Welcome to

ORGANIC CHEMISTRY

How to master Organic Chemistry easily and perfectly?

STUDY TIPS FOR STUDENTS

1. **RRR Reading Formula:**

   First Reading = Confusion; Second Reading = Clarity; Third Reading = Confidence.

   Organic Chemistry takes time to master - Slow and Steady Wins the Race.

2. **Apply RAW (Read And Write) :** First Read & Understand. Then Write without seeing.

3. **Teach and explain to some one:** If you can explain simply, you can understand deeply.

4. **Use short memory tricks (remember key rules):**

   SN^1 - carbocation - Racemisation

   SN^2 - backside attack - inversion

5. **Understand perfectly the real meanings of the new terms.**

6. **Analyse & Master the basics:** Understand why such reactions happen.

   • Stability • Polarity • Acidity • Electophiles Vs nucleophiles

   Inductive effect (+I, –I) • Resonance • Hyper conjugation

7. **Practice Named Reactions and write structures again and again:**

   Practice daily and revise weekly: IUPAC Names with structures, Named reactions.

8. **Identify reaction Patterns:** Understand that same patterns repeat with small changes.

   • Substitution SN^1, SN^2 • Elimination E_1, E_2 • Addition • Oxidation / reduction

9. **Learn mechanisms like a story:**

   • Every reaction has a step by step flow.

   • **Think:** who attacks, why?, who leaves?

10. **Always keep in mind the 'common side headings' of various chapters:**

    i) Common & IUPAC Names **ii)** Nomenclature **iii)** Classification

    iv) Stability, polarity, acidity/ basicity, rate of reaction

    v) Special types of reactions/ mechanisms. **vi)** Preparations with Named reactions.

    vii) Physical properties **viii)** Chemical properties **ix)** Uses

11. **Super Tip:** If you master the first chapter (Haloalkanes) perfectly in the best way, then the remaining chapters become very easy to learn.

12. **Link chapters like a conversion chain :** Haloalkanes - Alcohols - Aldehydes - Carboxylic acids.

DO YOUR BEST

AMAZING BENEFITS FOR STUDENTS / LEARNERS
WHO MASTER ORGANIC CHEMISTRY
DEAR STUDENTS!

More than Marks, Mastering **Organic Chemistry** trains your brain in multiple cognitive domains.

1. **Memory Power (Retention & Recall):**

   When you learn reactions, mechanisms, and reagents; you repeatedly store and retrieve information.

   This strengthens neural connections of your Brain (like exercising muscles).

   Remembering Named Reactions builds Long-term Memory .

   Result: Faster recall in exams + improved general memory

2. **Analytical Thinking (Cause → Effect Reasoning):**

   Organic chemistry constantly asks: Why does this reaction happen? Why is one product major?

   You analyze: Stability; Electron flow; Reaction conditions

   Result: Strong logical reasoning and decision-making skills

3. **Pattern Recognition (Smart Learning Skill):**

   You start noticing patterns like: 3° $\rightarrow SN^1$; reactivity of Aldehydes > Ketones

   Result: Brain becomes efficient at: Predicting outcomes, Spotting trends.

4. **Problem-Solving Ability:**

   Every question and concept is like a puzzle: Identify reactants, Apply mechanism, Predict product.

   You develop: Step-by-step thinking and Multi-step reasoning.

5. **Concept Integration:**

   Organic chemistry connects manythings: Haloalkanes → Alcohols → Acids →Amines

   Result: You learn to Link concepts, Think holistically.

6. **Attention to Detail:** A tiny change (like position of –OH) changes everything.

   Result: Improves Accuracy, Focus, Careful observation.

7. **Spatial Intelligence (3D Picture Thinking) :**

   You imagine molecules in 3D; Tetrahedral structures, Optical isomers.

   Result: You improve strong visualization skills (useful in engineering, design, medicine).

8. **Cognitive Flexibility:**

   Same reaction, different conditions , different results.

   Result: Brain becomes Adaptable, Flexible in thinking.

9. **Confidence & Mental Discipline:**

   Once you master organic chemistry- You trust your reasoning, You handle complex problems calmly.

   Result: Confidence + Discipline +Memory + Logic + Visualization + Practice = **Strong Brain.**

REAL INSIGHT

Organic Chemistry is not just a subject;

It is a **brain training system** that **improves Thinking, Reasoning, Learning ability**

6.HALOALKANES (R-X) & HALOARENES (Ar-X)

STUDY NOTES

1. Haloalkanes & Haloarenes:

i) Common name : **Alkyl halides**

ii) IUPAC name : • **Haloalkanes(open chain - aliphatic)**

• **Haloarenes** (closed chain - aromatic - (4n+2) π rule)

iii) General Formula : • **C_nH_{2n+1} –X** (or) R-X, where R=Alkyl group, X = F, C*l*, Br, I;

• **C_nH_{2n-7} –X** (or) Ar-X, where Ar=Aryl group

iv) Haloalkanes **Ex** : • CH_3Cl, C_2H_5Br, $CHCl_3$, CCl_4

v) Haloarenes **Ex** : •C_6H_5Cl or 

2. Classification of Alkyl halides :

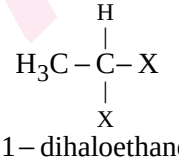
I) Classification based on number of Halogen atoms :

i) **Monohalo alkanes** - One halogen, CH_3Cl

ii) **Dihalo alkanes** - Two halogens , CH_2Cl_2

a) **Gem dihalides** (Halides with two identical halogen atoms attached to the same carbon)

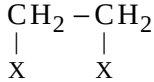
Ex: $C_2H_4X_2$ (or) (CH_3CHX_2)



1,1 – dihaloethane

b) **Vicinal dihalides** (Halides with two identical halogen atoms attached on adjacent carbons)

Ex: $C_2H_4X_2$ (or) (XCH_2-CH_2X)



1,2 dihaloethane

iii) **Trihalo alkanes** - Three halogens - $CHCl_3$

iv) **Polyhalo alkanes** - More than three halogens - CCl_4

II) Classification based on type of C bonded to X (or) No.of alkyl groups (R) attached to C:

a) Aliphatic alkyl halides (R-X) : Compounds containing SP^3 C-X bond.

i) Primary (1°) alkyl halides: One alkyl group is attached to **primary carbon in C–X**

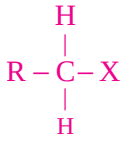
Carbon in C-X is bonded to one carbon of one R(alkyl group)

ii) Secondary (2°) alkyl halides: Two alkyl groups are attached to **two carbons in C–X**

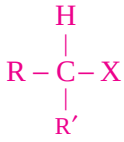
Carbon in C-X is bonded to two carbons of two R.

iii) Tertiary (3°) alkyl halides: Three alkyl groups are attached to **three carbons in C–X**

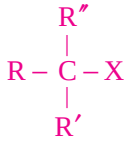
Carbon in C-X is bonded to three carbons of three R.



Primary(1°)



Secondary (2°)



Tertiary (3°)

X-attached to saturated carbon

☞ This classification is useful to determine

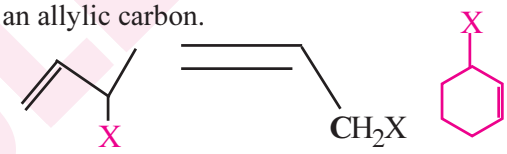
i) Stability of carbocation (3°>2°>1°) ii) Mechanisms of SN^1, SN^2

b) Allylic halides: In these compounds, halogen atom (X) is bonded to an SP^3 carbon atom(CH_2) which is adjacent to a carbon-carbon double bond (C=C).

Here, the carbon bearing halogen is said to be an allylic carbon.

Structure: R–CH=CH–CH_2–X

Ex: Allylic chloride $CH_2 = CH - CH_2 - Cl$

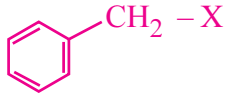


☞ These allylic halides are seen in SN^1, SN^2 reactions.

c) Benzylic halides: In these halides, the halogen(X) is bonded to an SP^3 carbon atom (CH_2) adjacent to benzene ring (C_6H_5–).

Structure: Benzene ring + CH_2–X

Ex: Benzyl chloride: $C_6H_5CH_2Cl$.

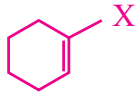


III) Classification based on compounds containing SP^2 C– X bond:

a) Vinylic halides: In these compounds, halogen atom (X) is attached directly to an SP^2 carbon in C=C double bond.

Structure: RCH=CH–X

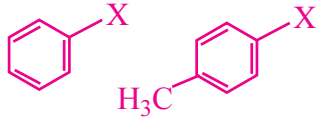
Ex: Vinyl chloride: CH_2=CHCl.



b) Haloarenes (Aryl halides): Haloarenes are aromatic compounds where a halogen atom is directly attached to an SP^2 carbon of an aromatic ring like benzene.

Structure: AR–X, AR is alkyl group.

Ex: C_6H_5Cl , Phenyl chloride or Chloro benzene



☞ When multiple halogen atoms are present , the following prefixes are used to indicate the position of substituent. Ortho (o-), Meta (m-), Para (p-)

3) IUPAC Nomenclature:

Rule 1: Halo prefix (X-bromo, chloro, fluoro, iodo) + **Parent alkane Ex:** CH_4(methane); C_2H_6 (ethane); C_3H_8 (propane) ; C_4H_{10} (butane)

Ex : CH_3Cl - Chloromethane.; C_2H_5Cl , Chloroethane

Rule 2: Carbon position number (attached to halo substituent) + halo prefix (o) + parent alkane

Ex 1: C_3H_7Cl = $CH_3–CH_2–CH_2Cl \rightarrow$ 1- chloropropane **(Single halogen)**

Ex 2: C_3H_7Cl = $CH_3–CHCl–CH_3 \rightarrow$ 2- chloropropane **(Single halogen)**

Rule 3: For multiple number of same halogen or differnt halogens use di for 2; tri for 3; tetra for 4

Ex 1 : $C_2H_4Cl_2 = CHCl_2–CH_3 \rightarrow$ 1,1- dichloroethane **(same multiple halogens)**

Ex 2: $C_2H_4Cl\,Br = CH_2Cl–CH_2Br \rightarrow$ 1- bromo- 2-chloroethane **(different multiple halogens)**

4) C-X bond:

It plays a key role in the chemical reactions of alkyl halides.

C-X is polar, because Halogens (X) are more electronegative than Carbon.

Thus, C bears a partial positive charge (δ^+) and halogen atom bears a partial negative charge (δ^-)

☞ The polarity of C-X bond makes alkylhalides reactive in nucleophilic substitution reactions. (SN^1 & SN^2) and Elimination reactions (E_1& E_2) .

5.1) Preparation of Haloalkanes:

(a) From alcohols : Hydroxyl group of alcohol is replaced by halogen.

(b) From alkanes : By free radical Halogenation- chlorination, bromination

(c) From alkenes : (i) Addition of HX (ii) Addition of Halogens

(d) From hydrogen exchange method

5.2) Preparation of Haloarenes:

(a) **From hydrocarbons** (Electrophilic substitution in benzene)

(b) From diazonium salt (Sandmeyer's reaction & Gatterman reaction)

6) Physical properties of alkylhalides:

i) **Solubility:** Mostly insoluble in water and soluble in organic solvents.

ii) Order of BP : R–I > R–Br > R–Cl > R–F

(MP & BP increase with molecular mass and decrease with branching.)

iii) **Order of Polarity :** R–F >R–Cl >R–Br>R–I

7) Chemical reactions of alkylhalides:

i) Nucleophilic substitution reactions (SN^1 & SN^2) : These reactions transform alkylhalides into formation of functional groups like alcohols , ethers, amines, nitrites.

SN^1: Hydrolysis of tert-butyl bromide results 2 methyl propan 2-ol(racemisation.)

SN^2: Hydrolysis of **2-bromobutane** in aqueous KOH forms **2-butanol.**

ii) Elimination reactions (E_1,E_2):

Removing HX from haloalkane (Dehydrohalogenation) to form alkenes.

iii) Reaction with metals:

Wurtz reaction - formation of higher alkanes & Grignard reagent (R-Mg-X)

8) Stereochemistry (3d arrangements & structures of atoms in molecules) :

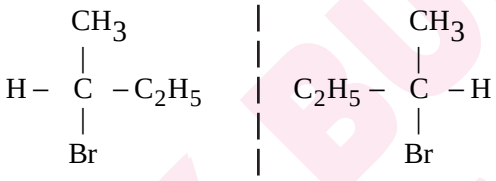
i) Achiral molecules are super imposable on their mirror images.

ii) Chiral molecules are non -super imposable asymmetric.

They are optically active which can rotate a plane polarised light.

iii) Enantiomers: A pair of chiral isomers that are non-superimposable mirror images of each other, usually represented as R and S forms.

Ex: Optically active 2- bromo butane



9) Daily life uses:

- **Chloroform ($CHCl_3$):** Earlier used as anesthetic; now mainly solvent in labs
- **Freons (CFCs):** Used in refrigerators &AC's(now restricted due to ozone depletion)
- **DDT (Dichloro-diphenyl-trichloroethane):** Powerful insecticide (now banned/restricted).
- **Teflon (PTFE):** Non-stick coating in cookware.

Quick Revision Points

- **Haloalkane**→ Halogen + chain
- **Haloarene**→ Halogen + benzene
- C–X bond is polar.
- SN1 → carbocation → racemisation
- SN2 → one-step→ inversion
- Haloarenes → less reactive than haloalkanes