

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

Using a Qualitative analysis by precipitation to see whether Mg^{2+} or Ca^{2+} ions are present in the water. These ions are the ions which make water 'hard' or 'soft'. The less their is the soft the water is.

- (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.

$$\begin{aligned}
 M &= 6 \times 10^{-4} \text{ mol/L} & \text{Moles} &= \text{molarity} \times \text{Volume} \\
 \text{Mass} &= ? & &= 6 \times 10^{-4} \times 0.15 \\
 \text{Volume} &= 150 \text{ mL} = 0.15 \text{ L} & &= 9 \times 10^{-5} \text{ moles} \\
 \text{Mg}(\text{CO}_3)_2 &= 24 + [12 + (6 \times 3) \times 2] & \text{mass} &= \text{moles} \times \text{molar mass} \\
 &= 132 & &= 9 \times 10^{-5} \times 132 \\
 & & \text{Mass} &= 0.01188 \\
 & & &= 11.88 \text{ mg}
 \end{aligned}$$