KEY

Concentration

1. 0.240 mol of washing soda, Na_2CO_3, is dissolved in water to make 0.500 L of a solution for softening water.
   a. What is the ppm concentration of the solution?

$m = nM = (0.240\text{ mol})(105.99\text{ g/mol}) = 25.4376\text{ g}$

$ppm = \frac{m}{V} = \frac{25437.6\text{ mg}}{0.500\text{ L}} = 50875.2\text{ ppm} = \boxed{5.09 \times 10^4\text{ ppm}}$

   b. What is the molar concentration of a solution in which

$C = \frac{n}{V} = \frac{0.240\text{ mol}}{0.500\text{ L}} = \boxed{0.480\text{ mol/L}}$

   c. What is the %W/V concentration of the solution?

$\%\text{ w/v} = \frac{m}{V} \times 100 = \frac{25.4376\text{ g}}{500\text{ mL}} \times 100 = \boxed{5.09\%\text{ w/v}}$

2. What is the amount concentration of 500 mL of a solution that contains 12.7 g of swimming pool chlorinator, calcium hypochlorite? $Ca(OCl)_2$

$n = \frac{m}{M} = \frac{12.7\text{ g}}{142.98\text{ g/mol}} = 0.0888\ldots\text{ mol}$

$C = \frac{n}{V} = \frac{0.0888\ldots\text{ mol}}{0.500\text{ L}} = 0.17764\ldots\text{ mol/L} = \boxed{0.178\text{ mol/L}}$

3. How many moles of solid sodium hydrogen carbonate would be needed to make 0.100 L of a 0.600 mol/L solution suitable for use as an antacid? $NaHCO_3$

$C = \frac{n}{V}$ $\quad 0.600\text{ mol/L} = \frac{n}{0.100\text{ L}}$ $\quad n = 0.0600\text{ mol}$

$m = nM = (0.0600\text{ mol})(84.01\text{ g/mol}) = \boxed{5.04\text{ g}}$

4. What mass of sodium hydroxide (lye) must be added to 1.50 L of water in order to prepare a solution with a concentration of 0.0750 mol/L? $NaOH = 40.00\text{ g/mol}$

$C = \frac{n}{V}$ $\quad 0.0750\text{ mol/L} = \frac{n}{1.50\text{ L}}$

$n = 0.1125\text{ mol}$

$m = nM = (0.1125\text{ mol})(40.00\text{ g/mol}) = \boxed{4.50\text{ g}}$

5. Calculate the volume of 0.100 mol/L solution that can be prepared from 3.60 mmol of caustic soda.

0.00360 mol

$C = \frac{n}{V}$ $\quad 0.100\text{ mol/L} = \frac{0.00360\text{ mol}}{V}$

$V = 0.036\text{ L} = \boxed{36.0\text{ mL}}$

6. What volume of 0.700 mol/L brush cleaning solution can be prepared from 126 g of sodium phosphate, $Na_3PO_{4(s)}$?

$n = \frac{m}{M} = \frac{126\,g}{163.94\,g/mol}$

$= 0.7685...\,mol$

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

$0.700\,mol/L = \frac{0.7685...\,mol}{V}$

$V = 1.0979...\,L = \boxed{1.10\,L}$

7. Calculate the % W/V of an ink solution that contains 0.210 g of iron(II) sulphate dissolved in 0.048 L of water.

$\%\ w/v = \frac{m}{V} \times 100$

$= \frac{0.210\,g}{48\,mL} \times 100 = 0.4375\ \%\ w/v$

$= \boxed{0.44\%\ w/v}$

8. Sodium phosphate can be used to remove scale deposits from a car radiator.
   a. What volume of a 0.075 mol/L solution would contain 1.10 mol of sodium phosphate?

Na_3PO_4

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

$0.075\,mol/L = \frac{1.10\,mol}{V} = 14.66...\,L$

$= \boxed{15\,L}$

   b. What would be the %W/V concentration of the solution?

$m = nM$

$= (1.10\,mol)(163.94\,g/mol)$

$= 180.334\,g$

$\%\ w/v = \frac{180.334\,g}{1466.6...\,mL} \times 100 = 1.229...\%\ w/v$

$= \boxed{1.2\%\ w/v}$

9. A solution of windshield washer fluid is 46.5% V/V of propanol. What volume of propanol is present in a 3.5 L jug of winshield washer fluid?

$\%\ \frac{V}{V} = \frac{V}{V} \times 100$

$46.5\% = \frac{V}{3.5\,L} \times 100$

$V = 1.6275\,L$

$= \boxed{1.6\,L}$