

# The Four Fundamentals of Organic Reactions

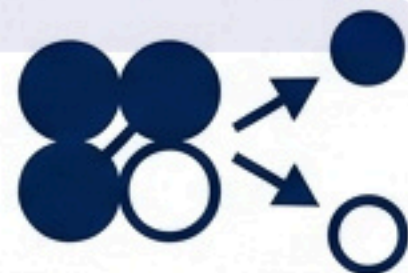
A visual diagnostic guide to the molecular choreography of organic chemistry.



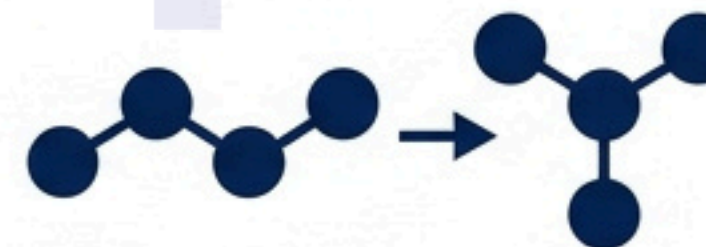
**Substitution**



**Addition**



**Elimination**



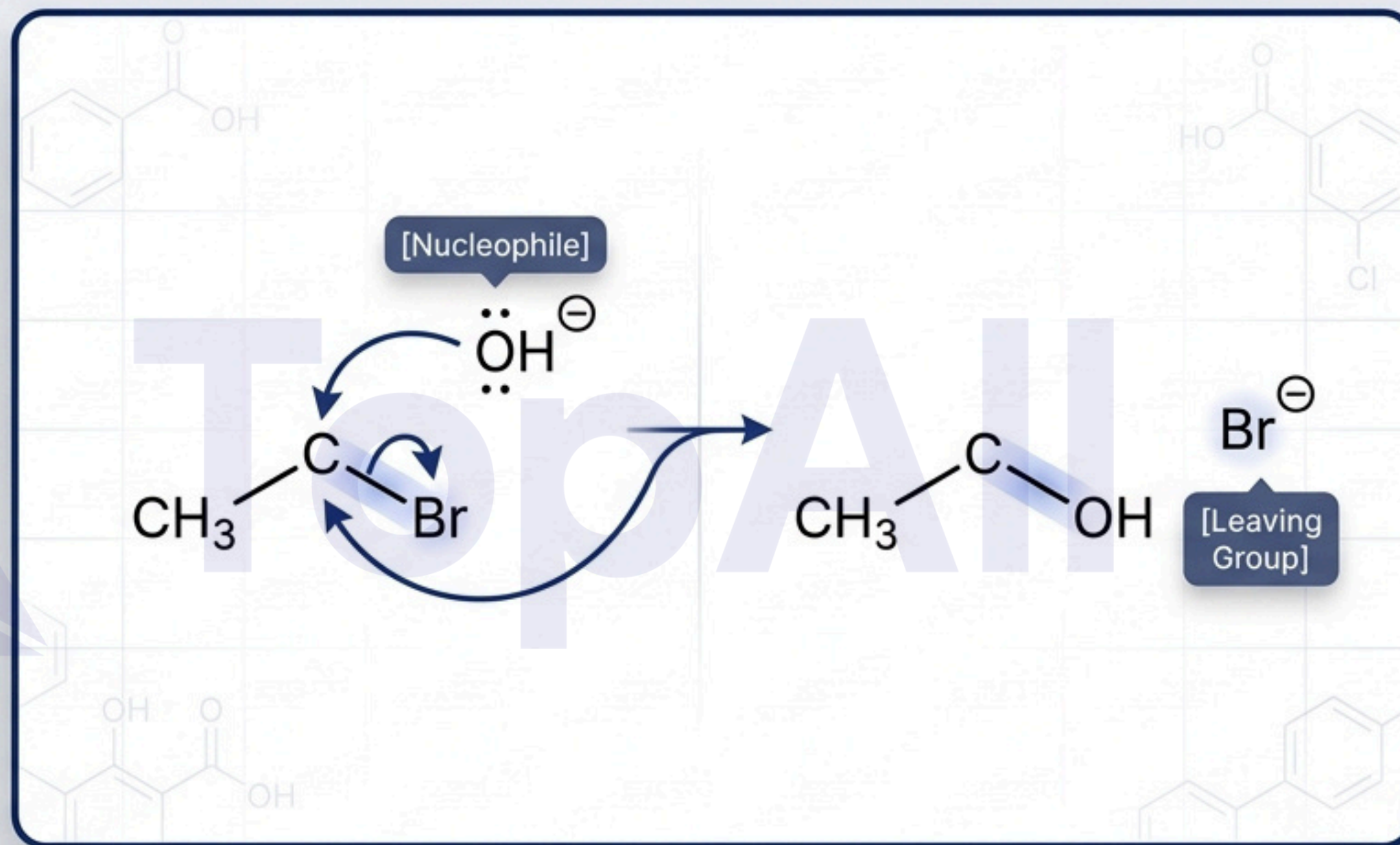
**Rearrangement**

A reaction mechanism is a sequential account describing details of electron movement, energetics during bond cleavage, and bond formation. Every organic transformation falls into one of these four foundational categories.

# Substitution

An atom or group of atoms in a molecule is entirely replaced by a different atom or group.

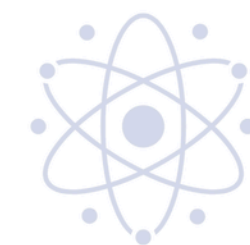
Observe how the incoming nucleophile ( $\text{OH}^-$ ) targets the carbon, seamlessly displacing the bromide ion in a 1-for-1 molecular swap.





# You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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## Key Highlights

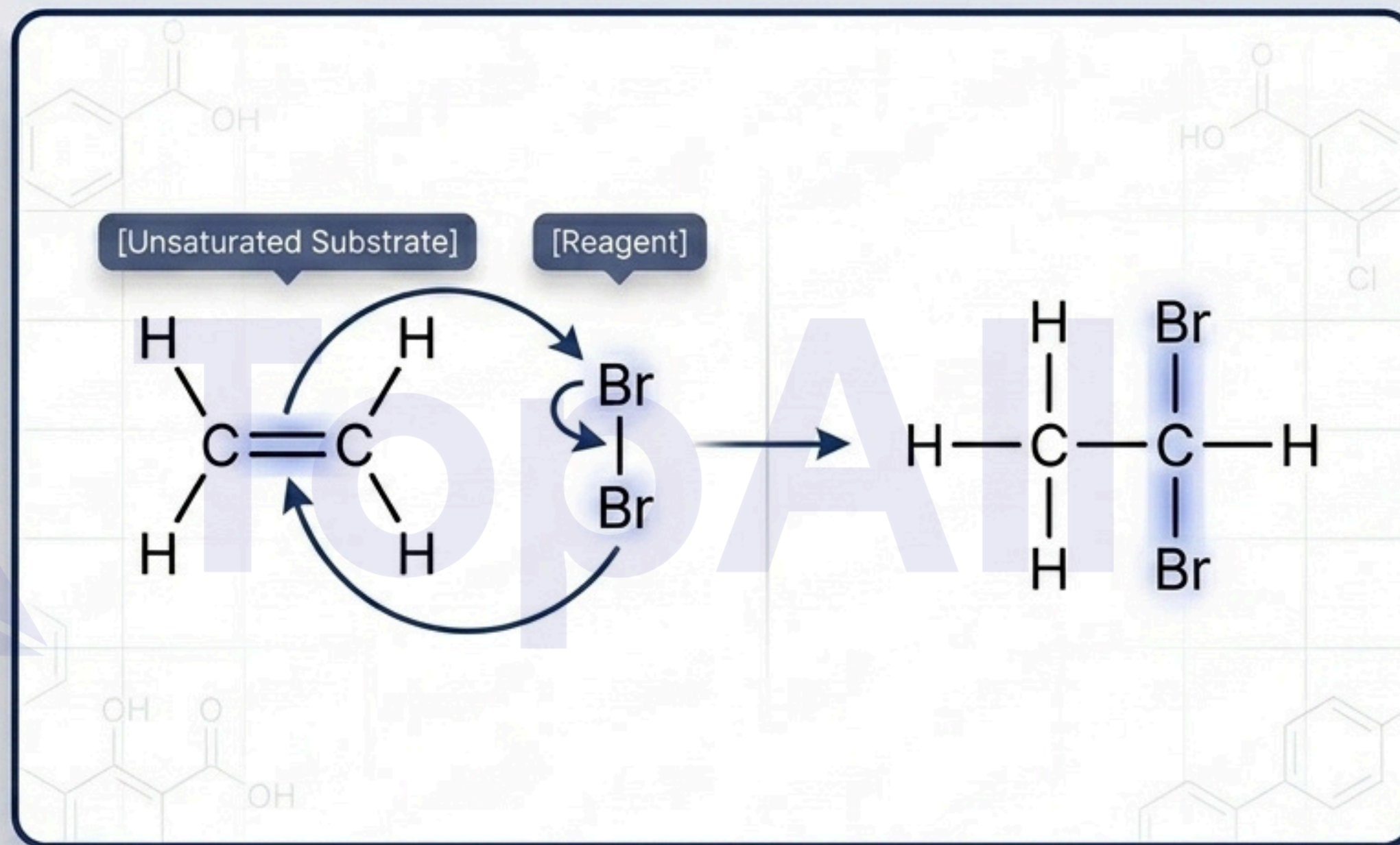
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# Addition

Two or more molecules combine to form a single, larger product molecule, breaking a multiple bond in the process.

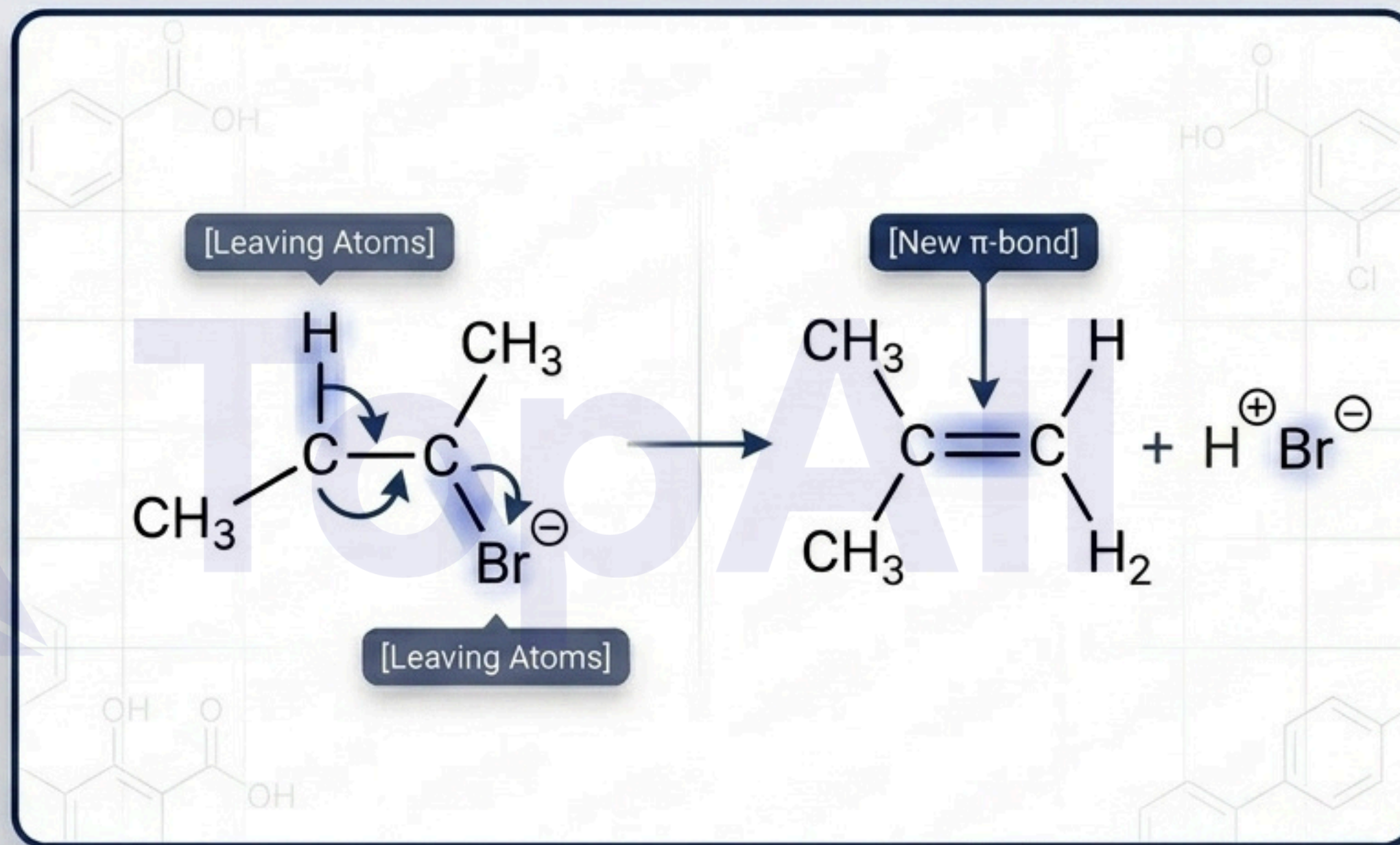
Notice the transformation: the  $\pi$ -bond acts as an electron source, breaking apart to form two new  $\sigma$ -bonds. The molecule goes from unsaturated to fully saturated.



# Elimination

Two atoms or groups are removed from adjacent carbon atoms, forcing the molecule to form a new multiple bond.

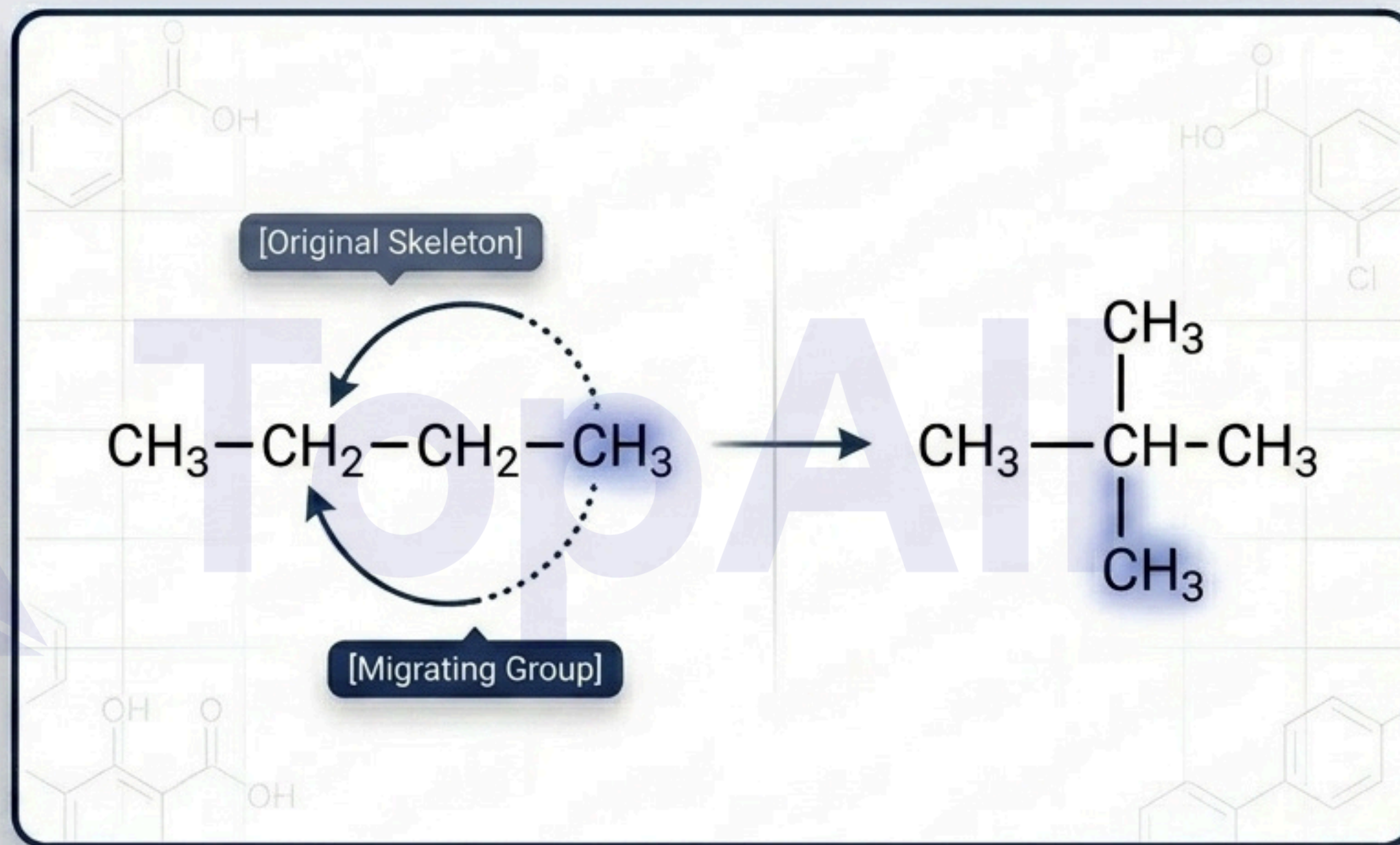
The exact reverse of addition.  
Watch how the removal of atoms forces the carbon skeleton to share more electrons internally, creating a new double bond to satisfy valency.



# Rearrangement

The molecular skeleton is reorganized to form a structural isomer, with absolutely no net loss or gain of atoms.

A purely internal reorganization. The molecular formula remains completely identical, but the skeletal connectivity shifts to find a more stable spatial arrangement.



# Classifying the Molecular Choreography

Use this diagnostic matrix to reverse-engineer organic reaction mechanisms by observing the reactant-to-product ratios and saturation states.

| Reaction Type | Core Mechanism    | Change in Saturation     | Reactants → Products |
|---------------|-------------------|--------------------------|----------------------|
| Substitution  | Atom Swap         | None (usually)           | 2 → 2                |
| Addition      | Bond Saturation   | Double → Single <b>X</b> | 2 → 1                |
| Elimination   | Bond Desaturation | Single → Double <b>X</b> | 1 → 2                |
| Rearrangement | Skeleton Shift    | None                     | 1 → 1                |



# You've Learned the Theory.

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