

Cambridge IGCSE Biology



2026 - 2028 Syllabus
Complete notes



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Classification

2

2.1 The Concept Of Classification

- Organisms are classified using features that they have in common
- A **species** is a group of organisms that can **reproduce to produce fertile offspring**
- The **binomial system** of naming species gives a scientific name to every organism
- There are three **rules to be followed** when writing the name of an organism using the binomial system:
 - It is made of two parts; the **genus name comes first**, and then comes the species name
 - Genus name must start with a capital letter**, while species name starts with a small letter
 - The binomial name is **written in Latin** so that it can be recognised internationally



Written in Latin

Panthera leo

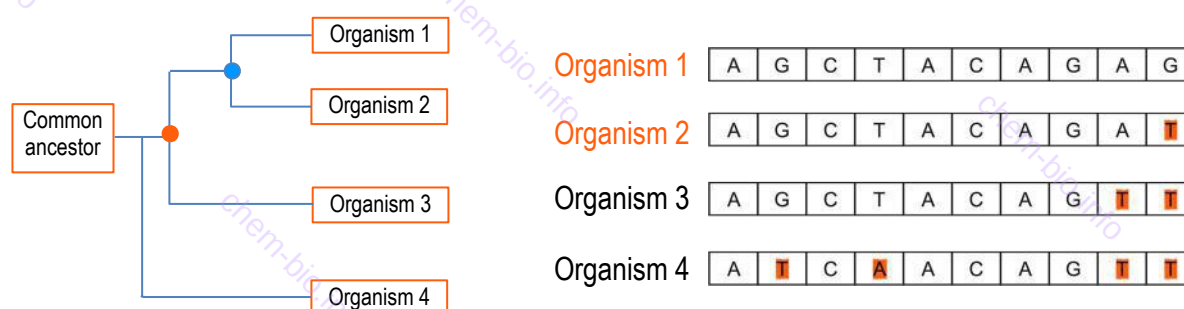
Genus name starts with a capital letter

Species name second



2.2 Classification Reflects Evolutionary Relationships

- In the **past**, classification was based on **morphology** (appearance) like wings or **anatomy** (structure) like a skeleton
- However, this was **not very accurate** because many organisms have common visible features, but they are not closely related
- According to the **modern** classification system, the similarities between all present-day organisms indicate the presence of a **common ancestor** (an early organism) from which all known species, living and extinct, have come through the process of **evolution** (page: 96)
- Modern classification is based on studies of the genetic material (DNA) and proteins**
- DNA classification is **more accurate**; it is **cheaper and only requires a trace** of the organism to be identified
- DNA is made of simple bases named A, T, C and G (page 71)
- Organisms that share a more recent ancestor (more closely related) have more similar DNA bases**
- DNA contains instructions for the making of proteins**; proteins are made up of building blocks called amino acids
- If two organisms share a common ancestor, then they also share similar amino acid sequences**
- The diagram below shows the DNA bases for four organisms:
- Organism 1 is more closely related to organism 2** than it is related to any of the other organisms
- This is because it only has one different DNA base (the last base)
- Note that organism 4 is the least related one because it has four different bases
- Organisms 1 and 2 have a recent common ancestor (shown in the diagram as ●)
- Organisms 1, 2 and 3 share a more distant ancestor ●. While organism 4 is the most distant
- Nonetheless, all organisms must have had a common ancestor due to the similarities in their DNA bases**

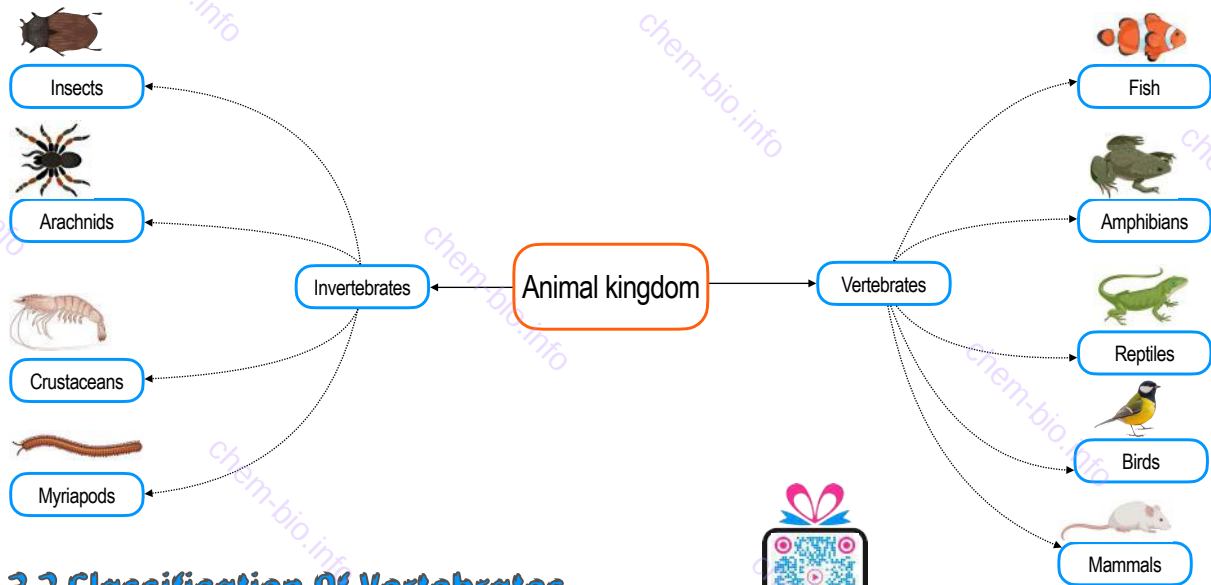


Classification of Animals & Plants

3

3.1 Classification Of Animals

* The animal kingdom is divided into two main groups: animals with backbones or vertebrates and invertebrates



3.2 Classification Of Vertebrates

* The table below summarises the main features of vertebrates:

Vertebrate	Fish	Amphibians	Reptiles	Birds	Mammals
Example					
Body covering	Moist scales	Moist skin	Dry scales	Feathers (legs with scales)	Hair and whiskers
Types of eggs	Jelly-covered	Jelly-covered	Rubbery shell	Hard shell	Give Birth
Eggs are laid in	In water	In water	On land	On land	No eggs
Limbs	Fins	Legs	Legs	Legs and Wings	Legs
Body temperature	Cold blooded	Cold blooded	Cold blooded	Warm Blooded	Warm Blooded
Gas exchange	Gills	Skin and lungs	Lungs	Lungs	Lungs
Other features	* Streamlined body * Tail to change direction	Lives in water and on land	Snakes have no limbs	Beaks and wings	* External ear (pinna) * Breast-feeding * 4 types of teeth

3.3 Regulation Of Body Temperature

* As it is noted in the table above, only mammals and birds can control their body temperature

* Various processes, such as sweating or shivering (page: 63), are used to maintain a constant body temperature

* The body temperature of cold-blooded animals changes with the environment

* Animals like reptiles, fish and amphibians are limited to their habitat because they cannot adapt to environments with different temperatures



10.2 Physical Digestion By Teeth

* The grinding of food by the teeth (physical or mechanical digestion) helps in two ways:

1. **Increase the surface area** of the food, which provides more access for enzymes and increases their rate
2. **Make food easier to swallow** and pass along the digestive tract (alimentary canal)

* There are four types of teeth, as shown in the table below:

Name	Incisor	Canine	Premolar	Molar
Shape				
Shape Description	Chisel-shaped	Pointed	Has 2 cusps	Has 4-5 cusps
Number of roots	1	1	1	2-3
Effect on food	Biting	Tearing	Grinding	Grinding

Cusp

Root

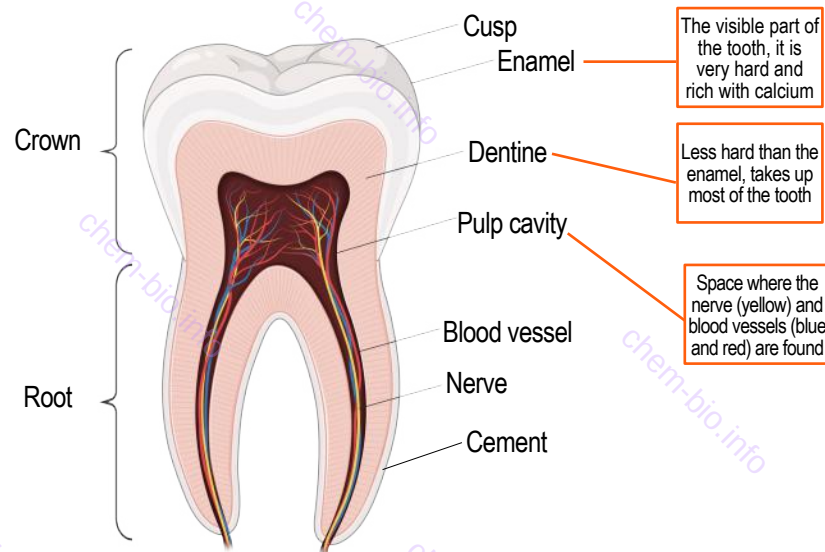


10.3 Tooth Structure

* The part of a tooth that is **visible above the gum line** is called the **crown**

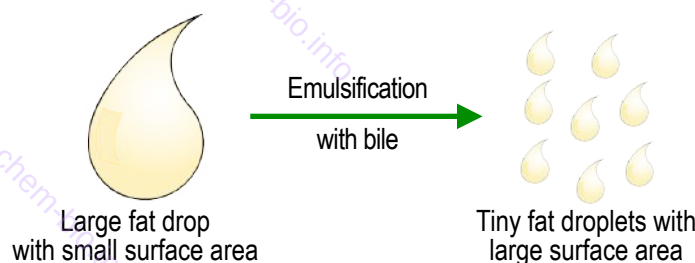
* The other part of the tooth that is **embedded in the jaw bone** is called the **root**

* The dentin of the root is covered with **cement**, which attaches the tooth to the bone in the jaw



E 10.4 Physical Digestion By Bile

- **Bile** is a fluid made in the liver (from dead red blood cells) and stored in the gall bladder
- It is stored in the **gall bladder** and delivered to the duodenum through the bile duct
- **Emulsification** is the breaking down of fats by bile into droplets **smaller droplets, increasing their surface area**
- This helps to increase the rate of chemical digestion by lipase (see the next page)





6.5 Comparison Of Food Contents

- * The following guidelines are essential to ensure a fair comparison between different food samples:
- * When given a solid food sample such as seeds, ①take equal masses of each sample, ②crush the seeds ③add equal volume of distilled water ④filter ⑤use the filtrate in the food test
- * If the samples are liquids, then measure equal volumes using a measuring cylinder
- * Add equal volumes of the food indicator solution
- * For Benedict's test, keep both samples in the water bath for equal time (5 minutes)



6.6 Summary Of Food Tests³

Food test	Solution	Positive result	Negative result	How to compare between different samples?
Starch	Iodine	Blue Black	Brown	Darker blue colour indicates more starch
Reducing sugars	Benedict's	Green, yellow, orange or red	Blue	The higher the intensity of the red colour the higher the amounts of reducing sugars 
Proteins	Biuret	Violet	Blue	The more intense the violet colour, the more the proteins
Fats	Ethanol	Milky white emulsion	Solution remains colourless	Thicker white emulsion indicates more fats
Vitamin C	DCPIP	Colourless	Blue	If it takes more volume of the juice to decolourise DCPIP, this means that the juice has less vitamin C

Exam tip

Always mention safety precautions such as wearing goggles or gloves while your writing investigations

Hosni



Crush

Dissolve in water

Add iodine solution

BLUE - BLACK COLOUR

STARCH IS PRESENT

COLOUR STAYS BROWN

NO STARCH

Add BIURET solution

COLOUR TURNS VIOLET

PROTEINS ARE PRESENT

COLOUR REMAINS BLUE

NO PROTEINS

Add BENEDICT'S solution

COLOUR TURNS RED

REDUCING SUGARS ARE PRESENT

COLOUR REMAINS BLUE

NO REDUCING SUGARS

Dissolve in ethanol

Add water

White emulsion

Fats are present

NO white emulsion

No fats

³ When you get a positive result, this means that the food group that you are testing for is present. A negative result is when the food group is missing

Plant Nutrition

8.1 Photosynthesis

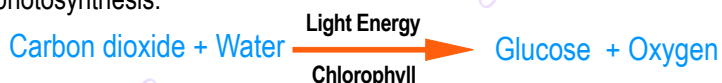
Photosynthesis is the process by which plants **make carbohydrates from raw materials using light energy**

* The raw materials (also known as reactants) of photosynthesis are carbon dioxide gas and liquid water

* **Oxygen is released as a by-product** (a waste product) of photosynthesis; some **oxygen is used for respiration**

Chlorophyll is a green pigment that is found in the chloroplast; it is required to capture light energy

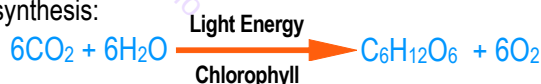
* The word equation for photosynthesis:



8.2 The Role Of Chlorophyll

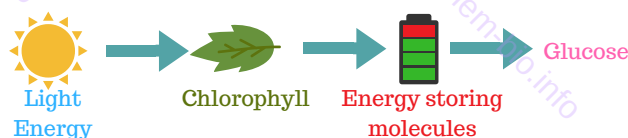
* Chlorophyll absorbs light energy necessary for photosynthesis to happen

* The formula equation of photosynthesis:



* Light energy is transferred into chemical energy that is stored, for a while, in energy-storing molecules

* The stored chemical energy can then be used to make glucose even in the absence of light



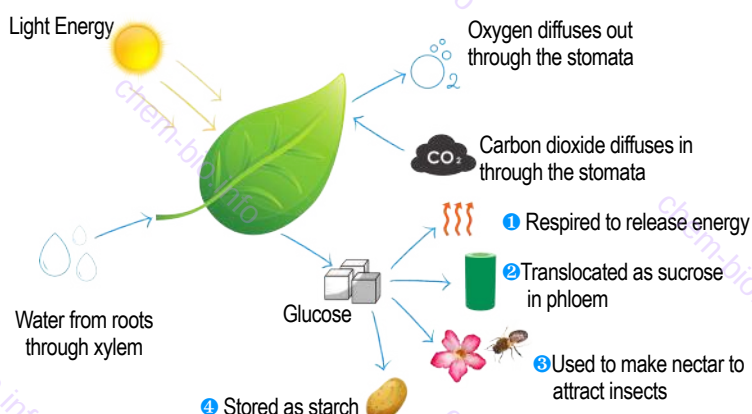
E 8.3 Using Glucose

* Glucose is the main product of photosynthesis; however, plants cannot store glucose for the following reasons:

1. **Glucose is soluble**; it lowers the water potential inside the cell; therefore, water will enter the cell by osmosis
2. **Glucose molecules are relatively small** and can easily escape out of the cell

* Therefore, **glucose has to be either respired to release energy or converted** into other forms:

1. Glucose can be **converted to sucrose** and translocated somewhere else in the plants through phloem (page: 28)
2. Glucose molecules can also be **stored as starch inside the cell**, mainly in the cytoplasm, and the chloroplast
Starch is insoluble, and it is too large to escape out of the cell



Exam tip

There are 3 types of carbohydrates in plants that you need to learn about:

Glucose: product of photosynthesis

Sucrose: transported sugar

Starch: Stored sugar

Hosni

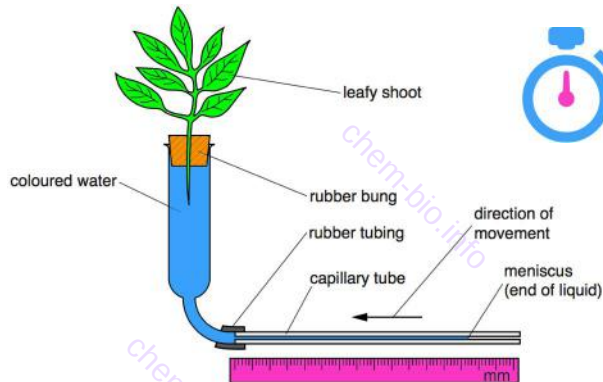
8.4 Gas Exchange In Plants

Material	Photosynthesis	Respiration	Daytime (photosynthesis rate is higher)	At night (respiration rate is higher)
Carbon dioxide	Raw material	Waste product	It mostly diffuses into the plant	It mostly diffuses out of the plant
Oxygen	Waste product	Required	It mostly diffuses out of the plant	It mostly diffuses into the plant
Water	Raw material	Waste product	Water vapour diffuses out of the leaves all the time (transpiration, page 28) which helps to pull water from the roots to the leaves	



9.10 Investigating Water Uptake In Plants

- * An apparatus like the one shown here is used to study the effect of environmental factors on transpiration
- * Water is lost from the attached leafy shoot by transpiration
- * Transpiration in the leaves causes the water in the capillary tube to move left
- * The rate of transpiration is the **distance travelled by the meniscus in the capillary tube over time**



Exam tip

The transpiration device must be set up under water to make sure that there are no air bubbles trapped inside this device

Hosni

- * **Cobalt chloride** papers can also be used to determine transpiration rate by attaching these papers to the leaves
- * These papers have blue colour when dry; they turn purple when exposed to water vapour
- * The transpiration rate is measured by calculating the **time it takes for the cobalt chloride papers to change their colour from blue to pink**

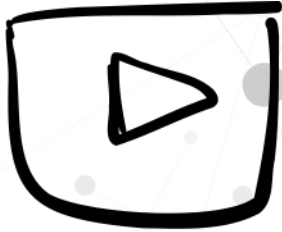


9.11 Investigating Factors That Alter Transpiration

- * Each of the following variables is a possible factor that you could be asked to investigate
- * If you are to change a specific variable (independent variable), then you have to control all the other variables

Variable	How is it manipulated?	How it controlled?	Effect on transpiration
Light intensity	Changing the distance of the lamp	- Same lamp - At a fixed distance	Positive correlation
Temperature	Altering the room temperature	Use a thermostat	
Wind	Using a fan	Limited airflow	
Humidity	Place a plastic bag around the leaves to trap humidity within the bag	Using a humidifier	Negative correlation
Number of leaves	Using shoots of the same plant with different number leaves	Using identical plant shoots	Positive correlation
Stomata on the upper or lower leaf side	Using petroleum jelly (waterproof) to cover the upper or the lower surfaces of the leaf	Cover both sides with petroleum jelly	The lower side usually has more stomata so more transpiration from the lower side

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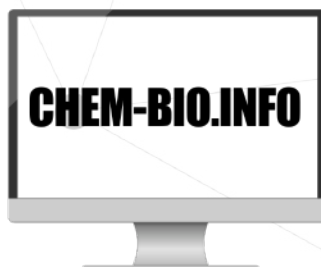
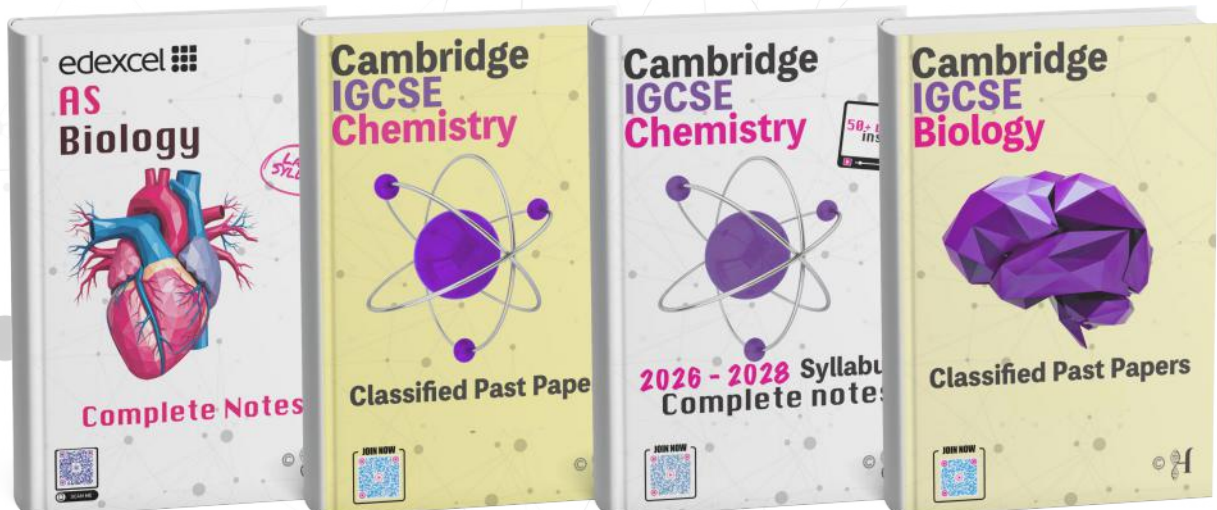


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