

CLASS 12 CHEMISTRY — FORMULA SHEET

Chapter 6 : Haloalkanes and Haloarenes (NCERT)

6.1 Classification & Nomenclature

Concept	Detail
Haloalkane (alkyl halide)	Halogen attached to sp^3 carbon ($R-X$)
Haloarene (aryl halide)	Halogen attached to sp^2 carbon of an aromatic ring
Primary (1°)	Halogen on a carbon attached to one other carbon
Secondary (2°)	Halogen on a carbon attached to two carbons
Tertiary (3°)	Halogen on a carbon attached to three carbons
Allylic halide	X on carbon next to $C=C$ double bond
Benzylic halide	X on carbon attached to benzene ring
Vinyllic / aryl halide	X on sp^2 carbon (unreactive to substitution)

6.2 Methods of Preparation

Method	Reaction
From alcohols (with HX)	$R-OH + HX \rightarrow R-X + H_2O$
With PCl_3 / PCl_5 / $SOCl_2$	$R-OH \rightarrow R-Cl$ ($SOCl_2$ gives purest product)
Free radical halogenation	$Alkane + X_2 \xrightarrow{UV \text{ light}} \text{haloalkane} + HX$
From alkenes (HX addition)	Markovnikov addition gives the major product
Finkelstein reaction	$R-Cl + NaI \rightarrow R-I + NaCl$ (in dry acetone)
Swarts reaction	$R-X + AgF / Hg_2F_2 \rightarrow R-F$
Sandmeyer reaction	Aryl diazonium salt + $CuX \rightarrow$ aryl halide

6.3 Nucleophilic Substitution — SN_1 vs SN_2

Feature	SN_1	SN_2
Molecularity	Unimolecular	Bimolecular
Steps	Two (carbocation intermediate)	One (concerted)
Rate depends on	[substrate] only	[substrate] and [nucleophile]
Favoured by	3° halides	1° halides
Solvent	Polar protic	Polar aprotic
Stereochemistry	Racemisation	Inversion (Walden)
Reactivity order	$3^\circ > 2^\circ > 1^\circ$	$1^\circ > 2^\circ > 3^\circ$

6.4 Elimination & Other Reactions

Reaction	Detail
Dehydrohalogenation (β-elimination)	$R-X + \text{alc. KOH} \rightarrow \text{alkene} + KX + H_2O$
Saytzeff's rule	More substituted (stable) alkene is the major product
With aqueous KOH	Gives alcohol (substitution), not alkene
Wurtz reaction	$2R-X + 2Na \rightarrow R-R + 2NaX$ (alkane)
Reaction with metals	Grignard reagent: $R-X + Mg$ (dry ether) $\rightarrow R-Mg-X$
Reduction	$R-X + H_2 / Zn-HCl \rightarrow R-H$ (alkane)

6.5 Haloarenes — Low Reactivity & Reactions

Concept	Detail
Why less reactive	Resonance (partial double bond character of C–X) + sp^2 carbon
C–X bond	Shorter and stronger than in haloalkanes
Nucleophilic substitution	Needs harsh conditions (high T, P) or activating groups
Effect of $-NO_2$ groups	$-NO_2$ at ortho/para greatly increases reactivity
Electrophilic substitution	Halogen is o/p-directing but deactivating
Wurtz–Fittig reaction	$\text{Aryl} + \text{alkyl halide} + Na \rightarrow \text{alkylarene}$
Fittig reaction	$2 \text{ Aryl halide} + Na \rightarrow \text{biaryl}$

6.6 Polyhalogen Compounds & Optical Activity

Concept	Detail
Chloroform ($CHCl_3$)	Anaesthetic ; stored in dark (forms toxic phosgene in light)
Carbon tetrachloride (CCl_4)	Fire extinguisher (pyrene) ; harms ozone layer
DDT	Insecticide ; non-biodegradable, banned in many countries
Freons (CFCs)	Refrigerants ; deplete the ozone layer
Chirality	Carbon with 4 different groups is a chiral (stereo) centre
Enantiomers	Non-superimposable mirror images ; rotate plane-polarised light oppositely
Racemic mixture	50:50 enantiomers ; optically inactive (net rotation 0)

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SN1 vs SN2	SN1: 3° halides, carbocation, racemisation. SN2: 1° halides, inversion.
Reactivity orders	SN1: $3^\circ > 2^\circ > 1^\circ$; SN2: $1^\circ > 2^\circ > 3^\circ$ (exactly opposite).
Finkelstein	$R-Cl/Br + NaI$ in dry acetone $\rightarrow R-I$ (halide exchange).
Saytzeff	Elimination gives the MORE substituted (more stable) alkene.
aq vs alc KOH	Aqueous KOH $\rightarrow$ alcohol (substitution) ; alcoholic KOH $\rightarrow$ alkene (elimination).
Haloarene low reactivity	Resonance + sp^2 carbon shorten/strengthen the C–X bond.

-NO₂ activates	Nitro groups at ortho/para boost nucleophilic substitution in haloarenes.
Chirality	4 different groups on a carbon → chiral. Equal enantiomers → racemic (inactive).

Class 12 Chemistry Formula Sheet | Chapter 6: Haloalkanes and Haloarenes | NCERT Rationalised Syllabus

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