

KMnO₄ Reaction With Fe(NO₂)₂

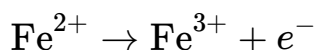
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Response: To find the number of moles of KMnO₄ required to react completely with 1 mole of Fe(NO₂)₂ in an acidic medium, we can analyze the oxidation and reduction half-reactions using the mole/electron balance method.

Step 1: Identify the Oxidation Half-Reaction

In Fe(NO₂)₂, both the iron ion (Fe²⁺) and the nitrite ions (NO₂⁻) undergo oxidation:

1. **Oxidation of Fe²⁺ to Fe³⁺:**



(1 electron released per Fe²⁺ ion)

2. **Oxidation of NO₂⁻ to NO₃⁻:**



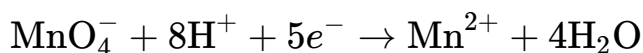
(2 electrons released per NO₂⁻ ion)

Since 1 mole of Fe(NO₂)₂ contains 1 mole of Fe²⁺ and 2 moles of NO₂⁻:

- Total electrons lost per mole of Fe(NO₂)₂ = 1(1e⁻) + 2(2e⁻) = 5 electrons

Step 2: Identify the Reduction Half-Reaction

In acidic medium, permanganate (MnO₄⁻) is reduced to Mn²⁺:



(5 electrons gained per MnO₄⁻ ion)

Step 3: Mole Ratio Calculation

By equating the total electrons lost in oxidation to the total electrons gained in reduction:

Moles of e⁻ released by 1 mole of Fe(NO₂)₂ = 5 moles

Moles of e⁻ consumed by 1 mole of KMnO₄ = 5 moles

$$\text{Moles of KMnO}_4 \text{ required} = \frac{\text{Moles of } e^{-} \text{ lost}}{\text{Electrons gained per KMnO}_4} = \frac{5}{5} = 1$$

Correct Option

