

ACID-BASE TITRATIONS – TOPIC TEST 1

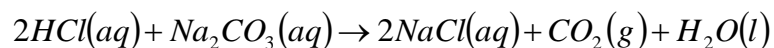
QUESTION 1

A 25.00 mL aliquot of sodium carbonate was standardised using 0.1M hydrochloric acid solution. The indicator chosen was methyl orange, which changes colour as all of the carbonate ions are converted to carbon dioxide. This will occur when the number of:

- A Hydrogen ions just exceeds double the number of carbonate ions that were initially present.
- B Hydrogen ions just exceeds the number of carbonate ions that were initially present.
- C Carbonate ions is exactly double the number of hydrogen ions that were initially present.
- D Carbonate ions exactly equals the number of hydrogen ions that were initially present.

QUESTION 2

In order to determine the concentration of a sample of hydrochloric acid, a pipette was used to transfer 20.00 mL of the acid into a conical flask. An indicator was added, and the hydrochloric acid was titrated against a 0.0513 M solution of sodium carbonate. The average titre was found to be 19.06 mL. Hydrochloric acid reacts with the sodium carbonate according to the following equation.



The concentration of the hydrochloric acid was:

- A 3.92×10^{-5} M
- B 2.45×10^{-2} M
- C 4.89×10^{-2} M
- D 9.78×10^{-2} M

Solution

QUESTION 3

A solution of sodium hydroxide is to be standardised by titrating it against a solution of sulphuric acid. It is known that the concentration of the sodium hydroxide is about 0.2 M. If the sulphuric acid has a concentration of 0.125 M, and the average titre should be about 20.00 mL, what is the most appropriate pipette to use?

- A 10.00 mL
- B 20.00 mL
- C 25.00 mL
- D 50.00 mL

Solution**QUESTION 4**

By referring to the way that standard solutions are prepared, explain why it is considered more accurate to use a primary standard than a secondary standard. (2 marks)

Solution**QUESTION 5**

A primary standard must be readily available in pure form. Explain why the primary standard must be available in pure form **and** identify two other properties of a primary standard. (3 marks)

Solution

QUESTION 6

Car batteries contain concentrated sulphuric acid. In order to determine the concentration of the sulphuric acid in one such battery, a 50.00 mL sample was diluted to 250.0 mL. A 10.00 mL aliquot of this dilute solution was then titrated against 1.015 M sodium hydroxide, and an average titre of 16.16 mL was obtained. What was the concentration of the concentrated sulphuric acid? (4 marks)

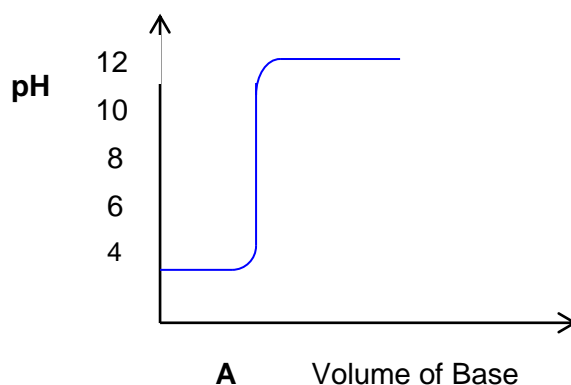
Solution

QUESTION 7

Different indicators change colour over different pH ranges. A student performs an acid-base titration and has access to the following indicators:

| Indicator | pH range for colour change | Colour acid form | Base form |
|----------------|----------------------------|------------------|-----------|
| Methyl Violet | 0.3 – 3.0 | Yellow | Violet |
| Methyl Red | 4.2 – 6.3 | Red | Yellow |
| Indigo Carmine | 11.6 - 14.0 | Blue | Yellow |

The following graph represents the change in pH as the titration proceeds. Which is the best choice of indicator, and what change in colour will be observed at the end point of the titration? (2 marks)



Solution

QUESTION 8

A student performs a titration, adding sodium hydroxide to a sample of sulphuric acid. Sketch a graph to show the change in pH as the titration proceeds. (3 marks)

Solution

ANSWERS

QUESTION 1 Answer is A

QUESTION 2 Answer is D

QUESTION 3 Answer is C

QUESTION 4

Preparing a primary standard involves: accurate weighing of the sample, accurate measuring of volume and one calculation. Preparing a secondary standard requires these steps and also accurately performing a titration – more chance for error.

QUESTION 5

Primary standard must be available in pure form so that the molar mass is known accurately, and calculations will be accurate.

QUESTION 6 4.1 M

QUESTION 7

Methyl Red, changes from red to yellow

QUESTION 8

Sulphuric acid is a strong acid, and the pH starts less than 7, and increases suddenly at the equivalence point. When there is an excess of sodium hydroxide, the pH is greater than 7.

