

BLOSSOMS VIDEO LESSON TRANSCRIPT

Stoichiometry

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 me what do you think about stoichiometry?
What is stoichiometry?

Activity 1 What is Stoichiometry 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 Hydrogen
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 into mass or volume.

Activity 3 If mole is converted to mass and volume, how do 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 Hydrogen is 1.01,
therefore,
1 mole of Nitrogen has a mass of 28.04 gram,
1 mole of Hydrogen 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 Hydrogen,
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 substance acts as the limiting reagent? 2. How many moles of NH_3 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 Hydrogen

Now you know

the amount of product produced
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 equation to 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.

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.

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 observe
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 cm^3

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 cm^3 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 know the amount of product produced
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.