Answer all the questions below then check your answers

1.   What is the purpose of a titration?

   a) To measure the temperature of a solution

   b) To determine the concentration of an unknown solution

    c) To separate mixtures into their components

   d) To measure the pressure of a gas

2.   Which of the following indicators is most suitable for a titration involving a strong acid and a strong base?

   a) Universal indicator

   b) Phenolphthalein

   c) Litmus

3.   In a titration, what equipment is used to measure the volume of the titrant?

   a) Pipette   b) Burette   c) Beaker   d) Test tube

4.   Fill in the gaps to complete the sentences:

In a titration, the solution of known concentration is called the _____.

The point at which the reaction is complete and the indicator changes colour is called the _____ point.

5.   Explain why universal indicator is not suitable for use in titrations, but methyl orange or phenolphthalein are.

6.   Describe the steps to carry out a titration to determine the concentration of an unknown hydrochloric acid solution using a standardised sodium hydroxide solution and phenolphthalein as the indicator. (5 marks)

7.   If 25.0 cm³ of 0.100 M NaOH solution is required to neutralise 50.0 cm³ of HCl solution, what is the concentration of the HCl solution?

<u>Answers</u>

Answer all the questions below then check your answers

1. What is the purpose of a titration?

   a) To measure the temperature of a solution

   b) To determine the concentration of an unknown solution

    c) To separate mixtures into their components

   d) To measure the pressure of a gas

   Answer: b) To determine the concentration of an unknown solution

2. Which of the following indicators is most suitable for a titration involving a strong acid and a strong base?

   a) Universal indicator

   b) Phenolphthalein

   c) Litmus

   Answer: b) Phenolphthalein

3. In a titration, what equipment is used to measure the volume of the titrant?

   a) Pipette   b) Burette   c) Beaker   d) Test tube

   Answer: b) Burette

4.   Fill in the gaps to complete the sentences:

In a titration, the solution of known concentration is called the _____.

The point at which the reaction is complete and the indicator changes colour is called the _____ point.

Answers:

In a titration, the solution of known concentration is called the titrant.

The point at which the reaction is complete and the indicator changes color is called the end point.

5.   Explain why universal indicator is not suitable for use in titrations, but methyl orange or phenolphthalein are.

Answer: Universal indicator is not suitable for titrations because it changes colour gradually over a range of pH values, making it difficult to determine the exact end point of the titration. Methyl orange and phenolphthalein, on the other hand, have a sharp colour change at specific pH values. Methyl orange changes from red to yellow over a pH range of 3.1 to 4.4, making it suitable for strong acid-weak base titrations. Phenolphthalein changes from colourless to pink over a pH range of 8.3 to 10, making it suitable for strong acid-strong base titrations.

6.   Describe the steps to carry out a titration to determine the concentration of an unknown hydrochloric acid solution using a standardised sodium hydroxide solution and phenolphthalein as the indicator. (5 marks)

Answer:

- Rinse a burette with sodium hydroxide solution and then fill it with the same solution.
- Record the initial volume of sodium hydroxide in the burette.
- Use a pipette to transfer a known volume (e.g., 25 cm³) of the hydrochloric acid solution into a conical flask using a pipette.
- Add a few drops of phenolphthalein indicator to the hydrochloric acid solution in the flask. The solution should remain colourless.
- Slowly add the sodium hydroxide from the burette to the acid solution, swirling the flask constantly until the solution just turns pink, indicating the end point has been reached.
- Record the final volume of sodium hydroxide in the burette.
- Repeat the titration until concurrent results are obtained
- Calculate the average volume of sodium hydroxide used and use the known concentration of sodium hydroxide to determine the concentration of the hydrochloric acid.

7. If 25.0 cm³ of 0.100 M NaOH solution is required to neutralise 50.0 cm³ of HCl solution, what is the concentration of the HCl solution?

Answer:

The balanced equation for the reaction is:

$NaOH + HCl \rightarrow NaCl + H_2O$
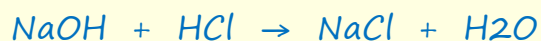
From the balanced equation 1 mole of sodium hydroxide neutralises 1 mole of acid. They react in the ratio of 1:1

Moles of NaOH used:

n= c x v

0.100 M × 0.025 dm³ = 0.0025 moles

From the balanced equation, moles of HCl = moles of NaOH

So we have 0.0025 moles of acid in the 5oml used.

Concentration of HCl:

Concentration = number of moles/volume in dm³

               =0.0025 moles/0.050 dm³

               =0.050 M

Therefore, the concentration of the HCl solution is 0.050 M.