

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

~~We added $MgSO_4$ to the water~~
 and a soft lather formed. We added soap ~~($MgSO_4$)~~ to the water, and if the water "lathered" it was soft water, as hard water doesn't lather due to the precipitation of soap ions from solution by Mg^{2+} and Ca^{2+} .

- (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. $MgCO_3$

$$6 \times 10^{-4} \text{ mol} \rightarrow 1000 \text{ mL}$$

$$\therefore x \text{ mol} \rightarrow 150 \text{ mL}$$

$$\therefore x = 0.00009 \text{ mol}$$

$$\therefore m_{MgCO_3} = \frac{m}{MM} \Rightarrow m = 0.0009 \times [24.31 + 12.01 + (3 \times 16)]$$

$$= 0.007589 \text{ g}$$

$$\therefore 7.5888 \text{ mg}$$