

Chapter 12 Review Problems

(Honors Chemistry)

1. How many grams of aluminum chloride are produced when an excess of aluminum reacts with 3.34×10^6 grams of hydrochloric acid in a single replacement reaction? $2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$

$3.34 \times 10^6 \text{ g HCl}$	1 mol HCl	2 mol AlCl_3	133.5 -g AlCl_3
<hr/>	36.5 g HCl	6 mol HCl	1 mol AlCl_3

$4.07 \times 10^6 \text{ -g AlCl}_3$

2. In a double replacement reaction, 200.0-g of aqueous silver nitrate reacts with 200.0-g of sodium phosphate. How many representative particles of silver phosphate are produced? $3\text{AgNO}_3 + \text{Na}_3\text{PO}_4 \rightarrow \text{Ag}_3\text{PO}_4 + 3\text{NaNO}_3$

200.0 g AgNO_3	1 mol AgNO_3	$1 \text{ mol Na}_3\text{PO}_4$	164 -g	$64.3 \text{ g Na}_3\text{PO}_4$
<hr/>	170 -g AgNO_3	3 mol AgNO_3	$1 \text{ mol Na}_3\text{PO}_4$	$\text{LR} = \text{AgNO}_3$

$200.0 \text{ g Na}_3\text{PO}_4$	$1 \text{ mol Na}_3\text{PO}_4$	3 mol AgNO_3	170 -g	622 g AgNO_3
<hr/>	164 -g	$1 \text{ mol Na}_3\text{PO}_4$	1 mol AgNO_3	

200.0 -g AgNO_3	1 mol AgNO_3	$1 \text{ mol Ag}_3\text{PO}_4$	$6.02 \times 10^{23} \text{ FU}$	$2.36 \times 10^{23} \text{ FU Ag}_3\text{PO}_4$
<hr/>	170 -g	3 mol AgNO_3	$1 \text{ mol Ag}_3\text{PO}_4$	

3. The percent yield of water was 87.6% after the combustion of 5.93×10^{13} grams of tricarbon octahydride. What was the actual yield of water? $\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$

5.93×10^{13}	$1 \text{ mol C}_3\text{H}_8$	$4 \text{ mol H}_2\text{O}$	18 -g	<u>Theoretical Yield</u>
<hr/>	44 -g	$1 \text{ mol C}_3\text{H}_8$	$1 \text{ mol H}_2\text{O}$	$9.70 \times 10^{13} \text{ g H}_2\text{O}$

$$9.70 \times 10^{13} \text{ -g} \times .876 \text{ (87.6\%)} = 8.50 \times 10^{13} \text{ g H}_2\text{O}$$

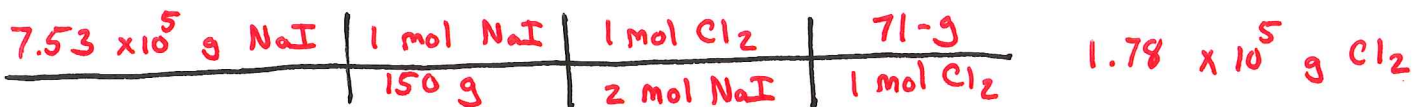
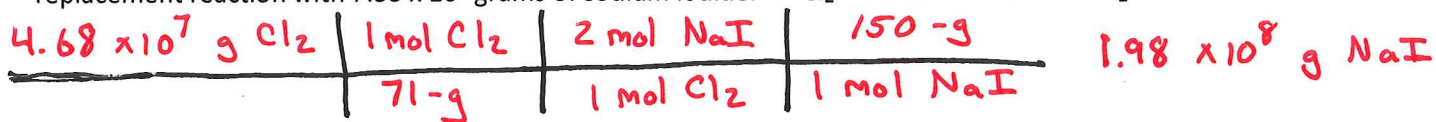
4. In a synthesis reaction @ STP, 3.51×10^{29} atoms of potassium reacts with 4.67×10^5 grams of chlorine gas. How much product, in grams, will be produced? $2\text{K} + \text{Cl}_2 \rightarrow 2\text{KCl}$

$3.51 \times 10^{29} \text{ atoms K}$	1 mol K	1 mol Cl_2	71 -g Cl_2	$2.07 \times 10^7 \text{ g Cl}_2$
<hr/>	$6.02 \times 10^{23} \text{ atoms}$	2 mol K	1 mol Cl_2	$\text{LR} = \text{Cl}_2$

$4.67 \times 10^5 \text{ g Cl}_2$	1 mol Cl_2	2 mol K	$6.02 \times 10^{23} \text{ atoms}$	$7.92 \times 10^{27} \text{ atoms K}$
<hr/>	71 -g	1 mol Cl_2	1 mol K	

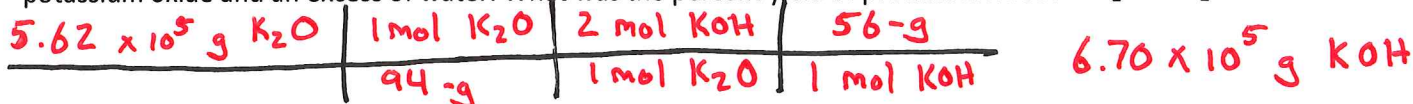
$4.67 \times 10^5 \text{ g Cl}_2$	1 mol Cl_2	2 mol KCl	74.5 -g	$9.80 \times 10^5 \text{ g KCl}$
<hr/>	71 -g	1 mol Cl_2	1 mol KCl	

5. Identify the excess reagent and how much excess reagent exists when 4.68×10^7 grams of chlorine gas reacts in a single replacement reaction with 7.53×10^5 grams of sodium iodide. $\text{Cl}_2 + 2\text{NaI} \rightarrow 2\text{NaCl} + \text{I}_2$



Excess Reagent = Cl_2 $4.68 \times 10^7 - 1.78 \times 10^5 = 4.66 \times 10^7 \text{ g excess}$

6. After a synthesis reaction @ STP, 7.54×10^4 grams of product was produced from the reaction of 5.62×10^5 grams of potassium oxide and an excess of water. What was the percent yield of product formed? $\text{K}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{KOH}$



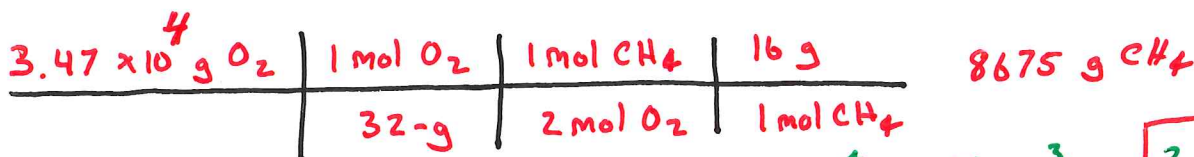
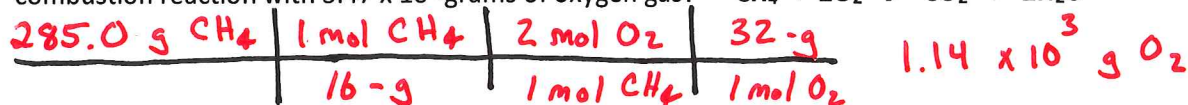
$$\frac{7.54 \times 10^4 \text{ g}}{6.70 \times 10^5 \text{ g}} \times 100 = 11.3\%$$

7. How many atoms of calcium are produced when 4.78×10^9 grams of lithium reacts with an excess of calcium sulfate in a single replacement reaction? $2\text{Li} + \text{CaSO}_4 \rightarrow \text{Ca} + \text{Li}_2\text{SO}_4$



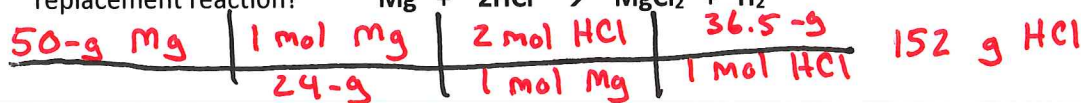
2.06×10^{32} atoms Ca

8. Identify the excess reagent and how much excess reagent exists when 285.0 grams of carbon tetrahydride reacts in a combustion reaction with 3.47×10^4 grams of oxygen gas? $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

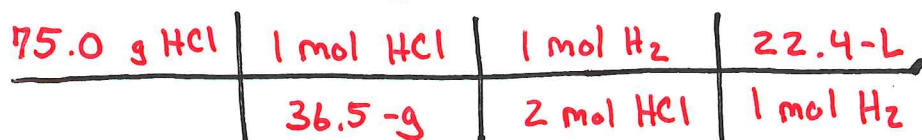


Excess Reagent = O_2 $3.47 \times 10^4 - 1.14 \times 10^3 = 3.36 \times 10^4 \text{ g Excess}$

9. What volume of hydrogen gas, at STP, is produced when 50.0 g of Mg reacts with 75.0 g of hydrochloric acid in a single replacement reaction? $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$



LR = HCl



$2.30 \times 10^1 \text{ L H}_2$