Honors Physical Science
Limiting Reactants Worksheet-In Class Practice
Name_____ **Date**_____ **Period**____

ammonia (gaseous)

1. Problem: How many grams of NH_3 can be produced from the reaction of 20.0 g of N_2 and 6.0g of H_2?

3sf 2sf

STEP 1 -- Write the balanced chemical equation for the reaction, using the state symbols.

$$N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$$

What is the product? NH_3 What are the reactants? N_2 + H_2

Write the molar ratios: 1 : 3 : 2

For every 1 mole of nitrogen how many moles of H_2 do I need? 3

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

$20.0\,g\,N_2 \left| \frac{1\,mol\,N_2}{28\,g\,N_2} \right. = 0.714\,mol\,N_2$

$6.0\,g\,H_2 \left| \frac{1\,mol\,H_2}{2\,g\,H_2} \right. = 3\,mol\,H_2$

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

$0.714\,mol\,N_2 \left| \frac{3\,mol\,H_2}{1\,mol\,N_2} \right. = 2.14\,mol\,H_2$ used (excess)

$3\,mol\,H_2 \left| \frac{1\,mol\,N_2}{3\,mol\,H_2} \right. = 1\,mol\,N_2$ (N_2 is LR) (N_2 limits)

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

$2.14\,mol\,H_2 \left| \frac{2\,g\,H_2}{1\,mol\,H_2} \right. = 4.28\,g\,H_2$ used

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

$6.0\,g - 4.28\,g = 1.72\,g\,H_2$ remaining

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

$0.714\,mol\,N_2 \left| \frac{2\,mol\,NH_3}{1\,mol\,N_2} \right. = 1.43\,mol\,NH_3 \left| \frac{17\,g\,NH_3}{1\,mol\,NH_3} \right. = 24.276\,g$

How many *moles* of product can I produce? 1.4 mol NH_3

How many *grams* of product can I produce? 24 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 1 equation

$$Fe(NO_3)_{3(aq)} + 3KOH_{(aq)} \rightarrow Fe(OH)_{3(s)} + 3KNO_{3(aq)}$$

Step 2 # of moles of reactants

$$91.9\,g\ Fe(NO_3)_3 \left| \frac{1\,mol}{241.85\,g} \right. = 0.38\,mol\ Fe(NO_3)_3$$

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

Step 3 LR

$$0.374\,mol\ KOH \left| \frac{1\,mol\ Fe(NO_3)_3}{3\,mol\ KOH} \right. = 0.125\,mol\ Fe(NO_3)_3$$

KOH is LR

$$0.38\,mol\ Fe(NO_3)_3 \left| \frac{3\,mol\ KOH}{} \right. \quad 0.9\ KOH$$

Step 4 mass of excess

$$0.125\,mol\ Fe(NO_3)_3 \left| \frac{241.85\,g}{1\,mol} \right. = 30.24\,g\ Fe(NO_3)_3\ used$$

Step 5 excess remaining

$$91.9\,g - 30.24\,g = 61.66\,g\ Fe(NO_3)_3\ remaining$$

Step 6 Mass of products

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

$$0.374\,mol\ KOH \left| \frac{3\,mol\ KNO_3}{3\,mol\ KOH} \right. \left| \frac{101.1\,g\ KNO_3}{1\,mol\ KNO_3} \right. = 38\ g\ KNO_3$$