

## 1.2 Exercise 2 - solutions

### Using molarities and concentrations

1. Calculate the number of moles of  $\text{H}_2\text{SO}_4$  in  $50 \text{ cm}^3$  of a  $0.50 \text{ mol dm}^{-3}$  solution.
2. Calculate the number of moles of  $\text{FeSO}_4$  in  $25 \text{ cm}^3$  of a  $0.2 \text{ mol dm}^{-3}$  solution.
3. Calculate the mass of  $\text{KMnO}_4$  in  $25 \text{ cm}^3$  of a  $0.02 \text{ mol dm}^{-3}$  solution.
4. Calculate the mass of  $\text{Pb}(\text{NO}_3)_2$  in  $30 \text{ cm}^3$  of a  $0.1 \text{ mol dm}^{-3}$  solution.
5. What is the molarity of 1.06g of  $\text{H}_2\text{SO}_4$  in  $250 \text{ cm}^3$  of solution?
6. What is the molarity of 15.0 g of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  in  $250 \text{ cm}^3$  of solution?
7. What volume of a  $0.833 \text{ mol dm}^{-3}$  solution of  $\text{H}_2\text{O}_2$  will be required to make  $250 \text{ cm}^3$  of a  $0.100 \text{ mol dm}^{-3}$  solution?
8. What volume of a  $0.50 \text{ mol dm}^{-3}$  solution of  $\text{HCl}$  will be required to make  $100 \text{ cm}^3$  of a  $0.050\text{M}$  solution?
9. How many moles of  $\text{NaCl}$  are there in  $25 \text{ cm}^3$  of a  $50 \text{ g dm}^{-3}$  solution?

## Reacting masses and volumes

1.  $25\text{ cm}^3$  of a solution of  $0.1\text{ mol dm}^{-3}$  NaOH reacts with  $50\text{ cm}^3$  of a solution of hydrochloric acid. What is the molarity of the acid?
2.  $25.0\text{ cm}^3$  of a  $0.10\text{ mol dm}^{-3}$  solution of sodium hydroxide was titrated against a solution of hydrochloric acid of unknown concentration.  $27.3\text{ cm}^3$  of the acid was required. What was the concentration of the acid?
3.  $10\text{ cm}^3$  of a solution of NaCl react with  $15\text{ cm}^3$  of a  $0.02\text{ mol dm}^{-3}$  solution of  $\text{AgNO}_3$ . What is the concentration of the NaCl solution in  $\text{g dm}^{-3}$ ?
4.  $25\text{ cm}^3$  of a  $0.1\text{ mol dm}^{-3}$  solution of an acid  $\text{H}_x\text{A}$  reacts with  $75\text{ cm}^3$  of a  $0.1\text{ mol dm}^{-3}$  solution of NaOH. What is the value of  $x$ ?  
Equation:  $\text{H}_x\text{A} + x\text{NaOH} \rightarrow \text{Na}_x\text{A} + x\text{H}_2\text{O}$
5. A solution of hydrochloric acid of volume  $25.0\text{ cm}^3$  was pipetted onto a piece of marble which is calcium carbonate. When all action had ceased,  $1.30\text{ g}$  of the marble had dissolved. Find the concentration of the acid  
Equation:  $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$
6. What volume of  $0.1\text{ mol dm}^{-3}$  hydrochloric acid would be required to dissolve  $2.3\text{ g}$  of calcium carbonate?  
Equation:  $\text{CaCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CaCl}_2(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
7.  $2.05\text{ g}$  of the carbonate of an unknown alkali metal ( $\text{X}_2\text{CO}_3$ ) required  $8.9\text{ cm}^3$  of  $2.0\text{ mol dm}^{-3}$  hydrochloric acid to completely dissolve it. What was the relative atomic mass of the metal and which metal was it?  
Equation:  $\text{X}_2\text{CO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow 2\text{XCl}(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
8.  $3.2\text{ g}$  of hydrated sodium carbonate,  $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$ , was dissolved in water and the resulting solution was titrated against  $1.0\text{ mol dm}^{-3}$  hydrochloric acid.  $22.4\text{ cm}^3$  of the acid was required. What is the value of  $x$ ?