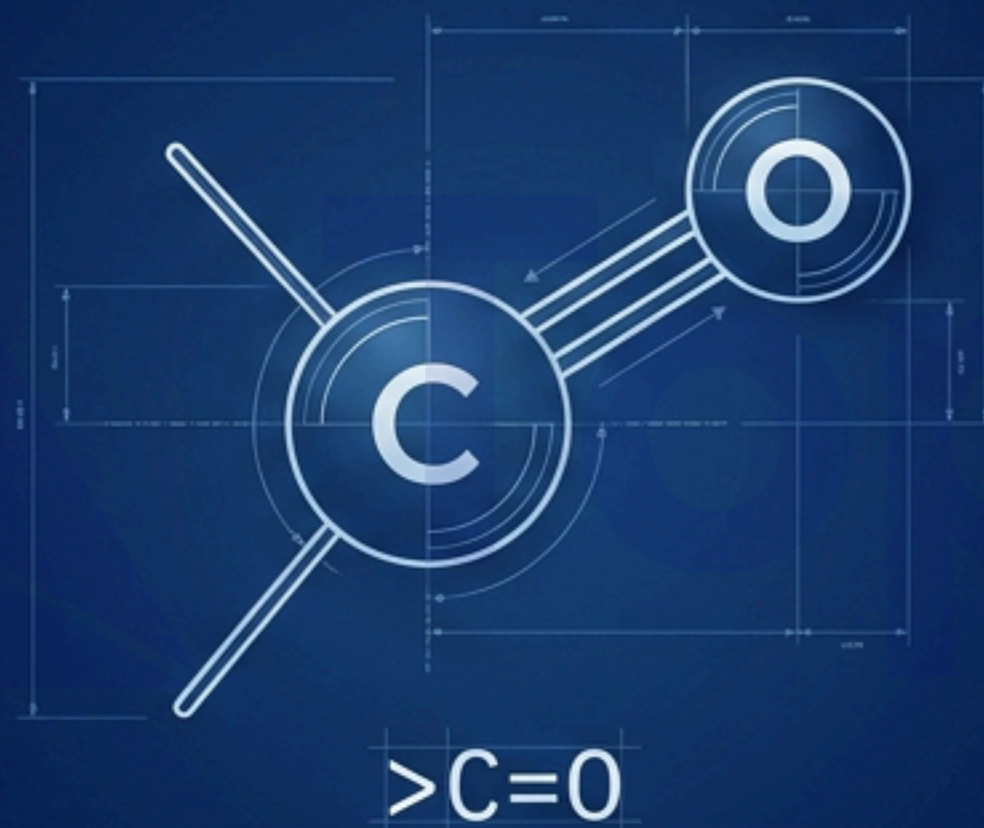


Preparation of Aldehydes

Reaction Blueprints, Reagents, and Synthesis Pathways.



[1. From Acyl Chlorides]

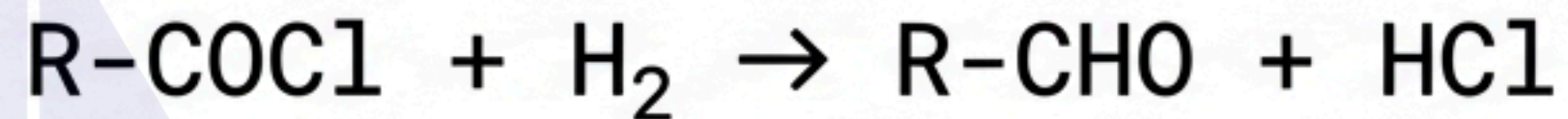
[2. From Nitriles/Esters]

[3. From Hydrocarbons]

1. FROM ACYL CHLORIDES

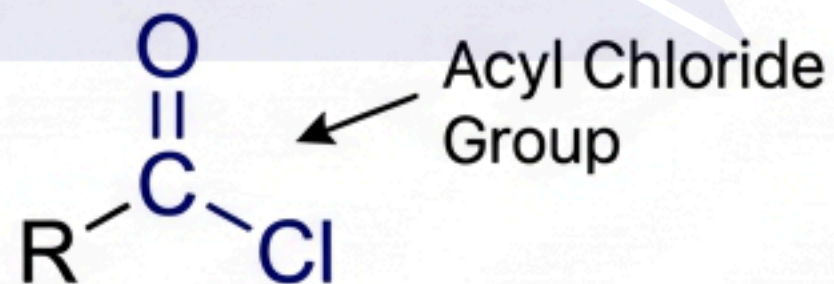
Rosenmund Reduction

Reaction Strip



Reactant

Acyl Chloride (Acid Chloride)



Catalyst System

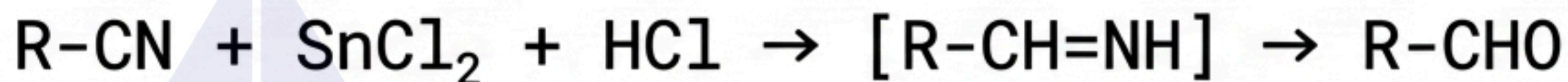


Palladium on Barium Sulphate

Exam-Smart Note: The Barium Sulphate acts as a catalytic poison. This intentionally halts the reaction at the aldehyde stage, preventing further reduction into a primary alcohol.

2A. FROM NITRILES

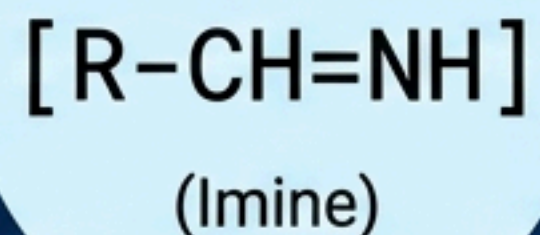
Stephen Reaction



Step 1: Reduction

Stannous chloride (SnCl_2) and HCl reduce the starting nitrile to an imine.

Intermediate



Step 2: Hydrolysis

Acidic hydrolysis (H_3O^+) of the imine unlocks the final aldehyde.

Method Utility: A highly specific, named route for converting nitriles to aldehydes using mild tin-based reduction.

2B. FROM NITRILES & ESTERS

Selective Reduction via DIBAL-H



Reagent Badge

DIBAL-H

(Diisobutylaluminium hydride)

Target 1

Nitriles (R-CN) $\rightarrow$ Imines $\rightarrow$ Aldehydes

Target 2

Esters ($\text{R-COOR}'$) $\rightarrow$ Aldehydes

Exam-Smart Note: DIBAL-H is a highly selective reducing agent. Its primary advantage is avoiding over-reduction, stopping cleanly at the aldehyde without producing an alcohol.



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Let's Test Them Now.**

$$E=mc^2$$



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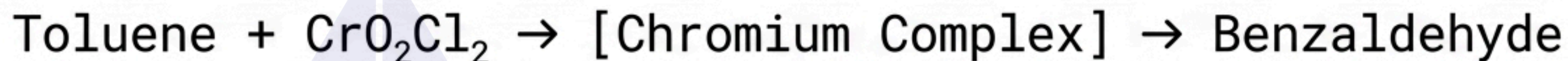
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- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter



Etard Reaction (Chromyl Chloride Route)



The Oxidizer



Chromyl Chloride initiates the oxidation of the methyl group.

The Trap

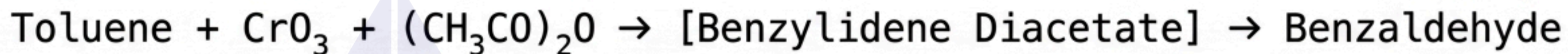
Forms a chromium complex intermediate. This physical trap prevents the strong oxidizer from taking the reaction all the way to benzoic acid.

Hydrolysis

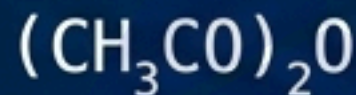
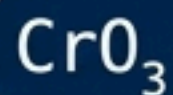
Aqueous acid unlocks the complex, releasing pure benzaldehyde.

Mechanism Insight: The critical feature is halting oxidation. Without the protective complex formation, toluene would fully oxidize directly to benzoic acid.

Chromic Oxide Route



Reagents



Chromic oxide paired with Acetic anhydride.

Intermediate

Benzylidene diacetate



Protective State

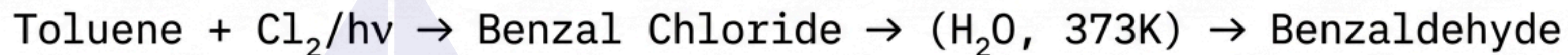
Release

Aqueous acid and heat release the target benzaldehyde.

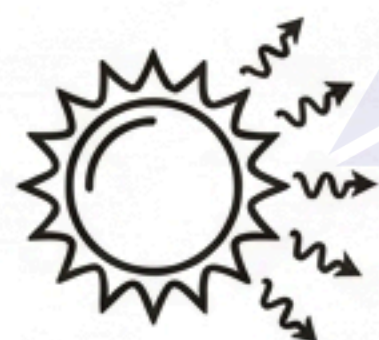
Exam-Smart Note: This utilizes the exact same chemical logic as the Etard reaction. The acetic anhydride captures the intermediate, preventing over-oxidation.

3C. FROM AROMATIC HYDROCARBONS

Side Chain Chlorination + Hydrolysis



Step 1: Photochemical Chlorination



$h\nu$

Photochemical halogenation of the side chain yields benzal chloride.

Step 2: High-Temp Hydrolysis



373K

Aqueous hydrolysis at high temperature forces the conversion to benzaldehyde.

Commercial Focus: Unlike elegant laboratory techniques, this raw, robust process is the primary industrial method for the mass manufacture of benzaldehyde.

3D. DIRECT FROM BENZENE

Gattermann-Koch Reaction



Starting Material



Benzene or its derivatives.
Skips toluene entirely.

Formylating Agents

CO

HCl

Carbon monoxide and Hydrogen chloride act together.

Catalyst System

AlCl_3 / CuCl

Anhydrous Aluminium Chloride
or Cuprous Chloride.

Exam-Smart Note: Direct formylation of an aromatic ring. Mentally frame this as a highly specialized Friedel-Crafts acylation that installs an aldehyde group directly onto an empty ring.



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