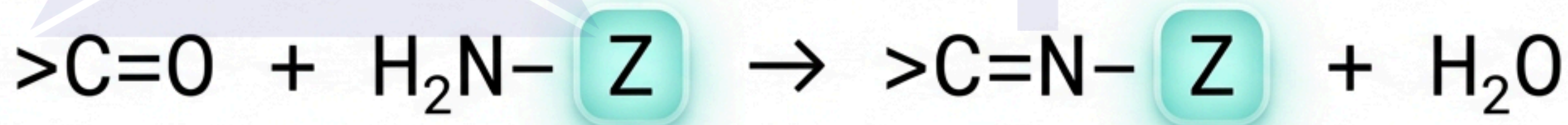


Addition of Ammonia and Its Derivatives

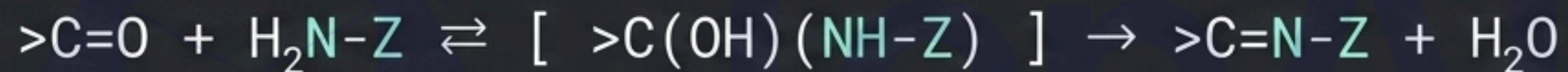
Understanding Nucleophilic Addition-Elimination Reactions (>C=N-Z Formation)



The Addition-Elimination Engine

Step 1: Nucleophilic Addition

Ammonia derivative ($\text{H}_2\text{N}-\text{Z}$) adds to the carbonyl group of an aldehyde or ketone, forming a tetrahedral intermediate.



Step 2: Rapid Dehydration

The intermediate loses a molecule of water to form the $>\text{C}=\text{N}-\text{Z}$ double bond.

Reaction is Reversible

Acid-Catalyzed

Equilibrium favored by rapid dehydration

Z-GROUP: -H & -R

Forming Imines & Schiff Bases

Ammonia Module

Reagent:

Ammonia ($\text{H}_2\text{N}-\text{H}$)

Product Name:

Imine



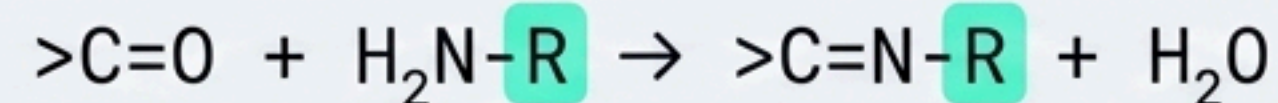
Amine Module

Reagent:

Amine ($\text{H}_2\text{N}-\text{R}$)

Product Name:

Substituted Imine / Schiff's Base





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Z-GROUP: -OH

Hydroxylamine to Oxime

Reagent:

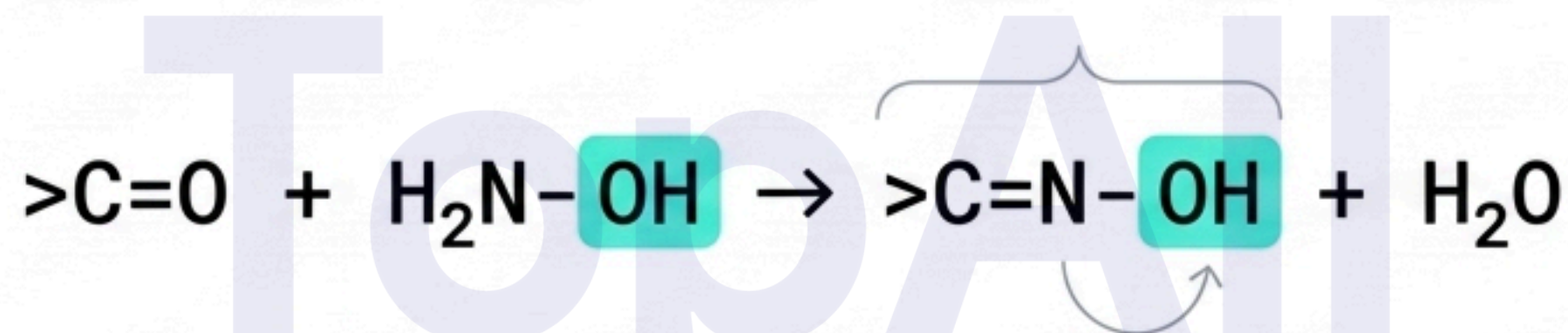
Hydroxylamine ($\text{H}_2\text{N}-\text{OH}$)

Product Name:

Oxime

Derivative Structure:

$>\text{C}=\text{N}-\text{OH}$



The nitrogen-oxygen bond defines the oxime functional group.

Z-GROUP: $-\text{NH}_2$ & $-\text{NHC}_6\text{H}_5$

Hydrazine & Phenylhydrazine Derivatives

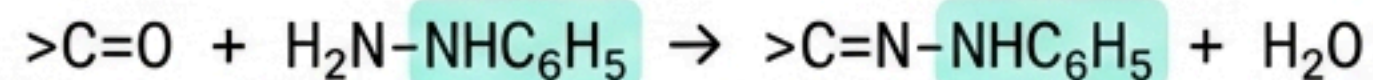
Z-Group = $-\text{NH}_2$

Reagent: Hydrazine ($\text{H}_2\text{N}-\text{NH}_2$)
→ Product: Hydrazone



Z-Group = $-\text{NHC}_6\text{H}_5$

Reagent: Phenylhydrazine
($\text{H}_2\text{N}-\text{NHC}_6\text{H}_5$)
→ Product: Phenylhydrazone



Semicarbazones & 2,4-DNP

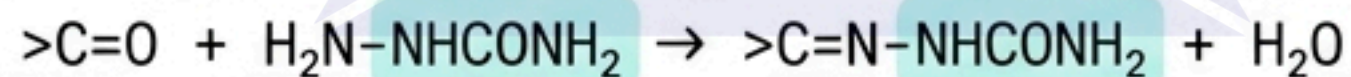
Semicarbazone

Reagent:

Semicarbazide ($\text{H}_2\text{N}-\text{NHCONH}_2$)

Product Name:

Semicarbazone



2,4-DNP

Reagent:

2,4-Dinitrophenylhydrazine (2,4-DNP)

Product Name:

2,4-Dinitrophenylhydrazone



Diagnostic Lab Test

2,4-DNP derivatives form brightly colored yellow, orange, or red solids. This reaction is highly useful for the characterization and identification of aldehydes and ketones.

N-Substituted Derivatives Matrix

Z Group	Reagent Name	Carbonyl Derivative	Product Name
-H	Ammonia	$>\text{C}=\text{N}-\text{H}$	Imine
-R	Amine	$>\text{C}=\text{N}-\text{R}$	Substituted imine (Schiff's base)
-OH	Hydroxylamine	$>\text{C}=\text{N}-\text{OH}$	Oxime
-NH ₂	Hydrazine	$>\text{C}=\text{N}-\text{NH}_2$	Hydrazone
-NHC ₆ H ₅	Phenylhydrazine	$>\text{C}=\text{N}-\text{NHC}_6\text{H}_5$	Phenylhydrazone
-NHC ₆ H ₃ (NO ₂) ₂	2,4-Dinitrophenylhydrazine	$>\text{C}=\text{N}-\text{NHC}_6\text{H}_3(\text{NO}_2)_2$	2,4-Dinitrophenylhydrazone
-NHCONH ₂	Semicarbazide	$>\text{C}=\text{N}-\text{NHCONH}_2$	Semicarbazone



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