# Prepare M/20 Ferrous Ammonium Sulphate (Mohr's salt) Solution. Find out the Percentage Purity of Impure $KMnO_4$ Sample 2.0 g of Which have been Dissolved per Litre

## Chemical Equations

*Molecular equations*

$$2KMnO_4 + 3H_2SO_4 \longrightarrow K_2SO_4 + 2MnSO_4 + 3H_2O + 5[O]$$

$$2FeSO_4(NH_4)_2SO_4.6H_2O + H_2SO_4 + [O] \longrightarrow Fe_2(SO_4)_3 + 2(NH_4)_2SO_4 + 13H_2O] \times 5$$

$$2KMnO_4 + 8H_2SO_4 + 10FeSO_4(NH_4)_2SO_4.6H_2O \longrightarrow K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 10(NH_4)_2SO_4 + 68H_2O$$

*Ionic equations*

$$MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$$

$$Fe^{2+} \longrightarrow Fe^{3+} + e^-] \times 5$$

$$MnO_4^- + 8H^+ + 5Fe^{2+} \longrightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$$

## Indicator

$KMnO_4$ is a self-indicator.

## End Point

Colourless to permanent pink colour ($KMnO_4$ in burette).

## Procedure

1. Prepare 250 ml of M/20 Mohr's salt solution by dissolving 4.9 g of Mohr's salt in water as described in experiment 11.4. Rinse the pipette with the M/20 Mohr's salt solution and pipette out 20.0 ml of it in a washed titration flask.
2. Rinse and fill the burette with the given $KMnO_4$ 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 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 a set of three concordant readings.

## Observations

Weight of watch glass =……. g
Weight of watch glass + Mohr's salt =…….g
Weight of Mohr's salt = 4.9 g
Volume of Mohr's salt solution prepared = 250 ml

Solution taken in burette = $KMnO_4$ solution
Volume of Mohr's salt 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

Calculation of molarity of $KMnO_4$ solution
From the overall balanced chemical equation, it is clear that 2 moles of $KMnO_4$ react with 10 moles of Mohr's salt.

$$\therefore \quad \frac{M_{KMnO_4} \times V_{KMnO_4}}{M_{Mohr's\ salt} \times V_{Mohr's\ salt}} = \frac{2}{10}$$

where, $M_{KMnO_4}$ = Molarity of $KMnO_4$ solution

$V_{KMnO_4}$ = Volume of $KMnO_4$ solution

$M_{Mohr's\ salt}$ = Molarity of Mohr's salt solution

$V_{Mohr's\ salt}$ = Volume of Mohr's salt solution

$$\frac{M_{KMnO_4} \times x}{1/20 \times 20} = \frac{2}{10}$$

$$M_{KMnO_4} = \frac{2}{10} \times \frac{1}{x} = \frac{2}{10x}$$

*Calculation of strength of $KMnO_4$ solution*

Strength (in g/litre) = Molarity × Molar of $KMnO_4$

$= M_{KMnO_4} \times 158$

$= \frac{2}{10x} \times 158 = a$ g/litre (say).

*Calculation of percentage purity of the given sample*

Percentage purity $= \frac{a}{2} \times 100$

**Instructions for the Preparation of Solutions**

Provide the following:

1. Crystals of Mohr's salt
2. $KMnO_4$ solution (1.6 g/litre)
3. 4N $H_2SO_4$.