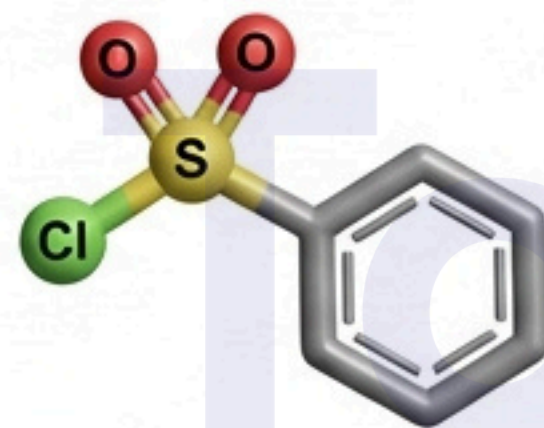


9.6.4 The Hinsberg Test

Distinguishing Primary, Secondary, and Tertiary Amines



$\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$
(Benzenesulphonyl Chloride)

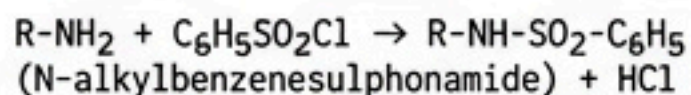
$\text{R}-\text{NH}_2$

Result: Soluble sulfonamide

$\text{R}-\text{NH}_2$ (Primary Amine)

Reaction with $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$ yields N-alkylbenzenesulphonamide. The acidic hydrogen (H) on the nitrogen allows solubility in alkali (KOH).

Observation: Clear solution formed.



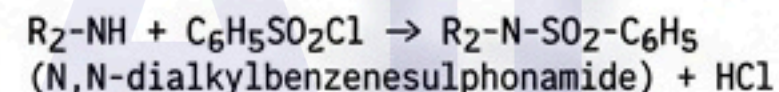
R_2-NH

Result: Insoluble sulfonamide

R_2-NH (Secondary Amine)

Reaction with $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$ yields N,N-dialkylbenzenesulphonamide. Lacks an acidic hydrogen on nitrogen, insoluble in alkali.

Observation: Insoluble precipitate formed.



R_3-N

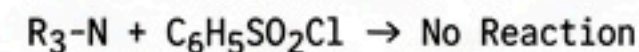
Result: No reaction

R_3-N (Tertiary Amine)

No reaction with $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$ due to the absence of hydrogen on the nitrogen atom.

Remains as an unreacted amine.

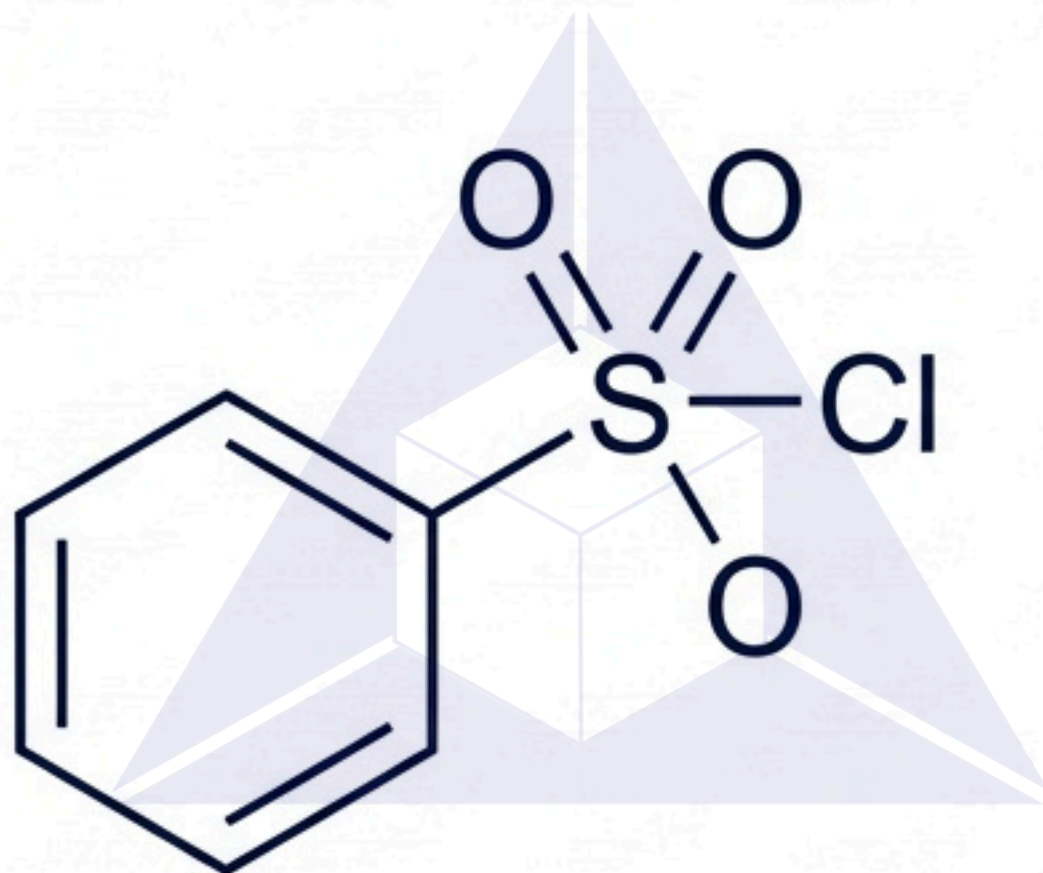
Observation: No reaction / No change in phase.



The Diagnostic Tool: Hinsberg's Reagent



The Chemical Actor



C6H5SO2Cl

Properties & Updates

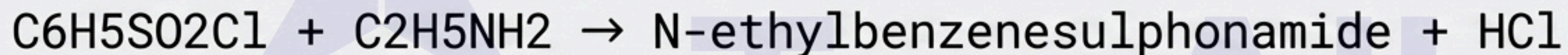
Benzenesulphonyl chloride, known as Hinsberg's reagent, reacts conditionally with amines to form sulphonamides.

Modern Standard: Today, benzenesulphonyl chloride is frequently replaced by p-toluenesulphonyl chloride in laboratory and industrial settings.

1° Amines: Soluble Sulphonamide Formation

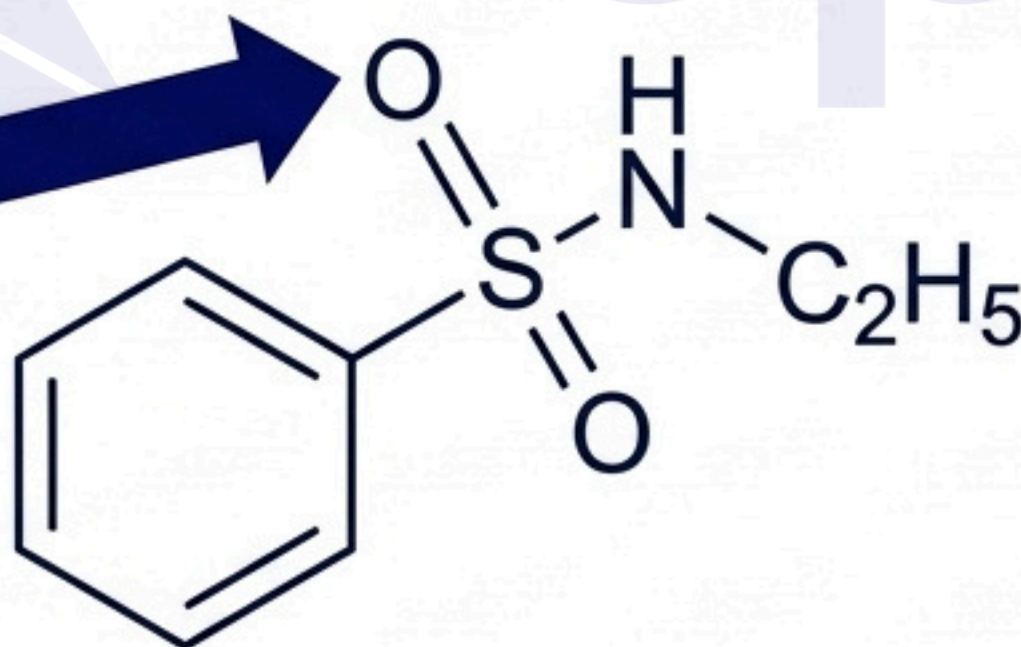
Reaction Concept

Primary amines react with Hinsberg's reagent to yield a highly acidic product.



Key Mechanism & Product Solubility

Strongly Acidic: The strong electron-withdrawing sulphonyl group makes this hydrogen easily removable.



[Solubility: Soluble in Alkali]



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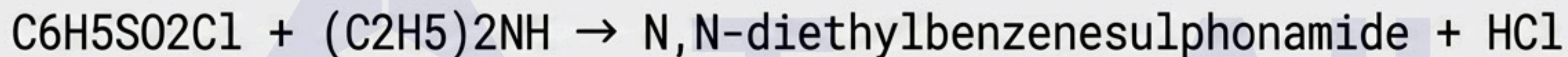
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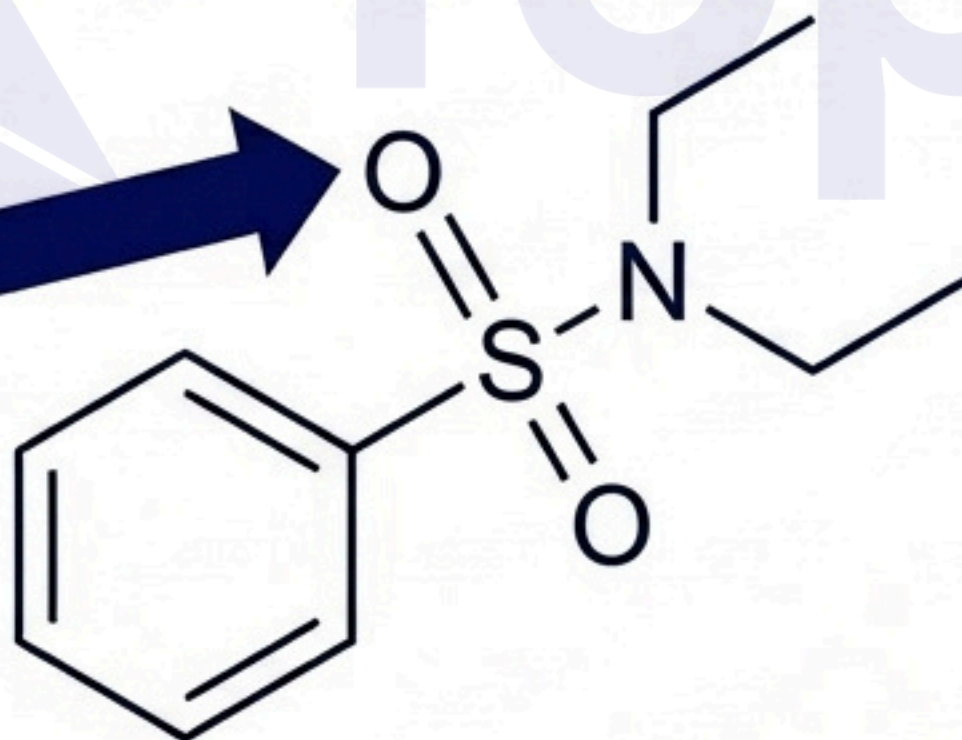


2° Amines: Insoluble Sulphonamide Formation

Secondary amines react to form a sulphonamide, but lack the necessary structure for acidity.



No Hydrogen Attached:
Because the nitrogen lacks an attached hydrogen, the molecule is not acidic.



[Solubility: Insoluble in Alkali]

3° Amines: The Non-Reactive Case

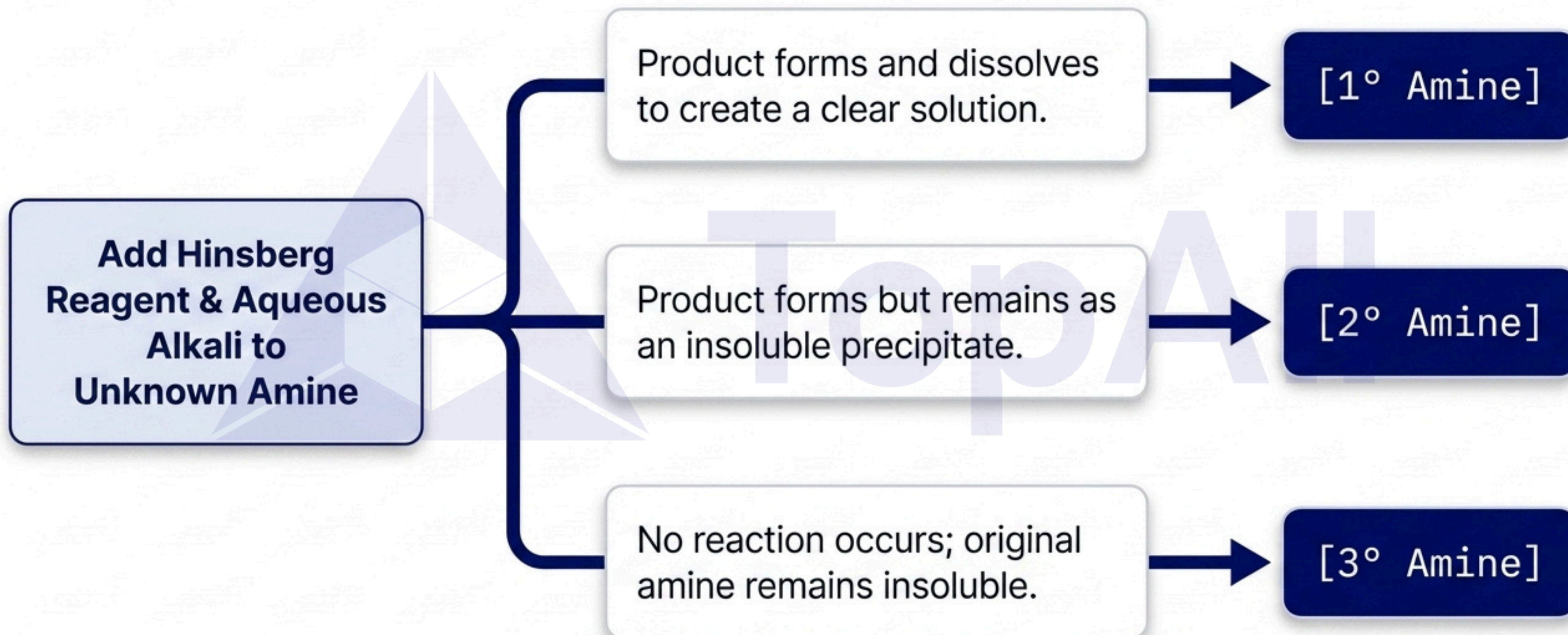
Tertiary amines completely lack a replaceable hydrogen atom on the nitrogen.



Without a replaceable hydrogen to initiate the reaction, no sulphonamide can form.

[Solubility: Remains insoluble in alkali (soluble in acid)]

The Diagnostic Algorithm



Rapid Recall Matrix: Amine Separation

Amine Class	Reagent Reaction	Acidic H Present?	Alkali Solubility
1° Amine	Forms N-alkylbenzenesulphonamide	✓	Soluble
2° Amine	Forms N,N-dialkylbenzenesulphonamide	✗	Insoluble
3° Amine	No Reaction	✗	Insoluble (No Product)

Key takeaway: This differential reactivity enables both the rapid identification and the physical separation of amine mixtures.



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