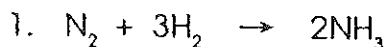


Practice Sheets

STOICHIOMETRY: MOLE-MOLE PROBLEMS

Name Key



How many moles of hydrogen are needed to completely react with two moles of nitrogen?

$$2 \text{ mol } N_2 \times \frac{3 \text{ mol } H_2}{1 \text{ mol } N_2}$$

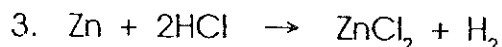
6 mol H₂



How many moles of oxygen are produced by the decomposition of six moles of potassium chlorate?

$$6 \text{ mol } KClO_3 \times \frac{3 \text{ mol } O_2}{2 \text{ mol } KClO_3}$$

9 mol O₂

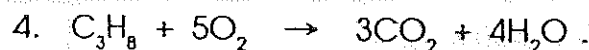


How many moles of hydrogen are produced from the reaction of three moles of zinc with an excess of hydrochloric acid?

ignore

$$3 \text{ mol } Zn \times \frac{1 \text{ mol } H_2}{1 \text{ mol } Zn}$$

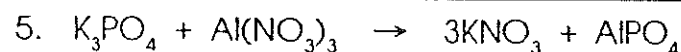
3 mol H₂



How many moles of oxygen are necessary to react completely with four moles of propane (C₃H₈)?

$$4 \text{ mole } C_3H_8 \times \frac{5 \text{ mol } O_2}{1 \text{ mol } C_3H_8}$$

20 mol O₂



How many moles of potassium nitrate are produced when two moles of potassium phosphate react with two moles of aluminum nitrate?

pick one to start with

$$2 \text{ mol } K_3PO_4 \times \frac{3 \text{ mol } KNO_3}{1 \text{ mol } K_3PO_4}$$

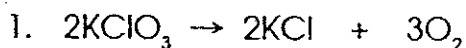
OR

$$2 \text{ mol } Al(NO_3)_3 \times \frac{3 \text{ mol } KNO_3}{1 \text{ mol } Al(NO_3)_3}$$

6 mol KNO₃

STOICHIOMETRY: MASS-MASS PROBLEMS

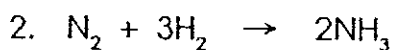
Name _____



How many grams of potassium chloride are produced if 25 g of potassium chlorate decompose?

$$25\text{g KClO}_3 \times \frac{1 \text{ mol KClO}_3}{122.549\text{g KClO}_3} \times \frac{2 \text{ mol KCl}}{2 \text{ mol KClO}_3} \times \frac{74.551 \text{g KCl}}{1 \text{ mol KCl}}$$

$$= 15.2\text{g KCl}$$



How many grams of hydrogen are necessary to react completely with 50.0 g of nitrogen in the above reaction?

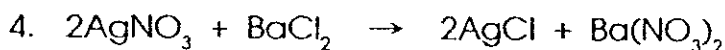
$$50.0\text{g N}_2 \times \frac{1 \text{ mol N}_2}{28.0134\text{g N}_2} \times \frac{3 \text{ mol H}_2}{1 \text{ mol N}_2} \times \frac{2.014\text{g H}_2}{1 \text{ mol H}_2}$$

$$10.8\text{g H}_2$$

3. How many grams of ammonia are produced in the reaction in Problem 2?

$$50.0\text{g N}_2 \times \frac{1 \text{ mol N}_2}{28.0134\text{g N}_2} \times \frac{2 \text{ mol NH}_3}{1 \text{ mol N}_2} \times \frac{17.027\text{g NH}_3}{1 \text{ mol NH}_3}$$

$$60.7\text{g NH}_3$$



How many grams of silver chloride are produced from 5.0 g of silver nitrate reacting with an excess of barium chloride?

$$5.0\text{g AgNO}_3 \times \frac{1 \text{ mol AgNO}_3}{169.9049\text{g AgNO}_3} \times \frac{2 \text{ mol AgCl}}{2 \text{ mol AgNO}_3} \times \frac{143.353\text{g AgCl}}{1 \text{ mol AgCl}}$$

$$4.22\text{g AgCl}$$

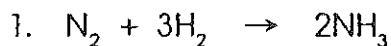
5. How much barium chloride is necessary to react with the silver nitrate in Problem 4?

$$5.0\text{g AgNO}_3 \times \frac{1 \text{ mol AgNO}_3}{169.9049\text{g AgNO}_3} \times \frac{1 \text{ mol BaCl}_2}{2 \text{ mol AgNO}_3} \times \frac{208.206\text{g BaCl}_2}{1 \text{ mol BaCl}_2}$$

$$3.06\text{g BaCl}_2$$

STOICHIOMETRY: VOLUME-VOLUME PROBLEMS

Name _____



What volume of hydrogen is necessary to react with five liters of nitrogen to produce ammonia? (Assume constant temperature and pressure.)

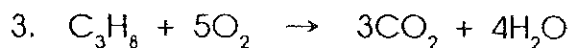
$$5L N_2 \times \frac{1 \text{ mol } N_2}{22.4 L N_2} \times \frac{3 \text{ mol } H_2}{1 \text{ mol } N_2} \times \frac{22.4 L H_2}{1 \text{ mol } H_2}$$

15 L H₂

2. What volume of ammonia is produced in the reaction in Problem 1?

$$5L N_2 \times \frac{1 \text{ mol } N_2}{22.4 L N_2} \times \frac{2 \text{ mol } NH_3}{1 \text{ mol } N_2} \times \frac{22.4 L NH_3}{1 \text{ mol } NH_3}$$

10 L NH₃



If 20 liters of oxygen are consumed in the above reaction, how many liters of carbon dioxide are produced?

$$20L O_2 \times \frac{1 \text{ mol } O_2}{22.4 L O_2} \times \frac{3 \text{ mol } CO_2}{5 \text{ mol } O_2} \times \frac{22.4 L CO_2}{1 \text{ mol } CO_2}$$

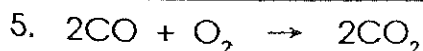
12 L CO₂



If 30 mL of hydrogen are produced in the above reaction, how many milliliters of oxygen are produced?

$$0.030L H_2 \times \frac{1 \text{ mol } H_2}{22.4 L H_2} \times \frac{1 \text{ mol } O_2}{2 \text{ mol } H_2} \times \frac{22.4 L O_2}{1 \text{ mol } O_2}$$

15 mL O₂



How many liters of carbon dioxide are produced if 75 liters of carbon monoxide are burned in oxygen? How many liters of oxygen are necessary?

$$75L CO \times \frac{1 \text{ mol } CO}{22.4 L CO} \times \frac{2 \text{ mol } CO_2}{2 \text{ mol } CO} \times \frac{22.4 L CO_2}{1 \text{ mol } CO_2}$$

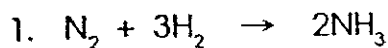
$$75L CO \times \frac{1 \text{ mol } CO}{22.4 L CO} \times \frac{1 \text{ mol } O_2}{2 \text{ mol } CO} \times \frac{22.4 L O_2}{1 \text{ mol } O_2}$$

75 L CO₂

37.5 L O₂

STOICHIOMETRY: MIXED PROBLEMS

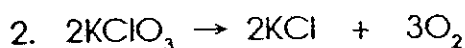
Name _____



What volume of NH_3 at STP is produced if 25.0 g of N_2 is reacted with an excess of H_2 ?

$$25.0 \text{ g } N_2 \times \frac{1 \text{ mol } N_2}{28.0134 \text{ g } N_2} \times \frac{2 \text{ mol } NH_3}{1 \text{ mol } N_2} \times \frac{22.4 \text{ L } NH_3}{1 \text{ mol } NH_3}$$

39.98 L NH_3



If 5.0 g of $KClO_3$ is decomposed, what volume of O_2 is produced at STP?

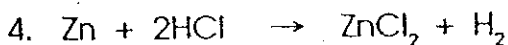
$$5.0 \text{ g } KClO_3 \times \frac{1 \text{ mol } KClO_3}{122.5492 \text{ g } KClO_3} \times \frac{3 \text{ mol } O_2}{2 \text{ mol } KClO_3} \times \frac{22.4 \text{ L } O_2}{1 \text{ mol } O_2}$$

1.37 L O_2

3. How many grams of KCl are produced in Problem 2?

$$5.0 \text{ g } KClO_3 \times \frac{1 \text{ mol } KClO_3}{122.5492 \text{ g } KClO_3} \times \frac{2 \text{ mol } KCl}{2 \text{ mol } KClO_3} \times \frac{74.551 \text{ g } KCl}{1 \text{ mol}}$$

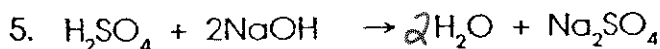
3.04 g KCl



What volume of hydrogen at STP is produced when 2.5 g of zinc react with an excess of hydrochloric acid?

$$2.5 \text{ g } Zn \times \frac{1 \text{ mol } Zn}{63.546 \text{ g } Zn} \times \frac{1 \text{ mol } H_2}{1 \text{ mol } Zn} \times \frac{22.4 \text{ L } H_2}{1 \text{ mol } H_2}$$

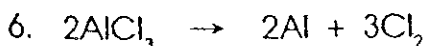
0.881 L H_2



How many molecules of water are produced if 2.0 g of sodium sulfate are produced in the above reaction?

$$2.0 \text{ g } Na_2SO_4 \times \frac{1 \text{ mol } Na_2SO_4}{142.0372 \text{ g } Na_2SO_4} \times \frac{2 \text{ mol } H_2O}{1 \text{ mol } Na_2SO_4} \times \frac{6.02 \times 10^{23} \text{ part. } H_2O}{1 \text{ mol } H_2O}$$

1.70×10^{22} part.



If 10.0 g of aluminum chloride are decomposed, how many molecules of Cl_2 are produced?

$$10.0 \text{ g } AlCl_3 \times \frac{1 \text{ mol } AlCl_3}{133.3405 \text{ g } AlCl_3} \times \frac{3 \text{ mol } Cl_2}{2 \text{ mol } AlCl_3} \times \frac{6.02 \times 10^{23} \text{ particles}}{1 \text{ mol } Cl_2}$$

6.77×10^{22}

Theoretical Yield Worksheet

1/ If you start the reaction with 500mL of 6.0M NH₃, what is the theoretical yield of N₂F₄? If we actually get 150g of N₂F₄ is our lab synthesis, what is our percent yield?



$$M = \frac{\text{mol}}{V_L}$$

$$\text{mol} = 6.0\text{M}(0.500\text{L})$$

$$= 3 \text{ mol NH}_3 \times \frac{1 \text{ mol N}_2\text{F}_4}{2 \text{ mol NH}_3} \times \frac{104.0054 \text{ g N}_2\text{F}_4}{1 \text{ mol N}_2\text{F}_4}$$

$$\% \text{ yield} = \frac{\text{actual}}{\text{theoretical}} \times 100$$

$$= \frac{150 \text{ g}}{156.0081} \times 100 = 96.1\%$$

$$= 156.0081 \text{ g N}_2\text{F}_4$$

2/ Some solid Calcium oxide reacts with 30 grams of water in order to produce Calcium hydroxide. What is the theoretical yield of Calcium hydroxide? If, in the lab, we obtain 120 grams of Calcium hydroxide, what is our percent yield?



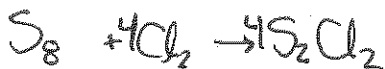
$$30 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.0134 \text{ g H}_2\text{O}} \times \frac{1 \text{ mol Ca(OH)}_2}{1 \text{ mol H}_2\text{O}} \times \frac{74.0932 \text{ g Ca(OH)}_2}{1 \text{ mol Ca(OH)}_2}$$

$$\text{theoretical yield} = 123.4 \text{ g Ca(OH)}_2$$

$$\% \text{ yield} = \frac{\text{actual}}{\text{theoretical}} \times 100 = \frac{120 \text{ g}}{123.4 \text{ g}} \times 100$$

$$= 97.2\%$$

3/ Disulphur dichloride is used to galvanize rubber. It is made by reacting Sulphur with chlorine gas. If we were to start out with 45 grams of Sulphur and we get 94 grams of disulphur dichloride after the reaction, what is the theoretical and percent yields?



$$45 \text{ g S}_8 \times \frac{1 \text{ mol S}_8}{256.48 \text{ g S}_8} \times \frac{4 \text{ mol S}_2\text{Cl}_2}{1 \text{ mol S}_8} \times \frac{135.04 \text{ g S}_2\text{Cl}_2}{1 \text{ mol S}_2\text{Cl}_2}$$

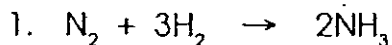
$$= 94.8 \text{ g S}_2\text{Cl}_2$$

$$\% = \frac{\text{actual}}{\text{theoretical}} \times 100$$

$$\frac{94 \text{ g}}{94.8 \text{ g}} \times 100 = 99.1\%$$

STOICHIOMETRY: LIMITING REAGENT

Name _____



How many grams of NH_3 can be produced from the reaction of 28 g of N_2 and 25 g of H_2 ?

$28\text{g } N_2 \times \frac{1 \text{ mol } N_2}{28.0134\text{g } N_2} = 0.9995 \text{ mol } N_2$ **limiting* [N_2] $12.413 \text{ mol } H_2 \times \frac{1 \text{ mol } N_2}{3 \text{ mol } H_2} = 4.138 \text{ mol } N_2$ *NEED*
HAVE

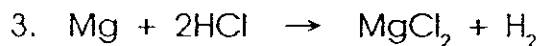
$25\text{g } H_2 \times \frac{1 \text{ mol } H_2}{2.014 \text{ g } H_2} = 12.413 \text{ mol } H_2$ **excess* [H_2] $0.9995 \text{ mol } N_2 \times \frac{3 \text{ mol } H_2}{1 \text{ mol } N_2} = 2.999 \text{ mol } H_2$
NEED

34.04g NH_3

2. How much of the excess reagent in Problem 1 is left over?

$12.413 \text{ mol } H_2 - 2.999 \text{ mol } H_2 = 9.414 \text{ mol } H_2$
 $9.414 \text{ mol } H_2 \times \frac{2.014 \text{ g}}{1 \text{ mol}} = 18.96 \text{ g } H_2$

18.96 g H_2



What volume of hydrogen at STP is produced from the reaction of 50.0 g of Mg and the equivalent of 75 g of HCl?

$50\text{g } Mg \times \frac{1 \text{ mol } Mg}{24.305\text{g } Mg} = 2.057 \text{ mol } Mg$ **excess* [HCl] $2.057 \text{ mol } Mg \times \frac{2 \text{ mol } HCl}{1 \text{ mol } Mg} = 4.114 \text{ mol } HCl$ *NEED*
HAVE

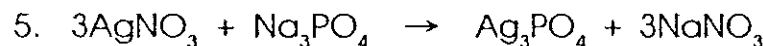
$75\text{g } HCl \times \frac{1 \text{ mol } HCl}{36.461\text{g } HCl} = 0.686 \text{ mol } HCl$ **limiting* [Mg] $0.686 \text{ mol } HCl \times \frac{1 \text{ mol } Mg}{2 \text{ mol } HCl} = 0.342 \text{ mol } Mg$
NEED

7.68 L H_2

4. How much of the excess reagent in Problem 3 is left over?

$2.057 \text{ mol } Mg - 0.342 \text{ mol } Mg = 1.715 \text{ mol } Mg$
 $1.715 \text{ mol } Mg \times \frac{24.305 \text{ g } Mg}{1 \text{ mol } Mg} = 41.68 \text{ g } Mg$

41.68 g Mg



Silver nitrate and sodium phosphate are reacted in equal amounts of 200. g each. How many grams of silver phosphate are produced?

$200\text{g } AgNO_3 \times \frac{1 \text{ mol } AgNO_3}{169.8729\text{g } AgNO_3} = 1.178 \text{ mol } AgNO_3$ **limiting* [Na_3PO_4] $1.178 \text{ mol } AgNO_3 \times \frac{1 \text{ mol } Na_3PO_4}{3 \text{ mol } AgNO_3} = 0.393 \text{ mol } Na_3PO_4$ *NEED*
HAVE

$200\text{g } Na_3PO_4 \times \frac{1 \text{ mol}}{163.94 \text{ g } Na_3PO_4} = 1.22 \text{ mol } Na_3PO_4$ **excess* [$AgNO_3$] $1.22 \text{ mol } Na_3PO_4 \times \frac{3 \text{ mol } AgNO_3}{1 \text{ mol } Na_3PO_4} = 3.66 \text{ mol } AgNO_3$ *NEED*
HAVE

164.36g Ag_3PO_4

6. How much of the excess reagent in Problem 5 is left over?

$1.22 \text{ mol } Na_3PO_4 - 0.393 \text{ mol } Na_3PO_4 = 0.827 \text{ mol } Na_3PO_4$
 $0.827 \text{ mol } Na_3PO_4 \times \frac{163.94 \text{ g } Na_3PO_4}{1 \text{ mol}} = 135.58 \text{ g } Na_3PO_4$

135.58g Na_3PO_4