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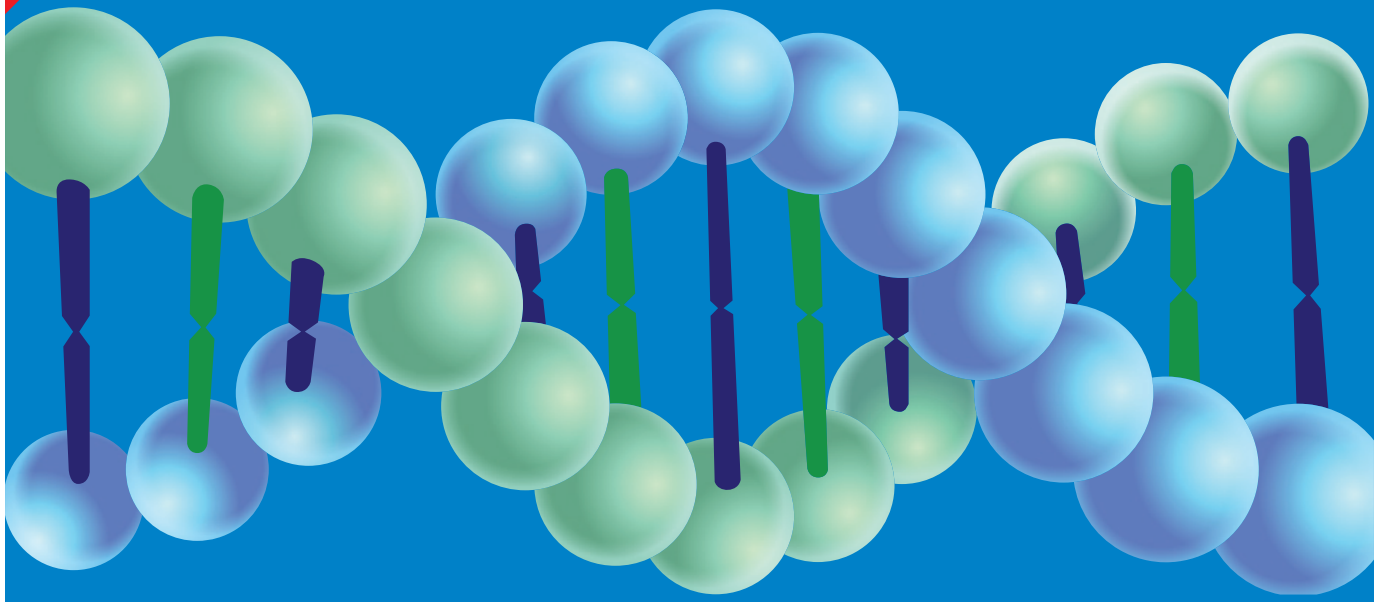

BIOLOGY TEXTBOOK

SENIOR ONE

LOWER SECONDARY CURRICULUM

PROTOTYPE

NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE

BIOLOGY TEXTBOOK

SENIOR ONE

LOWER SECONDARY CURRICULUM

Published 2020

This material has been developed as a prototype for implementation of the revised Lower Secondary Curriculum and as a support for other textbook development interests.

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CHAPTER 1

INTRODUCTION TO BIOLOGY

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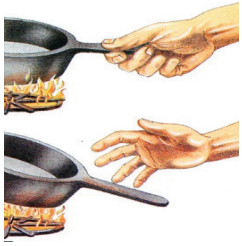

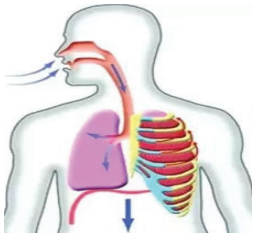

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CHAPTER 2

CELLS

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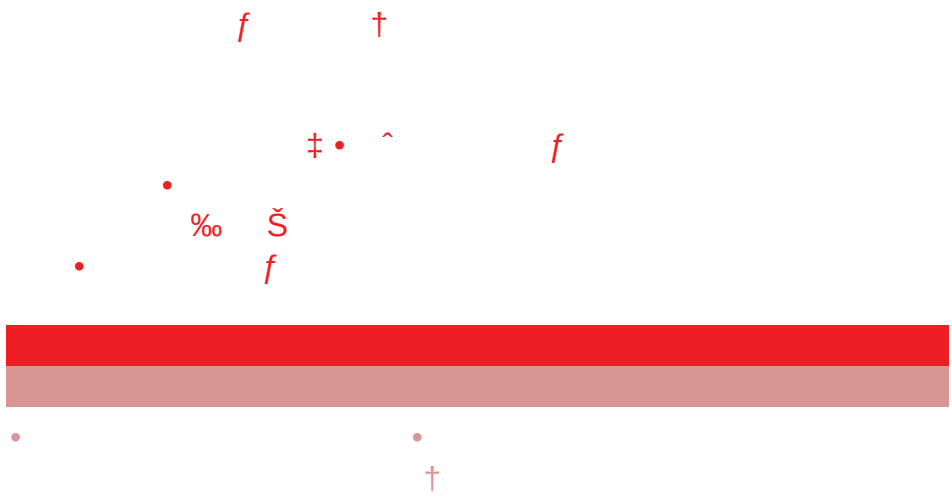

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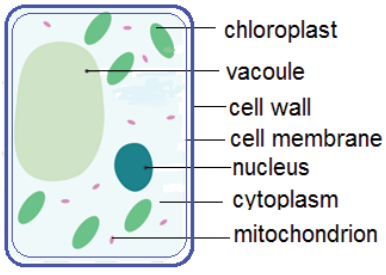

Plant cell

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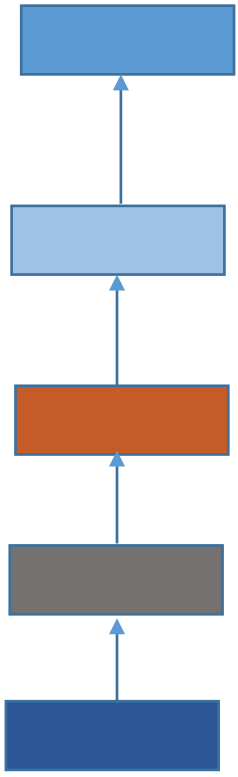

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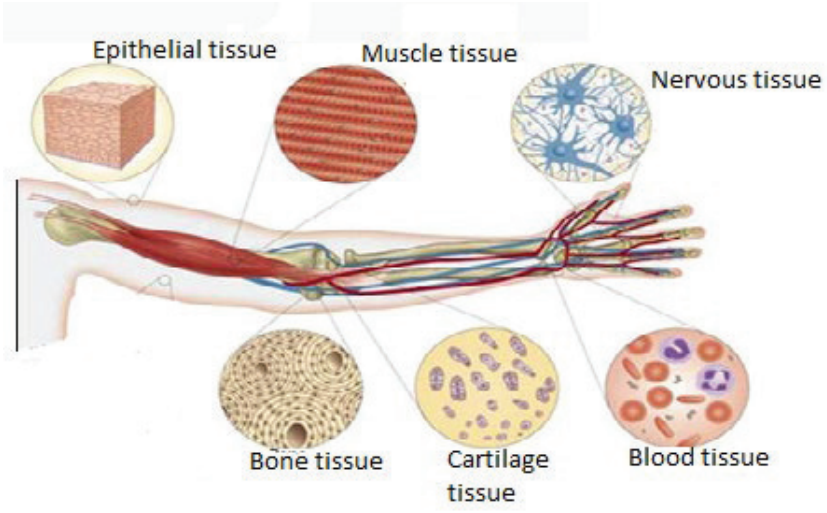
Epithelial tissue
Muscle tissue
Nervous tissue
Bone tissue
Cartilage tissue
Blood tissue

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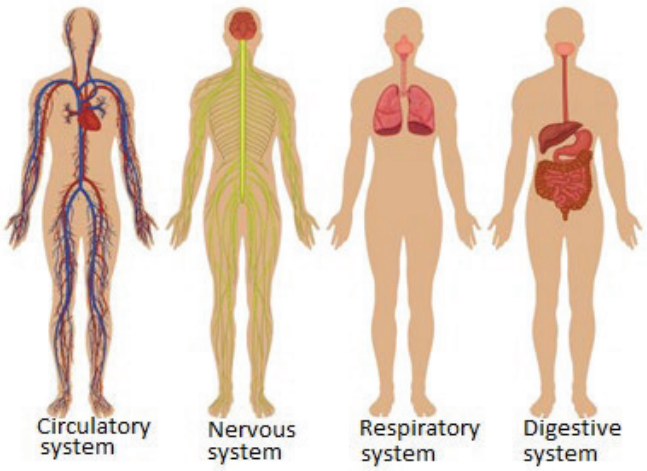
Circulatory system
Nervous system
Respiratory system
Digestive system

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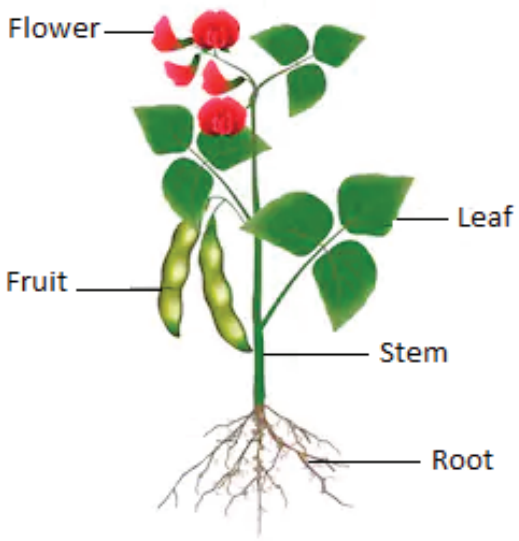

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Specialized Cells

Most of the cells in the body of an organism carryout general functions like respiration, growth and excretion. However, some cells are modified in structure to perform specific functions.

What are such cells called?

As earlier mentioned, some cells have special structures/features that enable them to carry out particular functions. In your body, a number of life processes take place, e.g. nutrition, reproduction and respiration.

For some of the life processes to be performed, specialised cells are required.

Key questions

1. What are the specialised cells in your body, and in a plant?
2. How are they adapted to their functions?

What you need

i) Notebook

ii) Pencil

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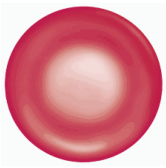

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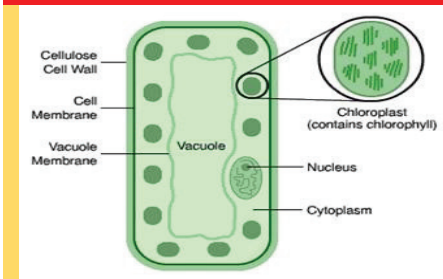
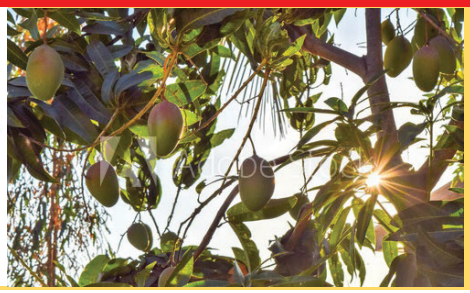
Activity of Integration





Chapter Summary

- A cell is the basic unit where most life processes take place.
- All living organisms are made up of cells.
- Cells have different shapes, sizes and structures to carryout specialized functions.
- In multicellular organisms, cells combine to form tissues that join together to form organs which group to form organ/body systems.

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CHAPTER 3

CLASSIFICATION

Key Words	By the end of this chapter, you should be able to learn:
x taxonomy x bi-nomial x monera x protoctista x fungi x bryophytes x pteridophytes x spermatophytes x arthropods x chordates x viruses	x how living organisms are grouped and the reasons why. x scientific names of living things that have two parts. x identification of the characteristics and examples of organisms in kingdom monera, protoctista and fungi. x the useful and harmful effects of bacteria, and fungi. x identification of the characteristics and examples of organisms in the plant kingdom. x identification of the characteristics and examples of organisms in the animal kingdom. x how to describe viruses, give common examples, their mode of transmission, effect on infected plants or animals and their prevention.

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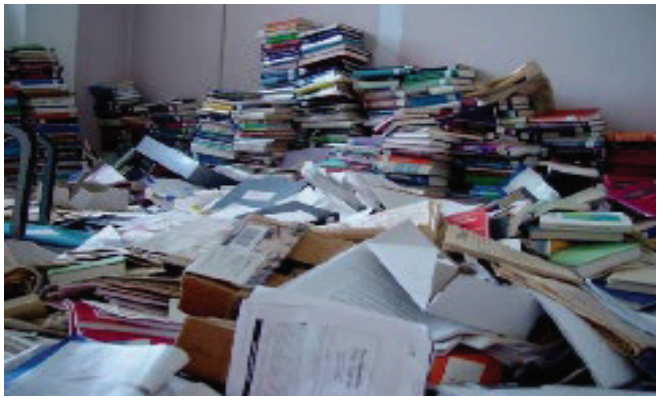
if you were given a collection of books and asked to put them into two groups. How would you do it? What characteristics would you use? Biologists use the same practice of putting things into groups of related organisms. This is called classification.

The Need to Group/Categorize Living Organisms



Key question

What you do

Imagine you are in charge of a new library and government has delivered a number of different kinds of textbooks to your school. Someone is going to put the books on shelves in the school library, and she needs instructions on how to sort them. Write, in not more than 50 words, the instructions to be followed in sorting the books so that the library users can easily get access to the books they need.

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iii) Chart with a list of words (county, village, district, continent, world, parish, country)

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Species: This is a group of organisms with similar characteristics that are able to breed freely among themselves and produce fertile offspring. This is a taxon/group with the fewest organisms.

Genus: This group consists of a number of similar or closely related species.

Family: This group is made up of closely related genera (genus-singular).

Order: This group is made up of closely related families.

Class: This group is made up of closely related orders.

Phylum: This group is made up of closely related classes.

Kingdom: This is the highest category into which organisms are classified. It consists of organisms belonging to closely related phyla (phylum-singular). This group contains the highest number of

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organisms. There are five kingdoms of living organisms today: Monera, Protoctista, Fungi, Plantae and Animalia.

The Two-Name Naming (Binomial) System of Living Organisms

Onion	Allium	cepa	Allium cepa
Man	Homo	sapiens	Homo sapiens
Housefly	Musca	domestica	Musca domestica
Butterfly	Papilio	demodocus	Papilio demodocus
Cockroach	Periplaneta	americana	Periplaneta americana
Lion	Panthera	leo	Panthera leo
Honey bee	Apis	mellifera	Apis mellifera

The binomial system is important because of the following reasons:

(i) Clarification: each organism has a unique name that is specific to that organism and can be identified.
(ii) Universal: using same name everywhere to identify the specific organism.
(iii) Education: names are short and easier to remember and learn.
(iv) Classification: organisms are more easily categorized and the categories are easier to understand.

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Exercise

The list below shows the meanings of several Latin prefixes, suffixes, or words that are frequently used in species names.
Using the information about Latin word parts, match the scientific name on the left with the correct common name on the right. Draw lines to match them. Then write each pair of names on a separate sheet of paper.

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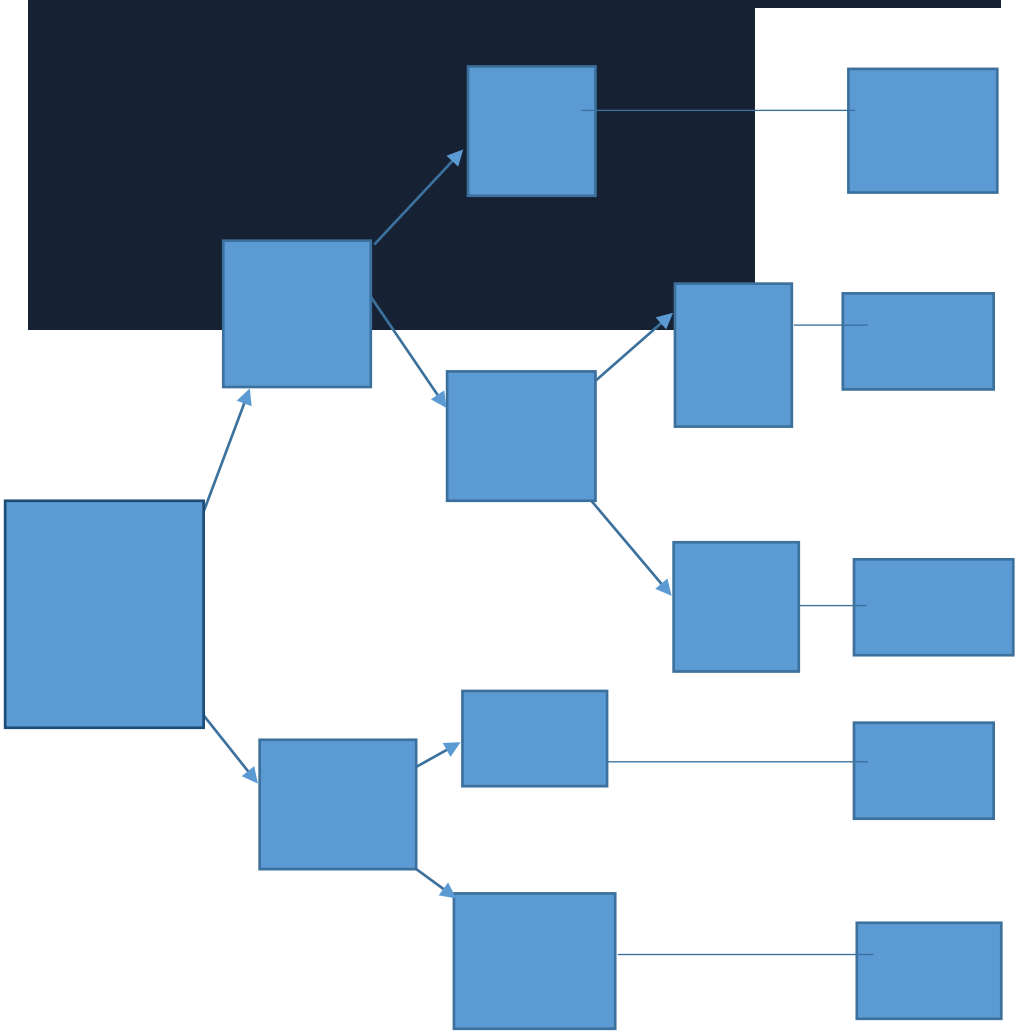
Using a Flow Chart for Biological Classification

Task: Study the flow chart shown below and answer the questions that



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The Five Kingdoms of Living Organisms

Kingdom Monera

This kingdom includes the simplest and smallest living organisms. The organisms are single-celled known as bacteria.

The bacteria have the following characteristics:

- They are unicellular (single celled) organisms
- The bacteria are grouped according to their shapes which can be rounded, coiled or rod-shaped.
- They have no true nucleus. Their genetic material is not enclosed by the nuclear membrane.

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Kingdom Protoctista

This kingdom consists of single celled and simple multicellular organisms that possess a true nucleus unlike monera.

Examples are:

1. Amoeba: does not have a permanent shape. It moves by use of pseudopodia (pseudo- means false while podia – is to do with limb). It causes dysentery in man.

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Kingdom Fungi

Kingdom fungi include mushrooms, yeast and moulds. Some fungi grow in wood and soil, and develop from tiny spores. Fungi have a nucleus and their cells have a cell wall made up of a substance known as chitin. They do not make their own food; instead feed on the decomposing organic matter of animals and plants.

You may already be aware that some types of fungi like mushrooms are grown and eaten while others like puff balls are poisonous. This informs you that fungi can be useful or harmful in nature.

Useful Aspects of Fungi

1. Fungi keep soil fertile by recycling organic material through decomposition.
2. Some fungi are food for humans, for example, mushrooms.
3. Manufacture of medicine, for example, antibiotic Penicillin

Yeast is a type of fungus used in baking of bread and brewing of beer in industries.

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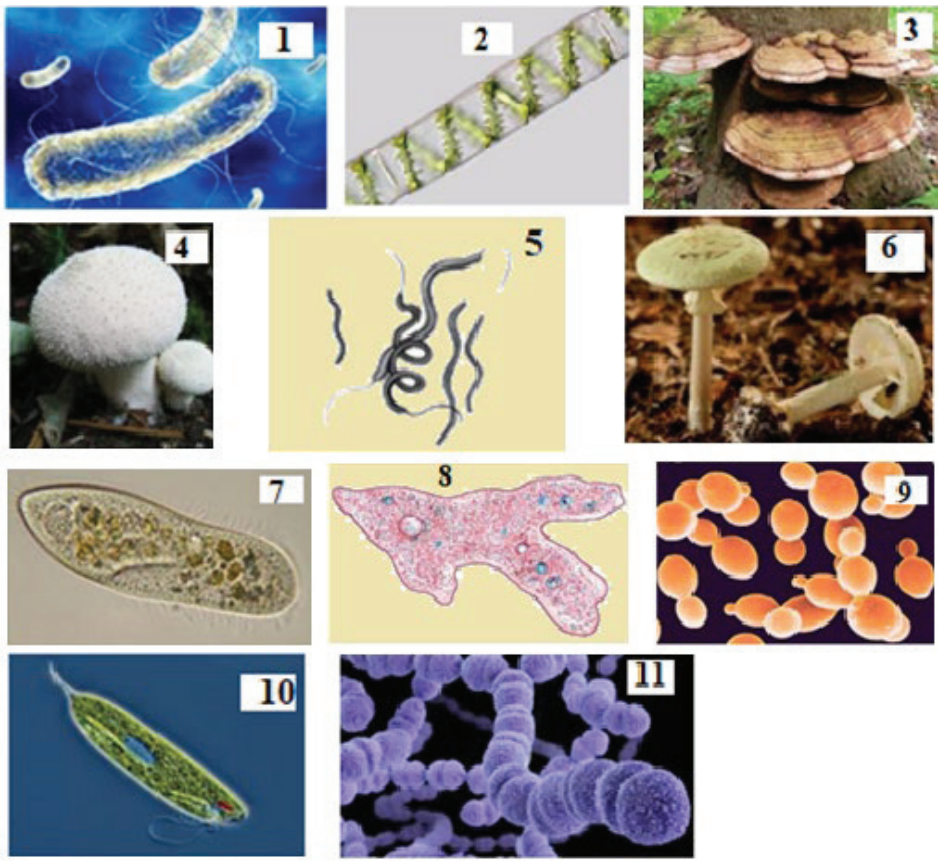

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2. Construct a flow chart for any four organisms based on the characteristics you have stated in the table above.

Project work: Making Yoghurt

In groups of 4 to 6 make yoghurt at school. Use the Internet, cookbooks or ask your teacher to assist you:

- Determine the materials to use.
- Identify the conditions.
- Develop the procedure.

Write a report including the materials used, explaining the important steps followed and the description of the product. State the living organisms involved in the process. Mention the nutrients found in yogurt and their importance to man.

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Kingdom Plantae

You have often used the word plant or plants in your conversations. Can you reflect on what organisms you have referred to as plants? You will notice that plants occur in different forms and sizes. Plants include trees, shrubs, ferns, mosses, and grasses. All plants are multi cellular. Their cells are surrounded by a cellulose cell wall and have a nucleus surrounded by a nuclear membrane. Their cells contain a green pigment known as chlorophyll that traps sunlight which the plant uses to make its own food (photosynthesis). Plants are grouped in divisions. A division is an equivalent of a phylum:

1. Non-vascular plants (Bryophytes)
2. Vascular plants (Pteridophytes and Spermatophytes)

Bryophytes

This group includes mosses, liverworts and hornworts. They are small plants that commonly inhabit shady moist places. They bear stem and leaf-like structures but no roots. They have no vascular tissue and no flowers. Bryophytes break down rocks to form soil and they

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Pteridophytes

This group includes ferns. They grow in damp shady places. They bear stems, leaves and roots. They have vascular tissues. They do not bear flowers.

Spermatophytes

This is a group of plants that bear seeds hence seed-bearing plants. These include some trees, shrubs and herbs. They have a stem, leaves, roots and a well-developed vascular system.

Spermatophytes are divided into two groups:

1. Angiosperms (flowering plants)
2. Gymnosperms

Angiosperms

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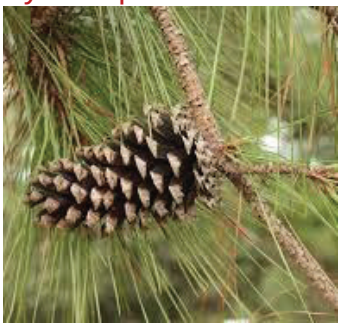
Gymnosperms



This group of plants does not bear flowers. Their seeds are not enclosed in an ovary hence these plants are sometimes referred to as “naked seed” bearing plants. They produce seeds on structures called cones. Most have needle-like leaves. Examples include pine trees, cyads and cypress.

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What you need

- Pictures or specimens (cycad, mango, papyrus, fern, water cabbage, cypress, eucalyptus, sugarcane, hornwort, clubmosses, wandering Jew)
- Group names (angiosperms, pteridophytes, gymnosperms, bryophytes)
- Characteristics of different organisms written on a chart (have roots, stems and leaves; seeds are in an ovary; have flowers; have vessels; have no flowers; have no vessels; have no roots; seeds are not in an ovary)

What to Do

1. Sort the organisms in the pictures according to their different groups using the common characteristics.

Fill in the table below.

Picture(s)	Group name	Characteristic(s)

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Kingdom Animalia

We usually tend to limit the word 'animal' to a few particular organisms leaving out others. In this unit, you are going to learn what organisms are classified as animals.

Animals are multicellular organisms. Their cells have no cell walls or chloroplasts therefore they cannot make their own food. Most animals ingest solid food and digest it internally.

The animal kingdom can be divided into 9 main groups (Phyla); eight of these groups are animals without a backbone (Invertebrates) and the other group comprises animals that have a backbone (Vertebrates).

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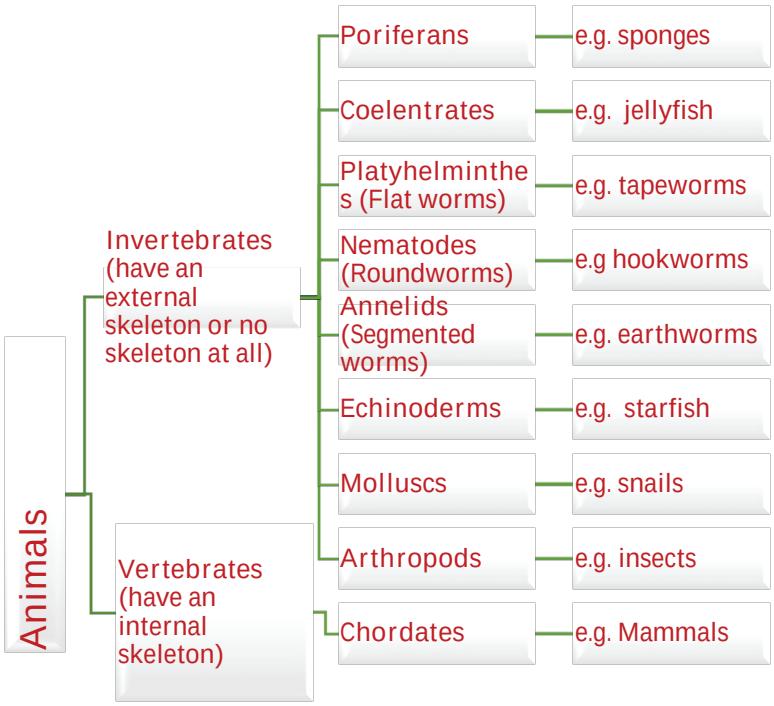

Arthropods

This is the largest phylum in the animal kingdom. They live on land, in water and in air.

They have an exoskeleton that protects their bodies and prevents them from losing excessive water. Their bodies are segmented with pairs of jointed appendages (legs and antennae). The segmented body eases movement.

Arthropods consist of four classes:

- myriapods
- crustaceans
- arachnids
- insects

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Myriapods
Examples

centipede

millipede

They have an elongated body with several segments. They have one pair of antennae. They have several legs and simple eyes.

Centipedes have one pair of legs on each body segment. They have a poison claw used to kill its prey.

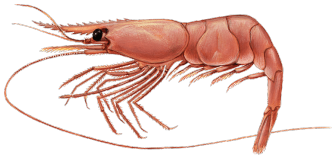
Millipedes coil when faced with danger.

Millipedes have two pairs of legs on each body segment.
They contribute to soil fertility by barrowing in soil to aerate the soil and add humus.

Crustaceans
Examples

crab

crayfish


prawn

They live in water or in damp places. They have two main body divisions i.e. fused head/thorax and abdomen. They have two pairs of antennae and two compound eyes. They have five pairs of jointed legs and in some species the front pair is modified into claws or pincers.

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Arachnids
Examples

spider tick scorpion

They have two body parts i.e. fused head/thorax and abdomen. They all have four pairs of legs. They do not have antennae or wings. They have simple eyes and breathe by book lungs. Most arachnids are predators and live on land. The tick is a parasite and transmits disease in farm animals e.g. cattle.

Insects
Examples

grasshopper cockroach butterfly housefly

Insects form the largest group in phylum Arthropoda. They can be found anywhere.
The insect's body is divided into three distinct body parts, namely; head, thorax and abdomen. They have three pairs of jointed legs on the thorax. They have a pair of compound eyes except the soldier termites. Most adults have one or two pairs of wings. Some insects are harmful or useful or both harmful and useful to other organisms.

Activity 3.5: Classifying invertebrates

What you need

Pictures or preserved specimens of the following: hook worm, tape worm, octopus, slug, jelly fish, sponge, mosquito, spider, starfish,

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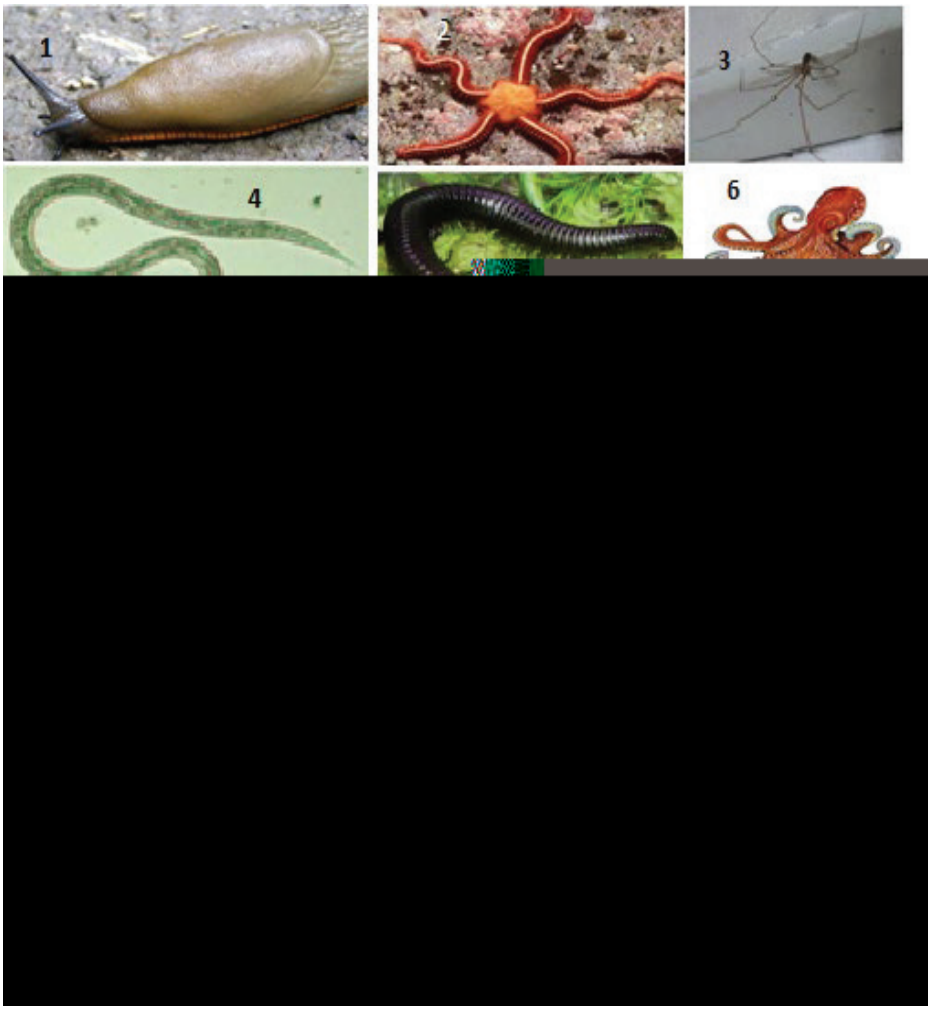

Chordates

Members of this group are also referred to as vertebrates (have a backbone). They all have an endoskeleton (inner skeleton) comprising a skull, backbone, limb bones and ribs. They have a dorsal nerve cord (spinal cord).

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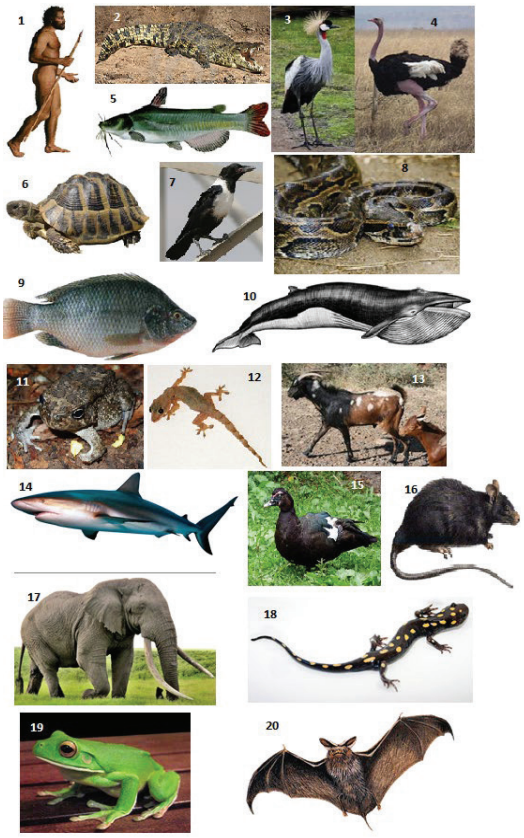

Viruses

Viruses though not living things exist in nature. Viruses are not classified under any of the five kingdoms. [redacted] and cause deadly diseases to humans, plants and other organisms, for example, AIDS, Hepatitis B and Ebola in man, Cassava Mosaic in cassava plants.

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What you need

i) Chart comparing viruses to bacteria
ii) Pen/pencil

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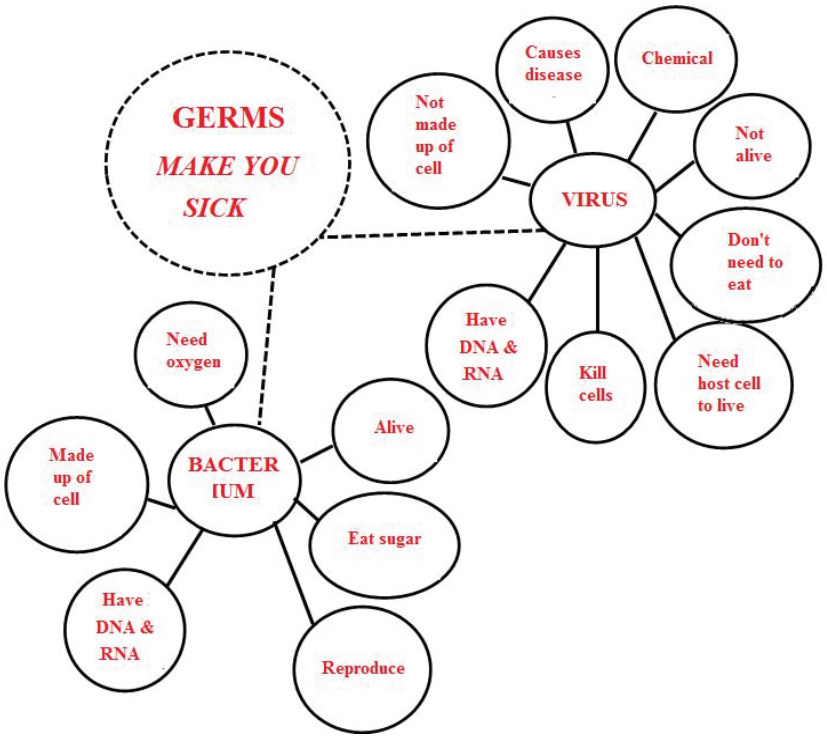

Chapter Summary

- Classification involves naming and grouping of living organisms according to characteristics.
- There are seven main levels/groups of classification. The largest group being the kingdom and the smallest is species.

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CHAPTER 4

INSECTS

Key Words	By the end of this chapter, you should be able to learn:
x dichotomous key x dorsal view x pest x methods of control	x description of the antennae, eyes, mouth parts, wings and legs of a housefly, cockroach, mosquito, termite, bee, and butterfly. x to use the observable characteristics of the different insects to construct a dichotomous key to identify each. x the beneficial and harmful aspects of a housefly, cockroach, mosquito, bee and butterfly. x identification of the different methods of controlling the harmful stages of a housefly, cockroach, mosquito and butterfly.

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External Features of an Insect

All insects have a head, thorax and abdomen. These parts bear other structures that enable the insect to function normally and live well in its environment.

Activity 4.1: Observing and drawing the back (dorsal) view of a cockroach

What you need

i) Freshly killed adult cockroach
ii) Notebook
iii) Pencil

What to do

Place (on a white background) the cockroach on its legs with the head away from you (dorsal view). Pull all the wings upwards and outwards. (Do not pluck them off).

Draw the structure of the whole cockroach.

Label the following parts: hind wing, leg, thorax, head, fore wing, abdomen, compound eye and antennae.

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The Head of an Insect

The head of an insect bears antennae, mouth parts suited to the type of food the insect feeds on and may or may not have eyes. If the insect has eyes they are either simple or compound.

Activity 4.2: Identifying the features on the head of an insect

What you need

i) Hand lens
ii) Freshly killed adult cockroach, housefly, mosquito, worker bee, butterfly and termite
iii) Notebook

What to do

Using a hand lens, observe the features of the antennae, eyes and mouth parts of the insects provided. Describe the features in the table below.

Insect	Description					
	Antennae		Eyes		Mouth parts	
Cockroach	number		number		number	
	length and shape		type		type	
	texture				shape	
Housefly	number		number		number	
	length and shape		type		type	
	texture				shape	
Mosquito	number		number		number	
	length and shape		type		type	
	texture				shape	
Worker bee	number		number		number	
	length and shape		type		type	
	texture				shape	
Butterfly	number		number		number	

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The Thorax of an Insect

The thorax of an insect bears its legs and may or may not have wings.

Activity 4.3: Identifying the features on the thorax of an insect

What you need

i) Hand lens
ii) Freshly killed adult cockroach, housefly, mosquito, worker bee, butterfly and termite
iii) Notebook

What to do

Using a hand lens observe the features of the thorax of the insects provided. Describe the features in the table below.

Insect	Description			
	Wings		Legs	
Cockroach	number		number	
	texture		texture	
Housefly	number		number	
	texture		texture	
Mosquito	number		number	
	texture		texture	
Worker bee	number		number	
	texture		texture	
Butterfly	number		number	
	texture		texture	
Termite	number		number	
	texture		texture	

1. What are the legs and wings in insects used for?
2. Did all the insects have wings? If no, which one(s) did not have and why?

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More about Insects

Cockroach	Cockroaches live in damp but warm places and are generally found in kitchens and cupboards. They are nocturnal animals hiding in holes and crevices during the day and coming out at night. They feed on plant and animal material.
Housefly	Houseflies live in warm places and are generally found everywhere around the homes. They are seen flying around during the day and hiding away at night. They feed on anything whether plant or animal material and your food left uncovered.
Mosquito	Mosquitoes live in dark and cool places. The eggs, larvae and pupa are found in ponds, slow flowing water or in

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Insect	General information

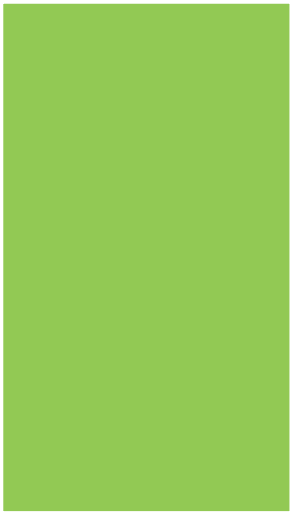
The Beneficial and Harmful Aspects of Insects

Insects have an important role they play for the existence of the rest of the organisms. This role may be positive/beneficial or it might be negative/harmful to the organism.

Activity 4.5: Finding out the helpful and harmful aspects of insects

What you need

i) markers
ii) charts/manila paper



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Methods of control

From Activity 4.3, you found out that some of the insects are pests. There are a number of ways we can control pests.

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What you need

i) markers
ii) charts/manila paper

What to do

In groups of 3 to 4, brainstorm:

i) the harmful (pest) stage in the life cycle of a cockroach, housefly, mosquito, butterfly and termite.
ii) the methods that are used to control the cockroach, housefly, mosquito, butterfly and termite in your environment.

For each insect, write down your discussion in form of a report include information on:

a) the harmful/pest stage of the insect.
b) control methods that are harmful to the environment and those that are not harmful to the environment.

Present to the rest of the class.

Activity 4.7: To create an insect trap

What you need

i) markers
ii) charts/manila paper
iii) locally available materials

What to do

In groups of 3 to 4, for any one of the insects you have studied, that is, a pest, design and make a trap using locally available materials.
Present your trap to the rest of the class explaining how it works.

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Activity of Integration

The following is an extract from a media brief on control of the Fall Armyworm in Uganda by the Minister for Agriculture, Animal Industry and Fisheries. Read the extract and answer the questions that follow.

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South Africa, Malawi, Mozambique, Namibia and Kenya. In Uganda to date, the pest has been confirmed in over 54 districts.

The pest is known to feed on more than 80 plant species, including cereals (maize, millet, sorghum, sugarcane, rice and wheat), legumes (cowpea, groundnuts and soybean), cotton and many pasture grasses (Rhodes grass, Kikuyu grass, Lucerne and other pasture grasses).

The destructive stage of the pest is the caterpillar. The caterpillar feeds aggressively on most parts of the plant including the leaves, stems of maize, sorghum, rice, Kikuyu grass, Napia grass and sugarcane crops. This feeding damage results in a reduction in both yield and grain quality.

The adult moths move in large swarms at night with each female laying up to 2000 eggs and the emerging caterpillars are aggressive feeders with the potential to destroy a hectare within 72 hours in its later stages. The moths are strong flyers, when the wind conditions are right; they are capable of covering over 2000 km per year.

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Chapter summary

- All insects have the same number of legs and body parts.
- The external characteristics of insects can be used to classify them and determine their mode of life.
- Most insects are beneficial and/or harmful to themselves, to other organisms or to the environment.

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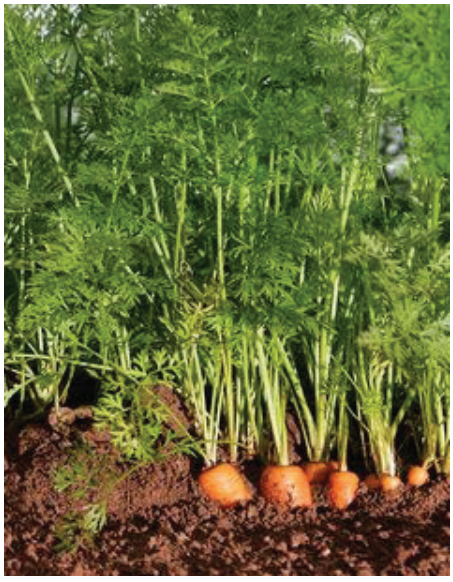
CHAPTER 5

FLOWERING PLANTS



Key Words	By the end of this chapter, you should be able to learn:
x adaptation x shoot system x monocotyledonous x dicotyledonous x leaf venation	x how to describe and outline the functions of the different observable external parts (root, stem, node, leaf, internode, bud, flower and fruit) of a typical flowering plant. x how roots, stems and leaves are adapted to their function. x classification of leaves.

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on land. The two systems are connected by vascular tissue (vessels) that run from the root through the shoot.

Parts of a Flowering Plant

Have you ever noticed any differences between plants?
Do Activities 5.1 and 5.2 given below and find out how much you really know about the flowering plant.

Activity 5.1: Identifying and comparing parts of a flowering plant

In this activity, you will explore the monocotyledonous and dicotyledonous plants and appreciate that the two plants have similar structures of different forms.

What you need

i) a dicotyledonous plant e.g. a bean plant
ii) a monocotyledonous plant e.g. maize plant
iii) notebook
iv) pen/pencil

What to do

1. In your groups observe the plants provided carefully; draw and label the parts of the plant.

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that are used as food in your community.

What you need

i) cabbage, water melon, bamboo shoot, sugar cane, irish potato, pumpkin, carrot, spinach, onion, lettuce, tomato, groundnuts, cassava, sweet potato, maize, yam, garlic
ii) notebook
iii) pen/pencil

What to do

i) Choose a partner to work with.
ii) Study each plant part provided carefully.
iii) For each of the plant parts used as food in your community, state whether they are fruits, leaves, stems or roots.
iv) Fill the information in the table below.

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3. Adventitious roots. Some plants have roots that originate above ground from stems or leaves but not roots and are called adventitious roots. They include the prop roots of corn/maize and certain other

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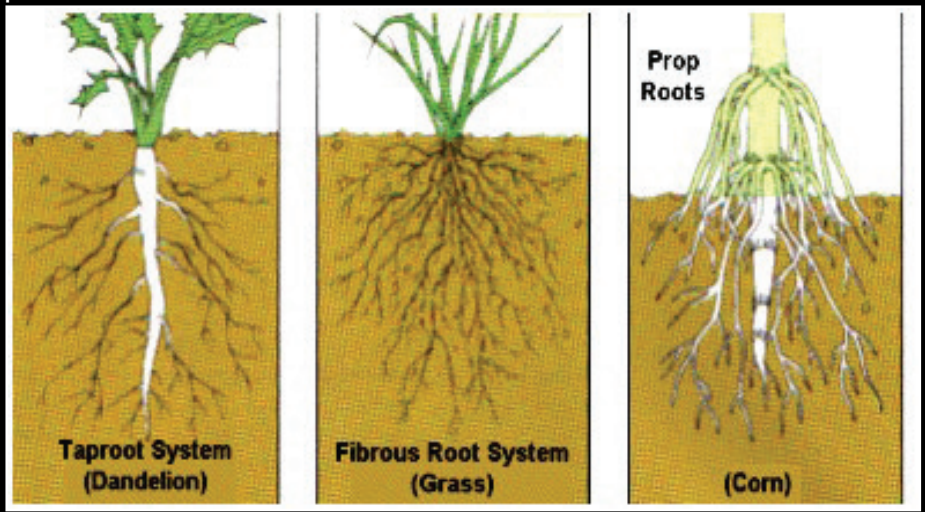
plants.


Taproot System
(Dandelion)
Fibrous Root System
(Grass)
Prop
Roots
(Corn)

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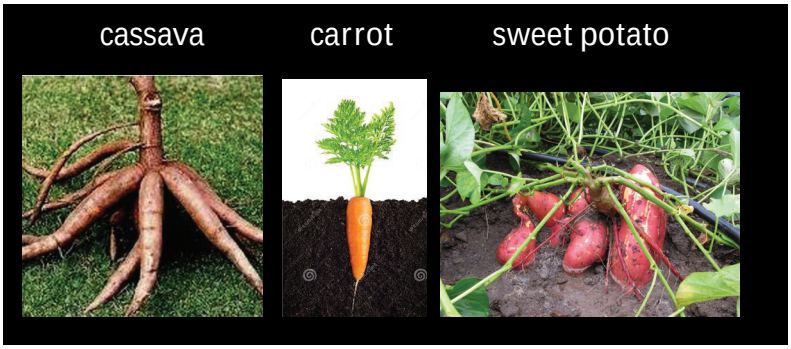
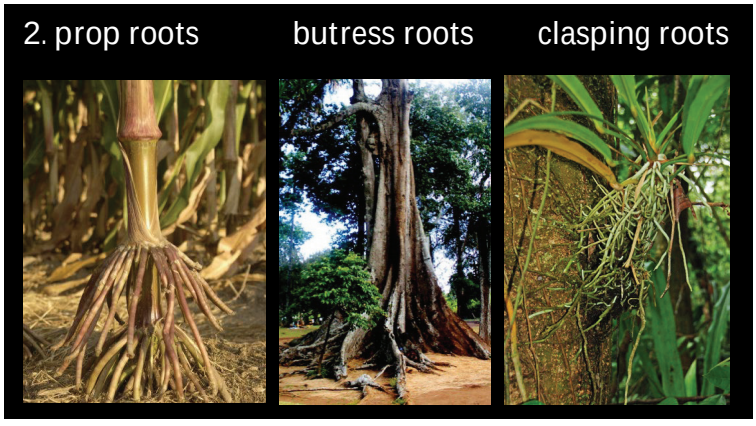

cassava
carrot
sweet potato


2. prop roots
butress roots
clasping roots

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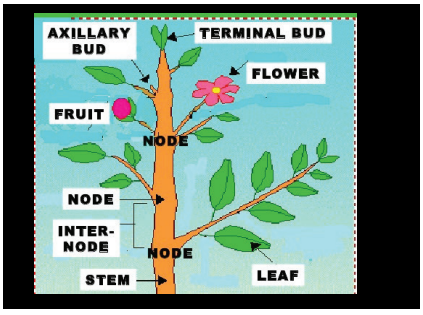
The stem makes up the largest part of some kinds of plants. For example, the trunk, branches, and twigs of trees are all stems. Other plants, such as cabbage and lettuce, have such short stems and large leaves that they appear to have no stems at all. The stems of plants, like potatoes, grow partly underground. Stems above the ground are either hard and woody or soft as herbs.



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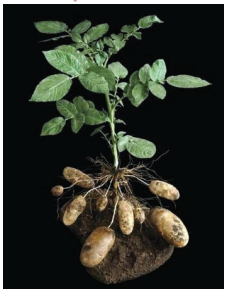
Vegetative reproduction is a form of reproduction that involves formation of new young plants from other parts of the parent plant except the flowers.

In this activity, you will observe pictures of modified stems. You may be familiar with some of the plants from which they were obtained.

What you need

Pictures of:

1. sugarcane stem	irish potato stem tuber	ginger rhizome
		

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