UNIQUE STUDY POINT

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Class: X	**Subject:** Science	**Session:** 2025-26
Chapter: 13 - Our Environment	**Time:** 1½ Hours	**Max. Marks:** 40

General Instructions:

1. All questions are compulsory.
2. This question paper contains 20 questions divided into five sections A, B, C, D and E.
3. Section A contains 10 MCQs of 1 mark each.
4. Section B contains 4 questions of 2 marks each.
5. Section C contains 3 questions of 3 marks each.
6. Section D contains 1 question of 5 marks.
7. Section E contains 2 Case Study Based questions of 4 marks each.

SECTION A - Multiple Choice Questions (1 mark each)

Q1. An ecosystem consists of:

(a) Only biotic components

(b) Only abiotic components

(c) Both biotic and abiotic components

(d) Neither biotic nor abiotic components

Q2. Which of the following is a producer?

(a) Cow

(b) Green plant

(c) Lion

(d) Mushroom

Q3. At which trophic level are herbivores present?

(a) First

(b) Second

(c) Third

(d) Fourth

Q4. What percentage of solar energy is captured by green plants?

(a) About 1%

(b) About 10%

(c) About 50%

(d) About 100%

Q5. The Montreal Protocol was signed in:

(a) 1985
(b) 1987
(c) 1990
(d) 1992

Q6. Which of the following materials takes the longest time to decompose?
(a) Paper
(b) Cotton cloth
(c) Plastic
(d) Vegetable peel

Q7. Organisms that feed on dead organic matter are called:
(a) Producers
(b) Consumers
(c) Saprophytes
(d) Autotrophs

Q8. Which radiation does ozone layer protect us from?
(a) Infrared
(b) Visible light
(c) Ultraviolet
(d) Gamma rays

Q9. An example of a natural ecosystem is:
(a) Garden
(b) Crop field
(c) Lake
(d) Aquarium

Q10. The maximum concentration of pesticides will be found in:
(a) Producers
(b) Primary consumers
(c) Secondary consumers
(d) Tertiary consumers

SECTION B - Short Answer Questions (2 marks each)

Q11. Name the three types of consumers in an ecosystem and give one example of each.

Q12. What will happen if decomposers are removed from an ecosystem?

Q13. Why is damage to the ozone layer a cause for concern?

Q14. Give two examples each of natural and artificial ecosystems.

SECTION C - Short Answer Questions (3 marks each)

Q15. Explain the 10% law of energy transfer in an ecosystem with an example.

Q16. What are the problems caused by non-biodegradable wastes that we generate?

Q17. Describe how an aquarium can be made self-sustaining. What components are necessary?

SECTION D - Long Answer Question (5 marks)

Q18. What is waste management? Discuss the methods of dealing with biodegradable and non-biodegradable waste separately. Suggest ways to reduce waste generation.

SECTION E - Case Study Based Questions (4 marks each)

Q19. Case Study 1:

A pond ecosystem has algae, water plants, small fish, large fish, and bacteria. The algae and water plants produce their own food using sunlight. Small fish eat algae and plants, while large fish eat small fish. When organisms die, bacteria decompose them.

(i) Identify producers and decomposers in this ecosystem. (1 mark)
(ii) Why do we find more algae and plants than large fish in this pond? (1 mark)
(iii) Draw a food chain from this pond with 4 organisms. (1 mark)
(iv) What would happen if all bacteria were removed from this pond? (1 mark)

Q20. Case Study 2:

Scientists discovered that the ozone layer over Antarctica had developed a large hole. Research showed that CFCs released from refrigerators, air conditioners, and aerosol sprays were responsible. International action was taken to phase out CFC production.

(i) What is the chemical formula of ozone? (1 mark)
(ii) Why is the ozone layer important for life on Earth? (1 mark)
(iii) Name the international agreement that helped reduce CFC emissions. (1 mark)
(iv) What alternatives are now being used instead of CFCs? (1 mark)

DETAILED ANSWER KEY - PAPER 02

SECTION A - Answers to MCQs

Ans 1. (c) Both biotic and abiotic components

An ecosystem consists of all interacting organisms (biotic) and the physical environment (abiotic) in a particular area working together as a functional unit.

Ans 2. (b) Green plant

Green plants are producers as they produce their own food through photosynthesis using sunlight, water, and carbon dioxide.

Ans 3. (b) Second

Herbivores are primary consumers that feed directly on producers. They occupy the second trophic level in a food chain.

Ans 4. (a) About 1%

Green plants capture approximately 1% of the solar energy that falls on their leaves and convert it into chemical energy through photosynthesis.

Ans 5. (b) 1987

The Montreal Protocol was signed in 1987 by UNEP to control and phase out the production of ozone-depleting substances like CFCs.

Ans 6. (c) Plastic

Plastic is non-biodegradable and can take hundreds to thousands of years to decompose, unlike paper, cotton, and vegetable peels which decompose relatively quickly.

Ans 7. (c) Saprophytes

Saprophytes (decomposers like bacteria and fungi) feed on dead organic matter and break it down into simpler substances.

Ans 8. (c) Ultraviolet

The ozone layer absorbs harmful ultraviolet (UV) radiation from the Sun, protecting life on Earth from its damaging effects.

Ans 9. (c) Lake

A lake is a natural ecosystem. Gardens, crop fields, and aquariums are human-made (artificial) ecosystems.

Ans 10. (d) Tertiary consumers

Due to biological magnification, the concentration of pesticides increases at each successive trophic level. Tertiary consumers, being at the top, have the maximum concentration.

SECTION B - Answers to Short Answer Questions

Ans 11.

Three types of consumers:

1. **Herbivores (Primary Consumers):** Animals that feed on plants
   Example: Deer, rabbit, grasshopper, cow

2. **Carnivores (Secondary/Tertiary Consumers):** Animals that feed on other animals
   Example: Lion, tiger, snake, eagle

3. **Omnivores:** Animals that feed on both plants and animals
   Example: Human beings, bear, crow

Ans 12.

If decomposers are removed from an ecosystem:

- Dead organic matter (dead plants and animals) will accumulate
- Complex organic substances will not be broken down into simpler inorganic substances
- Nutrients will not be returned to the soil
- Soil will become depleted of essential nutrients
- Plants will not get minerals for growth
- The ecosystem will collapse as nutrient cycling will stop

Ans 13.

Damage to the ozone layer is a cause for concern because:

- Ozone layer shields Earth from harmful ultraviolet (UV) radiation from the Sun
- UV radiation is highly damaging to living organisms
- It can cause skin cancer in human beings
- It can damage eyes and cause cataracts
- It can harm marine ecosystems, especially phytoplankton
- It can affect crop yields and plant growth
- Depletion allows more UV radiation to reach Earth's surface

Ans 14.

Natural Ecosystems: These develop on their own without human interference
Examples: Forest, pond, lake, ocean, desert, grassland

Artificial (Human-made) Ecosystems: These are created and maintained by humans
Examples: Garden, crop field, aquarium, park, dam reservoir

SECTION C - Answers to Short Answer Questions

Ans 15.

10% Law of Energy Transfer:
Only about 10% of the energy available at one trophic level is transferred to the next trophic level. The remaining 90% is lost through various metabolic processes.

Explanation:

- When organisms consume food, not all energy is converted to body mass
- Energy is used for movement, growth, reproduction, and maintaining body temperature
- Much energy is lost as heat during respiration

• Some energy is lost in undigested food waste
• Only approximately 10% is stored in the organism's body and becomes available to the next level

Example:
• Suppose plants (producers) capture 10,000 J of energy
• Herbivores (deer) eating these plants will get only 1,000 J (10%)
• Carnivores (tiger) eating deer will get only 100 J (10% of 1,000)
• Top carnivores will get only 10 J (10% of 100)

This is why food chains are limited to 3-4 trophic levels - too little energy remains after that.

Ans 16.

Problems Caused by Non-biodegradable Waste:

1. Environmental Pollution:
• Persists in the environment for very long periods
• Pollutes soil, water bodies, and air
• Plastic waste clogs water bodies and drains

2. Harm to Wildlife:
• Animals may eat plastic waste and die
• Marine animals get entangled in plastic debris
• Toxic chemicals from waste can poison animals

3. Health Hazards:
• Breeding ground for disease-carrying organisms
• Toxic substances can enter food chains
• Burning plastic releases harmful gases

4. Land Use Problems:
• Takes up valuable landfill space
• Makes soil infertile
• Reduces aesthetic value of landscapes

Ans 17.

Making a Self-Sustaining Aquarium:

A self-sustaining aquarium requires a balanced ecosystem with all necessary components:

Essential Components:

1. Physical Components:
• A large transparent container (glass jar or tank)
• Clean water
• Gravel or sand for the bottom
• Adequate sunlight or artificial light

2. Biological Components:

• Aquatic plants (producers) - for oxygen production and food
• Small fish (consumers) - in appropriate numbers
• Snails or other decomposers - to break down waste

3. How it Becomes Self-Sustaining:
• Plants produce oxygen through photosynthesis
• Fish use oxygen and release CO_2
• Plants use CO_2 for photosynthesis
• Fish waste provides nutrients for plants
• Decomposers break down dead matter
• Natural food chains are established

Maintenance:
• Even self-sustaining aquariums need periodic cleaning
• Remove excess waste and dead organic matter
• Monitor fish population to prevent overcrowding
• Ensure adequate light reaches the system

SECTION D - Answer to Long Answer Question

Ans 18.

Waste Management:
Waste management refers to the collection, transport, processing, recycling, and disposal of waste materials in a way that minimizes their impact on human health and the environment.

Methods of Dealing with Biodegradable Waste:

1. Composting:
• Collect organic waste separately
• Allow decomposition in compost pits
• Use the resulting compost as manure for plants

2. Vermicomposting:
• Use earthworms to convert organic waste into nutrient-rich compost
• Produces high-quality manure

3. Biogas Production:
• Use organic waste to produce biogas (methane)
• Provides clean cooking fuel
• Remaining slurry can be used as fertilizer

4. Landfilling:
• Controlled burial in designated areas
• Natural decomposition occurs over time

Methods of Dealing with Non-biodegradable Waste:

1. Recycling:
• Separate paper, plastic, glass, and metal

• Send to recycling facilities
• Convert into new products

2. Reuse:
• Use items multiple times before disposal
• Examples: refilling bottles, using cloth bags

3. Safe Disposal:
• Proper collection and transport to authorized sites
• Incineration at high temperatures (for certain wastes)
• Secure landfilling with proper treatment

4. Recovery of Materials:
• Extract valuable materials from e-waste
• Recover metals from discarded items

Ways to Reduce Waste Generation:

1. Reduce:
• Buy only what is needed
• Avoid excessive packaging
• Use products with longer life

2. Reuse:
• Use cloth bags instead of plastic
• Reuse containers and jars
• Donate old items instead of throwing them

3. Recycle:
• Separate waste for recycling
• Support recycled products

4. Refuse:
• Say no to unnecessary items
• Avoid disposable products
• Refuse plastic bags and straws

5. Behavioral Changes:
• Carry own water bottles and containers
• Use digital documents instead of paper
• Compost kitchen waste at home

SECTION E - Answers to Case Study Based Questions

Ans 19.

(i) Producers and Decomposers:

Producers: Algae and water plants (they produce their own food using sunlight through

photosynthesis)

Decomposers: Bacteria (they break down dead organic matter)

(ii) Why More Algae and Plants than Large Fish:

This follows the concept of energy pyramid and biomass pyramid:

- Producers (algae, plants) capture solar energy and are at the base
- Only 10% of energy transfers to each next level
- To support even one large fish, many small fish are needed
- To support small fish, even more algae and plants are needed
- Therefore, producer population is always largest
- As we move up trophic levels, population decreases

(iii) Food Chain:

Algae → Small fish → Large fish → Bacteria (decomposer)

Or:

Water plants → Small fish → Large fish → Bacteria

(iv) Effect of Removing Bacteria:

- Dead organisms and waste would accumulate in the pond
- Nutrients would not be recycled back into the ecosystem
- Water quality would deteriorate
- Decomposition would slow down drastically
- Plants would not get essential nutrients
- Eventually, the pond ecosystem would collapse

Ans 20.

(i) Chemical Formula of Ozone: O_3 (three atoms of oxygen bonded together)

(ii) Importance of Ozone Layer:

- Shields Earth's surface from harmful ultraviolet (UV) radiation from the Sun
- UV radiation can cause skin cancer and eye damage in humans
- It protects all life forms from the damaging effects of UV rays
- Without ozone layer, life as we know it would not be sustainable on Earth

(iii) International Agreement: The Montreal Protocol (signed in 1987 under the United Nations Environment Programme - UNEP)

(iv) Alternatives to CFCs:

- Hydrofluorocarbons (HFCs) - less harmful to ozone layer
- Hydrochlorofluorocarbons (HCFCs) - transitional substitutes
- Ammonia-based refrigerants
- Hydrocarbon refrigerants
- Carbon dioxide-based systems
- CFC-free aerosol propellants

Note: The Montreal Protocol made it mandatory for all manufacturing companies worldwide to produce CFC-free refrigerators and other products.

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