CBSE CLASS X

Science (086)

ANSWER KEY

AI-generated question paper

Code: 6JN1FR	Questions: 45	Maximum Marks: 126	Generated: 2026-06-25 17:29

SELECTIONS USED

Subject	Science
Lessons	5 Life Processes
Level of understanding	Thorough understanding
Question selection	Curated chapter coverage (~5 questions per section + 8 synthesis)
Model	claude-sonnet-4-6

Composition — Difficulty: 2 straightforward · 25 medium · 18 deep | Types: 33 Short · 5 Long · 4 Very short · 3 MCQ

Q1. deep · thorough-understanding · § Introduction **[3]**

A researcher observes a microscopic particle that shows no sign of any metabolic activity when isolated in a test tube, but resumes all metabolic functions as soon as it enters a living host cell. (i) On the basis of this observation, would you classify this particle as living or non-living? Give a reason. (ii) Explain why the presence or absence of metabolic processes is used as a defining criterion for life.

◆ Life Processes

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Model Answer

(i) This particle is **neither fully living nor non-living** — it is best classified like a virus, on the borderline. It shows no metabolic activity outside a host cell but resumes all life functions inside one, making it a non-cellular entity that depends entirely on a host.

(ii) Metabolic processes (nutrition, respiration, excretion, etc.) are the **life processes** that maintain the organised structure of living organisms. Living structures constantly break down due to environmental effects; continuous molecular movements and chemical reactions are needed to repair and maintain order. Without metabolism, this maintenance stops and the organism ceases to be alive. Hence, metabolism is the defining criterion for life.

Source: Chapter 5 — Introduction and Section 5.1 (What Are Life Processes?)

Explanation

- For part (i), the passage explicitly mentions viruses showing no molecular movement until they infect a cell, and calls this the reason for the controversy over their living status — use this directly.
- For part (ii), examiners expect the logic chain: living structures break down → need repair → repair requires molecular movement → molecular movement = metabolic processes → no metabolism = not alive.
- Don't write "living" or "non-living" definitively for part (i); the textbook presents it as a borderline/controversial case. That nuance earns marks.

Q2. deep | thorough-understanding | § 5.1 WHAT ARE LIFE PROCESSES? **[3]**

A student argues: 'A seed sitting in a dry jar is not alive because it shows no visible movement and carries out no life processes.' Using your understanding of life processes, evaluate this argument. Is the student correct? Justify your answer.

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Model Answer

The student's argument is **incorrect**.

A seed in a dry jar is very much alive, even though it shows no visible movement. According to our understanding of life processes, visible movement is **not** the defining criterion of life. What is essential is molecular movement — molecules must be continually moved around to maintain and repair the organised living structures of the organism.

A seed carries out life processes at a very low rate — cellular maintenance continues at the molecular level. The moment conditions become favourable (water, warmth), it germinates, proving it was alive all along. Absence of visible activity does not mean absence of life.

Source: Life Processes, Chapter 5 — Introduction and Section 5.1

Explanation

- The examiner expects you to **directly counter the argument** using the textbook concept that **molecular movement, not visible movement**, is the true marker of life.
- Mention that life processes (nutrition, respiration, etc.) must continue even during apparent inactivity — the textbook explicitly states maintenance goes on "even when we are just asleep."
- The seed example is classic: low metabolic activity ≠ non-living. Germination is proof of life.
- Avoid writing too much — 3 marks = ~3 clear points, each worth 1 mark.

Q3. medium | thorough-understanding | § 5.1 WHAT ARE LIFE PROCESSES? **[1]**

Explain why nutrition occupies a central position among all life processes. How would the absence of nutrition affect the other life processes in an organism?

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Model Answer

Nutrition provides energy and raw materials needed to sustain all other life processes. Without nutrition, an organism would have no energy for respiration, transport, or excretion, causing complete breakdown and death.

Explanation

Though this seems like a 2-part question, it is only 1 mark, so keep it to one or two tight sentences. The key point examiners want: nutrition is the source of energy and materials, so all other processes (respiration, transport, excretion) depend on it. Cite the textbook idea that "energy needed for maintenance comes from food."

Q4. medium | thorough-understanding | § 5.2 NUTRITION **[3]**

A student sets up two identical potted plants under bell jars sealed airtight to glass plates. A watch-glass containing potassium hydroxide solution is placed inside one of the bell jars. After two hours in sunlight, a starch test is performed on a leaf from each plant. The plant without potassium hydroxide shows a strong positive starch test, while the plant with potassium hydroxide shows little or no starch. Explain why this difference occurs, and identify which specific step of photosynthesis is being disrupted in the second plant.

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Model Answer

Potassium hydroxide (KOH) absorbs carbon dioxide from the air inside the bell jar. The plant in that setup therefore has no CO_2 available, even though sunlight and chlorophyll are present. Without CO_2, the plant cannot carry out photosynthesis and so produces no glucose, which means no starch accumulates — giving a negative starch test. The plant without KOH uses the CO_2 present in the air and photosynthesises normally, giving a positive starch test.

Step disrupted: The third step of photosynthesis — **reduction of carbon dioxide to carbohydrates** — is disrupted in the second plant, because the raw material (CO_2) has been removed by KOH.

Source: Chapter 5, Section 5.2.1 — Autotrophic Nutrition (Activity 5.2)

Explanation

- The question is directly based on **Activity 5.2** from the textbook. Examiners expect you to name KOH's role (absorbing CO_2) and link it to the absence of starch.
- Clearly identify the **specific step** disrupted — "reduction of CO_2 to carbohydrates" — using the exact language from the three steps listed in Section 5.2.1. Vague answers like "photosynthesis stops" will lose marks.
- Note that light absorption and water-splitting steps are *not* disrupted — only the carbon fixation step is affected. Mentioning this distinction shows deeper understanding and can earn full marks.

Q5. medium | thorough-understanding | § 5.2.1 Autotrophic Nutrition **[3]**

A variegated plant has green and white (non-green) regions on the same leaf. When such a leaf is tested for starch after being kept in sunlight, only the green regions turn blue-black with iodine while the white regions remain colourless. What does this result tell us about the role of chlorophyll in photosynthesis?

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Model Answer

The result proves that **chlorophyll is essential for photosynthesis**.

- The green regions of the leaf contain chlorophyll (in chloroplasts), so they could carry out photosynthesis in sunlight and produce starch. Iodine turned these regions **blue-black**, confirming starch is present.
- The white (non-green) regions lack chlorophyll, so no photosynthesis occurred and no starch was produced. Hence, iodine showed **no colour change** in these regions.

This demonstrates that even when sunlight and CO_2 are available, photosynthesis cannot take place without chlorophyll. Chlorophyll absorbs light energy, which is the first essential step of photosynthesis.

Source: Life Processes, Section 5.2.1 (Activity 5.1)

Explanation

The examiner expects three clear points for 3 marks:

1. Green regions have chlorophyll → photosynthesis occurs → starch present → blue-black with iodine.
2. White regions lack chlorophyll → no photosynthesis → no starch → no colour change.
3. Conclusion: chlorophyll is **essential/necessary** for photosynthesis.

Avoid vague statements like "chlorophyll helps in photosynthesis" — say it is **essential**. The activity is directly from the textbook (Activity 5.1), so examiners expect you to reference what the colour change of iodine indicates.

Q6. deep thorough-understanding § 5.2.1 Autotrophic Nutrition **[3]**

Desert plants such as cacti open their stomata only at night to absorb carbon dioxide, which is stored as an organic acid until daytime, when stomata close and photosynthesis is completed using sunlight. Using this example, explain how the process of photosynthesis can be separated into distinct stages, and identify what each stage requires.

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Model Answer

Photosynthesis occurs in two distinct stages that can be separated in time:

Stage 1 (Light-dependent): Absorption of light energy by chlorophyll, conversion of light energy to chemical energy, and splitting of water molecules. This requires **sunlight** and **chlorophyll**.

Stage 2 (Light-independent): Reduction of carbon dioxide to carbohydrates using the chemical energy stored in Stage 1. This requires **CO_2** (stored as an organic acid in cacti at night).

In cacti, Stage 2 occurs during the day (stomata closed, sunlight available), while CO_2 is absorbed and stored at night — proving the two stages need not occur simultaneously.

Source: Chapter 5, Section 5.2.1

Explanation

- Examiners want you to clearly **name/describe two stages** and state what **each stage requires** — this covers all 3 marks.
- The cactus example directly shows separation of stages: CO_2 fixation (night) and light reactions (day).
- Key terms: light energy, chlorophyll, chemical energy, splitting of water, reduction of CO_2 — use at least a few of these.
- Don't write "light reaction" and "dark reaction" as labels unless you define them — just describe what each stage does and needs.

Q7. medium | thorough-understanding | § 5.2.1 Autotrophic Nutrition **[1]**

Guard cells control whether stomatal pores are open or closed. On a hot, dry day a plant begins to wilt due to water loss. Which of the following best explains the stomatal response and its trade-off for the plant?

A Guard cells shrink, closing the stomata; this prevents further water loss but also stops the entry of CO_2 needed for photosynthesis.
B Guard cells swell, opening the stomata; this increases CO_2 uptake and simultaneously reduces water loss.
C Guard cells shrink, closing the stomata; this stops water loss and increases the rate of photosynthesis by trapping CO_2 inside the leaf.
D Guard cells swell, opening the stomata; this allows excess water vapour to leave and prevents the leaf from overheating without affecting photosynthesis.

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Model Answer

Answer: A

Guard cells shrink, closing the stomata; this prevents further water loss but also stops the entry of CO_2 needed for photosynthesis.

Explanation

The passage (Chapter 5, Section 5.2.1) states that guard cells **shrink** to **close** stomatal pores when the plant does not need CO_2 or needs to conserve water. While this prevents wilting by reducing water loss, it simultaneously blocks CO_2 entry, which is essential for photosynthesis — this is the trade-off. Options B and D incorrectly state that guard cells swell (which opens stomata). Option C is wrong because closing stomata traps no extra CO_2 and does not increase photosynthesis.

Q8. deep | thorough-understanding | § 5.2.1 Autotrophic Nutrition **[3]**

A farmer notices that even after providing adequate water, sunlight, and carbon dioxide, his crop plants show stunted growth and pale yellow leaves. He suspects a deficiency of certain soil minerals. Explain why mineral elements absorbed from the soil are essential for a plant's autotrophic nutrition even though they are not used directly to synthesise carbohydrates during photosynthesis.

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Model Answer

Although photosynthesis requires only CO_2, water, sunlight, and chlorophyll to produce carbohydrates, plants still need minerals from the soil for other essential life processes that support autotrophic nutrition.

- **Nitrogen** (as nitrates/nitrites) is essential for synthesising proteins and other compounds needed for growth and body-building.
- **Magnesium** is a component of chlorophyll; without it, chlorophyll cannot be formed, so photosynthesis itself fails — explaining the pale yellow (chlorotic) leaves.
- **Phosphorus and iron** are needed for synthesising important biological molecules and enzymes.

Thus, minerals are indispensable raw materials for building the plant body and enabling photosynthesis, even though they do not directly form carbohydrates.

Source: Chapter 5, Section 5.2.1 Autotrophic Nutrition

Explanation

- The key insight examiners want: minerals ≠ carbohydrate synthesis, but they are still essential for **body-building** (proteins) and for **making chlorophyll** (so photosynthesis can even occur).
- Always link the symptom (stunted growth = nitrogen/protein deficiency; yellow leaves = magnesium/chlorophyll deficiency) to the mineral — this shows applied understanding.
- Quote the textbook examples: nitrogen → proteins; nitrogen taken as inorganic nitrates/nitrites or via bacteria. Mention magnesium explicitly since the question gives the chlorosis clue.
- Do not write a full essay; 3 marks = 3 distinct points clearly stated.

Q9. medium | thorough-understanding | § 5.2.2 Heterotrophic Nutrition **[3]**

Fungi like bread moulds and mushrooms cannot engulf food particles the way Amoeba does, yet they successfully obtain nutrition from complex organic material. Explain how fungi achieve this, and why this strategy is particularly effective for organisms that lack the ability to move toward their food source.

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Model Answer

Fungi like bread moulds and mushrooms use **saprotrophic / extracellular digestion**. They secrete digestive enzymes onto the food material outside their body. These enzymes break down complex organic substances into simpler, soluble molecules, which are then **absorbed** directly through the body surface.

This strategy is particularly effective for non-motile organisms because the fungi simply grow over or into the food source (e.g., bread, dead matter). They do not need to move toward food — instead, they release enzymes wherever they are in contact with the material and absorb nutrients in place.

Source: Chapter 5, Section 5.2.2 — Heterotrophic Nutrition

Explanation

- The key terms examiners look for are: **secretion of enzymes outside the body**, **breakdown of complex substances**, and **absorption**.
- Distinguish this from Amoeba's method (engulfing → food vacuole → intracellular digestion).
- The "why effective" part needs a direct link to immobility: growing over food = no need to chase it.
- Avoid writing a long essay; 3 marks = 3 clear points (secretion → breakdown → absorption + reason for effectiveness).

Q10. deep | thorough-understanding | § 5.2.3 How do Organisms obtain their Nutrition? **[3]**

Bread mould and Amoeba are both heterotrophs, yet they obtain nutrition in fundamentally different ways. Compare their mechanisms of obtaining and breaking down food, and explain which strategy would be better suited to a food source that cannot be engulfed whole.

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Model Answer

Bread mould (Rhizopus) breaks down food *outside* its body by secreting enzymes onto the food material, then absorbing the digested simpler substances. This is called **saprotrophic/external digestion**.

Amoeba engulfs food particles using temporary finger-like extensions called **pseudopodia**, which fuse to form a **food vacuole**. Digestion occurs *inside* the body, and undigested material is expelled.

For a food source that **cannot be engulfed whole**, bread mould's strategy is better suited — it secretes enzymes externally to break down large or complex material and then absorbs the products, without needing to take the food in first.

Source: Chapter 5, Sections 5.2.2 and 5.2.3

Explanation

- The key contrast examiners look for: **external digestion (fungi) vs. internal digestion via phagocytosis (Amoeba)**.
- Use the correct terms: **pseudopodia**, **food vacuole**, **enzyme secretion**, **absorption**.
- The application part (which is better for large/non-engulfable food) must be answered explicitly — don't leave it implied. It's worth 1 mark and students often skip it.
- Keep the two organisms clearly separated; don't blend them in one paragraph.

Q11. medium | thorough-understanding | § 5.2.4 Nutrition in Human Beings **[3]**

The small intestine receives secretions from both the liver and the pancreas. What specific problem does each of these secretions solve for the digestion process occurring in the small intestine?

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Model Answer

Liver (Bile juice): The food coming from the stomach is acidic. Bile juice from the liver makes it alkaline so that pancreatic enzymes can function. It also breaks down large fat globules into smaller ones (emulsification) through bile salts, increasing the efficiency of fat-digesting enzymes.

Pancreas (Pancreatic juice): The pancreas secretes pancreatic juice containing enzymes — **trypsin** for digesting proteins and **lipase** for breaking down emulsified fats — enabling complete digestion of these nutrients in the small intestine.

Source: Life Processes, Section 5.2.4

Explanation

- The question has **two parts** (liver + pancreas), so address both clearly.
- Key points examiners look for: (1) bile making the medium alkaline, (2) bile's emulsification of fats, (3) pancreatic enzymes (trypsin/lipase) and what they digest. Name the enzymes for full marks.
- Do not mix up which organ does what — bile does NOT contain digestive enzymes for proteins; that is the pancreas's job.

Q12. medium | thorough-understanding | § 5.2.4 Nutrition in Human Beings **[3]**

A person's stomach lining produces insufficient mucus. Explain the consequence this would have, and why the stomach needs this protection in the first place.

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Model Answer

The stomach secretes **hydrochloric acid (HCl)** to create an acidic medium for the enzyme **pepsin** to digest proteins. This acid is highly corrosive and would damage the stomach's own inner lining.

Mucus secreted by the gastric glands **protects the inner lining of the stomach** from the action of this acid under normal conditions.

If insufficient mucus is produced, the acid will attack and erode the stomach lining, causing pain, inflammation, and ulcers — a condition commonly associated with **acidity or hyperacidity**.

Source: Chapter 5, Section 5.2.4 — Nutrition in Human Beings

Explanation

- Examiners expect you to link **HCl → need for protection → role of mucus → consequence of insufficient mucus** in a logical chain.
- The textbook directly states: *"The mucus protects the inner lining of the stomach from the action of the acid under normal conditions,"* and links its absence to acidity — mention this explicitly.
- The word "ulcer" is a reasonable inference and acceptable; the textbook hints at it through the "acidity" reference.
- For 3 marks, cover: (1) why acid is needed, (2) what mucus does, (3) consequence without it.

Q13. medium | thorough-understanding | § 5.2.4 Nutrition in Human Beings **[1]**

Herbivores like cows have a much longer small intestine than carnivores like tigers. What is the functional reason for this difference?

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Model Answer

Cellulose in plant food is harder to digest, so herbivores need a longer small intestine to allow sufficient time and surface area for complete digestion and absorption.

Source: Chapter 5, Section 5.2.2 Heterotrophic Nutrition

Explanation

The question tests application of the concept that diet determines digestive system design. The key points examiners expect are: (1) herbivores eat plant material containing cellulose, which is tough to digest, and (2) a longer intestine provides more time/surface area for digestion. The source passage hints that "what can be taken in and broken down depends on the body design and functioning" and that the digestive system differs based on food type. Keep the answer to one crisp line for 1 mark.

Q14. medium | thorough-understanding | § 5.2.4 Nutrition in Human Beings **[2]**

The large intestine does not produce any digestive enzymes. Despite this, explain why it is considered an essential organ in the process of digestion and excretion.

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Model Answer

Although the large intestine produces no digestive enzymes, it is essential for two reasons:

1. **Absorption of water and salts:** It absorbs a large amount of water and mineral salts from the undigested food, helping maintain the body's water balance.
2. **Excretion of solid waste:** The remaining undigested, semi-solid waste (faeces) is stored in the large intestine and eliminated through the anus, completing the process of excretion of solid wastes.

Explanation

The question tests understanding beyond enzyme-based digestion. Examiners expect two distinct functions: (i) water/salt reabsorption and (ii) formation and elimination of faeces. Note that the source passages focus on the alimentary canal's role in digestion and absorption — the large intestine's role in water absorption and waste elimination is the standard NCERT point to cite here. Avoid writing about enzymes since the question already states none are produced; focus on what it *does* do.

Q15. deep thorough-understanding § 5.2.4 Nutrition in Human Beings **[5]**

A student argues: 'Since digestion is already complete in the small intestine, the specific structure of the villi does not matter — nutrients would be absorbed into the blood regardless.' Critically evaluate this argument using your understanding of the structure and function of villi.

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Model Answer

The student's argument is **incorrect**. While digestion is indeed completed in the small intestine, absorption of nutrients into the blood is not automatic — it depends critically on the structure of the villi.

Why villi structure matters:

1. **Increased surface area:** The numerous finger-like projections called villi greatly increase the inner surface area of the small intestine, allowing faster and more efficient absorption of digested food.
1. **Rich blood supply:** Villi are richly supplied with blood vessels, which carry absorbed nutrients (glucose, amino acids) directly to all body cells.
1. **Fat absorption:** Fatty acids and glycerol are also absorbed through the villi into the lymph vessels (lacteals) before reaching the bloodstream.
1. **Without villi:** If the lining were flat, the surface area would be drastically reduced, absorption would be extremely slow and incomplete, and cells would be deprived of nutrients despite complete digestion.

Conclusion: Digestion and absorption are two distinct processes. The villi's specialised structure is essential for efficient absorption; without it, digested nutrients would largely pass out of the body unabsorbed.

Source: Chapter 5 — Life Processes, Section 5.2.4 Nutrition in Human Beings

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Explanation

Examiners look for: (1) a clear rebuttal of the argument, (2) specific mention of surface area increase, (3) role of blood vessels in villi, and (4) distinction between digestion and absorption. The key textbook line is: *"The inner lining of the small intestine has numerous finger-like projections called villi which increase the surface area for absorption... richly supplied with blood vessels."* Never confuse digestion (breaking down food) with absorption (taking it into blood) — they are separate processes.

Q16. straightforward | thorough-understanding | § 5.3 RESPIRATION **[1]**

Glucose is a six-carbon molecule. When it is broken down during cellular respiration, the first step produces a three-carbon molecule. What is this molecule, and where in the cell does this first step occur?

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Model Answer

The three-carbon molecule produced is **pyruvate**. This first step of cellular respiration (glycolysis) occurs in the **cytoplasm** of the cell.

Explanation

CBSE expects students to name the product (pyruvate/pyruvic acid) and the location (cytoplasm). Exercise Q4 of Chapter 5 confirms that the breakdown of pyruvate occurs in mitochondria — implying glycolysis (the prior step producing pyruvate) happens in the cytoplasm. Both facts are needed for full credit in a 1-mark question like this.

Q17. medium | thorough-understanding | § 5.3 RESPIRATION **[3]**

A student says: 'Anaerobic respiration in yeast and anaerobic respiration in human muscle cells are the same process.' Is this correct? Explain the key similarity and the key difference between the two.

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Model Answer

The student is **not correct**. The two processes are similar but not identical.

Key Similarity: Both are anaerobic processes (occur without oxygen). In both, glucose is first broken down to pyruvate in the cytoplasm.

Key Difference: In yeast, pyruvate is converted to **ethanol and carbon dioxide**. In human muscle cells, pyruvate is converted to **lactic acid** (a three-carbon molecule). The build-up of lactic acid in muscles causes cramps during sudden activity.

Source: Life Processes, Section 5.3 Respiration

Explanation

- Examiners expect you to clearly state the verdict (not correct), then give one similarity and one difference — all three earn separate marks.
- The similarity (anaerobic, pyruvate as common intermediate) and the difference (end products: ethanol + CO_2 vs lactic acid) are directly from the textbook passage.
- Naming the end products precisely is essential — vague answers lose marks.

Q18. medium | thorough-understanding | § 5.3 RESPIRATION **[3]**

Both aerobic and anaerobic respiration begin with the same glucose molecule, yet aerobic respiration releases far more ATP. Explain why, referring to what happens to the pyruvate produced in glycolysis under each condition.

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Model Answer

Both aerobic and anaerobic respiration begin with **glycolysis** in the cytoplasm, where glucose is broken down into **pyruvate**, producing a small amount of ATP.

- **Aerobic respiration:** Pyruvate is taken into the **mitochondria** and completely broken down into carbon dioxide and water. This releases a large amount of energy as ATP.
- **Anaerobic respiration:** Pyruvate is not fully broken down. It is converted into ethanol and CO_2 (in yeast) or lactic acid (in muscles) in the cytoplasm itself, releasing only a small amount of ATP.

Since aerobic respiration completely oxidises pyruvate, it extracts far more energy from each glucose molecule than anaerobic respiration.

Source: Life Processes, Chapter 5 (Respiration section)

Explanation

- The examiner wants you to mention **glycolysis** as the common first step, then contrast what happens to **pyruvate** under each condition.
- Key fact from the textbook: "breakdown of pyruvate to give CO_2, water and energy takes place in the **mitochondria**" (Exercise Q4) — always mention mitochondria for aerobic.
- The textbook states "aerobic respiration makes **more energy** available" — use this exact idea.
- Avoid over-explaining; three crisp points (common step → aerobic fate → anaerobic fate) are enough for 3 marks.

Q19. medium | thorough-understanding | § 5.3 RESPIRATION **[3]**

After an intense sprint, a runner experiences painful cramps in the leg muscles. Explain the biochemical reason for this, tracing the exact pathway that leads to cramp formation.

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Model Answer

During an intense sprint, muscles require more energy than oxygen can supply. When oxygen is insufficient, muscles switch from aerobic respiration to **anaerobic respiration**.

In anaerobic respiration, glucose is incompletely broken down:

Glucose → Lactic acid + Energy

Lactic acid accumulates in the muscle tissue. This build-up of lactic acid causes a drop in muscle pH and interferes with muscle contraction, leading to painful **cramps**. The cramps persist until the lactic acid is removed through the bloodstream and broken down once oxygen supply is restored.

Source: Life Processes, Chapter 1 (Respiration)

Explanation

- The question tests anaerobic respiration in muscles — a key concept from Chapter 1 (Life Processes), not Chapter 6. The source passages provided do not cover this, but a CBSE student must answer from the prescribed textbook content.
- **Key terms examiners look for:** anaerobic respiration, lactic acid accumulation, lack of oxygen/insufficient oxygen supply.
- The pathway must be clearly stated: oxygen deficit → anaerobic pathway → lactic acid build-up → cramps.
- Do NOT write aerobic respiration here; the whole point is the *switch* to anaerobic.
- Three marks = three distinct points: (1) oxygen deficit, (2) anaerobic respiration/lactic acid formed, (3) lactic acid causes cramps.

Q20. deep thorough-understanding § 5.3 RESPIRATION **[3]**

A sealed jar contains a germinating seed respiring aerobically. After 24 hours the oxygen inside is almost used up, but the seed is still alive and releasing CO_2. Which respiratory pathway has the seed most likely switched to, and what waste product, other than CO_2, would you expect to accumulate?

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Model Answer

The seed has most likely switched to **anaerobic respiration** (fermentation).

When oxygen is exhausted, the seed cannot continue aerobic respiration. Instead, pyruvate (formed in the cytoplasm from glucose) is converted without oxygen via anaerobic respiration. In plants and yeast, this pathway converts pyruvate into **ethanol (alcohol) and carbon dioxide**.

Therefore, the waste product other than CO_2 that would accumulate is **ethanol (ethyl alcohol)**.

Source: Chapter 5, Section 5.3 — Respiration

Explanation

- Examiners expect you to **name the pathway** (anaerobic respiration/fermentation) and **justify** it briefly (oxygen used up → switch from aerobic).
- The key fact from the textbook: in yeast/plants under anaerobic conditions, pyruvate → **ethanol + CO_2** (not lactic acid, which is the animal/muscle pathway).
- Do not confuse: lactic acid is produced in *muscle cells* (humans) during oxygen shortage; ethanol is produced in *plants and yeast*. Since the question is about a seed, ethanol is the correct answer.
- Mentioning pyruvate and where breakdown occurs (cytoplasm) adds accuracy and can earn full marks.

Q21. medium | thorough-understanding | § 5.3 RESPIRATION **[2]**

During bright daylight, a student holds a lit candle near a healthy potted plant and notices the flame is not extinguished. Yet the same plant placed in the dark causes the flame to flicker and go out after some time. Explain the biochemical basis of this observation in terms of the balance between photosynthesis and respiration.

◆ Life Processes

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Model Answer

In bright light, the plant performs **photosynthesis**, which produces O_2 and consumes CO_2, while simultaneously respiring. The net result is O_2 release, maintaining sufficient oxygen to keep the candle burning.

In the dark, photosynthesis stops but **respiration continues**, consuming O_2 and releasing CO_2. The depleted oxygen level starves the flame, causing it to flicker and extinguish.

Source: Chapter 5, Section 5.2.1 (Autotrophic Nutrition) and Section 5.1 (Life Processes)

Explanation

- Examiners expect you to explicitly contrast the two conditions: light (photosynthesis + respiration, net O_2 gain) vs. dark (respiration only, O_2 consumed).
- Key terms to use: **photosynthesis**, **respiration**, **oxygen**, **carbon dioxide** — these fetch marks.
- Do not just say "the plant releases oxygen in light"; link it to why the candle *stays lit* or *goes out*. That cause-effect link is what earns the second mark.

Q22. medium | thorough-understanding | § 5.3 RESPIRATION **[2]**

Aquatic fish breathe much faster than terrestrial mammals of a similar body size. What is the underlying reason for this difference in breathing rate?

◆ Life Processes

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Model Answer

Water contains very little dissolved oxygen (about 1%) compared to air (21%). So, to obtain the required amount of oxygen, aquatic fish must breathe water much more rapidly and pass larger volumes over their gills. Terrestrial mammals breathe air, which is far richer in oxygen, so fewer breaths are needed.

Explanation

The key point examiners expect is the **low oxygen content of water vs. air**. Fish compensate by increasing breathing rate to extract enough oxygen through gills. Note: the source passages do not directly state this, but it is standard NCERT Class 10 Biology knowledge from Chapter 5 (Life Processes, Respiration section). If your exam provides a specific passage on this, quote from it; otherwise, use this core reasoning. Keep the answer focused on the cause-effect link: low O_2 in water → faster breathing rate.

Q23. medium | thorough-understanding | § 5.3 RESPIRATION **[3]**

Carbon dioxide and oxygen are both transported through the same blood vessels, yet by entirely different mechanisms. (i) Describe how each gas is transported in human blood. (ii) Red blood corpuscles lack a nucleus. How does this structural feature directly aid their primary function in gas transport?

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Model Answer

(i) Transport of gases in blood:

- **Oxygen** is carried by **haemoglobin** present in red blood corpuscles (RBCs). It combines with haemoglobin to form oxyhaemoglobin.
- **Carbon dioxide** is transported in **dissolved form in the plasma**.

(ii) RBCs lack a nucleus, so the entire cell space is available to pack more haemoglobin molecules. This increases the oxygen-carrying capacity of each RBC, directly aiding efficient gas transport.

Source: Chapter 5, Section 5.4.1 Transportation in Human Beings

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Explanation

- The textbook explicitly states: *"Oxygen is carried by the red blood corpuscles"* (via haemoglobin) and *"Plasma transports food, carbon dioxide and nitrogenous wastes in dissolved form."* Use these exact mechanisms.
- For part (ii), the examiner wants you to link the structural feature (no nucleus → more space) to the functional benefit (more haemoglobin → more O_2 carried). This is a classic structure-function question — one crisp logical sentence scores full marks.
- Do not confuse the two gases: O_2 → RBCs/haemoglobin; CO_2 → plasma (dissolved).

Q24. straightforward | thorough-understanding | § 5.4 TRANSPORTATION **[1]**

Deoxygenated blood returning from the body enters the right atrium of the heart. Why is it essential that this blood is kept completely separate from the oxygenated blood leaving the left ventricle?

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Model Answer

If oxygenated and deoxygenated blood mix, the oxygen concentration delivered to body tissues would decrease, reducing the efficiency of energy release — which is essential for warm-blooded mammals with high energy needs.

Explanation

The examiner wants you to state the consequence of mixing: reduced oxygen supply to body cells, lowering metabolic efficiency. The key phrase from the textbook is "highly efficient supply of oxygen to the body." Mentioning that mammals have high energy needs adds the biological reason, which strengthens a 1-mark answer.

Q25. medium | thorough-understanding | § 5.4 TRANSPORTATION **[3]**

Arteries have thick, elastic walls while veins have thinner walls but contain valves. Explain why each of these structural features is necessary for the function that vessel performs.

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Model Answer

Arteries — Thick, Elastic Walls:
Arteries carry blood *away* from the heart. The heart pumps blood under high pressure, so arteries need thick, elastic walls to withstand and absorb this pressure without bursting. The elasticity also helps maintain smooth blood flow.

Veins — Thinner Walls with Valves:
Veins carry blood *back* to the heart. By the time blood reaches the veins, pressure has dropped significantly, so thick walls are unnecessary. However, valves are essential to prevent the backflow of blood, ensuring it flows only in one direction — towards the heart.

Source: Chapter 5, Section 5.4.1 — "The tubes – blood vessels"

Explanation

- The textbook directly states: *"arteries have thick, elastic walls"* because blood emerges from the heart **under high pressure**; veins *"do not need thick walls because the blood is no longer under pressure"* but have **valves** to ensure **one-directional flow**.
- Always link structure → function clearly. Examiners expect you to explain *why*, not just *what*.
- For 3 marks: award 1 mark for arteries' structure + reason, 1 mark for veins' structure + reason, 1 mark for correct direction of flow in each vessel.

Q26. deep thorough-understanding § 5.4 TRANSPORTATION **[3]**

Why do birds and mammals need a completely four-chambered heart with fully separated oxygenated and deoxygenated blood, while amphibians and many reptiles survive with a three-chambered heart that allows some mixing?

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Model Answer

Birds and mammals are **warm-blooded (homeothermic)** — they constantly use energy to maintain a stable body temperature regardless of the environment. This means they have **high energy needs** and require a highly efficient, continuous oxygen supply. A **four-chambered heart** completely separates oxygenated and deoxygenated blood, ensuring only pure oxygenated blood is pumped to body tissues, supporting their high metabolic rate.

Amphibians and many reptiles are **cold-blooded (poikilothermic)** — their body temperature depends on the environment, so they have **lower energy needs**. A **three-chambered heart** with some mixing of blood is sufficient for their slower metabolism. Hence, the incomplete separation is tolerated without significant harm.

Source: Chapter 5, Section 5.4.1 — Transportation in Human Beings

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Explanation

- The examiner expects you to link **heart structure → energy needs → body temperature regulation**. This is the core logic.
- Key terms to use: *warm-blooded/homeothermic*, *cold-blooded/poikilothermic*, *oxygenated/deoxygenated*, *efficient oxygen supply*, *high/low metabolic rate*.
- The textbook explicitly states: *"This is useful in animals that have high energy needs, such as birds and mammals, which constantly use energy to maintain their body temperature."* Quote or paraphrase this reasoning directly — examiners reward it.
- Do **not** describe the chambers of the heart in detail unless asked; focus on **why** the separation matters.

Q27. deep thorough-understanding § 5.4 TRANSPORTATION **[3]**

In fish, blood passes through the heart only once during a single trip around the body. In humans, blood passes through the heart twice. What is the physiological advantage of this double circulation over the single circulation seen in fish?

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Model Answer

In fish, blood is pumped from the heart to the gills for oxygenation, then directly to the body. By the time it reaches body tissues, the blood pressure has dropped significantly, reducing the efficiency of oxygen delivery.

In double circulation (humans), the heart pumps blood twice — once through the lungs (pulmonary circuit) and once through the body (systemic circuit). This ensures that oxygenated blood is returned to the heart before being pumped to the body with full pressure. As a result, oxygenated and deoxygenated blood do not mix, and tissues receive a highly efficient, high-pressure supply of oxygen. This is essential for warm-blooded animals like mammals, which need more energy to maintain constant body temperature.

Source: Chapter 5, Section 5.4.1 — "Our pump — the heart"

Explanation

- The examiner expects **two key points**: (1) separation of oxygenated and deoxygenated blood prevents mixing, and (2) re-pressurisation of blood before systemic circulation ensures efficient oxygen delivery.
- Mention that this is especially important for **birds and mammals** (warm-blooded) with high energy demands — the textbook explicitly states this.
- Don't just define double circulation — **compare** it to fish and explain the *advantage* (the question word is "advantage").
- Avoid over-explaining anatomy; focus on the physiological benefit.

Q28. medium | thorough-understanding | § 5.4 TRANSPORTATION **[3]**

Lymph is often described as 'returned tissue fluid.' (i) Explain how lymph is formed from blood plasma. (ii) State two ways in which the lymphatic system contributes to the body's functioning beyond simply returning fluid to the blood.

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Model Answer

(i) Formation of Lymph:
Blood plasma, along with some proteins and blood cells, seeps out through the pores in the thin walls of capillaries into the intercellular spaces of tissues. This collected fluid in the intercellular spaces is called tissue fluid or lymph. It is colourless and contains less protein than blood plasma.

(ii) Two additional functions of the lymphatic system:

1. It carries digested and absorbed fat from the intestine and transports it to the blood.
2. It drains excess fluid from extracellular spaces back into the blood, maintaining fluid balance in tissues.

Source: Chapter 5, Section 5.4.1 – Lymph

Explanation

- Part (i) expects you to link capillary permeability → plasma leakage → tissue fluid = lymph. Mention "less protein" and "colourless" for full credit.
- Part (ii): The textbook explicitly states **two** functions of lymph — fat transport from intestine and draining excess fluid. These are the expected points; don't invent others.
- Examiners look for the word **intercellular spaces** in part (i) and both distinct functions in part (ii).

Q29. deep | thorough-understanding | § 5.4 TRANSPORTATION **[2]**

Plants have two separate conducting tissues — xylem and phloem — for transport. Why can the same tissue not be used to transport both water and the products of photosynthesis?

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Model Answer

Water and minerals are transported **upward** from roots to leaves through xylem, driven by transpiration pull — a unidirectional, passive process. Food (sucrose) produced by photosynthesis must be transported **in all directions** (leaves to roots, fruits, etc.) through phloem, requiring energy (active transport). Since the direction, mechanism, and substances differ, separate tissues are necessary.

Source: Chapter 5, Section 5.4 – Transportation in Plants

Explanation

- Examiners expect **two clear contrasting points**: (1) xylem transports water/minerals upward passively; (2) phloem transports food in multiple directions using energy.
- Mentioning that using one tissue would cause **mixing** of water and dissolved food (disrupting concentration gradients needed for each) earns full credit.
- Don't over-explain — two tight points are enough for 2 marks.

Q30. deep thorough-understanding § 5.4 TRANSPORTATION **[3]**

During the day, transpiration pull is the major force driving water movement up the xylem, but at night, root pressure becomes more important. Why does this shift occur?

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Model Answer

During the day, stomata are open for photosynthesis, causing rapid transpiration. The loss of water vapour creates a tension (negative pressure) in xylem that pulls water upward — this is **transpiration pull**, the dominant force.

At night, stomata close, so transpiration virtually stops and transpiration pull disappears. However, root cells continue absorbing mineral salts by active transport, lowering their water potential. Water then enters root xylem by osmosis, building up **root pressure** (a positive pressure) that pushes water upward. With transpiration pull absent, root pressure becomes the primary driving force for water movement at night.

Explanation

This question tests understanding of two mechanisms of water transport in xylem and the conditions that favour each. Key points examiners expect:

- **Day:** stomata open → transpiration → tension/pull in xylem (cohesion-tension mechanism).
- **Night:** stomata close → no transpiration pull → root pressure (active uptake of ions → osmotic entry of water) takes over.
- Clearly link the shift to stomatal behaviour.

Note: The source passages provided do not cover this topic directly — this answer is based on standard CBSE Class 10 Biology content on transportation in plants.

Q31. deep thorough-understanding § 5.4 TRANSPORTATION **[3]**

Translocation of food in phloem requires ATP energy, whereas the ascent of water through xylem does not directly require cellular energy. What does this difference indicate about the mechanism of each transport process? Name the physical forces that drive water movement in xylem.

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Model Answer

Mechanism of Transport:

Translocation in phloem requires ATP energy, which means it is an **active transport** process — energy is used to load sugar into phloem cells against a concentration gradient. In contrast, water movement through xylem does not need cellular energy, indicating it is a **passive process** driven entirely by physical forces.

Physical forces driving water movement in xylem:

1. **Transpiration pull** — loss of water vapour from leaves creates suction that pulls water upward.
2. **Root pressure** — osmotic entry of water from soil into root cells pushes water up.
3. **Cohesion and adhesion** — cohesion between water molecules and adhesion to xylem walls help maintain a continuous water column.

Source: Life Processes, Section 5 (Transport in Plants)

Explanation

- The key contrast examiners look for: **active transport** (phloem, needs ATP) vs **passive transport** (xylem, no ATP).
- Name all three physical forces for xylem — transpiration pull, root pressure, and cohesion-adhesion — to secure full marks.
- Keep the phloem explanation brief (1 mark) and devote more space to naming and explaining xylem forces (2 marks).

Q32. medium | thorough-understanding | § 5.4 TRANSPORTATION **[3]**

A patient is found to have a systolic blood pressure of 160 mm Hg and a diastolic pressure of 100 mm Hg. (i) What condition does this indicate? (ii) If the arterioles are constricted, explain the mechanism by which this leads to the observed readings.

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Model Answer

(i) The readings (systolic: 160 mm Hg, diastolic: 100 mm Hg) are above the normal range (120/80 mm Hg). This condition is called **hypertension** (high blood pressure).

(ii) Constriction of arterioles increases resistance to blood flow. The heart must pump blood with greater force against this resistance. As a result, the pressure exerted by blood on arterial walls increases during both ventricular contraction (systole) and relaxation (diastole), leading to elevated systolic and diastolic readings.

Source: Chapter 5, Section 5.4.1 — Blood pressure (More to Know box)

Explanation

- Examiners expect the term **hypertension** in part (i) — one word/phrase is sufficient for 1 mark.
- For part (ii) (2 marks), two logical steps are needed: (1) constriction → increased resistance, and (2) increased resistance → heart exerts greater force → higher blood pressure. The passage directly states "high blood pressure is caused by constriction of arterioles, which results in increased resistance to blood flow."
- Do not confuse arterioles with arteries; use the correct term from the passage.

Q33. medium | thorough-understanding | § 5.4 TRANSPORTATION **[5]**

Compare the transport of water and minerals through xylem with the transport of food through phloem under the following heads: (i) direction of transport, (ii) driving force, (iii) role of energy, and (iv) types of substances transported. Using this comparison, explain why a herbicide that blocks ATP synthesis in phloem companion cells would affect food translocation but not water transport.

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Model Answer

(i) Direction of transport:
Xylem transports water and minerals **unidirectionally** — from roots to leaves (upward). Phloem transports food (sucrose, amino acids) **bidirectionally** — from leaves to other parts as needed.

(ii) Driving force:
Xylem: transpiration pull (suction created by water evaporation from leaves) and root pressure. Phloem: osmotic pressure gradient created by active loading of sugars.

(iii) Role of energy:
Xylem transport is a **physical/passive** process — no ATP is directly required. Phloem transport is an **active** process — ATP energy is needed to load sugars into phloem.

(iv) Substances transported:
Xylem — water and dissolved minerals. Phloem — sucrose (food/sugars) and amino acids.

Application: A herbicide blocking ATP synthesis in phloem companion cells would stop active loading of sugars into phloem, halting food translocation. Water transport through xylem is passive and requires no ATP, so it would be **unaffected**.

Source: Life Processes, Section 5 (Transport in Plants)

Explanation

- Examiners expect all **four heads** addressed — missing any costs marks.
- The key distinction is **active vs. passive**: xylem = passive (no ATP); phloem = active (needs ATP from companion cells).
- The application (herbicide) directly tests this distinction — always link back to ATP dependency of phloem.
- Use terms like *transpiration pull*, *root pressure*, *bidirectional*, and *companion cells* to score full marks.

Q34. medium | thorough-understanding | § 5.5 EXCRETION **[3]**

The kidneys filter approximately 180 litres of blood plasma per day, yet the composition of urine is very different from the original filtrate. (a) Which substances are selectively reabsorbed from the filtrate back into the blood, and why is this reabsorption necessary? (b) What would be the consequences for the body if this selective reabsorption did not take place?

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Model Answer

(a) As the filtrate flows through the nephron tubules, substances like **glucose, amino acids, salts, and a major amount of water** are selectively reabsorbed back into the blood. This reabsorption is necessary because these are useful substances that the body needs; excreting them would be wasteful and harmful to normal body functions.

(b) If selective reabsorption did not occur, the body would lose essential nutrients (glucose, amino acids), vital salts, and large amounts of water in urine. This would lead to dehydration, loss of energy sources, electrolyte imbalance, and ultimately failure of normal cellular activities — which could be life-threatening.

Source: Chapter 5, Section 5.5.1 – Excretion in Human Beings

Explanation

- **(a)** The textbook explicitly lists glucose, amino acids, salts, and water as reabsorbed substances. Examiners expect all four mentioned and a reason (they are useful/needed by the body).
- **(b)** Think logically from (a): if useful things aren't reabsorbed, they are lost. The key consequences are dehydration (water loss), energy loss (glucose), and ion imbalance (salts). The passage also notes that of 180 L filtered, only 1–2 L is excreted — underlining how critical reabsorption is.
- For a 3-mark question split into (a) and (b), aim for roughly 1.5 marks each — about 2–3 crisp points per part.

Q35. deep thorough-understanding § 5.5 EXCRETION **[3]**

A patient's kidneys have failed and they are put on hemodialysis. The dialysing fluid used in the artificial kidney is prepared to have the same osmotic pressure as blood, but contains no urea or other nitrogenous wastes. Why is this specific composition of the dialysing fluid critical for the machine to work correctly?

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Model Answer

The dialysing fluid must have the **same osmotic pressure as blood** so that useful substances like glucose, salts, and water are **not lost from the blood** by osmosis or diffusion — they remain in balance across the semi-permeable membrane.

The fluid must be **devoid of nitrogenous wastes (e.g., urea)** so that a **concentration gradient** is maintained between the patient's blood (high urea) and the dialysing fluid (no urea). This causes urea and other waste products to **move out of the blood into the dialysing fluid by diffusion**, thereby cleaning the blood.

If urea were present in the fluid, no gradient would exist and waste removal would stop. If osmotic pressure differed, the patient would lose vital substances.

Source: Chapter 5, Section 5.5.1 — Artificial Kidney (Hemodialysis)

Explanation

Examiners look for **two distinct logical points** linked to the two features of the dialysing fluid:

1. **Same osmotic pressure** → prevents loss of useful blood components (glucose, salts, water).
2. **No nitrogenous wastes** → maintains concentration gradient → wastes diffuse out by diffusion.

Both points must be connected to the mechanism (osmosis/diffusion across semi-permeable membrane). A common mistake is explaining only one feature. The textbook explicitly states: *"This fluid has the same osmotic pressure as blood, except that it is devoid of nitrogenous wastes... waste products pass into dialysing fluid by diffusion."* Use this as your anchor.

Q36. medium | thorough-understanding | § 5.5 EXCRETION **[1]**

Which of the following correctly explains why plants do not need a specialised excretory organ like the kidneys found in animals?

((A)) Plants excrete all their waste products through their stomata as gases, eliminating the need for any storage.

((B)) Plants produce very little metabolic waste, and much of what is produced is either reused in other metabolic processes or stored in dead cells and vacuoles.

((C)) Plants absorb their waste products back from the environment through their roots, so none accumulates in the body.

((D)) Plants release all nitrogenous wastes into the soil through their roots, which acts as a natural excretory organ.

A Plants do not produce any metabolic waste products at all.

B Plants can store wastes in dead cells, vacuoles, shed leaves, and as gums and resins, and also release some wastes into the soil.

C All waste products in plants are broken down by enzymes and recycled within the same cell.

D Plants excrete all their wastes as gases through the stomata.

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Model Answer

Option B — Plants can store wastes in dead cells, vacuoles, shed leaves, and as gums and resins, and also release some wastes into the soil.

Explanation

The passage (5.5.2) states plants store waste in cellular vacuoles, dead cell tissues, falling leaves, resins/gums in old xylem, and also excrete some wastes into surrounding soil. This multi-strategy approach means specialised excretory organs like kidneys are unnecessary. Option B captures all these strategies; the other options are either too narrow (only stomata/gases) or factually incorrect per the textbook.

Q37. medium | thorough-understanding | § 5.5 EXCRETION **[2]**

Oxygen released during photosynthesis is described as a waste product of plants. Justify this statement, and explain how plants manage to dispose of this 'waste' without a dedicated excretory organ.

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Model Answer

During photosynthesis, water molecules are split to release hydrogen; **oxygen is a by-product** of this reaction and is not used further by the plant, making it a waste product.

Plants dispose of it through **simple diffusion** — oxygen passes out directly through stomata and the surfaces of leaves, stems, and roots into the surrounding air. No specialised excretory organ is needed because gases diffuse easily across thin cell surfaces.

Source: Life Processes, Section 5.5.2 Excretion in Plants; Section 5.2.1 Autotrophic Nutrition

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Explanation

- The examiner wants two things: (1) **why** O_2 is a waste (it's a by-product of water-splitting in photosynthesis, not used by the plant), and (2) **how** it is removed (diffusion through stomata/cell surfaces — no organ needed).
- Don't confuse O_2 released in photosynthesis with O_2 consumed in respiration; some O_2 is reused internally, but the excess is excreted as waste.
- The key term is **diffusion** — plants rely on it because gaseous molecules move easily across moist cell surfaces, unlike bulky nitrogenous wastes that need specialised organs.

Q38. deep thorough-understanding § 5.5 EXCRETION **[5]**

The initial filtrate produced in the kidneys of a healthy adult is about 180 litres per day, yet only 1–2 litres of urine is actually excreted. (a) Identify the structure in the nephron responsible for this massive reduction in volume and describe how it achieves this. (b) The composition of urine varies — for example, a person who drinks very little water produces more concentrated urine. Using your understanding of reabsorption in the tubular part of the nephron, explain how the body adjusts the final composition and volume of urine according to its needs.

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Model Answer

(a) The **tubular part of the nephron** (kidney tubule) is responsible for this massive reduction in volume. After blood is filtered in the Bowman's capsule, the initial filtrate (~180 L/day) passes through the tubule. Here, useful substances such as glucose, amino acids, salts, and a large amount of water are **selectively reabsorbed** back into the blood. Only waste-rich fluid remains, which becomes urine. This reabsorption reduces the volume from ~180 L to just 1–2 L of urine per day.

(b) The amount of water reabsorbed in the tubule depends on the body's needs. If a person drinks very little water, the body needs to conserve water, so **more water is reabsorbed** from the tubule back into the blood. This produces a smaller volume of more concentrated urine. Conversely, excess water in the body leads to less reabsorption, producing dilute, larger-volume urine. Similarly, the reabsorption of dissolved wastes is regulated so that harmful substances are retained in the filtrate and excreted. Thus, the tubule adjusts both the composition and volume of the final urine according to the body's requirements.

Source: Chapter 5, Section 5.5.1 (Excretion in Human Beings)

Explanation

- **(a)** Examiners expect you to name the **tubule/tubular part of the nephron** and explain **selective reabsorption** of water, glucose, amino acids, and salts. Mentioning Bowman's capsule as the filtration site adds context.
- **(b)** The key phrase from the textbook is: *"The amount of water reabsorbed depends on how much excess water there is in the body."* Use this logic to contrast low-water-intake (more reabsorption → concentrated urine) vs. high-water-intake (less reabsorption → dilute urine). Do not go beyond the textbook's explanation — no need to mention ADH or hormones, as the CBSE Class 10 syllabus does not require it.
- Keep answers tied to the source passage; avoid over-detailing the structure of the nephron unless directly asked.

Q39. deep | thorough-understanding | § (whole-chapter synthesis) **[3]**

Trace the journey of a single glucose molecule from its synthesis in a leaf cell to its use in releasing energy in a root cell of the same plant. In your answer, name the tissue that transports it, the energy source used for that transport, and the cellular location where energy is finally released from glucose.

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Model Answer

Glucose is synthesised in the **chloroplast** of leaf cells during photosynthesis. It is then loaded into the **phloem** tissue, which transports it from the leaf (source) to the root (sink). This transport — called translocation — is an **active process that requires ATP energy**. Once glucose reaches the root cell, it is broken down during aerobic respiration. The final stage of respiration, where most ATP is released from glucose, occurs in the **mitochondria** of the root cell.

Source: Life Processes, Chapter 5

Explanation

- **3 marks = 3 key points**: (1) phloem as transport tissue, (2) ATP/energy used for transport, (3) mitochondria as the site of energy release.
- Examiners expect all three named correctly. Saying "vascular tissue" without naming **phloem** specifically may cost a mark.
- Don't confuse xylem (water/minerals) with phloem (food/glucose).
- The textbook (Exercise Q4) explicitly states energy release from pyruvate happens in the **mitochondria** — use that exact word.

Q40. deep | thorough-understanding | § (whole-chapter synthesis) **[5]**

Both the alveolus in the lungs and the nephron in the kidney perform filtration across thin-walled capillaries, yet their roles in maintaining the body are fundamentally different. Compare the two structures by explaining (i) what is filtered in each, (ii) what happens to the useful substances after filtration, and (iii) what the body ultimately expels from each.

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Model Answer

Alveolus vs. Nephron — A Comparison

(i) What is filtered:
In the **alveolus**, gases are exchanged across thin-walled capillaries — CO_2 passes out of the blood into the air sac, and O_2 enters the blood. In the **nephron**, blood is filtered under pressure at the Bowman's capsule; the filtrate contains water, glucose, amino acids, salts, urea, and uric acid.

(ii) Fate of useful substances after filtration:
In alveoli, O_2 absorbed into the blood is carried by haemoglobin to all body cells — nothing is "reabsorbed" as such. In nephrons, useful substances — glucose, amino acids, salts, and a large amount of water — are **selectively reabsorbed** back into the blood as filtrate flows along the kidney tubule.

(iii) What the body expels:
From the lungs, CO_2 is breathed out as a gaseous waste. From the kidneys, nitrogenous wastes (urea, uric acid) dissolved in water are expelled as **urine** through the ureter, bladder, and urethra.

Source: Chapter 5, Section 5.5.1 (Excretion in Human Beings)

Explanation

- The examiner wants a **direct comparison** across three specific points — structure your answer clearly under each point (or make it obvious in flow).
- The key contrast: alveoli deal with **gaseous exchange** (respiratory waste = CO_2); nephrons deal with **nitrogenous waste** (urea/uric acid) via **filtration + selective reabsorption**.
- The phrase **"selectively reabsorbed"** is textbook language — use it for nephron; it earns marks.
- Don't forget that ~180 L is filtered daily in kidneys but only 1–2 L is excreted — this shows the scale of reabsorption and is a good detail if you have space.
- Alveoli have no reabsorption step — that's the fundamental structural difference the question is targeting.

Q41. deep thorough-understanding § (whole-chapter synthesis) **[3]**

A plant simultaneously performs photosynthesis, aerobic respiration and transpiration during a sunny afternoon. Explain how the opening of stomata during this period creates a situation where one gas exchange process directly benefits another, and identify one unavoidable cost the plant pays as a result.

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Model Answer

When stomata open during a sunny afternoon, CO_2 enters the leaf for **photosynthesis**. Simultaneously, O_2 produced by photosynthesis becomes directly available inside the leaf for **aerobic respiration**, without needing a separate gas-exchange mechanism. As the textbook states, "CO_2 generated during respiration is used up for photosynthesis... oxygen release is the major event at this time." Thus, the two processes mutually supply each other's raw materials through the same open stomata.

Unavoidable cost: Large amounts of **water vapour are lost through the open stomata** (transpiration). Since "large amounts of water can also be lost through these stomata," the plant cannot take in CO_2 without simultaneously losing water — this is the unavoidable trade-off.

Source: Chapter 5, Sections 5.2.1 and 5.3

Explanation

- The key insight examiners want is the **mutual benefit**: O_2 from photosynthesis feeds aerobic respiration, and CO_2 from respiration feeds photosynthesis — both via the *same* open stomata.
- The "unavoidable cost" must be **water loss/transpiration** — directly supported by the passage. Don't write vague answers like "energy loss."
- Quote or paraphrase the textbook lines to show you are grounding the answer in source material.
- At 3 marks: ~2 marks for the gas-exchange benefit explanation, ~1 mark for the cost.

Q42. medium | thorough-understanding | § (whole-chapter synthesis) **[3]**

In human beings, the circulatory system acts as a link between the respiratory system and the excretory system. Explain what specific substances the blood transports that make this linkage essential for each of these two systems to function.

◆ Life Processes

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Model Answer

Blood acts as the crucial link between the respiratory and excretory systems in the following ways:

Link with the Respiratory System:
Blood transports **oxygen** (carried by red blood corpuscles/haemoglobin) from the lungs to all body cells, and carries **carbon dioxide** (dissolved in plasma) from the cells back to the lungs for removal. Without this transport, gas exchange in the respiratory system would be purposeless.

Link with the Excretory System:
Blood carries **nitrogenous wastes** such as urea and uric acid (dissolved in plasma) from the body cells to the kidneys, where they are filtered out and excreted as urine. Without blood transporting these wastes, the excretory system cannot function.

Source: Chapter 5, Sections 5.4.1 and 5.5.1

Explanation

- Examiners expect you to name the **specific substances** transported — oxygen, CO_2 for respiration; nitrogenous wastes (urea/uric acid) for excretion. Vague answers like "waste materials" alone lose marks.
- Mentioning that RBCs carry O_2 and plasma carries CO_2 and nitrogenous wastes shows textbook accuracy and earns full credit.
- The question has two parts (respiratory + excretory); address both clearly for all 3 marks.

Q43. medium | thorough-understanding | § (whole-chapter synthesis) **[1]**

Assertion (A): Mammals and birds maintain a complete separation between oxygenated and deoxygenated blood in their hearts, whereas amphibians do not.
Reason (R): Mammals and birds use energy to maintain a constant body temperature, so they require a more efficient and uninterrupted oxygen supply to their tissues.

Choose the correct option:
(A) Both A and R are true, and R is the correct explanation of A.
(B) Both A and R are true, but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

A Both A and R are true, and R is the correct explanation of A.
B Both A and R are true, but R is not the correct explanation of A.
C A is true but R is false.
D A is false but R is true.

◆ Life Processes

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Model Answer

(A) Both A and R are true, and R is the correct explanation of A.

Mammals and birds have four-chambered hearts keeping oxygenated and deoxygenated blood separate, because they use energy to maintain constant body temperature and thus require efficient, uninterrupted oxygen supply.

Explanation

The textbook (Ch. 5, section 5.4.1) directly states: "Such separation allows a highly efficient supply of oxygen to the body. This is useful in animals that have high energy needs, such as birds and mammals, which constantly use energy to maintain their body temperature." This makes R the correct explanation of A. Amphibians have three-chambered hearts and tolerate some mixing because they don't regulate body temperature. Both statements are true and R logically explains why A is true.

Q44. medium | thorough-understanding | § (whole-chapter synthesis) **[5]**

Both autotrophic plants and heterotrophic animals ultimately depend on ATP as their cellular energy currency, yet they obtain the raw materials for making it in completely different ways. Compare the two nutritional strategies, and explain how, despite starting from different raw materials and energy sources, both organisms arrive at the same final cellular process for ATP generation.

◆ Life Processes

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Model Answer

Autotrophic Nutrition (Plants):
Autotrophs like green plants take in simple inorganic raw materials — carbon dioxide and water — from the environment. Using sunlight and chlorophyll, they convert these into carbohydrates through photosynthesis. This stores chemical energy in organic compounds like glucose and starch.

Heterotrophic Nutrition (Animals):
Heterotrophs cannot synthesise their own food. They consume complex organic material prepared by autotrophs. In humans, food is broken down by enzymes along the alimentary canal and absorbed in the small intestine, ultimately yielding glucose.

Common Final Process — Respiration:
Despite their different starting points, both autotrophs and heterotrophs arrive at glucose as the key organic compound. This glucose is then broken down during respiration (aerobic or anaerobic) in the mitochondria, releasing energy stored as **ATP**. ATP is the universal energy currency used for all cellular reactions in both types of organisms.

Thus, heterotrophs depend directly or indirectly on autotrophs, yet both share the same final mechanism of ATP generation through respiration.

Source: Chapter 5, Sections 5.2 and 5.2.1

Explanation

- The examiner wants: (1) clear definition/description of autotrophic nutrition with raw materials + energy source, (2) clear description of heterotrophic nutrition, (3) the link — both produce/obtain glucose → respiration → ATP.
- Key phrase from the textbook to include: *"During respiration, organic compounds such as glucose are broken down to provide energy in the form of ATP."*
- Don't just define the two modes — the question specifically asks you to **connect** them to the common ATP-generating process (respiration). That connecting paragraph is worth the most marks.
- Avoid writing more than ~120 words; the examiner rewards precision over length.

Q45. deep | thorough-understanding | § (whole-chapter synthesis) **[3]**

A plant is placed in a well-lit but very dry environment, and its stomata close in response. Explain how this single stomatal response creates a chain of consequences for photosynthesis, the ascent of water through the xylem, and the supply of minerals to the leaves.

◆ Life Processes

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Model Answer

When stomata close, CO_2 cannot enter the leaf. Without CO_2, photosynthesis slows down, so less carbohydrate is produced for the plant.

Stomatal closure also reduces transpiration. Since the transpiration pull is the main force driving the ascent of water through the xylem, reduced transpiration means less water is pulled up from the roots. Consequently, water movement through the xylem slows down.

Since minerals like nitrogen, phosphorus, and magnesium are dissolved in soil water and carried to the leaves along with this water through the xylem, a reduced water flow means fewer minerals reach the leaves. This further limits processes like protein synthesis that depend on these minerals.

Source: Chapter 5, Section 5.2.1

Explanation

- The examiner expects a **chain/linked** response — each consequence must flow from the previous one.
- Three distinct effects are needed for 3 marks: (1) reduced photosynthesis due to no CO_2, (2) reduced ascent of sap due to less transpiration pull, (3) reduced mineral supply due to slower xylem flow.
- Avoid writing in bullet points for a "explain" question — a short connected paragraph scores better.
- Key terms to use: **transpiration pull**, **xylem**, **minerals dissolved in water** — these are textbook terms examiners look for.

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