The Limiting Reactant

$2CuCl_{(aq)} + Mg_{(s)} \rightarrow MgCl_2 (aq) + 2\ Cu_{(s)}$

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

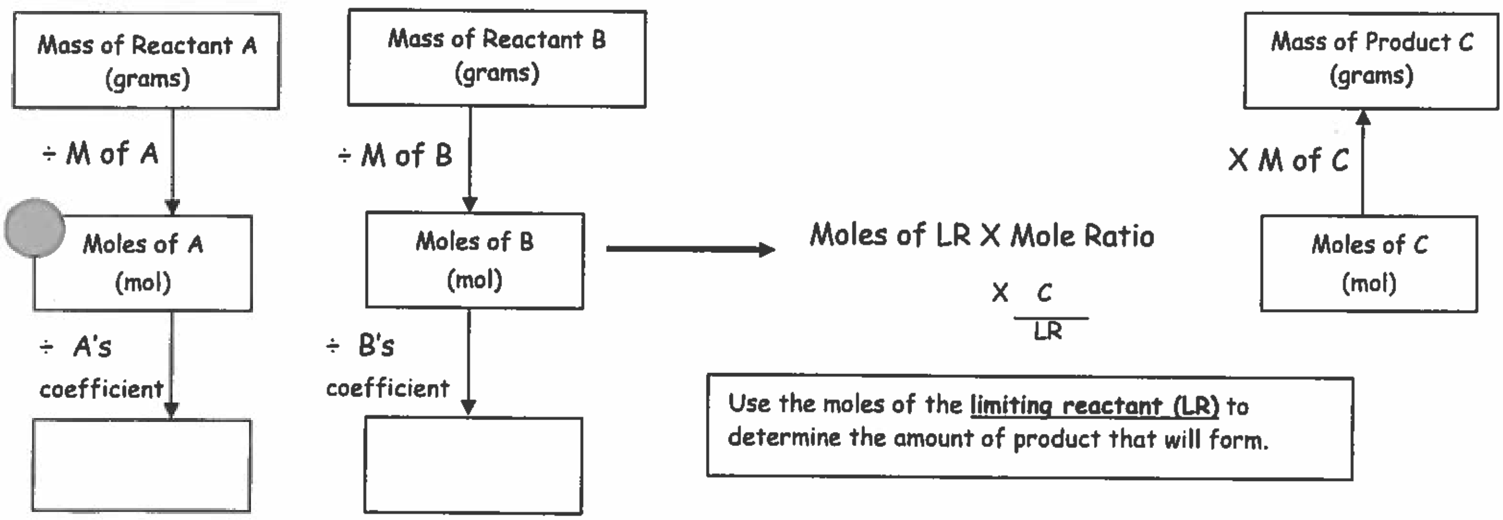
a) If I have 6 frames and 11 wheels, what is the limiting reactant?

wheels

b) How many bikes can I make?

5 bikes

<u>Steps to Solving Limiting Reactant Problems (when given mass of reactants)</u>



smaller number = LR

Ex 2. If 7.26 g of KNO_3 is reacted with 9.50 g of Mg metal, what is the limiting reactant? How many grams of N_2 are expected to be produced?

$2KNO_3 + 5Mg \rightarrow N_2 + K_2O + 5MgO$

$$2\,KNO_3 + 5\,Mg \rightarrow N_2 + K_2O + 5\,MgO$$

	$2\,KNO_3$	$5\,Mg$	N_2
m	7.26 g	9.50 g	?
M	101.102 $\frac{g}{mol}$	24.305 $\frac{g}{mol}$	28.014 $\frac{g}{mol}$
n	$\frac{0.07181\text{ mol}}{2}$	$\frac{0.3909\text{ mol}}{5}$	
	0.03590	0.07817	

↑ smaller #
∴ LR

$$m_{N_2} = 0.07181\text{ mol } KNO_3 \times \frac{1\text{ mol } N_2}{2\text{ mol } KNO_3} \times \frac{28.014\text{ g } N_2}{\text{mol } N_2}$$

$= 1.01\text{ g}$

∴ KNO_3 was the limiting reactant and 1.01 g of N_2 were produced

OR

Do 2 line equations

$$m_{N_2} = 7.26\text{ g } KNO_3 \times \frac{1\text{ mol } KNO_3}{101.102\text{ g } KNO_3} \times \frac{1\text{ mol } N_2}{2\text{ mol } KNO_3} \times \frac{28.014\text{ g } N_2}{\text{mol } N_2}$$

$= 1.01\text{ g}$ ← smaller # ∴ KNO_3 is the LR and 1.01 g of N_2 will be produced.

$$m_{N_2} = 9.50\text{ g } Mg \times \frac{1\text{ mol } Mg}{24.305\text{ g } Mg} \times \frac{1\text{ mol } N_2}{5\text{ mol } Mg} \times \frac{28.014\text{ g } N_2}{\text{mol } N_2}$$

$= 2.19\text{ g}$