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Life Processes Class 10 Notes | CBSE Chapter 5 Science

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Life Processes Class 10 Notes | CBSE Chapter 5 Science

Life Processes is Chapter 5 of CBSE Class 10 Science. All living organisms — from a single-celled amoeba to a human being — must carry out certain basic processes to stay alive. These are: **Nutrition, Respiration, Transportation, and Excretion**. This chapter explains how each of these processes works in plants, animals, and humans.

This is a high-weightage chapter for board exams — expect 8–10 marks. The human digestive system, heart, nephron, and photosynthesis are the most frequently tested topics.

Key Concepts

1. What Are Life Processes?

Life processes are the essential biological activities that maintain life in an organism. They include:

- **Nutrition** — obtaining energy from food
- **Respiration** — releasing energy from food
- **Transportation** — moving materials within the body
- **Excretion** — removing waste products
- Growth, reproduction, and movement also qualify as life processes

Even when we sleep, these processes continue — stopping any one of them can mean death.

2. Nutrition

Nutrition is the process by which organisms obtain and use food for energy, growth, and repair.

Types of Nutrition

- **Autotrophic nutrition:** Organisms make their own food using sunlight or chemical energy (e.g., plants, algae, some bacteria)
- **Heterotrophic nutrition:** Organisms depend on other organisms for food (e.g., animals, fungi, most bacteria)

Autotrophic Nutrition — Photosynthesis

Plants make their own food through **photosynthesis** — a process that converts light energy into chemical energy stored in glucose.

Overall equation:

$6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ (in the presence of sunlight and chlorophyll)

Raw materials needed:

- Carbon dioxide — enters through stomata in leaves
- Water — absorbed by roots, travels up via xylem
- Sunlight — absorbed by chlorophyll (the green pigment in chloroplasts)

Where does photosynthesis occur? In the **chloroplasts** — mainly in leaf cells. The green colour of leaves is due to chlorophyll.

Two stages of photosynthesis:

1. **Light reaction (Light-dependent):** Water is split using light energy → oxygen is released; ATP and NADPH are produced
2. **Dark reaction / Calvin cycle (Light-independent):** CO_2 is fixed using ATP and NADPH to produce glucose

Stomata: Tiny pores on the leaf surface through which CO_2 enters and O_2 exits. They are opened and closed by **guard cells**.

Heterotrophic Nutrition

Type	Description	Example
Holozoic	Ingests solid food, digests internally	Humans, Amoeba, most animals
Saprophytic (Saprotrophic)	Feeds on dead and decaying matter by secreting digestive enzymes outside body	Fungi, some bacteria
Parasitic	Lives on/in a host, gets nutrition at host's expense	Tapeworm, Cuscuta plant, lice

Nutrition in Amoeba

Amoeba is a unicellular organism that feeds by a process called **phagocytosis**:

1. Amoeba extends pseudopodia (false feet) around the food particle
2. The food is engulfed into a **food vacuole**
3. Digestive enzymes break down the food inside the vacuole
4. Nutrients are absorbed into the cytoplasm; undigested matter is expelled

Nutrition in Humans — The Digestive System

The human digestive system is a long tube (about 9 metres) called the **alimentary canal**, along with accessory glands.

Part	What happens here	Key enzymes/secretions
Mouth (Buccal cavity)	Mechanical digestion (chewing); starch → maltose	Salivary amylase (ptyalin) in saliva
Oesophagus	Food passes by peristalsis (wave-like muscle contractions)	None — just transport
Stomach	Churns food; proteins → peptides; kills bacteria	HCl (pepsin activation, kills germs); Pepsin (protein digestion)
Small intestine	Main site of digestion and absorption of all nutrients	Pancreatic juice (amylase, lipase, trypsin); Bile (emulsifies fats); Intestinal juice
Large intestine	Absorbs water; forms and stores faeces	None (mostly bacteria)
Rectum/Anus	Stores and eliminates faeces	—

Accessory glands:

- **Liver** — produces bile (stored in gallbladder); bile emulsifies fats (breaks large fat droplets into smaller ones for easier enzyme action)
- **Pancreas** — produces pancreatic juice containing amylase (carbs), lipase (fats), trypsin (proteins)

Villi and Microvilli: The inner lining of the small intestine has finger-like projections called **villi** (singular: villus). They massively increase the surface area for absorption. Each villus contains blood capillaries and lymph capillaries (lacteals).

3. Respiration

Respiration is the process of breaking down glucose to release energy for cellular activities. It occurs in every living cell.

Respiration ≠ Breathing. Breathing is just the physical act of inhaling/exhaling air. Respiration is the chemical process of releasing energy from glucose.

Types of Respiration

a) Aerobic Respiration (with oxygen)



- Occurs in mitochondria
- Complete breakdown of glucose
- Large amount of energy released
- Used by: most animals, plants during day

b) Anaerobic Respiration (without oxygen)

In yeast: $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2 + \text{Energy (2 ATP)}$ — called fermentation

In human muscles (during intense exercise): $C_6H_{12}O_6 \rightarrow 2C_3H_6O_3$ (lactic acid) + Energy (2 ATP)

- Incomplete breakdown of glucose
- Very little energy released
- Lactic acid build-up in muscles causes cramps
- Used by: yeast, bacteria, and muscles during intense exercise

Comparison Table

Feature	Aerobic	Anaerobic
Oxygen needed?	Yes	No
End products	$CO_2 + H_2O$	Lactic acid OR ethanol + CO_2
Energy (ATP)	38 ATP (high)	2 ATP (low)
Location	Mitochondria	Cytoplasm

Human Respiratory System

Pathway of air: Nostrils → Nasal cavity → Pharynx → Larynx → Trachea → Bronchi → Bronchioles → Alveoli

Alveoli are tiny air sacs in the lungs where gas exchange occurs:

- O_2 from air diffuses into blood capillaries surrounding the alveolus
- CO_2 from blood diffuses into the alveolus to be exhaled
- Alveoli have very thin walls (one cell thick) and a rich blood supply to maximise diffusion
- About 300 million alveoli in each lung → huge surface area ($\sim 70 \text{ m}^2$)

Haemoglobin: The red pigment in RBCs that binds O_2 and carries it around the body. $O_2 + \text{Haemoglobin} \rightarrow \text{Oxyhaemoglobin}$ (in lungs). CO_2 is mainly carried dissolved in blood plasma as bicarbonate ions.

4. Transportation

Transportation in Plants

Plants have two types of vascular tissue for transport:

Tissue	What it transports	Direction
Xylem	Water and dissolved minerals from roots to leaves	Upward only (unidirectional)
Phloem	Food (glucose/sucrose) made in leaves to all parts of plant	Both up and down (bidirectional)

How does water rise in tall trees? Two main forces:

- **Transpiration pull:** Water evaporates from leaves through stomata (transpiration), creating a suction that pulls water up through xylem — like drinking through a straw
- **Root pressure:** Osmotic pressure in roots pushes water up

Translocation: The movement of food (sugars) through phloem. It requires energy (active process — uses ATP), unlike xylem transport which is passive.

Transportation in Humans — The Circulatory System

Blood — Composition and Functions

Component	Description	Function
Plasma	Yellowish liquid (90% water)	Transports nutrients, hormones, CO ₂ , waste, clotting factors
Red Blood Cells (RBCs)	Biconcave disc, no nucleus, contain haemoglobin	Transport oxygen
White Blood Cells (WBCs)	Irregular shape, have nucleus	Fight infection (immunity)
Platelets	Cell fragments	Blood clotting — seal wounds

The Human Heart

The heart is a muscular pump about the size of a fist, located slightly to the left in the chest. It beats about 72 times per minute.

Structure: 4 chambers

- **Right atrium** — receives deoxygenated blood from body (via vena cava)
- **Right ventricle** — pumps deoxygenated blood to lungs (via pulmonary artery)
- **Left atrium** — receives oxygenated blood from lungs (via pulmonary vein)
- **Left ventricle** — pumps oxygenated blood to entire body (via aorta) — has the thickest walls

Valves between chambers prevent backflow of blood.

Double circulation: Blood passes through the heart twice in one complete circuit:

- **Pulmonary circulation:** Heart → Lungs → Heart (for oxygenation)
- **Systemic circulation:** Heart → Body → Heart (delivers oxygen to tissues)

This ensures oxygenated and deoxygenated blood don't mix — making the system highly efficient for warm-blooded animals.

Blood Vessels

Vessel	Direction	Wall	Key feature
Arteries	Away from heart	Thick, muscular, elastic	Carry blood under high pressure; no valves (except at heart)
Veins	Towards heart	Thin, less muscular	Have valves to prevent backflow; carry deoxygenated blood (except pulmonary veins)
Capillaries	Connect arteries to veins	One cell thick	Site of exchange of nutrients, O ₂ , CO ₂ between blood and tissues

Exception: Pulmonary artery carries deoxygenated blood; pulmonary vein carries oxygenated blood. Don't be tricked in exams!

Lymph

Some plasma leaks out of capillaries into tissues — this becomes **lymph** (tissue fluid). It is colourless, contains WBCs (lymphocytes), and is collected by lymph capillaries → lymph nodes → returned to blood via lymphatic ducts. Lymph also carries absorbed fats from the small intestine (via lacteals).

5. Excretion

Excretion is the removal of metabolic waste products from the body. (Not to be confused with egestion — removal of undigested food.)

Excretion in Plants

- CO₂ and O₂ are excreted through stomata and lenticels
- Some waste is stored in old leaves, bark, or vacuoles as resins, gums, and oils
- Some waste is excreted into the soil through roots
- Plants do not have a dedicated excretory organ

Excretion in Humans — The Urinary System

Main nitrogenous waste in humans: **urea** (formed in liver from breakdown of excess amino acids)

Organs of excretion:

- **Kidneys (main):** Filter blood, form urine
- **Skin:** Sweating excretes water, salts, and small amounts of urea
- **Lungs:** Excrete CO₂ and water vapour
- **Liver:** Excretes bile pigments (from breakdown of old RBCs)

Structure of the Kidney

Each kidney contains about one million functional units called **nephrons**.

Parts of a nephron:

1. **Glomerulus:** A knot of capillaries inside the Bowman's capsule. Blood is filtered here under pressure — water, glucose, urea, salts pass into Bowman's capsule. Large proteins and blood cells do NOT pass through.
2. **Bowman's capsule:** Cup-shaped structure surrounding the glomerulus; collects the filtrate
3. **Proximal convoluted tubule (PCT):** Reabsorbs glucose, amino acids, and most water back into blood
4. **Loop of Henle:** Further concentrates urine by reabsorbing water and salts
5. **Distal convoluted tubule (DCT):** Fine-tunes salt and pH balance; secretes some waste into filtrate
6. **Collecting duct:** Collects urine from multiple nephrons; final water reabsorption; urine drains into renal pelvis → ureter → urinary bladder → urethra

Urine Formation — Three Steps

1. **Ultrafiltration:** Blood filtered in glomerulus under pressure into Bowman's capsule
2. **Reabsorption:** Useful substances (glucose, amino acids, water, salts) reabsorbed back into blood from tubules
3. **Secretion:** Some additional waste actively secreted from blood into tubular fluid

Dialysis (Artificial Kidney)

When kidneys fail, a machine takes over their function. The patient's blood is passed through a machine containing a semi-permeable membrane surrounded by dialysing fluid. Waste (urea) diffuses out of blood across the membrane; clean blood is returned to the body. Patients typically need dialysis 3 times a week.

Important Definitions

Term	Definition
Nutrition	Process of obtaining and using food for energy, growth, and repair
Photosynthesis	Process by which plants convert $\text{CO}_2 + \text{H}_2\text{O}$ into glucose using sunlight and chlorophyll
Stomata	Tiny pores on leaf surface for gas exchange; regulated by guard cells
Respiration	Biochemical process of breaking down glucose to release energy (ATP)
Fermentation	Anaerobic breakdown of glucose by yeast producing ethanol + CO_2
Alveoli	Tiny air sacs in lungs where gas exchange between air and blood occurs
Haemoglobin	Iron-containing red pigment in RBCs that carries oxygen
Transpiration	Loss of water vapour from leaves through stomata
Translocation	Movement of food (sugars) through phloem to all parts of the plant
Plasma	Liquid component of blood; transports nutrients, hormones, waste
Double circulation	Blood passes through the heart twice per circuit (pulmonary + systemic)
Excretion	Removal of metabolic waste products from the body
Nephron	Functional unit of the kidney; filters blood and forms urine
Glomerulus	Knot of capillaries in the nephron where ultrafiltration of blood occurs
Dialysis	Artificial process of filtering blood when kidneys fail
Peristalsis	Wave-like muscular contractions that push food through the alimentary canal

Solved Examples (NCERT-Based)

Example 1

What would happen if all the chlorophyll in a plant's leaves was destroyed?

Answer: The plant would not be able to perform photosynthesis since chlorophyll absorbs sunlight — the energy source for the process. Without photosynthesis, the plant cannot produce glucose (its food). It would eventually starve and die.

Example 2

Why does the left ventricle have thicker walls than the right ventricle?

Answer: The left ventricle pumps oxygenated blood to the entire body through the aorta — a much longer and higher-resistance circuit (systemic circulation). The right ventricle only pumps blood to the lungs (pulmonary circulation), which is a shorter distance. Therefore, the left ventricle needs much greater muscular force, hence its thicker walls.

Example 3

Why is glucose not found in urine in a healthy person, even though it passes through the glomerulus?

Answer: During ultrafiltration in the glomerulus, glucose does enter the Bowman's capsule along with water and salts. However, in the proximal convoluted tubule (PCT), all the glucose is selectively reabsorbed back into the blood. A healthy person's renal threshold can reabsorb all filtered glucose. Glucose appears in urine only in diabetics, whose blood glucose is so high that it exceeds the reabsorption capacity.

Example 4

Why does running fast cause muscle cramps?

Answer: During intense exercise, muscles need more energy than aerobic respiration can supply (oxygen runs out). The muscles switch to anaerobic respiration, producing lactic acid. Lactic acid accumulates in the muscles, causing the pain and cramps. When you rest and the oxygen supply is restored, the liver converts lactic acid back to glucose.

Important Questions for Board Exams

1-Mark Questions

1. Name the pigment in plants that absorbs light for photosynthesis.
2. Where does digestion of starch begin in the human body?
3. What is the role of villi in the small intestine?
4. Name the functional unit of the kidney.
5. What is the end product of anaerobic respiration in yeast?

2-Mark Questions

1. Distinguish between aerobic and anaerobic respiration. Give one example of each.
2. What is the difference between arteries and veins? Give two points.
3. What is transpiration? What is its role in the transport of water in plants?
4. What is the difference between excretion and egestion?
5. Why is bile not an enzyme yet important for digestion?

3-Mark Questions

1. Explain double circulation in humans. Why is it necessary?
2. Describe the process of urine formation in the nephron. Name the three steps.
3. How do plants obtain CO₂ and water for photosynthesis? What is the role of stomata?
4. What are the components of blood? State the function of each component.
5. Describe the passage of food through the human alimentary canal, naming the digestive juice acting at each stage.

5-Mark Questions

1. Draw a labelled diagram of the human heart and describe its functioning. What is meant by double circulation?
 2. Draw a labelled diagram of a nephron and explain the process of urine formation.
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Quick Revision Points

- Life processes: Nutrition, Respiration, Transportation, Excretion (remember: **NRTE**)
 - Photosynthesis: $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ — needs chlorophyll + sunlight; occurs in chloroplasts
 - Stomata open for gas exchange; controlled by guard cells
 - Digestion starts in mouth (amylase); main digestion and absorption in small intestine
 - Bile from liver emulsifies fats; pancreas makes amylase + lipase + trypsin
 - Aerobic: 38 ATP, CO₂ + H₂O; Anaerobic: 2 ATP, lactic acid (muscles) or ethanol + CO₂ (yeast)
 - Xylem = water upward; Phloem = food both ways
 - Heart: Right side = deoxygenated blood to lungs; Left side = oxygenated blood to body
 - Pulmonary artery → deoxygenated; Pulmonary vein → oxygenated (opposite of usual!)
 - Left ventricle has thickest walls — pumps blood to whole body
 - Nephron: Glomerulus (filter) → PCT (reabsorb glucose) → Loop of Henle (concentrate) → collecting duct (urine)
 - Glucose filtered but fully reabsorbed — appears in urine only in diabetes
 - Urea = nitrogenous waste made in liver; removed by kidneys
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Previous Chapter: Chapter 4 — Carbon and its Compounds

Next Chapter: Chapter 6 — Control and Coordination



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