SHS LEARNING ACTIVITY	CHEM1-06-06

Name: ____ **Score/Mark:** ____
Grade and Section: ____ **Date:** ____
Strand: ☐ STEM ☐ ABM ☐ HUMSS ☐ ICT (*TVL Track*)
Type of Activity : ☐ Concept Notes ☐ Skills: Exercise/Drill ☐ Illustration ☐ Laboratory Report ☐ Essay/Task Report ☐ Other: ____
Activity Title: 06-06.Calculating reagents from the products v01
Learning Target: To determine the necessary amounts of reagents from a desired amount of product in an industrial setting
Authors | References: Victor Sojo | Wikipedia: Hydrazine

We now know how to determine the limiting reagent, and calculate the remainder of the excess reagent, as well as the amounts of the products.

But many times chemists want to **synthesize** something, i.e. they want to **make a product**, normally in a specific amount. Hydrazine is the main compound in the air bags of cars, and it is also used as a rocket fuel. Let's say we own a chemical company and want to sell 5 ton (1 ton = 1,000 kg) of hydrazine. We previously balanced this equation:

	2 NH_3	+	H_2O_2	$\longrightarrow$	N_2H_4	+	**2** H_2O
i)							
r)							
f)							

We want to know how much ammonia (NH_3) and hydrogen peroxide (H_2O_2) we need to buy to make our 5 ton of hydrazine. For that, we need to find the proportions, but for that we need the molar mass of hydrazine:

$$\mu_{N_2H_4} = \mu_N \cdot 2 + \mu_H \cdot 4 = 32\text{ g/mol}$$

With this, we can calculate how many moles of hydrazine we want:

$$n_{N_2H_4} = 5\text{ ton } N_2H_4 \cdot \frac{1{,}000\ \cancel{\text{kg } N_2H_4}}{1\ \cancel{\text{ton } N_2H_4}} \cdot \frac{1{,}000\ \cancel{\text{g } N_2H_4}}{1\ \cancel{\text{kg } N_2H_4}} \cdot \frac{1\text{ mol } N_2H_4}{32\ \cancel{\text{g } N_2H_4}} = 1.56 \cdot 10^5\text{ mol } N_2H_4$$

We can go ahead and write that into the table above… and the rest is easy! We need just the same amount of hydrogen peroxide (the relation is 1:1) and double the amount of ammonia:

$$n_{NH_3} = 1.56 \cdot 10^5\text{ mol } N_2H_4 \cdot \frac{2\text{ mol } NH_3}{1\ \cancel{\text{mol } N_2H_4}} = 1.56 \cdot 10^5\text{ mol } NH_3$$

Exercises: We can't really buy moles from our industrial supplier, so let's calculate how many tons of each of the two reagents we need.

And just to make our industrial scenario a little more realistic, let's say the supplier sells us the reagents in 100 kg containers. How many containers of each reagent would we need?