Prepare N/20 Solution Of Oxalic Acid. Using this Solution, Find Out Strength & normality Of the Given Potassium Permanganate Solution

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Chemical equations

Molecular equations

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

$$\begin{matrix}COOH\\|\\COOH\end{matrix} . 2H_2O + [O] \xrightarrow{60—70°C} 2CO_2 + 2H_2O] \times 5$$

$$2KMnO_4 + 3H_2SO_4 + 5 \begin{matrix}COOH\\|\\COOH\end{matrix} . 2H_2O \longrightarrow K_2SO_4 + 2MnSO_4 + 18H_2O + 10CO_2$$

Ionic equations

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

$$C_2O_4^{2-} \longrightarrow 2CO_2 + 2e^-\ ] \times 5$$

$$2MnO_4^- + 16H^+ + 5C_2O_4^{2-} \longrightarrow 2Mn^{2+} + 8H_2O + 10CO_2$$

Indicator

$KMnO_4$ is a self-indicator.

Endpoint

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

Procedure

1. Rinse and fill the burette with the given $KMnO_4$ solution.
2. Weigh exactly 1.58 g of oxalic acid crystals and dissolve in water to prepare 500 ml of
   its solution using a 500 ml measuring flask. Rinse the pipette with the N/20 oxalic acid
   solution and pipette out 20 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. Heat the flask to 60-70°C and add $KMnO_4$ solution from the burette till a permanent light pink colour is just imparted to the solution in the titration flask.
6. Note the final reading of the burette.
7. Repeat the above steps 4-5 times to get three concordant readings.

Observations

Normality of oxalic acid solution = $\frac{N}{20}$.

Volume of oxalic acid 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 for 20 ml of $\frac{N}{20}$ oxalic acid solution.

Applying normality equation,

$$\underset{\text{Oxalic acid}}{N_1V_1} = \underset{KMnO_4}{N_2V_2}$$

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

$\therefore$ 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 :

1. Oxalic acid crystals
2. N/20 $KMnO_4$ solution (1.58 g/litre)
3. 4N H_2SO_4.