

Level - 1

MULTIPLE CHOICE QUESTIONS (MCQs)

(1 Mark)

1. Option (C) is correct.

Explanation:

- (A) is correct because producers (plants) form the first trophic level and absorb approximately 1% of the light energy from the sun.
- (B) is correct as producers use most of the energy they capture for their own processes like respiration, growth, and reproduction.
- (C) is incorrect because producers do not utilise 10% of the light energy and transfer the rest. In fact, they typically use most of the energy for their own needs and only about 10% of the energy is passed on to the next trophic level.
- (D) is correct because only about 10% of the energy captured by producers is transferred to the next trophic level (herbivores).

2. Option (B) is correct.

Explanation: Enrichment of oxygen in the atmosphere is not a role of decomposers. Oxygen is enriched in the atmosphere mainly through photosynthesis by producers (plants), not by decomposers.

3. Option (C) is correct.

Explanation: The food chain in which the organisms of the second trophic level are missing is (C) Tiger, grass, snake, frog. In this chain, grass represents the primary producers (the first trophic level), but there are no herbivores (primary consumers) at the second trophic level that feed on the grass. Instead, the snake and frog are secondary consumers, as they typically feed on smaller animals rather than directly consuming plant material. The tiger is at the top of the food chain, making it a tertiary or apex predator.

4. Option (A) is correct.

Explanation: In a food chain, only about 10% of the energy is transferred from one trophic level to the next, but with each transfer, a significant amount of energy is lost as heat due to various biological processes such as metabolism and movement. A food chain with fewer trophic levels has fewer energy transfers, which minimises the total energy loss. Therefore, a food chain with only two trophic levels (producers and primary consumers) allows for more efficient energy transfer, as it experiences the least energy loss compared to food chains with more trophic levels.

5. Option (B) is correct.

Explanation: The correct statements are (a) and (c). Ozone is indeed a poisonous gas, which makes it harmful to humans and animals. However, it plays a critical protective role in the stratosphere by absorbing harmful UV radiation from the Sun. The formation of ozone occurs when UV radiation splits oxygen molecules (O_2) into individual oxygen atoms, which then combine with other oxygen molecules to form ozone (O_3).

6. Option (B) is correct.

Explanation: Non-biodegradable wastes are the waste that do not decompose naturally and can persist in the environment for a long time. Among the given options, ball point pen refills and empty medicine bottles made of glass are non-biodegradable because they are made of materials like plastic and glass, which do not easily break down.

7. Option (D) is correct.

Explanation: A natural ecosystem refers to an ecosystem that exists naturally without significant human intervention, where organisms interact with each other and their environment in a balanced, self-sustaining way. Among the given options, a cropland ecosystem (D) is a human-made ecosystem, as it is created and maintained for agricultural purposes. Human activities such as planting crops, irrigation, and pest control disrupt the natural balance of the ecosystem, making it different from natural ecosystems.

8. Option (B) is correct.

Explanation: Statement I and Statement IV are correct as every step in a food chain is called a trophic level and linkages between various food chains constitute a food web. On the other hand, Statement II is incorrect because decomposers break down organic matter, not inorganic matter, and Statement III is also incorrect because energy decreases as you move up the trophic level.

9. Option (C) is correct.

Explanation: Biomagnification refers to the process where harmful chemicals, such as pesticides or heavy metals, accumulate in higher concentrations as they move up the food chain, affecting organisms at higher trophic levels.

10. Option (D) is correct.

Explanation: Organisms that consume producers directly, such as plants or grass, are considered the primary consumers in the food chain. Both rabbits and mice feed on plants and seeds, making them primary consumers in this food web.

11. Option (A) is correct.

Explanation: The energy plants receive from the Sun is used for various processes like photosynthesis, growth, respiration, and transport of substances. However, only the energy stored in the plant's biomass through growth (such as in leaves, stems, and fruits) is passed on to the next trophic level when herbivores consume the plant. Respiration and other processes like transport and reproduction use energy but do not store it in a way that can be transferred to the next consumer.

12. Option (B) is correct.

Explanation: The action of sunlight is crucial to the formation of ozone in the Earth's atmosphere. Ozone is formed in the stratosphere when ultraviolet (UV) radiation from the sun interacts with oxygen molecules (O_2), causing them to break apart into individual oxygen atoms (O).

13. Option (C) is correct.

Explanation: If all organisms of one trophic level in a food chain die, the populations of organisms in the lower trophic levels may increase. This is because the absence of predators or consumers at higher trophic levels reduces predation pressure, allowing organisms in the lower levels to thrive and reproduce.

14. Option (D) is correct.

Explanation: Biomagnification refers to the process by which non-degradable chemicals, such as pesticides or heavy metals, accumulate in increasing concentrations at each trophic level in a food chain. These substances are not broken down by organisms and become more concentrated as they move up the food chain, reaching their highest concentration in the bodies of top consumers or apex predators. This can lead to harmful effects on these organisms and the ecosystem.

15. Option (B) is correct.

Explanation: Biological magnification occurs when substances that are non-degradable (P) and are not easily broken down by organisms (R) accumulate in increasing concentrations at higher trophic levels. These substances cannot be excreted efficiently, leading to their buildup in the tissues of organisms.

ASSERTION-REASON QUESTIONS

(1 Mark)

1. Option (D) is correct.

Explanation: If the lions are removed from a food chain it will affect the food chain because being top predators, they play a crucial role in regulating the population of herbivores. If lions are removed, herbivore populations could increase uncontrollably, leading to overgrazing and depletion of plants, which would eventually disrupt the entire ecosystem. However, the reason is true because plants are producers that make food through photosynthesis, while lions are consumers (carnivores) that rely on other animals for food. Thus, assertion is false but reason is true.

2. Option (B) is correct.

Explanation: The assertion is true as the waste we generate daily can be biodegradable and non-biodegradable. Biodegradable waste breaks down naturally, while non-biodegradable waste, such as plastics, persists in the environment. However, improperly managed biodegradable waste can also create unhygienic conditions, attract pests, and contribute to pollution. Therefore, improper disposal of waste can lead to severe environmental issues. Thus, both assertion and reason are true but reason is not the correct explanation of assertion because reason does not directly explain why waste is classified as biodegradable or non-biodegradable.

3. Option (B) is correct.

Explanation: The assertion is true because oxygen is essential for all aerobic forms of life, as it is required for cellular respiration. The reason is also true as ozone

(O_3) is formed when free oxygen atoms react with molecular oxygen in the presence of UV radiation. Both assertion and reason are true but reason does not explain assertion as process of ozone formation is unrelated to the role of oxygen in supporting aerobic life.

4. Option (B) is correct.

Explanation: The assertion is true because the ozone layer protects the Earth's surface by absorbing most of the harmful ultraviolet (UV) radiation from the Sun which can cause serious health issues like skin cancer and cataracts, as well as harm ecosystems. The reason is also true, as chlorofluorocarbons (CFCs) are responsible for the depletion of the ozone layer. When released into the atmosphere, CFCs break down ozone molecules in the stratosphere, leading to thinning of the ozone layer and the formation of the ozone hole. Thus, both assertion and reason are true but reason is not the correct explanation of assertion.

5. Option (B) is correct.

Explanation: The assertion is correct because ozone (O_3) is indeed a molecule formed by three oxygen atoms, created when molecular oxygen (O_2) interacts with ultraviolet light, causing the oxygen molecules to split and recombine as ozone. The reason is also true, as ozone plays a crucial role in protecting the Earth's surface from harmful ultraviolet (UV) radiation from the Sun, which can cause various health problems. However, the reason does not directly explain the structure of ozone. Thus, both assertion and reason

are true but reason is not the correct explanation of assertion.

6. Option (A) is correct.

Explanation: The assertion is correct because the energy passed to herbivores from autotrophs does not return to the autotrophs. This is because the flow of energy in a food chain is unidirectional. This means that in a food chain, once energy is transferred to one trophic level, i.e., from producers (autotrophs) to consumers (herbivores, carnivores, etc.), it moves forward through the chain but does not reverse direction. Thus, both assertion and reason are true and reason is the correct explanation of assertion.

7. Option (C) is correct.

Explanation: The assertion is true because according to the 10% rule in ecological food chains, only about 10% of the energy is transferred from one trophic level to the next. Omnivores, which consume both plants (primary producers) and animals (herbivores or carnivores), receive energy from multiple trophic levels, typically from the level below them. However,

the reason is not true. While omnivores can be secondary consumers (in the third trophic level), their position in the food chain can vary depending on their feeding habits. They do not always occupy a trophic level immediately above herbivores, as they can feed on both primary producers and various levels of consumers. Thus, assertion is true but reason is false.

8. Option (A) is correct.

Explanation: While most organic kitchen waste like vegetable scraps and fruit peels can decompose to form compost, certain materials such as plastic milk packets cannot be broken down by natural biological processes. This is because materials like milk packets are made of non-biodegradable substances such as plastic or laminated layers, which cannot be decomposed by bacteria or other saprophytes. As a result, these materials do not break down in composting systems and remain in the environment for a long time. Thus, both assertion and reason are true and reason is the correct explanation of assertion.

Level - 2

CASE-BASED QUESTIONS

(4 Marks)

1. (i) Only 1% of the energy of sunlight that falls on leaves is converted into food energy by plants. So, if 10,000 J of solar energy falls on green plants, the amount of energy converted into food energy would be:
 $(1/100) \times 10000 = 100 \text{ J}$
- (ii) Curd/yogurt is derived from milk, which comes from herbivorous animals (e.g., cows). Since Ravi is consuming a product made from an herbivore (milk from cows), he is consuming energy that originally came from plants, processed through herbivores. Thus, in terms of trophic levels, Ravi would occupy the third trophic level, as he is consuming the product from a primary consumer (the cow).
- (iii) Decomposers, such as bacteria and fungi, are not typically included in the food chain because they break down organic matter from all trophic levels (producers, herbivores, carnivores) and recycle nutrients back into the soil, rather than

forming part of a direct energy transfer through the food chain. They act at every trophic level of the food chain, breaking down the remains of dead organisms from producers, herbivores, and carnivores.

2. (i) In this food web, primary consumers are herbivores that feed on producers (like grass). From the given data of ecosystem, grasshopper and the cricket are primary consumers.
- (ii) According to the 10% energy transfer rule in ecosystems, only about 10% of the energy from one trophic level is passed to the next. So, when a snake eats a frog, it would receive 10% of the energy that the frog gained from its food (which in turn would have gotten energy from primary consumers like grasshoppers or crickets).
- (iii) Based on the food web provided, the two organisms competing for food are organism B and organism C as both feed on A only.

Level - 3

VERY SHORT ANSWER TYPE QUESTIONS

(2 Marks)

1. The process shown in the cartoon refers to biological magnification, where harmful substances like pesticides or heavy metals accumulate at higher trophic levels in the food chain. If humans occupy the last trophic level, they will be at risk of accumulating these toxins in their bodies, as they consume organisms from higher trophic levels. Since these substances are not easily broken down or excreted, they become more concentrated as they move up the food chain. This can lead to serious health issues for humans, including neurological damage, reproductive problems, and cancer.

2. The term used for the materials which cannot be broken down by biological processes is non-biodegradable. Two ways in which non-biodegradable materials harm various components of an ecosystem are:

(i) **Soil and Water Pollution:** Non-biodegradable materials like plastic, glass and metals can accumulate in soil and water bodies, contaminating them. These pollutants can harm plants, aquatic life, and soil organisms, disrupting the natural balance and functioning of ecosystems.

- (ii) **Threat to Wildlife:** Animals may mistake non-biodegradable materials for food, leading to ingestion. This can cause physical harm, such as blockages in the digestive system, poisoning, or death. Non-biodegradable waste like plastic can also entangle animals, leading to injuries or fatalities.
3. Decomposers are micro-organisms, such as bacteria, fungi, and certain invertebrates, that break down dead organic matter (plants, animals and waste products) into simpler substances. They play a crucial role in recycling nutrients and maintaining the flow of energy in ecosystems.
Two consequences of their absence in an ecosystem are:
- (i) **Nutrient Depletion:** Without decomposers, dead organic matter would accumulate, and essential nutrients would not be recycled back into the soil. This would lead to nutrient deficiencies, affecting plant growth and overall ecosystem productivity.
- (ii) **Disruption of the Food Chain:** The absence of decomposers would mean that energy from dead organisms and waste materials would not be efficiently transferred to lower trophic levels. This could lead to an imbalance in the food web, affecting both producers and consumers.
4. A vegetarian food habit involves only two trophic levels food chain.
Produceer → Primary Consumer (herbivore)
An average of 10% of the amount of organic matter reaches to the next level of consumer; hence, it gets more energy.
5. Harmful chemicals get accumulated progressively at each trophic level in a food chain through a process called biological magnification. These chemicals, such as pesticides, enter the soil or water bodies from agricultural activities and are absorbed by plants or aquatic organisms. When herbivores consume these plants, the chemicals accumulate in their bodies, as they are non-degradable. At each higher trophic level, predators consume multiple contaminated prey, leading to a higher concentration of these chemicals in their tissues. Since humans occupy the top trophic level in the food chain, the highest concentration of harmful chemicals accumulates in our bodies, posing significant health risks.
6. Ponds and lakes, being large and natural ecosystems, maintain their cleanliness through self-regulating processes like water circulation, nutrient cycling, and decomposition by microorganisms. The larger volume of water dilutes waste, and harmful substances are naturally broken down, reducing the need for regular cleaning. In contrast, aquariums are small, controlled environments with limited water volume, where waste from fish, uneaten food, and decaying plants accumulate quickly. Without natural processes to break down waste and no dilution, harmful toxins like ammonia and nitrates build up, requiring regular cleaning and filtration to maintain a healthy environment.
7. The excessive use of pesticides in agriculture leads to their accumulation in rivers and ponds, causing serious concerns due to biomagnification. Pesticides washed into nearby water bodies through runoff are absorbed by aquatic plants and animals, and their concentration increases as they move up the food chain. This poses health risks to humans, who are at the top of the food chain, and can harm aquatic life, disrupting ecosystems and reducing biodiversity. This accumulation of harmful chemicals in water bodies not only affects the health of living organisms but also threatens the sustainability of ecosystems and food sources.
8. If 50 J of energy is available to the hawk, applying the 10% energy transfer rule:
- Energy at the snake (level before hawk) = $50 \text{ J} \times 10 = 500 \text{ J}$
 - Energy at the frog (level before snake) = $500 \text{ J} \times 10 = 5000 \text{ J}$
 - Energy at the grasshopper (level before frog) = $5000 \text{ J} \times 10 = 50,000 \text{ J}$
 - Energy at the grass (first trophic level) = $50,000 \text{ J} \times 10 = 500,000 \text{ J}$
- Thus, the energy at the first trophic level (grass) is 500,000 J, and at the third trophic level (frog) is 5000 J.
9. (i) One advantage of using cloth bags over plastic bags is that cloth bags are biodegradable and reusable, which makes them environmentally friendly by reducing pollution caused by non-biodegradable plastic bags.
- (ii) Two methods for safely disposing of solid wastes in urban areas are:
- (1) **Recycling:** Segregating waste into recyclable materials (like paper, glass, and metals) and processing them into new products.
- (2) **Composting:** Converting organic waste (like food scraps and garden waste) into nutrient-rich compost for agricultural use.
10. (i) The phytoplankton level (producers) is likely to have the most amount of energy in the aquatic ecosystem. Although their biomass is smaller compared to other levels, they have the highest energy content because they form the base of the energy pyramid, and all other trophic levels depend on them for energy.
- (ii) Aquatic ecosystems with inverted biomass pyramids are not sustainable because the biomass of the producers (phytoplankton) is much smaller than that of the consumers (zooplankton and fish). This imbalance requires producers to reproduce rapidly to sustain the energy demands of the consumers. If environmental conditions or other factors disturb the rapid regeneration of phytoplankton, the entire food web could collapse, leading to unsustainable ecosystem functioning.
11. The use of chlorofluorocarbons (CFCs) in aerosols, refrigeration, and air conditioning was primarily responsible for the marked decline in the ozone layer in the 1980s. CFCs, when released into the atmosphere, break down ozone molecules in the stratosphere, thinning the ozone layer.
The possible effect of this ozone depletion on human health is an increased risk of skin cancer due to higher exposure to ultraviolet (UV) radiation, as the ozone layer acts as a protective shield against harmful UV rays. Additionally, it can lead to eye damage, such as cataracts, and weaken the immune system.
12. The phenomenon likely responsible for the scientists' advisory is biomagnification, which occurs when

harmful substances, such as heavy metals like mercury, accumulate and increase in concentration as they move up the food chain.

The advisory to humans suggests limiting the consumption of fish like swordfish and king mackerel because these are tertiary consumers at the top of the food chain. As they consume smaller fish that contain

mercury, they accumulate higher levels of mercury in their bodies. This increased mercury concentration poses a greater health risk to humans who eat them. In contrast, secondary consumers like tilapia and salmon accumulate lower levels of mercury, making them safer to eat in moderate amounts.

SHORT ANSWER TYPE QUESTIONS

(3 Marks)

1. In the given food chain: Plants → Deer → Lion, removing all the organisms of the second trophic level (Deer) would impact the first and third trophic levels as follows:

- **First Trophic Level (Plants):** The removal of deer, which are herbivores, will reduce the grazing pressure on plants. As a result, the plant population may increase since fewer deer will be consuming them.
- **Third Trophic Level (Lion):** Lions, being carnivores, depend on deer for food. If the deer population is removed, the lions will face a food shortage, which could lead to a decrease in their population due to lack of food.

Impact in the context of a Food Web:

In a food web, the impact on the third trophic level (lions) would not be the same. In a food web, organisms usually have multiple food sources and are part of several interlinked food chains. If one prey species (like deer) is removed, lions may shift to other available prey in the ecosystem, thereby reducing the direct impact on them. This flexibility in diet helps stabilise the population of apex predators (lions) in a food web, unlike in a simple food chain, where the removal of a single species (deer) can have a more dramatic effect on the higher trophic levels.

2. The gas 'X' is Ozone (O₃), which is primarily found in the ozone layer, which is located in the stratosphere.

Function of Ozone in the atmosphere: This layer performs an essential function by absorbing and blocking the majority of the harmful ultraviolet (UV) radiation from the sun. UV radiation is detrimental to living organisms, as it can cause skin cancer, cataracts, and damage to ecosystems.

Chemical linked to the decrease in ozone levels:

The depletion of the ozone layer is largely linked to chlorofluorocarbons (CFCs). CFCs are chemicals that, when released into the atmosphere, break down ozone molecules. Once in the stratosphere, CFCs are broken down by UV radiation, releasing chlorine atoms that react with ozone, leading to its depletion.

International measures to check depletion: In response to the alarming depletion of the ozone layer, the Montreal Protocol was established in 1987. The protocol is an international treaty designed to phase out the production and use of ozone-depleting substances (such as CFCs, halons, and other chemicals). The Montreal Protocol has been successful in reducing the use of these chemicals and has contributed significantly to the recovery of the ozone layer.

3. The phenomenon involved is biomagnification, which refers to the process, where the concentration of toxic

substances, such as pesticides, increases as they move up through the food chain. It occurs because of:

(i) **Pesticide Application:** Chemicals known as pesticides are intended to eradicate or manage pests that cause harm to crops. Farmers use pesticides to keep insects, fungi, and other undesirable organisms away from their crops.

(ii) **Uptake by Plants:** When pesticides are administered to crops, the plants may assimilate certain residues. These leftovers may be located on the plant surface or within the plant tissues.

(iii) **Ingestion by Herbivores:** Herbivores, including insects and animals that devour vegetation, ingest pesticide residues found on or within the plants. The pesticide content in herbivores may exceed that in plants.

(iv) **Bioaccumulation:** The concentration of pesticides tends to rise as we go up the food chain. Higher concentrations of pesticides are accumulated by predators that prey on herbivores.

(v) **Impact on Humans:** The concentration of these compounds can be much higher in human tissues when humans eat higher trophic-level species, such as fish or livestock that have bioaccumulated pesticides. This is especially true of persistent organic pollutants, such as some pesticides, which the environment finds difficult to break down and remove.

(vi) **Health Effects:** Pesticides may be harmful to people's health. Long-term exposure to specific pesticides has been connected to several health concerns, such as malignancies, neurological impairments, and reproductive abnormalities.

4. (i) The ecosystem in food chain (b) is a terrestrial ecosystem, likely a forest or grassland, and the ecosystem in food chain (c) is a marine/pond ecosystem.

(ii) The first trophic level in all food chains consists of producers, as they are capable of synthesising their own food from inorganic substances using light or chemical energy. Producers, mainly plants and algae, utilise photosynthesis to convert solar energy into chemical energy, which is stored in carbohydrates. On average, producers capture only about 1% of the available solar energy for their metabolic processes.

(iii) The arrows in the diagram represent the unidirectional flow of energy, moving from producers to consumers. Energy is transferred when one organism consumes another. However, some energy is lost as heat during metabolic processes, which means it cannot flow back in the opposite direction. This is why the flow of energy in an ecosystem is always unidirectional.

5. Difference between Food chain and Food web

Food chain	Food web
A food chain is a linear sequence of organisms through which nutrients and energy flows from one organism to another.	A network of different food chains is called food web.
It consists of only one straight chain.	It consists of many interconnected food chains.
If one group of an organism disturbs, the whole chain will become unstable.	The food web does not become unstable by the removal of one group of organisms.
Food chain consists of only 4-5 trophic levels of different species.	Food web contains numerous trophic levels also of different populations of species.

If the population of deer decreases in a food chain consisting of deer, grass, and tiger, the following will likely happen:

- **First Trophic Level (Producers-Grass):** The population of grass may increase as the herbivores (deer) are consuming less grass. Without enough deer to graze on them, the grass may grow more abundantly.
 - **Third Trophic Level (Tertiary Consumer-Tiger):** The population of tigers may decrease. Since tigers feed on deer, a decrease in the deer population means fewer prey for the tigers. This would likely lead to a reduction in the tiger population due to insufficient food availability.
6. (i) A kitchen garden is an artificial ecosystem because humans modify both the biotic (plants, animals) and abiotic (soil, water) factors to suit their needs, such as growing vegetables or herbs. In contrast, a forest is a natural ecosystem where the biotic and abiotic components evolve and interact naturally without human intervention. While a kitchen garden relies on human management and control, a forest is self-sustaining, driven by natural processes like competition, predation, and nutrient recycling.
- (ii) **Proper Balance of Producers, Consumers, and Decomposers:** To create a self-sustaining system, it is essential to include all three trophic levels: producers (plants), consumers (herbivores, carnivores), and decomposers (bacteria, fungi). This ensures that the plants produce oxygen and food, herbivores and carnivores maintain balance, and decomposers break down organic matter to recycle nutrients back into the system. This cycle of energy and matter is crucial for sustainability.
- Efficient Waste Management:** A self-sustaining system should have a natural waste recycling mechanism, such as composting plant waste or using decomposers to break down organic matter. This prevents the accumulation of waste

and ensures that essential nutrients are recycled back into the soil, supporting plant growth.

7. (i) The food chain involving the given organisms is: Plants (producers) → Rat (primary consumer) → Snake (secondary consumer) → Hawk (tertiary consumer)
- (ii) On average, about 10% of the energy from one trophic level is passed on to the next level, while the rest is lost.
- Energy transferred to the second trophic level (rat) = 20,000 J
 - Energy transferred to the third trophic level (snake) = 10% of 20,000 J = 2,000 J
 - Energy transferred to the fourth trophic level (hawk) = 10% of 2,000 J = 200 J

Thus, 200 J of energy will be transferred from the snake (third trophic level) to the hawk (fourth trophic level).

8. Harmful chemicals, such as pesticides and heavy metals, enter the food chain when they are absorbed by plants and then consumed by herbivores. These chemicals accumulate as they move up the trophic levels because each predator consumes many contaminated organisms from lower levels. Since humans are at the top of the food chain and eat a variety of organisms, they accumulate the highest concentration of these harmful chemicals. This process, known as biomagnification, results in maximum chemical concentration in human bodies, leading to potential health risks like cancer, neurological disorders, and other long-term effects.

Biodegradable Waste	Non-Biodegradable Waste
Waste that can be broken down by natural processes (e.g., bacteria, fungi) into simpler, non-toxic substances. Examples: food scraps, paper, leaves.	Waste that cannot be broken down by natural processes and remains in the environment for a long time. Examples: plastics, metals, glass.

Impacts on the Environment:

Biodegradable Waste:

- (1) **Soil Contamination:** If not disposed of properly, it can decay and release harmful substances into the soil, affecting plant growth.
- (2) **Odor and Attracts Pests:** Decomposing organic waste can produce foul odours and attract pests like rodents and flies, which can spread diseases.

Non-Biodegradable Waste:

- (1) **Pollution:** Accumulation of non-biodegradable waste, such as plastics, can pollute land, water and air, harming wildlife and ecosystems.
- (2) **Landfill Overflow:** Non-biodegradable items take up space in landfills for decades, contributing to overburdened waste management systems and reducing available land.

10. (i) (a) Autotrophs (plants and algae) capture only about 1% of the available solar energy through photosynthesis to produce food.

(b) Only about 10% of the energy produced by autotrophs is transferred to the next trophic level (herbivores or primary consumers), as energy is lost at each step due to metabolic processes and heat.

(ii) Trophic levels are the various steps or levels in the food chain where transfer of food or energy takes place. Trophic levels represent the different feeding positions in a food chain. They include, producers (autotrophs), primary consumers (herbivores), secondary consumers (carnivores) and tertiary consumers (top predators).

Food chains typically have 4 to 5 trophic levels because energy decreases significantly with each transfer. Only about 10% of the energy is passed on to the next level, while the rest is lost as heat. After 4–5 trophic levels, insufficient energy remains to support higher levels, limiting the number of trophic levels in an ecosystem.

11. **Trophic Levels:** Trophic levels refer to the different feeding positions in a food chain, representing the

flow of energy from one organism to another. Each level in the chain is composed of organisms that occupy a similar position in the energy transfer process.

(i) Secondary Consumers are typically found at the third trophic level in a food chain. They are carnivores that feed on primary consumers (herbivores).

(ii) Tertiary Consumers are found at the fourth trophic level. These are apex predators that feed on secondary consumers.

If all organisms of a trophic level die, the flow of energy would be interrupted, as organisms at higher levels depend on those at lower levels for food. For example, if primary consumers (herbivores) die, secondary consumers (carnivores) lose their food source and may also perish. The death of organisms in one level can cause an ecological imbalance. For instance, without decomposers, organic waste would not break down, leading to a buildup of dead matter and a disruption in nutrient cycling. Additionally, the death of herbivores may result in overgrowth of plants, which can alter resource availability for other organisms in the ecosystem.

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