

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 addition of soap to a water sample proved the sample to be hard as a scum formed on the stirring rod, showing that Ca²⁺/Mg²⁺ were present. If the water sample was soft water, the precipitate would not have occurred.

- (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.

$\text{conc} = \frac{\text{mass}}{\text{volume}}$	$\text{mass} = \text{moles} \times \text{MM}$
$\text{moles} = \frac{\text{conc}}{\text{V. in L}}$	$= 0.004 \times (24.31 + 12.01 + 3 \times 16)$
$= \frac{6 \times 10^{-4}}{0.15}$	$= 0.004 \times 84.37$
$= 0.004 \text{ moles}$	$= 0.34 \text{ g of MgCO}_3 \text{ (2 d.p.)}$