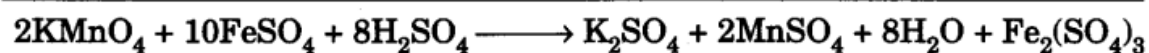
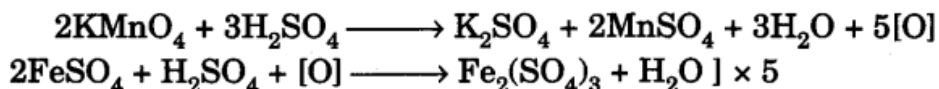


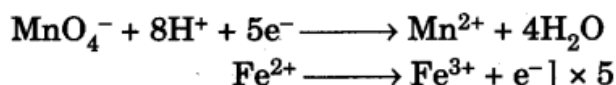
**Calculate the Percentage Of Fe^{2+} ions In a Sample Of Ferrous Sulphate. Prepare a Solution Of the Given Sample Having Strength Exactly Equal to 14.0 g/litre.
Provided M/100 KMnO_4**

Chemical Equations

Molecular Equation



Ionic equation



Theory

Since the given sample contains partially oxidized ferrous sulphate, it contains both ferrous ions, Fe^{2+} (unoxidised) and ferric ions Fe^{3+} (oxidised). The strength of partially oxidised sample is known. The solution of partially oxidised FeSO_4 of known strength is titrated against standard KMnO_4 solution to determine the molarity and strength of the unoxidised ferrous sulphate. From this the percentage oxidation of the sample can be calculated.

Indicator

KMnO_4 is a self-indicator.

End Point

Colourless to permanent pink (KMnO_4 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 KMnO_4 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.

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

Concordant volume = x ml (say).

Calculations

Volume of M/100 KMnO_4 solution required for the oxidation of 20.0 ml of the prepared ferrous sulphate solution = x ml.

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

∴

$$\frac{M_{\text{KMnO}_4} \times V_{\text{KMnO}_4}}{M_{\text{FeSO}_4} \times V_{\text{FeSO}_4}} = \frac{2}{10}$$

$$\frac{\frac{1}{100} \times x}{M_{\text{FeSO}_4} \times 20.2} = \frac{2}{10}$$

$$M_{\text{FeSO}_4} = \frac{1 \times x \times 10}{100 \times 20.0 \times 2} = \frac{x}{400}$$

$$\text{Molarity of Fe}^{2+} \text{ ions} = \text{Molarity of ferrous sulphate} = \frac{x}{400}$$

$$\text{Strength of Fe}^{2+} \text{ ions} = \text{Molarity} \times \text{Formula mass}$$

$$= \frac{x}{400} \times 56 \text{ g/litre}$$

$$= y \text{ g/litre (say)}$$

Percentage of Fe^{2+} ions in the given sample of ferrous sulphate

$$= \frac{\text{Strength of Fe}^{2+} \text{ ions in g/litre}}{\text{Strength of ferrous sulphate in g/li}}$$

$$= \frac{y}{14} \times 100.$$

Instructions for the Preparation of Solutions

Provide the following :

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

Exercises

1. Prepare a standard solution of M/50 $\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$ (Mohr's salt). Using this solution find out the molarity of the given solution of KMnO_4 .
2. Prepare M/50 solution of oxalic acid. Using this solution find out the molarity and strength of the given solution of KMnO_4 .

3. Prepare a solution of ferrous ammonium sulphate containing exactly 4.9 g of the salt per 250 ml of solution. Using this solution determine the concentration of KMnO_4 in g/litre in the given solution.
4. Prepare M/20 solution of oxalic acid. Using this solution find out percentage purity of impure sample of KMnO_4 , 3.5 g of which have been dissolved per litre.
5. Prepare M/50 ferrous ammonium sulphate solution. With its help, find out the percentage purity of impure sample of KMnO_4 , 3.6 g of which have been dissolved per litre.
6. Prepare M/20 oxalic acid solution. You are provided two solutions of KMnO_4 , A and B. Find out volumetrically which solution, (A or B) is more concentrated. Report the strength of more concentrated solution in g/litre.
7. You are provided with a solution of alkali metal permanganate, AMnO_4 containing 3.15 g of it per litre of the solution. Prepare M/20 oxalic acid solution and using this solution determine the atomic mass of the alkali metal 'A'.
8. Determine volumetrically the percentage purity of a given sample of sodium oxalate. Provided M/50 KMnO_4 solution.