

UNIT 8 • ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

Cannizzaro Reaction & Electrophilic Substitution

Mastering disproportionation pathways
and aromatic ring directing effects.

Key Vocabulary

Disproportionation

A specific type of redox reaction where a single species is simultaneously oxidized and reduced.

Meta-directing

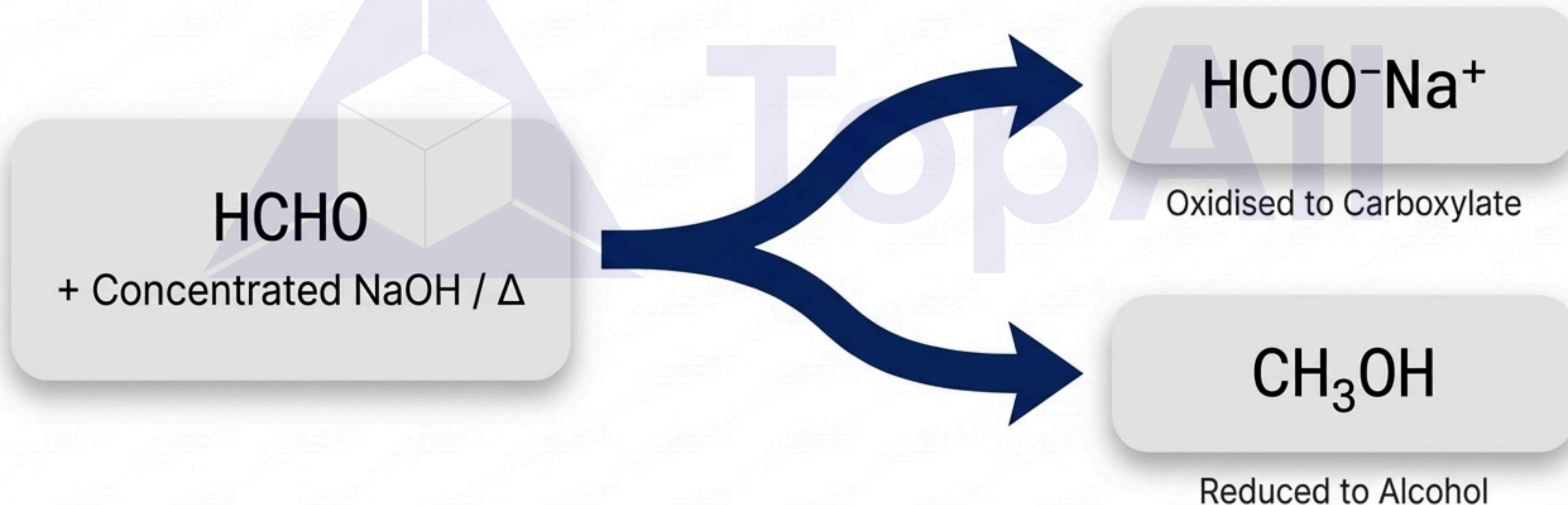
A substituent effect that directs incoming electrophiles to the meta (3 or 5) position on an aromatic ring.

Deactivating

An electron-withdrawing effect that makes an aromatic ring less reactive to electrophilic substitution than benzene itself.

The Disproportionation Split

When heated with concentrated alkali, aldehydes lacking an α -hydrogen undergo simultaneous self-oxidation and self-reduction.





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$$E=mc^2$$



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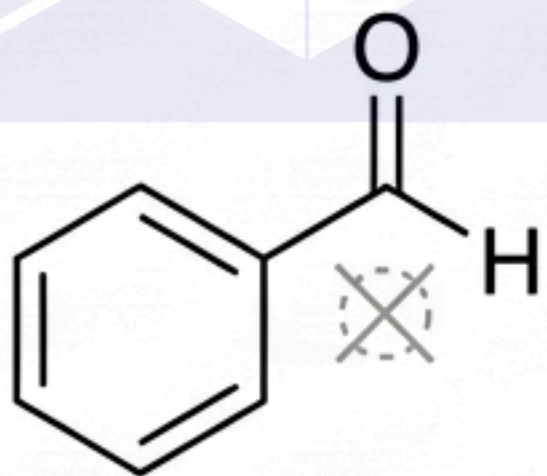


The α -Hydrogen Switch

NO α -H

Examples: Benzaldehyde,
Formaldehyde

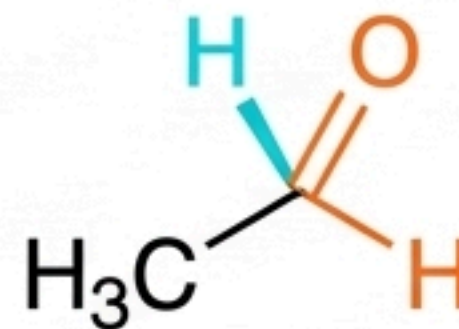
**Result: Disproportionation
(Cannizzaro Reaction)**



Has α -H

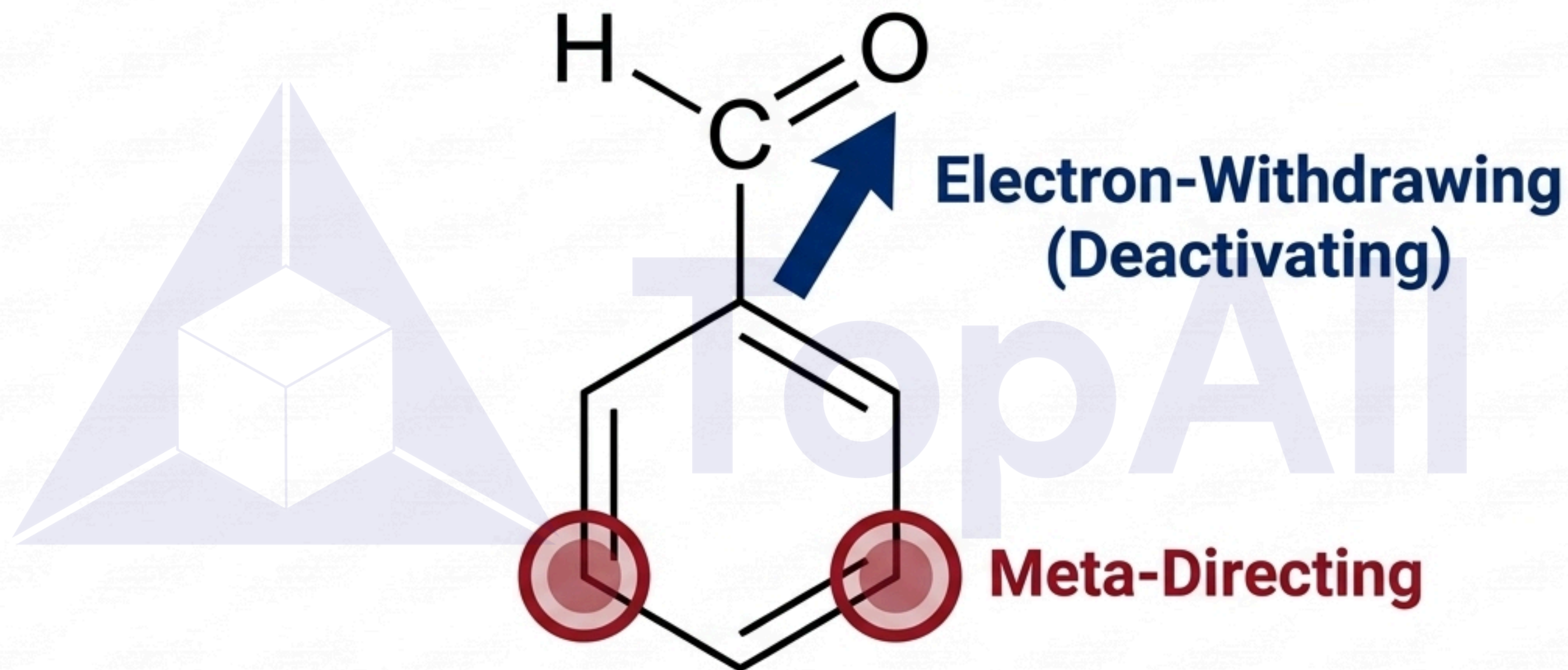
Examples: Acetaldehyde,
Propanal

**Result: Aldol Condensation
(β -hydroxy aldehydes)**



The presence of a single alpha-hydrogen diverts the reaction entirely.

The Carbonyl Effect on Aromatic Rings



The strong electron-withdrawing nature of the carbonyl group pulls electron density out of the ring, deactivating it and steering incoming electrophiles exclusively to the *meta* position.

Watch for this: The Alpha-Hydrogen Trap

Exam questions will intentionally mix aldehydes with and without α -hydrogens under alkaline conditions to test your diagnostic speed.

Always map the alpha-carbon first!

- ✓ Verify the absence of an α -hydrogen before predicting a Cannizzaro product.
- ✓ If even one α -H is present, pivot your prediction to Aldol condensation.

Key Takeaways

- **Cannizzaro Reaction:** Aldehydes with NO α -hydrogens undergo disproportionation in concentrated alkali. One molecule is simultaneously oxidized to a carboxylate while another is reduced to an alcohol.
- **Electrophilic Substitution:** On an aromatic ring, the carbonyl group acts as a strongly deactivating and meta-directing substituent due to its electron-withdrawing nature.



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