Balance the following chemical reaction: C_8H_{18} (l) + O_2(g) → CO_2(g) + H_2O (l)

$$C_8H_{18(\ell)} + \frac{25}{2} O_{2(g)} \longrightarrow 8CO_{2(g)} + 9H_2O_{(\ell)}$$

or

$$2\,C_8H_{18(\ell)} + 25O_{2(g)} \longrightarrow 16CO_{2(g)} + 18H_2O_{(\ell)}$$

If you have 1.75 kg of C_8H_{18}, how many kg of oxygen gas do you need to react with all of the C_8H_{18}? And how much CO_2 will form if that reaction occurs?

$$1.75\,kg\,C_8H_{18} \times \frac{1000\,g}{1\,kg} \times \frac{1\,mol\,C_8H_{18}}{114.3\,g} = 15.3\,mol\,C_8H_{18}$$

$$15.3\,\text{Mgoles}\,C_8H_{18} \times \frac{25\,mol\,O_2}{2\,mol\,C_8H_{18}} \times \frac{32.0\,g\,O_2}{1\,mol\,O_2} \times \frac{1\,kg}{1000\,g} = 6.12\,kg\,O_2$$

$$15.3\,mol\,C_8H_{18} \times \frac{16\,mol\,CO_2}{2\,mol\,C_8H_{18}} \times \frac{44.01\,g\,CO_2}{1\,mol\,CO_2} \times \frac{1\,kg}{1000\,g} = 5.39\,kg\,CO_2$$

If you react 1.25 kg of C_8H_{18} with 575 grams of O_2, how much water will be formed?

$$1250\,g\,C_8H_{18} \times \frac{1\,mol}{114.3\,g} = 10.94\,\text{moles}\,C_8H_{18}$$

$$575\,g\,O_2 \times \frac{1\,mol}{32.0\,g} = 17.97\,mol\,O_2$$

need 25 mol O_2 for every 2 mol C_8H_{18}
O_2 is limiting reactant

$$\text{Via}\ 17.97\,mol\,O_2 \times \frac{18\,mol\,H_2O}{25\,mol\,O_2} \times \frac{18.02\,g\,H_2O}{1\,mol} = 233\,g\,H_2O$$

How much sodium nitrate do you need to make 750 mL of a 0.28 M sodium nitrate solution?

$$0.75\,L \times \frac{0.28\,mol}{L} \times \frac{84.99\,g}{1\,mol\ NaNO_3} = 17.8\,g\ NaNO_3$$

If you combine 352 grams of $C_6H_{12}O_6$ with enough water to make 1.50 L of solution, what is the molarity of this solution?

$$352\,g\ C_6H_{12}O_6 \times \frac{1\,mol}{180.2\,g} = 1.95\,mol\ C_6H_{12}O_6$$

$$\frac{1.95\,mol}{1.5\,L} = 1.30\,M\ C_6H_{12}O_6$$

If you combine 79.5 grams of sodium oxalate with enough water to make 2.5 L of solution, what will be the concentration of the **sodium ion** in this solution?

$$79.5\,g\ Na_2C_2O_4 \times \frac{1\,mol\ Na_2C_2O_4}{134\,g} \times \frac{2\,mol\ Na}{1\,mol\ Na_2C_2O_4} = 1.19\,mol\ Na^+$$

$$\frac{1.19\,mol\ Na^+}{2.5\,L} = 0.47\,M\ Na^+$$

If you have 500 mL of a 0.45 M solution of magnesium nitrate, how do you make 250 mL of a 0.18 M magnesium nitrate solution?

$$0.25\,L \times \frac{0.18\,mol}{L} = 0.045\,mol\ Mg(NO_3)_2\ needed$$

$$0.045\,mol \times \frac{1\,L}{0.45\,mol} = 0.1\,L = 100\,mL$$

Take 100 mL of more conc. solution and dilute to final volume of 250 mL

You combine 350 mL of 0.25 M aluminum nitrate with 425 mL of 0.15 M ammonium carbonate.
a) Write the balanced total and net ionic equations for what happens

$$2Al^{3+}_{(aq)} + 6NO_3^-{}_{(aq)} + 6NH_4^+{}_{(aq)} + 3CO_3^{2-}{}_{(aq)} \rightarrow Al_2(CO_3)_3(s) + 6NO_3^-{}_{(aq)} + 6NH_4^+{}_{(aq)}$$

Net: $2Al^{3+}_{(aq)} + 3CO_3^{2-}{}_{(aq)} \rightarrow Al_2(CO_3)_3(s)$

b) How many grams of precipitate form?

Al^{3+}: $0.35L \times \frac{0.25\ mol\ Al^{3+}}{1L} = 0.0875\ mol\ Al^{3+}$

CO_3^{2-}: $0.425L \times \frac{0.15\ mol\ CO_3^{2-}}{1L} = 0.06375\ mol\ CO_3^{2-}$

$0.0875\ mol\ Al^{3+} \times \frac{3\ mol\ CO_3^{2-}}{2\ mol\ Al^{3+}} = 0.13125\ mol\ CO_3^{2-}$ required to react w/ all Al^{3+} → CO_3^{2-} runs out 1st → limiting

$0.06375\ mol\ CO_3^{2-} \times \frac{1\ mol\ Al_2(CO_3)_3}{3\ mol\ CO_3^{2-}} \times \frac{233.96\ g}{1\ mol\ Al_2(CO_3)_3} = 4.97\ g$

c) What is the concentration of each ionic species in solution after the mixing occurs?

~~M~~ $[CO_3^{2-}] = 0$

$\frac{0.25\ mol\ Al(NO_3)_3}{1L} \times 0.350L \times \frac{3\ mol\ NO_3^-}{1\ mol\ Al(NO_3)_3} = \frac{0.2625\ mol\ NO_3^-}{0.775L} = 0.339M\ NO_3^-$

$0.425L\ (NH_4)_2CO_3 \times \frac{0.15\ mol}{L} \times \frac{2\ mol\ NH_4^+}{1\ mol\ (NH_4)_2CO_3} = \frac{0.1275\ mol}{0.775L} = 0.165M\ NH_4^+$

$0.0375\ mol\ CO_3^{2-} \times \frac{2\ mol\ Al^{3+}}{3\ mol\ CO_3^{2-}} = 0.0425\ mol\ Al^{3+}$ react → $0.045\ mol\ Al^{3+}$ remaining

0.045 mol/.775L = **0.058 M Al 3+** $\frac{0.045\ mol}{} = 0.058M\ Al^{3+}$