**BLOSSOMS VIDEO LESSON TRANSCRIPT**

**Stoichoimetry**

Hello, I’m Norini,

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I want to present a topic called Stoichiometry.

Ha! What a difficult and tongue

twisting word to pronounce.

Can all of you pronounce the word

STOICHIOMETRY?

So what is stoichiometry?

Let’s see

how Stoichiometry is used

in our daily lives,

such as baking a cake.

Now watch this scene

where you can see that Mrs Nurul

is preparing a cake.

I’m going to bake a butter cake.

I need 200 gram of flour,

250 gram of butter,

200 gram of sugar

and 4 eggs.

Mrs Nurul needs specific

proportions of flour,

butter,

sugar and eggs

to bake a nice and tasty butter cake.

Without complete ingredients,

the cake may collapse!

Besides other added ingredients,

Mrs Nurul require these

main ingredients to bake a butter cake.

Yummy,

the butter cake looks so delicious!

So, after watching Mrs Nurul baking a cake

by using a recipe,

can you tell mewhat do you think about stoichiometry?

What is stoichiometry?

**Activity 1** What is Stoichoimetry to your understanding?

Welcome back!

What is your understanding of stoichiometry?

As we saw from the last segment,

the formula or equation used for cake-baking

describes the relationship

between each ingredient and product

so that we can use it to

determine the amount of ingredients

we need to prepare

or the amount of the product we can get.

Stoichiometry is the study

of the quantity aspect

of the chemical formulas and reactions.

Stoichiometry involves problem solving

where you are required to calculate

of the quantity aspect

of the chemical formulas and reactions.

Stoichiometry involves problem solving

where you are required to calculate

the masses of other reactants consumed

and other products formed

with the aid of a balanced chemical equation,

given the mass of a reactant

or product in a chemical reaction.

This cake is so yummy

Can you make one for

my birthday party next month?

Sure, Zamil

glad that the cake turns out well

although it was my first attempt.

What are you doing mum?

I am baking 4 butter cakes for

your birthday party tomorrow.

One won’t be enough

since we are expecting 30 guests.

I’m going to get the ingredients

that I need now.

Oh my,

I only have 200 g of sugar.

Is 200 gram of sugar

enough to bake four cakes?

Can Mrs Nurul bake four cakes

with only 200 gram of sugar?

How much sugar

does Mrs Nurul need to make 4 cakes?

Can you do the math for Mrs Nurul?

**Activity 2** 200g flour + 250g butter + 200g sugar + 4 eggs = 1 cake

Now,

let’s discuss the answers

to the activity.

In the first place,

of course Mrs. Nurul

cannot bake 4 cakes

with only 200 gram of sugar!

These are the possible solutionfor the problem faced by Mrs Nurul.

From the equation of the recipe,

200 gram of sugar is needed to bake a cake.

To make 4 cakes as we planned,

the sugar is not enough

and will be used up first,

so here,

the amount of the sugar

will limit the amount of the

for the problem faced by Mrs Nurul.

From the equation of the recipe,

200 gram of sugar is needed to bake a cake.

To make 4 cakes as we planned,

the sugar is not enough

and will be used up first,

the amount of the sugar

will limit the amount of the

cakes that we can make.

So sugar can be called limiting reagent

and we’ll talk more about this concept later.

So boys and girls,

how much ingredients

does Mrs Nurul need to bake 4 cakes?

To understand better,

let’s convert the recipe into an equation

Before that,

let’s say

1 portion of flour,

butter and sugar

is equivalent to 100 gram,

1 portion of egg

is equivalent to 4 eggs

and 1 whole cake

is equivalent to 1 cake

Thus the recipe

can be represented as follows

This means 2 portion of flour, 2.5 portion of butter,

2 portion of sugar

and 1 portion of eggs

are needed to produce 1 cake.

Therefore,

how many portions of flour,

butter,

sugar and eggs

are needed to produce 4 cakes?

From the equation,

to produce 4 cakes,

you need to multiply

the whole equation by 4.

and 1 portion of eggs

are needed to produce 1 cake.

Therefore,

how many portions of flour,

butter,

sugar and eggs

are needed to produce 4 cakes?

From the equation,

to produce 4 cakes,

you need to multiply

the whole equation by 4.

Therefore,

8 portions of flour,

10 portions of butter,

8 portions of sugar

and 4 portions of eggs

are needed to produce 4 cakes.

To know the amount,

convert the unit of portion

to gram and number of eggs and cakes.

that is,

are needed to make 4 cakes.

Thus Mrs Nurul needs

So students,

do you have similar answers?

If you do then excellent,

if not

then you can discuss your difficulty

with your teacher.

Now,

can you see how important a recipe

formula or equation is

when we are cooking,

especially baking a cake.

This recipe gives us

the information about the relative

amounts of the ingredients,

which are flour,

butter, sugar and eggs

and the product which is cake in this case.

According to this recipe,

Determine

how many cakes we can bake

if we know the amount of

each ingredient we have,

or how much we need

to prepare for each ingredient.

Also

if we know how many cakes

we are going to make.

Next,

to enhance your understanding

on the concept of stoichiometry,

let’s think of other everyday examples

where stoichiometry is used.

Let me bring you back

to the use of this

baking cake concept in chemistry.

Please remember,

you need to apply correct proportions.

To refresh,

in chemical equations,

the amount is usually mentioned in mole.

Do you remember,

in the last segment,

we use the recipe to describe

the proportional relation

between the ingredients and the products.

But in chemical equations,

the coefficients represent mole.

Therefore

the equation for Haber process

in the animation can be described as

1 mole of Nitrogen

reacts with 3 moles of Hidrogen

to produce 2 moles of Ammonia

However,

in the practice,

we can’t measure the reactants

or products in moles,

we usually measure them

by their mass or volume.

As you have learned before,

the amount of moles can be converted intomass or volume.

**Activity 3** If mole is converted to mass and volume, how to you transform or describe the equation?

Class,

do you agree with the

answer given by your friend?

Let’s discuss the answer.

If mole is converted to mass and volume,

the equation can be described as the following

As the relative atomic mass of Nitrogen is 14.02

and the relative atomic mass of Hidrogen is 1.01,

therefore,

1 mole of Nitrogen has a mass of 28.04 gram,

1 mole of Hidrogen has a mass of 2.02 gram

and 1 mole of Ammonia has a mass of 17.05 gram.

Thus,

the chemical equation in terms of mass is

Now boys and girls,

I give you a situation.

If one mole of Nitrogen

reacts with 6 moles of Hidrogen,

how many moles of Ammonia produced?

In order to solve this problem,

you got to recall Mrs Nurul’s situation

when she wanted to bake 4 cakes

with only 200 g of sugar.

Although Mrs Nurul has

enough ingredients for baking 4 cakes

but if she has 200 gram of sugar,

she could only bake 1 cake.

This means,

Mrs Nurul has limited amount of sugar.

With this information

can you solve the problem above?

**Activity 4** 1. Which subtance acts as the limiting reagent? 2. How many moles of NH3 produced?

As you can see,

I’ve used the word limited amount of sugar

in the example.

This shows that the number of cakes can be baked

depends on the amount of sugar.

Since there is only 200 gram of sugar,

therefore only 1 cake can be baked.

In a chemical reaction

the limited substance is

known as the limiting reagent.

Thus,

in the activity that you have done,

the limiting reagent is Nitrogen.

Therefore only 2 moles of Ammonia

can be produced

although there are 6 moles of Hidrogen

Now you know

the amount of product produce

depends on the amount

of the limiting reactants used.

You might understand better

about limiting reagent

with the following example.

Making cars,

For each car you need 4 wheels,

1 steering wheel

and 4 doors

If you have 10 wheels,

2 steering wheels and 10 doors,

what is the "limiting reagent"?

How many cars can you get？

**Activity 5** 1. How many cars can be formed? 2. Which is the limiting part or the car?

Did you get the answer?

From the activity

each car needs

4 wheels,

1 steering wheel

and 4 doors.

Since there are only 2 steering wheels,

therefore,

8 wheels and 8 doors are needed.

Hence,

the “limiting reagent” here

is the number of steering wheels

and 2 cars can be produced

because there are only 2 steering wheels

Now let’s try a simple activity

to determine the mass of water

can be made from 1 kg of fat tristearin

in the camel hump.

Your teacher will

provide you with a hand out.

Work in groups

to solve the question from the hand out.

Remember,

when you want to solve problems

related to stoichiometric relations,

steps to be taken are:

**Activity 6** What mass of water can be made from 1.0 kg of fat?

In the activity the

chemical equation is given.

You can use the equationto get the necessary information.

In this question,

the limiting reactant

will be the 1.0 kg of fat

because the oxygen around the

camel should be enough.

Did you answer the questions correctly?

Well done.

If your answers are incorrect,

you can further discuss

them with your friends or teacher.

Well students,

based on the activity you just did,

hope you have realised that

stoichiometry involves

using a BALANCED chemical equation

to determine the amount of products produced

during a chemical reaction.

them with your friends or teacher.

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during a chemical reaction.

An appropriate ratio

needed to ensure

how much of each particle is created

relative to one another.

This can be done through the

stoichiometric coefficient.

You can relate this

to the baking cake situation earlier.

To understand better

the calculations you can solve

more problems with your teacher.

You have seen the videos

and carried out activities

which are related to stoichiometry.

From this lesson

and activities carried out,

I’m sure you have learned the meaning of

stoichiometry and understand its concept.

As you have seen,

stoichiometry involves the writing of

a balanced chemical equation

which represents a certain chemical reaction.

From this balanced chemical equation,

amount of products could be determined

when certain amount of reactants

are used and vice versa.

With the chemical equation,

you can also determine

the specific amount of product you want

and then calculate the reactants required

to produce the specific amount of product.

This notion you could observed

from the activities of Haber Process,

making cars and water from a camel.

From each activity

we could see that

the amount of product produced

is determined by the

amount of the limiting reactant.

You have also seen

from the activity of baking cakes,

when you need to prepare a

certain number of cakes,

you need specific amount of other ingredients

in order to get the amount of product you need.

If one of the ingredients is limited,

the number of cakes could be baked

depends on the limited reactant

I hope you have enjoyed the lesson in this video.

Have a nice day and see you again.

**Teacher’s Guide**

Thank you for choosing this lesson for your students.

This lesson takes about 50 minutes to carry out.

This video basically

explains the meaning of stoichiometry

and its importance in solving numerical problems.

At the end of the lesson,

your students should be able to use

the balanced chemical equation

to determine the amount of reactants needed

to produce certain amount of product,

determine the amount of products produced

from certain amount of reactants used

and identify the limiting reagent.

Students also can relate the concepts of stoichiometry

in their daily lives.

Please acknowledge,

before watching this video

students should have prior knowledge

on writing correct chemical

formulas of compound,

write balanced chemical equations,

conversion of mole to mass

and volume of gas

and vice versa

and relationship between number of mole

and molarity.

I would like to also suggest

some activities you can use

to conduct similar lesson.

You can try problem solving

with brainstorming session,

carry out a simple experiment

and you may want to use mind mapping.

Besides using the equation and activities

to produce Ammonia

from limited amount of Nitrogen

and to determine the number of cars

that can be produced from limited

number of steering wheels,

the understanding of the limited reagent

can be further explained

by carrying out an experiment of reaction

between marble chips and hydrochloric acid

Materials needed

marble chips which is calcium carbonate

0.1 molar hydrochloric acid,

with volume of 50 cm3

Apparatus needed are,

Basin half-filled with water

Conical flask with delivery tube

and measuring cylinder, 250 ml

Here are the procedures

on how to carry out the experiment

First,

pour 50 cm3 of 0.1 molar of hydrochloric acid

into the conical flask

Then,

fill the measuring cylinder

with water

and invert it into the basin filled with water.

After that,

adjust the end of the delivery tube

into the measuring cylinder.

Put in

2.5 gram of marble chips

into the conical flask

and immediately stopper the conical flask.

Gently swirl the conical flask

and record the volume of gas collected

when the reaction has stopped.

After finished,

you need to repeat the experiment

by using 10 gram of marble chips.

Done with experiment,

teacher guides the students

to construct their knowledge

of the concept

which is to construct the chemical

equation of the reaction.

Remember to tell the student

that marble chips are

actually calcium carbonate.

From equation

1 mol of marble chips

reacts 2 mole of hydrochloric acid

to produce

1 mole of Carbon Dioxide

But,

for the first experiment,

the number of mole marble chips used

is 0.025 mol.

and number of mole acid is

0.025 mol.

However,

0.025 mol acid

can only react with

0.0125 mol marble chips.

So,

the 0.025mol acid

which is the limited reactant,

will first run out

while marble chips is still in excess.

The reaction will stop

when the acid is used up.

Therefore,

the amount of the product is determined

by the amount of acid,

not by the amount of the marble chips,

so,

only 0.0125 mole of

Carbon Dioxide is produced.

So,

in a chemical reaction

the limiting reactant is

the reactant that runs out first.

If 10 gram of marble chips is used

in the second experiment,

still

0.025 mole of hydrochloric acid

used to produce

0.0125 mole of

Carbon Dioxide produced.

Therefore,

volume of Carbon Dioxide is

This shows that hydrochloric acid

is the limiting reactant

and marble chips is the excess reactant.

Now you knowthe amount of product produce

depends on the amount of

the limiting reactants used.

Here I give you suggested

questions that you can ask your students

based on the experiment.

This is where your students will

perform discussion

and find answers.

If you think the activities

will require longer time,

you can divide this video into two lessons.

I would like to also suggest

some problem solving activities

that teachers can use as hand-outs

to complete the following equations

by putting in the relevant values

in the boxes provided.

The following are the hand outs

that should be given

to students to carry out the activities.

These are suggested activities

which you can use

to conduct similar lesson in Activity 6.

Teacher can also show

that the lack of a certain reactant

in a chemical reaction

will produce products which are not as expected.

For example,

for the growth of healthy paddy plants,

enough fertilizers are required.

If the composition of fertilisers

is not in the correct proportion

paddy plants may not give good yield of rice.

Well teachers,

you can carry out a brainstorming sessions

with your students

to solve such problem.