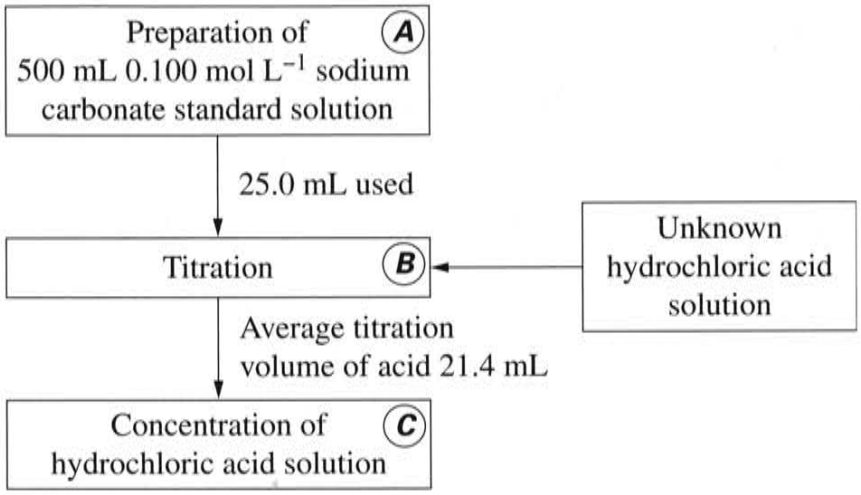
**Question 28** (8 marks)

The flowchart shown outlines the sequence of steps used to determine the concentration of an unknown hydrochloric acid solution. **8**




Describe steps ***A***, ***B*** and ***C*** including correct techniques, equipment and appropriate calculations. Determine the concentration of the hydrochloric acid.

Step A: weigh out accurately 5.3g of sodium carbonate ($Na_2CO_3$). Add 20mL of distilled water and stir with a stirring rod, ~~Re~~ Repeat 5-6 times or until all the $Na_2CO_3$ is dissolved. Transfer the solution to a pre-rinsed conical flask, ensuring the beaker is washed with a wash bottle several times to ensure all the $Na_2CO_{3(aq)}$ has been transferred. Add distilled water until the bottom of the meniscus hits the 500mL mark. Now calculate the concentration of the sodium carbonate standard solution. moles = $\frac{5.3g}{22.99+2+12.01+3+16} = 0.05000$

$\therefore 0.05000 \text{ moles} / 500\text{mL} = 0.1000 \text{ moles/L} = 0.100 \text{ mol/L}$

**Question 28 continues on page 18**

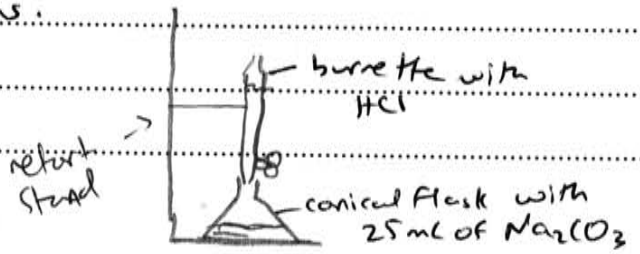
Question 28 (continued)

Rinse four conical flasks with distilled water

Step B - ~~Place 25mL of the standard solution~~ except rinse with $Na_2(O_3(aq))$ ~~Do~~ Do the same with the pipette, ~~Then~~

Then draw out 25mL of $Na_2(O_3(aq))$ using the pipette and place in each conical flask. Wash the burrette with distilled water and then hydrochloric acid (HCl). Then fill it up with HCl upto the etched 0mL mark. (the apperatus should look like the diagram below.) Place a suitable indicator in the conical flask and titrate. ~~The so~~ The first reading should be a rough guide, but ~~the~~ be careful and release ~~drop~~ the HCl drop by drop to ensure a more accurate reading for the next three and ensure ~~those~~ there are no outliers in those three values before averaging them.

Titration apperatus:




**End of Question 28**

Step 3C - when the two react it does so accordingly

$$Na_2(O_3(aq) + 2HCl(aq) \longrightarrow 2NaCl(aq) + H_2O(l) + (O_2(g))$$

$\therefore$ moles of $Na_2(O_3 = 0.100 \times \frac{25\times10^{-3}}{} = \frac{0.0500}{} 2.5\times10^{-3}$

$\therefore$ moles of $HCl = 2\times$ moles of $Na_2CO_3 = 2\times \frac{2.5\times10^{-3}}{0.0500} = \frac{0.100}{} 5\times10^{-3}$

$\therefore$ ~~0.100 moles / 21.4x10$^{-3}$~~

$\therefore 5\times10^{-3}$ moles / $21.4\times10^{-3}$ L

$\therefore 0.23364$ mol/L $= 0.234$ mol/L