Directorate of Education, NCT, Delhi; Ranveer Singh, *Lecturer*, Sarvodaya Bal Vidyalaya, Timarpur, Delhi; Bharat Poorey, *Professor* (Retd.), Govt. Post Graduate College, Indore; Gagandeep Bajaj, *Lecturer*, S.P.M. College, Delhi University, Delhi; Ravinder Kaur, *TGT*, Kendriya Vidyalaya, Rohini, Delhi; Renu Puri, *TGT*, N.C. Jindal Public School, New Delhi; Sarita Kumar, *Reader*, Acharya Narendra Dev College, Delhi University, Delhi; Shashi Prabha, *Lecturer*, DESM, NCERT, Delhi; Rashmi Sharma, *Lecturer*, NERIE, Shillong; Sushma Jaireth, *Reader*, DWS, NCERT, New Delhi; Y.P. Purang, Addl. Director of Education (Retd.), NCT, Delhi; Neeta Agarwal, *TGT*, D.L.D.A.V. Model School, Pitampura, Delhi; Roma Anand, *TGT*, D.L.D.A.V., Pitampura, Delhi; Veer Pal Singh, *Reader*, DEME, NCERT, New Delhi and S.L. Varte, *Lecturer*, DESM, NCERT, New Delhi.

The Council also acknowledges the valuable contribution of Sunita Farkya (*Professor*, DESM), Pushplata Verma (*Assistant Professor*, DESM), K.C. Tripathi (*Professor*, DEL) and Jatindra Mohan Misra (*Professor*, DEL) in updating Chapter 16 titled "Sustainable Management of Natural Resources", and also in the review of this textbook.

The contribution of R.S. Sindhu, *Professor* (Retd.), DESM; V.P. Srivastava, *Professor* (Retd.), DESM; R.K. Parashar, Rachna Garg (*Professors*, DESM); V.V. Anand, *Professor* (Retd.), RIE Mysore; S.V. Sharma (*Professor*, RIE Mysore); V.P. Singh (*Professor*, RIE Ajmer); R. Joshi, *Associate Professor* (Retd.), DESM; C.V. Shimray, Ruchi Verma (*Associate Professors*, DESM); Ram Babu Pareek (*Associate Professor*, RIE Ajmer); A.K. Srivastava, Rejaul Karim Barbhuiya, Pramila Tanwar (*Assistant Professors*, DESM); R.R. Koireng (*Assistant Professor*, DCS); V. Tangpu (*Assistant Professor*, RIE Mysore) and Akhileshwar Mishra (*Head Master*, DMS, RIE Bhubaneswar), in the review of this textbook in 2017-18 are acknowledged.

Special thanks are due to Hukum Singh, *Professor* and Former *Head*, DESM, NCERT, New Delhi, for providing all academic and administrative support.

The Council also gratefully acknowledges the support provided by the APC Office of DESM, administrative staff of DESM; Deepak Kapoor, *Incharge*, Computer Station, DESM; Saima and Arvind Sharma, *DTP Operators* and Rajesh Handa, *Illustrator*; Mohd. Qamar Tabrez and Musarrat Parveen, *Copy Editors*; Seema Yadav, *Proof Reader*. The efforts of the Publication Department, NCERT are also highly appreciated.

CONTENTS

<i>Foreword</i>		<i>iii</i>
<i>Preface</i>		<i>v</i>
Chapter 1	Chemical Reactions and Equations	1
Chapter 2	Acids, Bases and Salts	17
Chapter 3	Metals and Non-metals	37
Chapter 4	Carbon and its Compounds	58
Chapter 5	Periodic Classification of Elements	79
Chapter 6	Life Processes	93
Chapter 7	Control and Coordination	114
Chapter 8	How do Organisms Reproduce?	127
Chapter 9	Heredity and Evolution	142
Chapter 10	Light – Reflection and Refraction	160
Chapter 11	The Human Eye and the Colourful World	187
Chapter 12	Electricity	199
Chapter 13	Magnetic Effects of Electric Current	223
Chapter 14	Sources of Energy	242
Chapter 15	Our Environment	256
Chapter 16	Sustainable Management of Natural Resources	266
	Answers	281-282

CONTENTS

THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a ¹**[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 ²[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.**

1. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Unity of the Nation" (w.e.f. 3.1.1977)