CBSE CLASS X

Science (086)

ANSWER KEY

AI-generated question paper

Code: SK2J4H	Questions: 31	Maximum Marks: 90	Generated: 2026-06-25 17:26

SELECTIONS USED

Subject	Science
Lessons	13 Our Environment
Level of understanding	Thorough understanding
Question selection	Curated chapter coverage (~5 questions per section + 8 synthesis)
Model	claude-sonnet-4-6

Composition — Difficulty: 18 medium · 13 deep | Types: 25 Short · 3 MCQ · 3 Long

Q1. medium | thorough-understanding | § Introduction **[3]**

A garden and a forest both contain living organisms interacting with their physical surroundings, yet one is considered a natural ecosystem and the other an artificial one. Identify the fundamental criterion that distinguishes a natural ecosystem from an artificial one. In what way does the role of abiotic components differ, if at all, between the two types of ecosystems?

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Model Answer

Fundamental Criterion: A natural ecosystem (e.g., forest, pond) is formed and sustained without human intervention, while an artificial ecosystem (e.g., garden, crop-field) is created and maintained by human beings.

Role of Abiotic Components: In both types of ecosystems, abiotic components — such as temperature, rainfall, wind, soil, and minerals — play the same fundamental role. They interact with the living organisms and affect their growth, reproduction, and other activities. There is no difference in the *role* of abiotic components; the only distinction lies in whether the overall system is set up naturally or by humans.

Source: Chapter 13, Section 13.1 — Eco-system: What Are Its Components?

Explanation

- Examiners expect you to clearly state the **criterion** (human intervention / human-made vs. naturally occurring) — this is the key 1-mark point.
- The second part must address whether abiotic components *differ in role* — the answer is they do **not**; both types have the same abiotic factors performing the same functions. Saying "there is no difference in role" scores the mark; avoid vague statements.
- Avoid over-writing — the passage itself directly states gardens and crop-fields are artificial while forests and ponds are natural, and that abiotic components affect biotic components in all ecosystems equally.

Q2. medium | thorough-understanding | § 13.1 ECO-SYSTEM — WHAT ARE ITS COMPONENTS? **[3]**

A garden and a forest both contain living organisms interacting with physical factors. What makes one a natural ecosystem and the other an artificial ecosystem? What does this distinction tell us about the role of human beings in shaping ecosystems?

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Model Answer

A **natural ecosystem** like a forest develops on its own without human interference, where all biotic and abiotic components interact and self-sustain naturally. An **artificial ecosystem** like a garden is created and maintained by human beings, who select, arrange, and manage its living and non-living components.

This distinction shows that human beings actively shape ecosystems — choosing which organisms grow, controlling abiotic factors, and intervening regularly to maintain balance. Unlike natural ecosystems that are self-sustaining, artificial ones depend on continuous human effort, revealing how significantly humans can alter and control nature's processes.

Source: Chapter 13, Section 13.1

Explanation

- The key differentiator examiners look for is **human intervention** — state it clearly for both types.
- Mention **self-sustaining** for natural and **human-maintained** for artificial; these are the textbook terms.
- The third part of the question (role of humans) must be answered — students often skip it. Link it to the idea that humans **create, modify, and maintain** artificial ecosystems.
- Avoid listing examples alone; explain the *why* behind the distinction.

Q3. medium | thorough-understanding | § 13.1 ECO-SYSTEM — WHAT ARE ITS COMPONENTS? **[1]**

Which of the following best explains why decomposers are essential for the continuity of any ecosystem?
(A) They produce food from inorganic substances using sunlight.
(B) They return complex organic compounds back to simple inorganic substances that producers can reuse.
(C) They transfer energy from one consumer to the next without any loss.
(D) They regulate the population of herbivores by feeding on them.

A They produce food from inorganic substances using sunlight.
B They return complex organic compounds back to simple inorganic substances that producers can reuse.
C They transfer energy from one consumer to the next without any loss.
D They regulate the population of herbivores by feeding on them.

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Model Answer

(B) They return complex organic compounds back to simple inorganic substances that producers can reuse.

Explanation

Decomposers (like bacteria and fungi) break down dead organic matter into simple inorganic nutrients, which are then absorbed by producers (plants) to restart the cycle. Without them, nutrients would remain locked in dead matter and the ecosystem would collapse. Option A describes producers, C is incorrect (energy is always lost), and D describes predators.

Q4. medium | thorough-understanding | § 13.1 ECO-SYSTEM — WHAT ARE ITS COMPONENTS? **[3]**

Only about 10% of the energy available at one trophic level is passed on to the next. Where does the remaining ~90% go, and why does this make a food chain with six or seven trophic levels practically impossible?

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Model Answer

About 90% of the energy at each trophic level is lost to the environment as **heat** during metabolic processes such as digestion, respiration, and doing work, and some is used for the organism's own growth and reproduction. Only 10% is stored in body tissues and passed to the next level.

This makes a six- or seven-level food chain practically impossible because the energy diminishes drastically at each step. By the fourth trophic level, so little usable energy remains that it cannot support organisms at a fifth or sixth level. Hence, food chains are generally limited to **three or four trophic levels**.

Source: Chapter 13, Section 13.1.1 – Food Chains and Webs

Explanation

What examiners look for (3 marks):

- **1 mark** – State where the 90% goes: lost as heat to the environment through metabolic activities (digestion, respiration, work).
- **1 mark** – Explain the consequence: energy keeps diminishing at each successive level.
- **1 mark** – Conclude: after 3–4 trophic levels, usable energy is negligible, so a 6–7 level chain is impossible.

Key tip: Always use the textbook phrase "lost as heat to the environment" — avoid vague terms like "wasted." The 10% law is the core concept here; state it clearly before explaining its consequence on food chain length.

Q5. deep thorough-understanding § 13.1 ECO-SYSTEM — WHAT ARE ITS COMPONENTS? **[3]**

A farmer uses pesticides on crops over many years. A hawk that hunts small mammals in those fields is found to have pesticide concentrations thousands of times higher than the soil. Explain, step by step, the process responsible for this, and predict whether a human who regularly eats those hawks would have even higher concentrations.

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Model Answer

Biological Magnification:

Pesticides sprayed on crops are absorbed by plants (1st trophic level). Small mammals eat large amounts of these plants, so pesticides accumulate in their bodies (2nd trophic level). The hawk eats many such mammals, concentrating the chemical further (3rd trophic level). Since pesticides are **non-biodegradable**, they are not broken down and keep accumulating — a process called **biological magnification**.

A human regularly eating those hawks (4th/higher trophic level) would have **even higher** pesticide concentrations, because humans occupy the top trophic level where maximum accumulation occurs.

Source: Chapter 13, Section 13.1.1 (Biological Magnification)

Explanation

- Examiners expect the term **biological magnification** to be used and defined/implied.
- Key idea: non-biodegradable chemicals **increase in concentration** at each successive trophic level.
- The three steps to mention: absorption by plants → accumulation in herbivores/small animals → further concentration in carnivores.
- For the prediction part, simply state **yes, higher concentration**, because humans are at the top trophic level — this fetches the final mark.
- Don't write a long essay; the 3-mark limit means roughly 3 clear points.

Q6. deep | thorough-understanding | § 13.1 ECO-SYSTEM — WHAT ARE ITS COMPONENTS? **[3]**

In a pond ecosystem, if all the decomposers were suddenly removed, the producers and consumers might initially appear unaffected. Explain why the ecosystem would eventually collapse, referring to the role decomposers play in the cycling of matter.

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Model Answer

Decomposers break down dead organic matter into simple inorganic substances (like minerals and nutrients) that are returned to the soil and used again by producers (plants).

Without decomposers, dead organisms and waste would accumulate and nutrients would **not** be recycled back into the soil. Producers would gradually exhaust the available inorganic nutrients and fail to grow. Since producers support all consumers, the entire food chain would collapse — leading to the breakdown of the ecosystem.

Source: Our Environment, Chapter 13, Section 13.1

Explanation

- The key idea examiners want: **nutrient/matter cycling**, not energy flow.
- Three points worth 1 mark each: (1) decomposers recycle nutrients from dead matter → (2) without them, nutrients get locked in dead biomass and soil is depleted → (3) producers fail → entire food chain collapses.
- Avoid confusing energy flow (unidirectional, not recycled) with matter/nutrient cycling (recycled by decomposers). This question is specifically about **cycling of matter**.
- The phrase "initially appear unaffected" is addressed by noting nutrients already in soil last a while, but eventually run out — you don't need to over-explain this.

Q7. medium | thorough-understanding | § 13.1 ECO-SYSTEM — WHAT ARE ITS COMPONENTS? **[2]**

A field ecologist studying a grassland notices that when a population of rabbits crashes due to disease, foxes switch to eating voles and birds instead of starving. Could this adaptive behaviour be explained using a single food chain? Justify your answer by explaining how a food web more accurately represents real feeding relationships in an ecosystem.

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Model Answer

No, this adaptive behaviour cannot be explained using a single food chain. A food chain shows a fixed, linear sequence (e.g., grass → rabbit → fox), with no alternative links. A food web, however, shows that "each organism is generally eaten by two or more other kinds of organisms," forming branching relationships. This allows foxes to switch prey (voles, birds) when rabbits decline, which is only visible in a food web.

Explanation

The key contrast examiners want is **linear (food chain) vs. branching (food web)**. Use the textbook's own language: "series of branching lines." The scenario tests whether you understand that a food web captures real flexibility in feeding — organisms have multiple prey/predator options. Mention the definition of food chain (fixed trophic levels) and why it fails here (no alternate prey shown). Keep it concise.

Q8. medium | thorough-understanding | § 13.1.1 Food Chains and Webs **[2]**

Only about 10% of the energy at one trophic level is available to the next level. Where does the remaining 90% go?

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Model Answer

The remaining 90% of energy is lost at each trophic level in the following ways:

- A large amount is lost as **heat** to the environment.
- Some energy is used in **digestion** and carrying out life processes (doing work).
- The rest is used for **growth and reproduction** of the organism.

Only 10% of the food eaten is converted into the organism's own body mass and made available to the next trophic level.

Source: Chapter 13, Section 13.1.1 — Food Chains and Webs

Explanation

Examiners expect three distinct fates of the lost energy: heat loss, energy used in digestion/body functions, and energy used for growth/reproduction. Mentioning all three earns full marks. Simply saying "it is lost as heat" is incomplete and will likely cost you a mark. The 10% law is the key concept being tested here.

Q9. medium | thorough-understanding | § 13.1.1 Food Chains and Webs **[3]**

A food chain in a grassland ecosystem is: Grass → Grasshopper → Frog → Snake → Hawk. If the grass captures 10,000 J of energy from sunlight, how much energy (in joules) is available to the snake? Show your reasoning.

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Model Answer

Food chain: Grass (T1) → Grasshopper (T2) → Frog (T3) → Snake (T4) → Hawk (T5)

10% Law: Only 10% of energy passes from one trophic level to the next.

Calculation:

- Grass (T1): 10,000 J
- Grasshopper (T2): 10% of 10,000 = **1,000 J**
- Frog (T3): 10% of 1,000 = **100 J**
- Snake (T4): 10% of 100 = **10 J**

Energy available to the snake = 10 J

Source: Chapter 13, Food Chains and Webs (Section 13.1.1)

Explanation

- The **10% law** states that only 10% of energy at one trophic level is transferred to the next; the rest is lost as heat, digestion, etc.
- Snake is at the **4th trophic level**, so apply the 10% rule three times: 10,000 → 1,000 → 100 → 10 J.
- Examiners expect you to show each step clearly — don't just state the final answer.
- A common mistake is starting the calculation from the wrong organism; always identify trophic levels first.

Q10. medium | thorough-understanding | § 13.1.1 Food Chains and Webs **[1]**

Food chains rarely extend beyond four trophic levels. Which of the following best explains this?
(A) Producers can only support four types of consumers.
(B) Energy loss at each level means very little usable energy remains after four levels.
(C) Decomposers break down the food chain after the fourth level.
(D) Carnivores at the fourth level have no natural predators.

A Producers can only support four types of consumers.
B Energy loss at each level means very little usable energy remains after four levels.
C Decomposers break down the food chain after the fourth level.
D Carnivores at the fourth level have no natural predators.

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Model Answer

(B) Energy loss at each level means very little usable energy remains after four levels.

Only 10% of energy transfers to the next trophic level; after four levels, usable energy becomes too little to sustain another level.

Source: Chapter 13, Section 13.1.1 Food Chains and Webs

Explanation

The textbook explicitly states: *"The loss of energy at each step is so great that very little usable energy remains after four trophic levels."* The 10% law is the key concept here. Options A, C, and D are incorrect — the textbook never mentions producers limiting consumer *types*, decomposers stopping chains, or predator absence as the reason. Always link this answer to the **10% energy transfer rule**.

Q11. medium | thorough-understanding | § 13.1.1 Food Chains and Webs **[3]**

Explain the process of biological magnification. A non-degradable pesticide was detected at a concentration of 0.1 ppm in the water of a pond. Arrange the following organisms in the order of increasing pesticide concentration in their bodies, and justify your answer: large fish, water plants, small fish, fish-eating birds.

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Model Answer

Biological Magnification: The accumulation of non-degradable chemicals (like pesticides) at each successive trophic level in a food chain is called biological magnification. Since these chemicals cannot be broken down, their concentration increases as we move up the food chain.

Order of increasing pesticide concentration:
Water plants → Small fish → Large fish → Fish-eating birds

Justification: Water plants absorb the pesticide (0.1 ppm) from water. Small fish eat many plants, accumulating higher concentrations. Large fish eat many small fish, concentrating it further. Fish-eating birds are at the highest trophic level and thus have the maximum pesticide concentration.

Source: Chapter 13, Our Environment

Explanation

- Examiners expect: (1) a one-line definition of biological magnification, (2) the correct sequence, and (3) a brief justification linked to trophic levels.
- The key phrase is **non-degradable** — these substances are not broken down, so they keep accumulating.
- The sequence must go from **producers → primary consumers → secondary consumers → tertiary consumers**, as concentration increases with each level.
- Don't just state the order — always link it to "each organism consumes many of the organisms below it," which is what drives magnification.

Q12. deep | thorough-understanding | § 13.1.1 Food Chains and Webs **[3]**

Energy flow through a food chain is described as unidirectional. What does this mean, and how is it different from the way matter (like minerals) moves through an ecosystem?

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Model Answer

Unidirectional flow of energy means that energy moves in one direction only — from the Sun to producers, then to herbivores, then to carnivores — and cannot return to a previous trophic level. The energy captured by autotrophs does not revert to solar input, and energy passed to herbivores does not come back to autotrophs. At each level, energy is lost as heat and cannot be reused.

Difference from matter: Minerals and other matter are recycled in an ecosystem. Decomposers break down dead organisms into simple inorganic substances that go back into the soil and are reused by plants. Thus, matter moves in a **cycle**, while energy flows in a single direction and is progressively lost.

Source: Chapter 13, Section 13.1.1 — Food Chains and Webs; Section 13.1 — Ecosystem Components

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Explanation

- The key contrast examiners look for is **unidirectional (one-way, non-recyclable) energy** vs **cyclic (recyclable) matter/minerals**.
- Mention that energy is *lost as heat* at each trophic level — this is why it cannot be returned.
- Decomposers are the link that explains why matter *can* be cycled but energy cannot.
- Avoid writing "energy is recycled" — that is a common error that costs marks.

Q13. deep thorough-understanding § 13.1.1 Food Chains and Webs **[3]**

A farmer sprays a non-degradable pesticide on a paddy field adjacent to a pond. Trace the pathway by which this pesticide could reach humans living in the nearby village. What is this phenomenon called, and why are humans more affected than the paddy plants?

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Model Answer

Pathway: The pesticide sprayed on the paddy field is washed into the pond. Microscopic organisms (phytoplankton/zooplankton) absorb it → small fish eat these organisms → large fish eat small fish → humans in the village eat the fish, thus consuming the pesticide.

Phenomenon: This is called **biological magnification** (biomagnification) — the progressive increase in concentration of non-degradable substances at each successive trophic level.

Why humans are more affected: Paddy plants are at the first trophic level, so they accumulate the least amount of pesticide. Humans are at the highest trophic level; the pesticide concentration multiplies at each level, so humans receive the maximum accumulated dose.

Explanation

- Examiners expect you to clearly **trace the food chain** (water → plankton → small fish → large fish → human).
- Name the phenomenon correctly: **biological magnification**.
- The key contrast is **trophic level position**: plants (T1) accumulate least; humans (T5) accumulate most. This directly answers "why humans more affected."
- This concept is from Ch. 15 (Our Environment) — Exercise Q6 asks exactly this.

Q14. deep | thorough-understanding | § 13.1.1 Food Chains and Webs **[5]**

Green plants in a terrestrial ecosystem capture only about 1% of the sunlight that falls on their leaves. Considering this, and the 10% energy transfer rule between trophic levels, explain why a large land area is needed to sustainably support a population of top-level carnivores compared to a population of herbivores of the same body mass.

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Model Answer

Green plants capture only **1% of sunlight** that falls on their leaves, converting it into food energy. When this energy passes from one trophic level to the next, only **10% is transferred**; the rest is lost as heat, digestion, and respiration.

Consider a simplified food chain:
Plants → Herbivores → Carnivores (top-level)

- If plants capture 1000 J, herbivores receive **100 J** (10% of 1000 J).
- Top-level carnivores receive only **10 J** (10% of 100 J).

So a herbivore population receives **10 times more energy** than a carnivore population from the same plant base. To sustain a population of top-level carnivores of the same body mass as herbivores, a **much larger land area** is needed to grow enough plants to support the additional trophic levels through which energy is progressively lost.

Source: Chapter 13, Section 13.1.1 — Food Chains and Webs

Explanation

- Examiners expect you to use **both facts**: 1% solar capture by plants AND 10% energy transfer rule.
- Show the **numerical logic** (even roughly) — it makes the answer concrete and earns marks.
- Key phrase to use: *"energy is lost as heat at each trophic level."*
- The conclusion must clearly state that carnivores are further from the energy source, so more producers (= more land) are needed to sustain them.
- Do not just describe food chains generally — the question asks you to **explain why**, so you must link the energy losses to the land-area requirement explicitly.

Q15. medium | thorough-understanding | § 13.2 HOW DO OUR ACTIVITIES AFFECT THE ENVIRONMENT? **[3]**

A farmer sprays pesticides on crops near a pond. Trace the path by which these pesticides could reach a human being who lives far from the farm, and explain why the concentration of pesticides in the human body would be far greater than in the pond water or soil where the chemicals were originally found.

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Model Answer

Pesticides sprayed on crops seep into the soil and wash into the nearby pond. Microscopic organisms (phytoplankton/algae) in the pond absorb these pesticides. Small fish eat these organisms, larger fish eat the small fish, and the larger fish may be transported and consumed by humans far away.

Because pesticides are non-biodegradable, they are **not broken down** at each trophic level but instead accumulate in the body tissues. As each organism at a higher trophic level consumes many organisms from the level below, the pesticide concentration **keeps increasing**. This process is called **biological magnification**, which is why the concentration in the human body is far greater than in the pond water or soil.

Source: Chapter 13, Our Environment

Explanation

- **Key concept to name:** Biological magnification (also called biomagnification) — examiners expect this term.
- **Two parts to answer:** (1) the pathway through the food chain, and (2) *why* concentration increases (non-biodegradable + accumulates up trophic levels).
- A simple food chain — pond water/soil → producers/plankton → small fish → large fish → human — earns the pathway marks.
- The reason for higher concentration is that each organism eats *many* of the level below, so the chemical concentrates at each step; this must be stated explicitly.

Q16. medium | thorough-understanding | § 13.2.1 Ozone Layer and How it is Getting Depleted **[3]**

Trace the step-by-step process by which UV radiation from the Sun leads to the formation of ozone in the upper atmosphere. How does the same UV radiation that is responsible for creating ozone also justify the need for an ozone layer? What would happen to life on Earth if this layer were to be significantly depleted?

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Model Answer

Formation of Ozone:
UV radiation from the Sun strikes oxygen molecules (O_2) in the upper atmosphere, splitting them into free oxygen atoms (O). These free atoms then combine with other O_2 molecules to form ozone (O_3):

$$O_2 \xrightarrow{\text{UV}} O + O$$

$$O + O_2 \rightarrow O_3$$

Need for Ozone Layer:
The same UV radiation that creates ozone is highly damaging to living organisms — it causes skin cancer in humans. Therefore, the ozone layer is essential as it shields Earth's surface from this harmful UV radiation.

Effect of Depletion:
If the ozone layer were significantly depleted, more UV radiation would reach Earth, causing increased skin cancer, genetic damage to organisms, and serious harm to ecosystems.

Source: Chapter 13, Section 13.2.1 — Ozone Layer and How it is Getting Depleted

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Explanation

- **3-mark structure:** Examiners expect three clear points — (1) the chemical process of ozone formation with equations, (2) why UV itself justifies the need for the layer, and (3) consequences of depletion.
- Always write the **two-step reaction** — splitting of O_2 and then combination to form O_3 — as it is directly from the textbook.
- The key logical link examiners look for: UV creates ozone **and** UV is harmful → ozone layer blocks UV → life is protected. This "same radiation" connection is the heart of the question.
- Avoid writing irrelevant points about CFCs here; the question is specifically about UV and ozone formation/need.

Q17. deep | thorough-understanding | § 13.2.1 Ozone Layer and How it is Getting Depleted **[3]**

CFCs were widely praised as safe, useful chemicals when they were first introduced. In light of what we now know about their effect on the atmosphere, explain why a chemical being non-reactive and non-toxic at ground level is not sufficient proof that it is environmentally safe.

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Model Answer

A chemical being non-reactive and non-toxic at ground level does not guarantee environmental safety because its behaviour can change drastically at higher levels of the atmosphere.

CFCs are stable and harmless near the ground, but when they rise to the upper atmosphere, UV radiation breaks them down, releasing chlorine atoms that deplete the ozone layer. The ozone layer shields Earth from harmful UV radiation, which causes skin cancer and damages organisms.

Therefore, a chemical must be evaluated for its effects throughout the entire atmosphere and ecosystem, not just at ground level.

Source: Chapter 13, Section 13.2.1 — Ozone Layer and How it is Getting Depleted

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Explanation

- The examiner wants you to connect **ground-level stability of CFCs → upper atmosphere behaviour → ozone depletion → UV damage**. These are the three logical steps worth the 3 marks.
- Mention the specific harm (UV radiation, skin cancer) to show you understand *why* ozone depletion matters.
- Don't just say "CFCs are bad" — explain the *mechanism*: UV breaks CFCs apart at higher altitude, and they then destroy ozone.
- The UNEP/1987 agreement is useful background but not required for this specific question.

Q18. medium | thorough-understanding | § 13.2.2 Managing the Garbage we Produce **[3]**

Why can bacteria and fungi not break down plastics in the environment, even though they can break down food and other organic matter?

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Model Answer

Bacteria and fungi break down organic matter like food using specific **enzymes**. However, enzymes are highly specific in their action — a particular enzyme can break down only a particular substance.

Plastics are **human-made (synthetic) materials** whose chemical structure is not found in nature. Therefore, bacteria and fungi do not possess the specific enzymes needed to break down plastics. As a result, plastics are **non-biodegradable** and persist in the environment for a very long time. They can only be broken down by physical processes like heat and pressure, not by biological processes.

Source: Our Environment, Chapter 13, Section 13.2.2 — Managing the Garbage we Produce

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Explanation

The key concept here is **enzyme specificity**. The textbook explicitly states: *"Enzymes are specific in their action; specific enzymes are needed for the break-down of a particular substance."* Since plastics are synthetic, no natural biological enzyme exists to decompose them. Examiners expect students to clearly link enzyme specificity → absence of suitable enzymes → plastics being non-biodegradable. Avoid vague answers like "bacteria can't eat plastic" — use correct terminology: enzymes, specific, non-biodegradable.

Q19. medium | thorough-understanding | § 13.2.2 Managing the Garbage we Produce **[3]**

A student buries two pits in the school garden — one with vegetable peels and spoilt food, and another with plastic wrappers and empty medicine strips. After several months, which pit would show greater decomposition, and why?

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Model Answer

The pit containing **vegetable peels and spoilt food** would show greater decomposition.

Reason: Vegetable peels and spoilt food are **biodegradable** substances. Bacteria, fungi, and other saprophytes (decomposers) produce enzymes that break these organic materials down into simpler substances over time.

Plastic wrappers and medicine strips are **non-biodegradable**. Specific enzymes needed to break down plastics are absent in microorganisms, so these materials are not acted upon by biological processes and persist in the environment unchanged for a long time.

Source: Our Environment, Section 13.2.2

Explanation

- The examiner expects you to name the correct pit **and** give a biological reason — both are needed for full marks.
- Key terms to use: *biodegradable*, *non-biodegradable*, *decomposers/saprophytes*, *enzymes* (enzyme specificity is the core concept from the passage).
- Avoid just saying "plastic doesn't decompose" — explain *why* (no specific enzymes in microbes to act on it).
- One mark each for: identifying correct pit, explaining biodegradable decomposition, explaining why plastic does not decompose.

Q20. medium | thorough-understanding | § 13.2.2 Managing the Garbage we Produce **[1]**

Which of the following best explains why improvements in lifestyle and changes in packaging together pose a greater environmental challenge than either factor alone?

(A) Lifestyle improvements generate more biodegradable waste, while packaging changes reduce total waste volume.

(B) Lifestyle improvements increase the total quantity of waste, and packaging changes make a larger proportion of that waste non-biodegradable.

(C) Packaging changes reduce waste generation, but lifestyle improvements increase the use of decomposers.

(D) Both factors together cause depletion of the ozone layer through increased CFC emissions.

A Lifestyle improvements generate more biodegradable waste, while packaging changes reduce total waste volume.

B Lifestyle improvements increase the total quantity of waste, and packaging changes make a larger proportion of that waste non-biodegradable.

C Packaging changes reduce waste generation, but lifestyle improvements increase the use of decomposers.

D Both factors together cause depletion of the ozone layer through increased CFC emissions.

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Model Answer

(B) Lifestyle improvements increase the total quantity of waste, and packaging changes make a larger proportion of that waste non-biodegradable.

Explanation

The passage directly states: *"Improvements in our life-style have resulted in greater amounts of waste material generation... Changes in packaging have resulted in much of our waste becoming non-biodegradable."* Option B combines both effects accurately. Options A, C, and D contradict or misrepresent the passage.

Q21. medium | thorough-understanding | § 13.2.2 Managing the Garbage we Produce **[3]**

Distinguish between biodegradable and non-biodegradable substances with one example each. Describe one specific way in which accumulation of non-biodegradable substances disrupts the balance of an ecosystem.

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Model Answer

Biodegradable substances are broken down by biological processes (microorganisms). *Example:* vegetable peels.

Non-biodegradable substances cannot be broken down by biological processes and persist in the environment for a long time. *Example:* plastic.

Disruption of ecosystem — Biological Magnification: Non-biodegradable chemicals (e.g., pesticides) enter the food chain and accumulate at each trophic level. Their concentration increases progressively, becoming highest in top consumers (e.g., humans), causing serious health damage and disrupting the ecological balance.

Source: Chapter 13, Section 13.2.2

Explanation

- The question has **3 marks**: 1 mark each for defining biodegradable (with example), non-biodegradable (with example), and describing the ecosystem disruption.
- **Biological magnification** is the key concept examiners expect for "disruption by non-biodegradable substances" — always name it and briefly explain the increasing concentration across trophic levels.
- Don't just say "it harms animals"; specify *how* (concentration increases up the food chain → highest in top consumers).
- Keep examples simple and textbook-aligned: vegetable peels / fruit peels for biodegradable; plastic / DDT for non-biodegradable.

Q22. deep | thorough-understanding | § 13.2.2 Managing the Garbage we Produce **[3]**

A town switches entirely to biodegradable packaging and stops using plastics. A student argues that this means the town's waste will have no negative impact on the environment at all. Is this argument valid? Justify your answer.

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Model Answer

No, the argument is **not valid**.

Even though biodegradable waste does not persist like plastic, its disposal still causes serious environmental problems. When biodegradable waste decomposes in large quantities, it can:

1. **Pollute soil and water** — excess decomposition releases harmful gases and leachates that contaminate groundwater.
2. **Disturb the ecosystem** — large amounts of organic waste upset the natural balance of nutrients and can lead to problems like eutrophication in water bodies.
3. **Generate greenhouse gases** — decomposing waste produces methane, contributing to climate change.

Therefore, the **disposal of waste — whether biodegradable or not — has an impact on the environment**. Switching to biodegradable packaging reduces some problems but does not eliminate environmental harm.

Source: Our Environment, Chapter 13 — 13.2.2 Managing the Garbage we Produce

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Explanation

The examiner expects students to directly reject the argument and give **two or more valid reasons** why biodegradable waste still affects the environment. The key phrase from the textbook is: *"The disposal of the waste we generate is causing serious environmental problems"* — this applies to **all** waste, not just non-biodegradable. Avoid writing only about non-biodegradable waste; focus on biodegradable waste's own negative impacts. This aligns with Exercise Q8: *"If all the waste we generate is biodegradable, will this have no impact on the environment?"*

Q23. deep | thorough-understanding | § 13.2.2 Managing the Garbage we Produce **[3]**

The introduction of disposable plastic cups in trains was initially welcomed for hygiene reasons, yet it created a serious environmental problem. Explain why, and state what principle this illustrates about assessing the long-term impact of new materials or technologies before adopting them widely.

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Model Answer

Disposable plastic cups were welcomed in trains because each passenger got a fresh, hygienic cup. However, plastic is **non-biodegradable** — it cannot be broken down by bacteria or other biological processes and persists in the environment for a very long time. Millions of cups discarded daily led to massive accumulation of plastic waste, harming the ecosystem.

This illustrates the principle that **new materials or technologies must be assessed for their long-term environmental impact before being adopted widely**, not just for their immediate benefits.

Source: Chapter 13, Section 13.2.2 — Managing the Garbage we Produce

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Explanation

- Examiners expect two clear parts: (1) **why** plastic cups became a problem (non-biodegradable nature) and (2) **the principle** illustrated.
- Use the term "non-biodegradable" — it is the key vocabulary from this section.
- The textbook's "Think it over" box on disposable cups is the direct source; quote its idea that "no one thought about the impact of disposing millions of cups daily."
- Don't go beyond ~80 words; this is a 3-mark answer. Two focused points + the principle = full marks.

Q24. deep | thorough-understanding | § 13.2.2 Managing the Garbage we Produce **[2]**

A non-biodegradable substance is sometimes described as 'environmentally inert.' Under what conditions might this be partially true? Even if a substance does not react chemically in the environment, explain one way it can still cause harm to living organisms or ecosystems.

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Model Answer

A non-biodegradable substance may be considered "environmentally inert" if it does not chemically react or decompose under natural conditions — meaning it simply persists without direct chemical toxicity.

However, it can still cause harm through **biological magnification**: as it passes up the food chain from one trophic level to the next, its concentration increases in organisms' bodies, reaching harmful or even lethal levels in top consumers.

Explanation

The textbook (ch. 13) explicitly states that non-biodegradable substances "may be inert and simply persist in the environment for a long time **or** may harm the various members of the ecosystem." Examiners expect: (1) a valid condition for 'inert' being partially true, and (2) one specific harm mechanism — biological magnification is the best textbook example here. Avoid vague answers like "it pollutes."

Q25. medium | thorough-understanding | § 13.2.2 Managing the Garbage we Produce **[3]**

What is the role of decomposers in managing natural waste, and why does their absence create a problem that human waste-disposal systems must compensate for?

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Model Answer

Decomposers (bacteria, fungi) break down dead organic matter and waste into simpler substances, returning nutrients to the soil. In nature, they recycle all biodegradable waste automatically, preventing its accumulation.

The problem arises because many human-made materials — plastics, synthetic chemicals — are **non-biodegradable**. Decomposers cannot act on them since specific enzymes needed to break these substances down are absent in microorganisms. These materials persist in the environment for very long periods and may harm ecosystem members.

Therefore, human waste-disposal systems (recycling, landfills, sewage treatment) must intervene to manage what decomposers cannot, compensating for this biological limitation.

Source: Chapter 13, Section 13.2.2 — Managing the Garbage we Produce

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Explanation

- The question has two linked parts: (1) what decomposers do, and (2) why human systems must compensate. Address both clearly.
- Key concept: biodegradable waste is handled by decomposers naturally; non-biodegradable waste is not, because the right enzymes don't exist in bacteria/saprophytes.
- Examiners expect the terms **biodegradable**, **non-biodegradable**, and the enzyme-specificity logic from the chapter.
- Don't over-explain decomposers from outside the textbook — stay grounded in the passage.

Q26. deep | thorough-understanding | § (whole-chapter synthesis) **[5]**

Trace the journey of a pesticide molecule from a farmer's field all the way to a human body, explaining the role of each trophic level and the ecosystem process that makes the final concentration in humans the highest.

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Model Answer

Journey of a Pesticide Molecule — Biological Magnification

A farmer sprays pesticides on crops to protect them from pests. These chemicals are washed into the soil and water bodies by rain.

- **1st Trophic Level (Producers):** Plants absorb the pesticide along with water and minerals. A small concentration accumulates in plant tissues.
- **2nd Trophic Level (Primary Consumers/Herbivores):** Animals like insects or cattle eat large quantities of plants. Since the pesticide is **non-biodegradable**, it is not broken down and accumulates in their bodies at a higher concentration.
- **3rd Trophic Level (Secondary Consumers):** Small carnivores eat many herbivores, concentrating the pesticide further.
- **4th Trophic Level (Humans/Tertiary Consumers):** Humans, being at the **top of the food chain**, consume organisms from all lower levels. The pesticide accumulates to its **maximum concentration** in the human body.

This progressive increase in concentration of non-biodegradable chemicals at each successive trophic level is called **biological magnification**.

Source: Chapter 13, Section 13.1.1 — Food Chains and Webs

Explanation

- The key concept examiners look for is **biological magnification** — name it and define it.
- Explain **why** concentration increases: the chemical is **non-biodegradable** (does not break down) and accumulates because organisms consume large amounts from the level below.
- Mention all 4 trophic levels and link each to the food chain: producers → herbivores → small carnivores → humans.
- The phrase "humans occupy the top trophic level" is directly from the textbook — use it.
- Do not confuse biological magnification with energy loss (10% rule); these are opposite concepts — energy *decreases*, pollutant concentration *increases* up the food chain.

Q27. deep | thorough-understanding | § (whole-chapter synthesis) **[3]**

The energy available at each trophic level decreases, yet harmful chemicals like pesticides increase in concentration at each trophic level. Explain why these two phenomena — energy loss and chemical accumulation — behave oppositely as you move up a food chain.

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Model Answer

Energy Loss: At each trophic level, only about **10%** of the energy is transferred to the next level. The remaining 90% is lost as heat, used in digestion, and for daily activities. Since energy is non-recyclable and continuously lost, it diminishes as we move up the food chain.

Chemical Accumulation (Biological Magnification): Pesticides and harmful chemicals are **non-biodegradable**. They are absorbed by producers and, since they cannot be broken down, they accumulate in the body of each consumer. As one organism at a higher level eats many organisms from the lower level, the concentration of chemicals **increases** progressively. This is called **biological magnification**, with maximum concentration at the top trophic level.

Source: Chapter 13, Section 13.1.1 – Food Chains and Webs

Explanation

- The examiner expects you to contrast the **10% energy rule** (energy loss) with the concept of **non-biodegradability** (chemical build-up). These are the two key reasons for opposite behaviour.
- Always use the term **biological magnification** — it is a defined term in the chapter and earns a dedicated mark.
- A common mistake is saying chemicals "increase" without explaining *why* — the reason is they are **non-degradable** and accumulate across multiple organisms consumed at each level.

Q28. medium | thorough-understanding | § (whole-chapter synthesis) **[3]**

Green plants capture only about 1% of the sunlight falling on them, and only about 10% of energy at any trophic level is transferred to the next. Using both these facts, explain why a given area of wheat fields can support a larger human population when humans eat the wheat directly than when the same wheat is first consumed by deer that are then hunted for human food.

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Model Answer

Green plants convert only 1% of sunlight into food energy. When humans eat wheat directly, they are at the **second trophic level** (producers → humans), and receive 10% of that stored energy.

When wheat is first eaten by deer, deer retain only 10% of the wheat's energy. Humans eating deer then receive only 10% of that — i.e., just **1% of the original plant energy**.

Thus, direct consumption of wheat provides **10 times more energy** per unit area than eating deer fed on wheat. The same wheat field can therefore sustain a far larger human population when wheat is eaten directly.

Source: Chapter 13, Section 13.1.1 — Food Chains and Webs

Explanation

- The key idea is **two successive 10% transfers** vs **one 10% transfer**: wheat→deer→human gives 10% × 10% = 1% of plant energy to humans; wheat→human gives 10%.
- Examiners expect you to explicitly name the trophic levels involved and calculate/compare the energy available at each path.
- Mention both given facts (1% sunlight capture and 10% transfer rule) — they are separately stated in the question, so use both.
- You don't need long paragraphs; a clear comparison with the word "therefore" or "hence" signals a complete logical answer.

Q29. deep | thorough-understanding | § (whole-chapter synthesis) **[3]**

Decomposers play a vital role in sustaining the productivity of green plants in an ecosystem. Separately, the depletion of the ozone layer also threatens life on Earth, including plant life. Explain, for each — decomposers and ozone layer depletion — the specific mechanism by which the absence or reduction of each affects producers (green plants) and, ultimately, all life in the ecosystem.

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Model Answer

Decomposers: Decomposers (bacteria, fungi) break down dead organic matter and return nutrients like nitrogen, phosphorus, and minerals to the soil. Without them, these nutrients would remain locked in dead matter. Green plants would be unable to obtain essential minerals needed for growth and protein synthesis, reducing photosynthesis and productivity. This would reduce food availability for all consumers, eventually collapsing the entire ecosystem.

Ozone Layer Depletion: The ozone layer shields Earth from harmful UV radiation. Its depletion allows excess UV rays to reach the surface, damaging chlorophyll and plant tissues, reducing photosynthesis in producers. Since all consumers depend on producers for energy, reduced plant productivity threatens all life in the ecosystem.

Source: Chapter 13, Section 13.2.1; Chapter 5, Section 5.2.1

Explanation

- Examiners expect **two clearly separated parts** — one for decomposers, one for ozone depletion.
- For decomposers, the key mechanism is **nutrient recycling** → minerals back to soil → absorbed by plants. Without this, plant growth fails.
- For ozone, the key mechanism is **UV radiation damages plants/chlorophyll** → less photosynthesis → less food for all trophic levels.
- Always link back to **producers first**, then the broader ecosystem impact — this shows understanding of interdependence.
- Do not write about CFCs as the answer here; focus on the *effect* of depletion, not its cause.

Q30. deep | thorough-understanding | § (whole-chapter synthesis) **[5]**

Consider a simple food chain: Grass → Grasshopper → Frog → Snake → Hawk.
(i) At which trophic level would biological magnification of a non-biodegradable pesticide be the highest, and why?
(ii) If the frog population is entirely wiped out, predict two consequences for the ecosystem, one for the trophic level below and one for the trophic level above.

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Model Answer

(i) Trophic Level with Highest Biological Magnification:

The **5th trophic level (Hawk)** would have the highest concentration of the non-biodegradable pesticide. Since these chemicals are not broken down, they accumulate progressively at each trophic level. By the time they reach the top consumer (hawk), the concentration is the greatest. This phenomenon is called **biological magnification**.

(ii) Two Consequences if Frog Population is Wiped Out:

- **Effect on trophic level below (Grasshopper):** Without frogs to prey on them, the grasshopper population would **increase enormously**. This would lead to overgrazing of grass, destroying vegetation and destabilising the ecosystem.
- **Effect on trophic level above (Snake):** Snakes would lose their primary food source. The snake population would **decline sharply** due to starvation, which would further affect hawks at the next level.

Source: Chapter 13, Section 13.1.1 – Food Chains and Webs

Explanation

- **Part (i):** Examiners expect you to name the correct trophic level (hawk/5th), state the principle that non-biodegradable chemicals accumulate and are not excreted, and use the term *biological magnification*.
- **Part (ii):** One consequence must address the level *below* (grasshoppers increase → grass depleted) and one must address the level *above* (snakes decline). Both directions must be covered for full marks. Keep each point crisp — one cause-effect sentence each.
- Avoid vague answers like "the ecosystem will be disturbed"; be specific about which population rises or falls and why.

Q31. medium | thorough-understanding | § (whole-chapter synthesis) **[3]**

Modern lifestyle changes and new packaging practices have led to a significant rise in non-biodegradable waste. Explain how this increase in non-biodegradable waste creates TWO distinct environmental problems — one concerning the flow of energy and matter through food chains, and one concerning the long-term management of solid waste in the environment.

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Model Answer

Problem 1 — Biological Magnification (Energy/Matter flow in food chains):
Non-biodegradable substances like pesticides cannot be broken down, so they accumulate in organisms. As these pass from one trophic level to the next, their concentration increases — a process called **biological magnification**. Organisms at higher trophic levels (e.g., humans) accumulate the highest, most harmful concentrations.

Problem 2 — Long-term Solid Waste Accumulation:
Since non-biodegradable wastes (e.g., plastics) are not broken down by bacteria or other biological processes, they persist in the environment for a very long time. This leads to large-scale accumulation of solid waste, making disposal increasingly difficult and causing serious environmental problems.

Source: Chapter 13, Section 13.2.2 — Managing the Garbage we Produce

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Explanation

- The question explicitly asks for **two distinct problems**: one linked to **food chains** (biological magnification is the expected answer) and one about **solid waste management** (persistence of non-biodegradable waste).
- Examiners look for the term **biological magnification** by name for full credit on the first point.
- For the second point, the key idea is that non-biodegradable substances **persist** in the environment because no enzyme/bacterium can break them down — directly from the passage.
- Don't mix up the two points; keep them clearly separated as the question demands "two distinct" problems.

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