**The Limiting Reactant**

2CuCl (aq) + Mg (s) 🡪 MgCl2 (aq) + 2 Cu (s)

If reactants are mixed according to the mole ratio (stoichiometric amounts), there will be no leftover chemicals.

* this rarely happens in practice (sometimes extra reactants are added to speed up a reaction)

**Limiting Reactant**: the reactant that runs out first. When used up, the reaction stops.

Ex 1. 1 frame + 2 wheels 🡪 1 bike

1. If I have 6 frames and 11 wheels, what is the limiting reactant?
2. How many bikes can I make?

Ex 2. If 7.26 g of KNO3 is reacted with 9.50 g of Mg metal, what is the limiting reactant? How many grams of N2 are expected to be produced?

2KNO3 + 5Mg 🡪 N2 + K2O + 5MgO

Ex 3. Fe2O3 + 3CO 🡪 2Fe +3O2

1. If 11.5 g of Fe2O3 reacts with 2.63 x 1024 molecules of CO, what mass of Fe is expected?

b) What mass of excess reactant is there?

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**Steps to Solving Limiting Reactant Problems (when given mass of reactants)**

÷ M of A

Mass of Reactant A
(grams)

Moles of A
(mol)

÷ M of B

Mass of Reactant B
(grams)

Moles of B
(mol)

Use the moles of the **limiting reactant (LR)** to determine the amount of product that will form.

X M of C

Mass of Product C
(grams)

Moles of C
(mol)

Moles of LR X Mole Ratio

X C
 LR

÷ A’s
coefficient

÷ B’s
coefficient

**smaller number = LR**

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**SCH 3U Limiting Reactant Problem Set**

1. The following balanced chemical equation shows the reaction of aluminum with copper(II) chloride. If 0.25 g of aluminum reacts with 0.51 g of copper(II) chloride, determine the limiting reactant.

2Al(s) + 3CuCl2(aq) 🡪 3Cu(s) + 2AlCl3(aq)

2. Hydrogen fluoride is a highly toxic gas. It is produced by the double displacement reaction of calcium fluoride with concentrated sulfuric acid.

CaF2(s) + H2SO4(l) 🡪 2HF(g) + CaSO4(s)

Determine the limiting reactant when 10.0 g of CaF2 reacts with 15.5 g of H2SO4.

3. Use the following equations to answer the questions below:

6ClO2(g) + 3H2O(l) 🡪 5HClO3(aq) + HCl(aq)

a) If 71.00 g of ClO2 is mixed with 19.00 g of water, what is the limiting reactant?

b) What mass of HClO3 is expected in part a)?

4. A student performs the following reaction with 61.8 g of MnI2 and 41.8 g of F2.

2MnI2(s) + 13F2(g) 🡪 2MnF3(s) + 4IF5(l)

1. What is the limiting reactant?
2. What mass of MnF3 is expected?
3. How many formula units of MnF3 will be produced?

5. A student mixes 5.3 g of barium chloride and 6.9 g of sodium sulfate. What mass of barium sulfate is expected?

**ANSWERS:** 1. CuCl2 2. CaF2 3. a) ClO2 b) 74.08g 4. a) F2 b) 18.9 g c) 1.02 x 1023 formula units 5. 5.9g

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