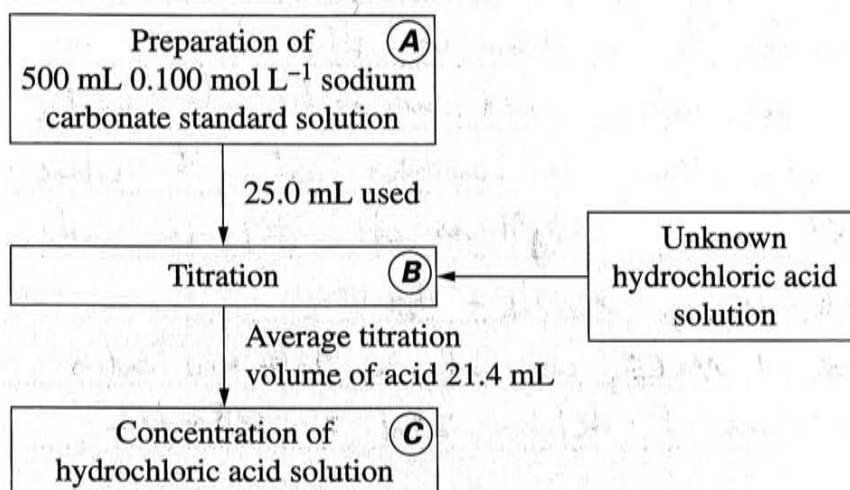**Question 28** (8 marks)

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

⑧

```
┌─────────────────────────────┐
│   Preparation of      (A)   │
│ 500 mL 0.100 mol L⁻¹ sodium │
│   carbonate standard solution│
└─────────────────────────────┘
              │
         25.0 mL used
              │
              ▼                          ┌──────────────────┐
┌─────────────────────────────┐         │    Unknown       │
│     Titration         (B) ◄──┼─────────┤ hydrochloric acid│
└─────────────────────────────┘         │    solution      │
              │                          └──────────────────┘
       Average titration
      volume of acid 21.4 mL
              │
              ▼
┌─────────────────────────────┐
│   Concentration of    (C)   │
│  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 such low molarity
we dilute a more concentrated solution. $NaCO_3$ has a molar
weight of 22.99 + 12 + 3(16) = 82.99 we would weigh out
165.98g of Sodium carbonate using a senior balance as
accurately as possible. As this would give us 2moles of
Sodium carbonate. dissolving 2moles in 1L gives us 1L
of 1mol L⁻¹ solution if we take 50ml of this solution
what has been stored thoroughly to ensure that it has
all dissolved and dilute it up to 500ml we
would then have 500ml of 0.100 ml L⁻¹ sodium carbonate solution,
in volumetric Flasks.

**Question 28 continues on page 18**

Question 28 (continued)

(B) Weak base strong acid titration requires a indicator which will change at around 6 pH. And add a few drops of methyl orange to the HCl which should be pipeted into a clean d beaker. The pipett should be rinced with HCl. Slowly add Sodium carbonate from the buret which has been rinced with sodium carbonate until the indicator changes colour. repeat the titration for reliability of results.

(C) we calculate the concentration of HCl because we know how much sodium carbonate was needed to neutralise it and we know its concentration and the volume of the HCl. assuming 25 mL was of HCl was used.

$HCl_{(aq)} + Na CO_{3(aq)} \rightarrow NACl + H_2O HCO_3$
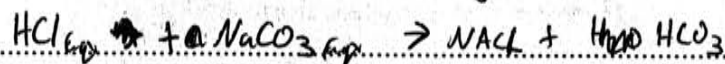
21.4 mL of $NaCO_3$ was used ie $2.14 \times 10^{-3}$ moles

∴ $2.14 \times 10^{-3}$ moles of HCl in 25ml $= .08 mols L^{-1}$

**End of Question 28**