Limiting & Excess Reactants

Recipe	You have:	
1.5 TBS Peanut butter	84 TBS PB	56
1 TBS grape jelly	52 TBS jelly	52
2 slices bread	114 slices	57

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

↑ jelly (limiting reactant)

52 complete sandwiches

Limiting reactant vs **Excess reactant**

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

all the other reactants

Ex) $Cu(s) + 2\,AgNO_3(aq) \rightarrow 2\,Ag(s) + Cu(NO_3)_2(aq)$

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?

$$2.00\,g\,Cu \left|\frac{1\,mol\,Cu}{63.55\,g\,Cu}\right|\frac{2\,mol\,Ag}{1\,mol\,Cu}\left|\frac{107.87\,g\,Ag}{1\,mol\,Ag}\right| = 6.79\,g\,Ag$$

$$4.00\,g\,AgNO_3 \left|\frac{1\,mol\,AgNO_3}{169.88\,g\,AgNO_3}\right|\frac{2\,mol\,Ag}{2\,mol\,AgNO_3}\left|\frac{107.87\,g\,Ag}{1\,mol\,Ag}\right| = 2.54\,g\,Ag$$

MM Ag $1 \times 107.87\,g = 107.87\,g$
N $1 \times 14.01\,g = 14.01\,g$
O $3 \times 16.00\,g = 48.00\,g$
$169.88\,g$

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

$3\,Zn(s) + Al_2(SO_4)_3(aq) \rightarrow 2\,Al(s) + 3\,ZnSO_4(aq)$

GIVEN 1 GIVEN 2

If .900g of zinc reacts with .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? ??
(4) How much excess reactant is left over after the reaction is complete?

$$.900\,g\,Zn \left|\frac{1\,mol\,Zn}{65.41\,g\,Zn}\right|\frac{3\,mol\,ZnSO_4}{3\,mol\,Zn}\left|\frac{161.46\,g\,ZnSO_4}{1\,mol\,ZnSO_4}\right. = ?\ 2.22\,g\,ZnSO_4$$

$$.900\,g\,Al_2(SO_4)_3 \left|\frac{1\,mol\,Al_2(SO_4)_3}{342.17\,g\,Al_2(SO_4)_3}\right|\frac{3\,mol\,ZnSO_4}{1\,mol\,Al_2(SO_4)_3}\left|\frac{161.46\,g\,ZnSO_4}{1\,mol\,ZnSO_4}\right. = \boxed{1.27\ g\ ZnSO_4}$$

TY #1

#2 LR - $Al_2(SO_4)_3$
ER - Zn

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

$= 78.7\%$

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

$$.900\,g\,Al_2(SO_4)_3 \left|\frac{1\,mol\,Al_2(SO_4)_3}{342.17\,g\,Al_2(SO_4)_3}\right|\frac{3\,mol\,Zn}{1\,mol\,Al_2(SO_4)_3}\left|\frac{65.41\,g\,Zn}{1\,mol\,Zn}\right. = .516\,g\,Zn\ used$$

.900g started
− .516g used
.384g left over Zn