

Characteristics and classification

IGCSE Biology 0610 · Topic 1 revision notes

Everything from the 3 lessons of this topic on a few pages: the key idea of each lesson, the diagram to remember, the points to learn and the traps examiners set. Read it, cover it, test yourself.

1. Characteristics of living organisms

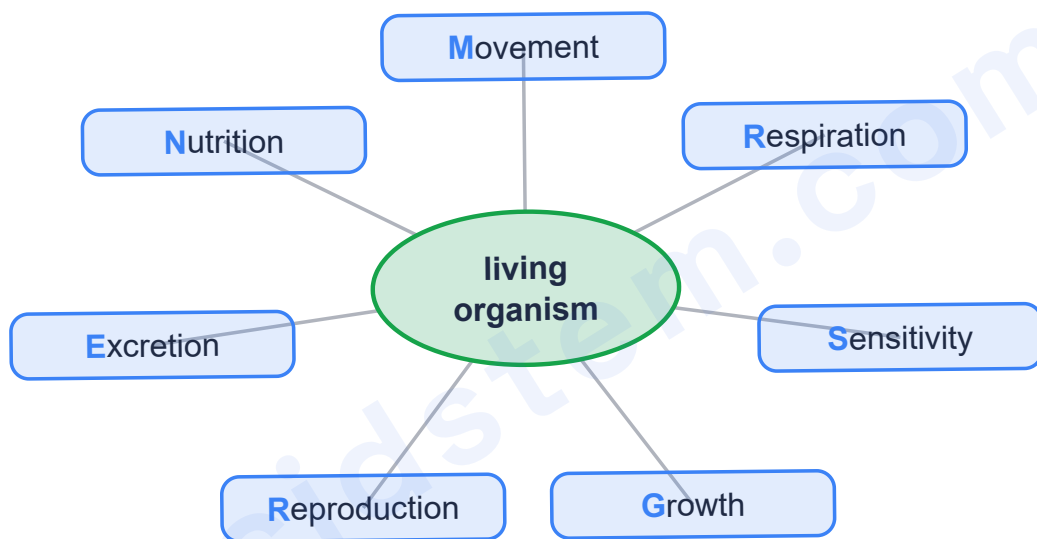
2. Classification and dichotomous keys

3. Features of organisms

1 Characteristics of living organisms

Syllabus 1.1

Every living organism shows all seven characteristics of life, often remembered as MRS GREN: **m**ovement, **r**espiration, **s**ensitivity, **g**rowth, **r**eproduction, **e**xcretion and **n**utrition. Each has a precise definition. Respiration happens in cells and releases energy; growth is a permanent increase in size and dry mass; excretion removes the waste products of metabolism. Non-living things may seem to show one or two, but never all seven, and never by the processes that happen in cells.



all seven, all the time: one or two is not enough

Fig. 1: the seven characteristics of living organisms (MRS GREN)

Learn the definitions word for word.

- ✓ **MRS GREN:** movement, respiration, sensitivity, growth, reproduction, excretion, nutrition.
- ✓ **Respiration** is chemical reactions in cells that release energy; it is not breathing.
- ✓ **Growth** is a permanent increase in size and dry mass.
- ✓ **Alive** means all seven, carried out by the organism's own cells.

Watch out!

Respiration is **not** breathing. Breathing moves air in and out of the lungs; respiration is the chemical reactions **in cells** that release energy. A plant has no lungs, but every one of its living cells respire all the time.

Growth means a **permanent** increase in size **and dry mass**. A seed that swells by absorbing water gets bigger, but it has not grown, because water is not part of dry mass and can be lost again. Always write both parts of the definition.

2 Classification and dichotomous keys

Syllabus 1.2

Organisms are classified into groups by the features that they share. A **species** is a group of organisms that can reproduce to produce **fertile** offspring. The **binomial system** is an internationally agreed system in which the scientific name has two parts: the *genus* then the *species*, as in *Panthera leo*. A **dichotomous key** identifies an organism through pairs of statements about features you can see. Extended: classification aims to reflect evolutionary relationships, and organisms that share a more recent ancestor have more similar DNA base sequences.

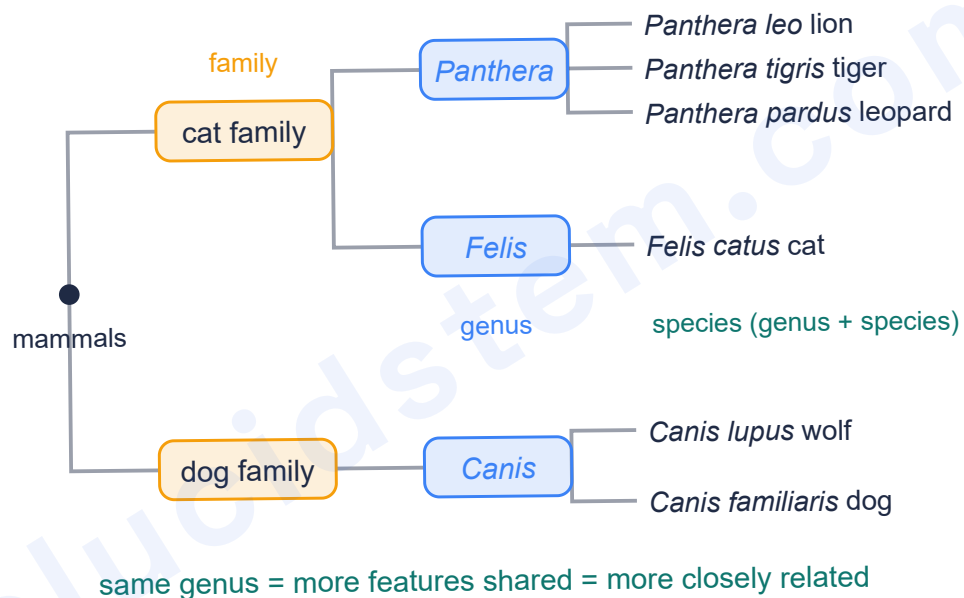


Fig. 1: species in the same genus share more features than species in different families

Fertile offspring, two names, two choices.

- ✓ **Species:** can reproduce to produce fertile offspring.
- ✓ **Binomial name:** *Genus species*, capital then small letter, in italics.
- ✓ **Key statements:** a pair of opposites about one visible, fixed feature; n organisms need $n - 1$ steps.
- ✓ **Extended:** more similar DNA base sequences mean a more recent common ancestor.

Watch out!

A species is **not** defined by appearance. Animals that look alike can be separate species, and animals that look very different, like dog breeds, can be one species. The test is whether they produce **fertile** offspring. Offspring alone is not enough: a mule is offspring, but it is sterile.

Base every statement on a feature you can **see** and that does not change. "Is large", "is brown" or "lives in a pond" lose marks: size and colour vary between individuals and with age, and habitat is not a feature of the organism.

3 Features of organisms

Syllabus 1.3

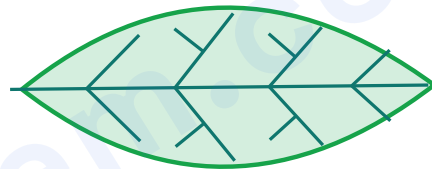
Animals and plants are both multicellular, but plant cells have **cellulose cell walls** and **chloroplasts** while animal cells have neither. Vertebrates are grouped by skin covering, breathing and reproduction: **fish, amphibians, reptiles, birds, mammals**. Arthropods have jointed legs, a segmented body and an exoskeleton, and are grouped by counting legs, body parts and antennae: **insects, arachnids, crustaceans, myriapods**. Extended: every organism is in one of five kingdoms (animal, plant, fungus, prokaryote, protocist); flowering plants are monocotyledons or dicotyledons; a virus is only genetic material in a protein coat.

monocotyledon



1 cotyledon in the seed
long leaves, parallel veins
flower parts in 3s

dicotyledon



2 cotyledons in the seed
broad leaves, net of veins
flower parts in 4s or 5s

ferns: fronds, spores in sori, no flowers and no seeds

Fig. 1: Extended: telling monocotyledons from dicotyledons

Features, not habitat.

- ✓ **Plant v animal cells:** cellulose cell wall and chloroplasts in plants only.
- ✓ **Vertebrates:** scales and gills (fish), moist skin (amphibians), dry scales (reptiles), feathers (birds), fur and milk (mammals).
- ✓ **Arthropods:** count pairs of legs, body parts and antennae: 3/3/1 insect, 4/2/0 arachnid, >4 pairs with 2 pairs of antennae crustacean, many segments myriapod.
- ✓ **Extended:** fungi have chitin walls; prokaryotes no nucleus; viruses only genetic material in a protein coat.

Watch out!

Fungi are **not** plants. A mushroom grows out of the ground, but fungal cell walls are made of chitin, not cellulose, and fungi have no chloroplasts, so they cannot photosynthesise.

Classify by features, not by habitat or lifestyle. A whale and a dolphin live in the sea but breathe with lungs and feed their young on milk: **mammals**. A penguin cannot fly but has feathers: a **bird**. A bat flies, but it has fur and its wings are skin: a **mammal**.

Read whether a question gives **legs** or **pairs of legs**. Eight legs is four pairs (arachnid); eight pairs would point to a myriapod or crustacean. A spider is not an insect: it has four pairs of legs, two body parts and no antennae.