Class: 10th

Subject: Biology

Chapter 16: Man and His Environment

Important MCQs:

1. A group of organisms of the same species living in a specific area at a particular time is called:

(a) Community

(b) Population ✅

(c) Ecosystem

(d) Species

2. Which level of biological organization includes all living organisms and the regions they inhabit on Earth?

(a) Ecosystem

(b) Biosphere ✅

(c) Community

(d) Population

3. A group of different populations that interact with each other in a habitat is called:

(a) Community ✅

(b) Population

(c) Ecosystem

(d) Species

4. The combination of biotic and abiotic components interacting together is known as:

(a) Biosphere

(b) Community

(c) Ecosystem ✅

(d) Habitat

5. Which of the following is an example of an artificial ecosystem?

(a) Pond

(b) Forest

(c) Aquarium ✅

(d) Lake

6. What are the non-living components of an ecosystem called?

(a) Biotic components

(b) Organic components

(**c**) Abiotic components ✅

(d) Living factors

7. Which organisms synthesize food from inorganic materials?

(a) Consumers

(b) Decomposers

(c) Heterotrophs

(**d**) Producers ✅

8. What are the floating photosynthetic organisms in aquatic ecosystems called?

(a) Zooplankton

(**b**) Phytoplankton ✅

(c) Protozoa

(d) Algae

9. Which organisms break down dead matter into simpler substances?

(a) Producers

(b) Herbivores

(c) Decomposers ✅

(d) Carnivores

10. Which of the following is a secondary carnivore (tertiary consumer)?

(a) Rabbit

(b) Fox

(c) Owl ✅

(d) Grasshopper

11. The level at which an organism feeds in a food chain is called:

(a) Food step

(b) Consumer level

(c) Trophic level ✅

(d) Biomass level

12. Which is the primary source of energy for all ecosystems?

(a) Plants

(b) Soil

(c) Sun ✅

(d) Water

13. The process by which producers convert solar energy into chemical energy is:

(a) Respiration

(b) Transpiration

(c) Fermentation

(d) Photosynthesis ✅

14. The energy flow in a food chain is:

(a) Cyclic

(b) Unidirectional ✅

(c) Bidirectional

(d) Random

15. Which organisms transform energy into mechanical and heat energy during metabolism?

(a) Only consumers

(b) Only producers

(c) Both producers and consumers ✅

(d) Only decomposers

16. A food chain always starts with:

(a) Herbivore

(b) Carnivore

(c) Producer ✅

(d) Decomposer

17. A network of interlinked food chains is called:

(a) Food block

(b) Energy loop

(c) Food web ✅

(d) Biomass chain

18. Who introduced the concept of ecological pyramids in 1927?

(a) Charles Darwin

(**b**) Charles Elton ✅

(c) Robert Hooke

(d) Carl Linnaeus

19. Which type of ecological pyramid shows the number of individuals at each trophic level?

(a) Pyramid of Biomass

(**b**) Pyramid of Numbers ✅

(c) Pyramid of Energy

(d) Pyramid of Decomposition

20. In a terrestrial ecosystem, maximum biomass is found in:

(a) Tertiary consumers

(b) Primary consumers

(**c**) Producers ✅

(d) Secondary consumers

21. Which process brings carbon from the atmosphere into the living world?

(a) Respiration

(b) Photosynthesis ✅

(c) Combustion

(d) Decomposition

22. The major source of carbon for living organisms is:

(a) Glucose

(b) Oxygen

(c) Carbon dioxide ✅

(d) Fossil fuels

23. What is released back into the atmosphere during respiration and decomposition?

(a) Oxygen

(b) Nitrogen

(c) Carbon dioxide ✅

(d) Methane

24. Human activities like deforestation and burning of fossil fuels increase:

(a) Nitrogen

(b) Oxygen

(c) Carbon dioxide ✅

(d) Water vapor

25. The greenhouse effect and global warming are mainly caused by excess:

(a) Oxygen

(b) Carbon dioxide ✅

(c) Nitrogen

(d) Sulfur dioxide

26. Which gas is most abundant in the atmosphere but cannot be directly used by most organisms?

(a) Oxygen

(b) Carbon dioxide

(c) Nitrogen ✅

(d) Hydrogen

27. The process of converting nitrogen gas into nitrates is called:

(a) Nitrification

(b) Ammonification

(c) Assimilation

(**d**) Nitrogen fixation ✅

28. Which bacteria convert ammonia into nitrites?

(a) Nitrobacter

(**b**) Nitrosomonas ✅

(c) Denitrifying bacteria

(d) Rhizobium

29. The biological process of converting nitrates back to nitrogen gas is called:

(a) Nitrification

(**b**) Denitrification ✅

(c) Ammonification

(d) Fixation

30. What is the process called in which plants absorb nitrates to make proteins?

(**a**) Assimilation ✅

(b) Nitrification

(c) Respiration

(d) Photosynthesis

31. What are interactions between members of the same species called?

(a) Interspecific interactions

(b) Intraspecific interactions ✅

(c) Predator-prey interactions

(d) Symbiosis

32. Which type of competition is more intense?

(a) Interspecific

(b) Intraspecific ✅

(c) Symbiotic

(d) Commensalism

33. In predation, the organism that is hunted and eaten is called the:

(a) Predator

(b) Host

(c) Parasite

(d) Prey ✅

34. Which of the following is an example of a carnivorous plant?

(a) Pea

(b) Rose

(c) Pitcher plant ✅

(d) Neem

35. Which relationship helps control the population of prey in nature?

(a) Mutualism

(b) Predation ✅

(c) Commensalism

(d) Parasitism

36. In parasitism, the organism that benefits and harms the other is called the:

(a) Host

(b) Symbiont

(c) Parasite ✅

(d) Predator

37. Tapeworm and Plasmodium are examples of:

(a) Ectoparasites

(b) Endoparasites ✅

(c) Mutualists

(d) Predators

38. In mutualism, both species:

(a) Are harmed

(b) Are benefited ✅

(c) One benefits, other is harmed

(d) One benefits, other is neutral

39. Rhizobium bacteria living in root nodules of leguminous plants show:

(a) Parasitism

(b) Commensalism

(c) Mutualism ✅

(d) Predation

40. Sucker fish attaching to a shark is an example of:

(a) Mutualism

(b) Commensalism ✅

(c) Parasitism

(d) Predation

41. What maintains the balance in ecosystems by recycling natural resources?

(a) Deforestation

(b) Food chains

(c) Biogeochemical cycles ✅

(d) Global warming

42. Which human activity has greatly upset the balance in ecosystems?

(a) Photosynthesis

(b) Tree plantation

(c) Cutting of trees ✅

(d) Nitrogen fixation

43. The trapping of heat in Earth's atmosphere by certain gases is known as:

(a) Acid rain

(**b**) Greenhouse effect ✅

(c) Carbon fixation

(d) Fossil burning

44. Which of the following is a greenhouse gas?

(a) Oxygen

(b) Nitrogen

(**c**) Carbon dioxide ✅

(d) Sulfur dioxide

45. The rise in Earth's average temperature due to greenhouse gases is called:

(a) Acidification

(**b**) Global warming ✅

(c) Solar radiation

(d) Urbanization

46. Global warming leads to:

(a) Increase in biodiversity

(b) Decrease in sunlight

(c) Melting of glaciers and sea-level rise ✅

(d) Less rainfall

47. The Maldives are at risk of becoming uninhabitable due to:

(a) Acid rain

(b) Earthquakes

(c) Rising sea levels ✅

(d) Industrial pollution

48. Which international organization formed the Intergovernmental Panel on Climate Change (IPCC)?

(a) WHO

(b) WWF

(c) United Nations ✅

(d) Greenpeace

49. Which gases are responsible for acid rain?

(a) Carbon dioxide and methane

(b) Sulphur and nitrogen oxides ✅

(c) Oxygen and ozone

(d) Helium and hydrogen

50. What is the pH range of acid rain?

(a) 0 to 2

(b) 3 to 6 ✅

(c) 6 to 7

(d) 7 to 10

51. How does acid rain damage buildings and monuments?

(a) By freezing

(b) By bleaching

(c) By forming soluble compounds ✅

(d) By staining

52. What is deforestation?

(a) Planting trees in deserts

(b) Clearing forests for human use ✅

(c) Growing forests naturally

(d) Burning fossil fuels

53. One major consequence of deforestation is:

(a) Decreased rainfall

(b) Increased photosynthesis

(c) Soil erosion ✅

(d) Decreased urbanization

54. The world's population is expected to reach 8 billion by:

(a) 2020

(b) 2025 ✅

(c) 2035

(d) 2050

55. What is urbanization?

(a) Decrease in city population

(b) Movement of people from cities to villages

(c) Growth of cities due to rural migration ✅

(d) Building dams in cities

56. What is pollution?

(a) A useful change in the environment

(b) A natural process

(**c**) Any undesirable change in air, water, or land ✅

(d) A seasonal change

57. Which of the following is a major source of air pollution?

(a) Afforestation

(**b**) Industrial and automobile emissions ✅

(c) Recycling

(d) Photosynthesis

58. Burning of petroleum produces:

(a) Methane

(**b**) Sulphur dioxide ✅

(c) Oxygen

(d) Fluorine

59. Which industry releases cotton dust and chlorine as air pollutants?

(a) Fertilizer industry

(b) Textile industry ✅

(c) Steel industry

(d) Thermal industry

60. What causes smog formation in the atmosphere?

(a) Dust and smoke

(b) Oxygen and ozone

(c) Hydrocarbons and nitrogen oxides in sunlight ✅

(d) Sulphur and water

61. Ozone depletion is mainly caused by:

(a) Sulphur dioxide

(b) Chlorofluorocarbons (CFCs) ✅

(c) Nitrogen

(d) Carbon monoxide

62. What is the role of the ozone layer?

(a) Reflects sunlight

(b) Produces oxygen

(c) Absorbs ultraviolet rays ✅

(d) Filters smog

63. Which of the following is a method to control air pollution?

(a) Using fossil fuels

(b) Afforestation ✅

(c) More industrialization

(d) Open burning

64. Lead-free fuels help in reducing:

(a) Carbon dioxide

(b) Sulphur emissions

(c) Lead pollution ✅

(d) Smog

65. Water pollution can result from:

(a) Fresh rain

(b) Industrial and sewage waste ✅

(c) Use of clean energy

(d) Tree plantation

66. One major source of organic water pollution is:

(a) Pesticides

(**b**) Sewage ✅

(c) Oil spills

(d) Plastics

67. Fertilizers and pesticides in water bodies cause:

(a) Filtration

(**b**) Eutrophication ✅

(c) Distillation

(d) Freezing

68. What causes oil to stay on the water surface and block oxygen exchange?

(a) Petroleum smoke

(**b**) Oil spills ✅

(c) Plastic waste

(d) Algal blooms

69. Mercury and lead contamination in water can

cause:

(a) Better health

(b) Nervous system damage ✅

(c) Plant growth

(d) Solar energy increase

70. What was established under the Kasur Tannery Pollution Control Project?

(a) Airport

(b) Tannery mills

(c) Effluent treatment plant ✅

(d) Textile center

71. Which heavy metal was found in Kasur's drinking water?

(a) Sodium

(b) Calcium

(c) Mercury ✅

(d) Zinc

72. What is the effect of algal bloom in water

bodies?

(a) Increases oxygen

(b) Promotes biodiversity

(**c**) Reduces oxygen and light ✅

(d) Clears water

73. What kind of water pollutants can enter food chains?

(a) Biodegradable

(**b**) Non-biodegradable ✅

(c) Organic

(d) Gas-based

74. Which activity changes soil pH and affects cultivation?

(a) Oil spills

(**b**) Acid rain ✅

(c) Irrigation

(d) Reforestation

75. One way to control land pollution is to:

(a) Increase pesticide use

(b) Scatter waste

(c) Recycle non-biodegradable materials ✅

(d) Use nuclear waste

76. What is meant by conservation of nature?

(a) Planting trees only

(b) Saving money for future use

(c) Conservation of natural resources ✅

(d) Collection of wild animals

77. Which of the following is a non-renewable natural resource?

(a) Air

(b) Water

(c) Fossil fuels ✅

(d) Sunlight

78. Which principle ensures sustainable use of resources?

(a) 5Rs

(b) Recycle Only

(c) Reduce, Reuse, Recycle ✅

(d) Replace and Reuse

79. What is the main goal of the 'Reduce' strategy?

(a) To increase solid waste

(b) To stop using water

(c) To use less and avoid wastage ✅

(d) To throw things quickly

80. Which of the following is an example of reuse?

(a) Burning plastic

(b) Throwing paper in trash

(c) Using a glass jar for storage again ✅

(d) Dumping containers in landfills

81. Recycling helps in:

(a) Increasing water use

(b) Decreasing waste volume ✅

(c) Wasting natural resources

(d) Making more fossil fuels

82. What was the goal of Pakistan's National Conservation Strategy (1992)?

(a) To increase population

(b) To conserve wildlife only

(c) To conserve and use resources efficiently ✅

(d) To build factories

83. What is the objective of National Drinking Water and Sanitation Policy?

(a) To sell bottled water

(b) To increase water pollution

(c) To provide clean water and conserve it ✅

(d) To drain lakes and rivers

84. Which project was launched by UNDP in 2006 in Pakistan?

(a) Plant for Pakistan

(b) Mass Awareness for Water Conservation ✅

(c) Safe Water Act

(d) Water Filter for All

85. What is the full name of WWF now?

(a) World Water Fund

(b) World Wildlife Forum

(c) World Wide Fund for Nature ✅

(d) Wild Forest Foundation

Exercise Short Questions:

1. What are the different levels of ecological organization?

Answer:

The different levels of ecological organization are:

- Organism
- Population
- Community
- Ecosystem
- Biosphere

2. Define ecosystem and its components.

Answer:

An ecosystem is a self-sufficient unit formed by the interaction of biotic (living) and abiotic (non-living) components.

- Biotic components include producers, consumers, and decomposers.
- Abiotic components include light, air, water, soil, and minerals.

3. How is the flow of energy different from that of materials?

Answer:

Energy flow in an ecosystem is unidirectional—from Sun ⇒ Producers ⇒ Consumers ⇒ Decomposers.

Material flow is cyclic, as nutrients and elements are recycled through biogeochemical cycles.

4. Define food chain and food web.

Answer:

A food chain is a linear sequence of organisms where each feeds on the previous one.

(e.g., Grass ⇒ Grasshopper ⇒ Frog ⇒ Snake ⇒ Eagle)

A food web is a complex network of interconnected food chains in an ecosystem.

5. What do you mean by the concept of 3Rs with reference to the conservation of natural resources?

Answer:

The 3Rs stand for:

Reduce: Minimize resource usage and avoid waste.

Reuse: Use items again instead of throwing them.

Recycle: Process materials like paper, plastic, and glass to make new products.

This concept helps conserve both renewable and non-renewable natural resources.

Important Short Questions:

1. What is ecology?

Answer:

Ecology is the branch of biology that deals with the study of interrelationship between organisms and their environment.

2. What is meant by environment?

Answer:

Environment is the sum of all physical (abiotic) and biological (biotic) conditions that affect an organism.

3. Define population.

Answer:

A population is a group of organisms of the same species inhabiting a specific geographical area at a particular time.

4. What is a community in ecology?

Answer:

A community is the group of all populations living and interacting in a particular habitat.

5. Define ecosystem with examples.

Answer:

An ecosystem is a self-sufficient unit formed by interaction between biotic and abiotic components.

Examples: Pond, forest, aquarium.

6. What is biosphere?

Answer:

The biosphere is the sum of all ecosystems on Earth. It includes all living organisms and the regions they inhabit, from ocean floors to mountain tops.

7. Name the two main components of an ecosystem.

Answer:

The two main components of an ecosystem are:

- Abiotic components (light, air, water, soil)
- Biotic components (producers, consumers, decomposers)

8. Who are producers in an ecosystem?

Answer:

Producers are autotrophs like plants, algae, and

photosynthetic bacteria that make their own food through photosynthesis.

9. What are primary and secondary consumers?

Answer:

- Primary consumers are herbivores that feed on producers (e.g., rabbit, deer).
- Secondary consumers are carnivores that feed on primary consumers (e.g., frog, snake).

10. What role do decomposers play in an ecosystem?

Answer:

Decomposers break down dead plants and animals into simpler substances, returning nutrients to the environment. Examples include bacteria and fungi.

11. What is a trophic level?

Answer:

The level at which an organism feeds in a food chain is called a trophic level.

12. Name the first trophic level in an ecosystem.

Answer:

The first trophic level consists of producers (e.g. plants, algae).

13. Define food chain.

Answer:

A food chain is a series of organisms in which each feeds on the previous one and is food for the next.

14. What is a food web?

Answer:

A food web is a network of interconnected food chains at various trophic levels.

15. What is the direction of energy flow in an ecosystem?

Answer:

Energy flows in a unidirectional way—from the Sun to producers to consumers to decomposers.

16. What is the source of energy in an ecosystem?

Answer:

The Sun is the primary source of energy in all

ecosystems.

17. What happens to energy at each trophic level?

Answer:

At each trophic level, useful energy decreases, mostly lost as heat during metabolism.

18. Define ecological pyramid.

Answer:

An ecological pyramid is a graphical representation of the number of individuals, biomass, or energy at different trophic levels.

19. What is pyramid of numbers?

Answer:

It shows the number of individuals at each trophic level in a given area.

20. What is pyramid of biomass?

Answer:

It shows the total biomass (living mass) at each trophic level in a specific area.

21. What is the carbon cycle?

Answer:

The carbon cycle is the cyclic movement of carbon between environment and organisms through processes like photosynthesis, respiration, decomposition, and combustion.

22. Which process brings carbon into the living world?

Answer:

Photosynthesis brings carbon into the living world by converting CO_2 into organic compounds.

23. What is nitrogen fixation?

Answer:

Conversion of atmospheric nitrogen gas into nitrates by bacteria, lightning, or industry is called nitrogen fixation.

24. What is ammonification?

Answer:

It is the process of breaking proteins of dead organisms and wastes into ammonia by

ammonifying bacteria.

25. What is denitrification?

Answer:

Denitrification is the conversion of nitrates/nitrites back to nitrogen gas by denitrifying bacteria, completing the nitrogen cycle.

26. What is meant by intraspecific and interspecific interactions?

Answer:

Intraspecific interactions occur between members of the same species, while interspecific interactions occur between members of different species.

27. Why is intraspecific competition more severe than interspecific competition?

Answer:

Because members of the same species have similar needs and compete for identical resources.

28. What is the role of competition in an ecosystem?

Answer:

Competition helps maintain a balance between available resources and population size.

29. Define predation and give one example.

Answer:

Predation is an interaction in which one organism (predator) kills and feeds on another (prey).

Example: Frog eats mosquito.

30. How do carnivorous plants obtain their nutrients?

Answer:

They trap and digest insects to fulfill their nitrogen needs due to lack of minerals in the soil.

31. How is predation helpful in biological control?

Answer:

Predators are released to control the population of pests and weeds naturally.

32. What is parasitism? Give one example of an ectoparasite.

Answer:

It is a relationship where a parasite derives food and shelter from the host and harms it.

Example: Mosquito.

33. Differentiate between ectoparasites and endoparasites.

Answer:

Ectoparasites live on the host's surface; endoparasites live inside the host's body.

34. What is mutualism? Give one example.

It is a symbiotic relationship where both species benefit.

Example: Rhizobium bacteria and leguminous plants.

35. What is commensalism? Give one example.

Answer:

It is a relationship where one organism benefits, and the other is neither harmed nor benefited.

Example: Epiphytes on large trees.

36. What is meant by ecosystem balance?

Answer:

It refers to the steady and balanced interaction between organisms and their environment.

37. How do biogeochemical cycles help maintain ecosystem balance?

Answer:

By recycling natural resources so they do not deplete.

38. What is global warming?

Answer:

It is the rise in Earth's temperature due to the buildup of greenhouse gases in the atmosphere.

39. Name three important greenhouse gases.

Answer:

Carbon dioxide, methane, and nitrous oxide.

40. What is the greenhouse effect?

Answer:

It is the process in which greenhouse gases trap heat in the Earth's atmosphere like a greenhouse glass.

41. What is acid rain and how is it formed?

Answer:

Acid rain is rain mixed with acidic compounds formed when sulphur and nitrogen oxides react with water vapour.

42. Give two harmful effects of acid rain.

Answer:

It destroys aquatic life and damages buildings, especially historical monuments.

43. What is deforestation and how does it affect the environment?

Answer:

Deforestation is the clearing of forests which leads to floods, soil erosion, droughts, and habitat loss.

44. What is meant by urbanization?

Answer:

It is the growth of cities due to people migrating from rural areas for better opportunities.

45. Why is overpopulation a threat to ecosystem balance?

It increases resource consumption, causes pollution, and disturbs the natural balance.

46. What is pollution?

It is any undesirable change in air, water, or land that may harm living organisms and natural resources.

47. Define air pollution.

Air pollution is the contamination of air by harmful substances like industrial and vehicle emissions.

48. Name any three air pollutants.

Answer:

Carbon monoxide, sulphur dioxide, nitrogen oxides.

49. What is smog and how is it formed?

Answer:

Smog is a yellowish-brown haze formed by the

reaction of hydrocarbons and nitrogen oxides in sunlight.

50. What is acid rain?

Answer:

Rain that contains sulphuric and nitric acids formed by atmospheric pollutants reacting with water.

51. What is ozone depletion and what causes it?

Answer:

It is the destruction of ozone layer caused by chemicals like CFCs, allowing UV rays to reach Earth.

52. How can afforestation help control air pollution?

Answer:

Plants absorb and filter air pollutants, thus reducing air pollution.

53. What are environment-friendly fuels?

Fuels like lead-free petrol and sulphur-free coal that reduce harmful emissions.

54. Define water pollution.

Answer:

It is the contamination of water by harmful substances that affect aquatic life and human health.

55. What is eutrophication?

Answer:

It is the enrichment of water with nutrients like nitrates and phosphates, leading to algal blooms.

56. How do pesticides pollute water?

Answer:

Pesticides enter water bodies through rainwater and seepage, remaining for long periods and entering the food chain.

57. What is the effect of oil spills on aquatic life?

Answer:

Oil forms a layer on water, preventing oxygen exchange and causing death of aquatic animals.

58. Name two heavy metals that pollute water and their effect on humans.

Answer:

Mercury and lead: they can cause cancer, nervous system damage, and joint diseases.

59. What is land pollution?

Answer:

It is the contamination of soil by chemicals, garbage, radioactive waste, and pesticides.

60. How can we control land pollution?

Answer:

By proper waste disposal, recycling non-biodegradable materials, and using organic pesticides.

61. What is meant by conservation of nature?

Answer:

It means the careful use and protection of natural resources to prevent their depletion.

62. Why should non-renewable resources be conserved?

Answer:

Because their reserves are limited and cannot be replenished once exhausted.

63. What are the 3Rs in conservation and what do they mean?

Answer:

Reduce (use less), Reuse (use again), and Recycle (process materials for reuse).

64. What is the role of WWF-Pakistan in conservation?

Answer:

WWF-Pakistan runs various projects like wetland conservation, forest assessment, and water security projects.

65. What is the aim of the National Drinking Water and Sanitation Policy?

Answer:

To provide clean drinking water to all and conserve water resources.

Important Long Questions:

🌟 **Q1: Explain the different levels of biological organization in ecology.**

❖ **Introduction:**

Ecology is the study of the interactions between living organisms and their environment. In ecology, the levels of biological organization describe how life is structured and grouped in nature.

🔹 1. Organism:

- It is the basic unit of biological organization.
- An organism may be unicellular (single-celled) like bacteria or multicellular like humans.
- It performs all life processes independently.

🧪 **Example**: A single frog, a human being, or an alga.

🔹 2. Population:

- A population is a group of organisms of the same species living in a particular area at the same time.

- They interact, reproduce, and share resources.

🧪 **Example**: A group of frogs in a pond.

🔹 3. Community:

- A community is formed by all populations living in a particular habitat.
- It includes many species (plants, animals, microbes) that interact in different ways (competition, predation, etc.).

🧪 **Example**: All frogs, fish, insects, algae, and plants living in a pond.

🔹 4. Ecosystem:

- An ecosystem is the interaction between living (biotic) and non-living (abiotic) components of an environment.
- It is a self-sufficient system.
- It may be natural (pond, forest) or artificial (aquarium).

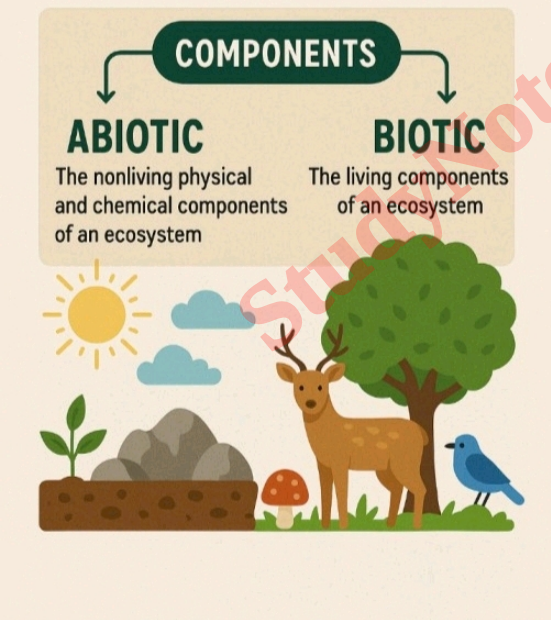
🧪 **Example**: Forest, lake, aquarium.

🔹 5. Biosphere:

- The biosphere is the sum of all ecosystems on Earth.
- It includes all life forms and the regions they inhabit – from deep oceans to mountain tops.
- It is about 20 km thick.

🧪 **Example**: Whole Earth's life zone – air, land, and water.

🌟 **Q2: What is an ecosystem? Describe its components in detail.**



❖ **Definition of Ecosystem:**

An ecosystem is a self-contained unit of nature, formed by the interaction between biotic (living) and abiotic (non-living) components of the environment.

🔹 1. Abiotic Components:

These are the non-living parts of an ecosystem.

They influence and support life.

Main abiotic components:

Light: Needed for photosynthesis.

Water: Essential for all life processes.

Air: Provides oxygen and carbon dioxide.

Soil: Source of minerals for plants.

Temperature & Climate

🔹 2. Biotic Components:

These are the living organisms in an ecosystem.

They are divided into three main groups:

✅ a. Producers (Autotrophs):

They make their own food through photosynthesis.

Provide energy to all other organisms.

Examples:

- Plants (on land)
- Algae, phytoplankton (in water)

✅ b. Consumers (Heterotrophs):

- Cannot make their own food.
- Depend on producers or other consumers.

Types of Consumers:

- **Primary Consumers** (Herbivores): Eat plants

Examples: Cow, rabbit, deer

- **Secondary Consumers** (Primary Carnivores): Eat herbivores

Examples: Frog, fox, snake

- **Tertiary Consumers** (Top Carnivores): Eat secondary consumers

Examples: Lion, tiger, eagle

✅ c. Decomposers (Reducers):

- Break down dead organisms and return nutrients to the environment.
- Help in recycling of matter.

Examples: Bacteria and fungi

📝Summary:

An ecosystem is a complete system of life and environment, where living organisms and non-living factors interact in a balanced way. Both components are essential for ecosystem stability.

🌟 Q3: Differentiate between producers, consumers, and decomposers in an ecosystem.

❖ Introduction:

In an ecosystem, living organisms interact with one another and with their environment. Based on how they obtain energy, organisms are classified into three main groups: producers, consumers, and decomposers. Each plays a distinct and essential role in the ecosystem.

🔸 1. Producers

Definition:

Producers are organisms that can make their own food through the process of photosynthesis. They convert solar energy into chemical energy (glucose).

Function:

They form the base of all food chains by supplying

energy-rich food to other organisms. Producers also release oxygen into the environment.

Examples:

Green plants, algae, and photosynthetic bacteria.

🔸 2. Consumers

Definition:

Consumers are organisms that cannot produce their own food. They depend on other organisms (plants or animals) for energy and nutrients.

Types and Roles:

Primary consumers: Herbivores that eat plants.

Secondary consumers: Carnivores that feed on herbivores.

Tertiary consumers: Top predators that feed on other carnivores.

Function:

Consumers transfer energy from one organism to another and help regulate population sizes within the ecosystem.

Examples:

Cow, deer (herbivores), frog, fox (carnivores), lion, eagle (top predators).

🔸 3. Decomposers

Definition:

Decomposers are organisms that break down dead plants, animals, and waste materials into simpler substances.

Function:

They recycle nutrients back into the soil and water, making them available for producers. Decomposers help maintain the cleanliness and nutrient balance of the ecosystem.

Examples:

Bacteria and fungi.

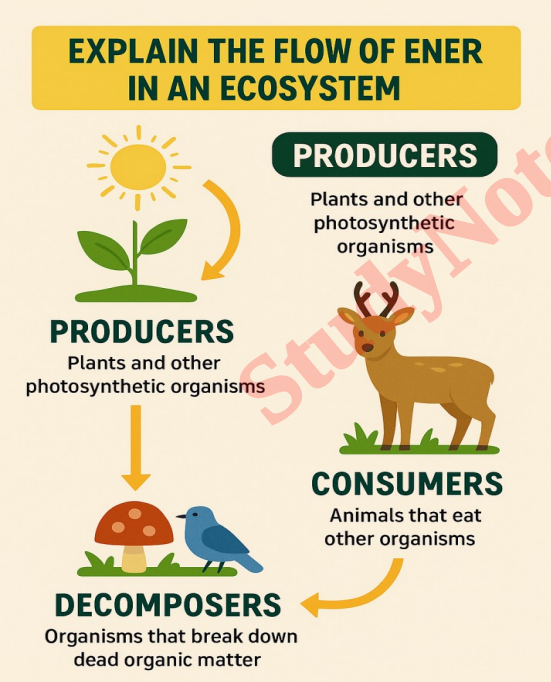
🖋️ Summary:

- The roles of producers, consumers, and decomposers are interconnected and form the foundation of all ecosystems.

- Producers generate food and energy.
- Consumers utilize this energy through feeding relationships.
- Decomposers return nutrients to the environment for reuse.

Together, they maintain the balance and sustainability of life in nature.

🌟 Q4: Explain the flow of energy in an ecosystem.



❖ Introduction:

In an ecosystem, energy flows in one direction—from the sun to producers and then to various consumers. This flow of energy takes place

through trophic levels in the food chain and helps sustain life processes.

🔸 1. Role of the Sun

- The Sun is the primary source of energy for all ecosystems.
- Producers absorb solar energy to perform photosynthesis and convert light energy into chemical energy.

🔸 2. Producers and Energy Conversion

Green plants, algae, and some bacteria (producers) convert solar energy into glucose.

A portion of this energy is used by producers for their own metabolism, and the rest is stored in their tissues.

🔸 3. Transfer of Energy to Consumers

- When herbivores (primary consumers) feed on producers, energy is transferred.
- This energy is again partially used for body functions (mechanical and heat energy), while the rest is stored in their bodies.

- Carnivores feed on herbivores and continue the transfer.

🔸 4. Role of Decomposers

After producers and consumers die, decomposers (like bacteria and fungi) break down their bodies.

This releases the remaining stored energy back into the environment in the form of heat or nutrients.

🔸 5. Law of Thermodynamics

According to the First Law of Thermodynamics, energy cannot be created or destroyed, only transformed.

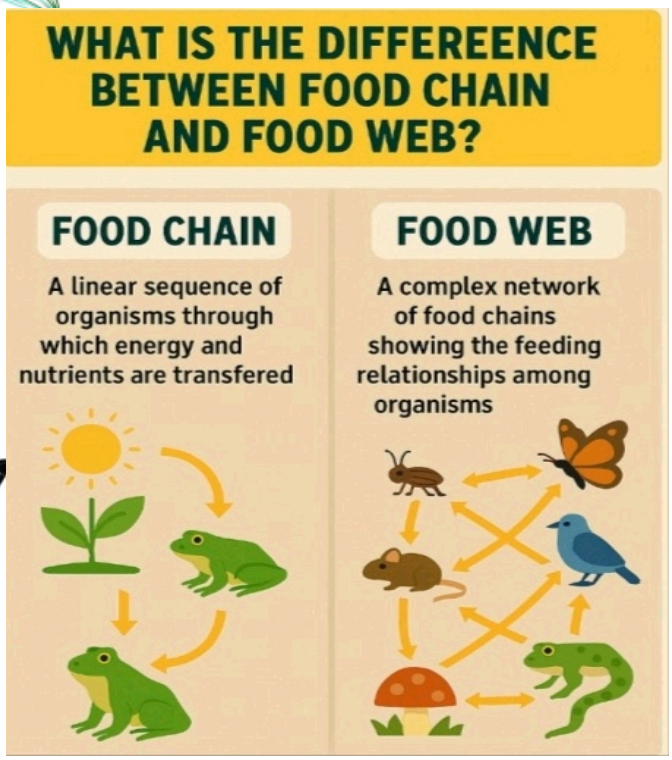
In each trophic level, some energy is lost as heat, making energy transfer inefficient.

🔸 6. Unidirectional Flow

Energy flows only in one direction (Sun ⇒ producers ⇒ consumers ⇒ decomposers).

It cannot be recycled like materials.

🌟 Q5: What is the difference between food chain and food web? Explain with examples.



❖ Introduction:

A food chain and a food web describe the feeding relationships in an ecosystem. They show how energy and nutrients flow between organisms.

🔸 1. Food Chain

- A food chain is a linear sequence showing who eats whom.
- It always begins with a producer and ends with a top consumer.

Example:

Grass ⇒ Grasshopper ⇒ Frog ⇒ Snake ⇒ Eagle

🔸 2. Characteristics of Food Chain

Usually consists of 4 to 5 trophic levels.

Energy is transferred step by step.

Shorter chains are more efficient.

🔸 3. Food Web

- A food web is a network of interconnected food chains.
- It shows how multiple organisms are interlinked through various feeding relationships.
- It is more realistic and complex than a food chain.

🔸 4. Example of Food Web

In a grassland:

- Grass is eaten by grasshopper, rabbit, or deer.
- Rabbit may be eaten by fox or eagle.
- Fox may also eat the grasshopper or mouse.

✏️Summary:

A food chain is simple and shows one path of energy flow, while a food web represents all possible feeding connections in an ecosystem. A food web provides stability to the ecosystem.

🌟 **Q6: Describe ecological pyramids and explain its types with examples.**

❖ **Introduction:**

Ecological pyramids are graphical representations that show the relationship among organisms in different trophic levels of an ecosystem. The concept was introduced by Charles Elton in 1927.

🔸 **1. Pyramid of Numbers**

- It shows the number of individuals per unit area at each trophic level.
- Typically, the number of organisms decreases as you go higher in the food chain.

Example:

Many grass plants ⇒ fewer grasshoppers ⇒ fewer frogs ⇒ one snake

🔸 **2. Pyramid of Biomass**

It shows the total biomass (living mass) at each trophic level.

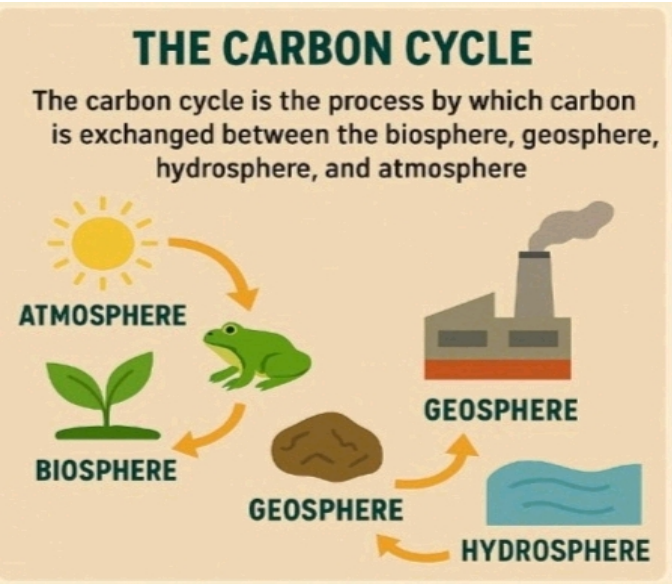
In terrestrial ecosystems, producers have the highest biomass.

Biomass decreases as we move to higher trophic levels.

🔸 3. Importance of Pyramids

- Helps understand energy transfer, population structure, and health of an ecosystem.
- Shows the efficiency and stability of food chains.

🌟 Q7: What are biogeochemical cycles? Describe the carbon cycle in detail.



❖ Introduction:

Biogeochemical cycles are natural processes that recycle essential elements like carbon, nitrogen, and water between the living organisms and the environment.

🔸 1. Importance of Carbon

Carbon is found in all organic molecules: carbohydrates, proteins, fats, etc.

It is present in the atmosphere as carbon dioxide.

🔸 2. Entry into Living Organisms

- Plants use photosynthesis to absorb CO_2 from the air and convert it into organic compounds.
- Carbon enters the food chain as plants are eaten by herbivores and then by carnivores.

🔸 3. Return to Environment

CO_2 returns to the atmosphere through:

- Respiration of plants and animals
- Decomposition by decomposers
- Burning of fossil fuels and wood

🔸 4. Human Impact

- Deforestation and burning of fossil fuels increase CO_2 levels.
- This leads to the greenhouse effect and global warming.

🌟 Q8: Write a detailed note on nitrogen cycle.

❖ Introduction:

Nitrogen is essential for proteins and DNA. Although 78% of the air is nitrogen, most organisms cannot use it directly. The nitrogen cycle converts nitrogen into usable forms and returns it to the atmosphere.

🔸 1. Nitrogen Fixation

Atmospheric fixation: Lightning converts nitrogen into nitrates.

Biological fixation: Bacteria like Rhizobium fix nitrogen in plant roots.

Industrial fixation: Ammonia is produced and used as fertilizer.

2. Ammonification

Decomposers break down dead organisms and waste into ammonia.

3. Nitrification

- Ammonia is converted to nitrites (NO_2^-) by Nitrosomonas.
- Nitrites are converted to nitrates (NO_3^-) by Nitrobacter.

4. Assimilation

- Plants absorb nitrates to build proteins.
- Animals get nitrogen by eating plants or other animals.

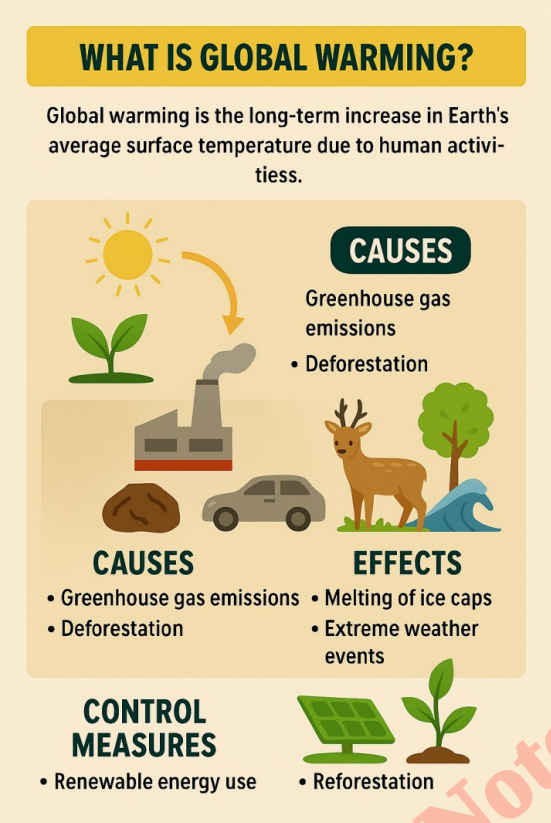
5. Denitrification

Denitrifying bacteria convert nitrates back to nitrogen gas, completing the cycle.

6. Human Impact

Overuse of nitrogen fertilizers causes pollution and disrupts aquatic systems.

🌟 Q9: What is Global Warming? What are its Causes, Effects, and Control Measures?



❖ Definition of Global Warming

Global warming is the gradual increase in the Earth's average temperature due to the accumulation of greenhouse gases in the atmosphere. These gases trap heat and prevent it from escaping into space.

☁️ Causes of Global Warming

1. Greenhouse Gases (GHGs):

The main contributors are carbon dioxide (CO_2), methane (CH_4), ozone (O_3), and nitrous oxide (N_2O).

These gases are released through burning fossil fuels, deforestation, and industrial emissions.

2. Greenhouse Effect Mechanism:

- Sunlight reaches Earth, and the surface converts it into heat energy.
- This heat is radiated back as infrared rays.
- GHGs trap the infrared radiation, warming the Earth's atmosphere.

3. Human Activities:

- Deforestation reduces the number of trees that absorb CO_2.
- Industrial processes and vehicles emit large amounts of GHGs.
- Since the 1800s, CO_2 levels have increased by 30%, and methane has more than doubled.

❄️ Effects of Global Warming

1. Melting of Ice Caps and Glaciers:

- Glaciers are melting faster than new ice can form.
- This causes rising sea levels and flooding.

2. Rise in Sea Level:

- Thermal expansion of ocean water and melting glaciers contribute to this.
- Maldives, a low-lying country, is at serious risk of being submerged in the next 100 years.

3. Weather Changes:

Increased temperatures cause extreme weather conditions, such as droughts, floods, and heatwaves.

🌐 Role of IPCC

- The Intergovernmental Panel on Climate Change (IPCC) was formed by the UN in 1990.
- It provides scientific research and guidance to world leaders on climate change.
- According to IPCC, Earth's temperature has increased by 0.2°C per decade over the last 30

years.

🌱 Control Measures

1. Reduce Fossil Fuel Use:

- Shift to renewable energy sources like solar and wind.
- Promote energy-efficient technologies.

2. Afforestation:

Plant more trees to absorb excess CO_2 from the atmosphere.

3. Public Awareness:

Educate people on eco-friendly practices and environmental conservation.

4. International Cooperation:

Follow international agreements like the Paris Climate Accord.

🌟 Q10: What is the Greenhouse Effect? Explain How Greenhouse Gases Affect the Earth's Temperature.

❖ Definition of Greenhouse Effect

The greenhouse effect is the process by which certain gases trap heat in the Earth's atmosphere, similar to how a glasshouse traps heat inside.

🌡️ How Greenhouses Work (Analogy)

- In a real greenhouse, sunlight enters through the glass.
- The heat gets trapped inside and cannot escape.
- Similarly, greenhouse gases in the atmosphere act like glass, trapping heat.

☁️ Main Greenhouse Gases

1. Carbon Dioxide (CO_2):

Released by burning fossil fuels.

2. Methane (CH_4):

Emitted by livestock, landfills, and agriculture.

3. Nitrous Oxide (N_2O):

From fertilizers and industrial processes.

🔁 Process of Trapping Heat

1. Sunlight reaches the Earth's surface.

2. Earth reflects back the energy as infrared radiation.

3. Greenhouse gases trap the infrared rays, preventing heat from escaping.

4. This increases the average atmospheric temperature.

📈 Rise in Temperature Due to Human Activity

Since the industrial revolution, the amount of:

- CO_2 increased by 30%
- Methane more than doubled
- Nitrous oxide increased by 8%

🖋️Summary:

The greenhouse effect is a natural phenomenon that keeps Earth warm. However, due to excess greenhouse gases, it has intensified, leading to global warming and climate change. Reducing emissions is essential to restore balance.

🌟 Q11: What is Overpopulation? How Does It Affect the Environment and Natural Balance?

❖ **Definition:**

Overpopulation occurs when the number of people exceeds the capacity of natural resources and infrastructure to support them sustainably.

📊 Global Statistics

- In 1750, the world population was 600 million.
- Now it is over 8 billion, and still growing.

🔍 Causes of Overpopulation

1. Industrial Revolution:

- Improved technologies and agriculture led to increased food supply.

2. Better Health Facilities:

- Lower death rates due to vaccines and medicines.
- Birth rates remained high.

⚠ Effects on Environment and Natural Balance

1. Resource Depletion:

- Overuse of food, water, fuel, and land.

- Scarcity of clean water and farmland.

2. Pollution:

More people = more waste, air and water pollution.

3. Habitat Destruction:

- Forests cut down for housing and agriculture.
- Endangers wildlife and biodiversity.

4. Unemployment and Poverty:

- Fewer job opportunities.
- Poor quality of life in overpopulated areas.

5. Climate Change Acceleration:

Higher demand for fossil fuels and transport.

💡 Solutions

1. Education and Awareness:

- Promote education, especially for women.
- Awareness about responsible parenting.

2. Family Planning:

Encourage use of contraceptives and small families.

3. Government Policies:

Provide incentives for population control programs.

🌟 Q12: What is Pollution? Explain Air Pollution, its Sources, Effects, and Control Measures.

❖ Definition of Pollution:

Pollution refers to any undesirable change in the physical, chemical, or biological characteristics of air, water, or land that negatively affects living organisms and natural resources.

🔹 What is Air Pollution?

Air pollution is defined as the contamination of air due to the addition of harmful substances, especially due to human activities like industrial processes and fuel burning.

🔹 Major Sources of Air Pollution:

Industrial emissions (fertilizer, textile, thermal, and steel industries)

Vehicle exhausts

Burning of fossil fuels (coal, petroleum)

Domestic burning (wood, waste materials)

Common Air Pollutants:

- Carbon monoxide (CO)
- Sulphur dioxide (SO_2)
- Nitrogen oxides (NOx)
- Chlorofluorocarbons (CFCs)
- Particulate matter (dust, soot)
- Hydrocarbons

Effects of Air Pollution:

Smog formation: Mixture of gases (NOx + hydrocarbons + sunlight) that causes visibility issues and respiratory problems.

Acid rain: SO_2 and NOx react with water vapor, forming sulphuric and nitric acid – damaging buildings, soil, and aquatic life.

Ozone depletion: CFCs destroy the ozone layer, allowing harmful UV rays to reach Earth – leads to skin cancer and global warming.

Respiratory diseases: Increased asthma, bronchitis,

and allergies in polluted cities.

🔹 Control Measures:

Afforestation: Planting trees to absorb pollutants.

Industrial filters: Using devices like scrubbers and filters to trap pollutants.

Use of eco-friendly fuels: Switching to lead-free petrol and low-sulphur coal.

Public awareness: Educating citizens on minimizing pollution sources.

🌟 Q13: Describe Water Pollution, Its Causes, Harmful Effects, and Methods of Control.

❖ Definition of Water Pollution:

Water pollution is the contamination of water bodies such as rivers, lakes, and oceans due to the addition of harmful substances, affecting aquatic life and human health.

🔹 Causes of Water Pollution:

Sewage: Contains human and animal waste, causes microbial growth.

Industrial waste: Acids, alkalis, dyes, and chemicals change water pH.

Fertilizers and pesticides: Washed into rivers by rain, enter groundwater.

Hot water discharge: From factories, increases water temperature.

Oil spills: Block oxygen exchange, suffocating aquatic organisms.

Heavy metals: Lead, mercury, cadmium from urban runoff and factories.

- **Effects of Water Pollution:**

Eutrophication: Excess nutrients lead to algae blooms ⇒ less oxygen ⇒ fish die.

Food chain contamination: Toxins enter fish ⇒passed to humans.

Epidemics: Waterborne diseases like cholera and gastroenteritis.

Biodiversity loss: Kills aquatic plants and animals.

- **Case Study: Kasur Tannery Pollution**

- 200+ tanneries discharge 9000 m³ of toxic waste daily.
- Resulted in cancer, kidney failure, and vision loss.
- UNDP + Pakistan Govt. launched the Kasur Tannery Pollution Control Project (effluent treatment plant, chromium plant, waste disposal site).

🔹 **Control Measures:**

- Sewage treatment before disposal.
- Industrial waste treatment using purification plants.
- Public awareness about waste management.
- Legislation against illegal dumping of waste.

🌟 **Q14: What is Land Pollution? Discuss Its Causes, Effects on Environment, and Control Methods.**

❖ **Definition of Land Pollution:**

Land (or soil) pollution is the degradation of the

earth’s surface caused by the disposal of harmful waste and chemicals, making land unfit for cultivation and habitation.

Causes of Land Pollution:

Pesticides and fertilizers: Leave behind chemical residues in soil.

Acid rain: Alters soil pH, making it unsuitable for plants.

Urban garbage: Plastic, glass, metal waste dumped in open areas.

Industrial chemicals: Untreated factory waste contaminates land.

Nuclear waste: Remains in soil for hundreds of years.

Open latrines: Spread diseases and pollute ground.

Effects of Land Pollution:

Infertility of soil: Reduces agricultural productivity.

Blocked water absorption: Due to plastic and non-permeable waste.

Toxic vegetables: Contaminants absorbed by crops ⇒ enter human food chain.

Habitat destruction: Affects animals, plants, and microbes in soil.

🔹 Control Measures:

Safe disposal of waste: Especially chemical and radioactive.

Recycling: Paper, glass, metal, plastic should be reused.

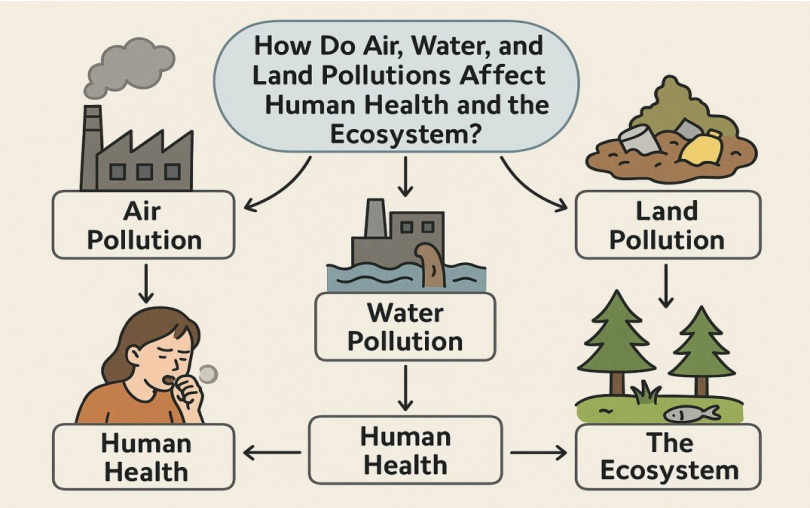
Organic farming: Replace inorganic with natural pesticides.

Proper sanitation: Avoid open defecation and waste dumping.

📝 Summary:

Land pollution silently threatens food security and environmental stability. It can be controlled through waste reduction, recycling, and eco-friendly agriculture.

🌟 Q15: How Do Air, Water, and Land Pollutions Affect Human Health and the Ecosystem?



Overview:

Pollution in air, water, and soil creates an unbalanced ecosystem, harms biodiversity, and leads to various chronic health issues in humans and animals.

Impact on Human Health:

Air pollution: Causes asthma, lung cancer, cardiovascular issues.

Water pollution: Spreads epidemics like cholera, hepatitis.

Land pollution: Toxic vegetables, heavy metal poisoning ⇒ organ damage, cancer.

Environmental Imbalance:

- Acid rain destroys forests and aquatic life.
- Eutrophication reduces oxygen, killing fish.
- Ozone depletion increases UV exposure ⇒ skin cancer.
- Global warming raises sea levels and causes extreme weather.

🔹 Disruption of Food Chains:

- Pollutants enter food chains via plants and fish.
- Accumulate in animal tissues (biomagnification).
- Affect humans at the top of the food chain.

🔹 Solutions:

Sustainable practices: Reduce, reuse, recycle.

Environmental education: Raise awareness.

Government policies: Enforce strict pollution control.

Global cooperation: Climate treaties, eco-projects.

📝 Summary:

All types of pollution are interconnected and together damage both the ecosystem and human civilization. Solutions require a combined effort by governments, industries, and individuals to protect the Earth.

Note:

This chapter is designed to provide a solid foundation of knowledge, with the goal of deepening understanding and encouraging further exploration of the subject. The content has been carefully selected to support effective learning and inspire students to engage with the topic more deeply.

Author: Muhammad Asghar

Purpose: To contribute to education by offering insightful, valuable content that enhances learning and understanding.

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