	SHS LEARNING ACTIVITY	CHEM1-06-04

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: 06-04.Stoichiometry: reaction with excess of one reagent v02
Learning Target: To start calculating amounts of reagents and products
Authors | References: Victor Sojo

We can use balanced equations to calculate the amounts of products formed in a chemical reaction. For example, let's calculate the amount of CO_2 and H_2O that would be produced in a **full combustion** of 6.84 g of sucrose ($C_{12}H_{22}O_{11}$) with oxygen in the air.

The proportions in a chemical equation do not work for grams, but they do work for particles, so the first thing we must do is find out how much 6.84 g of sucrose is in mol. For that, we need the molar mass of sucrose:

$$\mu_{C_{12}H_{22}O_{11}} = \mu_C \cdot 12 + \mu_H \cdot 22 + \mu_O \cdot 11 = 342 \text{ g/mol}$$

With this, we can calculate the number of mol "n" of butane:

$$n_{sucrose} = 6.84 \cancel{\text{ g sucrose}} \cdot \frac{1 \text{ mol sucrose}}{342 \cancel{\text{ g sucrose}}} = 0.02 \text{ mol sucrose}$$

Next we need a balanced equation. A full combustion of butane with oxygen in air would produce carbon dioxide and water, so we have in total:

$$C_{12}H_{22}O_{11} + \mathbf{12}\ O_2 \longrightarrow \mathbf{12}\ CO_2 + \mathbf{11}\ H_2O$$

And from here we can easily calculate how much of each product was formed. This is easily seen using a table, where we start by filling the first row with the initial ("i") data that we have, in mol:

	$C_{12}H_{22}O_{11}$	+	**12** O_2	⟶	**12** CO_2	+	**11** H_2O
i)	0.02		(in excess)		0		0

We don't know how much O_2 there was to start with, but the reaction was happening in air, so we know there was a lot of it (it was "in excess"). Of course, there were no products before the reaction, so their initial quantities are both zero. Now we can add two more rows, one for what happened in the reaction "r", and another one for the final conditions "f":

	$C_{12}H_{22}O_{11}$	+	**12** O_2	⟶	**12** CO_2	+	**11** H_2O
i)	0.02		(in excess)		0		0
r)	−0.02		−0.24		+0.24		+0.22
f)	0 (nothing)		(still in excess)		0.24		0.22

Question: Can you calculate where the "r" numbers came from?