

# class notes:

TEST 1 TEST 2 TEST 3 TEST 4 TEST 5

Topic: Practice with

1) Theoretical Yield This is from your calculation:

$$\frac{g}{mol} \times \frac{mol}{g} \times \frac{mol}{mol} = \frac{g}{mol}$$

2) Percent Yield

READ THE SCALE

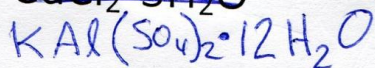
$$\% = \frac{\text{ACTUAL YIELD}}{\text{THEORETICAL YIELD}} \times 100$$

3) Limiting Reagent

$$\#1 \quad \frac{g}{mol} \times \frac{mol}{g} \times \frac{mol}{mol} = \frac{19}{mol} = \text{ANSWER}$$

$$\#2 \quad \frac{g}{mol} \times \frac{mol}{g} \times \frac{mol}{mol} = \frac{9}{mol} = \text{ANSWER}$$

Warmup: Calculate the molecular mass (in grams per mole) of ~~CuCl<sub>2</sub> · 3H<sub>2</sub>O~~



K:  $1 \times (39.10) = 39.10$

Al:  $1 \times (26.98) = 26.98$

S:  $2 \times (32.07) = 64.14 = 474.44 \text{ g/mol}$

O:  $20 \times (16.00) = 320.00$

H:  $24 \times (1.01) = 24.24$

"THEORETICAL YIELD" - the amount of product you were "supposed" to get according to your calculator.

TEST FRIDAY over the last two weeks

NEXT LAB DAY: TOMORROW NORMAL CLASS: TODAY

Topic: Practice with

1) Theoretical Yield Your calculated yield in a perfect world

2) Percent Yield

$$\% \text{ yield} = \frac{\text{grams you actually weigh out IN LAB}}{\text{grams theoretical yield}} \times 100$$

3) Limiting Reagent the reactant you ran out of; the reactant that gives the least product!

Warmup: Calculate the molecular mass (in grams per mole) of  $\text{CuCl}_2 \cdot 3\text{H}_2\text{O}$  (three waters)

$$\text{Cu: } 1 \times (63.55) = 63.55$$

$$\text{Cl: } 2 \times (35.45) = 70.90$$

$$\text{H: } 6 \times (1.01) = 6.06$$

$$\text{O: } 3 \times (16.00) = 48.00$$

$$\underline{188.51} \text{ grams/mole}$$

# hints on how to solve the homework tonight:

limiting reactant & percent yield

Chemistry: <http://genest.weebly.com>

Stop in for help every day at lunch and Tues, Weds., & Thurs after school!

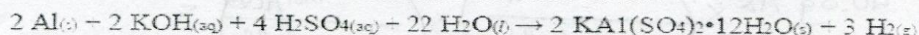
After-hours question? Email me at home: [eggeneest@madison.k12.wi.us](mailto:eggeneest@madison.k12.wi.us)



**HINTS**  
Name \_\_\_\_\_  
Period \_\_\_\_\_

1. (Circle answers). You calculate the theoretical yield by converting the amount of each of the (reactants / products) into the amount of just one of the (reactants / products).
2. The reactant that gives the least product is called the \_\_\_\_\_.
3. The formula for finding percent yield is:

The balanced reaction we used in lab:



4. Using a periodic table and *the information above*, fill in these conversion factors:

**use periodic table** → 1 mole of potassium hydroxide = \_\_\_\_\_ grams

**USE the BALANCED REACTION** → \_\_\_\_\_ mole of  $\text{H}_2\text{SO}_4$  = \_\_\_\_\_ moles of  $\text{H}_2$

**use the balanced reaction** → \_\_\_\_\_ mole of Al = \_\_\_\_\_ moles of  $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$

**use the periodic table** → 1 mole of  $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$  = \_\_\_\_\_ grams  $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$

5. In a perfect world, if you react 808 moles of  $\text{H}_2\text{SO}_4$  in the above reaction how many moles of  $\text{H}_2$  will you get?

$$\frac{808 \text{ mol.}}{? \text{ mol.}} \times \frac{? \text{ mol.}}{? \text{ mol.}} = ? \text{ mol H}_2$$

6. In the real world, Bobby Brown does the above reaction with 808 moles of  $\text{H}_2\text{SO}_4$  and he only gets 501 moles of  $\text{H}_2$ . What was Mr. Brown's % yield?

**Find theoretical yield first:**

$$808 \text{ mol H}_2\text{SO}_4 \times \left( \frac{\text{mol H}_2}{\text{mol H}_2\text{SO}_4} \right) =$$

**THEN USE THE % yield formula from class notes**

7. If Mr. Brown tries the experiment again, 123 grams of aluminum and 123 grams of KOH and more than enough of the other reactants,

a. which will be the limiting reactant?

#1  $\frac{123g \text{ Al}}{?} \times ( \text{---} ) \times ( \text{---} ) \times ( \text{---} ) =$

#2  $\frac{123g \text{ KOH}}{?} \times ( \text{---} ) \times ( \text{---} ) \times ( \text{---} ) =$

the smaller one is limiting

b. How many grams of  $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$  will be his theoretical yield?

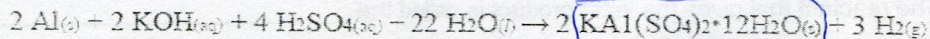
- c. If he only gets 208 g of  $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ , what was his % yield?

$$\frac{208g}{\text{theoretical yield from #7(B)}} \times 100 = \% \text{ yield}$$

8. Calculate the answer writing both number and correct UNIT.

$$\left(\frac{4 \text{ grams Zn}}{7 \text{ mL Zn}}\right) \times \left(\frac{3 \text{ mL H}_2\text{O}}{1 \text{ mL Zn}}\right) \times \left(\frac{5 \text{ mL Zn}}{2 \text{ mL H}_2\text{O}}\right) =$$

The balanced reaction we used in lab:



9. In a perfect world, if you react 40.8 grams of Al in the above reaction how many moles of  $\text{KAl(SO}_4)_2 \cdot 12\text{H}_2\text{O}$  will you get?

$$40.8 \text{ g Al} \times \left(\frac{\text{mol Al}}{\text{g Al}}\right) \times \left(\frac{\text{mol ALUM}}{\text{mol Al}}\right) =$$

10. In the real world you attempt the above reaction with 40.8 grams of Al and you only get 680. grams of  $\text{KAl(SO}_4)_2 \cdot 12\text{H}_2\text{O}$ .

a. What was your % yield?

FIRST FIND YOUR THEORETICAL YIELD

$$40.8 \text{ g Al} \times \left(\frac{? \text{ mol Al}}{? \text{ g Al}}\right) \times \left(\frac{? \text{ mol KAl(SO}_4)_2 \cdot 12\text{H}_2\text{O}}{? \text{ mol Al}}\right) \times \left(\frac{? \text{ g KAl(SO}_4)_2 \cdot 12\text{H}_2\text{O}}{? \text{ mol KAl(SO}_4)_2 \cdot 12\text{H}_2\text{O}}\right) =$$

then use % YIELD FORMULA

b. List three things that might have caused your yield to be so low:

11. If you try the above reaction again, using 3.00 grams of aluminum and 16.5 grams of KOH and more than enough of the other reactants, ANSWER: ALUMINUM IS THE LIMITING REAGENT

a. which will be the limiting reactant?\*

$$\#1 \quad \frac{3.00 \text{ g Al}}{1} \times \left(\frac{1 \text{ mol Al}}{26.98 \text{ g Al}}\right) \times \left(\frac{3 \text{ mol H}_2}{2 \text{ mol Al}}\right) \times \left(\frac{2.02 \text{ grams H}_2}{1 \text{ mol H}_2}\right) = 0.337 \text{ grams H}_2$$

$$\#2 \quad \frac{16.5 \text{ grams KOH}}{1} \times \left(\frac{1 \text{ mol KOH}}{56.1 \text{ g KOH}}\right) \times \left(\frac{3 \text{ mol H}_2}{2 \text{ mol KOH}}\right) \times \left(\frac{2.02 \text{ g H}_2}{1 \text{ mol H}_2}\right) = 0.89 \text{ grams H}_2$$

b. How many grams of  $\text{KAl(SO}_4)_2 \cdot 12\text{H}_2\text{O}$  will be your theoretical yield?\*

$$3.00 \text{ grams Al} \times \left(\frac{\text{mol Al}}{\text{g Al}}\right) \times \left(\frac{\text{mol ALUM}}{\text{mol Al}}\right) \times \left(\frac{\text{g ALUM}}{\text{mol ALUM}}\right) = \text{g ALUM}$$

c. If you only get 30.6 g of  $\text{KAl(SO}_4)_2 \cdot 12\text{H}_2\text{O}$ , what was your % yield?

\*Strategy: Try converting grams of the first reactant into grams of product, Then do the same for the second reactant. The limiting reactant will be whichever reactant gives the least product

\*\*Strategy: Do a conversion, using the grams of your limiting reactant as the starting point and trying to finish up in grams of your product.