

Honors Chemistry 1B
Limit Reactant and Percent Yield Worksheet
(with excess calculation)

Name: _____

STO.4	Solve stoichiometric problems from a balanced chemical equation.	3
STO.5	Differentiate between the actual yield and theoretical yield of a chemical reaction.	3
STO.6	Calculate the theoretical yield from a balanced chemical equation using dimensional analysis.	3
STO.7	Determine the limiting reactant from stoichiometric calculations.	3

1. Balance the equation for the reaction given below:



- a) If 15 grams of copper (II) chloride react with 20. grams of sodium nitrate, how much sodium chloride can be formed?
- b) What is the name of the limiting reagent? _____
- c) How much of the excess reagent is left over in this reaction?
- d) If 11.3 grams of sodium chloride are formed in the reaction, what is the percent yield of this reaction?

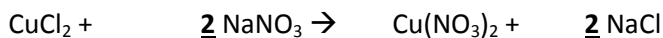
2. Write the equation for the reaction of iron (III) phosphate with sodium sulfate to make iron (III) sulfate and sodium phosphate.
- a) If you perform this reaction with 25 grams of iron (III) phosphate and an excess of sodium sulfate, how many grams of iron (III) sulfate can you make?
- b) If 18.5 grams of iron (III) sulfate are actually made when you do this reaction, what is your percent yield?
- c) Is the answer from problem b) reasonable? Explain.
- d) If you do this reaction with 15 grams of sodium sulfate and get a 65.0% yield, how many grams of sodium phosphate will you make?

Answers:

1. $\text{CuCl}_2 + \underline{2} \text{NaNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \underline{2} \text{NaCl}$
- a) 13 grams of NaCl (smaller of the 2 yields)
- b) copper (II) chloride
- c) 1 gram CuCl_2
- d) 86.9%
2. $2 \text{FePO}_4 + 3 \text{Na}_2\text{SO}_4 \rightarrow \text{Fe}_2(\text{SO}_4)_3 + 2 \text{Na}_3\text{PO}_4$
- a) 17.2 grams
- b) 108%
- c) No. Any yield over 100% is a violation of the Law of conservation of mass.
- d) 7.48 grams

Answer Sheet

1. Balance the equation for the reaction given below:



- a) If 15 grams of copper (II) chloride react with 20. grams of sodium nitrate, how much sodium chloride can be formed?

To solve this problem determine how much sodium chloride can be made from each of the reagents by themselves. When you work out how much sodium chloride can be made with 15 grams of copper (II) chloride, you find that 13 grams will be formed. When starting with 20 grams of sodium nitrate, 14 grams will be formed. Since 13.0 grams is the smaller number, that's our answer. Please note that rounding differences may cause your answers to be slightly different, so if they are, don't panic.

- b) What is the limiting reagent for the reaction in a)? **copper (II) chloride**
c) How much of the excess reagent is left over in this reaction?
excess reagent remaining = 20 grams – 19 grams (13.0 / 13.6) = 1 grams
d) If 11.3 grams of sodium chloride are formed in the reaction described in problem a), what is the percent yield of this reaction?

$$11.3/13.0 \times 100\% = 86.9\%$$

2. Write the equation for the reaction of iron (III) phosphate with sodium sulfate to make iron (III) sulfate and sodium phosphate.



- a) If I perform this reaction with 25 grams of iron (III) phosphate and an excess of sodium sulfate, how many grams of iron (III) sulfate can I make? **17.2 grams**
b) If 18.5 grams of iron (III) sulfate are actually made when I do this reaction, what is my percent yield? **(18.5 / 17.2) x 100% = 108%**
c) Is the answer from problem b) reasonable? Explain. **No. Any yield over 100% is a violation of the Law of conservation of mass.**
d) If I do this reaction with 15 grams of sodium sulfate and get a 65.0% yield, how many grams of sodium phosphate will I make?

According to the stoichiometry, the theoretical yield is 11.5 grams. Multiplying this by 0.650, you get 7.48 grams.