

### STOICHIOMETRY AND LIMITING REACTANT REVIEW

- Calcium carbonate reacts with phosphoric acid to produce calcium phosphate, carbon dioxide, and water.
  - How many grams of phosphoric acid react with excess calcium carbonate to produce 3.74 g of calcium phosphate? (**2.38 g  $H_3PO_4$** )
  - Calculate the number of grams of carbon dioxide formed with .773 g of water is produced. (**1.89 g  $CO_2$** )
- Nitric acid and zinc react to form zinc nitrate, ammonium nitrate, and water.
  - How many atoms of zinc react with 1.49 g of nitric acid? ( **$5.70 \times 10^{21}$  atoms Zn**)
  - Calculate the number of grams of zinc that must react with an excess of nitric acid to form 29.1 g of ammonium nitrate. (**95.2 g Zn**)
- Hydrazine ( $N_2H_4$ ) is used as a rocket fuel. It reacts with oxygen to form nitrogen and water.
  - How many liters of Nitrogen gas (at STP) form when 1.0 kg of hydrazine reacts with 1.0 kg of oxygen gas? ( **$7.0 \times 10^2$  L  $N_2$** )
  - How many grams of the excess reactant remain after the reaction? (*no reactant in excess*)
- When 50.0 g of silicon dioxide is heated with an excess of Carbon, 32.2 g of silicon carbide ( $SiC$ ) - another product is carbon monoxide.
  - What is the percent yield of this reaction? (**96.4%**)
  - How many grams of carbon monoxide gas are made? (**45.0 g**)
- If the reaction below proceeds with a 96.8% yield, how many kilograms of Calcium sulfate are formed when 5.24 kg sulfur dioxide reacts with excess of Calcium carbonate and oxygen? (**10.7 kg  $CaSO_4$** )  
 $CaCO_3 + SO_2 + O_2 \rightarrow CaSO_4 + CO_2$
- Ammonium nitrate will decompose explosively at high temperatures to form nitrogen, oxygen, and water vapor. ( $NH_4NO_3 \rightarrow N_2 + H_2O + O_2$ ) What is the total number of liters of gas formed when 228 g of ammonium nitrate is decomposed? (*Assume STP*) (**224 L of gas**)
- Ethyl alcohol ( $C_2H_5OH$ ) can be produced by the fermentation of glucose ( $C_6H_{12}O_6$ ). If it takes 5.0 hr to produce 8.0 kg of alcohol, how many days will it take to consume  $1.0 \times 10^3$  kg of glucose? (**13 days**)  
 $C_6H_{12}O_6 \rightarrow C_2H_5OH + CO_2$
- What is the limiting reactant when 150.0 g of  $N_2$  reacts with 32.1 g of  $H_2$  to produce  $NH_3$ ? (*no LR*)
- A 500 g sample of aluminum sulfate is reacted with 450 g of calcium hydroxide. A total of 596 g of calcium sulfate is produced. What is the limiting reactant in this reaction, and how many moles of excess reactant are unreacted? (*LR is  $Al_2(SO_4)_3$ ; 1.69 mol  $Ca(OH)_2$  remaining*)
- If 5.0 g of Hydrogen are reacted with excess carbon monoxide, how many grams of  $CH_3OH$  are produced, based on a yield of 86%  $CO + H_2 \rightarrow CH_3OH$  (**34 g  $CH_3OH$** )
- The decomposition of potassium chlorate yields oxygen gas. If the yield is 95% how many grams of potassium chlorate are needed to produce 10.0 L of oxygen; the other product is  $KCl$ ? (**38.4 g  $KClO_3$** )
- For the reaction of the synthesis sodium chloride, how many grams of sodium chloride could be produced from 103.0 g of sodium and 13.0 L of chlorine (at STP)? (**67.3 g  $NaCl$** )
- Identify which of these unbalanced equations represent redox reactions.
  - $Li + H_2O \rightarrow LiOH + H_2$
  - $K_2Cr_2O_7 + HI \rightarrow KI + CrCl_3 + H_2O + Cl_2$
  - $Al + HCl \rightarrow AlCl_3 + H_2$
  - $P_4 + S_8 \rightarrow P_2S_5$
- For each redox equation in problem 13, identify what is oxidized and what is reduced.
- Determine the oxidation number of phosphorus in each substance.  
 a.  $P_2O_5$  b.  $PO_4^{3-}$  c.  $PO_3^{3-}$  d.  $P_2O_3$  e.  $P_2O_2$  f.  $H_3PO_4^{-1}$
- Write the complete ionic equation and net ionic equation for each of the following:
  - $Zn + HCl \rightarrow H_2 + ZnCl_2$
  - $Pb(NO_3)_2 + NaI \rightarrow NaNO_3 + PbI_2$
- Balance the following with the half reaction method in an acidic or neutral solution:
  - $H_2S + NO_3^{-1} \rightarrow SO_4^{2-} + NO_2$
  - $NH_4^{+1} + O_2 \rightarrow NO_3^{-1} + H_2O$
- Balance the following with the half reaction method in a basic solution:
  - $Br_2 + C_6H_5O_6 \rightarrow Br^{-1} + C_6H_5O_6$
  - $Zn + VO_3^{-1} \rightarrow V^{+2} + Zn^{+2}$