

# Determination of the molar mass of a dibasic acid



**ASSIGN  
BUSTER**

A dibasic acid is one in which there are two hydrogen atoms which can be donated as protons ( $H^+$ ):-

If a solution of this dibasic acid is titrated with a standard base, the concentration of the acid solution can be determined and ultimately so can the molar mass.

## PROCEDURE

## APPARATUS

- \* Weighing scales
- \* Weighing bottle
- \* Solid dibasic acid
- \* Beaker
- \* Distilled water
- \* 250cm<sup>3</sup> volumetric flask
- \* Stopper
- \* Pipette
- \* 250cm<sup>3</sup> conical flasks
- \* Phenolphthalein indicator
- \* Burette

\* Sodium hydroxide

Using the weighing scales, 1.5 - 1.7g of the solid dibasic acid was weighed out into a weighing bottle, not including the mass of the weighing bottle. The solid dibasic acid was transferred into a beaker, making sure that every last bit of the acid had gone into the beaker. The acid was dissolved in approximately 150cm<sup>3</sup> of distilled water.

This solution was then transferred into a 250cm<sup>3</sup> volumetric flask, and made up to the graduation mark. The stopper was placed on the volumetric flask and inverted several times to make sure that the solution was homogeneous.

A pipette was then rinsed with the solution. This was done to avoid contamination of the pipette, which would affect the experiment. 25cm<sup>3</sup> of the solution, of dibasic acid and distilled water, was added to separate 250cm<sup>3</sup> conical flasks.

To each conical flask, containing the solution of dibasic acid and distilled water, 3 drops of phenolphthalein indicator was added.

The solution was then ready to be titrated with the sodium hydroxide. This was done until I had consistent titres.

DIAGRAM

RESULTS

Mass of dibasic acid without weighing bottle

1.571g

1st titre

22. 1cm<sup>3</sup> of sodium hydroxide

2nd titre

24. 1cm<sup>3</sup> of sodium hydroxide

3rd titre

24. 2cm<sup>3</sup> of sodium hydroxide

Mean titre

23. 47cm<sup>3</sup> of sodium hydroxide

The aim of this experiment is to find out the molar mass of the dibasic acid. To do this, titration was required, titration of sodium hydroxide into the dibasic acid.

Once the dibasic acid had been dissolved in distilled water, and everything was weighed, 3 drops of the phenolphthalein indicator was added and the titration was ready to be performed. This was quite a tricky titration, as one drop too many would ruin the whole titration. If done right, the dibasic acid, distilled water and the phenolphthalein indicator would turn a very light shade of pink. Once it had done that the reading of how much sodium hydroxide was used was recorded and that was how I got my three titres readings. The mean titre was needed, and worked out by:-

$$22.1 + 24.1 + 24.2 = 70.4$$

???

1st 2nd 3rd

titre titre titre

70.4 = 23.47

because there were 3 readings ? 3

### CALCULATIONS AND ANALYSIS

The following needed to be determined before the molar mass of the dibasic acid could be found:-

- \* The number of mols of sodium hydroxide in the mean titre
- \* The number of mols of dibasic acid in 25cm<sup>3</sup>
- \* The number of mols of dibasic acid in 250cm<sup>3</sup> and therefore the mass that was weighed out

So, the number of mols of sodium hydroxide (NaOH) was found using the equation:-

Concentration x Volume

1000

With my figures:-

0.1 x 23.47

1000

= 0.002347 mols of NaOH in the mean titre

The ratio of acid and alkali is:-

Dibasic acid : Alkali

$2\text{H}^+ : \text{OH}^-$

1 : 2

Therefore, knowing the ratio and the number of mols of the alkali, the number of mols of acid in 25cm<sup>3</sup> of solution could be determined:-

Acid : Alkali

0.002347 : 0.002347

2:

0.0011735 : 0.002347

As the number of mols of acid in 25cm<sup>3</sup> was 0.0011735, the number of mols of acid in 250cm<sup>3</sup> could easily be found by simply multiplying the figure by 10:-

$0.0011735 \times 10 = 0.011735$  mols of acid in 250cm<sup>3</sup> of solution

It is now possible to work out the molar mass:-

Molar mass = mass?????????

number of mols of acid

$$= 1.571 \underline{\quad}$$

$$0.011735$$

$$= 133.87$$

= 134 is the molar mass of the dibasic acid

The results were not too bad as the molar mass should have been around 120, so 134 is adequate.

## CONCLUSION AND EVALUATION

The calculation worked out quite well, although the molar mass was not spot on.

Acids were originally identified by their sour taste. Now they are recognized by the colour changes of dyes called indicators and by their reactions with metal oxides, hydroxides and carbonates and also with metals themselves. All of these reactions produce ionic compounds called salts.

Bases were originally identified by their slimy feel. Now they are recognised by their effect on indicators, and by the fact that they react with or neutralise acids. If a base dissolves in water it is called an alkali.

\* Acids are substances, which donate protons ( $H^+$  ions).

\* Bases are substances, which accept protons ( $H^+$  ions).

\* Acidity and alkalinity are measured on the pH scales.

<https://assignbuster.com/determination-of-the-molar-mass-of-a-dibasic-acid/>

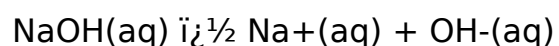
\*  $\text{pH} = -\log [\text{H}^+ (\text{aq})]$ .

\* In acid solutions the pH is less than 7, the lower the pH the greater the acidity.

\* In alkaline solutions the pH is greater than 7.

\* In aqueous solution strong acids are fully dissociated.

\* For example, sodium hydroxide dissociates:



\* In aqueous solution weak acids are partially dissociated.

\* For example, the weak acid ethanoic acid dissociates:



As I was using a weak acid/strong base titration (ethanoic acid and sodium hydroxide), methyl orange solution would not have been adequate, as it does not change vertically on the graph from the previous page.

Phenolphthalein will change sharply at exactly 25.0 cm<sup>3</sup> (as shown on the graph), the equivalence point, therefore a perfect choice for my experiment, as those were the volumes I was dealing with.

My titration went to plan and that can be seen by the fact that the molar mass I worked out from my results is realistic.

HEALTH AND SAFETY



Using acid, there are always precautions to be considered, such as wearing eye protection, lab coats and gloves to prevent burning