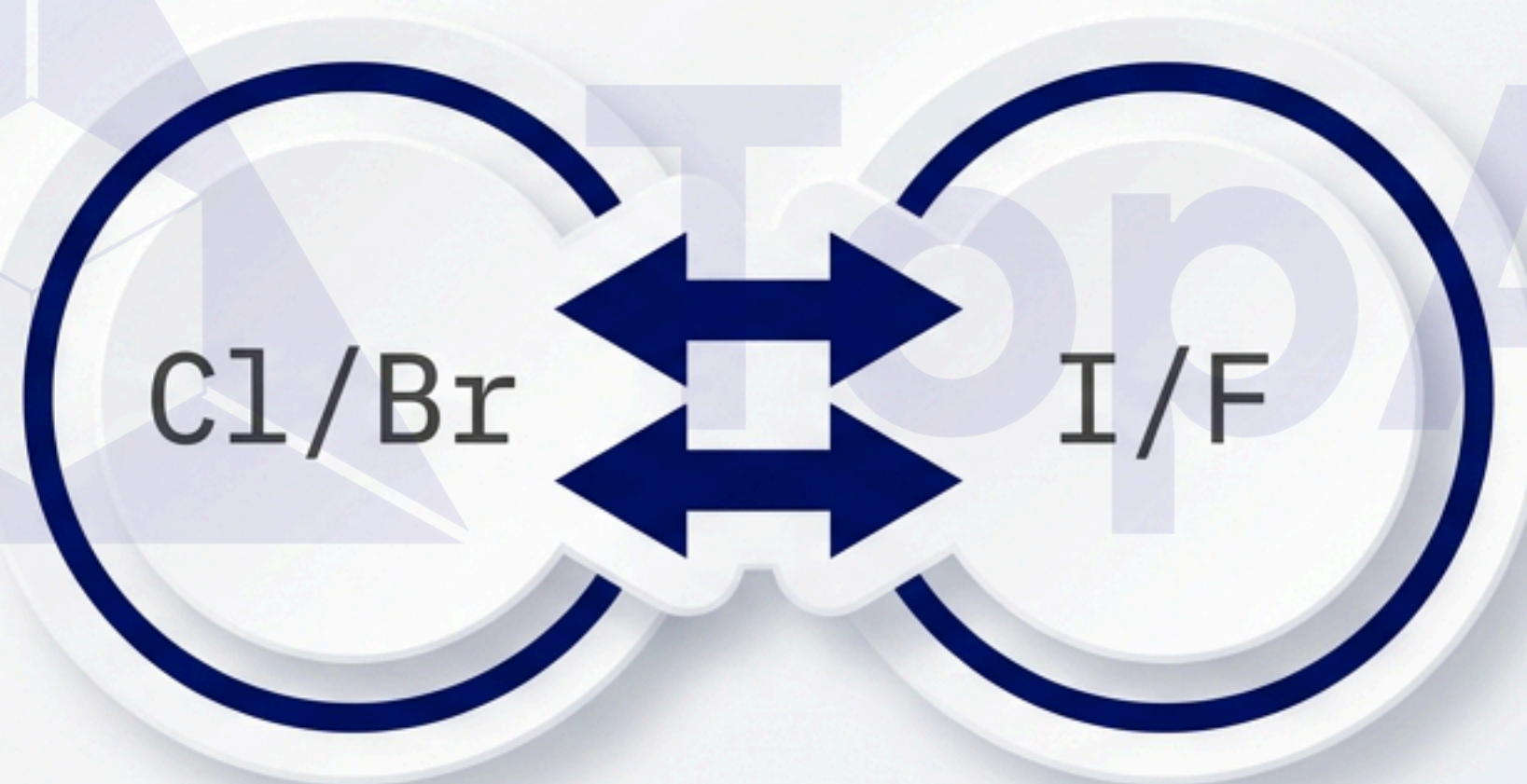


Swapping Halogens

An Overview of Halogen Exchange Reactions



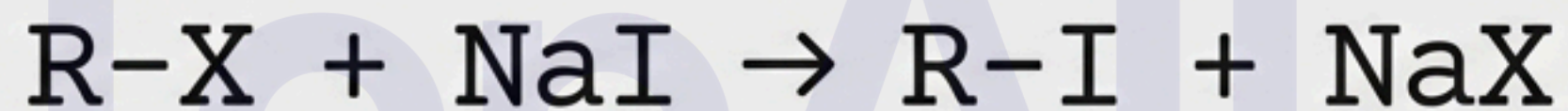
Organic Synthesis 101

The Finkelstein Reaction

Direct halogenation isn't always viable for synthesizing alkyl iodides. The Finkelstein reaction solves this through a controlled halogen exchange, converting alkyl chlorides or bromides directly into alkyl iodides.

Key Concept: Nucleophilic Substitution

The iodine acts as a nucleophile, efficiently replacing the existing halogen on the alkyl group.



Where X = Cl or Br

Driving the Reaction Forward

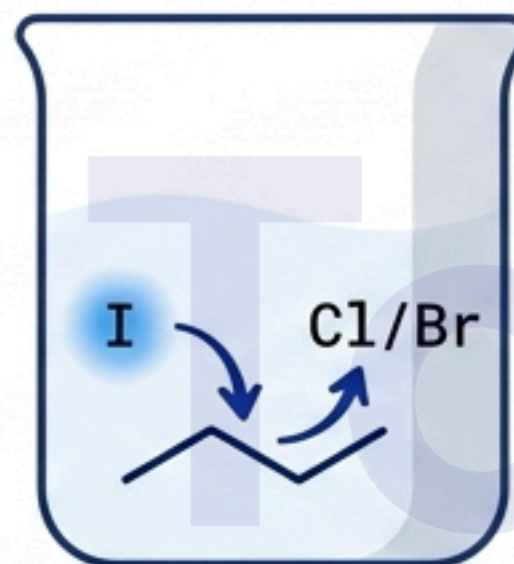
1. The Solvent

Condition: Dry Acetone



NaI is highly soluble in dry acetone, making iodide ions readily available.

2. The Swap



Iodine displaces the chlorine or bromine on the alkyl chain.

3. The Precipitate



The newly formed NaCl or NaBr is insoluble in dry acetone and drops out of the solution as a solid precipitate.

Le Chatelier's Principle

Because the byproduct (NaCl/NaBr) precipitates out, it is continually removed from the equilibrium system. This continuously forces the reaction forward to produce more alkyl iodide.



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The Swarts Reaction

Synthesizing alkyl fluorides requires a different approach due to the high reactivity of fluorine. The optimal method is heating an alkyl chloride or bromide with a specific metallic fluoride.



Heating Required

The exchange is driven by applying heat directly to the mixture of the alkyl halide and the chosen metallic fluoride.

Fluoride Replacement Card

Starting Material: R-Cl or R-Br



Metallic Fluoride Reagents:

- AgF (Silver Fluoride)
- Hg₂F₂ (Mercurous Fluoride)
- CoF₂ (Cobalt(II) Fluoride)
- SbF₃ (Antimony Trifluoride)



Product: R-F (Alkyl Fluoride)

Finkelstein vs. Swarts

A quick-reference matrix for Halogen Exchange.

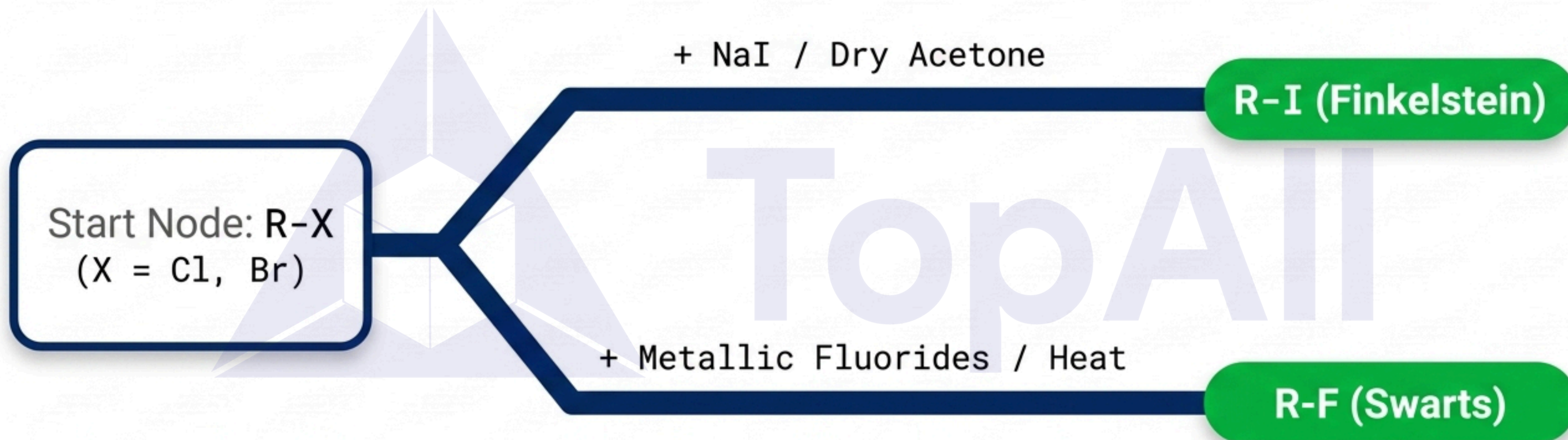


Feature	Finkelstein Reaction	Swarts Reaction
Target Product	Alkyl Iodides (R-I)	Alkyl Fluorides (R-F)
Starting Material	Alkyl Chlorides/Bromides	Alkyl Chlorides/Bromides
Primary Reagent	NaI (Sodium Iodide)	Heavy Metallic Fluorides (AgF, Hg ₂ F ₂ , etc.)
Key Driver / Condition	Precipitation in Dry Acetone	Application of Heat

The Exchange Map



Directing halogens to their final destination.



Why Exchange?

Direct iodination is reversible and tricky to manage; direct fluorination is violent and highly reactive. Halogen exchange provides a controlled, predictable, and high-yield detour for organic synthesis.



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