

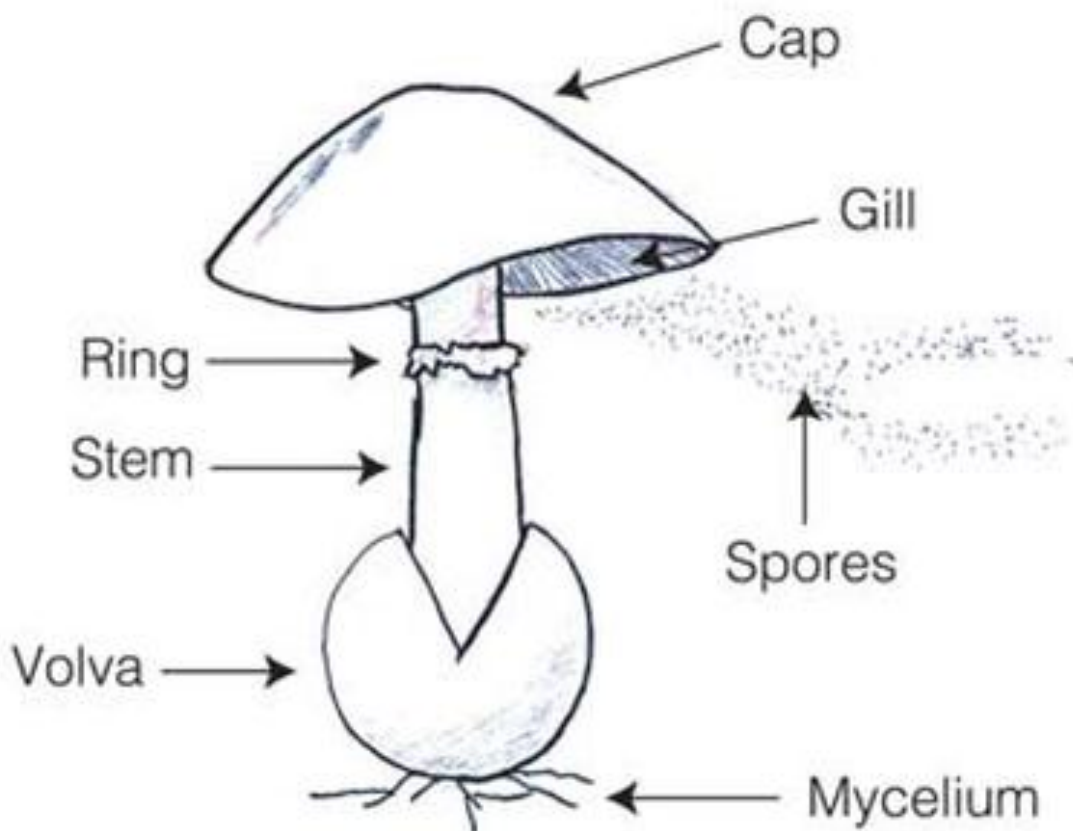


# Atika School

Free Online Academy

PRESENTS KCSE BIOLOGY NOTES

## TOPIC 7: CLASSIFICATION II



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## Classification II

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### General Principles of Classification

- ✓ Classification is the science that puts organisms into distinct groups to make their study easy and systematic.
- ✓ Modern scientific classification is based on structure and functions.
- ✓ Organisms with similar anatomical and morphological characteristics are placed in one group while those with different structures are grouped separately.
- ✓ Modern studies in genetics and cell biochemistry are used to give additional help in classifying organisms.
- ✓ There are seven major taxonomic groups.
- ✓ The kingdom is the largest group.
- ✓ Others are phylum (division for plants) class, order, family, genus and species, the smallest.

### Binomial Nomenclature

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- ✓ Living organisms are named using Latin or Latinised names.
- ✓ Every organism has two names.
- ✓ This double naming is called binomial nomenclature.
- ✓ This system of naming was devised by Carolus Linnaeus in the 18th Century.
- ✓ The first name is the generic name - the name of the genus.
- ✓ The second name is the name of the species.
- ✓ The generic name starts with a capital letter while that of the species starts with a small letter.
- ✓ The names are written in italics or are underlined in manuscripts.

#### *Examples:*

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- ✓ Bean =Phaseolus vulgaris.
- ✓ Phaseolus is the generic name,



- ✓ vulgaris is specific name.
- ✓ Dog =Canis familiaris.
- ✓ Canis is the generic name
- ✓ ,familiaris the specific name.

## General Characteristics of Kingdoms

*Organisms are classified into five kingdoms.*

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- ✓ Monera,
- ✓ Protoctista,
- ✓ Fungi,
- ✓ Plantae
- ✓ Animalia.

**Viruses do not fit neatly into any of the above kingdoms.**

- ✓ They are simple and not cellular.
- ✓ They are metabolically inactive outside the host cell.
- ✓ Most of them can be crystallised like chemical molecules.
- ✓ Therefore they do not exhibit the characteristics of living organisms.

Characteristics	Monera	Protoctista	Fungi	Plantae	Animalia
<b>Cell type</b>	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
<b>Unicellular multicellular</b>	Unicellular	Unicellular and multicellular	Unicellular and multicellular	Multicellular	Multicellular
<b>Mode of feeding</b>	Autotrophic or heterotrophic by absorption	Autotrophic or heterotrophic by absorption or phagocytosis	Heterotrophs by absorption	Autotrophs	Heterotrophic by ingestion
<b>Reproduction</b>	Asexual by binary fission	Asexual binary fission, fragmentation, sporulation	Asexual fission, fragmentation, sporulation	Asexual by sporulation and fragmentation, sexual	sexual



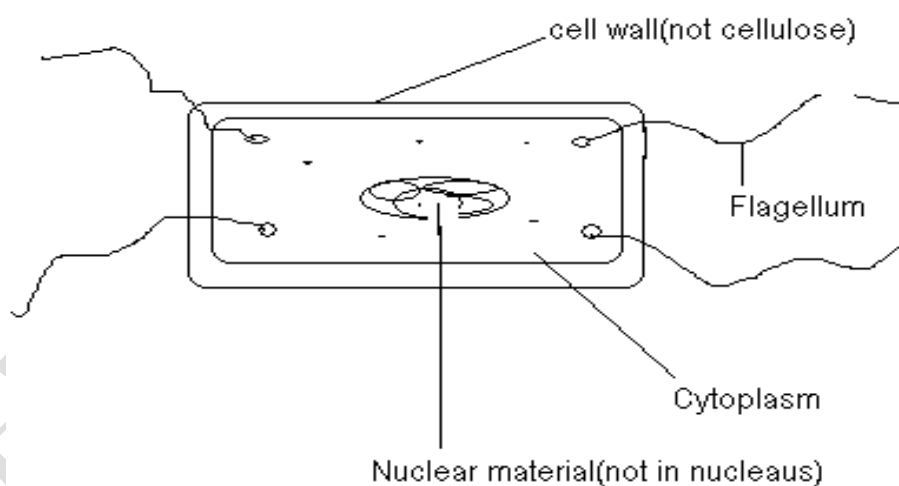
## Examples of Organisms in Each Kingdom and Their Economic Importance

### Kingdom Monera

#### General Characteristics

- ✓ Unicellular and microscopic
- ✓ Some single cells, others colonial
- ✓ Nuclear material not enclosed within nuclear membrane-prokaryotic
- ✓ Have cell wall but not of cellulose.
- ✓ Have few organelles which are not membrane bound
- ✓ Mitochondria absent
- ✓ Mostly heterotrophic, feeding saprotrophically or parasitically, some are autotrophic.
- ✓ Reproduction mostly asexual through binary fission
- ✓ Most of them are anaerobes but others are aerobes
- ✓ Most move by flagella

A generalised drawing of a bacterium



- ✓ Examples include *Escherichia coli*, *Vibrio cholerae* and *Clostridium tetani*.
- ✓ Spherical known as Cocci.
- ✓ Rod shaped - e.g. *Clostridium tetani*
- ✓ Spiral shaped e.g. spirilla



- ✓ Coma shaped- Vibrios -e.g., Vibrio cholerae.

***Economic importance of bacteria Benefits to man include:***

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- ✓ They are used in food processing e.g., Lactobacillus used in processing of cheese, yoghurt.
- ✓ Involved in synthesis of vitamin Band K, in humans and breakdown of cellulose in herbivores.

### **Genetic Engineering**

- ✓ Bacteria are easily cultured and are being used for making antibiotics, amino acids and enzymes e.g. amylase, and invertase e.g. Escherichia coli.

### **Nutrient cycling:**

- ✓ Saprophytes
- ✓ They are involved in decomposition of dead organic matter.
- ✓ They are useful in the nitrogen cycle.
- ✓ Nitrogen fixing and nitrifying bacteria.
- ✓ They increase soil fertility.
- ✓ Modern sewage works use bacteria in treatment of sewage.
- ✓ Cleaning oil spills in oceans and lakes.

### **Harmful Effects**

- ✓ Bacteria cause disease:
- ✓ To humans (e.g. Cholera).
- ✓ To animals (e.g. Anthrax).
- ✓ Bacteria cause food spoilage.
- ✓ Others cause food poisoning e.g. Salmonella.
- ✓ Denitrifying bacteria reduce soil fertility e.g., Pseudomonas denitrificans.



## Kingdom Protocista

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### *Examples include;*

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- ✓ Algae such as spirogyra, Chlamydomonas, euglena, Sargassum
- ✓ And protozoa such as amoeba, paramecium and Trypanosoma.

### General Characteristics

- ✓ They are said to be eukaryotic since their nucleus is bound by a membrane
- ✓ Most are mobile, and use flagella, cilia and pseudopodia.
- ✓ Some are sessile.
- ✓ They reproduce mainly asexually, by binary fission, fragmentation and sporulation.
- ✓ Some reproduce sexually by conjugation.
- ✓ Some are heterotrophic e.g. paramecium.
- ✓ Others are autotrophic e.g. spirogyra.

### Economic importance of protocista

- ✓ Algae are the primary producers in aquatic food chains.
- ✓ They release a lot of oxygen to the atmosphere.
- ✓ Some cause human diseases like malaria and amoebic dysentery, sleeping sickness
- ✓ Some are source of food for humans e.g. sargassum is a source of iodine
- ✓ Skeletons of diatoms used in paint making.

### Spirogyra:

- ✓ They have spiral chloroplast.
- ✓ They are green, thread-like filaments



## Chlamydomonas:

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- ✓ This is a unicellular green algae and has a cup shaped chloroplast.
- ✓ They move towards light using the flagella
- ✓ Cilia assist the organism to move.
- ✓ The shape is due to the presence of a thin flexible pellicle.

## Kingdom Fungi

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- ✓ Multicellular fungi are made of thread-like structures called hyphae (singular hyphae) that form a mycelium. .e.g.Saccharomyces cereviseae(bread yeast).
- ✓ Others include Penicillium, Rhizopus, and edible mushroom

## Economic Importance of Fungi

### Beneficial Effects

- ✓ Some fungi are used as food e.g. mushrooms.
- ✓ Some are decomposers which enhance decay to improve soil fertility - recycling of nutrients e.g., toadstools.
- ✓ Some are useful in brewing and bread making e.g., yeast. Yeast is used as food - a rich source of Vitamin B.
- ✓ Some are useful in production of antibiotics e.g. Penicillium griseofulvin.
- ✓ Used in sewage treatment e.g., Fusarium spp.

### Harmful Effects

- ✓ Some cause food poisoning by producing toxic compounds e.g. Aspergillus flavus which produces aflatoxins.
- ✓ Some cause food spoilage, fabric and wood spoilage through decomposition.
- ✓ Some cause diseases to humans e.g., athlete's foot and ringworms.
- ✓ Others cause diseases to plants e.g., potato blight (Irish potatoes) rust in tomatoes and smuts in cereals.



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## Kingdom Plantae

### General Characteristics

- ✓ They are multicellular and eukaryotic.
- ✓ They are photosynthetic and have a pigment chlorophyll.
- ✓ Their cells have cellulose cell walls.
- ✓ They reproduce sexually, others asexually.
- ✓ Kingdom Plantae has three major divisions:
  - Bryophyta,
  - Pteridophyta
  - Spermatophyta.

### Division Bryophyta

- ✓ These include mosses and liverworts.
- ✓ Plant body is not differentiated into root, stem and leaves.
- ✓ They have simple structures which resemble leaves and stems.
- ✓ They have rhizoids for absorbing water and anchoring the plant to substratum.
- ✓ Life cycle consists of two morphologically different plants, the gametophyte and sporophyte.
- ✓ The two alternate.
- ✓ They show alternation of generations.
- ✓ The gamete producing gametophyte is the persistent plant.
- ✓ The sporophyte is attached to the gametophyte and is nutritionally dependent on it.
- ✓ They lack vascular system.
- ✓ Sexual reproduction is dependent on water.





## Division Pteridophyta:

- ✓ These include ferns and horsetails.
- ✓ General Characteristics
- ✓ They have root and shoot system.
- ✓ Leaves are compound known as fronds, they have a vascular system.
- ✓ They show alternation of generations whereby the spore bearing sporophyte is the main plant.
- ✓ Spores are borne in clusters on the underside of leaves making sori.
- ✓ The gametophyte is an independent minute structure called prothallus which is short lived.
- ✓ Sexual reproduction is dependent on water.

## Division Spermatophyta

These are the seed bearing plants.

### General Characteristics

- ✓ Plant body is differentiated into root, stem and leaves.
- ✓ Vascular tissue consists of xylem and phloem.
- ✓ Sexual reproduction is independent of water.
- ✓ Male gametophyte (pollen grain) germinates and grows to reach female gametophyte.
- ✓ They are divided into two sub-divisions:
  - Gymnosperms
  - Angiosperms.

### Gymnosperms

- ✓ These are cone-bearing plants.
- ✓ Naked seeds.
- ✓ They are trees and shrubs.
- ✓ Xylem consists of tracheids only.



- ✓ Examples; pine, cypress and spruce.
- ✓ They show xerophytic characteristics like having needle-like leaves.

## Angiosperms

- ✓ Seeds are enclosed within a fruit.
- ✓ They comprise trees, shrubs and herbs.
- ✓ Xylem consists of vessels of tracheids.
- ✓ These are the most advanced plants.
- ✓ Angiosperms has two classes;
  - Monocotyledonae
  - Dicotyledonae.

## Comparison of Dicotyledonae and Monocotyledonae

Dicotyledonae	Monocotyledonae
Embryo has two cotyledons	Embryo has one
Leaves are broad and have network of veins.	Embryo has one cotyledon.
T.S. of root has no pith.	Leaves are long with parallel veins (have leaf sheath)
Have tap root system	T.S. of root has pith.
Cross section of stem reveals vascular bundles arranged in a ring	Have fibrous root system.
Vascular cambium present and have secondary growth	Cross section of stem reveals vascular bundles scattered all over.
Flower parts in four, five or multiples of these	Vascular cambium absent and do not have secondary growth.
Examples: herbs e.g. tomatoe; shrubs e.g. tea, hibiscus, lantana	Flower parts in three or multiples of three
	Examples: grass, wheat, sugar-cane.

## Economic Importance of Spermatophyta

- ✓ They are a source of food for humans and other animals.
- ✓ Source of fuel- wood fuel and charcoal.
- ✓ Source of timber for building and for paper.
- ✓ Ornamental plants.
- ✓ Useful in textile industry.



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## Kingdom Animalia

Most animals move from place to place in search of food.

*Major phyla are:*

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1. Platyhelminthes (Tapeworm).
2. Nematoda (Ascaris).
3. Annelida (Earthworm).
4. Mollusca (Snails).
5. Arthropoda
6. chordata

## Phylum Arthropoda

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### Distinguishing Characteristics

- ✓ They have jointed appendages, which are specialised for various functions.
- ✓ Their body is covered by a hardened exoskeleton made of chitin.
- ✓ It is shed at intervals to allow for growth.
- ✓ They have jointed body parts.
- ✓ Most are divided into head, thorax and abdomen.
- ✓ Some have two body parts,

### General Characteristics

- ✓ Body is segmented.
- ✓ They have bilateral symmetry.
- ✓ Gaseous exchange is through tracheal system, book lungs or gills which opens to the outside through spiracles.
- ✓ Aquatic forms use gills.
- ✓ Reproduction is mainly sexual.



- ✓ They have an open circulatory system.

*Phylum Arthropoda divided into five classes;*

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- a) Crustacea,
- b) Arachnida,
- c) Chilopoda,
- d) Diplopoda
- e) Insecta

*This division is based on:*

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- ✓ The number of limbs.
- ✓ Presence and number of antennae.
- ✓ Number of body parts.

## **Class Crustacea**

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Most of them are aquatic, a few are terrestrial found in moist places e.g., woodlouse.

### **Distinguishing Characteristics**

- ✓ Two body parts head and thorax are fused to form cephalothorax and an abdomen.
- ✓ They have two pairs of antennae; one is small and branched, the other is long.
- ✓ They have five or more parts of limbs.
- ✓ Some of these are modified for other functions e.g., locomotion, feeding and defence.
- ✓ Exoskeleton hardened with deposits of calcium carbonate i.e. carapace.

### **Other Characteristics**

- ✓ Mouthparts include a pair of mandibles and two pairs of maxillae.
- ✓ Gaseous exchange is through gills.
- ✓ They have a pair of compound eyes.
- ✓ Most crustaceans are free-living but a few are parasitic e.g., barnacles.



- ✓ Examples are Cray-fish and crab.

## Class Arachnida

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Members are carnivorous and paralyse prey using poison produced from poison claws.

### Distinguishing Characteristics

The body has two parts: cephalothorax and abdomen.

Cephalothorax is head fused to thorax.

A pair of chelicerae, on ventral side of cephalothorax.

They have four pairs of walking legs.

They have no antennae.

Instead they have a pair of short pedipalps which are sensitive to touch.

Most arachnids use book lungs for gaseous exchange.

Other characteristics include simple eyes.

*Examples include garden spider, ticks, and scorpions.*

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## Class Chilopoda

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e.g. Centipede

### Distinguishing Characteristics

- ✓ The body has 2 body parts, a head and trunk.
- ✓ The body is elongate, and has 15 or more segments.
- ✓ Has a pair of legs on each segment.
- ✓ The body is dorso-ventrally flattened.

*Other characteristics include:*

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- ✓ Head has a pair of antennae.
- ✓ Gaseous exchange through tracheal system.
- ✓ Are carnivorous.

## Class Diplopoda

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E.g. Millipede

### Distinguishing Characteristics

- ✓ Has two parts: head, short thorax and a trunk.
- ✓ Body elongate with 9-100 segments.
- ✓ Has two pairs of legs on each segment.
- ✓ They have a cylindrical body.
- ✓ Gaseous exchange is by tracheal system.

*Other characteristics:*

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- ✓ Head has a pair of antennae.
- ✓ Are herbivorous.

## Class Insecta

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- ✓ Distinguishing Characteristics
- ✓ Body is divided into three body parts head, thorax and abdomen.
- ✓ They have three pairs of legs.
- ✓ Most insects have a pair or two of wings.

*Other characteristics include:*

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- ✓ A pair of antennae.
- ✓ They breathe through spiracles, and gaseous exchange is through tracheal system.



*The class is divided into several orders based on:*

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- ✓ Mouth parts- - type e.g. biting or piercing.
- ✓ Position of mouthparts - ventral or anterior.
- ✓ Wings - presence or absence; number of wing types, structure, texture.
- ✓ Size of legs.

### **Order Orthoptera**

- ✓ Have biting and chewing mouthparts.
- ✓ Hind legs longer than other legs e.g. fore wings, leathery and longer than hind legs. E.g. locusts and grasshoppers.
- ✓ Swarming - locusts are a menace to farmers and the environment as they destroy crops and vegetation.

### **Order Diptera**

- ✓ True flies e.g. houseflies, and mosquitoes have sucking and piercing mouthparts, 1 pair of wings.
- ✓ The second pair is vestigial- acts as balancer.
- ✓ Mouthparts are ventral.
- ✓ These are disease vectors e.g., female anopheles mosquito transmits malaria.

### **Order Lepidoptera**

- ✓ Butterflies and moths have sucking mouthparts,
- ✓ Two pairs of wings covered by scales.
- ✓ This group is important to farmers in pollination.



## Order Hymenoptera

- ✓ Bees, wasps, ants.
- ✓ They have sucking mouthparts, two pairs of wings which are membranous.
- ✓ Some are non-winged e.g. some ants.
- ✓ Bees are important in pollination i.e. in production of honey.

## Order Isoptera - Termites

- ✓ They have biting mouthparts which are anterior.
- ✓ Most are wingless,
- ✓ Those with wings they are membranous and of the same size.
- ✓ They are important in nutrient cycling as they feed on cellulose.

## Order Coleoptera - Beetles

- ✓ Have biting mouthparts,
- ✓ Two pairs of wings,
- ✓ Fore wing hardened enclosing membranous wings.
- ✓ Destruction of stored grains and legumes (pulses)

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## Phylum Chordata

- ✓ This name is derived from the term notochord.
- ✓ This is a long flexible rod-like structure.
- ✓ The more familiar chordates are known as vertebrates.
- ✓ In vertebrates the notochord exists only in embryonic stages of development which in later stages is replaced by a vertebral column.





## Main Characteristics of Vertebrates

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- ✓ Members of the phylum have a notochord in early stages of development.
- ✓ They have visceral clefts - which are slits perforating the body wall at the pharynx.
- ✓ In fish these slits become gills while in higher chordates these slits are only present in embryo.
- ✓ They have a dorsal, hollow nerve cord.
- ✓ It develops into a brain at the anterior and spinal cord at the posterior end.
- ✓ The spinal cord is enclosed within the vertebral column.
- ✓ They have segmented muscle blocks known as myotomes on either side of the body.
- ✓ They possess a post-anal tail although rudimentary in some.
- ✓ They have a closed circulatory system.
- ✓ The heart is ventrally located.
- ✓ They possess an internal skeleton.

*The main classes of phylum chordata are;*

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- a) Pisces,
- b) Amphibia,
- c) Reptilia,
- d) Aves
- e) Mammalia.

### Class Pisces

- ✓ These are the fishes.
- ✓ Some fish have a skeleton made of cartilage e.g. the shark.
- ✓ Others like Tilapia have a bony skeleton.

### Distinguishing Characteristics

- ✓ They are aquatic.
- ✓ Movement is by means of fins.



- ✓ They have a streamlined body.
- ✓ They have a lateral line for sensitivity.
- ✓ Their heart has two chambers, the auricle and ventricle - simple circulatory system.

### **Other Characteristics**

- ✓ Their body temperature changes according to the temperature of the environment.
- ✓ They are ectothermic (poikilothermic).
- ✓ Body covered with scales.
- ✓ They have gills for gaseous exchange.
- ✓ Exhibit external fertilisation.

## **Class Amphibia**

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- ✓ Larval forms are aquatic while adults are terrestrial.
- ✓ Adults return to water for breeding e.g. frogs, toads, newts, salamanders.

### **Distinguishing Characteristics**

- ✓ Skin is soft and without scales.
- ✓ They have four well developed limbs.
- ✓ The hind limbs are longer and more muscular than forelimbs.
- ✓ The limb can be used for walking, jumping and swimming
- ✓ Gaseous exchange is through the skin, gills and lungs.
- ✓ Middle ear is present.

### **Other Characteristics**

- ✓ They have a three-chambered heart with two atria and one ventricle.
- ✓ Fertilisation is external.
- ✓ They are ectothermic (poikilotherms).



## Class Reptilia

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Examples are snakes, crocodiles, lizards, chameleons, tortoises and turtles.

### Distinguishing Characteristics

- ✓ The skin is dry and is covered by horny scales.
- ✓ Fertilisation is internal.
- ✓ Some species eggs contain a lot of yolk and have either leathery or calcareous shells.
- ✓ They have a double circulatory system.
- ✓ The heart has three chambers - two atria and a partly divided ventricle.
- ✓ However crocodiles have a four chamber heart.

### Other Characteristics

- ✓ They are ectothermic (poikilothermic).
- ✓ Have 2 pairs of limbs.
- ✓ They use lungs for gaseous exchange.

## Class Aves

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- ✓ These are birds.
- ✓ They are terrestrial and arboreal and others are aquatic e.g. flamingo, goose, ostrich, penguin, hawk, dove.

### Distinguishing Characteristics

- ✓ Body is covered by feathers and legs with horny scales.
- ✓ They have two pairs of limbs.
- ✓ Fore limbs modified to form wings for flight.
- ✓ Hind limbs are for walking or swimming.
- ✓ The mouth is a protruding beak.
- ✓ They have hollow bones.
- ✓ They have double circulation with a four-chambered heart (2 atria, 2 ventricles).



- ✓ They have lungs for gaseous exchange.
- ✓ Lungs are connected to air sacs in bones.
- ✓ Fertilisation is internal.
- ✓ They lay eggs with calcareous brittle shell.
- ✓ They have constant body temperatures hence are homoiotherms (endothermic).

## Class Mammalia

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- ✓ They are arboreal e.g. tree-squirrels,
- ✓ Others terrestrial e.g. humans
- ✓ Others are aquatic e.g. dolphins and whales.

### Distinguishing Characteristics

- ✓ They have mammary glands hence name of the class.
- ✓ Body is covered with fur or hair.
- ✓ Their teeth are differentiated into four types (heterodont dentition).
- ✓ They have external ear-pinna.
- ✓ Most have sweat glands.
- ✓ They have a diaphragm that separates the body cavity into thoracic and abdominal.

### Other Characteristics

- ✓ Internal fertilisation - most give birth.
- ✓ They have a double circulatory system with a four-chambered heart.
- ✓ They are endothermic (homoiotherms). Eg Duck-billed Platypus (egg-laying mammal)  
e.g.Kangaroo (pouched mammal)
- ✓ The young are born immature and are nourished in a pouch with milk from mammary glands.

### Placental Mammals

- ✓ They give birth to fully develop young ones which are fed on milk from mammary glands.



- ✓ Some are aquatic. E.g. dolphins, whale,
- ✓ Others are flying e.g., bat;
- ✓ Most are terrestrial e.g. rabbits, elephants, buffalo, giraffe, antelope, cow, human being.

***Placental mammals are divided into various orders:***

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- a) **Rodentia:** e.g. rats, mice - have one pair of upper incisors.
- b) **Insectivora:** e.g. mole - they are like rodents:
- c) **Carnivora:** e.g. dog; lion - flesh eaters, they have long pointed canines.
- d) **Cetacea:** e.g. whales and dolphins Aquatic mammals. Forelimbs are flippers.
- e) **Chiroptera:** e.g. bats - Forelimbs form wings.
- f) **Artiodactyla:** e.g. antelopes, cattle - they are even toed with split hooves.
- g) **Perissodactyla:** e.g. horse, donkey - they are odd toed with hooves.
- h) **Proboscidea:** e.g. elephant - upper lip and nose elongated to form trunk.
- i) **Lagomorpha:** e.g. rabbit, hare - mammals with upper and lower incisors. Have larger hind legs than forelegs.
- j) **Primata:** e.g. gorilla, orang utan, chimpanzee, monkeys - some are arboreal, with hand and foot for grasping.
- k) **Human** - Homo sapiens - upright gait, opposable thumb hence use of tools.

### **Construction and Use of Dichotomous Keys**

- ✓ Biological keys are sets of statements that act as clues leading to the identification of an organism.
- ✓ By following the keys we can be able to place an organism in its group.
- ✓ The most common key is the dichotomous key.
- ✓ This is a biological tool for identification of unknown organisms.
- ✓ The word dichotomous means branching into two.
- ✓ A single characteristic is considered at a time.



- ✓ Two contrasting statements are put forward to describe the characteristics in such a way as to separate the organisms.
- ✓ This continues until all the organisms have been identified.

### Rules Used to Construct a Dichotomous Key

- a) Use morphological characteristics as far as possible e.g. type of leaf - simple or compound.
- b) Select a single characteristic at a time and identify it by number. 1. Type of leaf. .
- c) Use identical forms of words for two contrasting statements e.g.:
  - a. Flowers scented.
  - b. Flowers not scented.
- d) Start with a major characteristic that divide the organisms into two large groups then proceed to lesser variations that would separate the organisms further into smaller groups.
- e) Use positive statements especially the first one.
- f) Avoid generalizations e.g. short plants. Be specific in your description e.g.:
  - a. Plants above 1m tall.
  - b. Plants below 1m tall.

### Some Common Features Used for Identification

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#### In Plants

#### Leaves

#### Type of leaf

(a) Compound leaves. (b) Type of venation.

- ✓ Simple leaf
- ✓ Trifoliate
- ✓ Pinnate
- ✓ Type of leaf margin.



- ✓ Type of leaf arrangement on stem.
- ✓ The colour of leaf.
- ✓ The texture of leaf; whether hairy or smooth.
- ✓ Shape of the leaf e.g. palmate.

### **Stem**

- ✓ Type of stem - woody or herbaceous.
- ✓ Shape of stem - cylindrical or rectangular.
- ✓ Texture of stem smooth or spiny.

### **Inflorescence**

- ✓ Are flowers terminal or lateral?

### **For each flower:**

- ✓ Is the flower regular or irregular?
- ✓ Number of floral parts for each whorl.
- ✓ Are floral parts free or fused?

### **Roots**

- ✓ Type of root system- Taproot or fibrous?
- ✓ Function of the root.

### **In Animals**

*Features used to identify animals:*

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- ✓ Type of mouthparts.
- ✓ Type of skeleton.
- ✓ Presence or absence of antennae.
- ✓ Body segmentation.



- ✓ Body covering: scales, fur, hair or feathers.
- ✓ Number of body parts.
- ✓ Locomotory structures: legs, wings and fins.
- ✓ Presence or absence of vertebral column.
- ✓ Presence and type of eyes.

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## Practical Activities

### To examine Bryophyta

- ✓ A mature moss plant is obtained.
- ✓ The specimen is observed using a hand -lens.
- ✓ A labelled drawing showing structures is made: rhizoids, set a capsule, gametophyte, sporophyte ..

### To examine Pteridophyta

- ✓ A mature fern plant is obtained.
- ✓ It is observed using a hand lens.
- ✓ Sori can be seen on the lower side of fronds.
- ✓ A labelled drawing showing: frond, pinna, sorus, rhizome and adventitious roots.

### To examine Spermatophyta

A mature twig of either cypress or pinus with cones is obtained.

- ✓ Observation of Male and female is made using a hand-lens.
- ✓ The naked seeds are noted.
- ✓ The leaves show xerophytic characteristics e.g. they are rolled, or needle-like.





### **A mature bean plant with pods is obtained,**

- ✓ Observation of the leaves, stem and roots is made.
- ✓ Leaves are compound, broad and have network of veins.
- ✓ The leaf has a leaf stalk.
- ✓ They have a tap root system.
- ✓ Floral parts are in five e.g. 5 petals.
- ✓ A bean seed has two cotyledons.

### **A mature maize plant is obtained.**

- ✓ Observation of the leaves, stems and roots is made.
- ✓ Leaves are simple, narrow and long with parallel veins.
- ✓ The petiole is modified to form a leaf sheath.
- ✓ They have a fibrous root system.
- ✓ Floral parts are in threes.
- ✓ A maize grain has one cotyledon.

### **Examination of Arthropoda**

- ✓ Specimens of crayfish, millipede, centipede grasshopper and spider are obtained.
- ✓ Where specimens are not available photographs are used.
- ✓ External features of the specimens are observed.

### **The differences in the following are noted:**

- ✓ Body parts.
- ✓ Antennae.
- ✓ Other appendages.
- ✓ Eyes.



## Examination of Chordata

- ✓ The following specimens are obtained:
- ✓ Tilapia, frog, Lizard, bird and rabbit.
- ✓ Using observable features each specimen is placed into its class.

### Features used include:

- ✓ Body covering.
- ✓ Limbs.
- ✓ Type of teeth.

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