

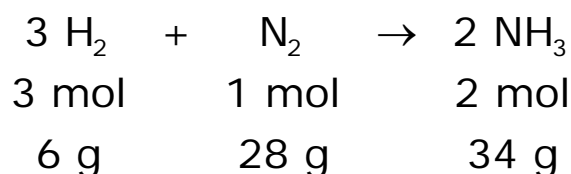
Topic:	LIMITING REACTANTS
Objective:	FK_08_03
<p>Given the amount of two reactants and a chemical equation the student must be capable of doing the following:</p> <ul style="list-style-type: none"> • determine which reactant is the limiting and which one is in excess • calculate the amount of product formed • calculate the excess of the reactant 	

Limiting reactant
<p>If we have a short supply of one reactant and an excess of all the others, the one that is in short supply is called the limiting reactant.</p> <p>The limiting reactant is important because it determines the amount of product that can be produced; the reaction stops when the limiting reactant disappears.</p>

Exercise	
<p>Given this chemical equation</p> $ \begin{array}{ccccccc} 3 \text{ H}_2 & + & \text{N}_2 & \rightarrow & 2 \text{ NH}_3 \\ 3 \text{ mol} & & 1 \text{ mol} & & 2 \text{ mol} \\ 6 \text{ g} & & 28 \text{ g} & & 34 \text{ g} \end{array} $ <p>determine which is the limiting reactant in the following cases:</p>	
1	6 grams of H ₂ and 30 grams of N ₂
2	12 grams of H ₂ and 28 grams of N ₂
3	12 grams of H ₂ and 56 grams of N ₂
4	60 grams of H ₂ and 250 grams of N ₂
5	3 moles of H ₂ and 2 moles of N ₂
6	6 moles of H ₂ and 1.5 moles of N ₂
7	6 moles of H ₂ and 60 grams of N ₂
8	3 moles of H ₂ and 20 grams of N ₂

How to determine the limiting reactant and how to calculate the excess of the other reactant

Let's have this chemical equation:



and the amounts of reactants we have are: 12.5 grams of H₂ and 58.5 grams of N₂. Let's determine which is the limiting reactant and calculate the excess of the other reactant.

Determination of the limiting reactant

First, we have to **compare the amounts of the reactants we have with the values of the table**. In our case:

$$x (\text{H}_2) = \frac{12.5}{6} = 2.083 \text{ times the value of the table}$$

$$x (\text{N}_2) = \frac{58.5}{28} = 2.089 \text{ times the value of the table}$$

The **smaller value corresponds to the limiting reactant**; in our case the limiting reactant is hydrogen and the reactant in excess is nitrogen.

Determination of the excess of the other reactant

First we need to calculate the amount of reactant that combines with the limiting reactant:

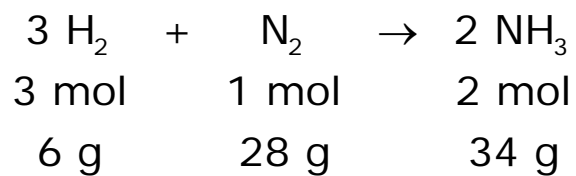
$$m (\text{N}_2) = 12.5 \text{ g H}_2 \times \frac{28 \text{ g N}_2}{6 \text{ g H}_2} = 58.33 \text{ g N}_2$$

To finish we subtract the amount that has reacted to the initial amount:

$$m_{\text{excess}} (\text{N}_2) = 58.5 \text{ g N}_2 - 58.33 \text{ g N}_2 = 0.17 \text{ g N}_2$$

Exercises

Calculate the limiting reactant and the excess of the other in the next cases:



1	36 grams of H ₂ and 170 grams of N ₂
2	12.3 moles of H ₂ and 4.1 moles of N ₂
3	2.6 moles of H ₂ and 25 grams of N ₂

BIBLIOGRAPHY

- "Introductory Chemistry". Russo, Silver. Addison Wesley Longman.