CALCULATIONS MIXTURE 3

1) a) How many moles in 5.74 kg of calcium nitrate, $Ca(NO_3)_2$. **M_r = 164** **moles = $\frac{5740}{164}$ = 35 mol**

b) What is the mass of 0.025 moles of methane, CH_4? **16 x 0.025 = 0.40 g**

2) a) What maximum mass of ammonia that can be made when 11.2 g of nitrogen reacts with an excess of hydrogen? $N_2 + 3H_2 \rightarrow 2NH_3$

moles N_2 = $\frac{11.2}{28}$ = 0.40 mol

moles NH_3 = 0.40 x 2 = 0.80 mol

mass NH_3 = 17 x 0.80 = 13.6 g

b) In a reaction, 3.0 g of ammonia was formed from 11.2 g of nitrogen. Calculate the percentage yield.

% yield = $\frac{3.0}{13.6}$ x 100 = 22.1%

3) Calculate the percentage atom economy to make ethanol (C_2H_5OH) by fermentation of glucose. $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

	$C_6H_{12}O_6 \rightarrow$	$2C_2H_5OH + 2CO_2$
M_r	180	46
Mass	180g	2(46)g

% atom economy = $\frac{2(46)}{180}$ x 100 = 51.1%

4) What volume of hydrogen gas is formed, measured at room temperature and pressure, when 0.36 g of magnesium reacts with sulfuric acid? $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$

moles Mg = $\frac{0.36}{24}$ = 0.015 mol

moles H_2 = 0.015 mol

volume H_2 = 24 x 0.015 = 0.36 dm^3

5) What volume of oxygen gas reacts with 100 cm^3 of propane gas (both gases are at room temperature and pressure)? $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

volume O_2 = 5 x 100 = 500 cm^3

6) 4.2 g of lithium (Li) reacts with 2.8 g of nitrogen (N_2). Find the simplest molar ratio in which lithium reacts with nitrogen.

Moles of Li = $\frac{4.2}{7}$ = 0.60 mol **Moles of N_2 = $\frac{2.8}{28}$ = 0.10 mol**

Reacting ratio Li : N_2 = 0.60 : 0.10 = 6 : 1

∴ 6 Li + N_2 →

7) Magnesium reacts with bromine to form magnesium bromide. When 1.2 g of magnesium reacts with 2.0 g of bromine, which is the limiting reagent and what mass of magnesium bromide is formed?

$Mg + Br_2 \rightarrow MgBr_2$

moles Mg = $\frac{1.2}{24}$ = 0.050 mol

moles Br_2 = $\frac{2.0}{160}$ = 0.0125 mol

Br_2 is limiting reagent and so 0.0125 mol of $MgBr_2$ is formed

Mass $MgBr_2$ = 184 x 0.0125 = 2.3 g

8) Find the concentration of sulfuric acid in mol/dm^3 and g/dm^3 given that 25.0 cm^3 of this solution reacts with 26.5 cm^3 0.100 mol/dm^3 sodium hydroxide solution in a titration.

$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$

moles NaOH = $0.100 \times \frac{26.5}{1000}$ = 0.00265 mol

moles H_2SO_4 = $\frac{0.00265}{2}$ = 0.001325 mol

concentration H_2SO_4 in mol/dm^3 = $\frac{0.001325}{\frac{25}{1000}}$ = 0.053 mol/dm^3

concentration H_2SO_4 in g/dm^3 = 0.053 x 98 = 5.19 g/dm^3

Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Can work out % atom economy			Understands limiting reagents		
Shows suitable working			Can work out % yield			Work out moles for solutions		
Can work out M_r			Understands why yield < 100%			Convert mol/dm^3 to g/dm^3		
Work out moles from mass			Work out gas volume from mass or mol			Does not round too much		
Can work out mass from moles			Understands reacting gas volumes			Gives units		
Use equation to find reacting moles			Deduce molar reacting ratio from mass			Which numbers are part of formula		