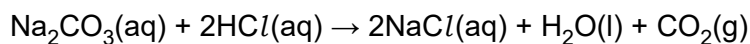


AS Level Chemistry A
H032/01 Breadth in chemistry

Question Set 19

1. A student carries out a titration to determine the concentration of some hydrochloric acid.

The student titrates the hydrochloric acid against a standard solution of sodium carbonate, Na_2CO_3 . The equation is shown below.



- The student prepares $0.150 \text{ mol dm}^{-3}$ Na_2CO_3 in a 250.0 cm^3 volumetric flask.
- The hydrochloric acid is added to a 50.0 cm^3 burette.
- The student pipettes the $\text{Na}_2\text{CO}_3(\text{aq})$ using a 25.0 cm^3 pipette.

- (a) The student's burette readings are shown in the table.
The rough titre has been omitted.

- (i) Complete the table by adding the titres to the table.

[1]

Final reading / cm^3	24.60	48.45	34.30
Initial reading / cm^3	0.40	24.60	10.00
Titre / cm^3	24.20	23.85	24.30

- (ii) Calculate the mean titre of HCl , to the nearest 0.05 cm^3 , that the student should use for analysing the results.

[1]

- (b) Calculate the concentration, in mol dm^{-3} , of the hydrochloric acid.

Give your answer to **3** significant figures.

[3]

- (c) In the titrations, the student measured volumes with a pipette and a burette.

- The pipette had an uncertainty of $\pm 0.04 \text{ cm}^3$ in the volume measured.
- The burette had an uncertainty of $\pm 0.05 \text{ cm}^3$ in the volume measured.

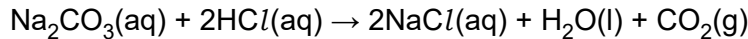
Determine whether the volume measured by the pipette or the volume measured by the burette has the greater percentage uncertainty.

[2]

Total Marks for Question Set 19: 7

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Titre / cm^3	...24.20...	...23.85....24.30.....

- (ii) Calculate the mean titre of HCl , to the nearest 0.05 cm^3 , that the student should use for analysing the results.

[1]

$$\textcircled{1} \text{ a) ii) } \frac{24.20 + 24.30}{2} = 24.25 \text{ cm}^3$$

- (b) Calculate the concentration, in mol dm^{-3} , of the hydrochloric acid.

[3]

Give your answer to 3 significant figures.

$$\text{iii) } \text{Moles } \text{Na}_2\text{CO}_3 = 0.15 \times 0.025 \\ = 0.00375$$

$$\text{Moles HCl} = 0.00375 \times 2 = 0.0075$$

$$\text{Concentration HCl} = \frac{\text{Moles}}{\text{Volume}} = \frac{0.0075}{0.02425} = 0.309278 \\ = 0.309 \text{ mol dm}^{-3}$$

- (c) In the titrations, the student measured volumes with a pipette and a burette.

- The pipette had an uncertainty of $\pm 0.04 \text{ cm}^3$ in the volume measured.
 - The burette had an uncertainty of $\pm 0.05 \text{ cm}^3$ in the volume measured.
- Determine whether the volume measured by the pipette or the volume measured by the burette has the greater percentage uncertainty.

[2]

c) pipette : burette :

$$100 \times \left(\frac{0.04}{25.0} \right) = 1.6 \times 10^{-3} \quad \frac{0.05 \times 2}{24.25} \times 100 = 0.41 \%$$

$$= 0.16 \%$$

\therefore the % uncertainty for the burette is greater than for the pipette

Total Marks for Question Set 19: 7

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