



Ministry of Education
and Sports

HOME-STUDY LEARNING

SENIOR
2

BIOLOGY

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This material has been developed as a home-study intervention for schools during the lockdown caused by the COVID-19 pandemic to support continuity of learning.

Therefore, this material is restricted from being reproduced for any commercial gains.

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FOREWORD

Following the outbreak of the COVID-19 pandemic, government of Uganda closed all schools and other educational institutions to minimize the spread of the coronavirus. This has affected more than 36,314 primary schools, 3129 secondary schools, 430,778 teachers and 12,777,390 learners.

The COVID-19 outbreak and subsequent closure of all has had drastically impacted on learning especially curriculum coverage, loss of interest in education and learner readiness in case schools open. This could result in massive rates of learner dropouts due to unwanted pregnancies and lack of school fees among others.

To mitigate the impact of the pandemic on the education system in Uganda, the Ministry of Education and Sports (MoES) constituted a Sector Response Taskforce (SRT) to strengthen the sector's preparedness and response measures. The SRT and National Curriculum Development Centre developed print home-study materials, radio and television scripts for some selected subjects for all learners from Pre-Primary to Advanced Level. The materials will enhance continued learning and learning for progression during this period of the lockdown, and will still be relevant when schools resume.

The materials focused on critical competences in all subjects in the curricula to enable the learners to achieve without the teachers' guidance. Therefore effort should be made for all learners to access and use these materials during the lockdown. Similarly, teachers are advised to get these materials in order to plan appropriately for further learning when schools resume, while parents/guardians need to ensure that their children access copies of these materials and use them appropriately. I recognise the effort of National Curriculum Development Centre in responding to this emergency through appropriate guidance and the timely development of these home study materials. I recommend them for use by all learners during the lockdown.



Alex Kakooza
Permanent Secretary
Ministry of Education and Sports

ACKNOWLEDGEMENTS

National Curriculum Development Centre (NCDC) would like to express its appreciation to all those who worked tirelessly towards the production of home-study materials for Pre-Primary, Primary and Secondary Levels of Education during the COVID-19 lockdown in Uganda.

The Centre appreciates the contribution from all those who guided the development of these materials to make sure they are of quality; Development partners - SESIL, Save the Children and UNICEF; all the Panel members of the various subjects; sister institutions - UNEB and DES for their valuable contributions.

NCDC takes the responsibility for any shortcomings that might be identified in this publication and welcomes suggestions for improvement. The comments and suggestions may be communicated to NCDC through P.O. Box 7002 Kampala or email admin@ncdc.go.ug or by visiting our website at <http://ncdc.go.ug/node/13>.



Grace K. Baguma
Director,
National Curriculum Development Centre

ABOUT THIS BOOKLET

Dear learner, you are welcome to this home-study package. This content focuses on critical competences in the syllabus.

The content is organised into lesson units. Each unit has lesson activities, summary notes and assessment activities. Some lessons have projects that you need to carry out at home during this period. You are free to use other reference materials to get more information for specific topics.

Seek guidance from people at home who are knowledgeable to clarify in case of a challenge. The knowledge you can acquire from this content can be supplemented with other learning options that may be offered on radio, television, newspaper learning programmes. More learning materials can also be accessed by visiting our website at www.ncdc.go.ug or ncdc-go-ug.digital/. You can access the website using an internet enabled computer or mobile phone.

We encourage you to present your work to your class teacher when schools resume so that your teacher is able to know what you learned during the time you have been away from school. This will form part of your assessment. Your teacher will also assess the assignments you will have done and do corrections where you might not have done it right.

The content has been developed with full awareness of the home learning environment without direct supervision of the teacher. The methods, examples and activities used in the materials have been carefully selected to facilitate continuity of learning.

You are therefore in charge of your own learning. You need to give yourself favourable time for learning. This material can as well be used beyond the home-study situation. Keep it for reference anytime.

Develop your learning timetable to cater for continuity of learning and other responsibilities given to you at home.

Enjoy learning



TOPIC: Soil

lesson 1: Physical and Chemical Properties of Soil

By the end of this sub-topic, you should be able to carry out an experiment to find the percentage of air in a soil sample.

Introduction

You learnt that one of the components of a good soil is air. A good soil in our everyday life is used to support plant growth. Air in soil is used by the plant roots for respiration for proper growth. Animals in soil also use the air to respire and add to soil fertility (goodness).

Different soil samples/types contain different amounts of air. Why is this so? In this lesson, you will determine the percentage of air in a soil sample. Why is it important to understand which soil contains more or less air?

How would you prove that there is air in a soil sample? How would you determine the amount of air and hence calculate the percentage of air in soil?

Materials you will need

2 cups of dry soil sample, a ruler, used 500/600ml mineral water bottle, water and a knife

Caution:

- Avoid making yourself dirty during this activity.
- Wash your hands with soap and clean water after this activity.
- Use the knife carefully.
- After the activity, wash and keep the apparatus you have made for future use.

Experiment 1: To show that soil contains air.

Procedure

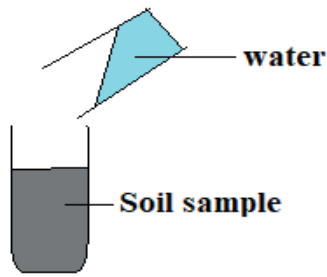
- i) Use a knife to cut off 1/3 of upper portions of the 2 empty clear plastic bottles.
- ii) Label one bottle as **A** and the other as **B**.
- iii) Put some of the soil sample in bottle **A**.
- iv) Put water twice the volume of soil in bottle **B**.
- v) Pour the water from **B** into the soil in **A** slowly and gently as you observe what happens.

BIOLOGY SELF-STUDY MATERIALS FOR SENIOR TWO 2020

COVID-19 is a disease caused by the corona virus. The symptoms include: dry cough, sneezing/running nose, fever and difficulty in breathing. The virus is transmitted through droplets when an infected person coughs or sneezes. A person can also get infected by touching surfaces contaminated with the virus and then touching their face (eyes, nose or mouth). The spread of COVID-19 can be slowed down or prevented by following:

- Clean your hands often. Use soap and water, or an alcohol-based hand rub.
- Avoid overcrowded places. Maintain a safe distance (at least one meter) from anyone, more particularly one who is coughing or sneezing.
- Wear a mask when physical distancing is not possible.
- Don't touch your eyes, nose or mouth.
- Cover your nose and mouth with your bent elbow or a tissue when you cough or sneeze.
- Stay home if you feel unwell.
 - If you have a fever, cough and difficulty breathing, seek medical attention and get tested.

All the best as you continue to study using these materials.



Questions

1. What do you observe as you pour water in the soil sample?
2. Explain your observation.
3. What is your conclusion from the observation and explanation made above?

Lesson conclusion

Conclude this lesson by filling in the gaps in the text below. Use the following words (air, water, bubbles and air spaces,).

As you pour water in a soil, _____ are observed coming out of the soil. This is because water occupies the _____ in the soil and forces (displaces) air to come out. This shows that soil contains _____.

Lesson 2- Percentage of air in soil

In Lesson 1, you showed that soil contains air. In this lesson, you are going to determine the percentage of air in the soil sample. However, you will first determine the amount of air.

How would you determine the amount of air in a soil sample?

Experiment 2: To determine the amount of air in a soil

Materials you will need

One cup of dry soil which remained during Lesson 1 or get it from the surrounding. A ruler, two empty mineral water bottles whose capacity is 500ml or 600ml, water and a knife. (You may use the bottles you used in Lesson 1)

Procedure

- i) Put some soil in the cut bottom part of the used water bottle about $\frac{1}{2}$ way.
- ii) Shake the bottle slightly to level the soil.
- iii) Using a ruler, measure the height of the soil and record it as H1(a).
- iv) In another bottle of the same type and size, put in water of the same height like that of the soil. Record the height as H1(b).
- v) Add the value for the height of soil to that of water i.e. say $H1(a) + H1(b)$. Call the sum, expected total H2.
- vi) Pour the measured water into the soil. Wait until no more air bubbles come out the soil.

- vii) Measure the height of the mixture of soil and water in the bottle. Record it as H₃. Call it the actual total value.

Questions

1. What do you notice between value H₂ and H₃?
2. Give a reason for your observation in the question 1.
3. Calculate the length of air in the soil.
4. Using length, calculate the percentage of air in the soil sample.

Complete the statements below by filling in the blank spaces

You notice that value H₃ (the real value) is less than H₂ (the expected value). This is because ... which was part of the soil was by water hence making the height of soil less. So the difference between and is the value for air in the soil.

Value of air in soil sample =-.....

Using the value for amount of air in the soil sample, calculate the percentage of air in the soil.

Percentage of air in soil = (value for air ÷ value for) × 100

Lesson conclusion

Please take note that in this lesson, although the amount of air is in terms of length, it is better to use volume determined by using calibrated measuring cylinders.

Air is used by plant roots and animals in the soil. Knowing the amount of air in different types of soil enables you to make the right choice of soil type for good crop growth.

Sub-topic 2: Soil Fertility and Conservation

By the end of the sub-topic, you should be able to:

- i) outline the features of a fertile soil.
- ii) name and describe the methods of soil conservation.

Lesson 3

You are aware that soil supports plant growth. Good plant growth enables us to get food to eat and sell. Have you ever observed the same type of plant growing well in one soil and growing poorly in another soil? Yes, it is because for proper plant growth, the soil must provide what the plants need. If this is not done, the plant grows poorly.

What do plants need from soil for them to grow well?

Clue! Use your knowledge on components of soil and your experience on plant growth.

Complete the statements below by filling in the blank spaces

A combination of, _____, soil organisms, _____, air and good retention of and mineral salts, drainage and capillarity make a soil fertile. However, the soil can lose fertility.

Soil can lose its fertility by soil erosion (removal of fertile top soil), soil exhaustion and bad farming activities. However, we can conserve soil fertility as we use it.

Soil Conservation

Complete the statements below by filling in the blank spaces

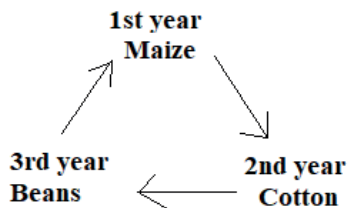
You can maintain soil fertility by avoiding or controlling soil..... and exhaustion. This is done by taking care of the soil organic matter, avoiding loss of: salts, top soil, _____ and air which are important for good crop growth. All these are achieved through good farming practices.

What are the Good Farming Practices?

1. Crop rotation

Different crops need different minerals from a soil, so you change the type of crop grown on a piece of land each year.

Illustration:



2. Mulching

Mulching involves covering top soil with dead plant materials like leaves or grass. It reduces water loss by evaporation and removal of top soil by erosion. When the plant material rots, they add humus.

Activity

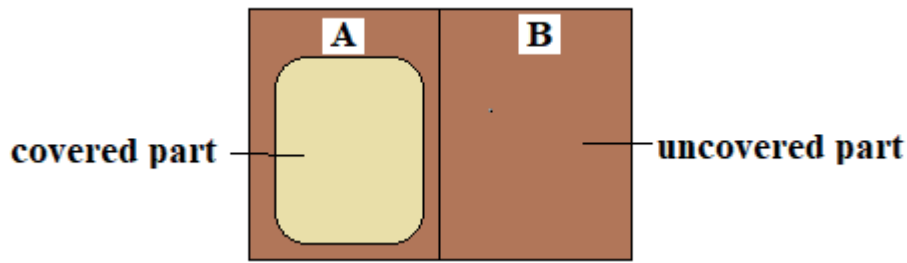
What you need

Bare dry ground, water, ruler and box paper or piece of wood

Procedure

On a sunny day:

- i) Pour water on an area of bare soil of approximately 50 X 50 cm.
- ii) Divide the area into two parts, **A** and **B**.
- iii) Obtain a piece of wood or box paper of that is approximately the same size as Part **A**. Cover part A using the piece of wood/paper
- iv) Leave part **B** uncovered.
- v) When the uncovered part B is dry, uncover part **A**.



1. What do you observe?
2. Explain your answer in 1.
3. What do the following in the activity represent in the real situation?
 - i) Pouring water on soil
 - ii) Box cover or any other cover used
4. What conclusion do make from the activity?

Conclusion

You observed that when you pour water on the soil, it gets wet just like when it rains. When the soil is left open, the heat from the sun dries it up. But when you cover it, soil loses little water so it retains water. Therefore, mulching conserves soil by reducing water loss and washing away of top soil.

Lesson 4: What are the Good Farming Practices (Continuation)

So far, we have looked at two soil conservation methods. Name them.
In this lesson, you will look at other methods of soil conservation.

3. Weeding

To understand better the concept of weeding as a soil conservation method, let us do an activity.

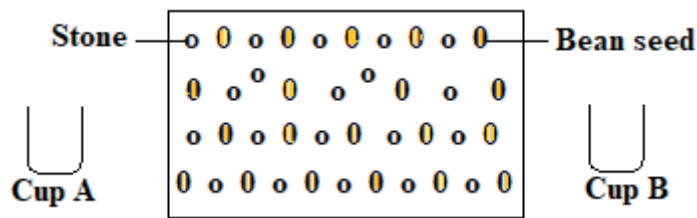
Activity

What you need

20 bean seeds, 20 small stones almost the size as the bean seeds and two empty cups cut from used mineral water bottles.

Procedure

- i) Mix the bean seeds and the stones and spread them on the ground.
- ii) Label your left hand **A** and the right hand **B**.
- iii) Label one cup **A** and the other **B**.
- iv) Place cup **A** on the left and cup **B** on the right.



- v) Using your hands **A** and **B**, pick a bean seed in each and place it in the cup. Hand **A** in cup **A** and hand **B** in cup **B**.
- vi) Repeat (v) until you pick 10 bean seeds for each hand.

Questions

1. How many bean seeds and how many stones were there at the beginning?
2. How many bean seeds and stones remained after procedure (vi)?
 - The bean seeds and stones represented mineral nutrients in the soil e.g. sulphates and phosphates respectively.
 - The left hand (**A**) represented the weeds and the right hand (**B**) represented the needed crops.
3. What was represented by the process of picking the bean seeds?
4. During the process, which mineral nutrient was heavily lost from the soil?
5. What would you do to the garden to reduce on the removal of the nutrients so that the soil remains fertile?

Fill in the blank spaces below

Weeding involves removal of _____ plants amongst the desired crops. Removal of weeds reduces removal of good mineral salts by unprofitable plant.

4. Adding fertilizers

Some of the necessary mineral salts in the soil are used up very fast and need replacement if the soil fertility is to be maintained. Fertilizers can be:

- i) *Organic/natural*: Organic fertilizer may be compost or animal manure which you make from plant and animal remains. It is cheap and adds humus to soil and improves the soil texture.
- ii) *Chemical/artificial*: These are manufactured e.g. nitrate, phosphate and potassium (NPK) fertilizers. They are expensive and not long term in soil.

5. Mixed farming

This involves growing different crops on the same land space. Mixed farming spreads nutrient drain and reduces soil stress. If maize is inter-planted with beans, the beans produce the nitrates for maize without using much from the soil directly.

6. Avoiding overgrazing

Many animals grazing on the same piece of land leads to the removal of a lot of cover grass. Therefore, managing a few animals on the land reduces exposure of soil and therefore reduces soil erosion.

7. Reduction of soil erosion

Soil erosion can be reduced by e.g. terracing and contour ploughing. Preventing soil erosion reduces loss of top soil and its mineral nutrients, hence maintaining soil fertility.

Summary

For a soil to sustain plant growth, the soil must be fertile providing the necessary mineral salts. However, many times the soil loses the necessary mineral salts. There is therefore need to conserve the soil in order for it to continue providing nutrients to crops.

Lesson 5

Sub-topic: Nitrogen Cycle

By the end of the sub-topic, you should be able to draw and describe the nitrogen cycle.

Nitrogen is very vital in plant life. It is used in the formation of chlorophyll and other tissues as well as in protein formation. Therefore, the need for nitrogen in air to be fixed in soil and used by plants.

In this lesson you will learn how nitrogen is recycled in nature through natural processes.

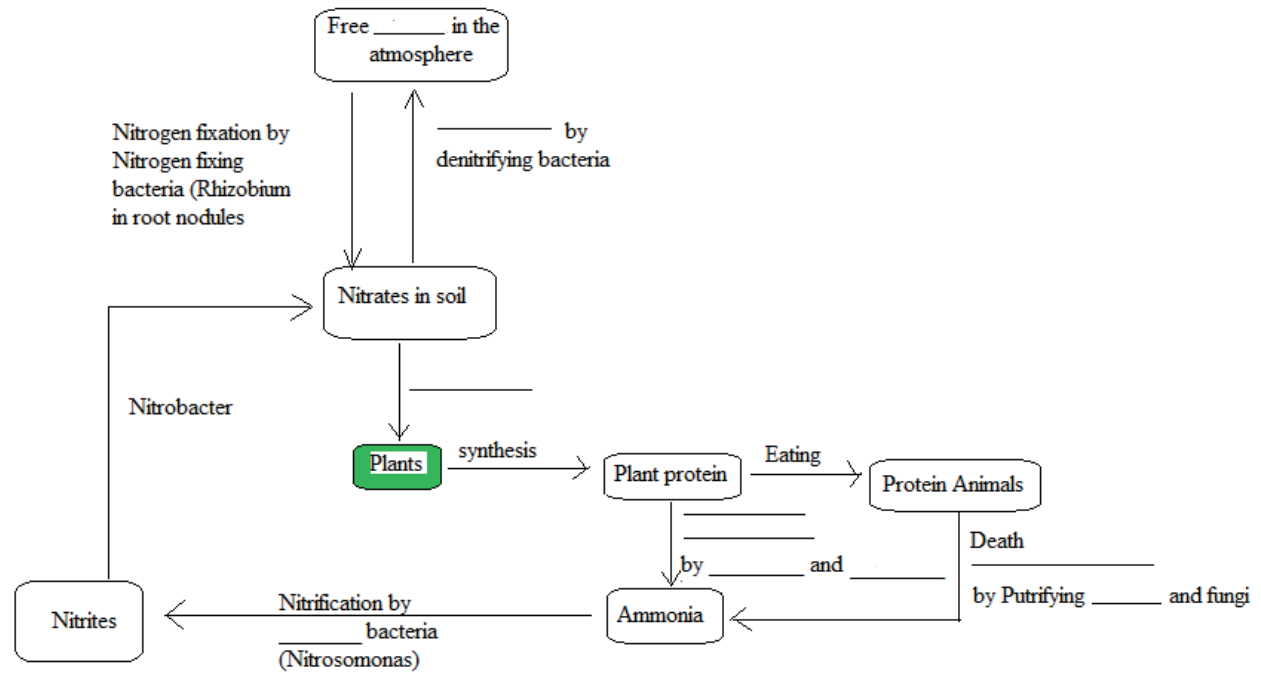
Where is nitrogen gas mostly found? It is mostly found in the atmosphere.

- i) Atmospheric nitrogen cannot be absorbed directly by plants. Plants can only use nitrogen in the form of nitrates which are soluble in soil water.
- ii) Nitrogen fixing bacteria which live freely in soil and *Rhizobium sp* which live in the root nodules of leguminous plants mix nitrogen in the atmosphere into ammonium compounds (NH_4^+) through a process called nitrogen fixation.
- iii) Nitrates are readily absorbed by the plant roots and used to make plant proteins.
- iv) When animals eat plants, the plant protein is changed into animal protein.
- v) The remains of dead plants and animals as well as their wastes are decomposed and changed into ammonium compounds.
- vi) Ammonium compounds are changed into nitrites and nitrites into nitrates by nitrifying bacteria through a process called **nitrification**.
- vii) The cycle is balanced by a continuous return of nitrogen to the atmosphere by denitrifying bacteria through **denitrification**. These bacteria break down the nitrates into gaseous nitrogen and oxygen. The oxygen is used by the bacteria while the nitrogen is released into the atmosphere.

Activity

Draw a nitrogen cycle by filling in the gaps on the diagram below:

The nitrogen cycle



TOPIC: Nutrition in Plants and Animals

Sub-topic: Nutrition in Animals

By the end of this sub-topic, you should be able to:

- i) name food nutrients and their uses in the body.
- ii) name sources of food nutrients.
- iii) Describe the structure and adaptations of teeth.

Introduction

Nutrition is the whole process by which organisms get energy from food for growth, maintenance and repair of damaged tissues. The substances needed for these in an organism are called nutrients.

The food you eat make up your diet. The different foods you eat provide your body with different chemical nutrients and hence, they are of different uses in the body. The nutrients are grouped into five: carbohydrates, lipids (fats and oils), proteins, vitamins and minerals

Lesson 1- Food nutrients

We eat many sorts of foodstuffs.

List foods you have ever eaten.

You will be able to place the foodstuffs in the five groups mentioned above. In this lesson, you are going to learn about food nutrients, their use in the body and the sources of the various food nutrients.

The first group is **Carbohydrates**. You have ever heard of carbohydrates. You have seen or eaten glucose, sucrose (sugar in sugar cane) and starch. These are examples of carbohydrates.

If you have not eaten, you will fail to do work. But when you eat food like sugar cane, maize, cassava, millet, bananas, etc., you are able to do work easily. Why is it so? This is because these foods give you energy to do the work. So carbohydrates are energy giving foods. The foods you eat and get energy are the sources of carbohydrates.

Another group is called **Lipids**. You have eaten oily seeds from plants and fatty meat from animals. Oils and fats are examples of lipids. Lipids are very important in our bodies because:

- i) they are broken down to provide energy. they produce more energy than carbohydrates.
- ii) they form food store in the body.
- iii) they insulate the body (control heat loss from the body).
- iv) they cushion internal organs.
- v) they form part of the cell structure e.g. the cell membrane.
- vi) they prevent excessive loss of water from the body e.g. in insects.

Name foods you eat and they are oily or fatty.

Foods like milk and its products e.g. butter, meat, fish, groundnuts, simsim and sun flower are sources of lipids.

The third group is **proteins**. You have been told to eat certain foods so that you grow well. In fact, babies are fed on such foods like milk to grow. Growth foods are called **proteins**. There are plant and animal proteins. Most of our body parts are made up of proteins e.g. the muscles. Therefore, proteins are important because:

- i) they make body tissues e.g. muscles.
- ii) they are used to make more body cells resulting in body growth.
- iii) when your body is cut, some tissues or part of the tissue is damaged. Proteins are used to repair and replace damaged and worn out tissues.
- iv) enzymes which control body reactions are protein in nature so proteins are used to make enzymes.

Name foods you eat that give us proteins.

When you eat beans, meat, fish, eggs and milk, you get proteins.

Another group of nutrients is called **Minerals**. Minerals are important in the structure formation and proper functioning of the body. There are many minerals needed by the body each with special functions. The following are examples of minerals.

- i) *Calcium* is got from foods like milk, cheese and fish. Calcium is used in bone, teeth and egg shell formation.
- ii) *Iron*: Sources of iron are liver, egg yolk and green vegetables. Iron is important in formation of blood.
- iii) *Sodium*: Sources of sodium is mostly common salt. Sodium is useful for nerve and muscle functioning.
- iv) *Iodine*: The main sources of iodine are sea food, the water we drink and common salt. Iodine is important for normal working of the thyroid gland in the neck.

The last group of nutrients are **Vitamins**. Generally, vitamins control the chemical reactions in the body. Examples of vitamins are:

- i) *Vitamin A* (retinol) is needed by the light sensitive cells in the eye for seeing in light. Sources of vitamin A are cod liver oil and carrots.
- ii) *Vitamin B1* (Thiamine) is useful in cell respiration. Yeast and cereals are sources of vitamin B1.
- iii) *Vitamin B2* (Riboflavin) plays a role in respiration. Sources of Vitamin B2 include fish, eggs and vegetables.
- iv) *Vitamin C* (Ascorbic acid) is mostly got from citric fruits like oranges. It is useful in wound healing.
- v) *Vitamin D* helps in bone formation by enabling bones and teeth to absorb calcium. Sources of vitamin D are cod liver oil and milk products. Vitamin D is made in the skin using sunlight.

To summarise this lesson, fill in the table below:

Nutrient	Examples	Use in the body	Sources of food nutrients
Carbohydrate			
	<ul style="list-style-type: none"> • Oils • Fat 		.
		Repair and replacement of damaged and worn out tissues	
Minerals		Important in the structure and proper functioning of the body	
	Calcium		Milk, cheese, fish
		Formation of haemoglobin in blood	
	Sodium		
		Normal working of the thyroid gland	Sea food and common salt

Nutrient	Examples	Use in the body	Sources of food nutrients
		Help in controlling the chemical reaction in the body.	
		Needed for the light sensitive cells in the eye for seeing in light	
	B1 (thiamine)		Yeast and cereals
			Citrus fruits, vegetables
	D	Helps bones and teeth absorb calcium	

Lesson 2 – Mammalian teeth

In this lesson, you are going to describe the structure and function of the mammalian teeth. Teeth are used in the mechanical digestion of food. Mechanical digestion involves cutting, tearing and crushing of food. Different teeth have different shapes to perform one of the above processes.

How are teeth adapted to their function?

To answer this question, you need to observe and study the teeth you have in your mouth.

Activity

To do this activity, you need the following: mirror and solid foodstuff ready to eat e.g. a fruit.

Open your mouth wide to see your teeth on the lower jaw in the mirror.



The lower jaw to be observed

1. How many types of teeth do you see?
2. Use your tongue to feel the structure of teeth.
3. Describe the structure of the teeth seen and felt by the tongue.
4. Note the type of teeth you use in the investigation below:
 - i) Using the fruit/food, use your teeth to get off a piece.
 - ii) Imagine the food was a bit hard e.g. beef and you wanted to pull off a piece, which teeth type would you use. Use your food to position it between the teeth you would use and try doing it.
 - iii) Lastly use the teeth to get a piece from the food, use your teeth to turn it into small particles that you can swallow.

iv) From the description of the structure of the teeth, suggest each type's function.

Answer the above questions by filling the table below. Leave out the names, it will be done later.

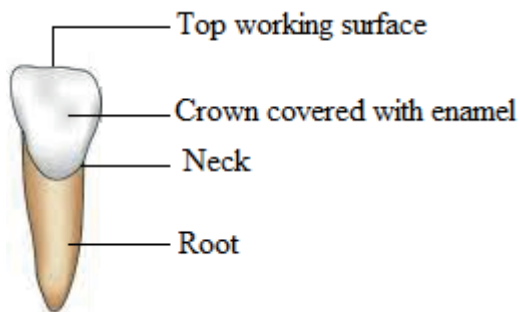
Type	Structural description	Name	Function


You have looked at the external structure of typical teeth. However, you could not remove the teeth from the jaw to see the lower part. The lower part is a root or roots which hold the tooth in the jaw. The number of roots are 1 or 2 or 3 or 4 depending on the type of tooth.




All teeth have a:

- Hard outer layer called the enamel
- Working surface at the top
- A position between the crown and the root called the neck.
- Root/roots for attachment

External structure of a tooth:



Tooth type	Illustration	Description	Function
Incisor		<ul style="list-style-type: none"> • Has a sharp chisel-shaped upper surface • Has one root 	For cutting or biting food

Tooth type	Illustration	Description	Function
Canine		<ul style="list-style-type: none"> Has a sharp pointed upper surface Has one root 	For tearing food
Premolar		<ul style="list-style-type: none"> Has a large broad ridged top surface Has two roots 	For chewing or crushing food into smaller particles
Molar		<ul style="list-style-type: none"> Has a larger and broader ridged top surface Has three roots 	For chewing or crushing food into smaller particles

Different types of teeth are located in strategic positions on the jaw. They have different shapes and structures that enable each to do a particular function. There are teeth for cutting, tearing and reducing size of food by crushing for easy swallowing.

Because teeth play a very important role in nutrition, you need to take care of them to sustain them healthy. Brush your teeth regularly and avoid eating solid sugary foods e.g. sweets. If possible, look at the internal structure of a tooth.

Lesson 3 – Digestion in man

In this lesson, you are going to learn about the process of digestion in man. Digestion is the chemical breakdown of ingested food (food eaten) in smaller soluble molecules that can be absorbed and used in the body. Digestion takes place in the digestive system. The digestive system comprises the alimentary canal and two associated organs namely, the liver and pancreas.

The alimentary canal is a long tube made up of the following parts connecting to each other:

Mouth → Gullet (oesophagus) → Stomach → Duodenum → Ileum → Colon → Rectum → Anus
Each of these parts plays a role in digestion of food as shown in the table below:

Part of alimentary canal	Digestive gland/organ	Digestive juice	Enzyme	Substrate and product
Mouth	Salivary gland	Saliva	Salivary amylase	Chewing of food Mixing food with saliva Amylase catalyses breakdown of starch to maltose
Stomach	Gastric gland	Gastric juice	Pepsin	Churning of food reducing it to a fluid

Part of alimentary canal	Digestive gland/organ	Digestive juice	Enzyme	Substrate and product
				Pepsin catalyses breakdown of Protein to polypeptides
			Rennin	Rennin catalyses breakdown of caseinogen to casein
Duodenum	Liver	Bile salts	None	Emulsification of fats to fat droplets
	Pancreas	Pancreatic juice	Pancreatic amylase	Amylase catalyses breakdown of starch to maltose
			Trypsin	Trypsin catalyses breakdown of polypeptides to peptides
			Lipase	Lipase catalyses breakdown of fats to fatty acids and glycerol
Ileum/ small intestine.	Intestinal gland	Intestinal juice	Maltase	Maltase catalyses breakdown of Maltose into glucose and maltose
			Lactase	Lactase catalyses breakdown of lactose to glucose and galactose
			Sucrase	Sucrase catalyses breakdown of sucrose to glucose and fructose
			Peptidase/ Erepsin	Peptidase catalyses breakdown of peptides digested to amino acids

Fill in the blank spaces

- Mechanical digestion by the teeth occurs in the _____. Chemical digestion starts in the mouth by action of salivary amylase on _____.
- Food moves from the mouth down the gullet to the _____ by peristalsis.
- Chemical digestion and absorption of digested food is completed in the _____. The ileum like the gas exchange surface is adapted for absorption of digested food.
- In the colon/large intestine, there are no enzymes therefore no digestion occurs there. It is a place for absorption of excess water from the undigested food material.

- Rectum temporarily stores the undigested food materials before being passed out through the anus.
- The absorbed food nutrients are used by the body for energy, growth, repair or replacement of dead cells. This is called assimilation.

Sub-topic: Nutrition in Plants

By the end of this sub-topic, you should be able to:

- list the factors that affect photosynthesis.
- list the adaptations of a leaf to carry out the process of photosynthesis.

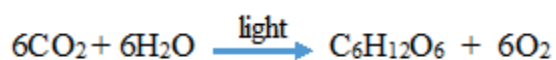
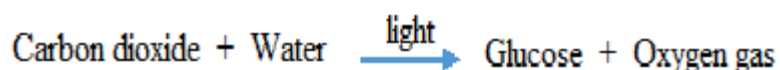
Lesson 4 - Photosynthesis

Introduction

Plants are able to make their own food through a chemical process called photosynthesis. This is because they have a green pigment called chlorophyll. Chlorophyll plays the role of trapping light energy used in the process of making food. Plants get the energy and the raw materials from their environment. The product of photosynthesis is glucose which is changed to starch for temporary storage. The by-product is oxygen gas given out to the atmosphere.

In this lesson, you are going to learn about the factors that affect the process of photosynthesis. The factors can be raw materials. These are the materials reacted or combined to get food. Other factors are energy or associated to energy.

The chemical equation for photosynthesis is:



From the equation, what is needed for photosynthesis to occur?

	What is needed i.e. factor affecting photosynthesis	What is it in the process of photosynthesis?	Where is it got from?
1	Carbon dioxide		The atmosphere
2		Raw material	Absorbed from the soil
3	Light		
4		Green pigment	

How do the factors above affect the process of photosynthesis?

To understand the effect, fill in the table below:

	Factor missing	Why will photosynthesis not take place?
1.	Water	Water is a raw material so one reactant will be missing, no reaction occurs
2.	Carbon dioxide	
3.		
4.	Chlorophyll	

Summary

Plants are autotrophic, they make their own food from water and carbon dioxide using light energy trapped by chlorophyll. Should any of these miss, photosynthesis does not take place.

To find out whether photosynthesis took place in a plant, you test for presence of starch in a leaf. You cannot do the experiment now because the deadly COVID19 is keeping us out of school.

Lesson 5 – Conditions for photosynthesis

You are aware of the factors that are needed for photosynthesis i.e. the raw materials, the energy and chlorophyll. A plant has many structures; the question is where does photosynthesis take place in a plant? All green parts of a plant carry out photosynthesis because they have chlorophyll. However, it is limited photosynthesis. So most photosynthesis occurs in the leaf which is a specialised plant organ for photosynthesis. In the leaf, photosynthesis occurs specifically in the chloroplast.

In this lesson, you are going to learn how a leaf is adapted for photosynthesis. In order to understand how a leaf is adapted to photosynthesis, you need to re-examine its structure by doing an activity.

In this lesson and activity, reference will be only on the external structures of the leaf.

Materials you will need

Three leaves from different plant species.

What to do

Examine a leaf or leaves whether big or small and make relative descriptions of its structures and fill in the table below. Choose the description from the alternative choice row.

	Leaf structure	Relative description	Alternative choice list	
1	Lamina	.....	Broad	Narrow
2	Lamina	.....	Thin	Thick
3	Cuticle covering the lamina	.....	Transparent	Not transparent
4	Cuticle	.....	Not waxy	Waxy
5	Leaf stalk/petiole	Stiff	Flexible

6	Veins	Many and divided several times	Very few and they are not divided
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Use the descriptions made in the table above to fill in the table below to summarise how a leaf is adapted to photosynthesis. Choose from the following words (water, support, sunlight, food and carbon dioxide). A word or words can be used more than once.

	Leaf external feature	Adaptation/how it enables photosynthesis to take place
1.	Lamina is broad/wide and flat	This makes the leaf to provide a large surface area to absorb _____ gas and light rays from the atmosphere.
2.	Lamina is thin	This reduces the distance over which carbon dioxide gas and _____ rays diffuse to reach the cells that carry out photosynthesis.
3.	Cuticle is waxy and transparent	Being transparent allows _____ to pass and reach the chloroplast. Being waxy makes the leaf surface waterproof. This reduces _____ loss so that it is conserved for photosynthesis.
4.	Presence of stomata	These openings allow passage of _____ gas into the leaf and excess oxygen out of the leaf.
5.	Petiole	The petiole holds the lamina in the best position to receive maximum sunlight rays.
6.	Mid rib and veins	These provide _____ to the lamina. They also contain the xylem which brings water to the leaf cells and the phloem which carries away the manufactured _____ to other parts.

Summary

The plants do not depend on other organisms for food. They make their own food. Therefore, plants ensure effective photosynthesis by having specialised sites in leaves adapted for photosynthesis. When plants make food, this food sustains other living organism like animals which cannot manufacture their own food. When you eat food, your body will be health and able to resist COVID19.

CORONAVIRUS (COVID-19) PREVENTION





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