S.6A

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Chemistry Laboratory Report

Title: Acid-base Titration

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Objective: (1) To determine the concentration of the unknown Sulphuric acid solution.
(2) To learn how to use the pipette and burette skillfully.

Result:
The solution will change from yellow to orange when it is neutralized.

	1st	2nd
Final burette reading (cm^3)	34.75	44.60
Initial burette reading (cm^3)	9.55	19.25
Volume of sodium carbonate solution (cm^3)	25.20	25.25

Calculation:
The volumes of 0.0500M sodium carbonate required for neutralization are: 25.20 cm^3, 25.25 cm^3.

Therefore the average volume of 0.0500 M sodium carbonate required for neutralization:

$$= \frac{25.20 + 25.25}{2} \ cm^3$$

$$= 25.23 \ cm^3$$

$$Na_2CO_3 (aq) + H_2SO_4 (aq) \rightarrow Na_2SO_4 (aq) + CO_2 (g) + H_2O (l)$$

0.0500M ? M
25.00cm^3 25.23cm^3

No. of moles of sodium carbonate

=Molarity of solution $\times$Volume of solution

=0.0500 M $\times$0.0025 dm^3

=0.000125mol

According to the equation,

1 mole of Na_2CO_3 required 1 mole of H_2S0_4 for complete neutralization.

$\therefore$No of moles of H_2SO_4 = 0.000125mol

Concentration of H_2SO_4 solution

$$= \frac{\text{No. of moles of } H_2SO_4}{\text{Volume of solution}}$$

$$= \frac{0.000125\text{mol}}{0.002523\text{dm}^3}$$

$=0.0495\text{mol/dm}^3$

Question:

1. In standardization of sulphuric acid solution with standa rd sodium sodium carbonate solution, methyl orange is used as the indicatior to show colour change for the end point. Why do we use methyl orange?

Ans: If we use phenolpthlein as indicator, the solution will turn from pink to colourless, however, the solution which is neutral or acidic remain as colourless, therefore it is not easy for us to determine the end point,we cannot obtain an accurate volume of acid used. But when we use methyl orange, the solution will turn from yelow to pale orange. When the solution is neutral, it remain pale orange, when it is acidic, it will turn red, therefore, it is easy for us to determine the end point, so that we can obtain a more accurate result.

(p.t.o. to continue)

For strong acid (H_2SO_4) with weak base (Na_2CO_3), the pH at the equivalence point is always less than 7 because of the acidity of the conjugate acid of the weak base. And from the titration curve for strong acid with weak base, we know that the pH range of methyl orange (3.1-4.4) is nearer to the equivalence point than the pH range of phenolpthalein (8.3-10.0), therefore it is more suitable for us to use methyl orange for standardization of sulphuric acid solution with standard sodium carbonate solution.

Titration curve for strong acid with weak base

2. What is the difference between the end point and the equivalence point in volumetric analysis?

   Ans.: Equivalence point of the reaction is the point at which the original acid (or base) in the solution has been exactly consumed by the titrant base (or acid). End point is the point at which indicator changes its colour, it occurs when the stoichiometric amount of acid has been added to the base. However as it is not easy for us to obtain an accurate value for end point, therefore it will be a little bit different from the equivalence point.

3. Why can phenolphthalein and methyl orange be used as the indicator when sodium hydroxide solution is titrated with standard sulphuric acid solution?

   Ans.: Because according to the titration curve for strong acid with strong base, the pH range for methyl orange (3.1 -4.4) and the pH range of phenolpthalein (8.3 -10.0) is very near to the equivalence point, therefore we can use both phenolpthalein and methyl orange as the indicator when sodum hydroxide solution is titrated with standard sulphuric acid solution.

Titration curve for strong acid with strong base