Titration

Objective: Define the products of an acid base reaction. Explain how acid-base titration is used to calculate the concentration of an acid or base. Explain the concept of equivalence in neutralization reactions. Describe the difference between equivalence point and the end of the titration.

Apr 30-1:51 PM

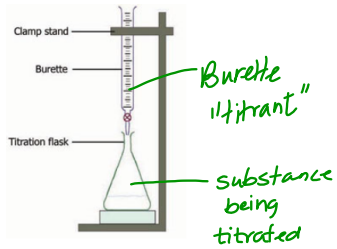
Titrations 19-4

Neutralization Reactions:

Acid-Base reactions:

If a strong acid containing hydronium ions is mixed with a strong base with an equal number of hydroxide ions a neutral solution will result. acid + base → neutral products.

Dec 7-4:16 PM



Apr 23-2:24 PM

Titration:

Titration is the process in which one solution is used to determine an unknown concentration second solution.

Dec 7-4:19 PM

Number of endpoints in a titration dictates how many H+ ions get donated from acid to base...

Sample 1

The concentration of sodium hydroxide is 0.50 mol/L and 17.11 ml are used.

Each sample of acetic acid that is titrated is 10.00ml. What is the concentration of the acid? (one endpoint)

$NaOH_{(aq)} + CH_3COOH_{(aq)} \rightarrow H_2O_{(l)} + NaCH_3COO_{(aq)}$

$c = 0.50\ mol/L$ (H+) $c = ?$ $c = \frac{n}{V}$

$V = 17.11\ mL \rightarrow 0.01711\ L$ $V = 10.00\ mL \rightarrow 0.01000\ L$

① moles of NaOH

$c = \frac{n}{V}$ $n = c \cdot V = 0.50\ mol/L \cdot 0.01711\ L = 0.00856\ mol$

② moles of acid

1:1 $n = 0.00856\ mol$

③ conc. acid

$c = \frac{n}{V} = \frac{0.00856\ mol}{0.01000\ L} = 0.86\ mol/L$

Apr 30-1:54 PM

Not all polyprotic substances react quantitatively.

Example:

1. A titration of sulfuric acid with sodium hydroxide was completed to the second end point. The second end point implies that two protons are transferred. $2H^+$

~~1st proton transfer~~

Net Reaction:

$H_2SO_{4(aq)} + 2NaOH_{(aq)} \rightarrow 2H_2O_{(l)} + Na_2SO_{4(aq)}$

$2H^+$

2. Not all polyprotic substances react quantitatively. Only two end points are found in the titration of phosphoric acid with sodium hydroxide.

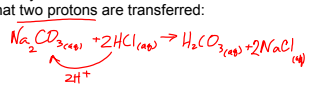
$H_3PO_{4(aq)} + 2\,NaOH_{(aq)} \rightarrow 2H_2O_{(l)} + NaHPO_{4(aq)}$

$2H^+$

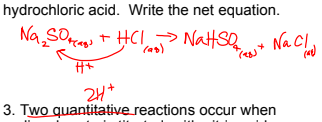
Apr 30-5:37 PM

Try:

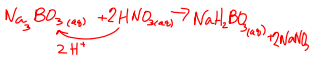
1. When sodium carbonate is neutralized with hydrochloric acid the results indicate that two protons are transferred:



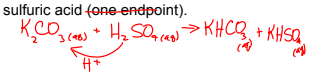
2. Only one end point is found in the titration of sodium sulfate with hydrochloric acid. Write the net equation.



3. Two quantitative reactions occur when sodium borate is titrated with nitric acid.



4. Potassium carbonate is titrated with sulfuric acid (one endpoint).



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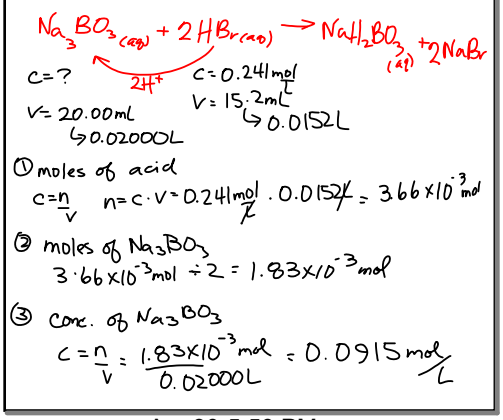
A sodium borate solution was titrated to the second endpoint with 0.241 mol/L hydrobromic acid. An average volume of 15.2 mL of hydrobromic acid was required to react with 20.00 mL samples of sodium borate. Calculate the concentration of sodium borate solution.



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A 30.0mL sample of phosphoric acid was titrated to the second endpoint using 2.50 mol/L sodium hydroxide. The average equivalence point of sodium hydroxide was 13.9 mL. What is the concentration of the phosphoric acid?

Dec 9-7:55 AM