Chemistry – Determining the concentration of an alkali using the standard solution of Sulphamic acid

Aim: To determine the concentration of an alkali using the standard solution of Sulphamic acid.

Apparatus

- Peppet filler
- Peppet
- Beaker
- Biuret
- Conical flask
- Funnel
- Universal Indicator (PHENOL PHTHALEIN)
- Sulphamic Acid
- Sodium Hydroxide
- Distilled water
- White tile
- Biuret Clamp
- Calculator, Pen, Pencil, Paper

Method:

For accurate results, carry this method out in rough for the first attempt, and then carry it out two more times taking accurate readings of all the solutions etc, then take an average can be achieved by adding the two accurate readings and then dividing by 2.

Using the peppet filler.

1) TIP: Do not need to wash apparatus before starting the experiment (practical). NB – There are two different type of peppet fillers (ASE and the 123)

A – Aspirate (Empty out air in bulb)
S – Suck up (Take up the solution into the peppet)
E – Evacuate (Release solution from peppet into beaker)

1 – Same as A
2 – Same as S
3 – Same as E

When placing the peppet filler into the peppet make sure that the peppet is held no more then an inch from the top. If it is held any lower then it could potentially snap and sharp glass could go straight through your hand when fitting in the peppet filler.

2) Place the peppet filler into the top of the peppet. TIP: Do not press hard as it will be difficult to take out. ☐

3) Press A and squeeze peppet filler empty out all the air out of the bulb. ☐

4) Then dip the peppet into Sulphamic acid solution. Do make sure that the end of the peppet is not touching the bottom. TIP: Make sure that peppet is always inside solution when pressing S to ensure that there are no air bubbles. ☐

5) Suck up just above the meniscus, about 1cm or so. Then press E to release liquid so that it's bang on the meniscus line. If you go slightly under it then just adjust again by pressing S until you are satisfied. ☐

6) Afterwards, pour contents of the peppet into a conical flask by pressing and holding down E (Evacuate). ☐

7) Next, add in 2-3 drops of PHENOL PHYTHALEIN indicator into the conical flask. Must use the indicator to show when the reaction has finished.

PHENOL PHYTHALEIN in Acid is colourless.
PHENOL PHYTHALEIN in Alkali is a pink colour.

8) After this, add a fair amount of distilled water into the conical flask. . NB: The moles of acid will be kept the same, but it will enable us to see the end point (colour change) more clearly. ☐

9) Then clamp the Biuret into the Biuret clamp and close the tap at the bottom. ☐

10) Place the funnel at the top of the Biuret and then pour sodium hydroxide into it to ensure no liquid is lost. NB: If you have over – poured then release liquid the alkali through the tap. ☐

11) Once poured a sufficient amount of the alkali into Biuret take out the funnel so that the content of solution does not increase. Afterwards take a recording on paper of the amount of liquid in the Biuret. TIP: Do not fill to 0.00cm3 as examiners do not see this as a reading. The Biuret reading must be to 2d.p. and it must be rounded of to 0.5. ☐

E.g. 12.05, 14.90, 15.75 (Correct)
12.09, 14.87, 19.66 (Incorrect)

12) Place the white colour tile underneath the bottom of the Biuret tap. Then place the conical flask on the tile. This is so that the colour can be identified clearly. ☐

13) Before pouring the alkali from the tap into the conical flask check there are no air bubbles. If there is an air bubble then pour the solution out from the top into another flask. If this does not work then start the experiment again. ☐

At this point the experiment should look like this:

14) Then start to open the tap slowly adding the sodium hydroxide into the acid (conical flask). At the same time, swirl the conical flask in a circular motion with hands. If it not changing colour then there are two possible reasons why: ☐

i) Not any indicator added
ii) Reacting acid with acid or alkali with alkali.

15) If you think that the reaction has almost reached its end point then close the tap. Take a reading of the solution in the Biuret, then add another drop and then take another reading etc until you have reached the end point. You will be able to notify the end point when there is a permanent colour change. ☐

16) Take the end reading and subtract from initial reading, to get the titration volume of sodium hydroxide added into the Sulphamic Acid. ☐

17) Repeat the experiment again two times (as said above), this time accurately and then get an average to get the most precise reading. ☐

Results

	Rough estimation	1st Accurate estimation	2nd Accurate estimation
Initial titration reading (cm3)	6.00	3.10	7.05
Final titration reading (cm3)	31.60	28.70	32.45
Titre (cm3)	25.60	25.10	25.40

1st accurate reading + 2nd accurate reading = 50.50 (25.10 + 25.40)

$\frac{50.50}{2} = 25.25$

Therefore the most accurate volume for NaOH would be 25.25 cm3, from our results.

Working out the concentration (Molarity) of NaOH (Sodium Hydroxide)

Balanced Equation

Sodium Hydroxide – 25.25 cm3

Sulphamic Acid – 25 cm3
- 0.098 M

$\text{Moles} = \frac{Volume}{1000} * \times Molarity$

$\text{Moles} = \frac{25}{1000} \times 0.098 = 0.0245 \text{ Moles}$

Moles statement
1 Mole of Sodium hydoxide reacts with 1 mole of Sulphamic acid
Therefore 0.0245 Moles reacts with 0.0245 Moles

$0.0245 = \frac{Volume}{1000} \times \text{Molarity}$

$\text{Molarity} = \frac{0.0245}{0.2525}$

Molarity (concentration) of NaOH solution = 0.097M (mol dm-3)

Using the formula
Ma*Va = Mb*Vb
25cm3*0.098 = 25.25*Molarity
Molarity = 0.097M (mol dm-3)