

Mass to Mass Conversions with Excess Reactants

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

- 1) Write the balanced equation for the reaction given above:



- 2) Place balanced equation in BCA table with each reactant and product a column heading

	CuCl_2	+	2NaNO_3	$\rightarrow$	$\text{Cu(NO}_3)_2$	+	2NaCl
Before							
Change							
After							

- 3) If reactant is given in grams then convert to moles (only moles can go in the table)

- 4) Place value of reactant in moles in the table. Then divide by the coefficient to determine the “cloud” amount. (Make sure all values in the table are to 3 sig figs.)

	CuCl_2	+	2NaNO_3	$\rightarrow$	$\text{Cu(NO}_3)_2$	+	2NaCl
Before							
Change							
After							

So here the coefficient was “1” so I divided 0.112 by 1 to get the cloud amount (make sure it is 3 sig figs)

- 5) If no value was given for the other reactants then they are considered in excess (we have extra of them) so we denote that in the table as “xs”.

We haven’t made any products yet, so their value is “0”.

	CuCl_2	+	2NaNO_3	$\rightarrow$	$\text{Cu(NO}_3)_2$	+	2NaCl
Before	0.112		xs		0		0
Change							
After							

The cloud amount is multiplied by the coefficient for each item to determine the change amount.

7) The after line is done by using the before and change lines. Subtract the reactants and add the products.

1. At least 3 sig figs in the table at all times.
2. The cloud must have 3 sig figs at all times
3. Only moles in the table.
4. Only use coefficients when you are going into the cloud or out of the cloud.
5. NEVER use coefficients for determining the molar mass!

Limiting Reactants:

1000 grams of sodium chloride is combined with 2000 grams of barium phosphate.

1. Write the Balanced Equation:



2. Convert the mass of each reactant into moles by dividing the grams by the molar mass. Record those values into the BCA Table. You have not made any products yet so record "0" for their mole amounts.

$$\boxed{\text{NaCl}} \quad \frac{1000}{58.5} = \boxed{17.1 \text{ mol NaCl}}$$

$$\begin{array}{r} \text{Na } 23.0 \\ \text{Cl } 35.5 \\ \hline 58.5 \end{array}$$

$$\boxed{\text{Ba}_3(\text{PO}_4)_2} \quad \begin{array}{r} \text{Ba } 3 \times 137.3 = 411.9 \\ \text{P } 2 \times 31.0 = 62.0 \\ \text{O } 8 \times 16.0 = +128.0 \\ \hline 601.9 \end{array}$$

$$\frac{2000}{601.9} = \boxed{3.32 \text{ mol Ba}_3(\text{PO}_4)_2}$$

	6 NaCl	+	Ba ₃ (PO ₄) ₂	□	2 Na ₃ PO ₄	+	3 BaCl ₂
Before	17.1		3.32		0		0
Change							
After							

3. We will have 2 clouds now instead of one, because we do not know which reactant is in excess *yet*. Divide the mole amounts of each reactant by their coefficient and record that as your clouds.

	6 NaCl	+	Ba ₃ (PO ₄) ₂	□	2 Na ₃ PO ₄	+	3 BaCl ₂
Before	17.1		3.32		0		0
Change							

After				
-------	--	--	--	--

4. Determine which cloud is the smallest and eliminate all the other clouds.

	6 NaCl	$+$	$\text{Ba}_3(\text{PO}_4)_2$	$\square$	$2 \text{ Na}_3\text{PO}_4$	$+$	3 BaCl_2
Before	7.1		3.32		0		0
Change							
After							

5. Proceed to find the Change and After values as shown in the Previous Lesson.

	6 NaCl	$+$	$\text{Ba}_3(\text{PO}_4)_2$	$\square$	$2 \text{ Na}_3\text{PO}_4$	$+$	3 BaCl_2
Before	7.1		3.32		0		0
Change	-						
After	0		0.470		5.70		8.55

6. You will be asked which reactant is in excess and which one is the limiting reactant. The reactant that has "0" left is your limiting reactant. This has prevented you from making any more product.

The excess reactant is any reactant that has an amount in the After row. This means that you have that reactant left over. They often want you to calculate the amount remaining in grams. To do this multiply the mole amount in the table by the molar mass of the substance.

Limiting Reactant = NaCl

Excess Reactant = $\text{Ba}_3(\text{PO}_4)_2$
 $0.470(601 \text{ A}) = 283 \text{ g Ba}_3(\text{PO}_4)_2 \text{ excess}$

7. Calculate the amount of the products by taking their molar mass and multiplying by the moles in the table.

Na_3PO_4 $\text{Na } 23.0 \times 3 = 69.0$
 $\text{P } 31.0 \times 1 = 31.0$
 $\text{O } 16.0 \times 4 = 64.0$

BaCl_2 $\text{Ba } 1 \times 137.3 = 137.3$
 $\text{Cl } 2 \times 35.5 = 71.0$
 $\underline{208.3}$