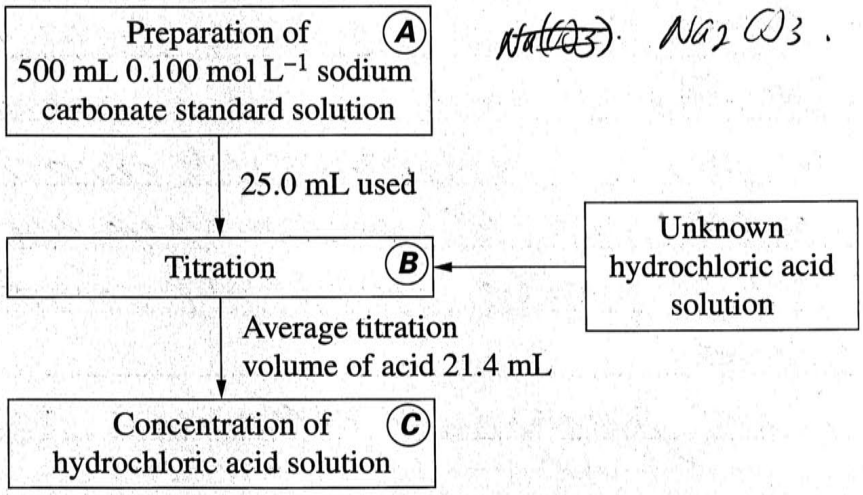
Question 28 (8 marks)

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 Preparation of A standard solution.

(1) measure out exactly 0.1 mol of sodium carbonate solid using an ~~gram~~ electronic balance (10.599 gram).

(2) place sodium carbonate into a 500mL volumetric flask.

(3) fill ~~20~~ 100mL of distilled water into volumetric flask.

(4) place a stopper in volumetric flask and swirer the flask until all of the Na_2O_3 is dissolved. Invert 3 times to ensure it is dissolved.

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Question 28 (continued)

(5) fill up the volumetric flask with distilled water till the etched mark (this should be the bottom of the meniscus.

Step B (1) rinse pipette with Na_2CO_3 solution from standard solution.

(2) rinse out burette with unknown HCl solution.

(3) Rinse out conical flask ~~[illegible]~~ with water

(4) pipette accurately 25mL of standard solution into a conical flask, tapping gently on side to ensure all drops of Na_2CO_3 are transfered into conical flask.

(5) fill up burette with HCl solution till the zero.

(6) open the top of burette and let HCl solution into conical flask.

(7) Swirl flask gently until observable colour change.

(8) Record the amount of HCl used.

(9) Repeat steps 1-8

End of Question 28

(10) calculate the average amount of HCl used, ignoring the inaccurate value.

Step C: calculations

fixed: average ~~number~~ volume of HCl used = 21.4mL

fixed: volume of Na_2CO_3 = 25mL

fixed: mol of Na_2CO_3 = ~~0.5 × 25/1000~~ = $\frac{0.5 mol}{20}$ = 0.025mol.

$$Na_2CO_{3(aq)} + 2HCl_{(aq)} \rightarrow 2NaCl(aq) + H_2O + CO_2$$

remained fixed: mol of HCl used = 0.025 × 2 = 0.05.

remained fixed: concentration of HCl = ~~n × V / 1000~~ $\frac{m}{V} = \frac{0.05}{\frac{21.4}{1000}}$

= 2.336448...

= 2.3mol L^{-1}