4.2

- Concentration Assignment

1. A 0.750 L aqueous solution contains 90.0 g of ethanol, C_2H_5OH. Calculate the molar concentration of the solution in mol $\cdot L^{-1}$.

$M = \frac{wt}{mm \cdot V} = \frac{90.0\,g}{(46.08\,g/mol)(0.75L)} =$ **2.60 M of C_2H_5OH**

MM: C - 2 × 12.01
H - 6 × 1.01
O - 16.00 × 1
46.08 g/mol

2. What mass of NaCl are dissolved in 152 mL of a solution if the concentration of the solution is 0.364 M?

0.152 L

$wt = M \cdot mm \cdot V = (0.364M)(58.44\,g/mol)(0.152L)$

$=$ **3.23 g of NaCl**

MM: Na 1 × 22.99
Cl 1 × 35.45
58.44 g/mol

3. How many grams of $CaCl_2$ would be dissolved in 1.0L of a 0.10M solution of $CaCl_2$?

$wt = M \cdot mm \cdot V = (0.1M)(110.98\,g/mol)(1.0L)$

$=$ **11 g of $CaCl_2$**

mm: Ca 1 × 40.08
Cl 2 × 35.45
110.98 g/mol

4. A mass of 98 g of sulfuric acid is dissolved in water to prepare a 0.500 M solution. What is the volume of the solution?

$V = \frac{wt}{mm \cdot M} = \frac{98\,g}{(98.085\,g/mol)(0.500M)}$

$=$ **2.0 L of solution**

mm: H 2 × 1.01
S 1 × 32.065
O 4 × 16.00
98.085 g/mol

5. A solution of sodium carbonate, Na_2CO_3, contains 53.0 g of solute in 215 mL of solution. What is its molarity?

$M = \frac{wt}{mm \cdot V} = \frac{53.0\,g}{(105.989\,g/mol)(.215L)}$

$=$ 2.33M Na_2CO_3

$[Na_2CO_3] = 2.33M$

mm: Na 2 × 22.99
C 1 × 12.01
O 3 × 16.00
105.989 g/mol

6. What is the volume of a solution of 0.0400 M HNO_3 that contains 12.6 g of solute?

$V = \frac{wt}{mm \cdot M} = \frac{12.6\,g}{(63.02\,g/mol)(0.04M)} =$ **5.00L of solution**

mm - H - 1×1.01
N - 1×14.01
O - 3×16.00
63.02 g/mol

7. Calculate the concentration in ppb of 670.3 mg of chlorine mixed into a pool containing 151 000 000 mL of water.

$ppb = \frac{g\ solute}{g\ solution} \times 10^9 = \frac{0.6703g}{151\,000\,000g} \times 10^9 = 4.44 ppb.$

8. A sample of water contains 20.0 ppm of NaOH. What is the molarity?

$M = \frac{mg/L}{mm \cdot 1000} = \frac{20 mg/L}{(40.00 g/mol) \times 1000}$

$= 0.000500M$ or **$5.00 \times 10^{-4} M$ NaOH**

Na - 1×22.99
O - 1×16.00
H - 1×1.01
40.00 g/mol

9. What mass of dextrose, $C_6H_{12}O_6$ is dissolved in 325 mL of 0.258 M solution?

$wt = M \cdot mm \cdot V$

$= (0.258M)(180.1548 g/mol)(0.325L)$

$= 15.1 g\ C_6H_{12}O_6$

mm: C 6×12.01
H 12×1.01
O 6×16.00
180.1548 g/mol

10. If you have 100.0 mL of a 30.0% aqueous solution of ethanol, what volumes of ethanol and water are in the solution?

$30\% = \frac{\text{volume ethanol}}{\text{volume solution (100mL)}} \times 100.$

$0.3 = \frac{\text{volume ethanol}}{100.0mL}$

30mL = volume ethanol.
∴ volume water = 100mL - 30mL = 70mL.