BBC BITESIZE

Titration calculations

Alisha Kakar: The concentration of an acid or alkali can be calculated by carrying out an experiment called a titration.

A titration measures how much of one solution is needed to completely react with another.

Titration calculations help us work out the concentrations involved.

Here's an example.

25 centimetres cubed of 0.2 moles per decimetre cubed of sodium hydroxide is exactly neutralised by 22.7 centimetres cubed of hydrochloric acid.

But the question is, what is the concentration of the hydrochloric acid to three significant figures?

This question also gives you the balanced equation for the reaction.

That might be a lot to take in, but don't worry, let me take you through it.

For titration calculations, we always follow the same five steps.

Step one.

Convert the volumes to decimetres cubed by dividing by 1000.

If we divide both numbers by 1000, we get 0.025 decimetres cubed of sodium hydroxide, and we get 0.0227 decimetres cubed of hydrochloric acid.

Step two.

Use the equation moles equals concentration multiplied by volume.

This is an important equation to remember.

We need to multiply the concentration of sodium hydroxide with the converted volume, which gives 0.005 moles.

Step three.

Apply the molar ratio from the balanced equation.

The equation shows that there is a one to one ratio.

There are no numbers in front of either of the symbols.

One mole of sodium hydroxide reacts with exactly one mole of hydrochloric acid.

As there are 0.05 moles of sodium hydroxide, there is the same number of moles of hydrochloric acid.

Step four.

Now we have the moles and volume of hydrochloric acid, we can rearrange our equation to find the unknown concentration.

We take the equation: Moles equals concentration multiplied by volume and, and we rearrange to give: Moles divided by volume.

To give a concentration of 0.22 moles per deciliter cubed.

And that's our answer.

Step five.

Check your units and rounding.

Are the units in the answer the same as what the question asked?

Is it to the correct number of significant figures?

If the answer to both of these questions is yes, then you should have the right answer.

Now it's your turn to give it a go.

We have 25 centimetres cubed of 0.124 moles per decimetre cubed of sodium carbonate solution, which is neutralised by 23.6 centimetres cubed of nitric acid.

Using the information given, you need to calculate the concentration of nitric acid to three significant figures.

You can pause the video whilst you work out.

If you followed all five steps correctly, you should get a concentration of 0.263 moles per decimetre cubed of nitric acid.

So, did you remember to double the number of moles of sodium carbonate to find the correct number of moles of nitric acid?

Always remember the five steps for titration calculations.

Convert units.

Use the formula.

Apply the ratio.

Rearrange.

And finally check your answer.

Follow these steps and you'll be able to turn any set of practical titration results into calculated concentrations.