Our Environm

DISCLAIMER: For educational reference only. All questions are from NCERT Exemplar Problems, Class 10 Science, Chapter 15. Attempt questions independently before consulting solutions.

KEY TERMS & GLOSSARY

Term	Definition
Ecosystem	A self-sustaining unit comprising all living organisms (biotic) and non-living factors (abiotic) in an area
Biotic components	Living components of an ecosystem: producers, consumers, decomposers
Abiotic components	Non-living physical factors: temperature, rainfall, wind, soil, light, humidity
Producer (Autotroph)	Organisms that synthesise food from inorganic compounds using sunlight (photosynthesis); green plants, algae
Consumer (Heterotroph)	Organisms that depend on producers or other consumers for food; herbivores, carnivores, omnivores
Herbivore (Primary consumer)	Organisms that eat plants directly; grasshopper, rabbit, deer, cow
Carnivore (Secondary consumer)	Organisms that eat herbivores; frog, fox, snake
Decomposer	Organisms that break down dead organic matter into simple inorganic substances; fungi, bacteria
Food chain	Linear sequence showing transfer of energy from producers through consumers
Food web	Interconnected network of multiple food chains in an ecosystem
Trophic level	Each step/level in a food chain where energy transfer occurs
10% Law	Only 10% of energy is transferred from one trophic level to the next; rest lost as heat
Biodegradable	Substances broken down by biological processes (bacteria/fungi); paper, food, cotton, wool
Non-biodegradable	Substances NOT broken down by biological processes; plastic, DDT, glass, metal, CFC
Biomagnification	Progressive increase in concentration of non-biodegradable pollutants at higher trophic levels
Eutrophication	Excessive growth of algae in water bodies due to nutrient enrichment (phosphates, nitrates)
Ozone layer	Layer of O3 in stratosphere (20-25 km) that absorbs harmful UV radiation from sun
CFC	Chlorofluorocarbons -- chemicals from refrigerators/AC/aerosols that deplete ozone layer
UV radiation	Ultraviolet radiation; blocked by ozone layer; causes skin cancer, cataracts, immune damage
Ecological pyramid	Diagrammatic representation of trophic levels; energy max at base (T1), minimum at top

KEY CONCEPTS: ENERGY FLOW & 10% LAW

Trophic Level	Organism	Energy Available	Energy Lost as Heat
T1 -- Producer	Grass / Plants	10,000 J (100%)	9,000 J (90%)
T2 -- Primary Consumer	Grasshopper / Rabbit	1,000 J (10%)	900 J (90%)
T3 -- Secondary Consumer	Frog / Fox	100 J (1%)	90 J (90%)
T4 -- Tertiary Consumer	Snake / Wolf	10 J (0.1%)	9 J (90%)
T5 -- Apex Predator	Hawk / Eagle	1 J (0.01%)	--

10% Law (Lindemann's Law): Only 10% of energy is transferred from one trophic level to the next. The remaining 90% is lost as heat during metabolic processes. This limits food chains to 4-5 trophic levels.

Energy flow is UNIDIRECTIONAL: Sun -> Producers -> Consumers. Energy cannot flow back from consumers to producers. Matter cycles, but energy flows in one direction only.

BIODEGRADABLE vs NON-BIODEGRADABLE

Property	Biodegradable	Non-Biodegradable
Definition	Broken down by microorganisms (bacteria/fungi)	Cannot be broken down by biological processes
Examples	Food waste, paper, wood, cotton, wool, leather, cowdung	Plastic, DDT, CFC, glass, metal, synthetic fibres, PVC, bakelite
Effect	Nutrient recycling; enriches soil	Accumulates in environment; causes pollution
Disposal	Composting, landfill (decomposes)	Recycling, incineration (difficult)
Biomagnification	Does NOT cause biomagnification	CAN cause biomagnification (DDT, pesticides)
Environmental impact	Minimal; returns to nature	Long-lasting; causes soil, water, air pollution

FOOD CHAIN vs FOOD WEB

Property	Food Chain	Food Web
Structure	Single linear sequence of organisms	Interconnected network of food chains
Feeding	One organism feeds on one organism	Organism may feed on several organisms
Stability	Less stable; one broken link collapses chain	More stable; alternative pathways exist
Representation	Simple, one pathway	Complex, multiple pathways
Example	Grass -> Rabbit -> Fox -> Eagle	Multiple chains interconnected in a forest ecosystem

SECTION A: MULTIPLE CHOICE QUESTIONS (Q1 to Q21)

Exam Strategy: For 'INCORRECT statement' questions, find the factually wrong option. For energy questions, apply the 10% law carefully working backwards from the given trophic level.

Q1. Which one of the following is an artificial ecosystem?

(a) Pond

(b) Crop field [CORRECT]

(c) Lake

(d) Forest

Answer: (b)

CROP FIELD is an artificial (man-made) ecosystem -- it is created, maintained and managed by humans. Crops are planted deliberately, irrigation is provided, and it would disappear without human intervention. Pond, lake and forest are NATURAL ecosystems that develop and sustain themselves without human management.

Tip: Artificial ecosystem = man-made, maintained by humans. Examples: crop field, aquarium, garden, zoo.

Q2. In a food chain, the third trophic level is always occupied by

(a) Carnivores [CORRECT]

(b) Herbivores

(c) Decomposers

(d) Producers

Answer: (a)

In a food chain: T1 = Producers (plants), T2 = Primary consumers (herbivores), T3 = Secondary consumers (CARNIVORES that eat herbivores). Example: Grass(T1) -> Rabbit(T2) -> Fox(T3). Decomposers are NOT part of the main food chain -- they act at all levels.

Tip: T1=Producers, T2=Herbivores, T3=Carnivores, T4=Top carnivores. Learn this sequence.

Q3. An ecosystem includes

(a) All living organisms

(b) Non-living objects

(c) Both living organisms and non-living objects [CORRECT]

(d) Sometimes living, sometimes non-living

Answer: (c)

An ECOSYSTEM includes BOTH biotic (living) AND abiotic (non-living) components working together. Biotic = producers, consumers, decomposers. Abiotic = temperature, rainfall, sunlight, soil, water, humidity. Neither alone constitutes an ecosystem.

Tip: Ecosystem = Biotic (living) + Abiotic (non-living) components. Both are essential.

Q4. In the food chain Grass -> Grasshopper -> Frog -> Snake -> Hawk, energy at fourth trophic level is 5 kJ. Energy at producer level is

(a) 5 kJ

(b) 50 kJ

(c) 500 kJ

(d) 5000 kJ [CORRECT]

Answer: (d)

Using 10% law (only 10% transferred per level): T4 (Snake) = 5 kJ. T3 (Frog) = 5 x 10 = 50 kJ. T2 (Grasshopper) = 50 x 10 = 500 kJ. T1 (Grass/Producer) = 500 x 10 = 5000 kJ. Working backwards: multiply by 10 for each level going down.

Tip: 10% law: to go UP one level multiply by 10. 4th level = 5 kJ, so T1 = 5 x 10 x 10 x 10 = 5000 kJ.

Q5. Accumulation of non-biodegradable pesticides in the food chain in increasing amount at each higher trophic level is known as

(a) Eutrophication

(b) Pollution

(c) Biomagnification [CORRECT]

(d) Accumulation

Answer: (c)

BIOMAGNIFICATION (also called biological magnification) is the progressive increase in concentration of non-biodegradable substances (like DDT, pesticides, mercury) at each successive higher trophic level of a food chain. Eutrophication = excessive algae growth in water bodies due to nutrient enrichment. Pollution = general contamination of environment.

Tip: Biomagnification = non-biodegradable toxins concentrate MORE at each higher trophic level. DDT in eagles > DDT in fish > DDT in water.

Q6. Depletion of ozone is mainly due to

(a) Chlorofluorocarbon compounds (CFCs) [CORRECT]

(b) Carbon monoxide

(c) Methane

(d) Pesticides

Answer: (a)

CHLOROFLUOROCARBONS (CFCs) are the main cause of ozone layer depletion. CFCs are used in refrigerators, air conditioners, aerosol sprays, and fire extinguishers. When released into atmosphere, CFC molecules rise to stratosphere where UV radiation breaks them down, releasing chlorine atoms that catalytically destroy ozone (O3). One Cl atom can destroy ~100,000 ozone molecules.

Tip: CFCs destroy ozone: Cl from CFC + O3 -> ClO + O2, then ClO + O -> Cl + O2. Cl is regenerated = catalytic destruction.

Q7. Organisms which synthesise carbohydrates from inorganic compounds using radiant energy are called

(a) Decomposers

(b) Producers [CORRECT]

(c) Herbivores

(d) Carnivores

Answer: (b)

PRODUCERS (autotrophs) synthesise organic compounds (carbohydrates) from inorganic raw materials (CO_2, water, minerals) using RADIANT ENERGY (sunlight) through the process of PHOTOSYNTHESIS. $6CO_2 + 6H_2O + \text{light} \rightarrow C_6H_{12}O_6 + 6O_2$. They are the foundation of all food chains and ecosystems.

Tip: Producers = autotrophs = photosynthesisers = green plants + algae + cyanobacteria. They make food from sunlight + inorganic matter.

Q8. In an ecosystem, the 10% of energy available for transfer from one trophic level to the next is in the form of

(a) Heat energy

(b) Light energy

(c) Chemical energy [CORRECT]

(d) Mechanical energy

Answer: (c)

The 10% of energy that is transferred from one trophic level to the next is in the form of CHEMICAL ENERGY -- stored in the chemical bonds of organic molecules (food). When an organism eats another, it gains the chemical energy stored in the prey's biomass. The remaining 90% is lost as HEAT energy during respiration, movement, and metabolic processes.

Tip: Chemical energy (in food) is transferred. Heat energy is lost. Only 10% of chemical energy passes to next level.

Q9. Organisms of a higher trophic level which feed on several types of organisms belonging to a lower trophic level constitute the

(a) Food web [CORRECT]

(b) Ecological pyramid

(c) Ecosystem

(d) Food chain

Answer: (a)

A FOOD WEB is formed when organisms at a higher trophic level feed on several different types of organisms at a lower trophic level. This creates an interconnected network of food chains. Example: A fox may eat rabbits, mice, birds, and insects -- creating multiple connections that form a web of feeding relationships.

Tip: Food web = multiple food chains interconnected. One organism feeding on SEVERAL others = food web, not simple food chain.

Q10. Flow of energy in an ecosystem is always

(a) Unidirectional [CORRECT]

(b) Bidirectional

(c) Multidirectional

(d) No specific direction

Answer: (a)

Energy flow in an ecosystem is always UNIDIRECTIONAL -- it flows in ONE direction only: from the Sun -> Producers -> Primary consumers -> Secondary consumers -> Tertiary consumers. Energy CANNOT flow back from consumers to producers. Once energy is lost as heat, it cannot be reused by the ecosystem. This is why food chains need a constant input of solar energy.

Tip: Energy flow = unidirectional (one way only). Matter/nutrients cycle. Energy does NOT cycle -- it flows and is lost as heat.

Q11. Excessive exposure of humans to UV-rays results in

(a) (i) and (ii)

(b) (ii) and (iv)

(c) (i) and (iii) [CORRECT]

(d) (iii) and (iv)

Answer: (c)

Excessive UV radiation exposure causes: (i) DAMAGE TO IMMUNE SYSTEM -- UV suppresses immune responses, making people more susceptible to infections. (iii) SKIN CANCER -- UV causes mutations in skin cells, leading to melanoma and other skin cancers. UV does NOT directly damage lungs (ii) or cause peptic ulcers (iv). Other effects: cataracts (eye damage), premature skin ageing, DNA damage.

Tip: UV effects: skin cancer, immune system damage, cataracts (eye). NOT lungs or peptic ulcers.

Q12. Which group contains only non-biodegradable items?

(a) (iii) only

(b) (iv) only -- Plastic, bakelite, DDT

(c) (i) and (iii)

(d) (ii) and (iv) [CORRECT]

Answer: (d)

Group (ii) Polythene, detergent, PVC -- all non-biodegradable. Group (iv) Plastic, bakelite, DDT -- all non-biodegradable. Group (i): Wood and paper are biodegradable; leather is debatable but generally biodegradable. Group (iii): Grass is biodegradable; only plastic and detergent are non-biodegradable. Therefore answer is (ii) AND (iv).

Tip: Non-biodegradable: plastic, PVC, polythene, bakelite, DDT, CFC, synthetic fibres, glass, metal. Biodegradable: wood, paper, food, cotton, leather, wool, grass.

Q13. Which of the following limits the number of trophic levels in a food chain?

(a) Decrease in energy at higher trophic levels [CORRECT]

(b) Sufficient food supply

(c) Polluted air

(d) Water

Answer: (a)

The NUMBER OF TROPHIC LEVELS in a food chain is limited by the DECREASE IN ENERGY at each successive higher level (10% law). By the 4th or 5th trophic level, so little energy remains (0.01% of original) that it cannot support another level of consumers. This is why food chains generally have only 4-5 trophic levels.

Tip: 10% law limits trophic levels. By T5, only 0.001% of original energy remains -- not enough to support T6.

Q14. Which of the statement is INCORRECT?

(a) All green plants and blue-green algae are producers

(b) Green plants get their food from organic compounds [CORRECT]

(c) Producers prepare their own food from inorganic compounds

(d) Plants convert solar energy into chemical energy

Answer: (b)

Option (b) is INCORRECT: Green plants do NOT get food from organic compounds. They are AUTOTROPHS (producers) that make their own food from INORGANIC compounds ($CO_2 + H_2O$) using solar energy through photosynthesis. Getting food from organic compounds describes HETEROTROPHS (consumers), not producers. Options (a), (c), (d) are all correct statements about producers.

Tip: Producers = autotrophs = make food from INORGANIC compounds. Getting food from organic compounds = heterotroph (consumers).

Q15. Which group of organisms are NOT constituents of a food chain?

(a) (i) and (iii)

(b) (iii) and (iv)

(c) (ii) and (iii) [CORRECT]

(d) (i) and (iv)

Answer: (c)

A valid food chain must start with a PRODUCER and follow a logical predator-prey sequence. Group (ii) Plankton, man, fish, grasshopper: not in logical order; man does not eat grasshopper in a chain with fish. Group (iii) Wolf, grass, snake, tiger: starts with wolf (carnivore), not a producer -- invalid. Group (i) Grass->lion->rabbit->wolf: lion eats rabbit but also wolf eats rabbit -- invalid sequence. Group (iv) Frog->snake->eagle->grass->grasshopper: valid if reordered as grass->grasshopper->frog->snake->eagle.

Tip: Valid food chain: must start with producer, follow logical predation sequence. Check each group carefully.

Q16. The percentage of solar radiation absorbed by all green plants for photosynthesis is about

(a) 1% [CORRECT]

(b) 5%

(c) 8%

(d) 10%

Answer: (a)

Only about 1% of the total solar radiation that falls on Earth is captured by green plants and used for photosynthesis. The rest is reflected, absorbed by atmosphere/soil/water, or converted to heat. This low efficiency means photosynthesis captures very little of the available solar energy -- highlighting the importance of conservation.

Tip: Only 1% of solar energy is captured by plants in photosynthesis. This is why energy decreases so rapidly up the food chain.

Q17. In Fig 15.1, the pyramid shows trophic levels T1-T4. At which trophic level is maximum energy available?

(a) T4

(b) T2

(c) T1 [CORRECT]

(d) T3

Answer: (c)

In an ECOLOGICAL PYRAMID (energy pyramid), T1 (the base/widest level) always has MAXIMUM energy. T1 = Producers (plants). Energy decreases as we go up: T1 > T2 > T3 > T4. The pyramid is widest at the bottom (T1) because most energy is there, and narrowest at top (T4) because least energy remains.

Tip: Energy pyramid: T1 (base) = maximum energy. T4 (apex) = minimum energy. 10% law makes energy decrease upward.

Q18. What will happen if deer is missing in the food chain Grass -> Deer -> Tiger?

(a) Population of tiger increases

(b) Population of grass decreases

(c) Tiger will start eating grass

(d) Population of tiger decreases and grass increases [CORRECT]

Answer: (d)

If deer are removed: Tiger loses its food source -> tiger population DECREASES (starvation, emigration). Without deer grazing, grass is not consumed -> grass population INCREASES (grows unchecked). Tigers cannot start eating grass -- they are obligate carnivores. This demonstrates the interdependence of organisms in a food chain.

Tip: Remove middle organism: predator (tiger) starves and decreases; prey of removed organism (grass) increases unchecked.

Q19. The decomposers in an ecosystem

(a) Convert inorganic material to simpler forms

(b) Convert organic material to inorganic forms [CORRECT]

(c) Convert inorganic materials into organic compounds

(d) Do not breakdown organic compounds

Answer: (b)

DECOMPOSERS (bacteria and fungi) break down complex ORGANIC material (dead plants, animals, excreta) into simple INORGANIC substances (CO2, water, mineral salts). This process is called decomposition or mineralisation. It returns nutrients to the soil, completing the nutrient cycle. Option (c) describes producers (photosynthesis). Option (a) is incorrect direction.

Tip: Decomposers: Organic -> Inorganic. Producers: Inorganic -> Organic. Opposite processes, both essential for cycling.

Q20. If a grasshopper is eaten by a frog, then the energy transfer is from

(a) Producer to decomposer

(b) Producer to primary consumer

(c) Primary consumer to secondary consumer [CORRECT]

(d) Secondary consumer to primary consumer

Answer: (c)

In the food chain: Grass(Producer) -> Grasshopper(Primary consumer/Herbivore) -> Frog(Secondary consumer). Grasshopper eats grass = primary consumer (herbivore). Frog eats grasshopper = secondary consumer (carnivore). When frog eats grasshopper: energy transfers from PRIMARY CONSUMER (grasshopper) to SECONDARY CONSUMER (frog).

Tip: Grasshopper = primary consumer (eats grass/producer). Frog = secondary consumer (eats grasshopper). Energy: primary -> secondary consumer.

Q21. Disposable plastic plates should not be used because

(a) They are made of lightweight materials

(b) They are made of toxic materials

(c) They are made of biodegradable materials

(d) They are made of non-biodegradable materials [CORRECT]

Answer: (d)

Disposable plastic plates should be avoided because they are made of NON-BIODEGRADABLE materials. They cannot be broken down by microorganisms and persist in the environment for hundreds of years. They clog drains, harm wildlife, pollute soil and water, and contribute to microplastic pollution. Plastic is not toxic in the sense of being poisonous by touch (option b is not the main reason).

Tip: Plastic = non-biodegradable = persists for 100s of years. Use cloth/paper/biodegradable alternatives.

MCQ ANSWER KEY

1	**(b)**	2	**(a)**	3	**(c)**	4	**(d)**
5	**(c)**	6	**(a)**	7	**(b)**	8	**(c)**
9	**(a)**	10	**(a)**	11	**(c)**	12	**(d)**
13	**(a)**	14	**(b)**	15	**(c)**	16	**(a)**
17	**(c)**	18	**(d)**	19	**(b)**	20	**(c)**

21	**(d)**						

SECTION B: SHORT ANSWER QUESTIONS (Q22 to Q30)

Q22. Why is improper disposal of waste a curse to environment?

Effects of improper waste disposal:

1. SOIL POLLUTION: Non-biodegradable waste (plastic, chemicals) contaminates soil, reducing its fertility and harming soil organisms. 2. WATER POLLUTION: Waste leaches into groundwater and surface water, contaminating drinking water sources and harming aquatic life. 3. AIR POLLUTION: Burning of waste releases toxic gases (CO, SO2, dioxins), causing respiratory diseases and contributing to greenhouse effect. 4. DISEASE SPREAD: Rotting organic waste attracts pests (flies, rats, mosquitoes) that spread diseases like cholera, malaria, dengue. 5. BIOMAGNIFICATION: Non-biodegradable toxins enter food chains and accumulate, harming top predators including humans. 6. AESTHETIC DAMAGE: Littering degrades natural landscapes and reduces quality of life.

Tip: Waste disposal affects soil, water, air, and living organisms. Non-biodegradable waste is the most problematic as it persists.

Q23. Write the common food chain of a pond ecosystem.

Pond ecosystem food chain:

Phytoplankton (producers/algae) -> Zooplankton (primary consumers) -> Small fish/insects (secondary consumers) -> Large fish (tertiary consumers) -> Fish-eating birds/Hawk (apex predator). Alternatively: Aquatic plants -> Water insects -> Small fish -> Large fish -> Bird. Or more simply: Algae -> Small aquatic animals (water fleas, larvae) -> Fish -> Bird (heron/kingfisher). Key: Starts with aquatic PRODUCERS (phytoplankton/algae) which photosynthesize. Energy flows from sun -> phytoplankton -> zooplankton -> fish -> birds.

Tip: Pond food chain always starts with aquatic producers (phytoplankton/algae). Common chain: Algae -> Zooplankton -> Small fish -> Large fish -> Bird.

Q24. What are the advantages of cloth bags over plastic bags during shopping?

Advantages of cloth bags:

1. BIODEGRADABLE: Cloth bags are made of natural fibres (cotton, jute) that decompose naturally, unlike plastic which persists for hundreds of years. 2. NO POLLUTION: Cloth does not release toxic chemicals when decomposing or burning. 3. REUSABLE: Cloth bags can be used many times, reducing waste generation. 4. STRONGER: Cloth bags can carry heavier loads without tearing. 5. NO WILDLIFE HARM: Animals do not mistake cloth for food (unlike plastic bags which are swallowed by cows, marine animals, birds, causing their death). 6. RECYCLABLE: Old cloth bags can be repurposed or recycled into other items. 7. COST-EFFECTIVE LONG-TERM: Though more expensive initially, long life makes them cheaper overall.

Tip: Cloth bags: biodegradable, reusable, strong, no wildlife harm, no toxic pollution. Plastic bags: non-biodegradable, choke animals, pollute environment.

Q25. Why are crop fields known as artificial ecosystems?

Crop fields as artificial ecosystems:

Crop fields are called ARTIFICIAL ECOSYSTEMS because: 1. CREATED BY HUMANS: They are deliberately planted and designed by humans, not formed naturally. 2. MAINTAINED BY HUMANS: They require constant human intervention -- irrigation, fertilisers, pesticides, weeding, ploughing -- to survive. Without this, they would be overtaken by weeds. 3. LIMITED BIODIVERSITY: Only selected crop species are grown; biodiversity is reduced compared to natural ecosystems. 4. DEPEND ON EXTERNAL INPUTS: They need external supply of nutrients (fertilisers), water (irrigation) and pest control that a natural ecosystem provides for itself. 5. NOT SELF-SUSTAINING: Unlike forests or ponds, crop fields cannot maintain themselves without continuous human management.

Tip: Artificial ecosystem = created and maintained by humans, not self-sustaining. Natural ecosystem = self-sustaining without human intervention.

Q26. Differentiate between biodegradable and non-biodegradable substances. Cite examples.

Biodegradable substances:

DEFINITION: Substances that can be broken down into simpler, harmless compounds by the action of microorganisms (bacteria, fungi) through biological processes. EXAMPLES: Food waste, vegetable peels, paper, wood, cotton, wool, leather, cow dung, dead organisms, agricultural waste. ENVIRONMENTAL IMPACT: Minimal -- decomposes naturally, nutrients return to soil.

Non-biodegradable substances:

DEFINITION: Substances that CANNOT be broken down by biological processes. They persist in the environment for very long periods (hundreds to thousands of years). EXAMPLES: Plastic, polythene, PVC, DDT, CFC, glass, metal, bakelite, synthetic fibres (nylon, polyester), e-waste, nuclear waste. ENVIRONMENTAL IMPACT: Severe -- causes soil, water and air pollution; undergoes BIOMAGNIFICATION in food chains; harms wildlife.

Tip: Key difference: biodegradable = broken down by microbes. Non-biodegradable = persists indefinitely, causes biomagnification.

Q27. Suggest one word for each of the following statements/definitions: (a) Physical and biological world we live in (b) Each level of food chain (c) Physical factors like temperature, rainfall, wind, soil (d) Organisms depending on producers for food

Answers:

(a) ENVIRONMENT -- The physical and biological world where we live, including all living organisms and their surroundings. (b) TROPHIC LEVEL -- Each step or level in a food chain where energy transfer takes place. The position an organism occupies in the food chain. (c) ABIOTIC FACTORS -- The non-living physical factors of an ecosystem such as temperature, rainfall, wind speed, soil type, humidity and light. (d) CONSUMERS (Heterotrophs) -- Organisms that depend on producers (directly as herbivores, or indirectly as carnivores) for their food and energy needs.

Tip: (a) Environment (b) Trophic level (c) Abiotic factors (d) Consumers/Heterotrophs

Q28. Explain the role of decomposers in the environment.

Role of decomposers:

Decomposers are microorganisms (mainly bacteria and fungi) that break down the complex organic compounds of dead plants, animals and their waste products into simple inorganic substances like CO2, water, and mineral salts. Their key roles are: 1. NUTRIENT RECYCLING: They release mineral nutrients (nitrogen, phosphorus, potassium) back into the soil, making them available for plants to absorb and reuse. This completes the nutrient/material cycle in the ecosystem. 2. CLEANING THE ENVIRONMENT: Without decomposers, dead bodies and waste would accumulate, making the environment uninhabitable. They 'clean up' the ecosystem. 3. SOIL FERTILITY: Decomposition produces humus which improves soil structure, water-holding capacity, and fertility. 4. COMPLETING BIOGEOCHEMICAL CYCLES: Carbon, nitrogen, phosphorus and other elemental cycles depend on decomposers to release elements from organic matter back to the environment.

Tip: Decomposers = bacteria + fungi. Function: organic -> inorganic = nutrient recycling. Without them, nutrients would be locked in dead matter.

Q29. Select the mis-matched pair and correct it: (a) Biomagnification -- Accumulation of chemicals at successive trophic levels (b) Ecosystem -- Biotic components of environment (c) Aquarium -- A man-made ecosystem (d) Parasites -- Organisms which obtain food from other living organisms

Mis-matched pair and correction:

The MIS-MATCHED pair is: (b) Ecosystem -- 'Biotic components of environment'. CORRECTION: An ECOSYSTEM includes BOTH biotic (living) AND abiotic (non-living) components of the environment -- not just biotic. Correct statement: Ecosystem -- Both biotic and abiotic components of environment. The other pairs are correctly matched: (a) Biomagnification correctly defined as accumulation at successive trophic levels. (c) Aquarium is indeed a man-made (artificial) ecosystem. (d) Parasites correctly defined as obtaining food from living host organisms.

Tip: Mis-matched: Ecosystem =/= only biotic components. Correct: Ecosystem = biotic + abiotic components together.

Q30. We do not clean ponds or lakes, but an aquarium needs to be cleaned. Why?

Explanation:

A POND or LAKE is a NATURAL, SELF-SUSTAINING ecosystem. It has: All trophic levels -- producers (algae, plants), consumers (fish, insects), and decomposers (bacteria, fungi). Decomposers break down waste products naturally; nutrients are recycled; the system maintains its own balance without human intervention. An AQUARIUM is an ARTIFICIAL ecosystem. It has: Limited or no decomposers; insufficient plant life to consume all waste; fish produce waste that accumulates (ammonia, nitrites) which cannot be naturally recycled in the confined space. Without cleaning: toxic waste builds up, oxygen depletes, fish die. Therefore the aquarium NEEDS periodic cleaning by humans to remove waste and maintain conditions, while the pond maintains itself naturally.

Tip: Pond = natural ecosystem with decomposers -> self-cleaning. Aquarium = artificial, no decomposers -> needs human cleaning.

SECTION C: LONG ANSWER QUESTIONS (Q31 to Q38)

Q31. Indicate the flow of energy in an ecosystem. Why is it unidirectional? Justify.

Flow of energy in an ecosystem:

Energy flows in a SINGLE DIRECTION through the ecosystem: SUN (solar energy) -> PRODUCERS (T1) -> PRIMARY CONSUMERS (T2) -> SECONDARY CONSUMERS (T3) -> TERTIARY CONSUMERS (T4). At each transfer, only 10% of energy moves to the next level (10% Law). The remaining 90% is lost as HEAT during cellular respiration, movement, and other metabolic processes. Example: If grass has 10,000 J: Grasshopper gets 1,000 J | Frog gets 100 J | Snake gets 10 J | Hawk gets 1 J.

Why energy flow is UNIDIRECTIONAL -- Justification:

1. SECOND LAW OF THERMODYNAMICS: Energy transformations are never 100% efficient. At each step, energy degrades to heat which disperses into the environment and cannot be reused by organisms in the ecosystem. 2. HEAT CANNOT BE RECYCLED: Unlike matter (which cycles through decomposers), heat energy cannot be converted back to useful chemical energy by any organism. 3. CONSUMERS CANNOT PASS ENERGY BACK: Consumers use energy for their own life processes and cannot return it to the organisms they consumed. 4. PHOTOSYNTHESIS REQUIRES SUN: New energy input must come from the sun through producers. 5. MATTER CYCLES, ENERGY FLOWS: Carbon, nitrogen and other nutrients cycle through the ecosystem (via decomposers), but energy is always lost as heat at each level and must be continuously resupplied by solar input.

Tip: Energy: Sun->T1->T2->T3->T4, 10% each step. Unidirectional because heat loss is irreversible. Matter cycles; energy only flows.

Q32. What are decomposers? What will be the consequence of their absence in an ecosystem?

Decomposers:

DECOMPOSERS are microorganisms (primarily BACTERIA and FUNGI) that obtain energy by breaking down complex organic matter from dead plants, animals, and their waste products into simple inorganic substances (CO_2, H_2O, mineral salts/nutrients). They are also called SAPROTROPHES or REDUCERS. Examples: Rhizobium bacteria, Aspergillus fungi, Penicillium, earthworms (physical decomposers). They operate at all trophic levels, acting on all dead organic matter.

Consequences of ABSENCE of decomposers:

1. NUTRIENT CYCLE BREAKS DOWN: Minerals and nutrients locked in dead organic matter would NOT be returned to the soil. Soil would become nutrient-poor. 2. ACCUMULATION OF DEAD MATTER: Dead bodies of plants and animals would accumulate and pile up everywhere -- the environment would become uninhabitable. 3. PLANT GROWTH STUNTED: Without decomposers releasing minerals, plants could not get nutrients from soil -> producers would decline -> ALL food chains would collapse. 4. COMPLETE ECOSYSTEM COLLAPSE: Since producers depend on recycled nutrients, their decline would cascade through all trophic levels, eventually causing total ecosystem breakdown. 5. CARBON CYCLE DISRUPTED: CO_2 would not be returned to atmosphere, reducing photosynthesis and causing major imbalance in biogeochemical cycles.

Tip: Decomposers = bacteria + fungi. Without them: nutrients locked up, dead matter accumulates, plants die, ecosystem collapses.

Q33. Suggest any four activities in daily life which are eco-friendly.

Four eco-friendly daily activities:

1. USE CLOTH/JUTE BAGS: Carry cloth or jute bags for shopping instead of single-use plastic bags. Reduces plastic pollution and saves petroleum used to make plastic. 2. SEGREGATE WASTE AT SOURCE: Separate biodegradable waste (kitchen scraps, vegetable peels) from non-biodegradable waste (plastic, glass, metal). Biodegradable waste can be composted; non-biodegradable sent for recycling. Prevents mixed waste pollution. 3. SAVE ENERGY: Switch off lights, fans and appliances when not in use. Use LED bulbs instead of incandescent bulbs. Use public transport/bicycle instead of private vehicles. Reduces fossil fuel consumption and CO2 emissions. 4. COMPOST ORGANIC WASTE: Convert kitchen and garden waste into compost for plants. Reduces landfill waste, avoids burning of waste, creates natural fertiliser. 5. (BONUS) REDUCE-REUSE-RECYCLE: Buy less, reuse items (paper, containers), recycle materials (paper, glass, metal). Reduces resource consumption and waste generation.

Tip: Eco-friendly activities: use cloth bags, segregate waste, save energy, compost, use public transport, plant trees, reduce plastic.

Q34. Give two differences between food chain and food web.

Two differences between food chain and food web:

DIFFERENCE 1 -- STRUCTURE: Food Chain: A LINEAR, single-pathway sequence of organisms where each organism feeds on only ONE type of organism from the lower trophic level. Simple, straight-line relationship. Example: Grass -> Rabbit -> Fox -> Eagle. Food Web: An INTERCONNECTED NETWORK of multiple food chains where organisms at one level feed on several different organisms from lower levels. Complex, branching network. Example: Fox feeds on rabbit, mouse, and birds; creating multiple connections.

DIFFERENCE 2 -- STABILITY: Food Chain: LESS STABLE -- if one organism in the chain is removed, the entire chain is disrupted. No alternative pathways exist. Example: If rabbits disappear, foxes starve AND grass overgrows. Food Web: MORE STABLE -- if one food source is disrupted, organisms can switch to alternative food sources. The network continues to function despite individual disruptions. Example: If rabbits disappear, fox can still eat mice and birds.

Tip: Food chain: linear, one path, less stable. Food web: networked, multiple paths, more stable. Food web is more realistic representation.

Q35. Name the wastes generated in your house daily. What measures for their disposal?

Types of household waste:

BIODEGRADABLE WASTE: Vegetable and fruit peels, food scraps, tea leaves, leftover food, newspaper, paper bags, flowers, garden waste, cotton cloth pieces. NON-BIODEGRADABLE WASTE: Plastic bags, plastic bottles, glass bottles, metal cans, synthetic cloth, batteries, electronic waste (e-waste), detergent packaging, thermocol, aluminium foil.

Disposal measures:

For BIODEGRADABLE waste: 1. COMPOSTING: Collect vegetable peels, food waste in a compost pit. After 2-3 months of decomposition, use as natural fertiliser for plants. 2. BIOGAS PLANT: Organic waste + cow dung can be fed to biogas plant for fuel + manure. 3. VERMICOMPOSTING: Use earthworms to rapidly decompose organic waste into rich compost. For NON-BIODEGRADABLE waste: 1. SEGREGATION: Separate plastics, glass, metals, paper at source. 2. RECYCLING: Send recyclable materials (paper, glass, metal, plastic) to recycling centres. 3. REDUCE USE: Stop using single-use plastics; switch to reusable alternatives. 4. HAZARDOUS WASTE: E-waste and batteries to authorised collection centres only.

Tip: Segregate waste at source: biodegradable -> compost. Non-biodegradable -> recycle. Never mix or burn -- both cause pollution.

Q36. Suggest suitable mechanism(s) for waste management in fertiliser industries.

Waste management in fertiliser industries:

Fertiliser industries produce various wastes: gaseous (ammonia, SO2, NOx, CO2), liquid (chemical effluents with heavy metals and nitrates), solid (slag, dust). Suitable mechanisms: 1. SCRUBBERS: Install gas scrubbers/absorbers to remove SO2, NOx and ammonia from exhaust gases before releasing into atmosphere. Prevents acid rain. 2. EFFLUENT TREATMENT PLANTS (ETP): Chemical effluents must be treated to remove toxins, heavy metals, and neutralise acids/bases before discharge to water bodies. 3. DUST COLLECTORS/PRECIPITATORS: Electrostatic precipitators or bag filters to capture particulate matter from chimney emissions. 4. WASTE HEAT RECOVERY: Capture heat from chemical reactions for use in the plant, reducing energy waste. 5. SOLID WASTE DISPOSAL: Slag and solid waste should be safely landfilled or used as raw material for other industries (e.g., in construction). 6. CLOSED-LOOP SYSTEMS: Recycle process water and chemical wastes back into the production process to minimise waste generation.

Tip: Fertiliser industry waste: gaseous (scrubbers), liquid (ETP), solid (landfill/recycle), particulate (electrostatic precipitators).

Q37. What are the by-products of fertiliser industries? How do they affect the environment?

By-products of fertiliser industries:

GASEOUS BY-PRODUCTS: Ammonia (NH3), sulphur dioxide (SO2), oxides of nitrogen (NOx), carbon dioxide (CO2), hydrofluoric acid vapour (in phosphate fertiliser plants). LIQUID BY-PRODUCTS: Effluents containing nitrates, phosphates, heavy metals (cadmium, mercury, arsenic), acidic/alkaline wastewater. SOLID BY-PRODUCTS: Gypsum slag, calcium sulphate, dust particles.

Environmental effects:

1. AIR POLLUTION: SO2 and NOx cause ACID RAIN (damages forests, buildings, aquatic life). NH3 causes eutrophication when deposited in water bodies. Particulate matter causes respiratory diseases. 2. WATER POLLUTION: Nitrate and phosphate effluents cause EUTROPHICATION -- excessive algae growth depletes dissolved oxygen, killing fish and aquatic organisms. Heavy metals accumulate in sediments and undergo BIOMAGNIFICATION in food chains. 3. SOIL POLLUTION: Improper disposal of solid wastes (gypsum slag) contaminates soil, changes its pH and affects soil organisms. 4. GLOBAL WARMING: CO2 released contributes to greenhouse effect and climate change. NOx also acts as greenhouse gas and depletes ozone layer.

Tip: Fertiliser by-products: SO2+NOx=acid rain; nitrates+phosphates=eutrophication; heavy metals=biomagnification; CO2=global warming.

Q38. Explain some harmful effects of agricultural practices on the environment.

Harmful effects of agricultural practices:

1. CHEMICAL FERTILISERS -- SOIL DAMAGE: Excessive use of chemical fertilisers (NPK) changes soil chemistry, destroys beneficial soil microorganisms, reduces soil fertility over time, and causes soil acidification. 2. CHEMICAL FERTILISERS -- WATER POLLUTION: Nitrates and phosphates leach into groundwater and run off into rivers/lakes causing EUTROPHICATION -- excessive algae growth, oxygen depletion, death of aquatic organisms. 3. PESTICIDES -- BIOMAGNIFICATION: Non-biodegradable pesticides (DDT, organochlorines) enter food chains and undergo BIOMAGNIFICATION -- concentrating at each higher trophic level, eventually reaching toxic levels in apex predators including humans. 4. IRRIGATION -- WATERLOGGING AND SALINITY: Excessive irrigation leads to waterlogging (roots suffocate) and soil salinisation (salt accumulation) making land unfit for cultivation. 5. DEFORESTATION FOR AGRICULTURE: Clearing forests destroys biodiversity, causes soil erosion, reduces rainfall, and releases stored carbon. 6. MONOCULTURE: Growing single crop species reduces biodiversity, makes crops susceptible to pests/diseases, and depletes specific soil nutrients. 7. BURNING CROP RESIDUE: Releases CO2, CO, particulate matter causing air pollution and destroying beneficial soil organisms.

Tip: Agricultural impacts: fertilisers -> soil damage + eutrophication; pesticides -> biomagnification; irrigation -> waterlogging; deforestation -> erosion.

COMMON MISTAKES TO AVOID

MISTAKE 1: Confusing biomagnification with eutrophication

BIOMAGNIFICATION: Increasing concentration of non-biodegradable pollutants (DDT, pesticides) at HIGHER trophic levels of food chain. DDT in apex predator > DDT in fish > DDT in water. EUTROPHICATION: Excessive algae growth in water bodies due to NUTRIENT enrichment (nitrates, phosphates). Causes oxygen depletion and fish death. These are COMPLETELY DIFFERENT phenomena.

MISTAKE 2: Thinking energy flows bidirectionally / in cycles

Energy flow is STRICTLY UNIDIRECTIONAL: Sun -> T1 -> T2 -> T3 -> T4. Energy NEVER flows backwards. MATTER (nutrients, carbon, nitrogen) CYCLES through ecosystems. ENERGY only flows in one direction and is lost as heat at each step. Common exam question: 'Why is energy flow unidirectional?' Answer: heat loss is irreversible.

MISTAKE 3: Forgetting that ecosystem includes BOTH biotic AND abiotic

Ecosystem = Biotic (all living organisms) + Abiotic (non-living factors: temperature, soil, water, air). Q29 in this chapter tests this: 'Ecosystem = Biotic components' is WRONG. Community = only biotic components. Ecosystem = community + abiotic environment.

MISTAKE 4: Confusing trophic level positions

T1 = Producers (plants) -- MAXIMUM energy. T2 = Primary consumers (herbivores). T3 = Secondary consumers (carnivores). T4 = Tertiary consumers (top carnivores). Decomposers are NOT part of main food chain. Grasshopper = primary consumer (not producer). Frog = secondary consumer.

MISTAKE 5: Wrong calculation using 10% law

10% law: multiply by 10 going DOWN (towards producers), divide by 10 going UP. Example: T4 = 5 kJ. T3 = 5 x 10 = 50 kJ. T2 = 500 kJ. T1 = 5000 kJ. Direction matters! Common error: multiplying going UP instead of dividing.

MISTAKE 6: Thinking CFC/ozone only affects lungs

Ozone layer depletion -> more UV radiation reaches Earth. UV causes: skin cancer, eye cataracts, immune system damage. UV does NOT directly cause lung damage or peptic ulcers. CFCs are from refrigerators/ACs/aerosols -- the main cause of ozone depletion.

QUICK REVISION TABLE

Topic	Key Point	Exam Tip
Ecosystem	Biotic + Abiotic components; self-sustaining unit	Ecosystem =/= only biotic (Community = only biotic)
Artificial ecosystem	Created and maintained by humans	Examples: crop field, aquarium, garden, zoo
Trophic levels	T1=Producers, T2=Herbivores, T3=Carnivores, T4=Top carnivores	T1 has MAX energy; T4 has MINIMUM energy
10% Law	Only 10% energy transfers per level; 90% lost as heat	To find T1 from T4: multiply by 10 three times
Energy flow	Always UNIDIRECTIONAL: Sun->T1->T2->T3->T4	Energy flows; matter cycles. Heat loss = irreversible
Food chain limit	Energy decrease limits chains to 4-5 levels	By T5 only 0.001% of T1 energy remains
Decomposers	Bacteria + fungi; organic -> inorganic; nutrient recycling	Without decomposers: nutrients locked, ecosystem coll
Biomagnification	Non-biodegradable toxins INCREASE up food chain	DDT: highest in apex predators, lowest in water/soil

Biodegradable	Broken down by microbes; paper, food, cotton, wood	Non-biodegradable: plastic, DDT, glass, metal, CFC
Ozone depletion	CFCs from refrigerators/ACs destroy ozone	UV effects: skin cancer + immune damage (NOT lungs)
Eutrophication	Nitrates+phosphates -> excessive algae -> O2 depletion	From fertiliser runoff; kills fish; different from biomagnifi
Food web vs chain	Chain: linear, less stable. Web: networked, more stable	Web has multiple pathways; chain has only one
Pond vs aquarium	Pond: natural, self-sustaining (has decomposers)	Aquarium: artificial, needs cleaning (no decomposers)
Green plants absorb	Only 1% of solar radiation for photosynthesis	NOT 5%, 8% or 10% -- 1% is the correct value