Preparing a solution of a primary standard

Transcript

Imagine that you wanted to find out the exact concentration of ethanoic acid in a bottle of vinegar. The label claims the bottle contains 5% ethanoic acid, but imagine that you wanted to check it accurately.

You might think of making up a solution of sodium hydroxide of known concentration and performing a standard acid-base titration. However, there is a problem with doing this. A solution of sodium hydroxide, even when made up fresh, does not have an accurate concentration. This is because sodium hydroxide is hygroscopic. This means that as soon as you place it on a balance to measure its mass, it starts to absorb water from the atmosphere. Therefore, you cannot measure its mass accurately. You also cannot make an accurately known solution of sodium hydroxide in this way.

We need to standardise our solution of sodium hydroxide using a primary standard. In this way, we will know its exact concentration. The primary standard we will use is called Potassium Hydrogen Phthalate or KHP.

The essential characteristics of a primary standard are that it should:

•Have high purity
•Have a high relative molecular mass
•Be soluble in the solvent used
•Be chemically stable
•Contain no water of hydration.
•Not be hygroscopic

This video will show you how to correctly prepare a standard solution of KHP, which has an accurately known concentration. Once prepared, it can be used to standardise a solution of a base such as sodium hydroxide.

KHP is an organic compound with this displayed formula. It has all the necessary qualities of a primary standard. The structure contains a carboxylic acid, which means that it is a weak acid.

Before starting your preparation, inspect all the equipment, especially the glassware, to check that it is thoroughly clean.

Transfer approximately 5 grams of KHP into a tare boat on the balance. Record the exact mass of the solid including the tare boat.

Transfer the solid to a 100 centimetre cubed glass beaker. Then re-weigh and record the mass of the tare boat. Don’t worry if traces of KHP remain on the tare boat.

Now calculate the exact mass of KHP to be used in the standardisation procedure. The exact mass used in this experiment is 5 grams.

Carefully add about 50 centimetres cubed of distilled water to the KHP. Stir it until it dissolves. Finally, make sure that you wash the stirring rod with distilled water several times into the beaker. This ensures that none of the KHP is left on the stirring rod.

Using a glass funnel, pour the solution carefully into the volumetric flask. Make up to the 250 centimetres cubed mark carefully with distilled water. When you get close to the graduation line, ensure that your eyes are level with it. Add water slowly, drop by drop, until the bottom of the meniscus is on the graduation line.

Stopper the volumetric flask and invert it a few times to ensure thorough mixing. Now we are ready to calculate the exact concentration of our standard solution.

You have now calculated the accurate concentration of the KHP solution. You can now use your standardised KHP solution to find out the exact concentration of the sodium hydroxide solution. And once the accurate concentration of the sodium hydroxide solution is known, it can be used to find the % of ethanoic acid in the vinegar solution.