Prepare N/20 Mohr's salt Solution. Using this Solution, Determine the Normality & Strength of the Given Potassium Permanganate Solution

Chemical Equations

Molecular equations

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

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

$$2KMnO_4 + 8H_2SO_4 + 10FeSO_4(NH_4)_2.SO_4.6H_2O \longrightarrow K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 10(NH_4)_2SO_4 + 68H_2O$$

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 ($KMnO_4$ in burette).

Procedure

1. Rinse and fill the burette with the given $KMnO_4$ solution.
2. Weigh exactly 4.90 g of Mohr's salt crystals and dissolve in water to prepare exactly 250 ml of solution using a 250 ml measuring flask. Rinse the pipette with the N/20 Mohr's salt solution and pipette out 20.0 ml of it in a washed titration flask.
3. Add one test-tube (~ 20 ml) full of dilute sulphuric acid (~ 4 N) 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 readings.

Observations

Normality of Mohr's salt solution = N/20

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

(a) Normality of the $KMnO_4$ solution

x ml of the given $KMnO_4$ solution are equivalent to 20 ml of N/20 Mohr's salt solution.

Applying normality equation.

$$\underset{\text{Mohr's salt}}{N_1V_1} = \underset{KMnO_4}{N_2V_2}$$

$$\frac{1}{20} \times 20 = N_2 \times x$$

$\therefore$ Normality of $KMnO_4$, $N_2 = \frac{1}{x}$.

(*b*) *Strength of the $KMnO_4$ solution*

Strength (in g/litre) = Normality × Eq. mass

$$= \frac{1}{x} \times 31.6$$ [$\because$ Eq. mass of $KMnO_4 = 31.6$]

Instructions for the Preparation of Solutions

Provide the following solutions :

1. Mohr's salt crystals
2. N/20 $KMnO_4$ solution (1.58 g/litre)
3. 4N H_2SO_4.