

# Applications of d- and f-Block Elements

The metallic engines behind the world's most important industrial processes.

## **Named Industrial Catalytic Processes**

Specific, large-scale chemical manufacturing methods that rely on the unique properties of transition metals (or their compounds)—specifically their ability to adopt multiple oxidation states and provide reactive surface areas—to function as essential catalysts.

# High-Yield Pairings (1 of 2)



Contact Process  
(Oxidation of  $\text{SO}_2$ )



Ziegler Catalyst  
(Polymerization  
of polyethene)



Haber Process  
(Ammonia  
synthesis from  
from  $\text{N}_2/\text{H}_2$ )



Catalytic  
Hydrogenation  
(Oils to fats)



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

$$E=mc^2$$



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## Key Highlights

- » Free Study Material, Videos & Infographics
- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
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# High-Yield Pairings (2 of 2)

**$\text{PdCl}_2$**  → Wacker Process  
(Ethyne to ethanal)

**$\text{TiO}$**  → Pigment Industry  
(White pigment manufacture)

**$\text{MnO}_2$**  → Dry Battery Cells  
(Depolarizer)

**$\text{AgBr}$**  → Photography  
(Light-sensitive properties)

# Process Spotlight: The Wacker Process



Palladium (II) chloride enables the controlled oxidation of alkenes/alkynes, a cornerstone reaction in organic synthesis.

# Examiner's Playbook

## Watch for this: Mixed-up Catalysts!

Examiners frequently swap the catalysts for the Wacker and Haber processes in multiple-choice questions. Keep them structurally distinct:

**$\text{PdCl}_2$**  → Wacker Process  
(Oxidation of ethyne)

**$\text{Fe}$**  → Haber Process  
(Ammonia synthesis)

# Knowledge Check

Match the catalyst to its industrial application:

- |               |                     |
|---------------|---------------------|
| (I) $V_2O_5$  | (P) Hydrogenation   |
| (II) Ni       | (Q) Contact Process |
| (III) AgBr    | (R) Wacker Process  |
| (IV) $PdCl_2$ | (S) Photography     |

**A: I-Q, II-P, III-S, IV-R**

**B: I-P, II-Q, III-R, IV-S**

**C: I-Q, II-P, III-R, IV-S**

**D: I-R, II-S, III-P, IV-Q**

# Module Summary



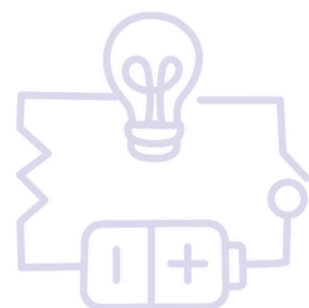
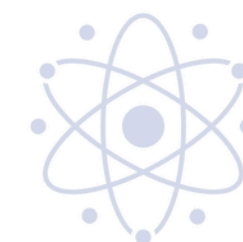
## Key Takeaways

- Transition metals and their compounds make exceptional industrial catalysts primarily due to their ability to adopt multiple oxidation states and provide highly reactive surface areas.
- Memorizing specific metal-to-process pairings (e.g., **TiCl<sub>4</sub>** → Ziegler, **V<sub>2</sub>O<sub>5</sub>** → Contact, **PdCl<sub>2</sub>** → Wacker) is highly testable and forms the basis of many discrete, direct scoring opportunities on exams.



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