Chemistry 20 - Unit 2 - Concentration

Name: _____

You may find the following formulas useful:

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

$$m = Mn$$

1. In moles per litre, calculate the molarity of each of the following solutions.

a. 1.50 mol of zinc nitrate is dissolved in 3.00 L of solution.

$$[Zn(NO_3)_2] = \frac{n_{Zn(NO_3)_2}}{V} = \frac{1.50\ mol}{3.00\ L} = \boxed{0.500\ M}$$

b. 2.25 mol of elemental oxygen is dissolved in 5.00 L of solution.

$$[O_2] = \frac{n_{O_2}}{V} = \frac{2.25\ mol}{5.00\ L} = 0.450\ mol/L = \boxed{0.450\ M}$$

c. 3.25 x 10^{-3} kmol of barium sulfide is dissolved in 1.25 L of solution.

$$[BaS_{(aq)}] = \frac{n_{BaS}}{V} = \frac{3.25\ mol}{1.25\ L} = \boxed{2.60\ M}$$

d. 4.56 x 10^{3} mmol of sodium is dissolved in 3.25 x 10^{9} nL of solution.

$$[Na] = \frac{n_{Na}}{V} = \frac{4.56\ mol}{3.25\ L} = \boxed{1.40\ M}$$

e. 40.00 grams of sodium hydroxide is dissolved in 450.0 mL of solution.

$$n = \frac{m}{M} = \frac{40.00\ g}{40.00\ g/mol} = 1.000\ mol$$

$$[NaOH] = \frac{n_{NaOH}}{V} = \frac{1.000\ mol}{0.4500\ L} = \boxed{2.222\ M}$$

f. 159.00 grams of iron (III) oxide is dissolved in 20.0 L of solution.

$$n = \frac{159.00\ g}{159.70\ g/mol} = 0.9956\ mol$$

$$[Fe_2O_3] = \frac{n_{Fe_2O_3}}{L} = \frac{0.9956\ mol}{20.0\ L} = \boxed{0.04978\ M}$$

g. 8.75 x 10^{4} milligrams of calcium chloride is dissolved in 4.50 x 10^{-4} kL of solution.

$$n = \frac{87.5\ g}{110.98\ g/mol} = 0.788\ mol$$

$$[CaCl_2] = \frac{n_{CaCl_2}}{V} = \frac{0.788\ mol}{4.50 \times 10^{-7}\ L} = \boxed{1.75 \times 10^{6}\ M}$$

2. In moles, calculate the chemical amount of solute in each of the following solutions. Following that, calculate the mass of solute in grams.

a. A 1.50 M zinc nitrate solution has a volume of 4.50 L.

$$n = CV = 1.50\ M \times 4.50\ L = \boxed{6.75\ mol}$$

b. A 2.45 M calcium chloride solution has a volume of 32.0 L.

$$n = CV = 2.45\ M \times 32.0\ L = \boxed{78.4\ mol}$$

c. A 6.26 mmol/L ammonium oxalate solution has a volume of 3500 mL.

$$n = CV = 6.26 \times 10^{-3}\ M \times 3.500\ L = \boxed{0.0219\ mol}$$

d. A 4.54 kmol/L hydrochloric acid ($HCl_{(aq)}$) solution has a volume of 2.65 x 10^{-3} kL.

$n = CV = 4.54 \times 10^3 M \times 2.65 L = 1.20 \times 10^4 mol$

e. A 3.28 x 10^{10} nmol/L sodium hydroxide solution has a volume of 5.6 x 10^{12} nL.

$32.8 M \times 5.6 \times 10^3 L = 1.8 \times 10^5 mol$

f. A 4.55 x 10^{-10} Gmol/L manganese (VII) oxide solution has a volume of 6.8 x 10^{-8} ML.

$0.455 M \times 0.068 L = 0.031 mol$

g. A 7.5 x 10^{-7} Mmol/L vanadium (V) nitrite solution has a volume of 6.78 x 10^{-13} GL.

$0.75 M \times 6.78 \times 10^{-4} L = 5.1 \times 10^{-4} mol$

3. In litres, calculate the volume of each of the following solutions.

a. 1.50 M zirconium nitrate solution has 12.0 mol of solute.

$V = \frac{n}{C} = \frac{12.0 mol}{1.50 M} = 8.00 L$

b. 3.25 M barium sulfide solution has 1.54 x 10^{-4} kmol of solute.

$V = \frac{n}{C} = \frac{0.154 mol}{3.25 M} = 0.0474 L = 47.4 mL$

c. 5.50 mmol/L ammonium hydroxide solution has 4.5 x 10^4 mmol of solute.

$\frac{45 mol}{0.00550 M} = 8.18 \times 10^3 L = 8.18 kL$

d. A 6.70 x 10^6 nmol/L rubidium selenide solution has 3.20 x 10^{-5} Mg of solute.

$n = \frac{m}{M} = \frac{32.0 g}{249.90 g/mol} = 0.128 mol$ Rb_2Se

$\frac{0.128 mol}{0.00670 M} = 19.1 L$

e. A 8.5 M nitric acid ($HNO_{3(aq)}$) solution has 7.85 x 10^{-8} Gg of solute.

$n = \frac{78.5 g}{63.02 g/mol} = 1.25 mol$

$\frac{1.25 mol}{8.5 M} = 0.147 L = 147 mL$