

Limiting & Excess Reactants

Recipe

1.5 TBS Peanut butter
1 TBS grape jelly
2 slices bread

You have:

84 TBS PB 56
52 TBS jelly 52
114 slices 57

How many complete sandwiches can you make & which ingredient do you run out of 1st?

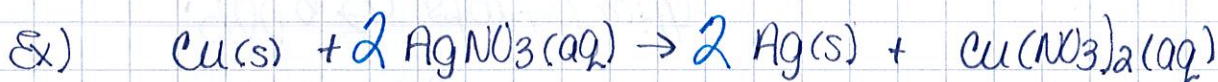
52 complete sandwiches

← jelly (limiting reactant)

Limiting reactant
reactant that is completely used up 1st in a reaction, controls the amount of product that can be made

vs

Excess reactant
all the other reactants



GIVEN 1

2.00g of copper reacts with 4.00g of silver (I) nitrate.

GIVEN 2

- (1) which reactant is the limiting reactant?
- (2) which reactant is the excess reactant?
- (3) what is the theoretical yield of silver?

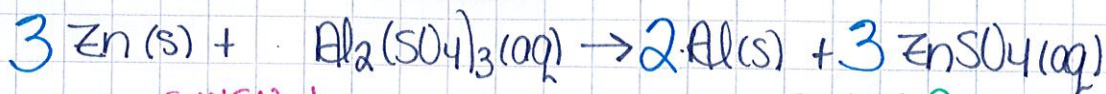
$$\frac{2.00 \text{ g Cu}}{63.55 \text{ g Cu}} \times \frac{1 \text{ mol Cu}}{1 \text{ mol Cu}} \times \frac{2 \text{ mol Ag}}{1 \text{ mol Cu}} \times \frac{107.87 \text{ g Ag}}{1 \text{ mol Ag}} = 6.79 \text{ g Ag}$$

$$\frac{4.00 \text{ g AgNO}_3}{169.88 \text{ g AgNO}_3} \times \frac{1 \text{ mol AgNO}_3}{1 \text{ mol AgNO}_3} \times \frac{2 \text{ mol Ag}}{2 \text{ mol AgNO}_3} \times \frac{107.87 \text{ g Ag}}{1 \text{ mol Ag}} = 2.54 \text{ g Ag}$$

MM Ag $1 \times 107.87 \text{ g} = 107.87 \text{ g}$
N $1 \times 14.01 \text{ g} = 14.01 \text{ g}$
O $3 \times 16.00 \text{ g} = 48.00 \text{ g}$

169.88 g

L.R. = AgNO_3
ER = Cu
TY = 2.54 g Ag



^{GIVEN 1}
 If .900g of zinc reacts with ^{GIVEN 2} .900g of aluminum sulfate...

- ??
- (1) What is the theoretical yield of zinc (II) sulfate?
 - (2) What are the limiting & excess reactants?
 - (3) What is the % yield if 1.00g of zinc (II) sulfate are actually produced? TY
 - (4) How much excess reactant is left over after the reaction is complete?

$$\frac{.900 \text{g Zn}}{65.41 \text{g Zn}} \times \frac{1 \text{mol Zn}}{3 \text{mol ZnSO}_4} \times \frac{3 \text{mol ZnSO}_4}{1 \text{mol ZnSO}_4} \times 161.46 \text{g ZnSO}_4 = 2.2 \text{g ZnSO}_4$$

$$\frac{.900 \text{g Al}_2(\text{SO}_4)_3}{342.17 \text{g Al}_2(\text{SO}_4)_3} \times \frac{1 \text{mol Al}_2(\text{SO}_4)_3}{3 \text{mol ZnSO}_4} \times \frac{3 \text{mol ZnSO}_4}{1 \text{mol ZnSO}_4} \times 161.46 \text{g ZnSO}_4 = 1.27 \text{g ZnSO}_4$$

TY #1

#2 LR - $\text{Al}_2(\text{SO}_4)_3$
 ER - Zn

#3 % yield = $\frac{1.00 \text{g}}{1.27 \text{g}} \times 100 = 78.7\%$

#4. To find out how much excess reactant you used:
 start w/ LR & solve for the ER

$$\frac{.900 \text{g Al}_2(\text{SO}_4)_3}{342.17 \text{g Al}_2(\text{SO}_4)_3} \times \frac{1 \text{mol Al}_2(\text{SO}_4)_3}{3 \text{mol Zn}} \times \frac{3 \text{mol Zn}}{1 \text{mol Zn}} \times 65.41 \text{g Zn} = .516 \text{g Zn used}$$

$$\begin{array}{r} .900 \text{g started} \\ - .516 \text{g used} \\ \hline .384 \text{g Zn left over} \end{array}$$