Year 11 Chemistry ***SOLUTIONS***

# Chemical Calculations Assignment 2

Concentration

1.

(a) *There is no single right answer for this but the diagram should clearly show that a more concentrated solution has more solute per volume of solvent.*

(b) If the solution with more volume also has more solvent, they can have the same concentration. *(There is no single right answer for an example).*

2.

(a) $57 \div 53.49 = 1.1 \text{ mol L}^{-1}$

(b) $M_{\mathrm{H_2SO_4}} = 98.076 \text{ g mol}^{-1}$

$15 \div 98.076 = 0.15 \text{ mol L}^{-1}$

(c) $0.93 \text{ kg L}^{-1} = 930 \text{ g L}^{-1}$

$930 \div 194.19 = 4.8 \text{ mol L}^{-1}$

3.

(a) $2.0 \times 63.01 = 130 \text{ g L}^{-1} \text{ (2 s.f.)}$

(b) $M_{\mathrm{Ca(HCO_3)_2}} = 162.116 \text{ g mol}^{-1}$

$5.0 \times 10^{-2} \times 162.116 = 8.1 \text{ g L}^{-1}$

(c) $1.5 \times 10^{-3} \text{ mol mL}^{-1} = 1.5 \text{ mol L}^{-1}$

$1.5 \times 39.997 = 60 \text{ g L}^{-1} \text{ (2 s.f.)}$

4. A solution could be much more dilute than calculated. For example, a solution of 15 g $L^{-1}$ sulfuric acid labelled 15 mol $L^{-1}$ is actually 0.15 mol $L^{-1}$.

5.

(a) $C = \frac{n}{V} = \frac{0.020}{1.0} = 0.020 \text{ mol L}^{-1}$

(b) $C = \frac{m}{V} = \frac{2.61}{0.500} = 5.22 \text{ g L}^{-1}$

(c) $C = \frac{m}{V} = \frac{0.12}{100} = 0.0012 \text{ g mL}^{-1} \quad \textit{or} \quad 1.2 \text{ g L}^{-1}$

(d) $C = \frac{n}{V} = \frac{65}{1.5} = 43 \text{ mg L}^{-1} \quad \textit{or} \quad 0.043 \text{ g L}^{-1}$

6. $C = \frac{n}{V}$ is used when the solute has been measured in moles, and $C = \frac{m}{V}$ is used when the solute has been measured as a mass. These numbers are usually very different.

*7. In these solutions, the mole/mass conversion has been done first. Doing the conversion afterwards would also have been fine.*

(a) $n = \frac{m}{M} = \frac{3.0}{39.997} = 0.075 \text{ mol}$

$C = \frac{n}{V} = \frac{0.075}{0.10} = 0.75 \text{ mol L}^{-1}$

(b) $m = nM = 0.00850 \times 36.46 = 0.3099 \text{ g}$

$500 \text{ mL} = 0.500 \text{ L}$

$C = \frac{m}{V} = \frac{0.3099}{0.500} = 0.620 \text{ g L}^{-1}$

8.

(a) Multiply both sides by volume, then swap sides.
(b) Multiple both sides by volume, then divide both sides by $C$.

9. $C = \frac{m}{V}$

$\therefore V = \frac{m}{C} = \frac{5.0}{22} = 0.23 \text{ L}$

10.

(a) $C = \frac{n}{V}$

$\therefore n = CV = 0.100 \times 0.150 = 0.015 \text{ mol}$

(b) $M_{AgNO_3} = 169.91 \text{ g mol}^{-1}$

$0.015 \times 169.91 = 2.55 \text{ g}$

*11. In this answer, the mole/mass conversion has been done first. Doing the conversion on the concentration instead would also have been fine.*

$n = \frac{m}{M} = \frac{5.0}{39.997} = 0.125 \text{ mol}$

$C = \frac{n}{V}$

$\therefore V = \frac{n}{C} = \frac{0.125}{3.0} = 0.042 \text{ L}$