



AMBITION INSTITUTE

INSPIRE • LEARN • ACHIEVE

CHAPTER – 5

NUTRITION

RESPIRATION

LIFE

Nutrition	→ Food
Respiration	→ Energy
Transport	→ Blood
Excretion	→ Waste

PROCESSES

Nutrition • Respiration • Transport • Excretion

CLASS
10th

SCIENCE

NOTES



EXCRETION



BIOLOGY

SCIENCE

NUTRITION

Life processes are the basic functions performed by living organisms to stay alive. Even when we are resting, molecular movement continues inside cells, and it needs a constant supply of energy.

What are Life Processes?

- Life processes **maintain** the body and keep it working.
- Main life processes: **Nutrition, Respiration, Transportation and Excretion.**
- Energy for all of them comes from **food**, so we need an outside source of energy.
- Raw material is also needed for **growth** and **repair** of the body.



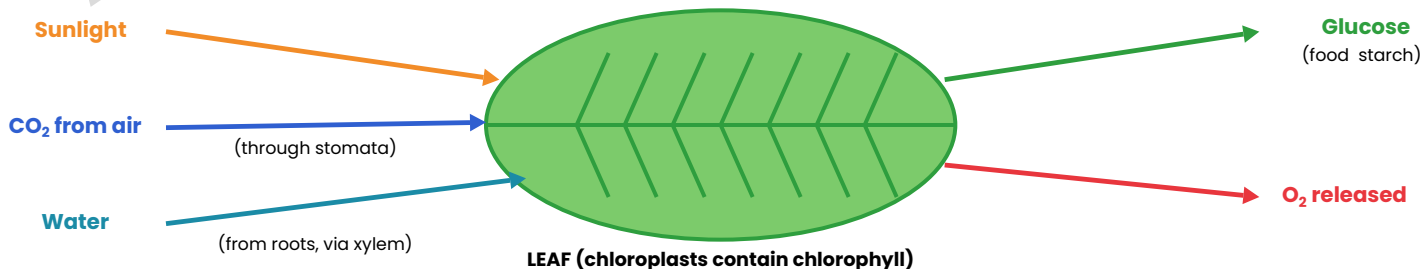
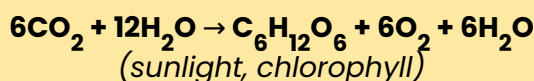
Nutrition

Nutrition is the process of taking in food and using it to get energy, grow and repair the body.

Mode	Meaning	Examples
Autotrophic nutrition	Organisms make their own food from simple inorganic substances (CO ₂ and water) using sunlight.	Green plants, algae, some bacteria
Heterotrophic nutrition	Organisms cannot make their own food and depend on other organisms for it.	Animals, fungi, most bacteria

Photosynthesis

Photosynthesis is the process by which green plants prepare carbohydrates (food) from CO₂ and water in the presence of sunlight and chlorophyll.



NUTRITION

Steps of Photosynthesis

1. Absorption of light energy by **chlorophyll**.
2. Conversion of light energy into **chemical energy** and splitting of water into hydrogen and oxygen.
3. Reduction of carbon dioxide to **carbohydrates**.

Starch made in leaves can be tested with iodine solution: it turns blue-black.

Stomata

- **Stomata** are tiny pores on the surface of leaves, surrounded by **guard cells**.
- Gaseous exchange (CO_2 in, O_2 out) takes place through them.
- Large amounts of water are also lost through stomata, so guard cells close them when not needed.
- When water flows into guard cells they swell and the pore **opens**; when they lose water the pore **closes**.

Heterotrophic Nutrition

Type	How food is obtained	Examples
Holozoic	Food is taken in as solid pieces, digested inside the body and the waste is thrown out.	Amoeba, humans, cow, lion
Saprotrophic	Organisms break down dead and decaying matter outside the body and absorb the nutrients.	Bread mould, yeast, mushrooms
Parasitic	Organisms live on or inside another living organism (host) and take food from it, often harming it.	Cuscuta, tapeworm, lice, <i>Plasmodium</i>

Amoeba (holozoic)

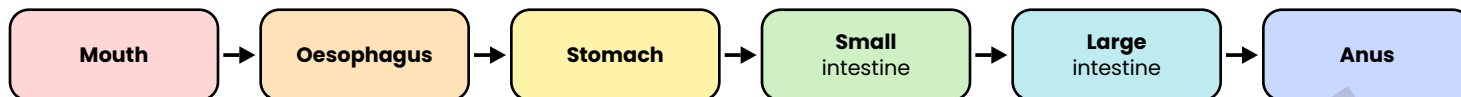
It takes in food using temporary finger-like **pseudopodia**. The food gets trapped in a **food vacuole**, where complex substances are broken down into simpler ones that diffuse into the cytoplasm. Unused material is expelled outside.



NUTRITION IN HUMANS

Human Digestive System

The **alimentary canal** is a long tube from the mouth to the anus. Digestion happens in stages as food moves along it, and glands such as the salivary glands, liver and pancreas pour in juices.



Organ	What happens here
Mouth	Teeth chew food; saliva moistens it and salivary amylase starts breaking down starch.
Oesophagus	Food moves down by rhythmic contractions called peristalsis .
Stomach	Muscular walls churn the food. Gastric glands release HCl, pepsin and mucus.
Small intestine	Longest part (about 6 m). Digestion is completed here and nutrients are absorbed through villi .
Liver and pancreas	Liver makes bile; pancreas makes pancreatic juice. Both empty into the small intestine.
Large intestine	Absorbs water from undigested food; waste is stored in the rectum.
Anus	Waste is removed from the body by egestion through the anal sphincter.

Remember: A sphincter muscle at the stomach exit controls how much food passes into the small intestine at a time.

NUTRITION IN HUMANS

Digestive Juices and Enzymes

Enzymes are biological catalysts. They speed up the breakdown of food into simpler, absorbable molecules.

Source	Juice / Enzyme	Action
Salivary glands	Salivary amylase	Starch → sugar (maltose)
Stomach	Hydrochloric acid	Makes the medium acidic for pepsin and kills germs
	Pepsin	Proteins → smaller peptides
	Mucus	Protects the stomach lining from acid
Liver	Bile	Makes food alkaline and emulsifies fats into small globules
Pancreas	Trypsin	Proteins → peptides and amino acids
	Lipase	Emulsified fats → fatty acids + glycerol
	Pancreatic amylase	Starch → sugars
Small intestine	Intestinal juice	Proteins → amino acids; carbohydrates → glucose; fats → fatty acids + glycerol

Absorption and Egestion

- Inner wall of the small intestine has finger-like projections called **villi**, which increase the surface area for absorption.
- Villi are rich in blood vessels that carry absorbed food to every cell for energy, growth and repair.
- Unabsorbed food goes to the large intestine, where water is absorbed, and the rest is egested.

Quick trick: A = Amylase → starch, P = Pepsin → proteins, L = Lipase → lipids (fats).

RESPIRATION

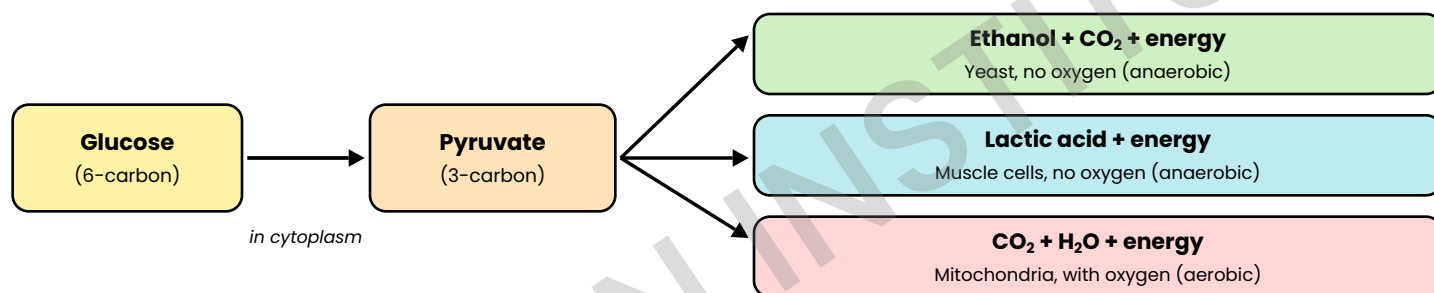
What is Respiration? _____

Respiration is the process of releasing energy from food inside the cell.

- Glucose is first broken down into **pyruvate** in the cytoplasm.
- Energy released is stored as **ATP**, the energy currency of the cell.
- When needed, ATP breaks into ADP + phosphate and releases energy (about 30.5 kJ/mol).



Breakdown of Glucose _____



Aerobic vs Anaerobic _____

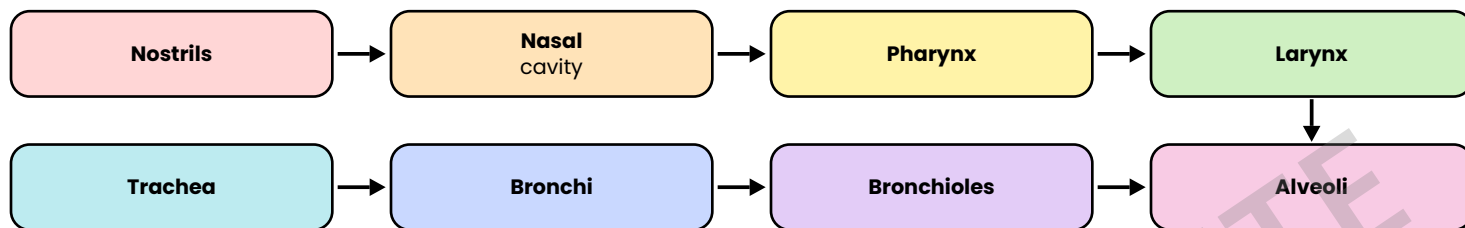
Feature	Aerobic respiration	Anaerobic respiration
Oxygen	Needed	Not needed
Site	Cytoplasm and mitochondria	Cytoplasm only
Energy released	Large (much more ATP)	Small (less ATP)
Products	CO ₂ + H ₂ O	Ethanol + CO ₂ (yeast) or lactic acid (muscles)
Examples	Most plants and animals	Yeast, bacteria, muscle cells during heavy exercise

Muscle cramps: during sudden heavy exercise, muscles run short of oxygen, so pyruvate turns into **lactic acid**, which builds up and causes cramps.

RESPIRATION

Human Respiratory System

Air we breathe in follows this path to the lungs, where oxygen enters the blood.



- **Trachea** has rings of cartilage so it does not collapse when air is not present.
- Inside the lungs the bronchi divide into smaller tubes ending in balloon-like **alveoli**.
- Alveoli have a very large surface area and thin, blood-rich walls, so gases exchange easily.
- **Haemoglobin** in red blood cells has a high affinity for oxygen and carries it to the tissues.

Breathing Mechanism

Feature	Inhalation	Exhalation
Diaphragm	Contracts and flattens	Relaxes and moves up (dome shape)
Ribs	Move up and outward	Move down and inward
Chest cavity volume	Increases	Decreases
Air pressure inside lungs	Decreases, so air rushes in	Increases, so air is pushed out

Respiration in Other Organisms

- **Aquatic animals** (fish) use gills to take dissolved oxygen from water. Water has less oxygen than air, so fish breathe faster.
- **Plants** exchange gases through **stomata** in leaves and through lenticels in stems; roots take air by diffusion.
- **Amoeba** and other simple organisms exchange gases directly through the body surface by diffusion.

TRANSPORTATION

Blood

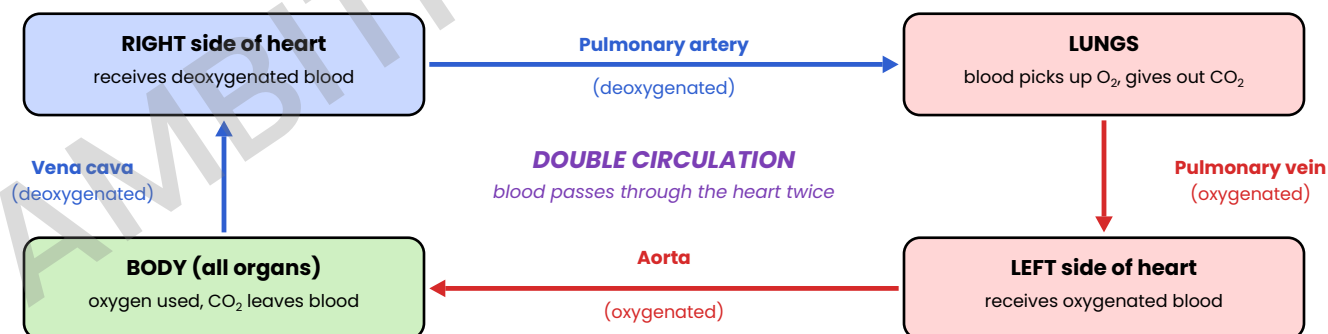
Blood is a fluid connective tissue that carries food, oxygen, CO_2 , hormones and waste around the body.

Component	Function
Plasma	Liquid part. Transports food, CO_2 , nitrogenous waste and salts in dissolved form.
Red blood cells (RBC)	Contain haemoglobin. Carry oxygen to all cells.
White blood cells (WBC)	Defend the body against germs (immunity).
Platelets	Help blood clot at a cut and stop bleeding.

The Human Heart

- Muscular organ the size of our fist; it has **four chambers**: two atria (upper) and two ventricles (lower).
- Right side holds **deoxygenated** blood; left side holds **oxygenated** blood. They never mix.
- Ventricle walls are thicker than atria walls because they pump blood out with force.
- Valves ensure that blood flows in one direction only.

Double Circulation



Birds and mammals need a lot of energy, so they separate oxygen-rich and oxygen-poor blood. This gives efficient oxygen supply.

TRANSPORTATION

Blood Vessels

Vessel	Carries	Wall	Other features
Arteries	Blood away from the heart (mostly oxygenated)	Thick and elastic	Deep in the body; blood under high pressure
Veins	Blood towards the heart (mostly deoxygenated)	Thin	Have valves to stop backflow
Capillaries	Connect arteries to veins	One cell thick	Exchange of materials with cells

Blood pressure: the force exerted by blood on the artery walls. Normal value is about **120/80 mm Hg** (systolic/diastolic). High blood pressure is called hypertension.

Lymph

- **Lymph** is a colourless fluid that escapes from capillaries into tissue spaces and drains back to the blood.
- It carries digested fat from the intestine and drains excess fluid from tissues.

Transport in Plants

Tissue	Transports	Direction	Process
Xylem	Water and minerals	Upward, roots to leaves	Driven by transpiration pull
Phloem	Food made in leaves (sucrose, etc.)	Both upward and downward	Translocation , needs energy (ATP)

Transpiration is the loss of water as vapour from aerial parts of the plant, mainly through stomata.

- Creates a suction force that pulls water up through the xylem.
- Helps in temperature regulation and the absorption and upward movement of water and minerals.

EXCRETION

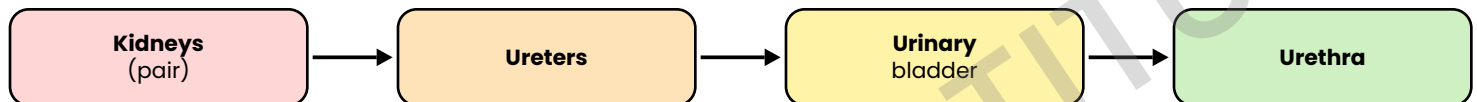
What is Excretion?

Excretion is the biological process of removing harmful metabolic wastes from the body.

- Main waste in humans: **urea** (nitrogenous), CO_2 , water and salts.
- Organs: kidneys, lungs, skin and liver.

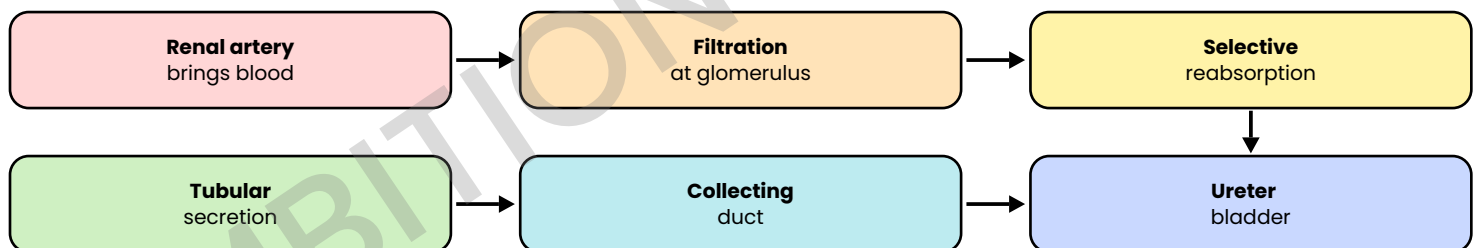


Human Excretory System



- **Nephron** is the filtering unit of the kidney. Each kidney has lakhs of nephrons.
- Nephron = **glomerulus** (cluster of capillaries) + **Bowman's capsule** + long tubule.

Urine Formation



- Useful substances (glucose, amino acids, salts, water) are **reabsorbed** into the blood.
- Urine is stored in the bladder and expelled through the urethra, controlled by a sphincter muscle.

Artificial Kidney (Dialysis)

If kidneys fail, blood is passed through a dialysis machine where nitrogenous waste is filtered out and cleaned blood returns to the patient.

Excretion in Plants

- Oxygen and CO_2 leave through stomata; extra water is lost by transpiration.
- Waste is stored in old xylem, leaves and bark, and removed as gums, resins and latex when leaves fall.

QUICK REVISION

Life Processes at a Glance

Process	Purpose	Key organs / structures	Key point
Nutrition	Obtain energy and raw materials	Chloroplast; alimentary canal	Autotrophic vs heterotrophic
Respiration	Release energy from glucose	Mitochondria; lungs, alveoli	Aerobic gives more ATP
Transportation	Carry materials around the body	Heart, blood vessels; xylem, phloem	Double circulation in humans
Excretion	Remove metabolic waste	Kidneys, nephron	Filtration, reabsorption, secretion

Key Terms

Peristalsis: wave-like muscle contractions that push food along the alimentary canal.

Emulsification: breaking large fat globules into smaller ones (by bile).

Villi: finger-like projections in the small intestine that increase absorption.

Alveoli: tiny air sacs in the lungs where gaseous exchange happens.

Haemoglobin: red pigment in RBCs that carries oxygen.

Transpiration: loss of water vapour from aerial parts of plants.

Translocation: transport of food from leaves to other parts through phloem.

Nephron: structural and functional unit of the kidney.

Important Equations

Photosynthesis: $6\text{CO}_2 + 12\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$

Aerobic respiration: Glucose $\rightarrow$ Pyruvate $\rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{Energy}$

Anaerobic (yeast): Glucose $\rightarrow$ Pyruvate $\rightarrow$ Ethanol + CO_2 + Energy

Anaerobic (muscle): Glucose $\rightarrow$ Pyruvate $\rightarrow$ Lactic acid + Energy

Exam tip: label diagrams neatly: alimentary canal, human heart, nephron and an open and closed stomata are frequently asked.

PRACTICE QUESTIONS

Short Answer Questions

Q1. Why is the rate of breathing in aquatic organisms much faster than in terrestrial organisms?

Ans. Water contains much less dissolved oxygen than air, so aquatic animals must breathe faster to obtain enough oxygen.

Q2. What are the functions of bile juice?

Ans. It makes the food alkaline for pancreatic enzymes and emulsifies fats to increase the surface area for lipase.

Q3. Why is the small intestine long in herbivores?

Ans. Cellulose in plant food takes a long time to digest, so a longer small intestine is needed.

Q4. Why do arteries have thick walls and veins have valves?

Ans. Arteries carry blood under high pressure; veins carry blood at low pressure, and their valves prevent backflow.

Differentiate Between

Aerobic vs Anaerobic	Xylem vs Phloem	Artery vs Vein
With O ₂ , more energy, CO ₂ + H ₂ O	Water upward vs food both ways	Away from heart vs towards heart
Without O ₂ , less energy, ethanol or lactic acid	Transpiration pull vs translocation	Thick wall vs thin wall with valves

Think and Answer

1. Which part of the heart has the thickest walls and why?
2. What would happen if the stomach produced no mucus?
3. How do guard cells control the opening of stomata?
4. Why does glucose appear in urine of a person with kidney damage?
5. State the difference between breathing and respiration.