

Class 12 Chemistry • Chapter 8

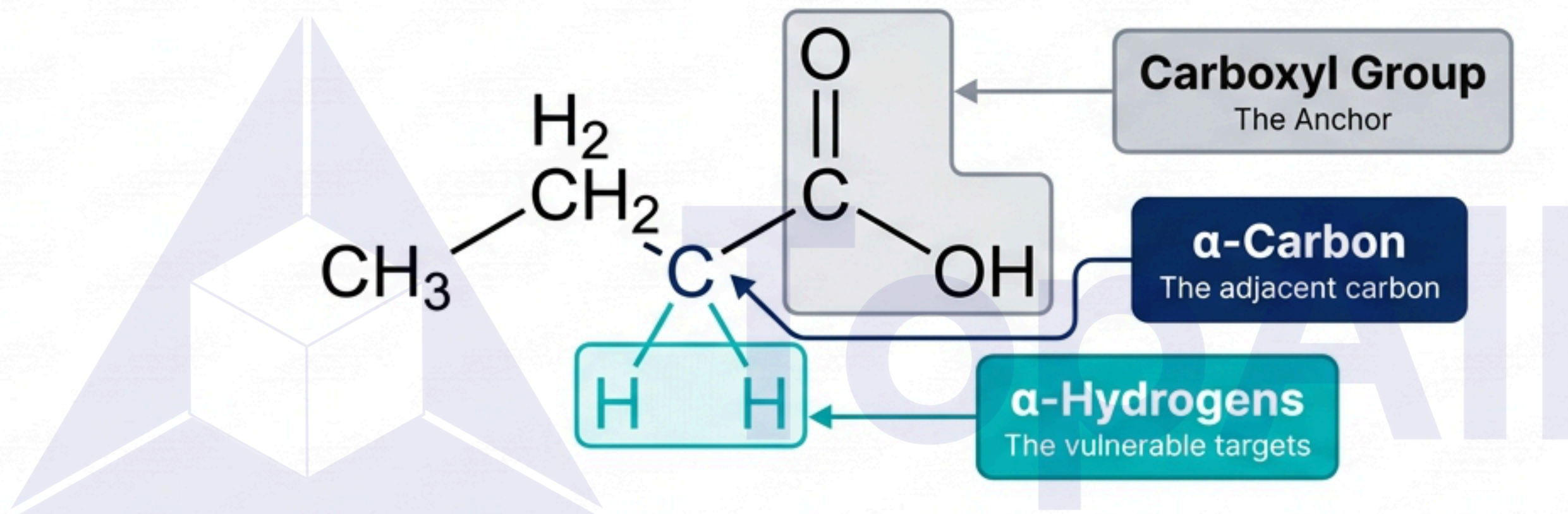
8.9.4 Substitution Reactions in the Hydrocarbon Part

Halogenation & The Hell-Volhard-Zelinsky (HVZ) Reaction



The α -Carbon Focus

The Target: Defining the α -Position



The Rule

Halogenation in the hydrocarbon part of a carboxylic acid exclusively occurs at the α -position.



The Requirement

The molecule must possess at least one α -hydrogen atom.



Exam Alert

Acids without α -hydrogens (like Benzoic acid) will not undergo this specific substitution.



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The HVZ Reaction Profile

Reactant

Substrate

Carboxylic acid possessing
 ≥ 1 α -hydrogen.

Catalyst & Halogen

Reagents

X₂ (Chlorine or Bromine)

Small amount of Red
Phosphorus (Red P)

Solvent

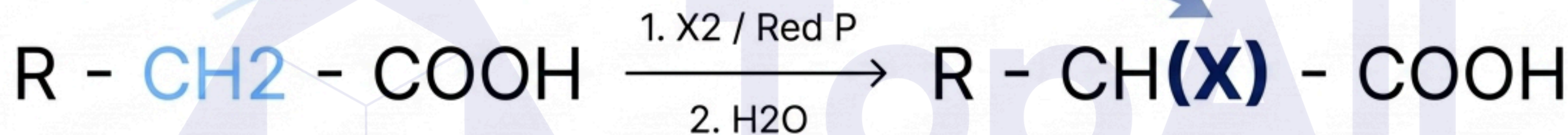
Workup

H₂O (Water for the
secondary hydrolysis step)



Insight: Red phosphorus acts as a crucial catalyst. It facilitates the formation of an active phosphorus trihalide (PX₃) intermediate, which ensures the reaction specifically targets the α -carbon instead of substituting the hydroxyl (-OH) group.

The Substitution Mechanism Strip

**Product**

Yields an
 α -halocarboxylic acid.

Condition

Valid only when X = Cl
or Br.

**Mechanism
Note**

Surgically targets the
hydrocarbon chain. The
-OH of the carboxyl group
remains completely intact.

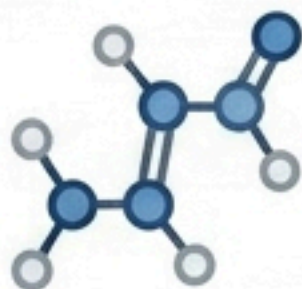
Substitution Next to the Carboxyl Group



The Site of Action: The reaction strictly targets the hydrocarbon part of the molecule, localizing entirely at the α -carbon.



The Strict Condition: Must possess an α -hydrogen. No α -H = No HVZ reaction.



The Result: Yields α -halocarboxylic acids, which serve as highly versatile intermediates for further organic synthesis.



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