

## UNIT 6 • HALOALKANES AND HALOARENES

# Preparation of Haloalkanes from Hydrocarbons

Precision vs. Chaos: Evaluating synthetic pathways from alkanes and alkenes.

# Core Concepts

## Free Radical Halogenation

The scattergun reaction of alkanes with UV/ $X_2$ . Produces a complex, difficult-to-separate mixture of isomeric mono- and polyhaloalkanes.

## Markovnikov's Rule

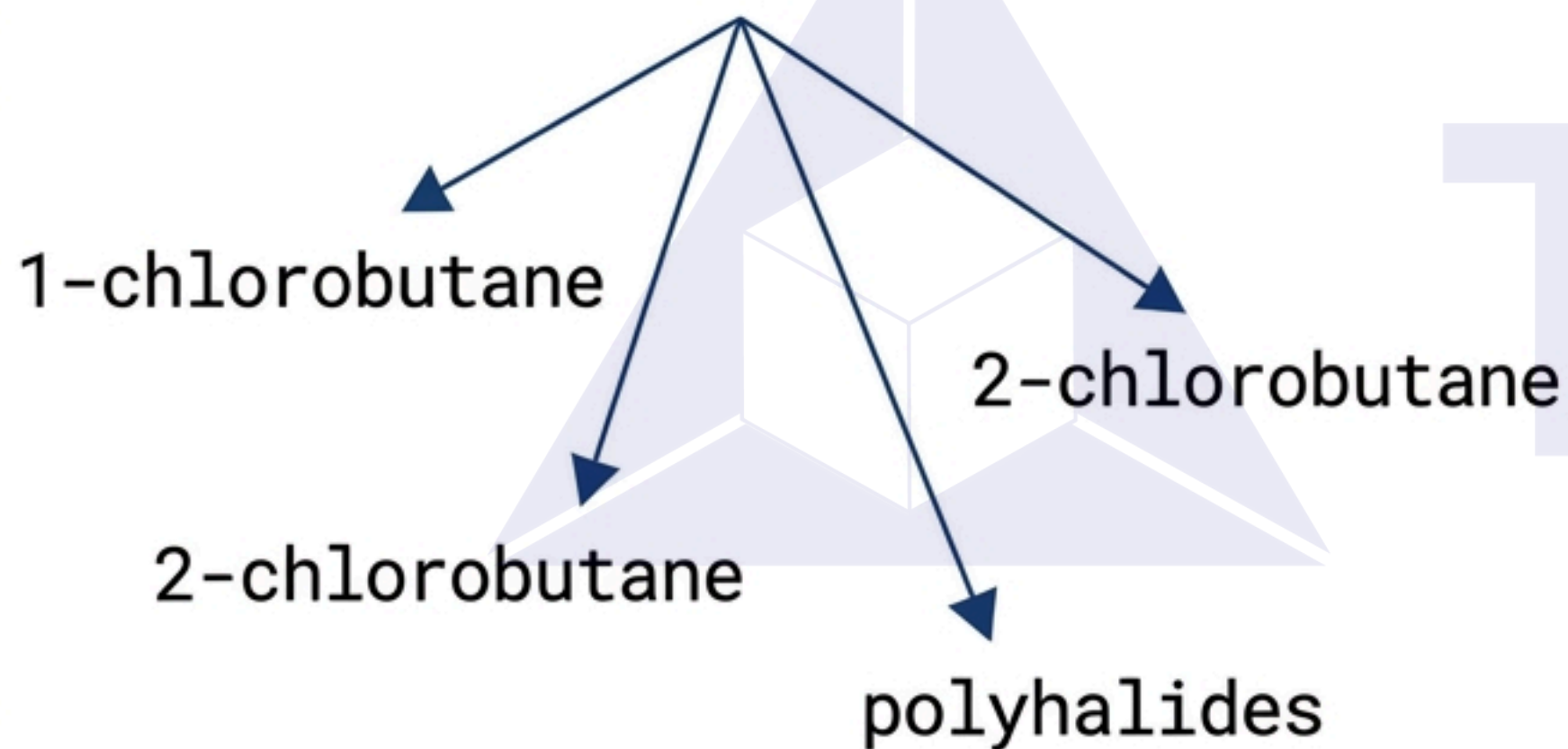
The governing rule for HX addition to asymmetrical alkenes. The halide attaches to the carbon with fewer hydrogen atoms.

## Vic-dibromides

Colourless products formed when halogens ( $X_2$ ) add across an alkene double bond, attaching to adjacent (vicinal) carbons.

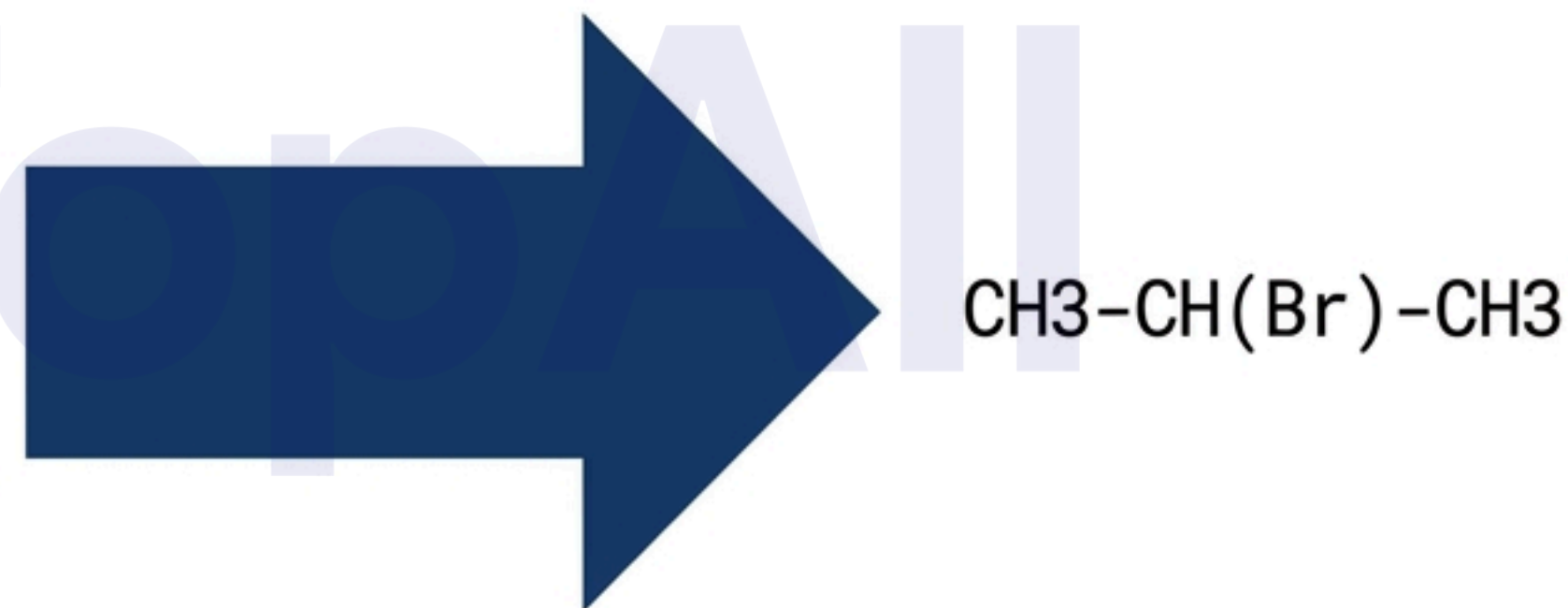
# Route Efficiency: The Swarm vs. The Arrow

## Free Radical Halogenation (Alkanes)



Yields low amounts of any single pure compound.

## Electrophilic Addition (Alkenes)



High-yield, directed synthesis following specific rules.



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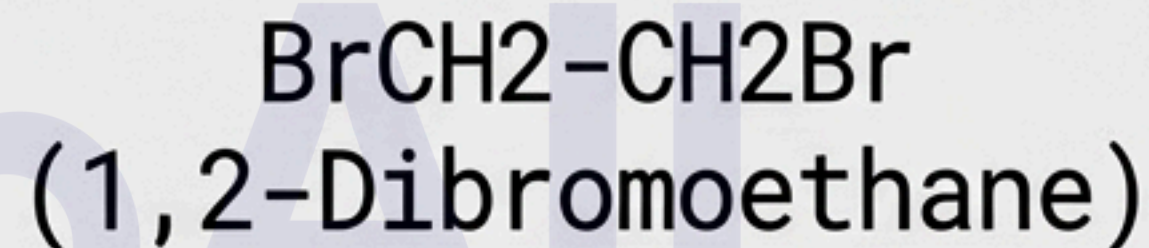
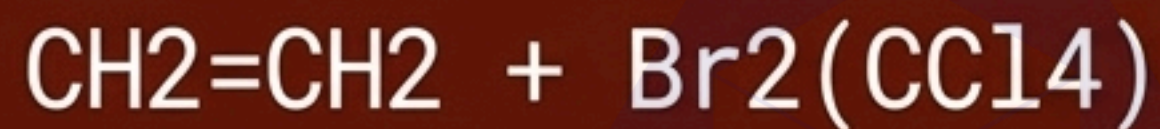


# Directed Synthesis: Markovnikov's Rule



The alkene's double bond dictates the precise landing spot of the hydrogen halide.

# The Visual Proof: Br<sub>2</sub> / CCl<sub>4</sub> Addition



This addition constitutes a vital laboratory test for detecting double bonds. The rapid discharge of the reddish-brown colour confirms the synthesis of a colourless vic-dibromide.

## Watch For This: The Yield Trap

Which reaction is best for preparing a high yield of pure 1-chlorobutane?

Reacting butane with  $\text{Cl}_2$  in the presence of UV light.

**Watch out for free radical halogenation.** While it does produce 1-chlorobutane, it gives a complex swarm of isomeric mono- and polyhaloalkanes. Because they are incredibly difficult to separate as pure compounds, the yield of any single compound is far too low for practical, targeted synthesis.

# Key Takeaways

- **Alkanes represent chaos:** Free radical halogenation generates inseparable mixtures of isomers, making it unsuitable for pure single-product synthesis.
- **Alkenes represent precision:** Addition routes (with HX or  $X_2$ ) provide clean, high-yield pathways dictated by predictable frameworks like Markovnikov's rule.



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