Ecosystem and Food Chain

Components of Ecosystem

Our environment consists of both living (biotic) and non-living (abiotic) components. The interaction between these components forms an ecosystem. Biotic components include producers, consumers, and decomposers, while abiotic components include water, air, soil, and sunlight.

Types of Ecosystem

There are two main types of ecosystems: natural and artificial. Natural ecosystems exist on their own in nature, such as forests, lakes, and oceans. Artificial ecosystems are man-made, such as gardens, crop fields, and aquariums.

Producers, Consumers, and Decomposers

Producers are green plants and certain photosynthetic bacteria that make their own food using sunlight through photosynthesis. Consumers depend on producers or other consumers for food and include herbivores (plant-eaters), carnivores (meat-eaters), omnivores (eat both plants and animals), and parasites (organisms living on or inside

hosts). Decomposers, such as bacteria and fungi, break down dead organic matter into simpler substances, recycling nutrients back into the soil.

Food Chain and Food Web

A food chain is a sequence of organisms where each is eaten by the next member in the chain, showing the flow of energy from producers to various consumers and finally to decomposers. A food web is a network of interconnected food chains representing the feeding relationships within an ecosystem.

Trophic Levels and Energy Flow

Trophic levels are the steps in a food chain where energy transfer occurs. Producers form the first trophic level, herbivores the second, carnivores the third, and so on. Only about 10% of the energy at one trophic level is transferred to the next; the rest is used in metabolic processes or lost as heat. This limits food chains to typically 3–4 trophic levels.

Biological Magnification

Harmful chemicals like pesticides accumulate in increasing concentrations at higher trophic levels, a process called biological magnification. This can lead to toxic effects on top-level consumers, including humans.

Solved Examples

Practice Set

- **Level 1:** Define producers, consumers, and decomposers with examples.
- **Level 2:** Explain why food chains usually have only 3–4 trophic levels.
- **Level 3:** If a plant captures 1000 J of energy from sunlight, how much energy is available to the secondary consumers? Show calculations.

Answer Key

Level 1: Producers are organisms that make their own food (e.g., green plants). Consumers eat other organisms (e.g., herbivores like grasshoppers). Decomposers break down dead matter (e.g., fungi).

Level 2: Food chains have 3–4 trophic levels because only about 10% of energy is transferred to the next level; the rest is lost, so energy becomes insufficient to support more levels.

Level 3: Energy at producer level = 1000 J
Energy at primary consumer (herbivore) = 10% of 1000 J = 100 J
Energy at secondary consumer (carnivore) = 10% of 100 J = 10 J

Biodegradable Waste and Ozone

Types of Waste

Waste materials are unwanted substances discarded after use. They are classified as biodegradable (can be decomposed by microorganisms, e.g., fruit peels, paper) and non-biodegradable (cannot be decomposed easily, e.g., plastics, metals).

Waste Management Methods

Biodegradable waste can be processed in biogas plants to produce energy and manure. Sewage treatment plants clean wastewater before releasing it into rivers. Landfilling involves burying waste in designated areas. Composting converts organic waste into manure. The three Rs—Reduce, Reuse, and Recycle—are important for minimizing waste and pollution.

Ozone Layer Formation and Importance

Ozone (O_3) is formed in the stratosphere by ultraviolet radiation acting on oxygen molecules. It absorbs harmful ultraviolet rays from the Sun, protecting life on Earth. The ozone layer is concentrated 20–30 km above the Earth's surface.

Ozone Depletion Causes and Effects

Ozone depletion occurs mainly due to chlorofluorocarbons (CFCs) and nitrogen monoxide released by human activities. These chemicals break down ozone molecules, thinning the ozone layer and allowing more ultraviolet rays to reach the Earth, causing health and environmental problems.

Protection Measures

Ozone layer protection involves stopping the release of CFCs, reducing nitrogen monoxide emissions, and minimizing the use of air conditioners. The Montreal Protocol is an international treaty aimed at controlling ozone-depleting substances.

Solved Examples

Practice Set

- **Level 1:** Differentiate between biodegradable and non-biodegradable waste with examples.
- **Level 2:** Explain how the ozone layer protects living organisms.
- **Level 3:** Describe the role of the Montreal Protocol in ozone layer protection.

Answer Key

Level 1: Biodegradable waste can be decomposed by microorganisms (e.g., vegetable peels), while non-biodegradable waste cannot (e.g., plastic).

Level 2: The ozone layer absorbs harmful ultraviolet radiation from the Sun, preventing it from reaching the Earth's surface and protecting living organisms from damage.

Level 3: The Montreal Protocol is an international agreement to reduce and stop the production of ozone-depleting substances like CFCs, helping to restore the ozone layer.

Quick Reference Table

Common Mistakes and Misconceptions

• Confusing producers, primary consumers, secondary consumers, and decomposers in food chains and food webs.
• Mislabeling biodegradable and non-biodegradable wastes.
• Incorrectly explaining energy transfer between trophic levels.
• Associating ozone depletion with general pollution instead of specific chemicals like CFCs.

Glossary

Ecosystem: A community of living organisms interacting with their non-living environment.
Producers: Organisms that make their own food through photosynthesis.
Consumers: Organisms that eat other organisms for food.
Decomposers: Organisms that break down dead matter and recycle nutrients.
Food Chain: A sequence showing who eats whom in an ecosystem.
Food Web: A network of interconnected food chains.
Trophic Level: A step in a food chain representing a feeding position.
Biodegradable Waste: Waste that can be decomposed by microorganisms.
Non-biodegradable Waste: Waste that cannot be easily decomposed.
Ozone Layer: A layer in the stratosphere containing ozone that protects Earth from ultraviolet radiation.
Chlorofluorocarbons (CFCs): Chemicals that cause ozone depletion.
Montreal Protocol: An international treaty to protect the ozone layer by controlling CFC emissions.