Limiting Reagents Worksheet

1. Nitric oxide (NO) reacts with oxygen gas to form nitrogen dioxide (NO_2), a dark brown gas:

$$2NO(g) + O_2 \rightarrow 2NO_2$$

In one experiment 0.866 mol of NO is mixed with 0.503 mol of O_2.
a)Determine the limiting reagent NO
b) Calculate the number of moles of NO_2 produced.

	$2NO$	$+ O_2 \longrightarrow$	$2NO_2$
I	.866	.503	0
C	-.866	-.433	+.866
End	0	.070 mol	.866 mol ←

2. The depletion of ozone (O_3) in the stratosphere has been a matter of great concern among scientists in recent years. It is believed that ozone can react with nitric oxide (NO) that is discharged from high altitude planes. The reaction is

$$O_3 + NO \rightarrow O_2 + NO_2$$

O_3 $7.40 \times \frac{1 mol}{47.7} = .154$

$\frac{1 mol}{29.9} .022$

If 7.40 g of O_3 reacts with 0.670 g of NO,

a) Which compound will be the limiting reagent?
b) How many grams of NO_2 will be produced?
c) Calculate the number of moles of the excess reagent remaining at the end of the reaction.

	$O_3 + NO \longrightarrow$	O_2	$+ NO_2$
	.154 mol	0	0
	-.0224	+.0224	+.0224
	.1316 mol	.0224 mol	.0224 mol

$.0224 mol NO_2 \times \frac{46.0 g}{1 mol}$

1.03g NO_2

3. Consider the reaction

$MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$

If 0.86 mol of MnO_2 and 48.2 g of HCl react, which reagent will be used up first? How many grams of Cl_2 will be produced?

LR

MnO_2	+ $4HCl$	$\rightarrow$ $MnCl_2$	+ Cl_2	+ $2H_2O$
.86 mol	1.32 mol	$\rightarrow$ 0	0	0
−.33 mol	−1.32 mol	$\rightarrow$	+.33 mol	
.53 mol excess	0		.33 mol	

$.33\,mol \times 71\,g/mol = 23.4\,g\ Cl_2$

4. 15.00 g of aluminum sulfide and 10.00 g of water react until the limiting reagent is used up:

$Al_2S_3 + 6H_2O \rightarrow 2Al(OH)_3 + 3H_2S$

$\frac{15}{150} = .10\,mol$

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a) Which is the limiting reagent?

b) What is the maximum mass of hydrogen sulfide that can form?

c) How much excess reagent remains after the reaction is complete?

LR

Al_2S_3	+ $6H_2O$	$\rightarrow$ $2Al(OH)_3$	+ $3H_2S$
.10 mol	.556 mol		0
−.0927	−.556 mol		+.2781
.0073 mol excess	0		.2781 mol

$.2781\,mol \times \frac{34\,g}{mol} = 9.455\,g\ H_2S$