Question 28 (8 marks)

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

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

To prepare a standard solution of Na₂CO₃, AR grade is used, which has 99.9% purity. This is then dried and placed in a beaker with water. The amount of Na₂CO₃ is 5.3 g and this is to ensure maximum accuracy in preparation as $n = \frac{m}{M}$ in the equation $n = 0.05$. Once this is in a beaker, a small amount of water is added and the solution is mixed until all the solid is dissolved in solution. In order to ensure accuracy, a spray bottle sprays the sides and the stirrer which has been stirring the solution to ensure no Na₂CO₃

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is lost. This is then transferred into a 500mL volumetric flask and a funnel and is filled with water until one cm from the engraved line. After this, water is added with a dropper till the engraved line and hence the standard solution is made up. After this, the titration is done to determine the concentration. In order to titrate effectively, you place the HCl in a beaker and pipette slowly until the engraved line. This is after the pipette is washed thoroughly with HCl to ensure validity of experiment. After this, the HCl solution is pipetted out using the bulb into another beaker and the beaker is then 25mL of HCl.

The prepared standard from before is then placed in the burette and after it has been washed thoroughly with the HCl and then an indicator is placed in the beaker containing the 2.5mL HCl which should be methyl orange as HCl is a strong acid. Then, the standard solution is slowly buretted into the HCl and the amount of the standard needed until the HCl first changes colour due to the indicator is recorded. This provides a rough estimate as to how much is needed. After this, the titration is done again until 3 consistent results are achieved and the result is averaged. In this case, the volume required was 81.4mL and the result is averaged. In this case, the volume required was 81.4mL and the result is averaged. In this case, the volume required was 81.4mL and the result is averaged. In this case, the volume required was 81.4mL and the result is averaged. In this case, the volume required was 81.4mL and the result is averaged. In this case, the volume required was 81.4mL and the result is averaged.