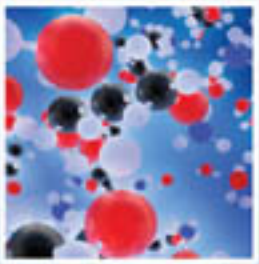
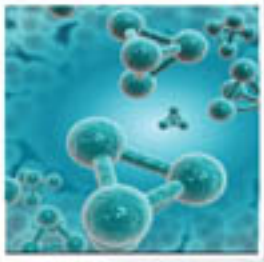
Revised Edition

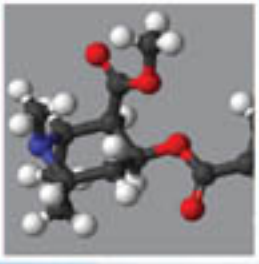
Saraswati

CHEMISTRY

X

R P Manchanda

NEW SARASWATI HOUSE

Strictly according to the latest syllabus prescribed by Central Board of Secondary Education, New Delhi

Saraswati

CHEMISTRY

[For Class X]

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CIN : U22110DL2013PTC262320
Import-Export Licence No. 0513086293

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Revised edition 2018

ISBN: 978-93-5272-401-7

Published by: New Saraswati House (India) Pvt. Ltd.
19 Ansari Road, Daryaganj, New Delhi-110002 (India)

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Printed at: Vikas Publishing House Pvt. Ltd., Sahibabad (Uttar Pradesh)

Product Code: NSS3SCH100CHEAC17CBN

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PREFACE

It gives me great pleasure in presenting the revised edition of **Saraswati Chemistry** in accordance with the **latest CBSE syllabus.** The book has been presented and designed strictly on the latest guidelines of **CBSE** to understand the basic principles of chemistry and apply them in solving problem.

Chemistry has made a strong impact in our lives. The rate of advancement in science is very fast. The young children must be aware of new developments in the field of science and technology and their applications. Students must be inspired to be future scientists, doctors, engineers who would make fundamental contribution to the progress of country.

The salient features of the book are:

- The book has been written in simple language as used by students.
- It covers each and every topic of the syllabus in detail.
- Diagrams are simple and fully illustrated.
- Systematic and coherent approach has been used in dealing with different topics with the help of experiments, illustrations and analogies.
- Instructional material has been prepared on the line of programmed learning approach maintaining the sequence of ideas and information needed by students.
- 'Learning Objectives' have been given so as to understand the expected learning outcome from the students.
- It has large number of 'Sample Questions' including all the textual questions (Intext and Exercise questions) and numerical problems of NCERT textbook with answers.
- Summary of chapters is given for quick revision covering each and every topic before solving questions of exercise.
- Exercises have variety of questions, such as Very Short Answer, Short Answer, Long Answer, Value Based, Practical Based Questions (Short Answer Type), Suggested Activities, etc., in each chapter.

I hope this book will develope an insight into fundamentals of chemistry and cultivate problem solving, critical thinking, scientific temper, spirit of inquiry and interest in chemistry.

I am thankful to New Saraswati House (India) Pvt. Ltd. for showing utmost faith in my capabilities and giving support whenever needed. I am thankful to my wife Mrs. Durgesh and my dearest son Shivanshu for helping me to write this book.

I shall be thankful if you kindly spare your precious time to give suggestions for improvement of this book.

—Author

SYLLABUS

General Instructions:

1. There will be an Annual examination based on entire syllabus.
2. The annual examination will be of 80 marks and 20 marks weightage shall be for internal assessment.
3. Out of 80 marks annual examination, 68 marks weightage shall be for theory and 12 marks weightage shall be for practical based questions.
4. For internal assessment
   (*a*) There will be three periodic tests conducted by the school. Average of the best two tests to be taken that will have a weightage of 10 marks towards the final result.
   (*b*) Practical/Laboratory work should be done throughout the year and the student should maintain record of the same. Practical Assessment should be continuous. There will be weightage of 5 marks towards the final result. All practicals listed in the syllabus must be completed.
   (*c*) Regularity, class work and home assignment completion along with neatness and upkeep of notebook will carry a weightage of 5 marks towards the final result.

COURSE STRUCTURE
(Annual Examination)
CLASS X

	Units	Marks
I.	Chemical Substances—Nature and Behaviour	25
II.	World of Living	23
III.	Natural Phenomena	12
IV.	Effects of Current	13
V.	Natural Resources	07
	TOTAL	**80**
	Internal assessment	**20**
	Grand Total	**100**

Note: Above weightage includes the weightage of questions based on practical skills.

Theme: Materials

Unit-I: Chemical Substances—Nature and Behaviour **(55 Periods)**

Chemical reactions: Chemical equation, Balanced chemical equation, implication of a balanced chemical equation, types of chemical reactions : Combination, decomposition, displacement, double displacement, precipitation, neutralization, oxidation and reduction.

Acids, bases and salts: Their definitions in terms of furnishing of H^+ and OH^- ions, General properties, examples and uses, concept of pH scale (Definition relating to logarithm not required), importance of pH in everyday life; preparation and uses of Sodium Hydroxide, Bleaching powder, Baking soda, Washing soda and Plaster of Paris.

Metals and non-metals: Properties of metals and non-metals; Reactivity series; Formation and properties of ionic compounds; Basic metallurgical processes; Corrosion and its prevention.

Carbon compounds: Covalent bonding in carbon compounds. Versatile nature of carbon. Homologous series. Nomenclature of carbon compounds containing functional groups (halogens, alcohol, ketones, aldehydes, alkanes and alkynes), difference between saturated hydrocarbons and unsaturated hydrocarbons. Chemical properties of carbon compounds (combustion, oxidation,

addition and substitution reaction). Ethanol and Ethanoic acid (only properties and uses), soaps and detergents.

Periodic classification of elements: Need for classification, Early attempts at classification of elements (Döbereiner's Triads, Newlands' Law of Octaves, Mendeleev's Periobic Table), Modern periodic table, gradation in properties, valency, atomic number, metallic and non-metallic properties.

Theme: The World of the Living

Unit-II: World of Living **(50 Periods)**

Life Processes: 'Living Being'. Basic concept of nutrition, respiration, transport and excretion in plants and animals.

Control and co-ordination in animals and plants: Tropic movements in plants; Introduction of plant hormones; Control and co-ordination in animals; Nervous system; Voluntary, involuntary and reflex action; Chemical co-ordination: animal hormones.

Reproduction: Reproduction in animals and plants (asexual and sexual), reproductive health-need and methods of family planning. Safe sex vs HIV/AIDS. Child bearing and women's health.

Heredity and Evolution: Heredity; Mendel's contribution–Laws for inheritance of traits: Sex determination: brief introduction; Basic concepts of evolution.

Theme: Natural Phenomena

Unit III: Natural Phenomena **(23 Periods)**

Reflection of light by curved surfaces; Images formed by spherical mirrors, centre of curvature, principal axis, principal focus, focal length, Mirror formula (Derivation not required), magnification. Refraction; Laws of refraction, refractive index.

Refraction of light by spherical lens; Image formed by spherical lenses; Lens formula (Derivation not required); Magnification. Power of a lens. Functioning of a lens in human eye, defects of vision and their corrections, applications of spherical mirrors and lenses.

Refraction of light through a prism, dispersion of light, scattering of light, applications in daily life.

Theme: How Things Work

Unit-IV: Effects of Current **(32 Periods)**

Electric current, potential difference and electric current. Ohm's law; Resistance, Resistivity, Factors on which the resistance of a conductor depends. Series combination of resistors, parallel combination of resistors and its applications in daily life. Heating effect of electric current and its applications in daily life. Electric power, Interrelation between P, V, I and R.

Magnetic effects of current : Magnetic field, field lines, field due to a current carrying conductor, field due to current carrying coil or solenoid; Force on current carrying conductor, Fleming's Left Hand Rule, Electric Motor, Electromagnetic induction. Induced potential difference, Induced current. Fleming's Right Hand Rule, Electric Generator Direct current. Alternating current: frequency of AC. Advantage of AC over DC. Domestic electric circuits.

Theme: Natural Resources

Unit-V: Natural Resources **(20 Periods)**

Sources of energy: Different forms of energy, conventional and non-conventional sources of energy: Fossil fuels, solar energy; biogas; wind, water and tidal energy; Nuclear energy. Renewable versus non-renewable sources of energy.

Our environment: Ecosystem, Environmental problems, Ozone depletion, waste production and their solutions. Biodegradable and non-biodegradable, substances.

Management of natural resources: Conservation and judicious use of natural resources. Forest and wild life; Coal and Petroleum conservation. Examples of people's participation for conservation of natural resources. Big dams: advantages and limitations; alternatives, if any. Water harvesting. Sustainability of natural resources.

PRACTICALS

Practical should be conducted alongside the concepts taught in theory classes

LIST OF EXPERIMENTS

1. Finding the pH of the following samples by using pH paper/universal indicator:
(*a*) Dilute Hydrochloric acid
(*b*) Dilute NaOH solution
(*c*) Dilute Ethanoic Acid solution
(*d*) Lemon juice
(*e*) Water
(*f*) Dilute Hydrogen Carbonate solution

Studying the properties of acids and bases (HCl & NaOH) by their reaction with:
(*a*) Litmus solution (Blue/Red)
(*b*) Zinc metal
(*c*) Solid sodium carbonate

2. Performing and observing the following reactions and classifying them into:
(*a*) Combination reaction
(*b*) Decomposition reaction
(*c*) Displacement reaction
(*d*) Double displacement reaction
- (*i*) Action of water on quick lime
- (*ii*) Action of heat on ferrous sulphate crystals
- (*iii*) Iron nails kept in copper sulphate solution
- (*iv*) Reaction between sodium sulphate and barium chloride solutions

3. Observing the action of Zn, Fe, Cu and Al metals on the following salt solutions:
(*a*) $ZnSO_4$ (aq)
(*b*) $FeSO_4$ (aq)
(*c*) $CuSO_4$ (aq)
(*d*) $Al_2(SO_4)_3$ (aq)

Arranging Zn, Fe, Cu and Al (metals) in the decreasing order of reactivity based on the above result.

4. Studying the dependence of potential difference (V) across a resistor on the current (I) passing through it and determine its resistance. Also plotting a graph between V and I.

5. Determination of the equivalent resistance of two resistors when connected in series and parallel.

6. Preparing a temporary mount of a leaf peel to show stomata.

7. Experimentally show that carbon dioxide is given out during respiration.

8. Study of the following properties of acetic acid (ethanoic acid):
(*i*) odour
(*ii*) solubility in water
(*iii*) effect on litmus
(*iv*) reaction with sodium Hydrogen Carbonate

9. Study of the comparative cleaning capacity of a sample of soap in soft and hard water.

10. Determination of the focal length of:
(*i*) Concave mirror
(*ii*) Convex lens

by obtaining the image of a distant object.

11. Tracing the path of a ray of light passing through a rectangular glass slab for different angles of incidence. Measure the angle of incidence, angle of refraction, angle of emergence and interpret the result.

12. Studying (*a*) binary fission in *Amoeba* and (*b*) budding in yeast with the help of prepared slides.

13. Tracing the path of the rays of light through a glass prism.

14. Finding the image distance for varying object distances in case of a convex lens and drawing corresponding ray diagrams to show the nature of image formed

15. Identification of the different parts of an embryo of a dicot seed (pea, gram or red kidney bean).

QUESTION PAPER DESIGN FOR SCIENCE

Time : 3 Hours						Max. Marks. 80	
S.No.	**Typology of Questions**	**Very Short Answer (VSA) 1 Mark**	**Short Answer-I (SA-I) 2 Marks**	**Short Answer-II (SA-II) 3 Marks**	**Long Answer (LA) 5 Marks**	**Total Marks**	**% Weight-age**
1	**Remembering (**Knowledge based simple recall questions, to know specific facts, terms, concepts, principles, or theories, Identify, define, or principles, or theories, identify, define, or recite, information)	2	-	1	1	10	15%
2	**Understanding** (Comprehension–to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase, or interpret information)	-	1	4	2	24	35%
3	**Application** (Use abstract information in concrete situation, to apply knowledge to new situations, use given content to interpret a situation, provide an example, or solve a problem)	-	1	2	2	18	26%
4	**High Order Thinking Skills** (Analysis & Synthesis—Classify, compare, contrast, or differentiate between different pieces of information, organize and/or integrate unique pieces of information from a variety of sources)	-	-	1	1	8	12%
5	**Inferential and Evaluative** (Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values)	-	1	1+1*	-	8	12%
	Total (Theory Based Questions)	2 × 1 = 2	3 × 2 = 6	10 × 3 = 30	6 × 5 = 30	68 (21)	100%
	Practical Based Questions (PBQs)		6 × 2 = 12			12 (6)	
	TOTAL	2 × 1=2	9 × 2 = 18	10 × 3 = 30	6 × 5 = 30	80 (27)	

1. Question paper will consist of 27 questions.
2. All questions would be compulsory. However an internal choice will be provided in two questions of 3 marks each and one question of five marks.
*** One question of 3 marks will be included to assess the values inherent in the texts.**

Contents

1. Chemical Reactions and Equations 1–68

Introduction • Symbol of Elements • Chemical Formulae • Valency • Binary Compounds • Formulae of Molecular Compounds • Naming of Binary Molecular Compounds • Formula of Ionic Compound • Chemical Equations • Types of Chemical Equations • Oxidation and Reduction • Practical Based Questions • NCERT (Intext and Exercise) Textual Questions with Answers

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CBSE Sample Question Paper 383

1 Chemical Reactions and Equations

LEARNING OBJECTIVES

After studying this Unit, you will be able to

- Write chemical formula with the help of symbols of elements and valency of elements and charge on radicals.
- Write symbols of common elements.
- Know the valency of common elements.
- Describe the information conveyed by a symbol of element.
- Describe the information conveyed by chemical formula.
- Write formula of molecular or covalent compounds.
- Write chemical equation with the help of symbols of elements and formulae of compounds.
- Balance chemical equations by hit and trial method.
- Write ionic equations and balance them.
- Describe the information conveyed by a chemical equation.
- Describe the advantages of chemical equation.
- Explain how to make equations more informative.
- Do calculations based on chemical equations.
- Classify the reactions as combination, decomposition displacement and double displacement reactions.
- Define and illustrate:

  1. Combination reaction 2. Decomposition reaction 3. Displacement reaction 4. Double displacement reaction 5. Electrolytic decomposition reaction 6. Isomerisation reactions 7. Precipitation reaction.
- Define and illustrate:

  (*a*) Oxidation (*b*) Reduction (*c*) Oxidising agent (*d*) Reducing agent (*e*) Redox reactions (*f*) Redox reactions involving ions.

Elements combine to form compounds. Compounds undergo chemical reactions. Chemistry is essentially a study of chemical reactions.

INTRODUCTION

We observe many chemical changes taking place in our daily life. The milk turns sour if kept for long time at room temperature. Milk changes to curd, rusting of iron and digestion of food in our body are examples of chemical changes.

In such changes, the nature and also the properties of the substances change and we say a chemical reaction has taken place.

Chemical reaction is represented by chemical equation which is short form of chemical reaction with the help of symbols of elements and formulae of chemical compounds.

In this chapter, we shall discuss about symbols of elements, chemical formulae, chemical equations, balancing of chemical equations and types of chemical reactions.

SYMBOLS OF ELEMENTS

115 elements are known at present. The names of elements are lengthy and difficult. Therefore, elements are represented by abbreviated names. **The short representation of name of element is called symbol of element.** Mostly, symbols are derived from the names of the elements. A few symbols are derived from Latin names of the elements.

The symbol of the element indicates one atom of that element. The symbols of following 12 elements are the only first letter of their full names:

Name of Element	Symbol	Name of Element	Symbol
1. Hydrogen	H	7. Phosphorus	P
2. Boron	B	8. Sulphur	S
3. Carbon	C	9. Vanadium	V
4. Nitrogen	N	10. Yttrium	Y
5. Oxygen	O	11. Iodine	I
6. Flourine	F	12. Uranium	U

The symbols of following elements are first two letters of their full names. **The first letter of a symbol is always written in capitals, the second letter, if any, is a small letter.**

Name of Element	Symbol	Name of Element	Symbol
1. Beryllium	Be	23. Xenon	Xe
2. Lithium	Li	24. Barium	Ba
3. Helium	He	25. Lanthanum	La
4. Neon	Ne	26. Tantalum	Ta
5. Aluminium	Al	27. Osmium	Os
6. Silicon	Si	28. Bismuth	Bi
7. Argon	Ar	29. Polonium	Po
8. Calcium	Ca	30. Francium	Fr
9. Scandium	Sc	31. Radium	Ra
10. Titanium	Ti	32. Actinium	Ac
11. Cobalt	Co	33. Cerium	Ce
12. Nickel	Ni	34. Praseodymium	Pr
13. Gallium	Ga	35. Europium	Eu
14. Germanium	Ge	36. Dysprosium	Dy
15. Selenium	Se	37. Holmium	Ho
16. Bromine	Br	38. Erbium	Er
17. Krypton	Kr	39. Lutetium	Lu
18. Molybdenum	Mo	40. Thorium	Th
19. Rhodium	Rh	41. Americium	Am
20. Indium	In	42. Nobelium	No
21. Iridium	Ir	43. Ruthenium	Ru
22. Tellurium	Te		

The symbols of following elements are first and third letters of their full names:

Name of Element	Symbol	Name of Element	Symbol
1. Magnesium	Mg	12. Astatine	At
2. Chlorine	Cl	13. Samarium	Sm
3. Chromium	Cr	14. Gadolinium	Gd
4. Manganese	Mn	15. Neptunium	Np
5. Zinc	Zn	16. Plutonium	Pu
6. Arsenic	As	17. Cadmium	Cd
7. Rubidium	Rb	18. Caesium	Cs
8. Strontium	Sr	19. Hafnium	Hf
9. Zirconium	Zr	20. Dubnium	Db
10. Technetium	Tc	21. Bohrium	Bh
11. Rhenium	Re	22. Hassium	Hs

In the following elements, the first and fourth letters of their full name is taken as a symbol:

Name of Element	Symbol	Name of Element	Symbol
1. Einsteinium	Es	7. Terbium	Tb
2. Fermium	Fm	8. Thallium	Tl
3. Neodymium	Nd	9. Berkelium	Bk
4. Niobium	Nb	10. Meitnerium	Mt
5. Platinum	Pt	11. Mendelevium	Md
6. Promethium	Pm		

Some of symbols are derived from Latin names of elements:

Name of Element	Latin Name	Symbol
1. Copper	Cuprum	Cu
2. Iron	Ferrum	Fe
3. Lead	Plumbum	Pb
4. Mercury	Hydrargyrum	Hg
5. Potassium	Kalium	K
6. Silver	Argentum	Ag
7. Tin	Stannum	Sn
8. Antimony	Stabium	Sb
9. Sodium	Natrium	Na
10. Gold	Aurum	Au
11. Tungsten	Wolfram	W

It is important to note that the first letter of every symbol is capital letter but, if the symbol consist of two letters, the second letter is a small letter and not capital letter, otherwise the meaning may change, *e.g.*, Co is symbol of cobalt whereas CO is formula for carbon monoxide.

INFORMATION CONVEYED BY SYMBOL OF ELEMENT

- It tells us about the name of the element.
- It represents an atom of the element.
- It represents one mole of the element.
- It represents definite mass of the element equal to atomic mass of element.

For example, Mn represents name of element, *i.e.*, manganese.

- It represents 1 atom of manganese.
- It represents 1 mole of Mn.
- It represents 55 g of Mn.

CHEMICAL FORMULAE

A formula represents a molecule of element or compound, *e.g.*, P_4 is molecular formula of phosphorus which is tetratomic element, S_8 is molecular formula of sulphur molecule which is octatomic.

Each compound is represented by a formula. The smallest particle of a compound is a molecule.

A chemical formula is a representation of a chemical compound using symbols of elements and numerical subscripts based on valency of elements. Actual number of atoms of each element are present in a molecule of a compound.

A compound is represented by chemical formula. It involves the atoms present in a compound and the exact number of atoms of various elements present in it, *e.g.*, H_2O is chemical formula of water. It is made of two atoms of hydrogen and one atom of oxygen. It is a covalent compound.

The chemical formulae of covalent or molecular compounds give the number of atoms making up the compounds. It is also called **molecular formula.**

The chemical formula of ionic compound gives the ratio of ions present in that compound and represents the formula unit, *e.g.*, NaCl is formula of sodium chloride.

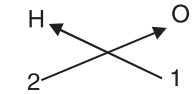
Let us take up the concept of Valency.

VALENCY

Valency is defined as number of electrons lost or gained or shared by an atom of an element.

It is also called combining capacity of an element with other elements, *e.g.*, hydrogen has 1 valence electron, it can share one electron to acquire stable electronic configuration, therefore, its covalency is 1. Oxygen atom has 6 valence electrons. It can share 2 electrons to complete its octet, so its covalency is 2.

The formula of water will be as follows:



H_2O is formula of water

In ionic compounds, the valency of element is determined by number of electron(s) lost or gained by one atom of element during formation of electrovalent or ionic compound, *e.g.*, sodium can lose one electron, it will acquire + 1 charge after losing one electron.

Chlorine can gain one electron. It will acquire –1 charge. Thus charges on Na and Cl atoms are shown and formula is written as follows:

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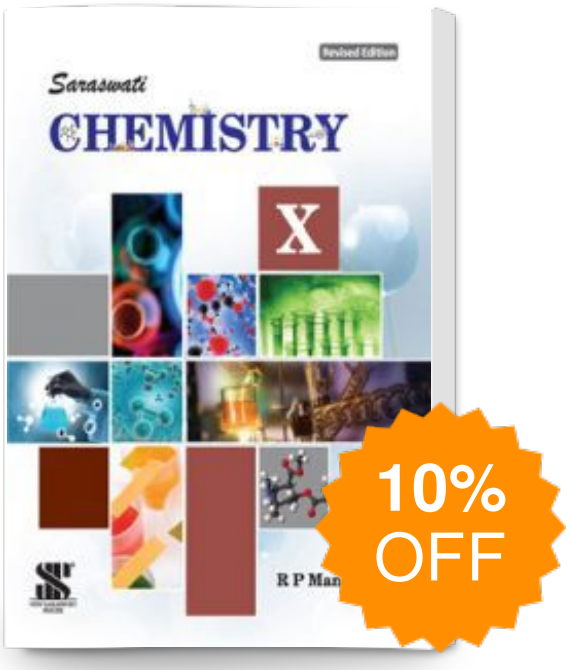

Publisher : New Saraswati House

ISBN : 9789352724017

Author : R P Manchanda

Type the URL : http://www.kopykitab.com/product/21361

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