CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

YOUR NOTES

CONTENTS:

VIEW EXAM QUESTIONS

1.1 CHARACTERISTICS

Characteristics of Living Organisms: Basics

- **Movement:** an action by an organism causing a change of position or place
- **Respiration:** the chemical reactions that break down nutrient molecules in living cells to release energy
- **Sensitivity:** the ability to detect and respond to changes in the environment
- **Growth**: a permanent increase in size
- **Reproduction:** the processes that make more of the same kind of organism
- **Excretion:** the removal from organisms of toxic materials and substances in excess of requirements
- **Nutrition:** the taking in of materials for energy, growth and development

CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

1.1 CHARACTERISTICS cont...

YOUR NOTES

EXTENDED ONLY

Characteristics of Living Organisms

- **Movement:** an action by an organism or part of an organism causing a change of position or place
- **Respiration:** the chemical reactions that break down nutrient molecules in living cells to release energy for metabolism
- **Sensitivity:** the ability to detect or sense stimuli in the internal or external environment and to make appropriate responses
- **Growth:** a permanent increase in size and dry mass by an increase in cell number or cell size or both
- **Reproduction:** the processes that make more of the same kind of organism.
- **Excretion:** the removal from organisms of toxic materials, the waste products of metabolism (chemical reactions in cells including respiration) and substances in excess of requirements
- **Nutrition:** the taking in of materials for energy, growth and development; plants require light, carbon dioxide, water and ions; animals need organic compounds, ions and usually need water

EXAM TIP

Use this mnemonic to help you remember these processes:

MRS. H. GREN

Movement **R**espiration **S**ensitivity
Homeostasis
Growth and development **R**eproduction **E**xcretion **N**utrition

CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

1.2 CLASSIFICATION

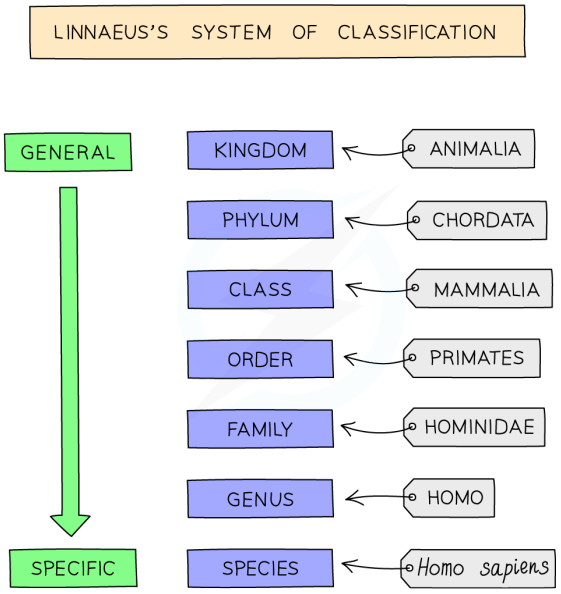
YOUR NOTES

How Organisms are Classified: Basics

- There are millions of species of organisms on Earth
- A species is defined as a group of organisms that can **reproduce to produce fertile offspring**
- These species can be classified into groups by the **features that they share** e.g. all mammals have bodies covered in hair, feed young from mammary glands and have external ears (pinnas)

The Binomial System

- Organisms were first classified by a Swedish naturalist called **Linnaeus** in a way that allows the subdivision of living organisms into smaller and more specialised groups
- The species in these groups have more and more features in common the more subdivided they get
- He named organisms in Latin using the **binomial system** where the scientific name of an organism is made up of two parts starting with:
  - the **genus** (always given a **capital letter**)
  - and followed by the **species** (starting with a **lower case letter**)
- When typed, binomial names are always in italics (which indicates they are Latin) e.g. Homo sapiens
- The sequence of classification is: **Kingdom, Phylum, Class, Order, Family, Genus, Species**



Linnaeus's system of classification

CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

1.2 CLASSIFICATION cont...

YOUR NOTES

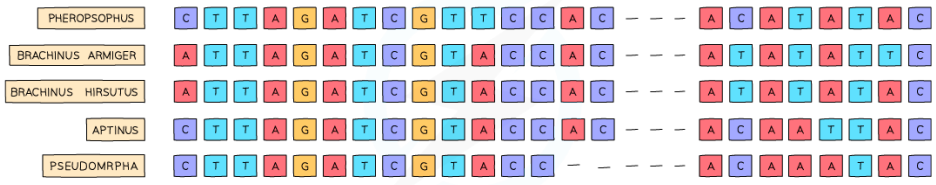
EXAM TIP

The order of classification can be remembered by using this mnemonic:
King **P**hilip **C**ame **O**ver **F**or **G**ran's **S**paghetti

EXTENDED ONLY

How Organisms are Classified

- Organisms share features because they originally descend from a **common ancestor**
- Example: all mammals have bodies covered in hair, feed young from mammary glands and have external ears (pinnas)
- Originally, organisms were classified using **morphology** (the overall form and shape of the organism, e.g. whether it had wings or legs) and **anatomy** (the detailed body structure as determined by dissection)
- As technology advanced, **microscopes**, knowledge of **biochemistry** and eventually **DNA sequencing** allowed us to classify organisms using a more scientific approach
- Studies of DNA sequences of different species show that the **more similar the base sequences in the DNA of two species, the more closely related those two species are** (and the more recent in time their common ancestor is)
- This means that the **base sequences in a mammal's DNA are more closely related to all other mammals** than to any other vertebrate groups



DNA sequences can show how closely related different species are

- The sequences above show that Brachinus armiger and Brachinus hirsutus are **more closely related** than any other species in the list as their DNA sequences are identical except for the last-but-one base (B.armiger has a T in that position whereas B.hirsutus has an A)
- As DNA base sequences are used to code for **amino acid sequences in proteins**, the similarities in amino acid sequences can also be used to determine how closely related organisms are

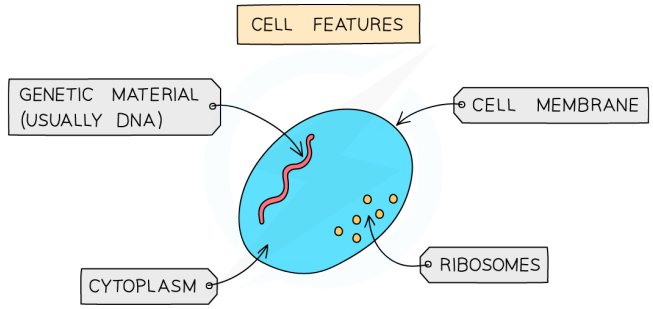
CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

1.3 FEATURES OF ORGANISMS

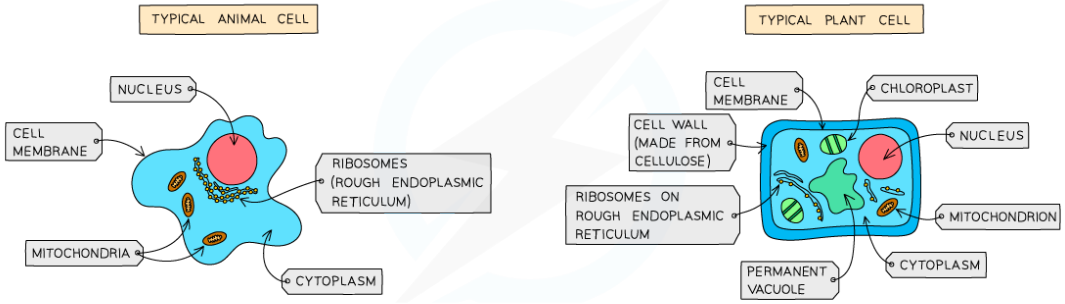
YOUR NOTES

Common Cell Structures

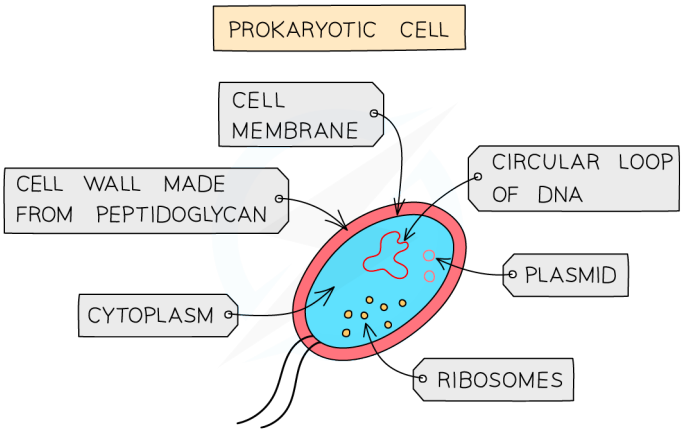
- The cells of all living organisms contain the following:
  - **Cytoplasm**
  - **Cell membrane**
  - **DNA as genetic material** (either found in the nucleus or free in the cytoplasm)



General cell features



A typical animal cell and plant cell



A typical prokaryotic cell

CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

1.3 FEATURES OF ORGANISMS cont...

YOUR NOTES

EXTENDED ONLY

Cell Composition & Structure

When viewed under an electron microscope (at a much higher magnification), all cells also contain the following:

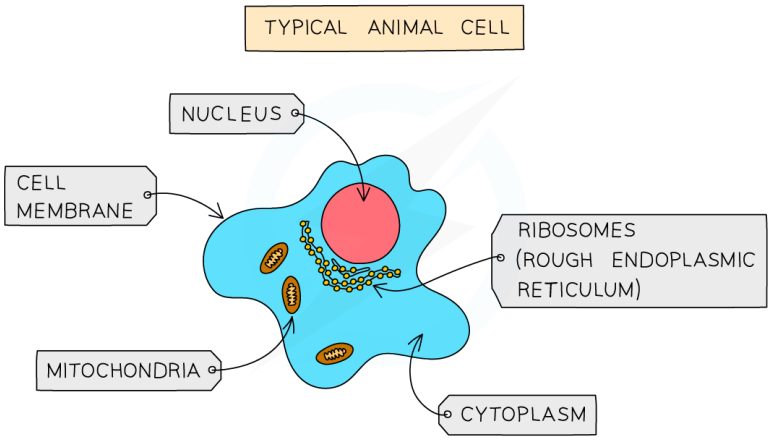
- **Ribosomes** for protein synthesis
- **Enzymes** for respiration (in many, but not all types of cells, found in mitochondria)

The Five Kingdoms

- **Animals**
- **Plants**
- **Fungi**
- **Protoctists**
- **Prokaryotes**

Main features of all animals:

- They are **multicellular**
- Their cells contain a **nucleus** but **no cell walls** or **chloroplasts**
- They feed on organic substances **made by other living things**



A typical animal cell

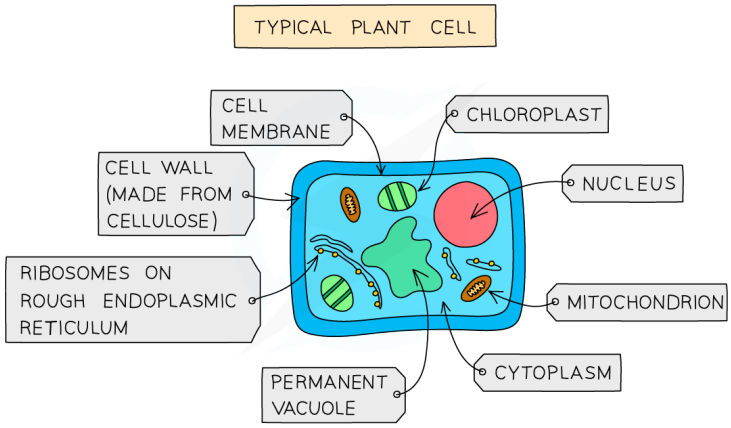
CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

1.3 FEATURES OF ORGANISMS cont...

YOUR NOTES

Main features of all plants:

- They are **multicellular**
- Their cells contain a **nucleus**, **chloroplasts** and **cellulose cell walls**
- They all feed by **photosynthesis**



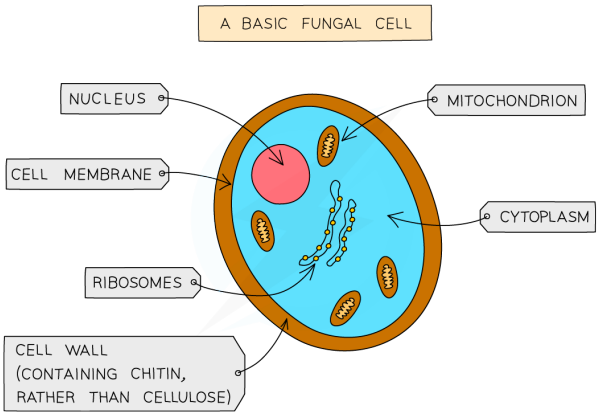
A typical plant cell

EXTENDED ONLY

Fungi, Protoctists & Prokaryotes

Main features of all fungi (e.g. moulds, mushrooms, yeast)

- usually **multicellular**
- cells have **nuclei** and **cell walls** not made from cellulose
- do not photosynthesize but **feed by saprophytic** (on dead or decaying material) **or parasitic** (on live material) **nutrition**



A typical fungal cell

CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

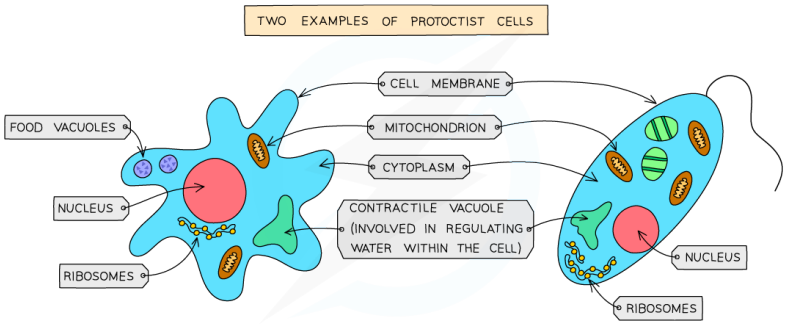
1.3 FEATURES OF ORGANISMS cont...

YOUR NOTES

EXTENDED ONLY cont...

Main features of all Protoctists (e.g. Amoeba, Paramecium, Plasmodium)

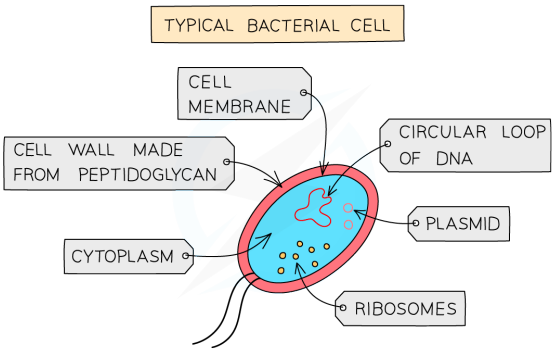
- **Most are unicellular** but some are multicellular
- All have a **nucleus**, some may have cell walls and chloroplasts
- This means that **some protoctists photosynthesise and some feed on organic substances** made by other living things



Two examples of protoctist cells

Main features of all Prokaryotes (bacteria, blue–green algae)

- They are often **unicellular**
- Their cells have **cell walls** (not made of cellulose) and **cytoplasm** but **no nucleus or mitochondria**



A typical bacterial cell

CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

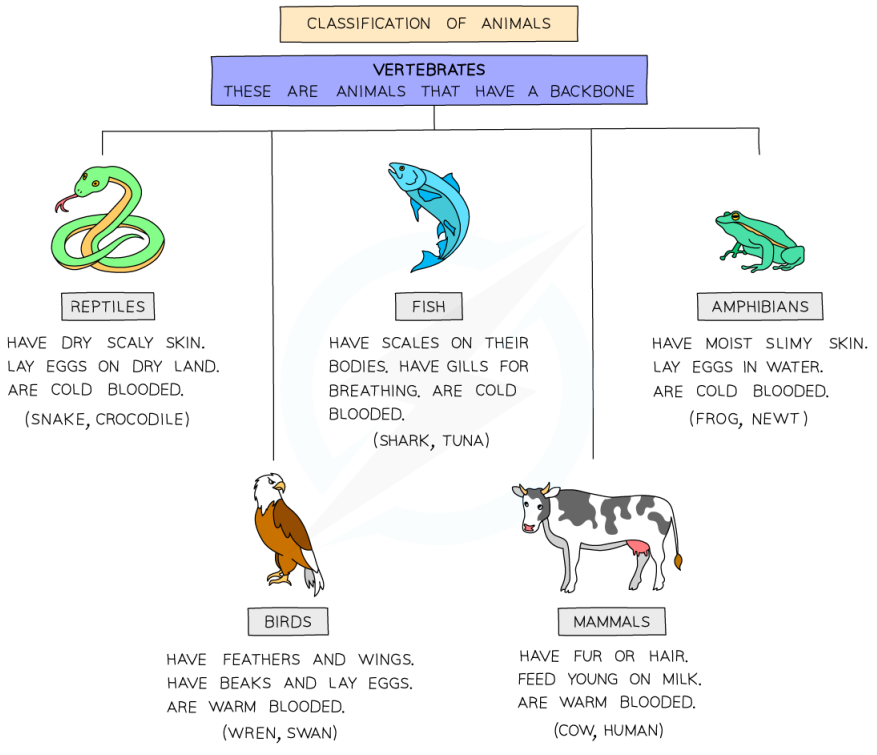
1.4 CLASSIFYING ANIMALS

YOUR NOTES

Vertebrates

All vertebrates have a backbone. There are 5 classes of vertebrates:

CLASS	MAIN FEATURES	EXAMPLES
MAMMALS	– FUR/HAIR ON SKIN – HAVE A PLACENTA – YOUNG FEED ON MILK FROM MAMMARY GLANDS – EXTERNAL EARS (PINNA) VISIBLE – ENDOTHERMIC	HORSE, DOG, SQUIRREL, HUMAN
BIRDS	– SKIN COVERED IN FEATHERS – HAVE 2 LEGS AND 2 WINGS INSTEAD OF FORELIMBS – LAY EGGS WITH HARD SHELLS ON LAND – HAVE A BEAK – ENDOTHERMIC	PARROT, BLUE TIT, EAGLE
REPTILES	– DRY, FIXED SCALES ON SKIN – LAY EGGS WITH RUBBERY SHELLS ON LAND	SNAKE, TURTLE, IGUANA
AMPHIBIANS	– SMOOTH, MOIST SKIN – ADULTS USUALLY LIVE ON LAND (SO HAVE LUNGS), LARVAE LIVE IN WATER (SO HAVE GILLS) – LAY EGGS WITHOUT SHELLS IN WATER	FROG, TOAD, NEWT
FISH	– LOOSE, WET SCALES ON SKIN – GILLS TO BREATHE – LAY EGGS WITHOUT SHELLS IN WATER	FLOUNDER, GROUPER



Vertebrate classification

CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

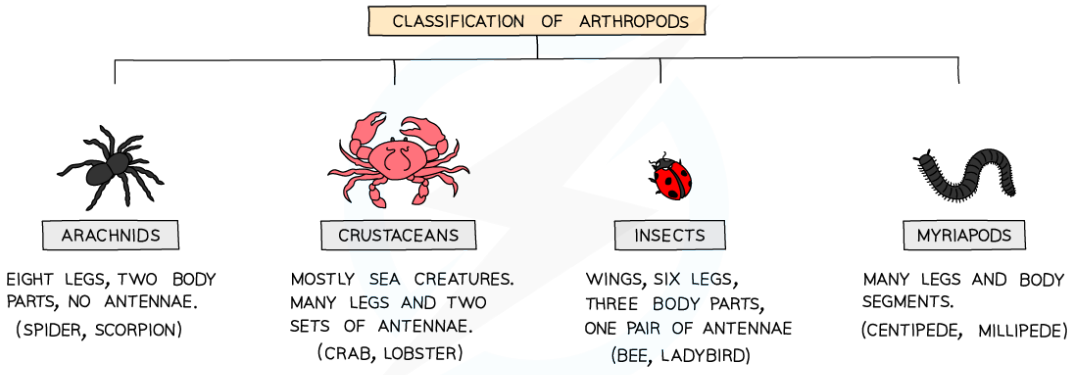
1.4 CLASSIFYING ANIMALS cont...

YOUR NOTES

Invertebrates

- One of the morphological characteristics used to classify invertebrates is **whether they have legs or not**
- All invertebrates with **jointed legs** are part of the phylum **Arthropods**
- They are classified further into the following classes:

CLASS	MAIN FEATURES	EXAMPLES
MYRIAPODS	– BODY CONSISTS OF **MANY SEGMENTS** – EACH SEGMENT CONTAINS AT LEAST **1 PAIR OF JOINTED LEGS** – 1 PAIR OF ANTENNAE	CENTIPEDE
INSECTS	– **3 PART BODY** – HEAD, THORAX AND ABDOMEN – **3 PAIRS** OF JOINTED **LEGS** – **2 PAIRS OF WINGS** (1 OR BOTH PAIRS MAY BE VESTIGIAL – MEANING NON–FUNCTIONAL AND UNDEVELOPED) – 1 PAIR OF ANTENNAE	BUTTERFLY
ARACHNIDS	– **2 PART BODY** – CEPHALOTHORAX AND ABDOMEN – **4 PAIRS** OF JOINTED **LEGS** – NO ANTENNAE	SPIDER
CRUSTACEANS	– **MORE THAN 4 PAIRS** OF JOINTED **LEGS** – **CHALKY EXOSKELETON** FORMED FROM CALCIUM – BREATHE THROUGH GILLS – **2 PAIRS OF ANTENNAE**	CRAB



Arthropod classification

CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

1.5 CLASSIFYING PLANTS

YOUR NOTES

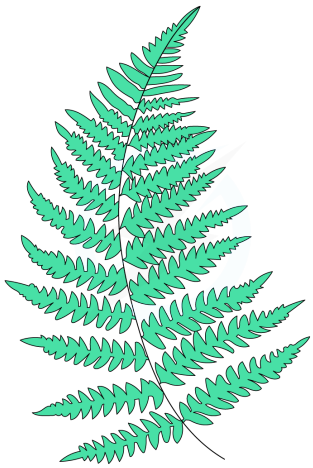
EXTENDED ONLY

Ferns & Flowering Plants

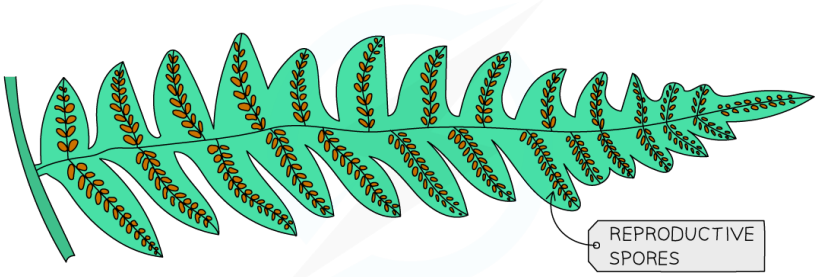
- At least some parts of any plant are green, caused by the presence of the pigment **chlorophyll** which absorbs energy from sunlight for the process of **photosynthesis**
- The plant kingdom includes organisms such as **ferns and flowering plants**

Ferns:

- Have leaves called **fronds**
- Do not produce flowers but instead **reproduce by spores** produced on the underside of fronds



Ferns



Ferns reproduce by spores found in the underside of their fronds

CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

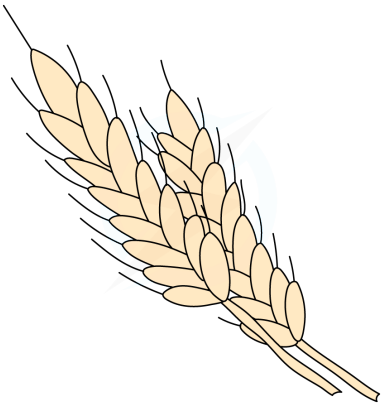
1.5 CLASSIFYING PLANTS cont...

YOUR NOTES

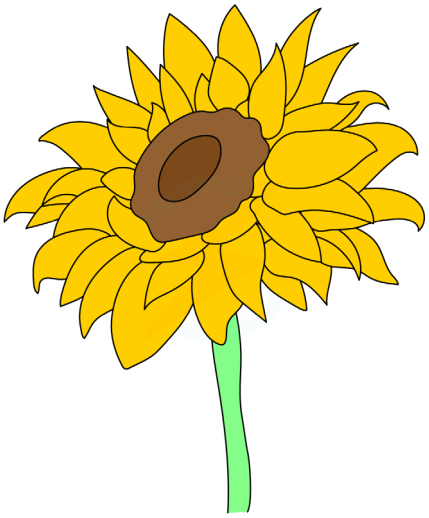
EXTENDED ONLY cont...

Flowering plants:

- Reproduce sexually by means of **flowers and seeds**
- Seeds are produced inside the ovary found at the base of the flower
- Can be divided into two groups – **monocotyledons** and **dicotyledons**



Wheat plants are monocotyledons



Sunflowers are dicotyledons

CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

1.5 CLASSIFYING PLANTS cont...

YOUR NOTES

EXTENDED ONLY cont...

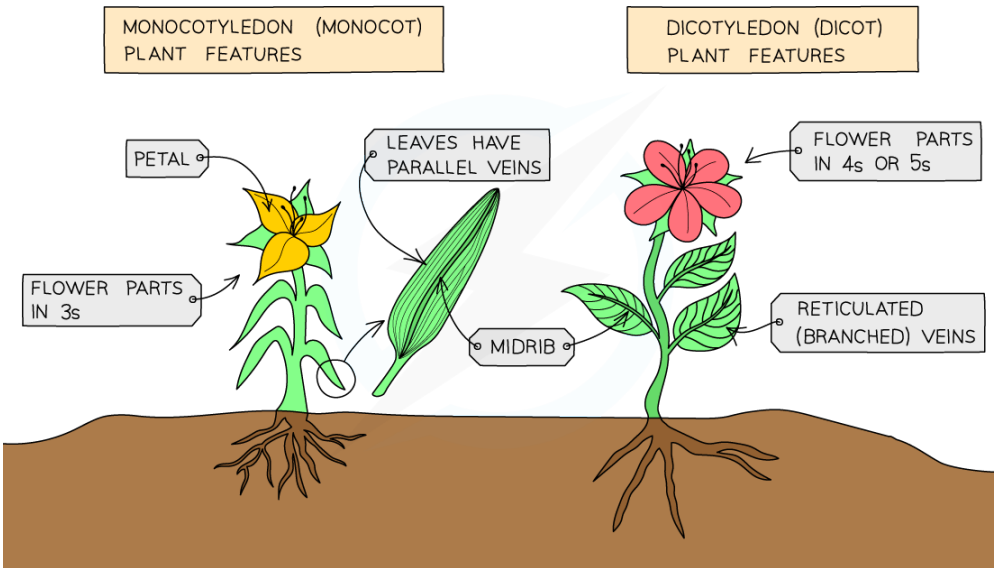
How to distinguish between monocotyledons and dicotyledons:

1. FLOWERS

- Flowers from **monocotyledons** contain petals in **multiples of 3**
- Flowers from **dicotyledons** contain petals in **multiples of 4 or 5**

2. LEAVES

- Leaves from **monocotyledons** have **parallel leaf veins**
- Leaves from **dicotyledons** have **reticulated leaf veins** (meaning that they are all interconnected and form a web like network throughout the leaf)



Comparing Monocots and Dicots

EXAM TIP

Identification of monocotyledons and dicotyledons comes up fairly frequently in the multiple choice paper.

So it is worth learning the two differences between their flowers and leaves.

CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

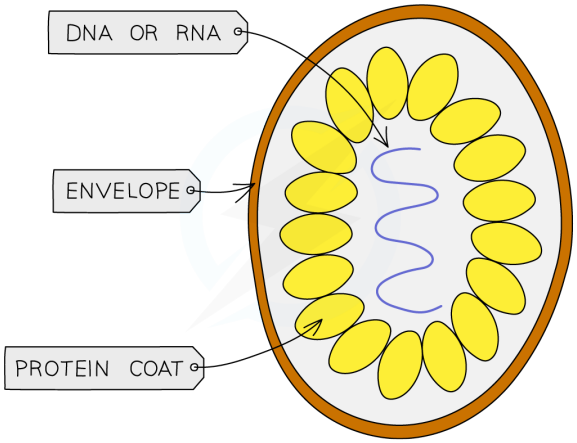
1.6 VIRUSES

YOUR NOTES

EXTENDED ONLY

Features of Viruses

- Viruses are not part of any classification system as they are not **considered living things**
- They **do not carry out the seven life processes** for themselves, instead they **take over a host cell's metabolic pathways** in order to make multiple copies of themselves
- Virus structure is simply **genetic material** (RNA or DNA) inside a **protein coat**



Structure of a typical virus

1.7 DICHOTOMOUS KEYS

Constructing & Using a Key

- Keys are used to identify organisms based on a **series of questions about their features**
- Dichotomous means 'branching into two' and it leads the user through to the name of the organism by giving **two descriptions at a time** and asking them to choose
- Each choice leads the user onto another two descriptions
- In order to successfully navigate a key, you need to pick a single organism to start with and **follow the statements from the beginning until you find the name**
- You then pick another organism and **start at the beginning of the key again**, repeating until all organisms are named

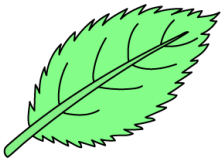
CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

1.7 DICHOTOMOUS KEYS cont...

YOUR NOTES

THE DIAGRAM SHOWS A LEAF

USE THE KEY TO IDENTIFY THE LEAF

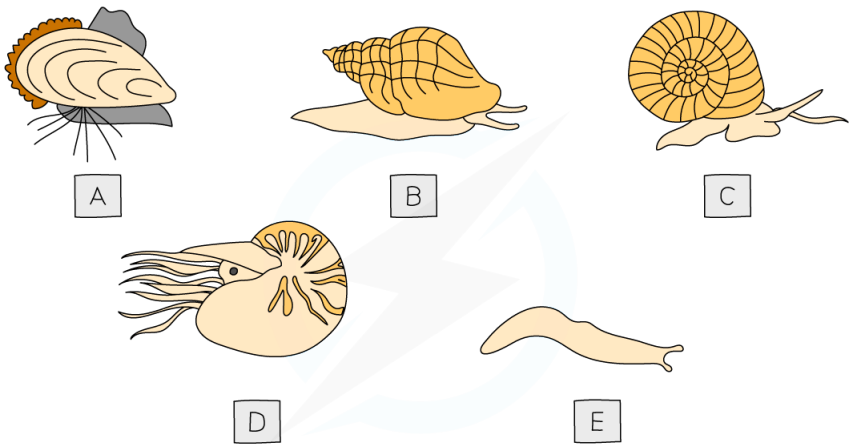


1 LEAF WITH SEVERAL SMALL LEAFLETS..... GO TO 2
LEAF WITH ONE LARGE LEAF BLADE.....GO TO 3

2 LEAFLETS ARE BROAD AND FLAT.....A
LEAFLETS ARE NARROW AND HAIR-LIKE.....B

3 LEAF WITH A SMOOTH EDGE.....C
LEAF WITH A TOOTHED EDGE.....D

Example of a dichotomous key *1



USE THE KEY TO IDENTIFY EACH SPECIES. WRITE THE LETTER OF EACH SPECIES (A TO E) IN THE CORRECT BOX BESIDE THE KEY.

Example of a Dichotomous Key *2

CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

1.7 DICHOTOMOUS KEYS cont...

YOUR NOTES

KEY		
1 (a)	BODY IS COMPLETELY OR PARTLY COVERED IN A SHELL	GO TO 2
(b)	BODY IS NOT COMPLETELY OR PARTLY COVERED IN A SHELL	LIMAX FLAVUS
2 (a)	SHELL IS ATTACHED TO ROCKS BY THIN THREADS	MYTILUS EDULIS
(b)	SHELL IS NOT ATTACHED TO ROCKS BY THIN THREADS	GO TO 3
3 (a)	SHELL IS A SPIRE THAT COMES TO A POINT	BUCCINUM UNDATUM
(b)	SHELL IS NOT A SPIRE THAT COMES TO A POINT	GO TO 4
4 (a)	ANIMAL HAS TENTACLES	NAUTILUS POMPILIUS
(b)	ANIMAL HAS 2 TENTACLES	PLANORBIS PLANORBIS

EXAM TIP

- Simple dichotomous keys almost always come up in the multiple choice paper, so make sure you can use one.
- Very occasionally they show up in the theory paper
- When they do you almost always have to use one instead of constructing one: so focus on this rather than spending hours learning to construct them yourself!

> NOW TRY SOME EXAM QUESTIONS

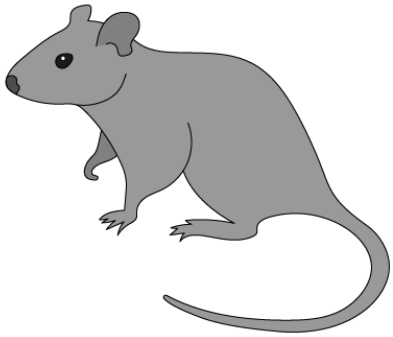
CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

EXAM QUESTIONS

YOUR NOTES

QUESTION 1

The image below shows a house mouse, whose scientific name is Mus musculus.



Which genus does it belong to?

A Mammal

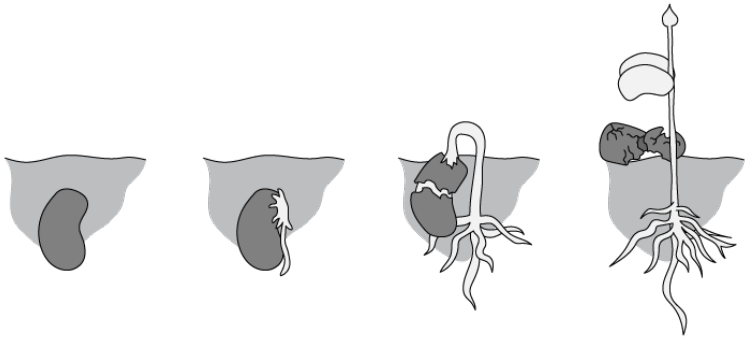
B musculus

C Mus

D Vertebrate

QUESTION 2

The image below shows what occurs to a seed during and after germination, the seed has been planted in well-watered soil.



Which characteristics of living things are demonstrated by this sequence?

A Nutrition and reproduction

B Reproduction and growth

C Nutrition and sensitivity

D Sensitivity and growth

CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

EXAM QUESTIONS cont...

YOUR NOTES

QUESTION 3

Which of the following would not be a characteristic seen in all living organisms?

A Reproduction

B Respiration

C Excretion

D Photosynthesis

QUESTION 4

Four different descriptions about plants are given below.

Which statement would apply to a plant that is a dicotyledon?

A The veins in the leaf are reticulated.

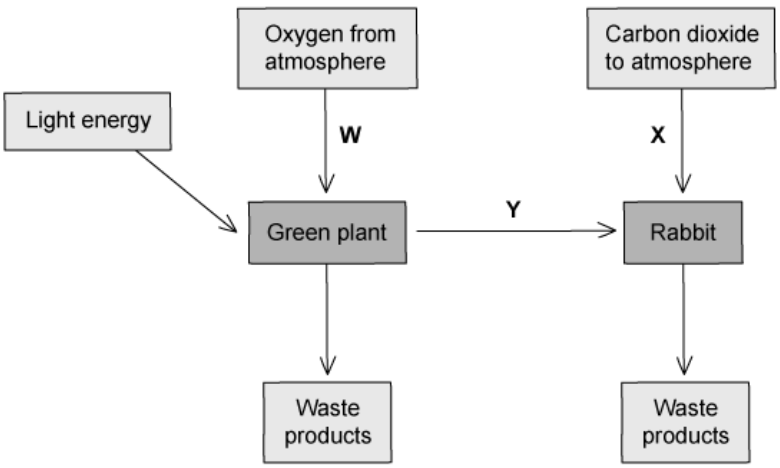
B Each flower has six petals.

C The flowers are all wind-pollinated.

D The leaves have parallel veins.

QUESTION 5

Some of the processes carried out by living organisms are illustrated in the diagram below.



CHARACTERISTICS & CLASSIFICATION OF LIVING ORGANISMS

EXAM QUESTIONS cont...

YOUR NOTES

QUESTION 5 cont...

Which row of the following table correctly describes the characteristics shown by living organisms in the diagram above?

	W	X	Y
A	respiration	photosynthesis	respiration
B	respiration	respiration	nutrition
C	photosynthesis	respiration	excretion
D	respiration	excretion	nutrition

> CHECK YOUR ANSWERS AT SAVEMY EXAMS.CO.UK