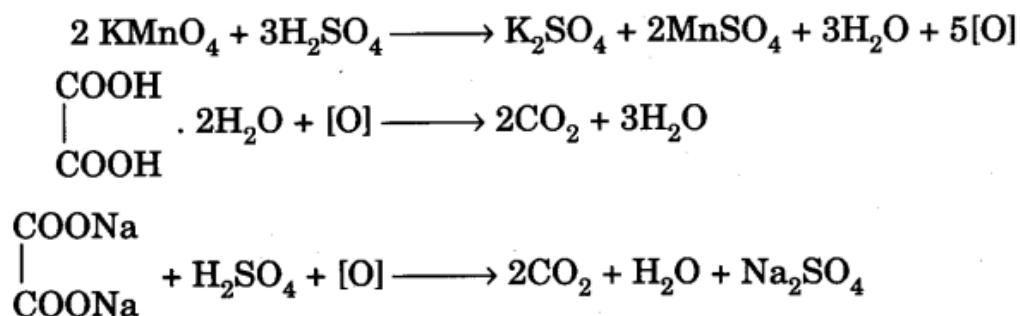


## Determine the Percentage Composition Of a Mixture Of

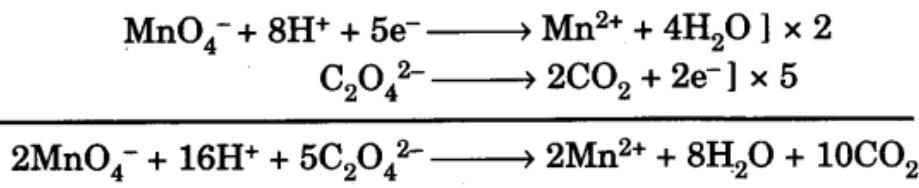
Sodium Oxalate  $\left[ \begin{array}{c} \text{COONa} \\ | \\ \text{COONa} \end{array} \right]$  & Oxalic Acid  $\left[ \begin{array}{c} \text{COOH} \\ | \\ \text{COOH} \end{array} \right] \cdot 2\text{H}_2\text{O}$   
Provided N/20  $\text{KMnO}_4$

### Chemical Equations

#### Molecular Equations



#### Ionic Equations



### Theory

Both oxalic acid and sodium oxalate can be titrated against N/20  $\text{KMnO}_4$  since both of them are reducing agents.

So normality ( $N_2$ ) of the solution will be due to both of them. From the combined normality ( $N_2$ ), the composition of each can be calculated.

### Indicator

$\text{KMnO}_4$  is a self-indicator.

### End Point

Colourless to permanent pink ( $\text{KMnO}_4$  in burette).

### Procedure

1. Rinse and fill the burette with the N/20  $\text{KMnO}_4$ , solution.

2. Weigh exactly 1.0 g of the given mixture of oxalic acid and sodium oxalate and dissolve in water to prepare exactly 250 ml of solution using a 250 ml measuring flask. Rinse the pipette with the prepared oxalate 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. Heat the solution of titration flask to 60-70°C and run down  $\text{KMnO}_4$  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  $\text{KMnO}_4$  solution = 1/20

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

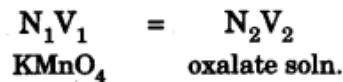
<b>S. No.</b>	<b><i>Initial reading of the burette</i></b>	<b><i>Final reading of the burette</i></b>	<b><i>Volume of the <math>\text{KMnO}_4</math> solution used</i></b>
1.	—	—	— ml
2.	—	—	— ml
3.	—	—	— ml
4.	—	—	— ml

Concordant volume =  $x$  ml (say).

### Calculations

$x$  ml of N/20  $\text{KMnO}_4$  solution are equivalent to 20 ml of the given oxalate solution.

Applying normality equation,



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

$$\therefore \text{Normality of oxalate solution, } N_2 = \frac{x}{400}$$

$\frac{x}{400}$  is the total normality due to oxalic acid and sodium oxalate.

Suppose, strength of oxalic acid =  $a$  g/litre

$\therefore$  Strength of sodium oxalate =  $(4 - a)$  g/litre

$$\text{Normality due to oxalic acid, } N_{\text{oxalic acid}} = \frac{a}{\text{Eq. mass of oxalic acid}} = \frac{a}{63}$$

$$\text{Normality due to sod. oxalate, } N_{\text{sod. oxalate}} = \frac{4 - a}{\text{Eq. mass of sod. oxalate}} = \frac{4 - a}{67}$$

$$\therefore \text{Total normality of the oxalate solution} = N_{\text{oxalic acid}} + N_{\text{sod. oxalate}}$$

$$\frac{x}{400} = \frac{a}{63} + \frac{4 - a}{67}$$

From this equation, 'a' can be calculated. Knowing 'a', the percentage composition of the mixture can be calculated.

$$\% \text{ of oxalic acid} = \frac{a}{4} \times 100 = X \text{ (say)}$$

$$\% \text{ of sod. oxalate} = \frac{4 - a}{4} \times 100 = Y \text{ (say).}$$

#### Instructions for the Preparation of Solutions

Provide the following solutions :

1.  $\text{KMnO}_4$  solution (1.58 g/litre)
2. A mixture of oxalic acid and sodium oxalate
3. 4N  $\text{H}_2\text{SO}_4$