Dougherty Valley HS Chemistry
Adv. Chemical Ratios – Extra Limiting Stoich Practice

Worksheet #5*

Name: **Period:** **Seat#:**

Directions: Any worksheet that is labeled with an * means it is suggested extra practice. We do not always have time to assign every possible worksheet that would be good practice for you to do. You can do this worksheet when you have extra time, when you finish something early, or to help you study for a quiz or a test. If and when you choose to do this Extra Practice worksheet, please do the work on binder paper. You will include this paper stapled into your Rainbow Packet when you turn it in, even if you didn't do any of this. We want to make sure we keep it where it belongs so you can do it later if you want to (or need to). If you did the work on binder paper you can include that in your Rainbow Packet after this worksheet. If we end up with extra class time then portions of this may turn into required work. If that happens you will be told which problems are turned into required. Remember there is tons of other extra practice on the class website…and the entire internet! See me if you need help finding practice on a topic you are struggling with.

- **Show work for ANY math problem and include ALL units.**
- **Use a SINGLE DIMENSIONAL ANALYSIS line method set ups for ALL conversions.**

1) 33.00 grams of oxygen react with 77.79 grams of iron. What is the limiting reactant? $2Fe+O_2 \rightarrow 2FeO$

2) 72 grams of HCl react with 80 grams of NaOH. What is the limiting reactant? $HCl+NaOH \rightarrow NaCl+H_2O$

3) 162.5 grams of Zn react with 648 grams of HCl. What is the limiting reactant? $Zn+2HCl \rightarrow ZnCl_2+H_2$

4) If 75.0g of CO react to produce 68.4g CH_3OH what is the percent yield of CH_3OH? $CO+2H_2 \rightarrow CH_3OH$

5) If 3.45 moles of oxygen reacts with 2.36 moles of iron. $2Fe+O_2 \rightarrow 2FeO$
- a) Which reactant is limiting?
- b) How many grams of rust are theoretically produced?
- c) What is the % yield if 160. grams of rust are produced?

6) When 25.0 g of lead (II) nitrate reacts with 15.0 g sodium iodide, sodium nitrate and lead (II) iodide are formed.
- a) Balance the following equation: $Pb(NO_3)_{2\,(aq)} + NaI_{\,(aq)} \rightarrow PbI_{2\,(s)} + NaNO_{3\,(aq)}$
- b) What is the limiting reagent in the reaction?
- c) How many grams of sodium nitrate can be formed?
- d) How many grams of lead (II) iodide is formed?
- e) How much of the non-limiting reagent will be left over from the reaction?
- f) If 6 grams of sodium nitrate are formed in the reaction, what is the percent yield of this reaction?

7) A chemist burns 160.0 g of Al with 200.0 g of O_2 to produce aluminum oxide, Al_2O_3.
- a) Write a balanced equation for the reaction. $Al + O_2 \rightarrow Al_2O_3$
- b) Determine the theoretical yield of Al_2O_3.
- c) Determine how many grams of the excess reagent are left over

8) Certain salts of benzoic acid have been used as food additives for decades. The potassium salt of benzoic acid, potassium benzoate, can be made by the action of potassium permanganate on toluene.

$$\underset{\text{toluene}}{C_7H_8} + KMnO_4 \rightarrow \underset{\text{potassium benzoate}}{KC_7H_5O_2} + MnO_2 + KOH + H_2O$$

If the yield of potassium benzoate cannot realistically be expected to be more than 68%, what is the minimum number of grams of toluene needed to achieve this yield while producing 10.0 g of $KC_7H_5O_2$? 8.45 g

9) Aluminum dissolves in an aqueous solution of NaOH according to the following reaction:
_____$NaOH$ + _____Al + _____$H_2O \rightarrow$ _____$NaAlO_2$ + _____H_2 [unbalanced]
If 84.1 g of NaOH and 51.0 g of Al react:
- a) Which is the limiting reagent? Al
- b) How much of the other reagent remains? 8.49 g NaOH
- c) What mass of hydrogen is produced? 5.73 g

10) Dimethylhydrazine, $(CH_3)_2NNH_2$, was used as a fuel for the Apollo Lunar Descent Module, with N_2O_4 being used as the oxidant. The products of the reaction are H_2O, N_2, and CO_2.
- a) Write a balanced chemical equation for the combustion reaction.
- b) If 150 kg of $(CH_3)_2NNH_2$ react with 460 kg of N_2O_4, what is the theoretical yield of N_2? 210 Kg
- c) If a 30 kg yield of N_2 gas represents a 68% yield, what mass of N_2O_4 would have been used up in the rxn? 96600 g

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11) Mg metal reacts with oxygen to give magnesium oxide, MgO. If 5.00 g of Mg and 5.00 g of O_2 are allowed to react, what weight of MgO is formed, and what weight of which reactant is left in excess? 1.71 g O_2 / 8.29 g MgO

12) Adipic acid, $C_6H_{10}O_4$, is a raw material for the making of nylon and it can be prepared in the laboratory by the following reaction between cyclohexene, C_6H_{10}, and sodium dichromate, $Na_2Cr_2O_7$ in sulphuric acid.

_____$C_6H_{10}(l)$ +_____$Na_2Cr_2O_7(aq)$ +_____$H_2SO_4(aq) \rightarrow$ _____$C_6H_{10}O_4(aq)$ +_____$Cr_2(SO_4)_3(aq)$ +_____$Na_2SO_4(aq)$ + _____H_2O

There are side reactions. These plus losses of product during its purification reduce the overall yield. A typical yield of purified adipic acid is 68.6%. To prepare 12.5 grams of adipic acid in 68.6% yield requires how many grams of cyclohexene? 10.2 g

13) An organic chemist reacted 10 g CH_4 with excess Cl_2 and obtained 10 g of CH_3Cl and hydrogen.

a) What should have been the theoretical yield. 31.5 g
b) What was their percentage yield? 31.8%

14) An inorganic chemist reacted 100 g of $PbCl_4$ with excess NH_4Cl, obtaining an 87% yield of ammonium chloroplumbate(IV), $(NH_4)_2PbCl_6$. How many grams did they obtain? 113.65 g

15) 4000 grams of heptane (C_7H_{16}) is combusted with 7000 grams of oxygen to produce carbon dioxide and water.

a) What is the limiting reactant?
b) How many grams of carbon dioxide are produced?
c) How many grams of excess reactant are left?