

EXEMPLAR PROBLEMS IN PHYSICS

CLASS XII



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

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**OFFICES OF THE PUBLICATION
DEPARTMENT, NCERT**

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

108, 100 Feet Road
Hosdakere Halli Extension
Banashankari III Stage
Bangalore 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 : **Neerja Shukla**
Department

Chief Production : **Shiv Kumar**
Officer

Chief Editor : **Shveta Uppal**

Chief Business : **Gautam Ganguly**
Manager

Assistant Editor : **R.N. Bhardwaj**

Assistant Production : **Atul Saxena**
Officer

Cover Design

Shweta Rao

FOREWORD

The National Curriculum Framework (NCF)–2005 initiated a new phase of development of syllabi and textbooks for all stages of school education. Conscious efforts have been made to discourage rote learning and to diffuse sharp boundaries between different subject areas. This is well in tune with the National Policy on Education (NPE)–1986 and *Learning Without Burden*–1993 that recommend child centred system of education. The textbooks for Classes IX and XI were released in 2006 and for Classes X and XII in 2007. Overall the books have been well received by students and teachers.

NCF–2005 notes that treating the prescribed textbooks as the sole basis of examination is one of the key reasons why other resources and sites of learning are ignored. It further reiterates that the methods used for teaching and evaluation will also determine how effective these textbooks prove for making children's life at school a happy experience, rather than source of stress or boredom. It calls for reform in examination system currently prevailing in the country.

The position papers of the National Focus Groups on *Teaching of Science*, *Teaching of Mathematics* and *Examination Reform* envisage that the physics question papers, set in annual examinations conducted by the various Boards do not really assess genuine understanding of the subjects. The quality of questions papers is often not up to the mark. They usually seek mere information based on rote memorisation, and fail to test higher-order skills like reasoning and analysis, let alone lateral thinking, creativity, and judgment. Good unconventional questions, challenging problems and experiment-based problems rarely find a place in question papers. In order to address the issue, and also to provide additional learning material, the Department of Education in Science and Mathematics (DESM) has made an attempt to develop resource book of exemplar problems in different subjects at secondary and higher secondary stages. Each resource book contains different types of questions of varying difficulty level. Some questions would require the students to apply simultaneously understanding of more than one chapters/units. These problems are not meant to serve merely as question bank for examinations but are primarily meant to improve the quality of teaching/learning process in schools. It is expected that these problems would encourage teachers to design quality questions on their own. Students and teachers should always keep in mind that examination and assessment should test comprehension, information recall, analytical thinking and problem- solving ability, creativity and speculative ability.

A team of experts and teachers with an understanding of the subject and a proper role of examinations worked hard to accomplish this task. The material was discussed, edited, and finally included in this resource book.

National Council of Educational Research and Training (NCERT) would welcome suggestions from students, teachers and parents which would help us to further improve the quality of material in subsequent editions.

New Delhi
21 May 2008

Yash Pal
Chairperson
National Steering Committee
National Council of Educational
Research and Training

PREFACE

The Department of Education in Science and Mathematics (DESM), National Council of Educational Research and Training (NCERT), initiated the development of 'Exemplar Problems' in science and mathematics for secondary and higher secondary stages after completing the preparation of textbooks based on National Curriculum Framework (NCF)–2005.

The main objective of the book on 'Exemplar Problems in Physics' is to provide the teachers and students a large number of quality problems with varying cognitive levels to facilitate teaching/learning of concepts in physics that are presented through the textbook for Class XII. It is envisaged that the problems included in this volume would help the teachers to design tasks to assess effectiveness of their teaching and to know about the achievement of their students besides facilitating preparation of balanced question papers for unit and terminal tests. The feedback based on the analysis of students' responses may help the teachers in further improving the quality of classroom instructions. In addition, the problems given in this book are also expected to help the teachers to perceive the basic characteristics of good quality questions and motivate them to frame similar questions on their own. Students can benefit themselves by attempting the exercises given in the book for self assessment and also in mastering the basic techniques of problem solving. Some of the questions given in the book are expected to challenge the understanding of the concepts of physics of the students and their ability to applying them in novel situations.

The problems included in this book were prepared through a series of workshops organised by the DESM for their development and refinement involving practicing teachers, subject experts from universities and institutes of higher learning, and the members of the physics group of the DESM whose names appear separately. We gratefully acknowledge their efforts and thank them for their valuable contribution in our endeavour to provide good quality instructional material for the school system.

I express my gratitude to Professor Krishna Kumar, *Director and* Professor G.Ravindra, *Joint Director*, NCERT for their valuable motivation and guidance from time to time. Special thanks are also due to Dr V.P.Srivastava, *Reader*, DESM for coordinating the programme, taking pains in editing and refinement of problems and for making the manuscript pressworthy.

We look forward to feedback from students, teachers and parents for further improvement of the contents of this book.

Hukum Singh
Professor and Head, DESM
National Council of Educational
Research and Training

DEVELOPMENT TEAM

MEMBERS

A.W.Joshi, *Professor (Rtd)*, Department of Physics, University of Pune, Pune

Aprajita, *PGT (Physics)*, Kendriya Vidyalaya No.3, Delhi Cantt, New Delhi

Atul Mody, *Lecturer (SG)*, Department of Physics, VES College of Arts, Science and Commerce, Chembur, Mumbai

B.K.Sharma, *Professor (Rtd)*, Department of Education in Science and Mathematics, NCERT, New Delhi

Gagan Gupta, *Reader*, Department of Education in Science and Mathematics, NCERT, New Delhi

H.S.Mani, *Raja Ramanna Fellow*, Institute of Mathematical Sciences, Chennai.

Kiran Nayak, *PGT (Physics)*, Apeejay School, Pitampura, New Delhi

M.A.H.Ahsan, *Lecturer*, Department of Physics, Jamia Millia Islamia, New Delhi

P. Arun, *Reader*, SGTB Khalsa College, University of Delhi, Delhi

Pragya Nopany, *PGT (Physics)*, Birla Vidya Niketan, Pushpa Vihar, New Delhi

Pushpa Tyagi, *PGT (Physics)*, Sanskriti School, Chanakya Puri, New Delhi

Ravi Bhattacharjee, *Reader*, SGTB Khalsa College, University of Delhi, Delhi

R. Joshi, *Lecturer (SG)*, Department of Education in Science and Mathematics, NCERT, New Delhi

S.Rai Choudhury, *Raja Ramanna Fellow*, Centre for Theoretical Physics, Jamia Millia Islamia, New Delhi

S.D.Joglekar, *Professor*, Department of Physics, I.I.T., Kanpur

Shashi Prabha, *Lecturer*, Department of Education in Science and Mathematics, NCERT, New Delhi

Suchitra Basu Kasturi, *PGT (Physics)*, Sardar Patel Vidyalaya, Lodi Estate, New Delhi

MEMBER-COORDINATOR

V.P.Srivastava, *Reader*, Department of Education in Science and Mathematics, NCERT, New Delhi

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The contribution of the Publication Department in bringing out this book is duly acknowledged.

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- I have the Right to a good education, and everyone has the Responsibility to encourage all children to go to school. (Article 28,29,23)
- I have the Right to be loved and protected from harm and abuse, and everyone has the Responsibility to love and care for others. (Article 19)
- I have the Right to be included whatever my abilities, and everyone has the Responsibility to respect others for their differences. (Article 23)
- I have the Right to be proud of my heritage and beliefs, and everyone has the Responsibility to respect the culture and belief of others. (Article 29,30)
- I have the Right to a safe and comfortable home and everyone has the Responsibility to make sure all children have homes. (Article 27)
- I have the Right to make mistakes, and everyone has the Responsibility to accept we can learn from our mistakes. (Article 28)
- I have the Right to be well fed, and everyone has the Responsibility to prevent people from starving. (Article 24)
- I have the Right to a clean environment, and everyone has the Responsibility not to pollute it. (Article 29)
- I have the Right to live without violence (verbal, physical, emotional), and everyone has the Responsibility not to be violent to others. (Article 28,37)
- I have the Right to be protected from economic and sexual exploitation, and everyone has the Responsibility to ensure that no child is forced to work and is given a free and secure environment. (Article 32,34)

These rights and responsibilities are enshrined in the United Nations Convention on the Rights of the Child, 1989. It contains all the rights which children and young people have all over the world. The Government of India signed this document in 1992.

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