Grade 11 Biology

CBC NOTES | Terms 1, 2 and 3 - notes for 10 topics

IN EVERY TOPIC

- What you will learn, the key words and key terms explained.
- Clear notes under headings and subheadings, with labelled pictures and step-by-step procedures.
- Comparison tables, and advantages and disadvantages where methods are compared.
- Key points to remember, then structured questions to practise.
- All the answers and a glossary at the back.

TOPICS IN THESE NOTES

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A TASTE OF THE FIRST TOPIC

Taxonomy I

There are millions of kinds of living things on Earth, from bacteria in sour milk to elephants in Tsavo. To study them, biologists sort them into groups and give each kind one scientific name that is used all over the world. In this topic we learn what taxonomy is and why it matters, the ranks used to group organisms, how scientific names are written, the five kingdoms of living things and the economic importance of bacteria, protoctists and fungi.

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1.1 Taxonomy I

WHAT YOU WILL LEARN

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

- explain the significance of classification of living organisms in nature
- illustrate the hierarchy of the major taxonomic units of classification
- describe the principles of binomial nomenclature in classification of living organisms
- classify organisms into the five taxonomic Kingdoms

KEY WORDS

taxonomy, classification, taxon, kingdom, species, binomial nomenclature, genus, prokaryote, eukaryote, hypha.

There are millions of kinds of living things on Earth, from bacteria in sour milk to elephants in Tsavo. To study them, biologists sort them into groups and give each kind one scientific name that is used all over the world. In this topic we learn what taxonomy is and why it matters, the ranks used to group organisms, how scientific names are written, the five kingdoms of living things and the economic importance of bacteria, protoctists and fungi.

1. Taxonomy and why we classify

Taxonomy
The science of identifying, naming and classifying (grouping) living organisms.

Classification
Placing organisms into groups according to the features they share.

Organisms are grouped mainly by their structure (morphology and anatomy). Today scientists also compare cells, proteins and DNA. Organisms placed in the same group are more closely related than organisms in different groups.

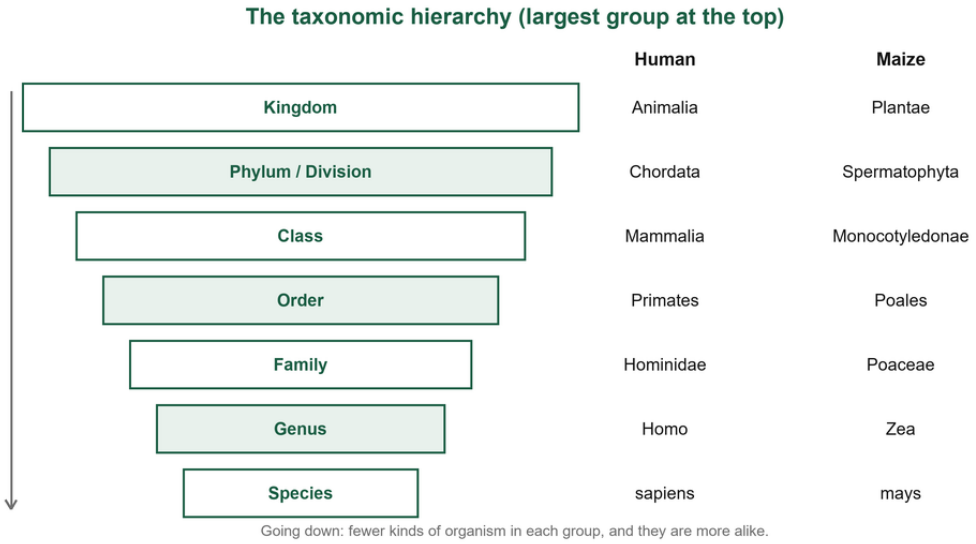
Significance of classification

- It puts the huge variety of organisms into a small number of groups that are easy to study.
- It helps us identify an unknown organism by comparing it with known groups.
- It shows how organisms are related to each other and how they may have evolved.
- It gives every organism one name understood by scientists in every country, avoiding confusion between local names.
- It helps conservation: we can count species in an area, notice rare or endangered ones and protect them.
- It guides agriculture and health: knowing that a pest or a germ belongs to a certain group tells us how to control it.

REMEMBER
Taxonomy is not only naming. It includes identifying, naming AND classifying. Give all three in a definition.

2. Taxonomic units (ranks)

Organisms are placed in groups inside bigger groups, like rooms inside a house inside a village. Each level is a TAXON (plural taxa) or taxonomic unit. There are seven main ranks.



The seven main ranks, with a human and a maize plant as examples

The taxonomic hierarchy

Rank	What it contains	Human	Maize
Kingdom	The largest group	Animalia	Plantae
Phylum (animals) / Division (plants)	Related classes	Chordata	Spermatophyta
Class	Related orders	Mammalia	Monocotyledonae
Order	Related families	Primates	Poales
Family	Related genera	Hominidae	Poaceae
Genus	Closely related species	Homo	Zea
Species	The smallest unit	sapiens	mays

Going down the hierarchy, each group contains fewer kinds of organisms, and the members share more features. Two organisms in the same genus are very similar; two organisms that only share a kingdom may look very different (a sponge and a lion).

> **Species**
> A group of organisms that look alike and can interbreed freely to produce fertile offspring.

A horse and a donkey can mate, but their offspring (a mule) is infertile, so horses and donkeys are different species.

> **MEMORY AID**
> Kingdom, Phylum, Class, Order, Family, Genus, Species: "King Philip Came Over For Good Soup".

3. Binomial nomenclature

Binomial nomenclature
The system of giving each species a scientific name of two parts: the genus name followed by the species name. It was developed by Carolus Linnaeus.

Rules for writing scientific names

- The first name is the genus; it begins with a CAPITAL letter.
- The second name is the species; it begins with a small letter.
- When printed, the name is in italics: Homo sapiens. When handwritten, each part is underlined separately: Homo sapiens with "Homo" and "sapiens" each underlined.
- Names are in Latin or Latinised words, so they are the same in every language.
- After the name is written once in full, the genus may be shortened to its first letter: Z. mays.
- The name of the scientist who first described the species may follow, e.g. Zea mays L. (L. for Linnaeus).

Examples of scientific names

Common name	Scientific name
Human	Homo sapiens
Maize	Zea mays
Bean	Phaseolus vulgaris
Domestic cat	Felis catus
Lion	Panthera leo
Malaria parasite	Plasmodium falciparum

EXAM POINT
Lion and leopard (Panthera pardus) share a genus, so they are more closely related than lion and cat, which only share a family (Felidae).

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4. The five kingdoms

Organisms are placed in five kingdoms using the type of cell (prokaryotic or eukaryotic), the number of cells, the presence of a cell wall and chlorophyll, and how the organism gets its food.

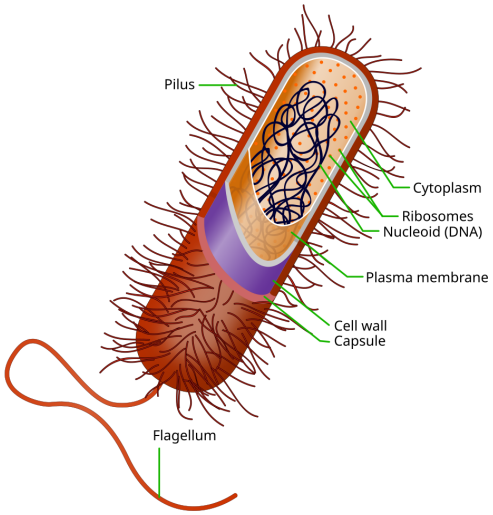
The five kingdoms

Monera	Protoctista	Fungi
Prokaryotes: no true nucleus. Bacteria, e.g. Lactobacillus in mala, Rhizobium.	Simple eukaryotes, mostly one-celled. Amoeba, Paramecium, Plasmodium, algae.	Chitin cell walls, no chlorophyll, absorb food. Yeast, mushroom, Rhizopus (bread mould).
Plantae	**Animalia**	**Binomial name**
Many-celled, chlorophyll, cellulose walls; make food by photosynthesis. Moss, fern, maize.	Many-celled, no cell wall, eat ready-made food, most move. Earthworm, insect, human.	Genus (capital) + species (small letter), in italics or underlined: Zea mays.

The five kingdoms and their main features

Characteristics of the five kingdoms

Kingdom	Main characteristics	Examples
Monera	Prokaryotic: no nucleus or membrane-bound organelles; DNA free in cytoplasm; cell wall without cellulose; mostly one-celled; reproduce by binary fission	Bacteria such as Lactobacillus, Rhizobium, Vibrio cholerae
Protoctista	Eukaryotic; mostly one-celled; some have chlorophyll (algae), others feed like animals (protozoa)	Amoeba, Paramecium, Plasmodium, Euglena, Spirogyra, seaweeds
Fungi	Eukaryotic; cell walls of chitin; no chlorophyll; feed by absorbing food (saprophytes or parasites); body of hyphae (mycelium) except yeast; reproduce by spores	Yeast, mushroom, Rhizopus (bread mould), Penicillium
Plantae	Eukaryotic; many-celled; cellulose cell walls; chlorophyll; make food by photosynthesis	Moss, fern, cypress, maize, bean
Animalia	Eukaryotic; many-celled; no cell wall; no chlorophyll; take in ready-made food; most can move	Sponge, earthworm, insect, fish, human



A bacterial (prokaryotic) cell: no nucleus; DNA lies free in the cytoplasm

5. Economic importance of Monera, Protoctista and Fungi

Economic importance

Kingdom	Useful	Harmful
Monera (bacteria)	Lactobacillus turns milk into mala and yoghurt; Rhizobium in legume root nodules fixes nitrogen; decomposers recycle nutrients; sewage treatment and biogas; making antibiotics, vaccines and insulin	Cause diseases: cholera, typhoid, tuberculosis, pneumonia; spoil food; cause plant diseases such as bacterial wilt
Protoctista	Algae make food by photosynthesis and release oxygen; algae are food for fish; some are used as fertiliser and in food (agar)	Plasmodium causes malaria; Trypanosoma causes sleeping sickness; Entamoeba causes amoebic dysentery; algal blooms poison water
Fungi	Yeast for baking bread and brewing; mushrooms as food; Penicillium gives penicillin; decomposers recycle nutrients	Cause diseases: ringworm, athlete's foot, thrush; crop diseases such as maize smut, rust and potato blight; moulds spoil food; aflatoxin in mouldy maize is poisonous

HEALTH LINK

Aflatoxin from moulds on damp, badly stored maize causes liver damage and cancer. Dry maize well and store it off the floor to stop fungi growing.

Taxonomy and biodiversity: by identifying and listing species, taxonomists show which organisms are rare or endangered (for example the hirola antelope and some indigenous trees), so they can be protected in parks, forests and seed banks.

KEY POINTS TO REMEMBER

- Taxonomy is the science of identifying, naming and classifying organisms.
- Classification makes study easier, shows relationships, helps identification and supports conservation.
- The ranks from largest to smallest are kingdom, phylum (division), class, order, family, genus and species.
- A species is a group that can interbreed to produce fertile offspring.
- Binomial names have two parts: Genus (capital) and species (small letter), printed in italics or underlined separately when handwritten.
- The five kingdoms are Monera, Protoctista, Fungi, Plantae and Animalia.
- Monera, Protoctista and Fungi include both useful organisms (decomposers, food makers, medicine) and harmful ones (disease and food spoilage).

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ANSWER THESE

1. Define taxonomy. (1 mark)
2. State three reasons why living organisms are classified. (3 marks)
3. Arrange the following ranks from the smallest to the largest: order, species, kingdom, family, genus, class, phylum. (2 marks)
4. The scientific name of the bean plant is Phaseolus vulgaris. (a) Name its genus. (b) State two rules followed in writing this name. (3 marks)
5. State two differences between organisms in Kingdom Monera and those in Kingdom Fungi. (2 marks)
6. Explain why a mule is not regarded as a species. (2 marks)
7. Give two useful and two harmful effects of fungi. (4 marks)
8. Explain how taxonomy helps in the conservation of biodiversity. (3 marks)

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1.2 Ecology

WHAT YOU WILL LEARN

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

- describe the characteristics of different ecosystems in nature
- explain the adaptations of organisms to different habitats
- describe factors affecting population sizes in ecosystems
- estimate population sizes of organisms in ecosystems
- illustrate the nitrogen and carbon cycles in ecosystems
- describe the effects of pollution in the environment

KEY WORDS

habitat, niche, population, community, ecosystem, biome, biomass, carrying capacity, succession, adaptation, quadrat, transect, nitrogen fixation, pollutant, greenhouse gas.

No organism lives alone. Every plant, animal and microorganism depends on other living things and on the soil, water, air and climate around it. Ecology studies these relationships. In this topic we look at the main kinds of ecosystems, how organisms are adapted to their habitats, how to describe and estimate populations, the factors that change population size, the nitrogen and carbon cycles, and the effects of pollution, including global warming and climate change.

1. Ecosystems and their components

Ecology
The study of the relationships between organisms and between organisms and their environment.

Ecosystem
A community of organisms interacting with each other and with their non-living (abiotic) environment, for example a forest, a pond or a grassland.

Habitat
The place where an organism lives, for example the bark of a tree or the bottom of a river.

Population
All the organisms of one species living in an area at the same time.

Community
All the populations of different species living and interacting in an area.