

Question 26 (5 marks)

Water can be described as either 'hard' or 'soft'.

- (a) Describe a test you have used to determine whether a given sample of water is 'hard' or 'soft'. 2

The amounts of Ca and Mg present in the water were measured. If soap is used in that sample of water and lathers it is 'soft'. If it doesn't lather much it is 'hard'.

- (b) A sample of hard water contains $6 \times 10^{-4} \text{ mol L}^{-1}$ of magnesium carbonate. 3

Calculate the mass, in mg, of magnesium carbonate in 150 mL of this sample.

$$\begin{aligned}
 n(\text{MgCO}_3) &= CV \\
 &= 6 \times 10^{-4} \times \frac{150}{1000} \\
 &= 9 \times 10^{-5} \text{ moles.}
 \end{aligned}$$

$$\begin{aligned}
 m &= nM \\
 &= 9 \times 10^{-5} \times 78.32 \\
 &= 7.05 \times 10^{-3} \text{ mg.}
 \end{aligned}
 \quad \left| \quad \begin{aligned}
 &= 9 \times 10^{-5} \times 0.15 \\
 &= 1.35 \times 10^{-5} \text{ mg.}
 \end{aligned}$$