CHAPTER 6

Life Processes

Class 10 Science | NCERT Exemplar - Complete Solved Study Guide

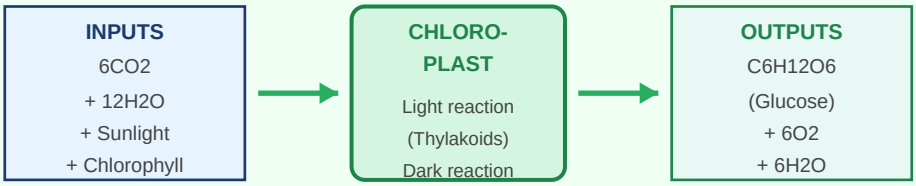
[GLOS] Key Terms / Glossary

Autotrophs	Organisms that make their own food using light energy (photosynthesis). E.g., green plants, algae.
Heterotrophs	Organisms that cannot make their own food; they depend on others. E.g., animals, fungi, most bacteria.
Photosynthesis	Process by which green plants convert CO2 + H2O -> glucose + O2 using sunlight and chlorophyll.
Stomata	Tiny pores on leaf surface through which gas exchange and transpiration occur; controlled by guard cells.
Glycolysis	First stage of respiration; glucose -> 2 pyruvate in cytoplasm; produces 2 ATP; no O2 needed.
Aerobic Respiration	Breakdown of glucose using O2 in mitochondria; produces CO2, H2O, and 36-38 ATP.
Anaerobic Respiration	Breakdown of glucose WITHOUT O2; produces less energy; in yeast -> ethanol + CO2; in muscle -> lactic acid.
Haemoglobin	Red iron-containing protein in RBCs that carries oxygen from lungs to body tissues.
Nephron	Functional unit of kidney; performs filtration, reabsorption and secretion to form urine.
Transpiration	Loss of water vapour through stomata of leaves; creates transpiration pull to draw water up from roots.
Peristalsis	Rhythmic wave-like muscular contractions in the walls of the alimentary canal that push food forward.
Emulsification	Process by which bile breaks large fat droplets into smaller ones, increasing surface area for lipase action.
Dialysis	Artificial filtration of blood when kidneys fail; mimics nephron's filtration function.

Villi	Finger-like projections in small intestine wall that greatly increase surface area for absorption of nutrients.

Photosynthesis at a Glance

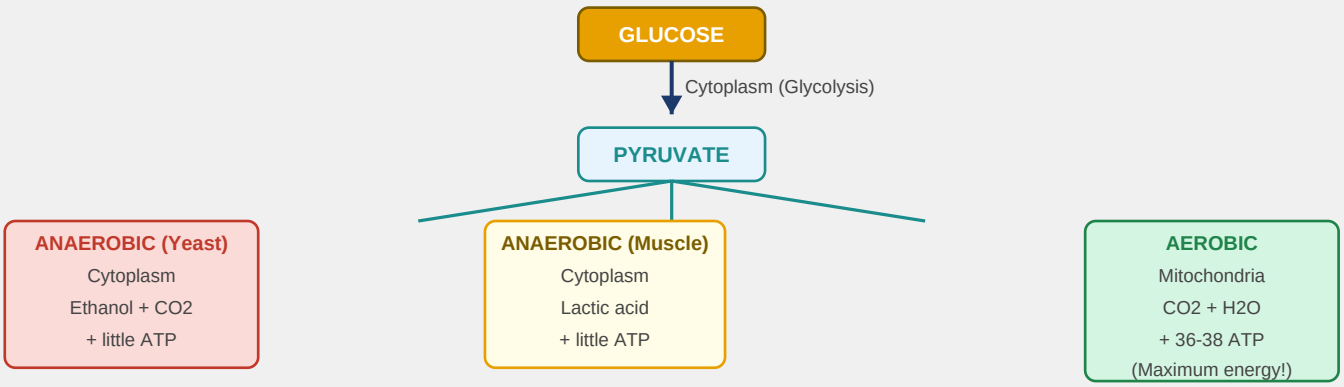
Photosynthesis Summary



6CO2 + 12H2O + Chlorophyll + Sunlight -> C6H12O6 + 6O2 + 6H2O

■ Three Pathways of Respiration

Three Pathways of Glucose Breakdown



SECTION A ❖ Multiple Choice Questions (Q. 1-35)

Q.1. Which of the following statements about autotrophs is **incorrect**?

(a) They synthesise carbohydrates from CO_2 and water in presence of sunlight and chlorophyll

(b) They store carbohydrates in the form of starch

(c) They convert CO_2 and water into carbohydrates in the **absence** of sunlight

(d) They constitute the first trophic level in food chains

[ANS] Answer: (c)

Autotrophs (green plants) need SUNLIGHT for photosynthesis. Without sunlight, the light-dependent reactions cannot proceed, so glucose cannot be formed. Options (a), (b), and (d) are all correct statements about autotrophs. Option (c) is incorrect because photosynthesis requires sunlight.

[TIP] **Exam Tip:** Autotrophs = self-feeders. They ALWAYS need light energy for photosynthesis. "Auto" = self, "troph" = feeding.

Q.2. In which group of organisms is food material broken down **outside the body** and then absorbed?

(a) Mushroom, green plants, Amoeba

(b) Yeast, mushroom, bread mould

(c) Paramecium, Amoeba, Cuscuta

(d) Cuscuta, lice, tapeworm

[ANS] Answer: (b) Yeast, mushroom, bread mould

Yeast, mushrooms, and bread mould are all **saprophytes** (or saprotrophic fungi). They secrete digestive enzymes OUTSIDE their body onto the food substrate, break it down into simpler substances, then absorb the nutrients through their body surface. Green plants make their own food. Amoeba and Paramecium digest food INSIDE food vacuoles. Cuscuta is a parasite.

[TIP] **Exam Tip:** Saprophytes = external digestion -> absorption. Holozoic = internal digestion (Amoeba). Parasites = absorb from host.

Q.3. Select the correct statement about heterotrophs.

(a) Heterotrophs do not synthesise their own food

(b) Heterotrophs utilise solar energy for photosynthesis

(c) Heterotrophs synthesise their own food

(d) Heterotrophs are capable of converting CO_2 and water into carbohydrates

[ANS] Answer: (a)

Heterotrophs cannot make their own food -- they must consume other organisms or organic matter. Only autotrophs (like green plants) can use solar energy for photosynthesis and convert $CO_2 + H_2O$ into carbohydrates. Options (b), (c), (d) describe autotrophs, not heterotrophs.

[TIP] **Exam Tip:** Hetero = other; troph = feeding. Heterotrophs feed on OTHERS. All animals are heterotrophs.

Q.4. Which is the correct sequence of parts in the human alimentary canal?

(a) Mouth -> Stomach -> Small intestine -> Oesophagus -> Large intestine

(b) Mouth -> Oesophagus -> Stomach -> Large intestine -> Small intestine

(c) Mouth -> Stomach -> Oesophagus -> Small intestine -> Large intestine

(d) Mouth -> Oesophagus -> Stomach -> Small intestine -> Large intestine

[ANS] Answer: (d)

The correct order of the human alimentary canal is:
Mouth -> Oesophagus -> Stomach -> Small intestine -> Large intestine -> Rectum -> Anus
Food is chewed in the mouth, travels down the oesophagus, is churned in the stomach, then finally digested and absorbed in the small intestine. Water is absorbed in the large intestine.

[TIP] **Exam Tip:** Easy memory: "MOSS-LA" -- Mouth, Oesophagus, Stomach, Small intestine, Large intestine, Anus!

Q.5. If salivary amylase is absent from saliva, which event in the mouth would be affected?

(a) Proteins breaking down into amino acids

(b) Starch breaking down into sugars

(c) Fats breaking down into fatty acids and glycerol

(d) Absorption of vitamins

[ANS] Answer: (b) Starch breaking down into sugars

Salivary amylase (ptyalin) is the only enzyme in saliva. Its job is to break down **starch** into maltose (a sugar). Without it, starch digestion does NOT begin in the mouth.
* Proteins are broken down by pepsin (in stomach) and trypsin (in small intestine) -- not in the mouth
* Fats are broken down by lipase (small intestine after bile emulsification) -- not in the mouth
* Vitamins do not need enzymes for absorption

[TIP] **Exam Tip:** Salivary amylase -> acts on STARCH only. Remember: Amylase -> Amyl (Greek for starch).

Q.6. The inner lining of the stomach is protected from hydrochloric acid by which of the following?

(a) Pepsin

(b) Mucus

(c) Salivary amylase

(d) Bile

[ANS] Answer: (b) Mucus

The gastric glands in the stomach wall secrete **mucus**, which coats the inner lining and protects it from the corrosive action of HCl (hydrochloric acid). Without mucus, the stomach would digest its own lining, causing ulcers. Pepsin is an enzyme that digests proteins. Bile comes from the liver and helps digest fats, not protect the stomach.

[TIP] **Exam Tip:** Mucus = stomach's shield! Lack of mucus -> gastric ulcers. Mucus is secreted by goblet cells.

Q.7. Which part of the alimentary canal receives bile from the liver?

(a) Stomach
(b) Small intestine
(c) Large intestine
(d) Oesophagus

[ANS] Answer: (b) Small intestine

Bile produced by the liver is stored in the gall bladder and released into the **duodenum** (the first part of the small intestine) through the bile duct. Bile does not function as an enzyme but emulsifies fats (breaks large fat globules into smaller droplets) to increase the surface area for lipase to act upon.

[TIP] **Exam Tip:** Liver makes bile -> stored in gall bladder -> released into duodenum (small intestine). Bile = emulsifier, not enzyme.

Q.8. A few drops of iodine solution were added to rice water. The solution turned blue-black. This indicates:

(a) Complex proteins
(b) Simple proteins
(c) Fats
(d) Starch

[ANS] Answer: (d) Starch

Iodine solution (iodine in potassium iodide) is a **standard test for starch**. It turns **blue-black** in the presence of starch because iodine molecules get trapped inside the helical coils of amylose (a component of starch). Rice is rich in starch, so the rice water tests positive. Proteins and fats do NOT give a blue-black colour with iodine.

[TIP] **Exam Tip:** Iodine test for starch: blue-black = starch PRESENT. Yellow/brown = starch ABSENT. This is a common lab-based MCQ!

Q.9. In which part of the alimentary canal is food **finally** digested?

(a) Stomach
(b) Mouth cavity
(c) Large intestine
(d) Small intestine

[ANS] Answer: (d) Small intestine

The **small intestine** is where digestion is **completed** and most absorption occurs:
* Bile from liver emulsifies fats
* Pancreatic juice (trypsin, lipase, amylase) digests proteins, fats, and carbohydrates
* Intestinal juice (succus entericus) completes digestion
* Villi and microvilli absorb the final products
The large intestine absorbs water; the stomach does partial protein digestion only.

[TIP] **Exam Tip:** Small intestine = site of FINAL digestion + ABSORPTION. Large intestine = water absorption only.

Q.10. Choose the correct function of pancreatic juice.

(a) Trypsin digests proteins and lipase carbohydrates

(b) Trypsin digests emulsified fats and lipase proteins

(c) Trypsin and lipase both digest fats

(d) Trypsin digests proteins and lipase digests emulsified fats

[ANS] Answer: (d)

Pancreatic juice contains several enzymes:
* **Trypsin**: digests **proteins** -> peptides -> amino acids
* **Lipase**: digests **emulsified fats** -> fatty acids + glycerol
* **Amylase**: digests remaining **starch** -> sugars
Option (d) correctly matches trypsin with proteins and lipase with emulsified fats.

[TIP] **Exam Tip:** TripL: Trypsin -> Proteins; Lipase -> Lipids (fats). Amylase -> starch. Easy memory: T=P, L=L.

Q.11. When air is blown from the mouth into lime water, it turns milky due to the presence of:

(a) Oxygen

(b) Carbon dioxide

(c) Nitrogen

(d) Water vapour

[ANS] Answer: (b) Carbon dioxide

Exhaled air contains about 4% **carbon dioxide** (CO_2), compared to 0.04% in inhaled air. CO_2 reacts with lime water (calcium hydroxide solution) to form calcium carbonate, which is insoluble and makes the solution turn **milky white**:
$Ca(OH)_2 + CO_2 \rightarrow CaCO_3$ (milky) + H_2O
O_2 and N_2 do not react with lime water.

[TIP] **Exam Tip:** CO_2 + lime water -> milky white ($CaCO_3$). This is the STANDARD test for CO_2. Remember this reaction!

Q.12. The correct sequence of anaerobic reactions in *yeast* is:

(a) Glucose ->(cytoplasm) Pyruvate ->(mitochondria) Ethanol + CO_2

(b) Glucose ->(cytoplasm) Pyruvate ->(cytoplasm) Lactic acid

(c) Glucose ->(cytoplasm) Pyruvate ->(mitochondria) Lactic acid

(d) Glucose ->(cytoplasm) Pyruvate ->(cytoplasm) Ethanol + CO_2

[ANS] Answer: (d)

In yeast (anaerobic):
* **Step 1:** Glucose -> Pyruvate (in **cytoplasm** via glycolysis)
* **Step 2:** Pyruvate -> Ethanol + CO2 (still in **cytoplasm**; no mitochondria involved!)
This is alcoholic fermentation. The entire process stays in the cytoplasm. Lactic acid formation is what happens in HUMAN MUSCLE cells, not yeast.

[TIP] **Exam Tip:** Yeast = Ethanol + CO2 (cytoplasm). Muscle = Lactic acid (cytoplasm). Both anaerobic. Both in CYTOPLASM!

Q.13. Which of the following is most appropriate for **aerobic** respiration?

(a) Glucose ->(mitochondria) Pyruvate ->(cytoplasm) CO2 + H2O + Energy
(b) Glucose ->(cytoplasm) Pyruvate ->(mitochondria) CO2 + H2O + Energy
(c) Glucose ->(cytoplasm) Pyruvate + Energy ->(mitochondria) CO2 + H2O
(d) Glucose ->(cytoplasm) Pyruvate + Energy ->(mitochondria) CO2 + H2O + Energy

[ANS] Answer: (b)

Aerobic respiration has two stages:
* **Stage 1 (Glycolysis):** Glucose -> Pyruvate, occurs in **cytoplasm**, produces a little energy
* **Stage 2 (Krebs cycle + ETC):** Pyruvate -> CO2 + H2O + large amount of Energy, occurs in **mitochondria**
Option (b) correctly shows cytoplasm -> mitochondria sequence.

[TIP] **Exam Tip:** Aerobic = cytoplasm (glycolysis) first, then MITOCHONDRIA (Krebs cycle). Mitochondria = "powerhouse of the cell" = where most ATP is made.

Q.14. Which statement(s) about respiration is/are TRUE?
(i) During inhalation, ribs move inward and diaphragm is raised
(ii) O2 from alveolar air diffuses into blood; CO2 from blood into alveolar air
(iii) Haemoglobin has greater affinity for CO2 than O2
(iv) Alveoli increase surface area for exchange of gases

(a) (i) and (iv)
(b) (ii) and (iii)
(c) (i) and (iii)
(d) (ii) and (iv)

[ANS] Answer: (d) (ii) and (iv)

* (i) WRONG: During inhalation, ribs move **outward** (not inward) and diaphragm moves **down** (not raised). This increases chest volume.
* (ii) CORRECT: In alveoli, O2 diffuses from high concentration (air) to low (blood); CO2 diffuses from blood to alveolar air.
* (iii) WRONG: Haemoglobin has greater affinity for **O2** than CO2. CO2 is transported mainly dissolved in plasma.
* (iv) CORRECT: Millions of alveoli (estimated 700 million) provide a huge surface area (~70 m^2 in adult) for efficient gas exchange.

[TIP] **Exam Tip:** Inhalation: ribs OUT and UP, diaphragm DOWN. Exhalation: ribs IN and DOWN, diaphragm UP. This is commonly tested!

Q.15. Which is the correct sequence of air passage during inhalation?

(a) Nostrils -> larynx -> pharynx -> trachea -> lungs

(b) Nasal passage -> trachea -> pharynx -> larynx -> alveoli

(c) Larynx -> nostrils -> pharynx -> lungs

(d) Nostrils -> pharynx -> larynx -> trachea -> alveoli

[ANS] Answer: (d)

The correct air passage during inhalation:
Nostrils -> Nasal cavity -> Pharynx -> Larynx -> Trachea -> Bronchi -> Bronchioles -> Alveoli
The nose filters, warms, and moistens air. The pharynx is the common passage for food and air. The larynx contains the vocal cords. The trachea leads to the two bronchi.

[TIP] **Exam Tip:** Memory: "No Particular Lethal Trachea Allowed" = Nostrils, Pharynx, Larynx, Trachea, Alveoli!

Q.16. During respiration, exchange of gases takes place in:

(a) Trachea and larynx

(b) Alveoli of lungs

(c) Alveoli and throat

(d) Throat and larynx

[ANS] Answer: (b) Alveoli of lungs

Gas exchange (O_2 in, CO_2 out) occurs ONLY in the **alveoli** of the lungs. The alveoli are tiny air sacs surrounded by a dense network of blood capillaries. Their thin walls (one cell thick), moist surface, and large surface area make them ideal for diffusion. The trachea, larynx, and throat are just passages for air.

[TIP] **Exam Tip:** Alveoli = only site of gas exchange. Trachea/larynx = just air passages (no gas exchange). Very commonly asked!

Q.17. Which statement(s) about the heart is/are TRUE?

(i) Left atrium receives oxygenated blood from body; right atrium from lungs

(ii) Left ventricle pumps oxygenated blood to body; right ventricle pumps deoxygenated blood to lungs

(iii) Left atrium transfers oxygenated blood to right ventricle

(iv) Right atrium receives deoxygenated blood from body; left ventricle pumps oxygenated blood to body

(a) (i) only

(b) (ii) only

(c) (ii) and (iv)

(d) (i) and (iii)

[ANS] Answer: (c) (ii) and (iv)

Let's analyse each:
* (i) WRONG: Left atrium receives oxygenated blood from **LUNGS** (via pulmonary veins), NOT from body. Right atrium receives deoxygenated blood from **BODY**.
* (ii) CORRECT: Left ventricle -> oxygenated blood -> body; Right ventricle -> deoxygenated blood -> lungs OK
* (iii) WRONG: Left atrium transfers blood to **LEFT** ventricle, not right ventricle (blood stays on same side!)
* (iv) CORRECT: Right atrium <- body (deoxygenated); Left ventricle -> body (oxygenated) OK

[TIP] **Exam Tip:** KEY RULE: Left side = oxygenated (red). Right side = deoxygenated (blue). Blood NEVER crosses the septum in a healthy heart!

Q.18. What prevents backflow of blood inside the heart during contraction?

(a) Valves in heart
(b) Thick muscular walls of ventricles
(c) Thin walls of atria
(d) All of the above

[ANS] Answer: (a) Valves in heart

The heart has four valves that act as one-way gates:
* **Tricuspid valve**: between right atrium and right ventricle
* **Bicuspid (mitral) valve**: between left atrium and left ventricle
* **Pulmonary valve**: between right ventricle and pulmonary artery
* **Aortic valve**: between left ventricle and aorta

These valves open and close based on pressure differences to prevent backflow.

[TIP] **Exam Tip:** Valves = one-way doors in the heart. Absent or defective valves -> heart murmur or regurgitation.

Q.19. Single circulation (blood passes through heart ONCE per cycle) is seen in:

(a) Labeo, Chameleon, Salamander
(b) Hippocampus, Exocoetus, Anabas
(c) Hyla, Rana, Draco
(d) Whale, Dolphin, Turtle

[ANS] Answer: (b) Hippocampus, Exocoetus, Anabas

Single circulation is found in **fish (Pisces)**.
* Hippocampus (sea horse), Exocoetus (flying fish), Anabas (climbing perch) are all fish -> single circulation OK
* Labeo is a fish, but Chameleon (reptile) and Salamander (amphibian) have double circulation
* Hyla, Rana, Draco are amphibian/reptile -> double circulation
* Whale and Dolphin are mammals -> double circulation

In fish: heart -> gills (oxygenated) -> body (deoxygenated) -> heart.

[TIP] **Exam Tip:** Single circulation = FISH only! Double circulation = Amphibians, Reptiles, Birds, Mammals (humans).

Q.20. In which vertebrate group does the heart NOT pump oxygenated blood to different body parts?

(a) Pisces and amphibians

(b) Amphibians and reptiles

(c) Amphibians only

(d) Pisces only

[ANS] Answer: (d) Pisces only

In **fish (Pisces)**, the heart pumps **deoxygenated blood** only to the gills (for oxygenation). The oxygenated blood from gills goes directly to the body -- it does NOT re-enter the heart first.
Amphibians have 3-chambered hearts with some mixing (impure blood reaches body), but they do pump some oxygenated blood. Reptiles, birds, and mammals have fully separated circulations.

[TIP] **Exam Tip:** Fish = 2-chambered heart = deoxygenated blood only pumped. Amphibians = 3-chambered (mixed). Mammals = 4-chambered (pure separation).

Q.21. Choose the correct statement describing arteries.

(a) Thick elastic walls; high pressure; collect blood from organs -> heart

(b) Thin walls with valves; low pressure; carry blood away from heart

(c) Thick elastic walls; low pressure; carry blood from heart to organs

(d) Thick elastic walls, no valves; high pressure; carry blood from heart to body parts

[ANS] Answer: (d)

Arteries carry blood **away** from the heart (A for Away):
* **Thick elastic walls**: to withstand the high pressure of blood pumped by the heart
* **No valves** (generally): blood flows in one direction due to high pressure
* **High pressure**: blood is pumped out with force from ventricles
Veins carry blood TO the heart; they have thin walls, low pressure, and valves (to prevent backflow).

[TIP] **Exam Tip:** Arteries = Away from heart, thick walls, high pressure, no valves. Veins = bring blood to heart, thin walls, low pressure, VALVES inside.

Q.22. The filtration units of kidneys are called:

(a) Ureter

(b) Urethra

(c) Neurons

(d) Nephrons

[ANS] Answer: (d) Nephrons

Each kidney contains approximately **one million nephrons**. Each nephron has:
* Bowman's capsule (with glomerulus): filtration of blood
* Proximal convoluted tubule: reabsorption
* Loop of Henle: concentration of urine
* Distal convoluted tubule: selective secretion
* Collecting duct: final concentration -> urine
Ureter carries urine from kidney to bladder. Urethra = final outlet. Neurons = nerve cells.

[TIP] **Exam Tip:** Nephron = filtration unit of kidney. ~1 million nephrons per kidney. "Nephro" = kidney in Greek.

Q.23. Oxygen liberated during photosynthesis comes from:

(a) Water
(b) Chlorophyll
(c) Carbon dioxide
(d) Glucose

[ANS] Answer: (a) Water

This was proven by experiments with isotope-labelled water ($H_2{}^{18}O$).
During the **light reactions** (photolysis of water):
$2H_2O \rightarrow 4H^+ + 4e^- + O_2$
The oxygen gas released during photosynthesis comes entirely from the **splitting of water**, NOT from CO_2.
CO_2's oxygen becomes part of the glucose molecule.

[TIP] **Exam Tip:** O_2 in photosynthesis comes from WATER (not CO_2). This is a FREQUENTLY asked fact in board exams!

Q.24. The blood leaving the tissues becomes richer in:

(a) Carbon dioxide
(b) Water
(c) Haemoglobin
(d) Oxygen

[ANS] Answer: (a) Carbon dioxide

As blood flows through body tissues, cells consume O_2 (for respiration) and produce CO_2 as a waste product.
So blood returning from the tissues (via veins) is:
* **Richer in CO_2** (from cellular respiration)
* Poorer in O_2 (O_2 was used by cells)
This deoxygenated blood returns to the right atrium and is sent to the lungs for reoxygenation.

[TIP] **Exam Tip:** Tissues consume O_2, produce CO_2. So blood FROM tissues = high CO_2 (deoxygenated). Blood FROM lungs = high O_2 (oxygenated).

Q.25. Which of the following is an **incorrect** statement?

(a) Organisms grow with time

(b) Organisms must repair and maintain their structure

(c) Movement of molecules does not take place among cells

(d) Energy is essential for life processes

[ANS] Answer: (c) Movement of molecules does not take place among cells

Option (c) is **incorrect**. Movement of molecules (such as nutrients, gases, hormones, waste products) is ESSENTIAL and continuously occurs among and within cells via diffusion, osmosis, active transport, and other mechanisms. All life processes depend on molecular movement. Options (a), (b), and (d) are all correct fundamental properties of life.

[TIP] **Exam Tip:** Life processes require: energy, molecular movement, growth, maintenance, and reproduction. All cells constantly exchange molecules.

Q.26. The internal (cellular) energy reserve in autotrophs is:

(a) Glycogen

(b) Protein

(c) Starch

(d) Fatty acid

[ANS] Answer: (c) Starch

Autotrophs (plants) store their food energy as **starch** (in chloroplasts and other storage organs like potatoes). Starch is a polymer of glucose and can be broken down when energy is needed.

* Glycogen is the energy reserve in **animals and fungi**
* Plants store starch, not glycogen

[TIP] **Exam Tip:** Autotrophs (plants) = starch storage. Heterotrophs (animals) = glycogen storage. Common confusion point!

Q.27. Which equation is the correct summary of photosynthesis?

(a) $6CO_2 + 12H_2O \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$

(b) $6CO_2 + H_2O + \text{Sunlight} \rightarrow C_6H_{12}O_6 + O_2 + 6H_2O$

(c) $6CO_2 + 12H_2O + \text{Chlorophyll} + \text{Sunlight} \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$

(d) $6CO_2 + 12H_2O + \text{Chlorophyll} + \text{Sunlight} \rightarrow C_6H_{12}O_6 + 6CO_2 + 6H_2O$

[ANS] Answer: (c)

The correct balanced equation for photosynthesis:

$6CO_2 + 12H_2O + \text{Chlorophyll} + \text{Sunlight} \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$

Key points:

* 12 molecules of water are needed (not just 1)
* Chlorophyll and sunlight must be mentioned (as they are reactants/conditions)
* Products: 1 glucose + 6 O_2 + 6 H_2O
* Option (d) is wrong: products cannot include CO_2 (CO_2 is a reactant, not product)

[TIP] **Exam Tip:** Learn this equation by heart! 6CO2 + 12H2O + Chlorophyll + Sunlight -> C6H12O6 + 6O2 + 6H2O. 6+6=12 water molecules used!

Q.28. Choose the event that does **NOT** occur in photosynthesis:

(a) Absorption of light energy by chlorophyll

(b) Reduction of carbon dioxide to carbohydrates

(c) Oxidation of carbon to carbon dioxide

(d) Conversion of light energy to chemical energy

[ANS] Answer: (c) Oxidation of carbon to carbon dioxide

In photosynthesis:
* (a) OK Chlorophyll absorbs light (mainly red and blue wavelengths)
* (b) OK CO2 is REDUCED (gains hydrogen) to form carbohydrates (glucose)
* (c) X Oxidation of carbon to CO2 is what happens in RESPIRATION, not photosynthesis! In photosynthesis, CO2 is taken IN and REDUCED, not oxidised.
* (d) OK Light energy is converted to chemical energy (ATP and NADPH) in light reactions

[TIP] **Exam Tip:** Photosynthesis = reduction of CO2. Respiration = oxidation of glucose (C -> CO2). These are OPPOSITE processes!

Q.29. The opening and closing of the stomatal pore depends upon:

(a) Oxygen

(b) Temperature

(c) Water in guard cells

(d) Concentration of CO2 in stomata

[ANS] Answer: (c) Water in guard cells

Stomatal opening/closing is controlled by the **turgor pressure** of guard cells, which depends on the water content:
* When guard cells absorb water -> they swell (become turgid) -> pore **opens**
* When guard cells lose water -> they shrink (become flaccid) -> pore **closes**
The uptake of water by guard cells is triggered by light (during day) through potassium ion (K^+) pumping.

[TIP] **Exam Tip:** Guard cells turgid (full of water) = stomata OPEN. Flaccid (empty) = CLOSED. This is turgor-pressure mechanism!

Q.30. Choose the forms in which most plants absorb nitrogen:
(i) Proteins (ii) Nitrates and Nitrites (iii) Urea (iv) Atmospheric nitrogen

(a) (i) and (ii)

(b) (ii) and (iii)

(c) (iii) and (iv)

(d) (i) and (iv)

[ANS] Answer: (b) (ii) and (iii)

Most plants absorb nitrogen from soil in the form of **nitrates (NO_3^-) and nitrites (NO_2^-)**. These are water-soluble and absorbed through root hair cells. Some plants also take up **urea** which is converted by soil bacteria to ammonia then nitrates.

* Proteins: plants cannot absorb proteins directly from soil
* Atmospheric N2: only legumes (via nitrogen-fixing bacteria like Rhizobium) can use N2

[TIP] **Exam Tip:** Plants absorb N as nitrates/nitrites mainly. Legumes (peas, beans) fix N2 via Rhizobium in root nodules.

Q.31. Which is the first enzyme to mix with food in the digestive tract?

(a) Pepsin
(b) Cellulase
(c) Amylase
(d) Trypsin

[ANS] Answer: (c) Amylase

Salivary amylase (ptyalin) is the first enzyme to act on food. It is present in saliva secreted in the mouth -- the very first part of the digestive tract where food enters.

* Pepsin acts in the stomach (second stop)
* Trypsin acts in the small intestine (pancreatic juice)
* Cellulase is not even secreted by humans (cellulose is indigestible for us)

[TIP] **Exam Tip:** Mouth = first stop -> Salivary amylase = first enzyme. Digestion begins in the MOUTH, not the stomach!

Q.32. Which statements are correct?

(i) Pyruvate can be converted into ethanol and CO2 by yeast
(ii) Fermentation takes place in aerobic bacteria
(iii) Fermentation takes place in mitochondria
(iv) Fermentation is a form of anaerobic respiration

(a) (i) and (iii)
(b) (ii) and (iv)
(c) (i) and (iv)
(d) (ii) and (iii)

[ANS] Answer: (c) (i) and (iv)

* (i) OK Yeast converts pyruvate -> ethanol + CO2 (alcoholic fermentation, anaerobic)
* (ii) X Fermentation takes place in **anaerobic** organisms/conditions, not aerobic bacteria
* (iii) X Fermentation takes place in the **cytoplasm**, not mitochondria
* (iv) OK Fermentation is indeed a type of anaerobic respiration (in absence of O2)

[TIP] **Exam Tip:** Fermentation = anaerobic, in CYTOPLASM. Aerobic respiration = in MITOCHONDRIA. This distinction is very important!

Q.33. Lack of oxygen in muscles leads to cramps in cricketers. This results due to:

(a) Conversion of pyruvate to ethanol

(b) Conversion of pyruvate to glucose

(c) Non-conversion of glucose to pyruvate

(d) Conversion of pyruvate to lactic acid

[ANS] Answer: (d) Conversion of pyruvate to lactic acid

When muscles work vigorously, oxygen supply becomes insufficient for aerobic respiration. The muscles switch to **anaerobic respiration**:
Pyruvate -> **Lactic acid** (in cytoplasm, no O2 needed)
The accumulation of lactic acid in muscles causes the burning sensation and **muscle cramps**. Rest and increased blood flow eventually remove the lactic acid.

[TIP] **Exam Tip:** Muscle cramps = lactic acid accumulation. Yeast = ethanol + CO2. Don't confuse muscle and yeast pathways!

Q.34. Choose the correct path of urine in our body:

(a) Kidney -> Ureter -> Urethra -> Urinary bladder

(b) Kidney -> Urinary bladder -> Urethra -> Ureter

(c) Kidney -> Ureters -> Urinary bladder -> Urethra

(d) Urinary bladder -> Kidney -> Ureter -> Urethra

[ANS] Answer: (c) Kidney -> Ureters -> Urinary bladder -> Urethra

The path of urine formation and excretion:
Kidneys -> Ureters -> Urinary Bladder -> Urethra -> Outside
* Kidneys: form urine via nephrons
* Ureters: tubes carrying urine from kidneys to bladder (one per kidney)
* Urinary bladder: stores urine temporarily
* Urethra: final tube for urine exit
Memory tip: "Kidneys Unleash Beautifully Uninterrupted" = K->U->B->U

[TIP] **Exam Tip:** Ureter (2) = carry urine kidney -> bladder. Urethra (1) = final exit. Don't confuse ureter and urethra!

Q.35. During oxygen deficiency in tissues, pyruvic acid is converted into lactic acid in the:

(a) Cytoplasm

(b) Chloroplast

(c) Mitochondria

(d) Golgi body

[ANS] Answer: (a) Cytoplasm

Anaerobic respiration (including lactic acid formation) occurs entirely in the **cytoplasm**:
Glucose ->(cytoplasm) Pyruvate ->(cytoplasm) Lactic acid
Chloroplasts are for photosynthesis (only in plant cells). Mitochondria are for aerobic respiration. Golgi body is for secretion/packaging of proteins.

[TIP] **Exam Tip:** Anaerobic = CYTOPLASM. Aerobic (Krebs cycle) = MITOCHONDRIA. Photosynthesis = CHLOROPLAST. Three organelles, three jobs!

SECTION B ❖ Short Answer Questions (Q. 36-72)

Q.36. Name the following:
(a) Process linking light energy with chemical energy in plants
(b) Organisms that can prepare their own food
(c) Cell organelle where photosynthesis occurs
(d) Cells surrounding a stomatal pore
(e) Organisms that cannot prepare their own food
(f) Enzyme from gastric glands acting on proteins

(a) Photosynthesis -- converts light energy (solar) into chemical energy (stored in glucose)

(b) Autotrophs -- e.g., green plants, algae, cyanobacteria

(c) Chloroplast -- contains chlorophyll; site of both light and dark reactions

(d) Guard cells -- bean-shaped cells that control stomatal opening/closing via turgor pressure

(e) Heterotrophs -- e.g., animals, fungi, most bacteria; depend on other organisms for food

(f) Pepsin -- secreted by chief cells in gastric glands; converts proteins -> peptides

[TIP] **Exam Tip:** These 6 terms are basic vocabulary for Life Processes. Learn them for 1-mark questions!

Q.37. "All plants give out oxygen during day and carbon dioxide during night." Do you agree? Give reasons.

Answer: PARTIALLY AGREE -- the statement is not entirely correct.

During the day:
Plants perform both PHOTOSYNTHESIS and RESPIRATION simultaneously. The rate of photosynthesis is much higher than respiration, so the NET gas exchange is: CO_2 absorbed and O_2 released. This is why the statement appears true during daytime.

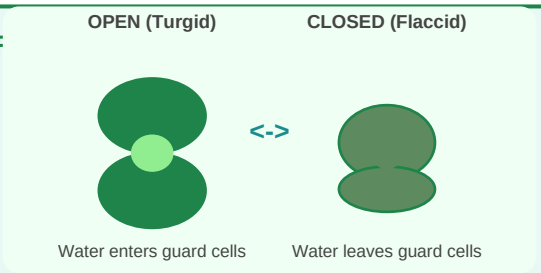
During the night:
No sunlight -> NO photosynthesis. Only respiration occurs. Therefore, plants absorb O_2 and release CO_2, just like animals. This part of the statement is correct.

Important correction:
Plants always perform respiration (24 hours). They perform photosynthesis ONLY during daylight. Even during the day, both processes run simultaneously -- but photosynthesis dominates.

[TIP] **Exam Tip:** Plants do BOTH photosynthesis and respiration. At night = only respiration. During day = both (photosynthesis dominates). This is a classic tricky question!

Q.38. How do guard cells regulate opening and closing of stomatal pores?

Guard cells regulate stomatal pores through TURGOR PR



Stomata OPEN (during day/light):
* Light triggers active transport of K^+ ions into guard cells
* This lowers water potential inside guard cells
* Water enters guard cells by osmosis -> cells become turgid
* The inner thick wall curves outward -> pore opens
* CO2 enters for photosynthesis; O2 and water vapour exit

Stomata CLOSE (at night/drought):
* In darkness or water stress, K^+ ions leave guard cells
* Water potential increases -> water exits by osmosis -> cells become flaccid
* Inner wall straightens -> pore closes
* Prevents water loss at night

[TIP] **Exam Tip:** Turgor = turgid = full of water = OPEN. Flaccid = empty = CLOSED. K+ ions control water entry/exit in guard cells.

Q.39. Two green plants in O2-free containers -- one in dark, one in continuous light. Which lives longer? Give reasons.

The plant in CONTINUOUS LIGHT will live longer.

Plant in dark:
* No photosynthesis possible (no light)
* Only respiration occurs, consuming glucose and O2
* O2 in the container quickly gets used up
* The plant will die quickly due to lack of food and O2

Plant in continuous light:
* Photosynthesis is active: 6CO2 + 12H2O -> C6H12O6 + 6O2 + 6H2O
* The plant produces its own O2 during photosynthesis
* The O2 produced by photosynthesis can be used for its own respiration
* As long as CO2 and water are available, the plant sustains itself
* The plant essentially recycles O2 and CO2 internally

[TIP] **Exam Tip:** Photosynthesis produces O2; respiration consumes O2. In light, plant = self-sustaining (net O2 producer). In dark = net O2 consumer.

Q.40. If a plant releases CO2 and takes in O2 during daytime, does this mean no photosynthesis is occurring? Justify.

Answer: NO -- Photosynthesis IS still occurring.

Plants perform BOTH photosynthesis and respiration simultaneously during the day. However, the relative rates can vary depending on light intensity.

If a plant appears to release CO2 during day:
This could mean that the rate of RESPIRATION is temporarily greater than PHOTOSYNTHESIS. This can happen at very low light intensities (e.g., dawn/dusk or deep shade).

The COMPENSATION POINT:
At the compensation point, photosynthesis rate = respiration rate. Below this light level, the plant appears to act like it's only respiring. But photosynthesis IS occurring -- just at a slower rate than respiration. The NET effect appears respiratory.

[TIP] **Exam Tip:** Both photosynthesis + respiration occur simultaneously during day. If respiration > photosynthesis = net CO2 release. This is the concept of COMPENSATION POINT.

Q.41. Why do fish die when taken out of water?

Fish die because their gills cannot extract oxygen from air.

Fish breathe through **gills**, which are specially adapted for extracting dissolved oxygen from water. The gill filaments have a large surface area and thin membranes for efficient gas exchange in an aquatic medium.

When taken out of water:
* The gill filaments dry out and **collapse** (they need water to stay apart)
* Gills cannot function in air -- O2 from air cannot be absorbed
* Fish cannot breathe through their skin effectively (unlike amphibians)
* Without O2, cellular respiration stops -> fish suffocates quickly

[TIP] **Exam Tip:** Gills work ONLY in water. Collapsed gills in air = no gas exchange = death. This is why amphibians can survive on land -- they can breathe through moist skin!

Q.42. Differentiate between an autotroph and a heterotroph.

AUTOTROPH vs HETEROTROPH

Feature	Autotroph	Heterotroph
Definition	Make own food using light/chemical energy	Cannot make food; depend on others
Mode of nutrition	Autotrophic (photosynthesis/chemosynthesis)	Heterotrophic (holozoic, parasitic, saprotrophic)
Energy source	Sunlight or chemical reactions	Organic food consumed
Chlorophyll	Present (in most)	Absent

Trophic level	Producers (1st trophic level)	Consumers (2nd level+)
Examples	Green plants, algae, cyanobacteria	Animals, fungi, most bacteria, Cuscuta

[TIP] Autotrophs = producers. Heterotrophs = consumers. A 4-row difference table usually fetches full marks.

Q.43. Is 'nutrition' a necessity for an organism? Discuss.

YES -- Nutrition is absolutely necessary for all living organisms.

Why nutrition is essential:
* **Energy supply:** Nutrition provides the fuel (glucose, fats, proteins) for all cellular activities. Without energy, life processes (movement, growth, reproduction) stop.
* **Growth and repair:** Proteins from food are needed to build new cells and repair damaged tissues.
* **Body maintenance:** Constant molecular breakdown and synthesis requires nutritional input.
* **Enzyme and hormone production:** Minerals and vitamins from food are essential for thousands of biochemical reactions.
* **Reproduction:** Organisms need adequate nutrition to have energy for reproduction.

Without nutrition, the organism would use up its own stored reserves, become deficient, and eventually die.

[TIP] **Exam Tip:** Nutrition provides: Energy + Building blocks (for growth) + Regulation (vitamins/minerals). All three are essential for life.

Q.44. What would happen if green plants disappeared from earth?

The consequences would be catastrophic -- life on earth would collapse.

Green plants are the **primary producers** and the foundation of all food chains. If they disappeared:

* **Food chains collapse:** Herbivores (primary consumers) would have no food -> they die.
Carnivores (secondary consumers) lose prey -> they also die. The entire food web breaks down.
* **O2 depletion:** Plants are the main source of O2 on Earth. Without photosynthesis, atmospheric O2 would gradually be consumed by respiration and not replenished -> most aerobic life dies.
* **CO2 accumulation:** CO2 released by respiration would not be fixed -> greenhouse effect worsens -> climate catastrophe.
* **Water cycle disruption:** Transpiration by plants plays a role in rainfall patterns.
* **Soil degradation:** Plant roots hold soil; without roots -> erosion -> desertification.

[TIP] **Exam Tip:** 5-marker: mention food chain collapse, O2 depletion, CO2 increase, water cycle disruption, soil erosion. 1 point each!

Q.45. Leaves of a healthy potted plant were coated with vaseline. Will the plant remain healthy for long? Give reasons.

NO -- the plant will NOT remain healthy for long.

Coating leaves with vaseline blocks the **stomata**. This prevents:

* **Gas exchange:** CO2 cannot enter the leaf -> photosynthesis is severely reduced -> the plant cannot make food -> it will slowly starve.
* **Transpiration:** Water vapour cannot exit -> no transpiration pull -> water and minerals cannot be drawn up from roots efficiently.
* **Evaporative cooling:** Without transpiration, the leaf may overheat.
* **O2 release:** The O2 produced during photosynthesis cannot escape.

Without CO2 entry and O2 exit, photosynthesis fails. The plant gradually starves and dies.

[TIP] **Exam Tip:** Vaseline blocks stomata -> blocks gas exchange + transpiration -> photosynthesis fails -> plant dies. Often asked as a 3-mark question.

Q.46. How does aerobic respiration differ from anaerobic respiration?

See comparison table below:

Feature	Aerobic Respiration	Anaerobic Respiration
O2 required	YES (oxygen present)	NO (no oxygen)
Site	Cytoplasm + Mitochondria	Cytoplasm only
End products	CO2 + H2O + Energy	Lactic acid OR Ethanol + CO2 + little energy
Energy yield	36-38 ATP per glucose	2 ATP per glucose
Efficiency	Very high	Very low
Examples	Most plants & animals	Yeast, muscle cells (during exercise)

[TIP] 36-38 ATP vs 2 ATP is the key difference. Aerobic = efficient. Anaerobic = quick but wasteful.

Q.47. Match the words of Column (A) with Column (B):
(a) Phloem (b) Nephron (c) Veins (d) Platelets
(i) Excretion (ii) Translocation of food (iii) Clotting of blood (iv) Deoxygenated blood

Answers:

(a) Phloem -> (ii) Translocation of food
Phloem is the vascular tissue that transports sugars (glucose/sucrose) from leaves to all parts of the plant.

(b) Nephron -> (i) Excretion
Nephron is the functional unit of the kidney, responsible for filtering blood and producing urine (excretion).

(c) Veins -> (iv) Deoxygenated blood
Veins (except pulmonary vein) carry deoxygenated blood from body tissues back to the heart.

(d) Platelets -> (iii) Clotting of blood
Platelets (thrombocytes) initiate the blood clotting process to seal wounds and prevent excessive bleeding.

[TIP] **Exam Tip:** Exception: Pulmonary VEIN carries OXYGENATED blood. Pulmonary ARTERY carries DEOXYGENATED blood. These are classic exceptions!

Q.48. Differentiate between an artery and a vein.

Comparison table below:

Feature	Artery	Vein
Direction	Away from heart	Towards the heart
Blood type	Oxygenated (usually)	Deoxygenated (usually)
Wall thickness	Thick, elastic, muscular	Thin, less elastic
Valves	No valves (usually)	Valves present (prevent backflow)
Blood pressure	High pressure	Low pressure
Pulse	Pulsating flow	Smooth, steady flow

Q.49. What are the adaptations of a leaf for photosynthesis?

Leaf adaptations for efficient photosynthesis:

* **Large, flat surface:** Maximises light absorption area
* **Thin blade (lamina):** Short diffusion path for CO2 to reach mesophyll cells
* **Transparent epidermis:** Allows light to penetrate to chloroplast-containing cells
* **Chloroplasts in palisade cells:** Packed near upper surface where light is strongest
* **Stomata on lower surface:** Allow CO2 in and O2 out; also on upper in some plants
* **Spongy mesophyll with air spaces:** Large internal surface area and gaseous diffusion
* **Network of veins (xylem/phloem):** Supply water and remove manufactured sugars
* **Petiole (leaf stalk):** Orients leaf towards sunlight

[TIP] **Exam Tip:** Leaf = solar panel of the plant. Adaptations = maximise light capture + CO2 supply + water supply + sugar export.

Q.50. Why is the small intestine in herbivores longer than in carnivores?

Because plant food (cellulose) takes much longer to digest than animal protein.

Herbivores eat plants which contain large amounts of cellulose (plant cell walls). Cellulose is complex and difficult to break down -- it requires more time, more enzymes, and a longer intestinal passage for complete digestion. A longer small intestine provides more time and more surface area for the digestion and absorption of this tough plant material.

Carnivores eat meat (mostly proteins and fats), which are relatively easier and faster to digest. A shorter intestine is sufficient for complete digestion and absorption of these nutrients.

[TIP] **Exam Tip:** Length of intestine reflects diet: plant-eaters (long) > omnivores (medium) > meat-eaters (short). Cellulose needs more time to digest.

Q.51. What will happen if mucus is not secreted by gastric glands?

Without mucus, the stomach wall would be damaged by its own HCl -- leading to gastric ulcers.

The gastric glands secrete hydrochloric acid (HCl) to create an acidic environment for pepsin activation and to kill bacteria in food. Mucus forms a protective coating on the inner stomach wall, shielding it from this acid.

Without mucus:
* HCl would directly contact and erode the stomach lining
* This causes inflammation and painful **gastric ulcers**
* If severe, it can lead to internal bleeding
* The stomach would literally start digesting itself (autodigestion)

[TIP] **Exam Tip:** Mucus = stomach's protective shield. No mucus = ulcers. NSAIDs (pain killers) can damage mucus lining too -> can cause ulcers.

Q.52. What is the significance of emulsification of fats?

Emulsification breaks large fat globules into tiny droplets, dramatically increasing surface area for lipase digestion.

Fats are large, non-polar molecules that clump together in water. Bile (from liver) emulsifies fats:

* Large fat globule -> many tiny fat droplets
* This greatly **increases the total surface area** for lipase to act upon
* Lipase (from pancreas) can then efficiently digest fats into fatty acids and glycerol
* Without emulsification, lipase can only act on the outer surface of the fat globule -> digestion would be very slow and incomplete

Analogy: Breaking a large rock into pebbles gives more surface for acid to react with -- same principle!

[TIP] **Exam Tip:** Bile = emulsifier, NOT enzyme. Bile does not digest fats; it just makes the job easier for lipase. IMPORTANT distinction!

Q.53. What causes movement of food inside the alimentary canal?

PERISTALSIS -- wave-like muscular contractions in the walls of the alimentary canal.

The walls of the alimentary canal have two layers of smooth muscle:
* **Circular muscle:** contracts to narrow the canal
* **Longitudinal muscle:** contracts to shorten and widen the canal

These muscles work in alternating waves (peristalsis): circular muscles contract BEHIND the food bolus while longitudinal muscles relax -> food is pushed forward. This is an involuntary action controlled by the enteric nervous system.

Peristalsis occurs throughout: oesophagus, stomach, small intestine, and large intestine.

[TIP] **Exam Tip:** Peristalsis = "wave of squeezing" that moves food forward. This is why you can swallow even upside down (though not advisable)!

Q.54. Why does absorption of digested food occur mainly in the small intestine?

Because the small intestine has special structural adaptations that maximise absorption.

Key reasons for efficient absorption in the small intestine:

* **Villi:** Thousands of finger-like projections increase surface area enormously
* **Microvilli (brush border):** Tiny projections on each villus cell further increase area
-> Total surface area of small intestine ~= 200-300 m^2 (tennis court area!)
* **Rich blood supply:** Dense capillary network in each villus absorbs nutrients directly into blood
* **Lacteals:** Lymph vessels in villi absorb fatty acids and glycerol
* **Fully digested food:** By the time food reaches small intestine, digestion is complete
* **Length:** Small intestine is ~6-7 metres long -> long transit time for absorption

[TIP] **Exam Tip:** Villi + microvilli = enormous surface area = efficient absorption. This is THE reason small intestine is the main absorption site.

Q.55. Match Group (A) with Group (B):
(a) Autotrophic nutrition (b) Heterotrophic nutrition (c) Parasitic nutrition (d) Digestion in food vacuoles
(i) Leech (ii) Paramecium (iii) Deer (iv) Green plant

(a) Autotrophic nutrition -> (iv) Green plant
Green plants make food using sunlight and CO2 (photosynthesis)

(b) Heterotrophic nutrition -> (iii) Deer
Deer consume plants -- it is a herbivore (holozoic heterotroph)

(c) Parasitic nutrition -> (i) Leech
Leech is an ectoparasite that sucks blood from host organisms

(d) Digestion in food vacuoles -> (ii) Paramecium
Paramecium (protozoan) ingests food particles; digestion occurs in food vacuoles (intracellular)

Q.56. Why is the rate of breathing in aquatic organisms much faster than in terrestrial organisms?

Because water contains much less dissolved O2 than air.

* Air contains about **21% oxygen** by volume
* Water contains only about **1% dissolved oxygen** (much less!)

Aquatic organisms must move much more water over their gills to extract the same amount of O2. This requires faster breathing movements. Land animals breathe air which is oxygen-rich, so slower, deeper breaths are sufficient to meet oxygen needs.

[TIP] **Exam Tip:** O2 in air >> O2 in water. Fish must work harder (breathe faster) to get enough O2. This is also why many fish die in stagnant water (low dissolved O2).

Q.57. Why is blood circulation in the human heart called double circulation?

Because blood passes through the heart TWICE in each complete cycle through the body.

Pulmonary circulation (1st pass through heart):
Deoxygenated blood -> Right side of heart -> Lungs (oxygenation) -> Back to heart

Systemic circulation (2nd pass through heart):
Oxygenated blood -> Left side of heart -> All body organs -> Deoxygenated -> Back to heart

Since blood travels through the heart twice before completing one full circuit of the body, it is called **double circulation**. This ensures fully oxygenated blood reaches the body.

[TIP] **Exam Tip:** Double circulation: heart pumped twice per body circuit. Fish = single circulation (heart pumped once). Double = more efficient O2 delivery!

Q.58. What is the advantage of having a four-chambered heart?

A four-chambered heart ensures COMPLETE SEPARATION of oxygenated and deoxygenated blood.

* **No mixing of blood:** The septum (wall) completely separates right (deoxygenated) and left (oxygenated) sides of the heart
* **Pure oxygenated blood reaches body:** Cells receive maximum O2 for efficient respiration
* **High metabolic efficiency:** Mammals and birds are warm-blooded -- they need more energy -> require high O2 supply -> four-chambered heart is essential
* **Higher activity level:** Animals with four-chambered hearts can sustain vigorous, prolonged activity
* Compared to 3-chambered (amphibians/reptiles): in 3-chambered hearts, some mixing occurs -> body receives impure blood -> less efficient

[TIP] **Exam Tip:** 4-chambered heart = complete separation = pure blood to body = high metabolic rate. Mammals + Birds = 4 chambers = endotherms (warm-blooded).

Q.59. Mention the major events during photosynthesis.

Photosynthesis has TWO major stages:

1. LIGHT REACTIONS (occurs in thylakoids of chloroplast):
* Chlorophyll absorbs light energy (mainly red and blue wavelengths)
* Light energy is converted to chemical energy (ATP and NADPH)
* Photolysis of water: 2H2O -> 4H+ + 4e- + O2 (oxygen is released as byproduct)
* The electrons from water replenish those lost from chlorophyll

2. DARK REACTIONS / CALVIN CYCLE (occurs in stroma of chloroplast):
* CO2 is fixed (combined with RuBP using enzyme RuBisCO)
* ATP and NADPH from light reactions are used to reduce CO2 to glucose
* Glucose (C6H12O6) is the final product
* Overall: 6CO2 + 12H2O -> C6H12O6 + 6O2 + 6H2O

Summary of major events:
(i) Absorption of light by chlorophyll
(ii) Splitting of water (photolysis) -> O2 released
(iii) Conversion of light energy -> chemical energy (ATP, NADPH)
(iv) Reduction of CO2 -> glucose (carbohydrate)

[TIP] **Exam Tip:** 4 events to remember: (1) Light absorption, (2) Water splitting, (3) ATP/NADPH formation, (4) CO2 fixation to glucose. Use this for 5-mark answers.

Q.60. What happens to the rate of photosynthesis in each situation?
(a) Cloudy days (b) No rainfall (c) Good manuring (d) Stomata blocked by dust

(a) Cloudy days:
Rate of photosynthesis **DECREASES**. Less light reaches the chlorophyll -> light reactions slow down -> less ATP and NADPH -> less glucose produced.

(b) No rainfall in the area:
Rate of photosynthesis **DECREASES**. Water shortage -> stomata close (to prevent water loss) -> CO2 cannot enter -> dark reactions slow down. Also, less water available for photolysis.

(c) Good manuring in the area:
Rate of photosynthesis **INCREASES**. Manure provides minerals (especially nitrogen for chlorophyll synthesis, and other minerals). More chlorophyll -> more light absorption -> more photosynthesis.

(d) Stomata blocked by dust:
Rate of photosynthesis **DECREASES significantly**. CO2 cannot enter the leaf -> dark reactions cannot proceed -> no glucose synthesis. The plant essentially starves.

[TIP] **Exam Tip:** Factors affecting photosynthesis rate: Light, CO2, Water, Temperature, Minerals. Any factor reduced -> rate decreases!

Q.61. Name the energy currency in living organisms. When and where is it produced?

ATP -- Adenosine Triphosphate -- is the energy currency of all living organisms.

Where is it produced?
* Small amount: in the **cytoplasm** (during glycolysis -- 2 ATP per glucose)
* Large amount: in the **mitochondria** (during Krebs cycle and electron transport chain -- 34-36 more ATP per glucose)
* Also in **chloroplasts** (during light reactions of photosynthesis)

When is it produced?
* During **cellular respiration** (both aerobic and anaerobic)
* During **light reactions of photosynthesis** (in plants only)
* Continuously, as long as the organism is alive and has fuel (glucose)

ATP stores energy in its phosphate bonds. When a bond breaks (ATP -> ADP + Pi), energy is released for cellular work.

[TIP] **Exam Tip:** ATP = energy currency. Mitochondria = main ATP factory. Photosynthesis also makes ATP (in thylakoids). "Mitochondria = powerhouse of the cell"!

Q.62. What is common for Cuscuta, ticks, and leeches?

All three are PARASITES -- they live on or inside another organism (host) and derive nutrition from it, often harming the host.

* **Cuscuta (Amarbel):** Plant parasite; twines around host plant and penetrates with haustoria to absorb water and nutrients. Host plant is weakened.
* **Ticks:** Animal parasites; they attach to skin of animals and suck blood (ectoparasites).
* **Leeches:** Worm-like ectoparasites; attach to skin and suck blood; secrete hirudin (anticoagulant) to prevent clotting during feeding.

Common features of parasites: (1) depend on host for food, (2) harm the host, (3) cannot survive without the host, (4) have special structures to attach to host.

[TIP] **Exam Tip:** Parasites: Endoparasites (inside) = tapeworm, Plasmodium. Ectoparasites (outside) = tick, leech, lice. Cuscuta = plant parasite.

Q.63. Explain the role of the mouth in digestion of food.

The mouth performs BOTH physical and chemical digestion.

Physical/Mechanical digestion:
* **Teeth** cut, tear, and grind food into smaller pieces (increasing surface area)
* Different types: incisors (cut), canines (tear), premolars and molars (grind)
* **Tongue** mixes food with saliva and pushes it to the back for swallowing

Chemical digestion:
* **Saliva** (secreted by 3 pairs of salivary glands) contains:
- **Salivary amylase (ptyalin):** breaks starch -> maltose
- **Mucin:** lubricates food for easy swallowing
- **Lysozyme:** kills bacteria in food

Formation of bolus:
Chewed food mixed with saliva forms a soft, moist ball called the **bolus**, which is then swallowed and pushed into the oesophagus.

Q.64. What are the functions of gastric glands present in the wall of the stomach?

Gastric glands secrete the GASTRIC JUICE, which contains:

1. Hydrochloric Acid (HCl):
* Creates strongly acidic environment (pH ~= 2)
* Activates pepsinogen -> pepsin (active enzyme)
* Kills bacteria and microorganisms in food
* Denatures proteins (unfolds them for easier digestion)

2. Pepsinogen / Pepsin:
* Pepsinogen (inactive) activated by HCl -> Pepsin
* Pepsin digests proteins -> peptides (partial protein digestion)

3. Mucus:
* Secreted by goblet cells
* Coats and protects the inner stomach lining from HCl
* Prevents autodigestion (stomach digesting itself)

4. Rennin (in infants):
* Coagulates milk protein (casein) for easier digestion

Q.65. Match Column (A) with Group (B):
(a) Trypsin (b) Amylase (c) Bile (d) Pepsin
(i) Pancreas (ii) Liver (iii) Gastric glands (iv) Saliva

(a) Trypsin -> (i) Pancreas
Trypsin is secreted in pancreatic juice from the pancreas; digests proteins.

(b) Amylase -> (iv) Saliva
Salivary amylase is secreted by salivary glands in saliva; digests starch in mouth. (Also secreted by pancreas)

(c) Bile -> (ii) Liver
Bile is produced in the liver, stored in gall bladder, released into small intestine; emulsifies fats.

(d) Pepsin -> (iii) Gastric glands
Pepsin (from pepsinogen) is secreted by gastric glands in stomach; digests proteins.

Q.66. Name the correct substrates for: (a) Trypsin (b) Amylase (c) Pepsin (d) Lipase

(a) Trypsin: Substrate = **Proteins** (partially digested proteins/polypeptides -> shorter peptides -> amino acids)

(b) Amylase: Substrate = **Starch** (complex carbohydrates -> maltose/glucose)

(c) Pepsin: Substrate = **Proteins** (proteins -> peptides; in stomach)

(d) Lipase: Substrate = **Emulsified fats** (fats/lipids after bile emulsification -> fatty acids + glycerol)

[TIP] **Exam Tip:** Enzyme -> Substrate: Amylase->Starch, Pepsin->Protein (stomach), Trypsin->Protein (small intestine), Lipase->Fats. Learn this list!

Q.67. Why do veins have thin walls compared to arteries?

Because veins carry blood at LOW PRESSURE, so they do not need thick muscular walls.

Arteries receive blood directly pumped by the heart at HIGH pressure -> they need thick, elastic, muscular walls to withstand this pressure without rupturing.

By the time blood reaches veins (after passing through capillaries), the pressure has dropped significantly. Veins carry blood at low pressure back to the heart. Thin walls are sufficient for this low-pressure return flow. Veins compensate with internal **valves** and the squeezing action of surrounding muscles to ensure blood flows back towards the heart.

Q.68. What will happen if platelets were absent in the blood?

Blood would NOT clot properly -- even small wounds would lead to excessive, life-threatening bleeding.

Role of platelets (thrombocytes):
* When a blood vessel is damaged, platelets rush to the site and stick together
* They release chemicals that trigger the clotting cascade
* A protein called fibrin forms a mesh-like net -> traps RBCs -> forms a clot
* The clot stops bleeding (haemostasis)

Without platelets:
* No clot formation -> constant bleeding from even minor cuts
* This condition is called **thrombocytopenia**
* Dengue fever destroys platelets -> dangerous internal bleeding

[TIP] **Exam Tip:** Platelets = clotting cells. No platelets = haemophilia-like condition = uncontrolled bleeding. Dengue causes platelet drop!

Q.69. Plants have low energy needs compared to animals. Explain.

Plants are non-motile, have no complex organ systems, and most body parts are non-living cell wall material.

Reasons why plants need less energy:
* **No locomotion:** Plants do not move around -> no muscle energy needed
* **No complex nervous system:** No brain or neural signalling requiring energy
* **Simpler body plan:** No complex organ systems (heart, lungs) to maintain
* **Large non-living structures:** Cell walls and vacuoles are non-living -> no energy for maintenance
* **Make own food:** Energy from sunlight is directly available without search/hunt
* **Ectothermic:** Plants don't regulate body temperature (unlike warm-blooded animals)

Q.70. Why and how does water enter continuously into the root xylem?

Water enters root xylem due to OSMOSIS driven by concentration gradients.

WHY:
The concentration of minerals and dissolved substances inside root cells is HIGHER than in soil water. This creates a water potential gradient -- water moves from higher water potential (soil) to lower water potential (root cells) by osmosis.

Additionally, as water moves up via xylem (transpiration pull), the xylem pressure drops -> more water is drawn in.

HOW (pathway):
1. Soil water -> Root hair cells (by osmosis through semi-permeable membrane)
2. Root hair -> Cortex cells -> Endodermis (cell to cell by osmosis)
3. Endodermis -> Xylem vessels
4. Xylem -> Up the stem via transpiration pull (cohesion-tension mechanism)

Q.71. Why is transpiration important for plants?

Transpiration is essential for several critical functions:

* **Creates transpiration pull:** The main driving force for upward movement of water and minerals from roots to leaves through the xylem (cohesion-tension mechanism)
* **Mineral distribution:** Minerals dissolved in water are transported to all parts of the plant
* **Cooling effect:** Evaporation of water from leaf surface cools the plant (like sweating in humans)
* **Maintains turgor:** Water pressure in cells maintains cell shape and plant rigidity
* **Gas exchange:** Open stomata allow CO2 in for photosynthesis while water exits

[TIP] **Exam Tip:** Transpiration pull is the main force for upward water movement in plants. More transpiration = more water pulled up = more nutrients distributed.

Q.72. How do leaves of plants help in excretion?

Leaves excrete waste products through several mechanisms:

* **O2 excretion:** Oxygen produced during photosynthesis (which is a waste by-product of photolysis) is released through stomata
* **CO2 excretion:** CO2 produced during respiration is released through stomata
* **Water vapour:** Excess water is lost as vapour through transpiration (stomata and cuticle)
* **Solid waste excretion:** Some plants deposit waste substances (resins, gums, tannins, oils) in their leaves -> when leaves fall, these wastes are removed from the plant body
* **Calcium oxalate crystals:** Stored in older leaves and removed when leaves drop

SECTION C ❖ Long Answer Questions (Q. 73-82)

Q.73. Explain the process of nutrition in *Amoeba*.

Amoeba uses HOLOZOIC nutrition -- it engulfs solid food particles.

Steps of nutrition in Amoeba:

1. Ingestion:
When Amoeba detects food (algae, bacteria), it extends arm-like pseudopodia (false feet) around the food particle. The pseudopodia surround the food completely, enclosing it in a membrane bubble called a **food vacuole**.

2. Digestion:
Digestive enzymes are secreted into the food vacuole from the cytoplasm. Complex food molecules (proteins, carbohydrates, fats) are broken down into simpler, soluble molecules (amino acids, glucose, fatty acids).

3. Absorption:
The digested, soluble nutrients diffuse from the food vacuole into the cytoplasm of the Amoeba, where they are used for energy and growth.

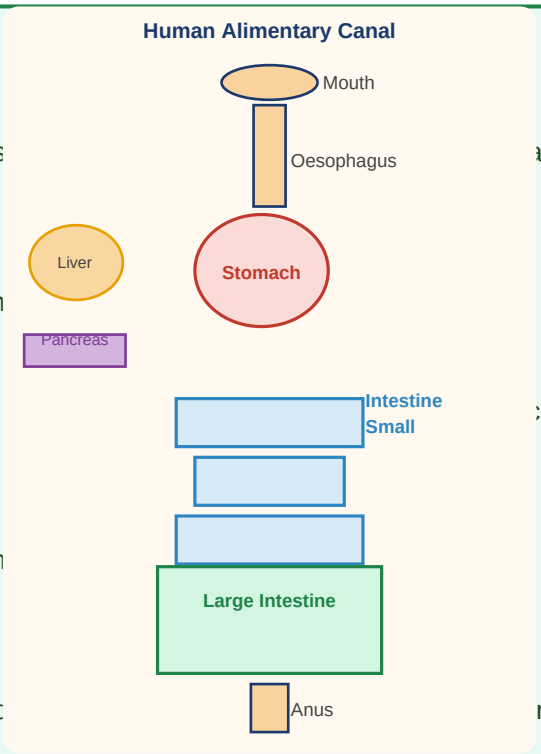
4. Assimilation:
The absorbed nutrients are used for building cell components (growth and repair) and for energy (respiration).

5. Egestion:
Undigested remains are expelled from the cell body when the food vacuole fuses with the cell membrane. Amoeba has no fixed anus -- waste is expelled at any point of the cell surface.

[TIP] **Exam Tip:** Holozoic nutrition steps: IDAAE -- Ingestion, Digestion, Absorption, Assimilation, Egestion. Amoeba has no mouth or anus!

Q.74. Describe the alimentary canal of man.

Human Alimentary Canal (Digestive System):



1. Mouth (Buccal Cavity):
Food enters here; teeth grind food; salivary amylase begins s -> bolus formed

2. Oesophagus (Food Pipe):
Muscular tube (~25 cm); carries bolus from throat to stomach

3. Stomach:
J-shaped muscular bag; secretes gastric juice (HCl + pepsin ; glands; churns food into liquid called chyme

4. Small Intestine (~6-7 m):
Site of complete digestion and absorption; receives bile (from completes digestion; villi absorb nutrients into blood

5. Large Intestine (~1.5 m):
Absorbs water and remaining minerals; remaining undigested ra)

6. Rectum and Anus:
Faeces stored in rectum; expelled through anus (defecation)

Associated Glands: Salivary glands, Liver (bile), Pancreas (pancreatic juice), Gastric glands

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Q.75. Explain the process of breathing in man.

Breathing involves alternating INHALATION and EXHALATION controlled by chest muscles and diaphragm.

INHALATION (Breathing in):
* External intercostal muscles CONTRACT -> ribs move upward and outward
* Diaphragm (dome-shaped muscle) CONTRACTS -> moves downward and flattens
* Chest (thoracic) cavity volume INCREASES
* Pressure inside lungs DECREASES below atmospheric pressure
* Air rushes in: Nostrils -> Nasal cavity -> Pharynx -> Larynx -> Trachea -> Bronchi -> Bronchioles -> Alveoli
* In alveoli: O2 diffuses into blood; CO2 diffuses from blood into alveoli

GAS EXCHANGE IN ALVEOLI:
* Alveoli are tiny air sacs (millions in each lung) with very thin walls (1 cell thick) and rich capillary network
* O2 concentration: alveolar air (high) > blood in capillaries (low) -> O2 diffuses into blood
* CO2 concentration: blood (high) > alveolar air (low) -> CO2 diffuses into alveoli

EXHALATION (Breathing out):
* Intercostal muscles RELAX -> ribs move downward and inward
* Diaphragm RELAXES -> moves upward (dome shape returns)
* Chest cavity volume DECREASES
* Lung pressure INCREASES -> air pushed out
* CO2-rich air exits: Alveoli -> Bronchioles -> Bronchi -> Trachea -> Larynx -> out through nostrils/mouth

Transport of gases in blood:
* O2: 97% carried by haemoglobin (as oxyhaemoglobin); 3% dissolved in plasma
* CO2: 70% as bicarbonate ions (HCO3-) in plasma; 23% by haemoglobin; 7% dissolved in plasma

[TIP] **Exam Tip:** Inhalation: ribs UP + OUT, diaphragm DOWN -> volume UP -> pressure DOWN -> air IN. Exhalation: reverse. The key is chest volume determines pressure!

Q.76. Explain the importance of soil for plant growth.

Soil provides the physical and chemical foundation for plant growth.

1. Anchorage:
Soil provides mechanical support. Plant roots anchor firmly in soil, enabling the plant to stand upright against wind and gravity.

2. Water supply:
Soil stores water in its pores. Plant roots absorb this water (essential for photosynthesis, transport of minerals, cell turgidity, and transpiration pull).

3. Mineral nutrients:
Soil contains essential mineral elements (nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, zinc, etc.) dissolved in soil water. Plants absorb these through root hair cells by osmosis and active transport.

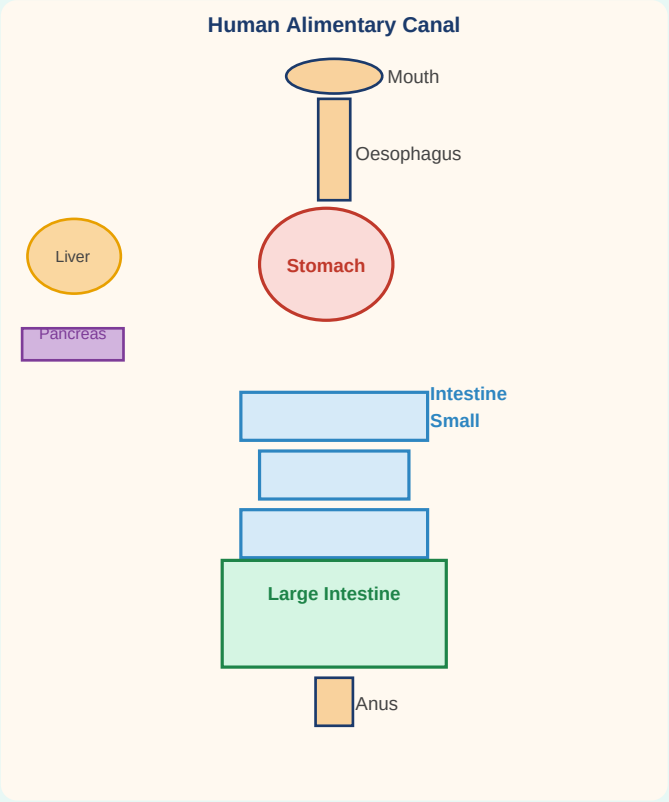
4. Soil air (oxygen):
Pore spaces in soil contain air. Root cells need O2 for aerobic respiration to generate energy for active transport of minerals. Waterlogged soil lacks O2 -> roots die.

5. Soil organisms:
Bacteria, fungi, and earthworms in soil decompose organic matter -> release mineral nutrients back into soil (nutrient cycling). Nitrogen-fixing bacteria (Rhizobium) in root nodules of legumes fix atmospheric N2 into usable nitrates.

6. pH and organic matter (humus):
Humus improves soil structure, water retention, aeration, and mineral availability. Soil pH affects mineral availability and microbial activity.

Q.77. Draw the diagram of alimentary canal and label: Mouth, Oesophagus, Stomach, Intestine

Labelled diagram of Human Alimentary Canal:



Key Labels:

* Mouth: Entry point; mechanical + chemical digestion begins (salivary amylase)
* Oesophagus: Muscular tube; peristalsis moves food to stomach
* Stomach: J-shaped; protein digestion by pepsin; food churned to chyme
* Small Intestine: Final digestion + absorption; villi present
* Large Intestine: Water absorption; faeces formed
* Liver & Pancreas: Accessory digestive glands (labelled in diagram)

Q.78. How do carbohydrates, proteins and fats get digested in human beings?

Digestion of the three major food groups occurs in stages throughout the alimentary canal.

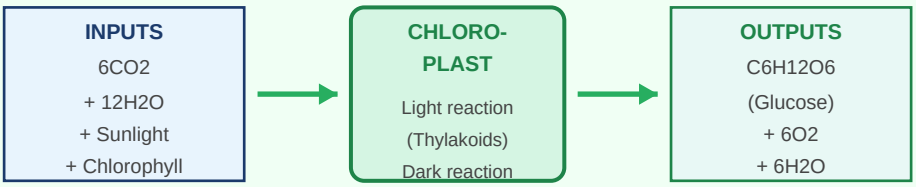
Nutrient	Site	Enzyme	Product
CARBOHYDRATES (Starch)	Mouth	Salivary amylase	Maltose (partial)
	Small intestine	Pancreatic amylase + Maltase	Glucose (complete)
PROTEINS	Stomach	Pepsin (in HCl)	Peptides (partial)
	Small intestine	Trypsin + Peptidases	Amino acids (complete)
FATS	Small intestine (after emulsification by bile)	Pancreatic lipase	Fatty acids + Glycerol

[TIP] Final products: Carbohydrates -> Glucose. Proteins -> Amino acids. Fats -> Fatty acids + Glycerol. These are ABSORBED into blood.

Q.79. Explain the mechanism of photosynthesis.

Photosynthesis occurs in the CHLOROPLAST and has TWO main stages:

Photosynthesis Summary



6CO2 + 12H2O + Chlorophyll + Sunlight -> C6H12O6 + 6O2 + 6H2O

STAGE 1 -- LIGHT REACTIONS (in thylakoid membranes):

* Chlorophyll pigments absorb sunlight (mainly red and blue wavelengths)
* Light energy splits water molecules: 2H2O -> 4H+ + 4e- + O2 (PHOTOLYSIS)
* O2 is released as a byproduct (the oxygen we breathe!)
* Light energy is converted to chemical energy: ATP and NADPH are formed
* Electrons from water replace those lost from excited chlorophyll

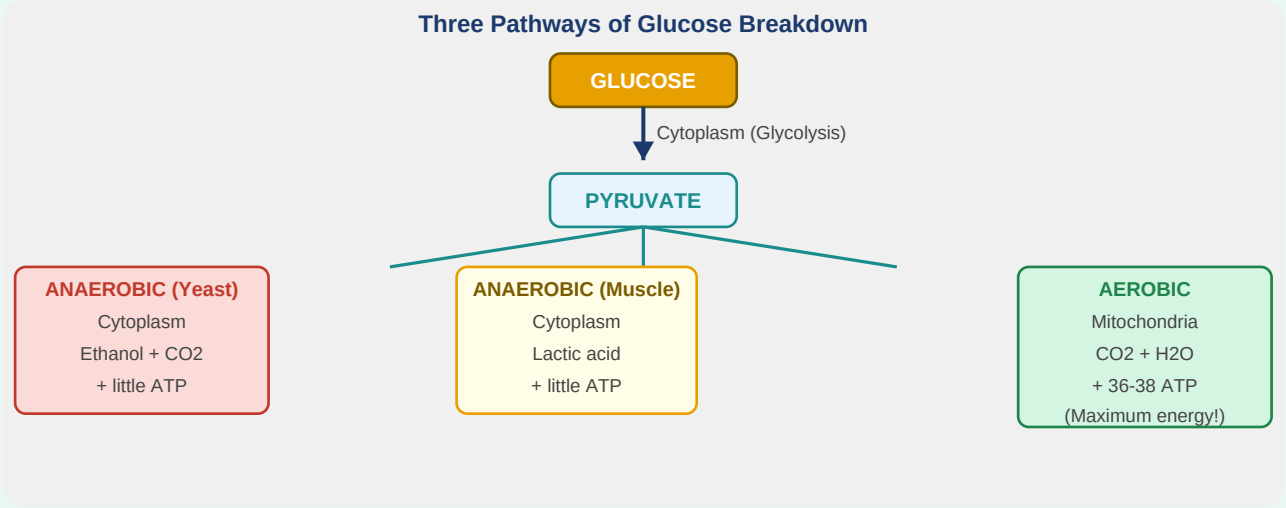
STAGE 2 -- DARK REACTIONS / CALVIN CYCLE (in stroma of chloroplast):

* CO2 from air combines with a 5-carbon compound (RuBP) using enzyme RuBisCO -> CARBON FIXATION
* ATP and NADPH from light reactions are used to REDUCE CO2 -> glucose (C6H12O6)
* RuBP is regenerated to continue the cycle
* "Dark reactions" does NOT mean they require darkness -- they just do not directly need light

Overall equation:
6CO2 + 12H2O + Chlorophyll + Sunlight -> C6H12O6 + 6O2 + 6H2O

Q.80. Explain the three pathways of breakdown (respiration) in living organisms.

All three pathways begin with GLYCOLYSIS (glucose -> pyruvate in cytoplasm):



PATHWAY 1 -- AEROBIC RESPIRATION (in presence of O2):

Glucose ->(cytoplasm) Pyruvate ->(mitochondria) CO2 + H2O + 36-38 ATP
* Occurs in mitochondria after glycolysis
* Pyruvate enters mitochondria -> Krebs cycle -> Electron Transport Chain -> Maximum ATP
* Complete oxidation of glucose; most efficient pathway

PATHWAY 2 -- ANAEROBIC RESPIRATION IN YEAST (no O2, in cytoplasm):

Glucose ->(cytoplasm) Pyruvate ->(cytoplasm) Ethanol + CO2 + 2 ATP
* Occurs entirely in cytoplasm
* Used in fermentation (beer, wine, bread making)
* Very little energy produced

PATHWAY 3 -- ANAEROBIC RESPIRATION IN MUSCLE CELLS (no O2, in cytoplasm):

Glucose ->(cytoplasm) Pyruvate ->(cytoplasm) Lactic acid + 2 ATP
* Occurs during intense exercise when O2 supply is insufficient
* Lactic acid accumulates -> muscle cramps
* Temporary; reversed when O2 becomes available (repayment of oxygen debt)

Q.81. Describe the flow of blood through the heart of human beings.

DOUBLE CIRCULATION in the Human Heart:

PULMONARY CIRCULATION (right side):

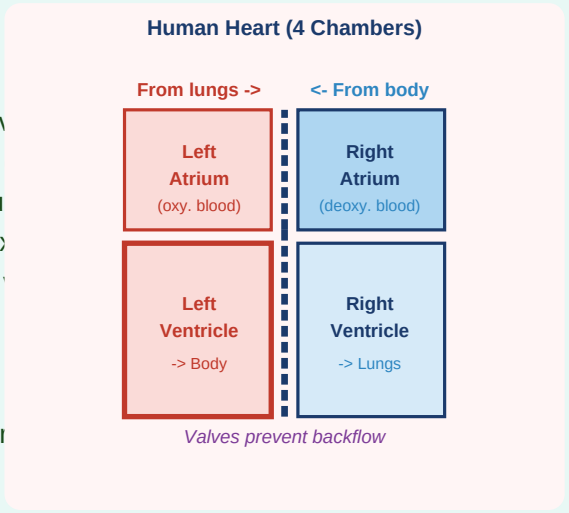
* Deoxygenated blood from body arrives at RIGHT ATRIUM v
* Right atrium contracts -> blood enters RIGHT VENTRICLE
* Right ventricle contracts -> blood pumped to LUNGS via pu
* In alveoli: CO2 released, O2 absorbed -> blood becomes ox
* Oxygenated blood returns to LEFT ATRIUM via pulmonary

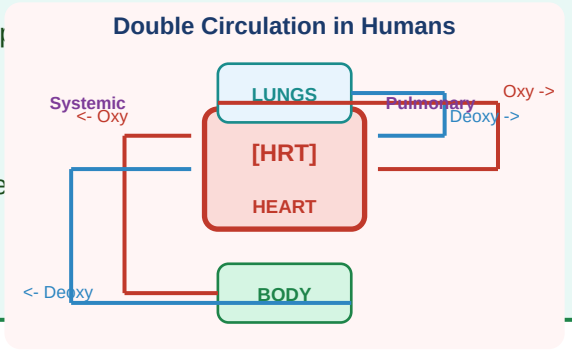
SYSTEMIC CIRCULATION (left side):

* Oxygenated blood enters LEFT ATRIUM from lungs
* Left atrium contracts -> blood enters LEFT VENTRICLE (thr
* Left ventricle (THICKEST wall) contracts forcefully -> blood
* Blood delivers O2 to all tissues and collects CO2
* Deoxygenated blood returns to RIGHT ATRIUM -> cycle rep

Key features:

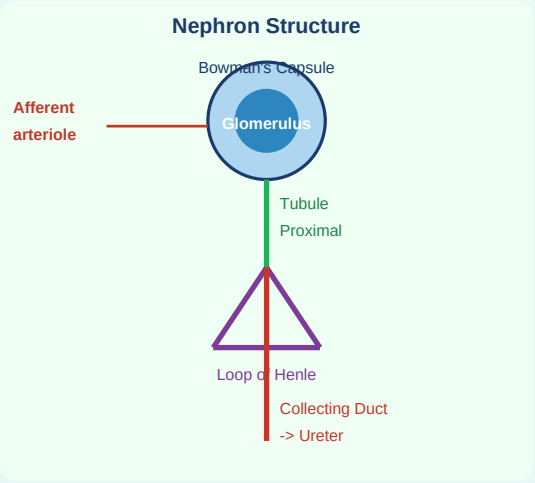
* 4 valves prevent backflow
* Left ventricle wall is THICKER (more force needed for syste
* Blood NEVER crosses the septum in healthy heart
* Heartbeat rate ~= 72 beats/min at rest





Q.82. Describe the process of urine formation in kidneys.

Urine formation occurs in NEPHRONS through three stag



1. ULTRAFILTRATION (in Bowman's Capsule / Glomerulu

* Blood enters glomerulus (a knot of capillaries) under HIGH
* Small molecules are forced out: water, glucose, urea, amino
* Large molecules remain in blood: proteins, blood cells, large
* The fluid that passes into Bowman's capsule = GLOMERUL
* About 180 litres of filtrate produced per day (but only 1.5L b

2. SELECTIVE REABSORPTION (in tubules):

* As filtrate passes through proximal tubule, loop of Henle, dis
- ALL glucose is reabsorbed (normally no glucose in urine)
- Most water is reabsorbed (water conservation)
- Useful amino acids are reabsorbed
- Useful mineral salts are reabsorbed
* Urea is NOT reabsorbed -- remains in filtrate

3. SECRETION (in tubules):

* Some additional waste products are actively secreted from blood INTO the tubule
* This ensures complete removal of harmful substances

Final urine composition:

Water + Urea + Uric acid + Creatinine + Excess salts

Urine -> Collecting duct -> Ureter -> Urinary bladder -> Urethra -> Outside

[TIP] 3 stages of urine formation: Ultrafiltration -> Reabsorption -> Secretion. Healthy urine has NO glucose, NO proteins. Presence of these indicates kidney disease!

[WARN] Common Mistakes & Exam Tips

[ERR] Day vs Night gas exchange in plants

Plants do BOTH photosynthesis (day only) and respiration (24 hrs). At night, only respiration -> CO2 out. During day, photosynthesis >> respiration -> net O2 out.

[ERR] O2 source in photosynthesis

O2 in photosynthesis comes from WATER (not CO2). CO2 provides the carbon for glucose. Very frequently tested!

[ERR] Bile is NOT an enzyme

Bile emulsifies fats but does NOT digest them. Lipase (from pancreas) does the actual digestion. Bile = emulsifier. Lipase = enzyme.

[ERR] Left vs Right heart sides

Left side = oxygenated blood. Right side = deoxygenated blood. EXCEPTION: Pulmonary artery carries deoxy; Pulmonary vein carries oxy.

[ERR] Aerobic vs Anaerobic site

BOTH start in cytoplasm (glycolysis). Aerobic continues in MITOCHONDRIA. Anaerobic stays in CYTOPLASM. Never say aerobic = only mitochondria!

[ERR] Ureter vs Urethra

Ureter (TWO): carry urine from kidneys to bladder. Urethra (ONE): carries urine from bladder to outside. Very commonly confused in exams!

[ERR] Single vs Double circulation

Fish = single (heart once). Amphibians/Reptiles/Birds/Mammals = double (heart twice). Amphibians have 3-chambered heart = some mixing of blood.

[ERR] Glycogen vs Starch

Plants store energy as STARCH. Animals store energy as GLYCOGEN. Both are polymers of glucose but in different organisms!

[REV] Quick Revision -- Chapter 6 at a Glance

Topic	Key Points
Photosynthesis equation	6CO2 + 12H2O + Chlorophyll + Sunlight -> C6H12O6 + 6O2 + 6H2O
O2 source in photosynthesis	WATER (H2O), not CO2
Aerobic respiration	Glucose -> CO2 + H2O + 36-38 ATP (cytoplasm + mitochondria)
Anaerobic (yeast)	Glucose -> Ethanol + CO2 + 2 ATP (cytoplasm only)

Anaerobic (muscle)	Glucose -> Lactic acid + 2 ATP (cytoplasm, causes cramps)
Alimentary canal order	Mouth -> Oesophagus -> Stomach -> Small intestine -> Large intestine -> Anus
Enzymes: substrate	Amylase->Starch, Pepsin->Protein, Trypsin->Protein, Lipase->Fats
Bile function	Emulsification of fats (NOT digestion). Made in liver, stored in gall bladder.
Heart chambers	2 atria + 2 ventricles. Left = oxygenated, Right = deoxygenated.
Nephron stages	Ultrafiltration -> Reabsorption -> Secretion -> Urine
Urine path	Kidney -> Ureter -> Urinary bladder -> Urethra
Guard cells mechanism	Turgid (water in) = stomata open. Flaccid (water out) = stomata closed.
Stomata function	Gas exchange (CO2 in, O2 out) + Transpiration (water vapour out)

[KEY] MCQ Answer Key Summary (Q. 1-35)

Q.No	Ans	Q.No	Ans	Q.No	Ans	Q.No	Ans	Q.No	Ans
Q.1	**(c)**	Q.2	**(b)**	Q.3	**(a)**	Q.4	**(d)**	Q.5	**(b)**
Q.6	**(b)**	Q.7	**(b)**	Q.8	**(d)**	Q.9	**(d)**	Q.10	**(d)**
Q.11	**(b)**	Q.12	**(d)**	Q.13	**(b)**	Q.14	**(d)**	Q.15	**(d)**
Q.16	**(b)**	Q.17	**(c)**	Q.18	**(a)**	Q.19	**(b)**	Q.20	**(d)**
Q.21	**(d)**	Q.22	**(d)**	Q.23	**(a)**	Q.24	**(a)**	Q.25	**(c)**
Q.26	**(c)**	Q.27	**(c)**	Q.28	**(c)**	Q.29	**(c)**	Q.30	**(b)**
Q.31	**(c)**	Q.32	**(c)**	Q.33	**(d)**	Q.34	**(c)**	Q.35	**(a)**

❖ Understand Life Processes -- understand Life itself! ❖