Molar Concentration

- Another way to represent a concentration is to use *molar concentration* or *molarity*

* • **Molar concentration** or **molarity** indicates the number of moles of solute dissolved in one liter of solvent

$$C = \frac{n}{V}$$ * memorize!

where C is concentration in mol/L

n is the number of moles of solute (mol)

V is volume of solvent in liters (L)

- The molar mass equation may also be needed to calculate the moles of a solute based on the mass of the solute

$$m = Mn$$

where m is the mass in grams (g)

M is the molar mass in g/mol

n is the number of moles (mol)

- EXAMPLES:
  1. Calculate the concentration of the acidic solution when 0.300mol of sulphuric acid are mixed in 500mL of water.

$n = 0.300\ mol$

$V = 500mL \times \left(\frac{10^{-3}L}{1mL}\right)$

$V = 0.500L$

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

$C = \frac{0.300mol}{0.500L}$

$C = 0.600\ mol/L$

2. What volume of a 0.85mol/L solution of sodium chloride, $NaCl_{(s)}$, could be made from dissolved 3.2g of sodium chloride?

$V = ?$

$C = 0.85\ mol/L$

$m = 3.2\ g$

$C = \frac{n}{V}$ ② → $m = M_n$ ①

aside

$M = 22.99\ g/mol + 35.45\ g/mol$

$M = 58.44\ g/mol$

① $n = \frac{m}{M} = \frac{3.2\ g}{58.44\ g/mol}$

$n = 0.054757...\ mol$

② $V = \frac{n}{C} = \frac{0.054757...\ mol}{0.85\ mol/L} = 0.06442...\ L$

$0.064\ L \times \left(\frac{1\ mL}{10^{-3}\ L}\right) = \boxed{64\ mL}$

3. Calculate the mass of lead nitrate, $Pb(NO_3)_{2(s)}$, needed to make 750mL of a 1.25mol/L solution.

$m = ?$

$V = 750\ mL \times \left(\frac{10^{-3}\ L}{1\ mL}\right)$

$V = 0.750\ L$

$C = 1.25\ mol/L$

$m = M_n$ ②

$C = \frac{n}{V}$ ①

aside

$M = 207.20\ g/mol + (2 \times 14.01\ g/mol) + (6 \times 16.00\ g/mol)$

$M = 331.22\ g/mol$

① $n = CV = (1.25\ mol/L)(0.750\ L)$

$n = 0.9375\ mol$

② $m = M_n = (331.22\ g/mol)(0.9375\ mol)$

$m = 310.51875\ g$

$\boxed{m = 311\ g}$

*****Now try Practice Problems*****

Practice Problems

1. Calculate the molar concentration of the solution when 0.289 mol of iron (III) chloride, $FeCl_{3(s)}$, is dissolved in 120mL of water. **[2.41 mol/L]**

2. Calculate the molar concentration of the solution when 1.2g of sodium nitrate, $NaNO_{3(s)}$, is dissolved in 80mL of water. **[0.18 mol/L]**

3. Calculate the mass of sodium chloride, $NaCl_{(aq)}$, in 125 mL of a 0.200mol/L solution. **[1.46 g]**

4. What volume of solution could be prepared from dissolving 2.0g of silver nitrate, $AgNO_3$ in water to make a 0.225mol/L solution? **[0.052 L or 52 mL]**

5. A 100mL bottle of skin lotion contains a number of solutes. One of these solutes is zin oxide, $ZnO_{(s)}$. The concentration of zinc oxide in the skin lotion is 0.915mol/L. What mass of zinc oxide is present in the bottle? **[7.45 g]**

6. Intravenous solutions are commonly 0.28mol/L glucose. What volume of a standard intravenous solution, measured in litres, could be made from 2.5kg of glucose, $C_6H_{12}O_{6(s)}$? **[50 L]**