**3** This question is about a white solid, $MHCO_3$, that dissolves in water and reacts with hydrochloric acid to give a salt.

$$MHCO_3 + HCl \rightarrow MCl + H_2O + CO_2$$

A student was asked to design an experiment to determine a value for the $M_r$ of $MHCO_3$. The student dissolved 1464 mg of $MHCO_3$ in water and made the solution up to 250 $cm^3$.

25.0 $cm^3$ samples of the solution were titrated with 0.102 mol $dm^{-3}$ hydrochloric acid. The results are shown in **Table 1**.

**Table 1**

|  | **Rough** | **1** | **2** | **3** |
|---|---|---|---|---|
| **Initial burette reading / $cm^3$** | 0.00 | 10.00 | 19.50 | 29.25 |
| **Final burette reading / $cm^3$** | 10.00 | 19.50 | 29.25 | 38.90 |
| **Titre / $cm^3$** | 10.00 | 9.50 | 9.75 | 9.65 |

**0 3 . 1** Calculate the mean titre and use this to determine the amount, in moles, of HCl that reacted with 25.0 $cm^3$ of the $MHCO_3$ solution.

**[3 marks]**

_____

_____

_____

_____

_____

**0 3 . 2** Calculate the amount, in moles, of $MHCO_3$ in 250 $cm^3$ of the solution.
Then calculate the experimental value for the $M_r$ of $MHCO_3$.
Give your answer to the appropriate number of significant figures.

**[3 marks]**

_____

_____

_____

_____

**0 3 . 3** The student identified use of the burette as the largest source of uncertainty in the experiment.

Using the same apparatus, suggest how the procedure could be improved to reduce the percentage uncertainty in using the burette.

Justify your suggested improvement.

**[2 marks]**

Suggestion _____

_____

Justification _____

_____

_____

**0 3 . 4** Another student is required to make up 250 cm³ of an aqueous solution that contains a known mass of $MHCO_3$. The student is provided with a sample bottle containing the $MHCO_3$.

Describe the method, including apparatus and practical details, that the student should use to prepare the solution.

**[6 marks]**

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

**More answer space is available on page 8**

**Turn over ▶**