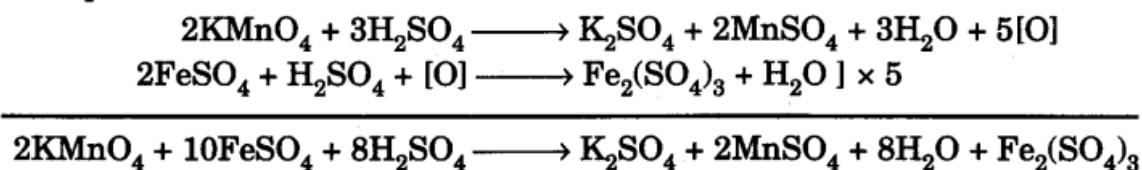


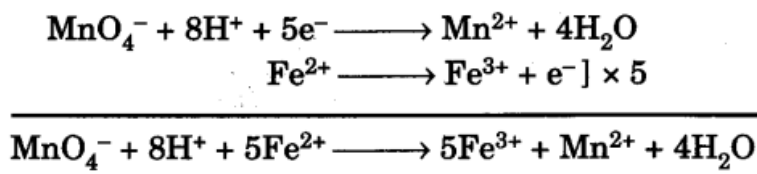
**You Are Provided With a Partially Oxidised Sample Of Ferrous Sulphate (FeSO₄.7H₂O) Crystals. Prepare a Solution By Dissolving 14.0 g Of these Crystals Per litre & Determine the Percentage Oxidation Of the given Sample.
Given M/100 KMnO₄ Solution**

Chemical Equations

Molecular Equation



Ionic equation



Theory

Since the given sample contains partially oxidized ferrous sulphate, it contains both ferrous ions, Fe²⁺(unoxidised) and ferric ions Fe³⁺ (oxidised). The strength of partially oxidised sample is known. The solution of partially oxidised FeSO₄ of known strength is titrated against standard KMnO₄ solution to determine the molarity and strength of the unoxidised ferrous sulphate. From this the percentage oxidation of the sample can be calculated.

Indicator

KMnO₄ is a self-indicator.

End Point

Colourless to permanent pink (KMnO₄ in burette).

Procedure

1. Weigh exactly 3.50 g of the given sample of ferrous sulphate on a watch glass and dissolve in water to prepare exactly 250 ml of solution using a 250 ml measuring flask. Rinse and fill the pipette with prepared ferrous sulphate solution and pipette out 20.0 ml of it in a washed titration flask.
2. Rinse and fill the burette with the M/100 KMnO₄ solution.

3. Add one test-tube (~ 20 ml) full of dilute sulphuric acid (- 2 M) to the solution in titration flask.
4. Note the initial reading of the burette.
5. Now add KMnO_4 solution from the burette till a permanent light pink colour is imparted to the solution in the titration flask on addition of a last single drop of KMnO_4 solution.
6. Note the final reading of the burette.
7. Repeat the above steps 4—5 times to get three concordant reading.

Observations

Weight of watch glass = g

Weight of watch glass + Mohr's salt =g

Weight of mixture = 3.50 g

Volume of solution prepared = 250 ml

Molarity of KMnO_4 solution = M/100

Volume of oxalate solution taken for each titration = 20.0 ml.

S. No.	Initial reading of the burette	Final reading of the burette	Volume of the KMnO_4 solution used
1.	—	—	— ml
2.	—	—	— ml
3.	—	—	— ml
4.	—	—	— ml

Concordant volume = x ml (say).

Calculations

Molarity of the standard KMnO_4 solution = $M/100$

Volume of $\frac{M}{100}$ KMnO_4 solution required for the oxidation of 20.0 ml of the given ferrous sulphate solution = x ml.

From the chemical equations, it is clear that 2 moles of KMnO_4 react with 10 moles of ferrous sulphate.

$$\begin{aligned}\therefore \frac{M_{\text{KMnO}_4} \times V_{\text{KMnO}_4}}{M_{\text{FeSO}_4} \times V_{\text{FeSO}_4}} &= \frac{2}{10} \\ \frac{\frac{1}{100} \times x}{M_{\text{FeSO}_4} \times 20.0} &= \frac{2}{10} \\ M_{\text{FeSO}_4} &= \frac{1 \times x \times 10}{100 \times 20.0 \times 2} = \frac{x}{400}\end{aligned}$$

$$\therefore \text{Molarity of unoxidized ferrous sulphate} = \frac{x}{400}$$

Strength of unoxidized ferrous sulphate

$$= \text{Molarity} \times \text{Molecular mass of } \text{FeSO}_4 \cdot 7\text{H}_2\text{O}$$

$$= \frac{x}{400} \times 278 = y \text{ g/litre}$$

Total strength of partially oxidised sample = 14 g/litre

\therefore Strength of oxidised ferrous sulphate = $(14 - y)$ g/litre

$$\% \text{ Oxidation} = \frac{14 - y}{14} \times 100.$$

Instructions for the Preparation of Solutions

Provide the following :

1. KMnO_4 solution (1.58 g/litre)
2. $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$
3. 4N H_2SO_4 .