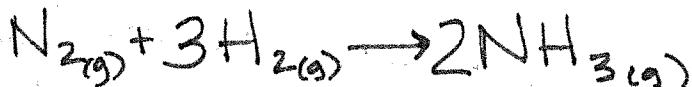


Honors Physical Science  
Limiting Reactants Worksheet-In Class Practice

Name \_\_\_\_\_ Date \_\_\_\_\_

Period \_\_\_\_\_

1. Problem: How many grams of <sup>ammonia (gaseous)</sup>  $\text{NH}_3$  can be produced from the reaction of <sup>3sf</sup> 20.0 g of  $\text{N}_2$  and <sup>2sf</sup> 6.0g of  $\text{H}_2$ ?  
 ✓ STEP 1 -- Write the balanced chemical equation for the reaction, using the state symbols.



What is the product?  $\text{NH}_3$  What are the reactants?  $\text{N}_2 + \text{H}_2$

Write the molar ratios:  $1:3:2$

For every 1 mole of nitrogen how many moles of  $\text{H}_2$  do I need?  $3$

STEP 2 -- How many moles of each reactant do I have? (Calculate givens in moles)

$$\frac{20.0 \text{ g N}_2}{28 \text{ g N}_2} \times 1 \text{ mol N}_2 = 0.714 \text{ mol N}_2$$

$$\frac{6.0 \text{ g H}_2}{2 \text{ g H}_2} \times 1 \text{ mol H}_2 = 3 \text{ mol H}_2$$

STEP 3 -- Which is the limiting reagent? (Calculate using mole ratios) pick a reactant - less moles

$$\frac{0.714 \text{ mol N}_2}{1 \text{ mol N}_2} \times 3 \text{ mol H}_2 = 2.14 \text{ mol H}_2 \text{ used (excess)}$$

$$\frac{3 \text{ mol H}_2}{3 \text{ mol H}_2} \times 1 \text{ mol N}_2 = 1 \text{ mol N}_2$$

$\text{N}_2$  is LR  $\text{N}_2$  limits

STEP 4 - Calculate amount of excess reactant needed to use up limiting reactant. (in grams)

$$\frac{2.14 \text{ mol H}_2}{1 \text{ mol H}_2} \times 2 \text{ g H}_2 = 4.28 \text{ g H}_2 \text{ used}$$

STEP 5 - Calculate amount of excess reactant remaining - subtract given minus Step 4.

$$6.0 \text{ g} - 4.28 \text{ g} = 1.72 \text{ g H}_2 \text{ remaining}$$

STEP 6 - Solve initial problem -- calculate amount of desired product using limiting reactant.

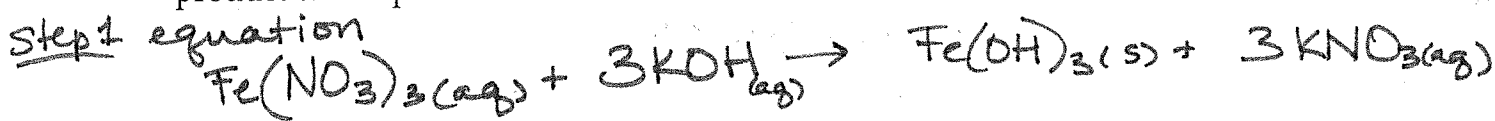
$$\frac{0.714 \text{ mol N}_2}{1 \text{ mol N}_2} \times 2 \text{ mol NH}_3 = 1.43 \text{ mol NH}_3$$

$$\frac{1.43 \text{ mol NH}_3}{1 \text{ mol NH}_3} \times 17 \text{ g NH}_3 = 24.276 \text{ g}$$

How many *moles* of product can I produce?  
 How many *grams* of product can I produce?

$$\frac{1.43 \text{ mol NH}_3}{24 \text{ g}}$$

2. Problem: A sample of a solution containing 91.9 grams of iron (III) nitrate is reacted with a solution containing 21 grams of potassium hydroxide. How many grams of each product can be produced?



Step 2 # of moles of reactants

$$\frac{91.9 \text{ g Fe}(\text{NO}_3)_3}{241.85 \text{ g}} \left| \frac{1 \text{ mol}}{\text{Fe}(\text{NO}_3)_3} \right. = 0.38 \text{ mol Fe}(\text{NO}_3)_3$$

$$\frac{21 \text{ g KOH}}{56.1 \text{ g}} \left| \frac{1 \text{ mol}}{\text{KOH}} \right. = 0.374 \text{ mol KOH}$$

Step 3 LR

$$\frac{0.374 \text{ mol KOH}}{3 \text{ mol KOH}} \left| \frac{1 \text{ mol Fe}(\text{NO}_3)_3}{1 \text{ Fe}(\text{NO}_3)_3} \right. = 0.125 \text{ mol Fe}(\text{NO}_3)_3$$

$$\frac{0.38 \text{ mol Fe}(\text{NO}_3)_3}{3 \text{ mol KOH}} \left| \frac{3 \text{ mol KOH}}{1 \text{ Fe}(\text{NO}_3)_3} \right. = 0.9 \text{ KOH}$$

KOH is LR

Step 4 mass of excess

$$\frac{0.125 \text{ mol Fe}(\text{NO}_3)_3}{1 \text{ mol}} \left| \frac{241.85 \text{ g}}{\text{Fe}(\text{NO}_3)_3} \right. = 30.24 \text{ g Fe}(\text{NO}_3)_3 \text{ used}$$

Step 5 excess remaining

$$91.9 \text{ g} - 30.24 \text{ g} = 61.66 \text{ g Fe}(\text{NO}_3)_3 \text{ remaining}$$

Step 6 Mass of products

$$\frac{0.374 \text{ mol KOH}}{3 \text{ mol KOH}} \left| \frac{1 \text{ mol Fe}(\text{OH})_3}{1 \text{ Fe}(\text{OH})_3} \right| \frac{106.9 \text{ g Fe}(\text{OH})_3}{1 \text{ mol Fe}(\text{OH})_3} = 13.36 \text{ g Fe}(\text{OH})_3$$

$$\frac{0.374 \text{ mol KOH}}{3 \text{ mol KOH}} \left| \frac{3 \text{ mol KNO}_3}{1 \text{ mol KNO}_3} \right| \frac{101.1 \text{ g KNO}_3}{1 \text{ mol KNO}_3} = 38 \text{ g KNO}_3$$