

UNIT 4 • d- AND f-BLOCK ELEMENTS

Potassium Permanganate (KMnO_4)

Preparation, Properties, and High-Yield Titration Traps

Manganate & Permanganate

The +6 and +7 oxidation states of manganese, forming tetrahedral oxoanions (MnO_4^{2-} and MnO_4^-).



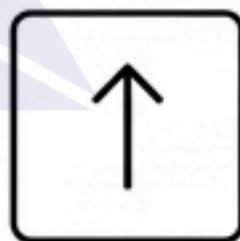
Disproportionation

A specific redox reaction where a single species is simultaneously oxidized and reduced to form two different products.

MnO_4^{2-} (Manganate)
(Manganate)

+6 Oxidation State

Paramagnetic



MnO_4^- (Permanganate)
(Permanganate)

+7 Oxidation State

Diamagnetic





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

$$E=mc^2$$



Turn theory into marks with **unlimited MCQs, smart analysis, and focused revision.**

Practice Now



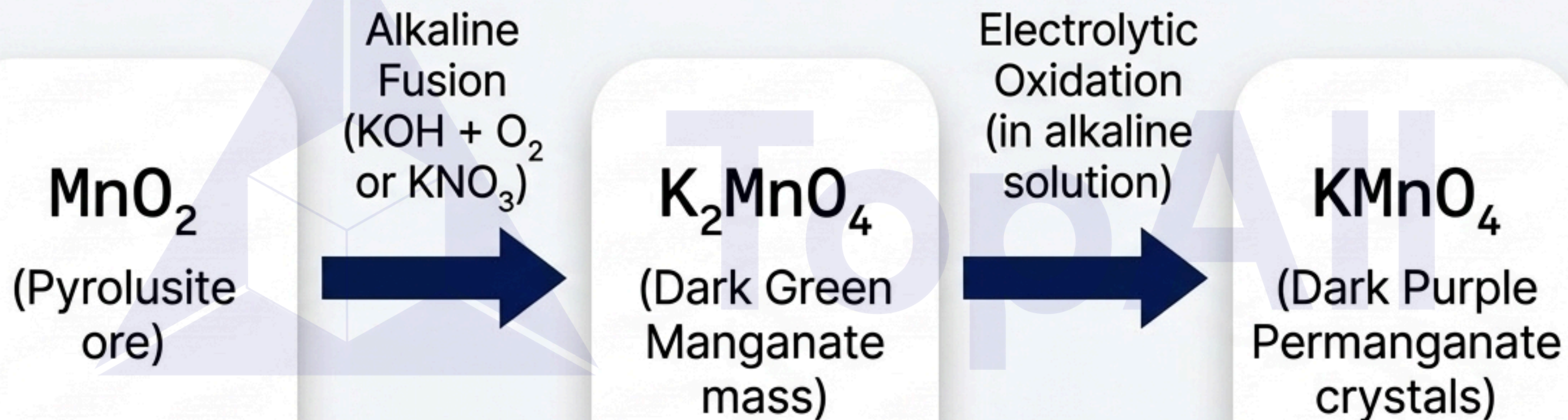
At prep.topall.app

Key Highlights

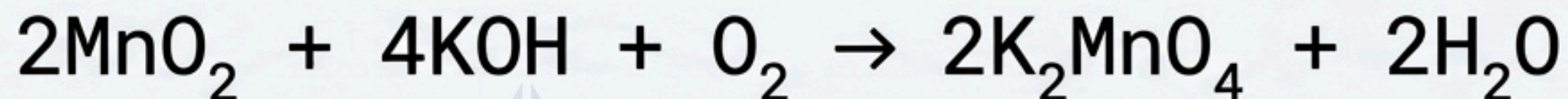
- » Free Study Material, Videos & Infographics
- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter



Preparation of KMnO_4



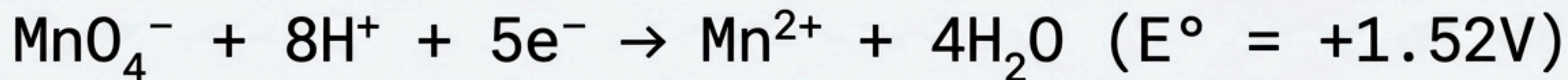
Alkaline Oxidative Fusion



Acidic Disproportionation



Acidic Reduction (Strong Oxidizing Agent)



Acidification in KMnO_4 Titrations

Clean Acidification (Use H_2SO_4)



Permanganate efficiently reduces to colorless Mn^{2+} , reacting solely with the analyte.

Unsatisfactory Acidification (Avoid HCl)



HCl interferes with the reaction, producing Cl_2 gas.

JEE Trap Alert

Watch for this setup in volumetric analysis questions.

Never use HCl in permanganate titrations. KMnO_4 is a strong enough oxidizing agent ($E^\circ = +1.52\text{V}$) to oxidize HCl into chlorine gas (Cl_2).

The titrant (KMnO_4) gets consumed by the acid rather than just the target analyte, leading to wildly inaccurate, elevated volume readings.

Acidification in KMnO_4 Titrations - Concept Check

Why is hydrochloric acid considered unsatisfactory for acidifying a potassium permanganate titration?

- A. It reduces the solubility of KMnO_4 in water.
- B. It stabilizes the +7 oxidation state, preventing reduction.
- C. It is oxidized to Cl_2 by permanganate, consuming the titrant.
- D. It forces the reaction to disproportionate into MnO_2 .

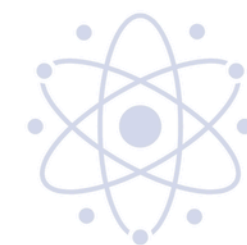
Key Takeaways

- **The Diagnostic Duo:** Manganate (MnO_4^{2-}) is green and paramagnetic (1 unpaired e^-). Permanganate (MnO_4^-) is purple and diamagnetic (0 unpaired e^-).
- **The Titration Rule:** Always acidify KMnO_4 titrations with H_2SO_4 . Never use HCl , as the permanganate will erroneously oxidize the acid into Cl_2 gas, ruining the quantitative result.



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

$$E=mc^2$$



Turn theory into marks with **unlimited MCQs, smart analysis, and focused revision.**

Practice Now



At prep.topall.app

Key Highlights

- » Free Study Material, Videos & Infographics
- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter

