The National Council of Educational Research and Training (NCERT) is the apex body concerning all aspects of refinement of School Education. It has recently developed textual material in Chemistry for Higher Secondary stage which is based on the National Curriculum Framework (NCF)-2005. NCF recommends that children’s experience in school education must be linked to the life outside school so that learning experience is joyful and fills the gap between the experience at home and in community. It recommends to diffuse the sharp boundaries between different subjects and discourages rote learning. The recent development of syllabi and textual material is an attempt to implement this basic idea. The present Laboratory Manual will be complementary to the textbook of Chemistry for Class XII. It is in continuation to the NCERT’s efforts to improve upon comprehension of concepts and practical skills among students. The purpose of this manual is not only to convey the approach and philosophy of the practical course to students and teachers but to provide them appropriate guidance for carrying out experiments in the laboratory. The manual is supposed to encourage children to reflect on their own learning and to pursue further activities and questions. Of course the success of this effort also depends on the initiatives to be taken by the principals and teachers to encourage children to carry out experiments in the laboratory and develop their thinking and nurture creativity.

The methods adopted for performing the practicals and their evaluation will determine how effective this practical book will prove to make the children’s life at school a happy experience, rather than a source of stress and boredom. The practical book attempts to provide space to opportunities for contemplation and wondering, discussion in small groups, and activities requiring hands-on experience. It is hoped that the material provided in this manual will help students in carrying out laboratory work effectively and will encourage teachers to introduce some open-ended experiments at the school level.

New Delhi
21 May 2008
The development of the present laboratory manual is in continuation to the NCERT's efforts to improve upon comprehension of concepts and practical skills among the students. The present laboratory manual will be complementary to the textbook of Chemistry for Class XII.

The expansion of scientific knowledge and consequently the change in the system of education has led to the development of new methods of instructions. Today the stress is laid on the enquiry approach and discussion method instead of lecture method of teaching. Unfortunately, it is believed that study of chemistry means abstract thinking, writing long formulas and complex structures and handling complicated equipments. The reason behind such endeavour is that even well-endowed schools tend to give only the cosmetic importance to the laboratory work. Children’s natural spirit of inquiry is often not nurtured.

The new syllabus of practical work in chemistry has been designed to cater to the needs of pupil who are desirous of pursuing science further. The fundamental objective of this course is to develop scientific attitude and desired laboratory skills required at this level. The practical syllabus includes content based experiments, which help in comprehension of the concepts.

The project work is expected to provide thrill in learning chemistry. It is expected to serve the real purpose of practical work, which means inculcating the ability to design an experiment, to make observations methodically and to draw conclusions out of experimental data. The real purpose of practical work should be to enable the students to represent the outcome of experiments logically to conclusion, with genuine appreciation of it’s limitation.

For each practical work, brief theory, material required, procedure, precautions and the questions for discussion are given in the book. The questions are aimed at testing learner’s understanding of the related problems. However, teacher may provide help in case the problem is found to be beyond the capability of the learner. Precautions must be well understood by the learners before proceeding with the experiments and projects.

In order to provide some basic idea about the investigatory projects, a brief description of some investigatory projects is given in the book. However, this list is only suggested and not exhaustive. The students may select projects from subject area of chemistry, interdisciplinary areas or from the environment. While selecting a project, care should be taken to see that the facilities for carrying it out are available.

Appendices related to the chemical data and logarithmic tables are attached at the end of the book. International symbols for hazards and hazard warnings are given at several places in the book. It is expected that this will make the learners more careful about the environment and make them careful while dealing with the chemicals. Some non-evaluative learning material has been given in the boxes to provide interesting information related to the practical work.
It is a pleasure to express my thanks to all those who have been associated at various stages of development of this laboratory manual. It is hoped that this practical book will improve teaching learning process in chemistry to a great extent. The learners will be able to understand the subject well and will be able to apply the acquired knowledge in new situations. I acknowledge with thanks the dedicated efforts and valuable contribution of Dr Alka Mehrotra, Coordinator of this programme and other team members who contributed and finalised the manuscript. I especially thank Professor Krishna Kumar, Director, and Professor G. Ravindra, Joint Director, NCERT for their administrative support and keen interest in the development of this laboratory manual. I am also grateful to the participating teachers and subject experts who participated in the review workshop and provided their comments and suggestions which helped in the refinement of this manual and make it learner friendly. We warmly welcome comments and suggestions from our readers for further improvement of this manual.

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FOREWORD

PREFACE

UNIT-1: COLLOIDS

• To prepare (a) lyophilic sol; and (b) lyophobic sol
• To purify prepared sol by dialysis
• To study the role of emulsifying agents in stabilising the emulsions of different oils

UNIT-2: CHEMICAL KINETICS

• To study the effect of concentration and temperature variation respectively on the rate of reaction between sodium thiosulphate and hydrochloric acid
• To study the effect of variation in concentration of iodide ions on the rate of reaction of iodide ions with hydrogen peroxide at room temperature
• To study the rate of reaction between potassium iodate (KIO₃) and sodium sulphite (Na₂SO₃)

UNIT-3: THERMOCHEMICAL MEASUREMENT

• To determine the enthalpy of dissolution of copper sulphate/potassium nitrate
• To determine the enthalpy of neutralisation of a strong acid (HCl) with a strong base (NaOH)
• To determine the enthalpy change for the interaction between acetone and chloroform (hydrogen bond formation)

UNIT-4: ELECTROCHEMISTRY

• To study the variation in cell potential of the cell Zn/Zn²⁺ || Cu²⁺/Cu with change in concentration of electrolytes (CuSO₄/ZnSO₄) at room temperature

CONTENTS

iii
v
1
8
19
30
UNIT-5 : CHROMATOGRAPHY

- Separation of pigments present in the leaves (spinach) and flowers (rose, marigold) by paper chromatography and determination of Rf value of components
- Separation of the constituents of a mixture of inorganic compounds containing two cations, Pb2+ and Cd2+, using chromatographic technique

UNIT-6 : TITRIMETRIC ANALYSIS (Redox Reaction)

- To determine the concentration/molarity of KMnO4 solution by titrating it against a 0.1 M standard solution of oxalic acid
- To determine the concentration/molarity of KMnO4 solution by titrating it against standard solution of ferrous ammonium sulphate

UNIT-7 : SYSTEMATIC QUALITATIVE ANALYSIS

- To detect one cation and one anion in the given salt
- Systematic analysis of anions
- Preliminary tests with dilute sulphuric acid
- Confirmatory tests for anions of dilute sulphuric acid group
- Preliminary tests with concentrated sulphuric acid
- Confirmatory tests for anions of concentrated sulphuric acid group
- Tests for sulphate and phosphate
- Systematic analysis of cations
- Preliminary examination of salt for identification of cation
- Wet tests for identification of cations
- Analysis of Group-zero cation
- Analysis of Group-I cations
- Analysis of Group-II cations
- Analysis of Group-III cations
- Analysis of Group-IV cations
- Analysis of Group-V cations
- Analysis of Group-VI cations
- Specimen record of salt analysis
UNIT-8: Tests for Functional Groups in Organic Compounds

- Test for unsaturation
- Tests for alcoholic group
- Tests for phenolic group
- Tests for aldehydic and ketonic groups
- Tests for carboxyl group
- Tests for amino group

UNIT-9: Preparation of Inorganic Compounds

- To prepare double salts: ferrous ammonium sulphate (Mohr’s salt) and potash alum
- To prepare potassium trioxalatoferrate(III)

UNIT-10: Preparation of Organic Compounds

- To prepare acetanilide
- To prepare dibenzalacetone (Dibenzylideneacetone)
- To prepare p-nitroacetanilide
- To prepare phenyl-azo-β-naphthol (an azo dye)
- To prepare aniline yellow (p-amino-azobenzene)

UNIT-11: Tests for Carbohydrates, Fats and Proteins

- Tests for carbohydrates
- Test for oils and fats
- Tests for proteins

PROJECTS

APPENDICES
Do You Know?

According to the 86th Constitutional Amendment Act, 2002, free and compulsory education for all children in 6-14 year age group is now a Fundamental Right under Article 21-A of the Constitution.

EDUCATION IS NEITHER A PRIVILEGE NOR FAVOUR BUT A BASIC HUMAN RIGHT TO WHICH ALL GIRLS AND WOMEN ARE ENTITLED.

Give Girls Their Chance!