LR and %Y Practice Name KEY

1) Methanol (CH_3OH) is the one carbon alcohol. It is synthesized by the reaction of hydrogen and carbon monoxide.

A) Balanced EQ: $2H_{2(g)} + CO_{(g)} \rightarrow CH_3OH_{(l)}$

B) If 500. mol of CO and 750. mol of hydrogen gas are present, which is the limiting reactant?

$500.\ mol\ CO \left(\frac{1\ mol\ CH_3OH}{1\ mol\ CO}\right) = 500.\ mol\ CH_3OH$ H_2

$750.\ mol\ H_2 \left(\frac{1\ mol\ CH_3OH}{2\ mol\ H_2}\right) = 375.\ mol\ CH_3OH$ less product

LR

C) Based on your LR, how many **moles** of methanol can be theoretically produced?

375. mol CH_3OH max

2) In the lab, silver nitrate was reacted with copper metal to produce copper (II) nitrate and silver metal

a) write balanced EQ: $2AgNO_3 + Cu \rightarrow Cu(NO_3)_2 + 2Ag$

LR b) If you react 1.24 g of $AgNO_3$ and 1.24 g of Cu, which reactant is the limiting reactant?

$1.24g\ AgNO_3 \left(\frac{1\ mol\ AgNO_3}{169.88g}\right)\left(\frac{2\ mol\ Ag}{2\ mol\ AgNO_3}\right)\left(\frac{107.87g}{1\ mol\ Ag}\right) = 0.796g\ Ag \approx 0.787g\ Ag$ less

$1.24g\ Cu \left(\frac{1\ mol\ Cu}{63.55g}\right)\left(\frac{2\ mol\ Ag}{1\ mol\ Cu}\right)\left(\frac{107.87g}{1\ mol\ Ag}\right) = 4.21g\ Ag$

c) Based on your answer from (b), how many grams of Ag could you theoretically produce?

0.787g Ag max

d) If you actually performed this reaction in the lab with the exact reactant amounts given in (b) and produced 0.69 g Ag, find your **percent yield.**

$\%\ yield = \frac{0.69g}{0.787g} \times 100 = 88\%\ Y$

3) Zinc metal reacts with hydrochloric acid to produce zinc (II) chloride and hydrogen gas.

A) Balanced EQ: $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

B) If 0.30 mol of zinc is added to 0.52 mol HCl, how many moles of hydrogen gas are produced? (this is a LR problem)

$0.30 \text{ mol } Zn \left(\frac{1 \text{ mol } H_2}{1 \text{ mol } Zn}\right) = 0.30 \text{ mol } H_2$

$0.52 \text{ mol } HCl \left(\frac{1 \text{ mol } H_2}{2 \text{ mol } HCl}\right) = 0.26 \text{ mol } H_2$ ← max you could produce

LR — less

C) If you run the experiment using the exact molar amounts in (B) and produce 0.50 grams of hydrogen gas, what was your **percent yield?**

$0.26 \text{ mol } H_2 \left(\frac{2.02 \text{ g}}{1 \text{ mol } H_2}\right) = 0.5252 = 0.53 \text{ g } H_2 \text{ theo}$

$\% Y = \frac{0.50 \text{ g}}{0.53 \text{ g}} \times 100 = 94\% \text{ yield}$

4) Ammonia (NH_3) can be burned (combined with oxygen) in the presence of a platinum catalyst to create nitric oxide (NO) and water.

A) Balanced EQ: $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

B) Suppose a vessel contains 2.045 g ammonia and 4.48 g oxygen gas. Which is the limiting reactant? (read part B first ✓)

$2.045 \text{ g } NH_3 \left(\frac{1 \text{ mol } NH_3}{17.04 \text{ g}}\right)\left(\frac{4 \text{ mol } NO}{4 \text{ mol } NH_3}\right) = 0.1200 \text{ mol } NO$

$4.48 \text{ g } O_2 \left(\frac{1 \text{ mol } O_2}{32.00 \text{ g}}\right)\left(\frac{4 \text{ mol } NO}{5 \text{ mol } O_2}\right) = 0.112 \text{ mol } NO$ — less

LR

C) Based on your B calculation, how many moles of NO can be theoretically obtained?

0.112 mol NO