

VOLUMETRIC ANALYSIS

Equivalent weights of some acids and bases

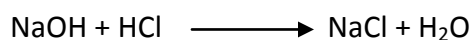
Acid/Base	Equivalent wt.
Hydrochloric acid (HCl)	36.5
Sulphuric acid (H ₂ SO ₄)	49
Nitric acid (HNO ₃)	63
Oxalic acid (H ₂ C ₂ O ₄ ·2H ₂ O)	63
Sodium hydroxide (NaOH)	40
Potassium hydroxide (KOH)	56
Sodium carbonate (Na ₂ CO ₃)	53
Potassium carbonate (K ₂ CO ₃)	69

ALKALIMETRY

1. Estimation of Sodium hydroxide using std. HCl

Aim: Determine the mass of sodium hydroxide in the whole of the given solution. You are supplied with a standard solution of HCl containing 3.7 g/L.

Principle



Procedure

The given NaOH solution is made upto 100mL in a clean standard flask. 20 mL of the made up solution (NaOH) is pipetted out into a clean conical flask. Add one or two drops phenolphthalein indicator and titrated against Std. HCl from the burette. At the end point the pink colour changes to colourless. The experiment is repeated to get concordant values.

Observations

Sl. No.	Volume of NaOH in mL	Burette Reading		Volume of HCl in mL
		Initial	Final	
1.	20	0		
2.	20	0		
3.	20	0		

Calculations:

Mass per litre of HCl = 3.7 g/L

Equivalent mass of HCl = 36.5

$$\text{Normality of HCl, } N_1 = \frac{\text{Mass per litre}}{\text{Equivalent mass}} = \frac{3.7}{36.5} = 0.1014 \text{ N}$$

Volume of HCl (V₁) = mL

Volume of NaOH solution pipetted out, V₂ = 20 mL

Normality of NaOH (N₂) = ?

From normality equation, N₁V₁ = N₂V₂,

$$N_2 = \frac{N_1 V_1}{V_2} = \frac{0.1014 \times \dots}{20} = \dots \text{ N}$$

Equivalent mass of NaOH = 40

Mass per litre of NaOH solution = Normality x Equivalent mass = x 40 = g/L

The mass of NaOH in the whole of the given solution = $\frac{\text{Mass per litre} \times 100}{1000}$

$$= \frac{\text{Mass per litre}}{10} = \frac{\dots\dots\dots}{10} = \dots\dots\dots \text{g}$$

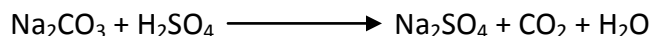
Result

The mass of NaOH in the whole of the given solution = g

2. Estimation of Sodium carbonate using std. H₂SO₄

Aim: Determine the mass of sodium carbonate (Na₂CO₃) in the whole of the given solution. You are supplied with a standard solution of sulphuric acid containing 4.8 g/L.

Principle



Procedure

The given Na₂CO₃ solution is made upto 100mL in a clean standard flask. 20 mL of the made up solution (Na₂CO₃) is pipetted out into a clean conical flask. Add two or three drops Methyl orange indicator and titrated against Std. H₂SO₄ solution from the burette. At the end point the golden yellow colour changes to orange red. The experiment is repeated to get concordant values.

Observations

Sl. No.	Volume of Na ₂ CO ₃ in mL	Burette Reading		Volume of H ₂ SO ₄ in mL
		Initial	Final	
1.	20	0		
2.	20	0		
3.	20	0		

Calculations:

Mass per litre of H₂SO₄ = 4.8 g/L

Equivalent mass of H₂SO₄ = 49

$$\text{Normality of H}_2\text{SO}_4, N_1 = \frac{\text{Mass per litre}}{\text{Equivalent mass}} = \frac{4.8}{49} = 0.0979 \text{ N}$$

Volume of H₂SO₄ (V₁) = mL

Volume of Na₂CO₃ solution pipetted out, V₂ = 20 mL

Normality of Na₂CO₃ (N₂) = ?

From normality equation, N₁V₁ = N₂V₂,

$$N_2 = \frac{N_1 V_1}{V_2} = \frac{0.0979 \times \dots\dots}{20} = \dots\dots \text{ N}$$

Equivalent mass of Na₂CO₃ = 53

Mass per litre of Na₂CO₃ solution = Normality x Equivalent mass = x 53 = g/L

The mass of Na₂CO₃ in the whole of the given solution = $\frac{\text{Mass per litre} \times 100}{1000}$

$$= \frac{\text{Mass per litre}}{10} = \frac{\dots\dots\dots}{10} = \dots\dots\dots \text{g}$$

Result

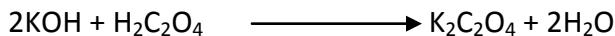
The mass of Na₂CO₃ in the whole of the given solution = g

ACIDIMETRY

1. Estimation of Oxalic acid using std. KOH

Aim: Determine the mass of oxalic acid in the whole of the given solution. You are supplied with a standard solution of potassium hydroxide containing 5.7 g/L.

Principle



Procedure

The given oxalic acid solution is made upto 100mL in a clean standard flask. A clean burette is rinsed with the made up oxalic acid solution upto the zero mark. 20 mL of the KOH solution is pipetted out into a clean conical flask. One or two drops phenolphthalein indicator is added and titrated against oxalic acid solution from the burette. At the end point, the pink colour changes to colourless. The final burette reading is noted. The experiment is repeated to get concordant values.

Observations

Sl. No.	Volume of KOH in mL	Burette Reading		Volume of H ₂ C ₂ O ₄ in mL
		Initial	Final	
1.	20	0		
2.	20	0		
3.	20	0		

Calculations:

Mass per litre of KOH = 5.7 g/L

Equivalent mass of KOH = 56

$$\text{Normality of KOH, } N_2 = \frac{\text{Mass per litre}}{\text{Equivalent mass}} = \frac{5.7}{56} = 0.1018 \text{ N}$$

Volume of KOH solution pipetted out, $V_2 = 20 \text{ mL}$

Volume of H₂C₂O₄ (V_1) = mL

Normality of H₂C₂O₄ (N_1) = ?

From normality equation, $N_1V_1 = N_2V_2$,

$$N_1 = \frac{N_2V_2}{V_1} = \frac{0.1018 \times 20}{\dots\dots\dots} = \dots\dots\dots \text{ N}$$

Equivalent mass of H₂C₂O₄ = 63

Mass per litre of H₂C₂O₄ solution = Normality x Equivalent mass = x 63 = g/L

The mass of H₂C₂O₄ in the whole of the given solution = $\frac{\text{Mass per litre} \times 100}{1000}$

$$= \frac{\text{Mass per litre}}{10} = \frac{\dots\dots\dots}{10} = \dots\dots\dots \text{ g}$$

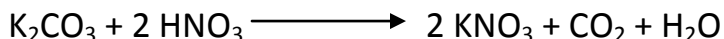
Result

The mass of H₂C₂O₄ in the whole of the given solution = g

2. Estimation of Nitric Acid using std. K₂CO₃

Aim: Determine the mass of nitric acid (HNO₃) in the whole of the given solution. You are supplied with a standard solution of potassium carbonate (K₂CO₃) containing 6.8 g/L.

Principle



Procedure

The given HNO₃ solution is made upto 100mL in a clean standard flask. A clean burette is rinsed with the made up solution and is filled upto the zero mark. 20 mL of K₂CO₃ solution is pipetted out into a clean conical flask. Two or three drops methyl orange indicator is added and titrated against HNO₃ solution from the burette. At the end point the golden yellow colour changes to orange red. The final burette reading is noted. The experiment is repeated to get concordant values.

Observations

Sl. No.	Volume of K ₂ CO ₃ in mL	Burette Reading		Volume of HNO ₃ in mL
		Initial	Final	
1.	20	0		
2.	20	0		
3.	20	0		

Calculations:

Mass per litre of K₂CO₃ = 6.8 g/L

Equivalent mass of K₂CO₃ = 69

$$\text{Normality of } K_2CO_3, N_2 = \frac{\text{Mass per litre}}{\text{Equivalent mass}} = \frac{6.8}{69} = 0.0985 \text{ N}$$

Volume of K₂CO₃ solution pipetted out, V₂ = 20 mL

Volume of HNO₃ (V₁) = mL

Normality of HNO₃ (N₁) = ?

From normality equation, N₁V₁ = N₂V₂,

$$N_1 = \frac{N_2 V_2}{V_1} = \frac{0.0985 \times 20}{\dots\dots\dots} = \dots\dots\dots \text{ N}$$

Equivalent mass of HNO₃ = 63

Mass per litre of HNO₃ solution = Normality x Equivalent mass = x 63 = g/L

$$\begin{aligned} \text{The mass of HNO}_3 \text{ in the whole of the given solution} &= \frac{\text{Mass per litre} \times 100}{1000} \\ &= \frac{\text{Mass per litre}}{10} = \frac{\dots\dots\dots}{10} = \dots\dots\dots \text{ g} \end{aligned}$$

Result

The mass of HNO₃ in the whole of the given solution = g

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