CALCULATIONS MIXTURE 2

1) Find the M_r of the following substances.

a) bromine, Br_2 **2(80) = 160**

b) magnesium nitrate, $Mg(NO_3)_2$ **24 + 2(14) + 6(16) = 148**

2) a) How many moles in the following:

i) 120 g of oxygen, O_2 $\frac{120}{32}$ = **3.75 mol**

ii) 2.6 kg of iron oxide, Fe_2O_3 $\frac{2600}{160}$ = **16.25 mol**

b) What is the mass of 0.015 moles of ammonia, NH_3? **17 x 0.015 = 0.255 g**

3) What mass of oxygen reacts with 3.6 g of magnesium to form magnesium oxide? $2Mg + O_2 \rightarrow 2MgO$

moles Mg = $\frac{3.6}{24}$ = **0.150 mol**

moles O_2 = $\frac{0.150}{2}$ = **0.075 mol**

mass O_2 = 32 x 0.075 = 2.40 g

4) What mass of bromine reacts with 16.2 g of aluminium? $2Al + 3Br_2 \rightarrow 2AlBr_3$

moles Al = $\frac{16.2}{27}$ = **0.60 mol**

moles Br_2 = 0.60 x $\frac{3}{2}$ = **0.90 mol**

mass Br_2 = 160 x 0.90 = 144 g

5) a) What is the maximum mass of tungsten that can be formed 200 g of tungsten oxide? $WO_3 + 3H_2 \rightarrow W + 3H_2O$

moles WO_3 = $\frac{200}{232}$ = **0.86 mol**

moles W = 0.86 mol

mass W = 184 x 0.86 = 159 g

b) In a reaction, 115 g of tungsten was formed from 200 g of tungsten oxide. Calculate the percentage yield.

% yield = $\frac{115}{159}$ **x 100 = 72.3%**

6) Calculate the percentage atom economy to form chlorine in this reaction. $2NaCl + 2H_2O \rightarrow Cl_2 + H_2 + 2NaOH$

	$2NaCl$	$+ 2H_2O \rightarrow$	Cl_2	$+ H_2 + 2NaOH$
M_r	**58.5**	**18**	**71**	
Mass	**2(58.5)g**	**2(18)g**	**71g**	

% atom economy = $\frac{71}{2(58.5)+2(18)}$ **x 100 = 46.4%**

7) Calculate the percentage atom economy to form the fertiliser ammonium sulfate in this reaction. $2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$

% atom economy = 100%

8) 7.8 g of potassium (K) reacts with 1.6 g of oxygen (O_2). Find the simplest molar ratio in which potassium reacts with oxygen.

Moles of K $= \frac{7.8}{39} = 0.20$ **mol** **Moles of O_2** $= \frac{1.6}{32} = 0.05$ **mol**

Reacting ratio $K : O_2 = 0.20 : 0.05 = \frac{0.20}{0.05} : \frac{0.05}{0.05} = 4 : 1$

$\therefore$ $4K + O_2 \rightarrow$

9) 1.7 g of phosphine (PH_3) reacts with 3.2 g of oxygen (O_2) to form 3.55 g of phosphorus oxide (P_2O_5) and 1.35 g of water (H_2O). By finding the moles of each substance taking part in the reaction, derive the balanced equation for the reaction.

Moles of PH_3 $= \frac{1.7}{34} = 0.050$ **mol** **Moles of P_2O_5** $= \frac{3.55}{142} = 0.025$ **mol**

Moles of O_2 $= \frac{3.2}{32} = 0.100$ **mol** **Moles of H_2O** $= \frac{1.35}{18} = 0.075$ **mol**

Reacting ratio $PH_3 : O_2 : P_2O_5 : H_2O = 0.050 : 0.100 : 0.025 : 0.075$

$= \frac{0.050}{0.025} : \frac{0.100}{0.025} : \frac{0.025}{0.025} : \frac{0.075}{0.025} = 2 : 4 : 1 : 3$

$\therefore$ $2PH_3 + 4O_2 \rightarrow P_2O_5 + 3H_2O$

10) 3.74 g of hydrated copper sulfate decompose to form 2.39 g of anhydrous copper sulfate on heating. Calculate the value of *x*. $CuSO_4.xH_2O \rightarrow CuSO_4 + xH_2O$

moles $CuSO_4$ $= \frac{2.39}{159.5} = 0.0150$ **mol**

mass H_2O $= 3.74 - 2.39 = 1.35$ **g**

moles H_2O $= \frac{1.35}{18} = 0.075$ **mol**

Ratio of moles $CuSO_4 : H_2O = 0.0150 : 0.0750 = \frac{0.0150}{0.0150} \frac{0.0750}{0.0150} = 1 : 5$

$\therefore$ **x = 5 (nearest whole number)**

Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Can convert units			Use equation to find reacting moles		
Shows suitable working			Which numbers are part of formula			Can work out % atom economy		
Does not round too much			Can work out M_r			Can work out % yield		
Can use sig figs			Work out moles from mass			Can deduce reacting ratios		
Gives units			Can work out mass from moles			Water of crystallisation calculations		