Reading a Mass Loss Record for a Hydrate

Base your answers on the information provided and your knowledge of chemistry. Use the 2025 Chemistry Reference Tables as needed.

A class compares two labels for a model sodium carbonate crystal. The labels are $Na_2CO_3 \cdot H_2O$ and $Na_2CO_3 \cdot 10H_2O$. On warming in the model, water leaves the crystal structure. The remaining solid is Na_2CO_3. Assume the carbonate stays in the container and only water leaves.

Material or measurement	**Value**
Initial hydrate mass	14.3 g
Final dry solid mass	5.30 g
Molar mass of Na_2CO_3	106 g/mol
Molar mass of H_2O	18.0 g/mol

1 Calculate the mass of water that left the hydrate. Show your setup. [1]

Answer and work

2 Find the mole ratio of water removed to sodium carbonate remaining. Show how you used both molar masses. [1]

Answer and work

3 Which conclusion about the labels is supported by that ratio?

(1) The result supports $Na_2CO_3 \cdot H_2O$.

(2) The result supports $Na_2CO_3 \cdot 10H_2O$.

(3) The result supports both labels equally.

(4) The result shows no water was in the initial crystal.

Another sample is tested, but the student stops while some water is still in the crystal structure. The student treats all the final solid mass as dry Na_2CO_3.

4 Would that procedure tend to make the estimated water-to-carbonate mole ratio too high or too low? Explain using both the water lost and final solid mass. [1]

Answer and work