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According to the Latest Syllabus

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Chemistry

Class-12 (Part-II)

For Rajasthan Board of Secondary Education

By

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Preface

We are extremely pleased to present this book according to latest syllabus of NCERT. The book has been written in easy and simple language so that students may assimilate the subject easily. We hope that students will get benefitted from it and teachers will appreciate our efforts. In comparison to other books available in market, this book has many such features which make it a unique book :

1. Theoretical subject-material is given in adequate and accurate description along with pictures.
2. The latest syllabus of NCERT is followed thoroughly.
3. Complete solutions of all the questions given at the end of the chapter in the textbook are given in easy language.
4. Topic wise summary is also given in each chapter for the revision of the chapter.
5. In every chapter, all types of questions that can be asked in the exam (Objective, Fill in the blanks, Very short, Short, Numerical and Long answer type questions) are given.
6. At the end of every chapter, multiple choice questions asked in various competitive exams are also given with solutions.

Valuable suggestions received from subject experts, teachers and students have also been given appropriate place in the book.

We wholeheartedly bow to the Almighty God, whose continuous inspiration and blessings have made the writing of this book possible.

We express our heartfelt gratitude to the publisher – Mr. Pradeep Mittal and Manoj Mittal of Sanjiv Prakashan, all their staff, laser type center and printer for publishing this book in an attractive format on time and making it reach the hands of the students.

Although utmost care has been taken in publishing the book, human errors are still possible, hence, valuable suggestions are always welcome to make the book more useful.

In anticipation of cooperation!

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HALOALKANES AND HALOARENES

CHAPTER

6

Chapter Overview

- 6.1 Classification
- 6.2 Nomenclature
- 6.3 Nature of C—X Bond
- 6.4 Methods of Preparation of Haloalkanes
- 6.5 Preparation of Haloarenes
- 6.6 Physical Properties
- 6.7 Chemical Reactions
- 6.8 Polyhalogen Compounds

Haloalkanes (Alkylhalide) and Haloarenes (Aryl halide)

The compounds obtained when one or more hydrogen atoms of aliphatic and aromatic hydrocarbons are replaced by halogen atoms are called haloalkanes and haloarenes respectively.

Many halogenated organic compounds are found in nature which are used in industries and daily life. They are used as solvents for non-polar compounds and as starting materials for the synthesis of many organic compounds.

These type of some compounds are also very important from the medical point of view, such as— (i) chlorinated antibiotic **chloramphenicol** is used in the

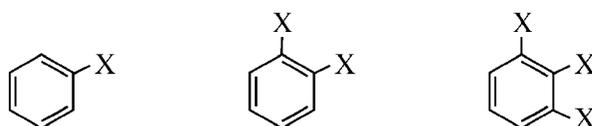
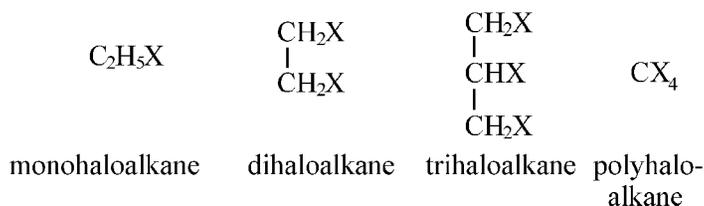
treatment of typhoid. This antibiotic is produced by soil microorganisms. (ii) **Chloroquine** is a synthesized compound which is used in the treatment of malaria. (iii) A compound called **halothane** is used as an anesthetic in surgery. (iv) Our body produces iodine rich hormone thyroxin. Its deficiency in our body causes goiter. (v) Some fluorinated hydrocarbons are being considered as effective blood substitutes which could be very useful in surgery.

Haloalkanes are represented by the general formula R—X and haloarenes are represented by Ar—X in which halogen atoms are linked to sp^3 and sp^2 hybridized carbon respectively. Due to this difference in hybridization, there is a difference in the properties of haloalkanes and haloarenes.

6.1 Classification

6.1.1 On the Basis of Number of Halogen Atoms

Based on the number of halogen atoms, haloalkanes and haloarenes are classified into mono, di, tri and poly halogen derivatives, example :



monohaloarene

dihaloarene

trihaloarene

(X = F, Cl, Br, I)

Derivatives of alkanes containing single halogen are called haloalkanes (alkyl halides) and such compounds of arenes are called haloarenes (aryl halides).

6.2 Nomenclature

(a) **R—X** : To write the common names of haloalkanes halide is added along with the name of the alkyl group, *i.e.*, the common name is alkyl halide and in the IUPAC system of nomenclature they are written as halo substituted hydrocarbons.

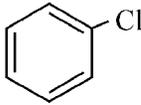
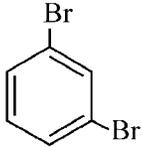
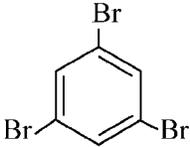
Example :	$\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$	$\begin{array}{c} \text{H}_3\text{C}-\text{CH}-\text{CH}_3 \\ \\ \text{Cl} \end{array}$	$\begin{array}{c} \text{CH}_3 \\ \\ \text{H}_3\text{C}-\text{CH}-\text{CHI}_2 \end{array}$
Common name—	n-Propyl bromide	Isopropyl chloride	Isobutyl chloride
IUPAC name—	1-Bromopropane	2-Chloropropane	1-Iodo-2-methylpropane

	$\begin{array}{c} \text{CH}_3 \\ \\ \text{H}_3\text{C}-\text{C}-\text{CH}_2-\text{Cl} \\ \\ \text{CH}_3 \end{array}$	$\begin{array}{c} \text{CH}_3 \\ \\ \text{H}_3\text{C}-\text{C}-\text{CH}_3 \\ \\ \text{Br} \end{array}$
Common name—	Neopentyl chloride	Tertiary butyl bromide
IUPAC name—	1-chloro-2, 2-dimethyl propane	2-Bromo-2-methyl propane

(b) **Ar—X** : Aryl halides are called haloarenes in both common name and IUPAC system of nomenclature. In case of dihalogen derivatives the prefix, *o*-(ortho), *m*-(meta) and *p*-(para) are used in common system,

respectively. In which two identical halogen atoms are present on alternate and opposite carbon atoms near the ring.

In the IUPAC system of nomenclature for *o*-, *m*- and *p*- position the numbers 1, 2; 1, 3 and 1, 4 are used.

Example :			
Common name—	Chlorobenzene	<i>m</i> -Dibromobenzene	Sym-Tribromobenzene
IUPAC name—	Chlorobenzene	1,3-Dibromobenzene	1,3,5-Tribromobenzene

(c) **Dihalogen derivatives of alkane** : In these compounds, the common name of gem dihalides is alkylidene halide, vicinal dihalides in alkylene dihalide (alkylene halide) and α , ω dihalides is polymethylene dihalide.

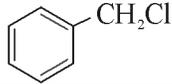
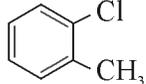
In the IUPAC system, all these are called dihaloalkanes in which the position of halogen atom is also mentioned.

Example :	$\begin{array}{c} \text{Cl} \\ \diagup \\ \text{CH}_3-\text{CH} \\ \diagdown \\ \text{Cl} \end{array}$	$\begin{array}{c} \text{CH}_2-\text{CH}_2 \\ \quad \\ \text{Br} \quad \text{Br} \end{array}$	$\begin{array}{c} \text{CH}_2-\text{CH}_2-\text{CH}_2 \\ \quad \quad \\ \text{Cl} \quad \quad \text{Cl} \end{array}$
Common name—	Ethylidene chloride	Ethylene dibromide	Trimethylene dichloride
IUPAC name—	1,1-Dichloroethane	1,2-Dibromoethane	1,3-Dichloropropane

The molecular formula, structural formula, common name and IUPAC name of monochloro derivatives from methane to butane are as follows :

S. No.	Molecular Formula	Structural Formula	Common Name	IUPAC Name
1.	CH ₃ -Cl	CH ₃ -Cl (1°)	Methyl chloride	Chloromethane
2.	C ₂ H ₅ -Cl	CH ₃ -CH ₂ -Cl (2°)	Ethyl chloride	Chloroethane
3.	C ₃ H ₇ Cl	(i) CH ₃ -CH ₂ -CH ₂ -Cl (1°)	<i>n</i> -propyl chloride	1-chloropropane
		(ii) CH ₃ -CH-CH ₃ (2°) Cl	Isopropyl chloride	2-chlorobutane
4.	C ₄ H ₉ Cl	(i) CH ₃ -CH ₂ -CH ₂ -CH ₂ (1°) Cl	<i>n</i> -butyl chloride	1-chlorobutane
		(ii) CH ₃ -CH ₂ -CH-CH ₃ (2°) Cl	sec-Butyl chloride	2-chlorobutane
		(iii) CH ₃ -CH-CH ₂ (1°) CH ₃ Cl	Isobutyl chloride	1-chloro-2-methyl butane
		(iv) CH ₃ -C-CH ₃ (3°) CH ₃ Cl	tert-Butyl chloride	2-chloro-2-methyl butane

Common and IUPAC name of some halides :

S. No.	Structural Formula	Common Name	IUPAC Name
(i)	CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ Cl	<i>n</i> -pentyl chloride	1-chloropentane
(ii)	CH ₃ CH ₃ -C-CH ₂ -Br CH ₃	Neo-pentyl bromide	1-bromo-2, 2 di-methyl propane
(iii)	CH ₂ = CH-Cl	Vinyl chloride	Chloro ethene
(iv)	CH ₂ = CH-CH ₂ -Br	Allyl bromide	3-bromo prop-1-ene
(v)	CH ₂ Cl ₂	Methylene chloride	Dichloromethane
(vi)	CHCl ₃	Chloroform	Trichloromethane
(vii)	CCl ₄	Carbon tetrachloride	Tetrachloro methane
(viii)		Benzyl chloride	Chlorophenyl methane
(ix)		<i>o</i> -chlorotoluene	1-Chloro-2-methyl benzene or 2-chlorotoluene