

9/20/2017

OBJ: SWBAT determine the limiting reactant in a balanced chemical reaction.

1. What are the steps needed to complete a mass to mass problem?

Limiting Reactants and Stoichiometry

Limiting Reactants

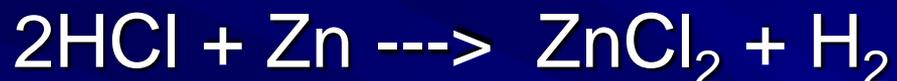
- In a chemical reaction, the amount of product that can be made depends on the amount of reactant available.
- **The reactant that determines the amount of product that can be made is called the limiting reactant.**

Basic Steps to finding the limiting reactant in a chemical equation:

1. Write a balanced equation.
2. Do a mass to mass problem using the starting amount for each reactant.
3. The limiting reactant is the reactant that gives you the smaller amount of product formed.

- Ex. How many grams of Zinc Chloride can be made when 5.0 g of Hydrochloric Acid reacts with 5.0 g of Zinc metal.

1. Write a balanced equation.



2. Do a mass to mass problem using the starting amount for each reactant.

$$\frac{5.0 \text{ g HCl}}{36.5 \text{ g HCl}} \times \frac{1 \text{ mole HCl}}{2 \text{ moles HCl}} \times \frac{1 \text{ mole ZnCl}_2}{1 \text{ mole ZnCl}_2} \times \frac{134.4 \text{ g ZnCl}_2}{1 \text{ mole ZnCl}_2} = 9.4 \text{ g ZnCl}_2$$

$$\frac{5.0 \text{ g Zn}}{65.4 \text{ g Zn}} \times \frac{1 \text{ mole Zn}}{1 \text{ mole Zn}} \times \frac{1 \text{ mole ZnCl}_2}{1 \text{ mole Zn}} \times \frac{134.4 \text{ g ZnCl}_2}{1 \text{ mole ZnCl}_2} = 10.3 \text{ g ZnCl}_2$$

3. The limiting reactant is the reactant that gives you the **smaller amount** of product. Therefore **HCl is the limiting reactant** in this problem.

You do not have enough HCl to react away all the zinc that was added to the beaker

$$\frac{5.0 \text{ g HCl}}{36.5 \text{ g HCl}} \times \frac{1 \text{ mole HCl}}{2 \text{ moles HCl}} \times \frac{1 \text{ mole ZnCl}_2}{1 \text{ mole ZnCl}_2} \times \frac{134.4 \text{ g ZnCl}_2}{1 \text{ mole ZnCl}_2} = 9.4 \text{ g ZnCl}_2$$

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In this reaction **9.4 grams of ZnCl₂** will form and **there will be leftover zinc** that did not react.

The HCl will be all used up!!!

- To find out how much of the excess reactant is left over, start with the initial mass of the limiting reactant and do a mass to mass problem to determine how much of the excess reactant was needed



$$\frac{5.0 \text{ grams HCl}}{36.5 \text{ g HCl}} \times \frac{1 \text{ mole HCl}}{2 \text{ moles HCl}} \times \frac{1 \text{ mole Zn}}{1 \text{ mole Zn}} \times \frac{65.4 \text{ g Zn}}{1 \text{ mole Zn}} = 4.48 \text{ g Zn needed}$$

Subtract this value from the initial mass of the excess reactant.

*4.48 grams is how much zinc reacted away given the amount of HCl available.

We used 5.0 grams in the reaction, so

5.0 grams – 4.48 grams = 0.52 grams Zn left over.

Limiting Reactant Example Problem:

- Silver Nitrate and sodium phosphate are reacted in equal amounts of 200.grams **each**. How many grams of silver phosphate are produced?

