Preparation of a standard solution of sodium carbonate

Theory

A standard solution is one whose concentration is accurately known. A primary standard is a substance that can be used to make a standard solution directly. A primary standard such as anhydrous sodium carbonate is available in a pure state, is stable and is water-soluble.

Anhydrous sodium carbonate (Na_2CO_3) has a molar mass of 106 g mol^{-1}. A 0.1 M solution is made up, using a 250 cm^3 volumetric flask. For 250 cm^3 of 0.1 M sodium carbonate solution, the mass required is:

106 x 0.1 x 250 / 1000 = 2.65 g

Procedure

Using a balance, measure accurately 2.65 g of pure anhydrous sodium carbonate on a clock glass.

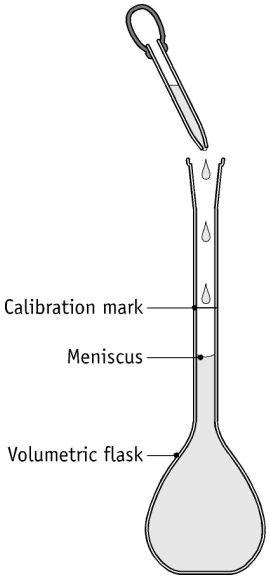
Slowly transfer the sodium carbonate with stirring, to about 50 cm^3 of deionised water in a clean 250 cm^3 beaker. To ensure that all the sodium carbonate is transferred, use a wash bottle to rinse the clock glass with deionised water, and add the rinsings to the beaker.

Continue stirring the mixture with a stirring rod until the sodium carbonate has fully dissolved.

Using a wash bottle, wash off the solution on the stirring rod with deionised water into the beaker.

Pour the solution through a clean funnel into the 250 cm^3 volumetric flask.

Using a wash bottle, rinse out the beaker several times with deionised water, and add the rinsings to the solution in the flask.



Rinse the funnel with deionised water, allowing the water to run into the flask.

Fill the flask to within about 1 cm of the calibration mark, and then add the water dropwise, using a dropping pipette, until the bottom of the meniscus just rests on the calibration mark.

Stopper the flask and invert it several times to ensure a homogeneous (evenly mixed) solution. Label the flask.

student questions

What is a standard solution?
A solution whose concentration is accurately known.

Why is it possible to make up a standard solution of sodium carbonate directly?
Because Na_2CO_3 is a primary standard, i.e. very pure and stable.

What precaution is taken to ensure that all of the sodium carbonate is transferred from the clock glass to the beaker?
The clock glass is rinsed with deionised water, and these rinsings are transferred to the beaker.

Why is a stirring rod used?
To speed up dissolving of the sodium carbonate, and to prevent the formation of hard lumps of the substance.

Why is it necessary to wash the solution off the stirring rod into the beaker?
To ensure that none of the sodium carbonate solution is lost

Why are the rinsings from the beaker added to the volumetric flask?
To ensure that all of the sodium carbonate solution is transferred to the volumetric flask.

Why is it necessary to be particularly careful when adding the last few drops of water to the volumetric flask?
There is a danger of 'overshooting' the mark, resulting in a solution of unknown concentration. If this occurs, the experiment will have to be started again.

When the solution has been made up, why is it necessary to mix the contents of the flask thoroughly? What feature of the volumetric flask makes this particularly necessary?
To ensure a homogeneous solution.
The narrow neck of the flask.

Why is a beaker, rather than a conical flask, used when the solute is being dissolved?
The beaker has a spout which facilitates pouring, and stirring is easier because it does not have a narrow neck.

Why is a funnel used in transferring the solution from the beaker to the volumetric flask?
To minimise the risk of any spillage.

Why is it necessary to slowly add the solid sodium carbonate, with stirring, to the water in the beaker?
To prevent the formation of hard lumps of sodium carbonate. These lumps are quite difficult to dissolve.

Industrial, Environmental & Social Links

A standard solution of sodium carbonate can be used in the standardisation of hydrochloric acid solutions for analytical work. It can also be used in the analysis of basic insoluble materials such as Milk of Magnesia tablets, using a back titration.