Our Environment

13.1 Ecosystem - What are its Components?

MCQ/VSA (1 mark)

1. Consider the following ecosystems :
   I. Ponds
   II. Forests
   III. Aquariums
   IV. Crop fields
   Out of these, the natural ecosystems are
   (a) I, II and III (b) II, III and IV
   (c) I and II only (d) I, II and IV
   (2020 C) U

2. What will happen if the deer are missing in the following food chain ?
   Grass → Deer → Tiger
   (a) The population of tigers will increase.
   (b) The amount of grass will decrease.
   (c) The tigers will die.
   (d) The tigers will start eating grass. *(2020 C)* Ap

3. A system of interdependent food chains represents
   (a) food web (b) trophic levels
   (c) ecosystem (d) community. *(2020 C)*

4. **Answer question number 4(i) to 4(iv) on the basis of your understanding of the following paragraph and the related studied concepts:**
   Human body is made up of five important components of which water is the main component. Food as well as potable water are essential for every human being. The food is obtained from plants through agriculture. Pesticides are being used extensively for a high yield in the fields. These pesticides are absorbed by the plants from the soil along with water and minerals and from the water bodies these pesticides are taken up by the aquatic animals and plants. As these chemicals are not biodegradable, they get accumulated progressively at each trophic level. The maximum concentration of these chemicals gets accumulated in our bodies and greatly affects the health of our mind and body.
   (i) Why is the maximum concentration of pesticides found in human beings? U
   (ii) Give one method which could be applied to reduce our intake of pesticides through food to some extent. Ev
   (iii) Various steps in a food chain represent
   (a) food web (b) trophic level
   (c) ecosystem (d) biomagnification.
   (iv) With regard to various food chains operating in an ecosystem, man is a
   (a) consumer
   (b) producer
   (c) producer and consumer
   (d) producer and decomposer. *(2020)* R

5. Food web is constituted by
   (a) relationship between the organisms and the environment
   (b) relationship between plants and animals
   (c) various interlinked food chains in an ecosystem
   (d) relationship between animals and environment.
   (2020) An

VSA (1 mark)

6. What is an ecosystem? *(Delhi 2017)*
7. Why is a lake considered to be a natural ecosystem? *(Delhi 2017)*
8. In the following food chain, plants provide 500 J of energy to rats. How much energy will be available to hawks from snakes?
   Plants → Rats → Snakes → Hawks *(AI 2017)* Ap
9. In the following food chain, 100 J of energy is available to the lion. How much energy was available to the producers?
   Plants → Deer → Lion *(AI 2017)*
10. List two biotic components of a biosphere. *(Delhi 2016)*
11. Why are green plants called producers? *(Delhi 2016)*
12. In a food chain of frog, grass, insect and snake, assign trophic level to frog. *(AI 2016)*
13. Why do producers always occupy the first trophic level in every food chain? *(Foreign 2016)*
14. We often use the word environment. What does it mean? *(Foreign 2016)*
15. Which of the following are always at the second trophic level of food chains?
    Carnivores, Autotrophs, Herbivores *(AI 2015)* R
16. The following organisms form a food chain. Which of these will have the highest concentration of non-biodegradable chemicals? Name the phenomenon associated with it.
    Insects, Hawk, Grass, Snake, Frog
    (Foreign 2015) Ap
17. List two examples of natural ecosystem.
    (Foreign 2015) R

SA I (2 marks)

18. Use of several pesticides which results in excessive accumulation of pesticides in rivers or ponds, is a matter of deep concern. Justify this statement. *(2023)*

19. (i) Why are crop fields considered as artificial ecosystems ?
    (ii) Write a common food chain of four steps operating in a terrestrial ecosystem.
    (Term II, 2021-22 C)

20. (i) List two human-made ecosystems.
    (ii) "We do not clean a pond in the same manner as we do in an aquarium." Give reason to justify this statement. *(Term II, 2021-22)* U

21. In the following food chain, only 2J of energy was available to the peacocks. How much energy would have been present in Grass? Justify your answer.
    Grass → Grasshopper → Frog → Snake → Peacock
    (Term II, 2021-22) Ap

22. What are decomposers? List two important roles they play in the environment. *(AI 2014)*

23. List two reasons to show that the existence of decomposers is essential in an ecosystem. *(AI 2014)*

24. State with reason any two possible consequences of elimination of decomposers from the earth. *(AI 2014)*

SA II (3 marks)

25. What are human-made ecosystems? Give an example. Can a human-made ecosystem become a self-sustaining ecosystem? Give reason to justify your answer. *(2022)*

26. (a) Name the group of organisms which form in the first trophic level of all food chains. Why are they called so?
    (b) Why are the human beings most adversely affected by biomagnification?
    (c) State one ill-effect of the absence of decomposers from a natural ecosystem.
    (Term II, 2021-22) U

27. What are consumers? Name the four categories under which the consumers are further classified.
    (2021 C)

28. (a) From the following group of organisms create a food chain which is most advantageous for human beings in terms of energy.

Hawk, Rat, Cereal plant, Goat, Snake, Human being

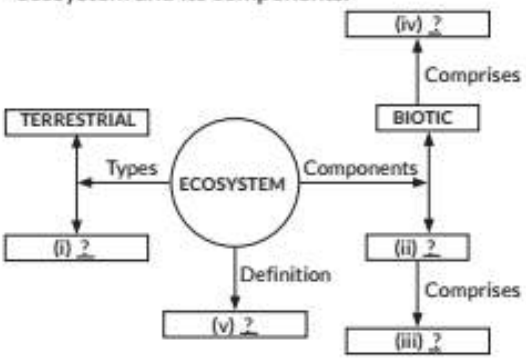
    (b) State the possible disadvantage if the cereal plant is growing in soil rich in pesticides.
    (c) Construct a food web using the organisms mentioned above. *(2020)* Ev

29. (a) Create a food chain of the following organisms.
    Insect, Hawk, Grass, Snake, Frog
    (b) Name the organism at the third trophic level of the created food chain.
    (c) Which organism of this food chain will have the highest concentration of non-biodegradable chemicals?
    (d) Name the phenomenon associated with it.
    (e) If 10,000 Joules of energy is available to frogs, how much energy will be available to snakes in this food chain? *(NCERT Exemplar, 2020)* Cr

30. (a) What is an ecosystem?
    (b) List any two natural ecosystems.
    (c) We do not clean ponds or lakes but an aquarium needs to be cleaned regularly. Why? *(2020)*

31. What is meant by trophic level in a food chain? Construct a terrestrial food chain with trophic levels. The energy flow in a food chain is always unidirectional. Why? *(2020)*

32. Complete the following flow chart based on ecosystem and its components.



(2020) An

33. (a) Construct a terrestrial food chain comprising four trophic levels.
    (b) What will happen if we kill all organisms in one trophic level?
    (c) Calculate the amount of energy available to the organisms at the fourth trophic level. If the energy available to the organisms at the second trophic level is 2000 J. *(2020)* An

34. (a) A food chain generally has three or four trophic levels. Explain.
    (b) What is biological magnification ? Explain.
    (2019 C)

35. Define an ecosystem. Draw a block diagram to show the flow of energy in an ecosystem. *(Delhi 2019)*

36. What is a food chain? Why is the flow of energy in an ecosystem unidirectional? Explain briefly. *(AI 2019)*

37. "Energy flow in food chains is always unidirectional." Justify this statement. Explain how the pesticides enter a food chain and subsequently get into our body. *(NCERT Exemplar, Foreign 2015, AI 2014)*

38. "Our food grains such as wheat and rice, the vegetables and fruits and even meat are found to contain varying amounts of pesticide residues." State the reason to explain how and why it happens. *(Delhi 2014)*

39. What is meant by food chain? "The number of trophic levels in a food chain is limited." Give reason to justify this statement. *(Foreign 2014)*

13.2 How do Our Activities Affect the Environment?

Ozone Layer and How it is Getting Depleted

MCQ

40. Choose the incorrect statement from the following:
    (a) Ozone is a molecule formed by three atoms of oxygen.
    (b) Ozone shields the surface of the earth from ultraviolet radiations.
    (c) Ozone is deadly poisonous.
    (d) Ozone gets decomposed by UV radiations. *(2020)*

VSA (1 mark)

41. The depletion of ozone layer is a cause of concern. Why? *(AI 2016)*

42. Why is excessive use of CFCs a cause of concern? *(Foreign 2016)* An

43. What is the function of ozone in the upper atmosphere? *(Delhi 2015)*

44. Write the full name of the group of compounds mainly responsible for the depletion of ozone layer. *(Foreign 2015)*

SA I (2 marks)

45. What is ozone? How is it formed in the upper layers of the earth's atmosphere? How does ozone affect our ecosystem? *(Term II, 2021-22)* R

SA II (3 marks)

46. How is ozone formed in the higher levels of the atmosphere? "Damage to the ozone layer is a cause of concern." Justify this statement. *(2023)*

47. (a) We do not clean ponds or lakes, but an aquarium needs to be cleaned regularly. Why?
    (b) Why is ozone layer getting depleted at the higher levels of the atmosphere? Mention one harmful effect caused by its depletion. *(Term II, 2021-22)* U

48. How is ozone layer formed? State its importance to all life forms on earth. Why the amount of ozone in the atmosphere dropped sharply in the 1980s? *(2020)* Ap

49. You have been selected to talk on "Ozone layer and its protection" in the school assembly on 'Environment Day'.
    (a) Why should ozone layer be protected to save the environment?
    (b) List any two ways that you would stress in your talk to bring in awareness amongst your fellow friends that would also help in protection of ozone layer as well as the environment. *(Delhi 2017)*

50. What is ozone? How and where is it formed in the atmosphere? Explain how does it affect an ecosystem. *(NCERT, Foreign 2015)* Ap

Managing the Garbage we Produce

MCQ

51. Disposable plastic plates should not be used because
    (a) they are made of non-biodegradable materials
    (b) they are made of biodegradable materials
    (c) they are made of toxic materials
    (d) they are made of materials with light weight. *(2020 C)* U

VSA (1 mark)

52. **Answer question numbers 52 (i) to 52 (iv) on the basis of your understanding of the following paragraph and the related studied concepts:**
    India today is facing the problem of overuse of resources, contamination of water and soil and lack of methods of processing the waste. The time has come for the world to say goodbye to "single use plastics". Steps must be undertaken to develop environment-friendly substitutes, effective plastics waste collection and methods of its disposal.
    Indore treated 15 lakhs metric tonnes of waste in just 3 years, through biomining and bioremediation techniques. Bioremediation involves introducing microbes into a landfill to naturally 'break' it down and biomining involves using trommel machines to sift through the waste to separate to 'soil' and the waste component. The city managed to chip away 15 lakh metric tonnes of waste at a cost of around ₹ 10 crore. A similar experiment was successfully carried out in Ahmedabad also.

(i) State two methods of effective plastic waste collection in your school.

(ii) Name any two uses of 'single use plastic' in daily life.

(iii) If we discontinue the use of plastic, how can an environment-friendly substitute be provided?

(iv) Do you think microbes will work similarly in landfill sites as they work in the laboratory? Justify your answer. *(2020)* An

53. Write one negative effect on the environment, of affluent lifestyle of few persons of a society.
(AI 2016, 2014)

54. Why should biodegradable and non-biodegradable wastes be discarded in two separate dustbins?
(Delhi 2015)

SA I (2 marks)

55. "Although gardens are created by man but they are considered to be an ecosystem." Justify this statement. *(2023)* Ev

56. What is the difference between biodegradable and non-biodegradable substances? List two methods of safe disposal of biodegradable domestic waste.
(2023) An

57. Kulhads (disposable cups made of clay) and disposable paper cups both are used as an alternative for disposable plastic cups. Which one of these two can be considered as a better alternative to plastic cups and why ? *(2022)* U

58. (a) What is meant by garbage? List two classes into which garbage is classified.

(b) What do we actually mean when we say that "enzymes are specific in their action"?
(Term II, 2021-22)

59. "Industrialisation has adversely deteriorated the environment." Give four reasons in support of this statement. *(Foreign 2016)* Ap

60. Why is Government of India imposing a ban on the use of polythene bags? Suggest two alternatives to these bags and explain how this ban is likely to improve the environment. *(Delhi 2014)*

61. In some states of our country there is a ban on the use of polythene bags for shopping. Why? List three advantages of using jute or cloth bags over polythene bags. *(Delhi 2014)*

62. "Affluent lifestyle has a negative effect on the environment." Justify this statement with the help of an example. *(Delhi 2014)* Ap

63. Give one example each from your daily life where the domestic waste can be effectively reused and recycled. *(AI 2014)*

64. "To discard the household waste we should have two separate dust-bins, one for the biodegradable waste and the other for the non-biodegradable waste." Justify this statement suggesting the proper way of disposal of these wastes.
(Foreign 2014)

65. We often observe domestic waste decomposing in the bylanes of residential colonies. Suggest ways to make the residents realise that the improper disposal of their waste is harmful to the environment.
(Foreign 2014) An

OR

Suppose you find a heap of domestic waste, in a nearby park, which is decomposing. What would you do to make the people of the surrounding area realise that such type of disposal of domestic waste is harmful to the environment? *(Foreign 2014)* Ev

SA II (3 marks)

66. Write one difference between biodegradable and non-biodegradable wastes. List two impacts of each type of the accumulated waste on environment if not disposed off properly. *(2023)* An

67. (a) Write two harmful effects of using plastic bags on the environment. Suggest alternatives to the usage of plastic bags.

(b) List any two practices that can be followed to dispose off the waste produced in our homes.
(2020)

68. After the examinations, Rakesh with his friends went on a picnic to a nearby park. All friends carried cooked food packed in plastic bags or plastic cans. After eating the food some friends collected the leftover food and plastic bags etc., and planned to dispose them off by burning. Rakesh immediately checked them and suggested to segregate the leftover food and peels of fruits from the plastic materials and respectively dispose them off separately in the green and red dustbins placed in the corner of the park.

(a) In your opinion, is burning plastic an eco-friendly method of waste disposal? Why? State the advantage of method suggested by Rakesh.

(b) How can we contribute in maintaining the parks and roads neat and clean?
(Delhi 2015) Ev

69. Differentiate between biodegradable and non-biodegradable substances with the help of one example each. List two changes in habit that people must adopt to dispose non-biodegradable waste, for saving the environment.
(NCERT Exemplar, AI 2015) An

CBSE Sample Questions

13.1 Ecosystem-What are its Components?

MCQ

1. **Assertion (A) :** Food chain is responsible for the entry of harmful chemicals in our bodies.
   Reason (R) : The length and complexity of food chains vary greatly.
   (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
   (b) Both (A) and (R) are true and (R) is not the correct explanation of (A).
   (c) (A) is true but (R) is false.
   (d) (A) is false but (R) is true. *(2020-21)* U

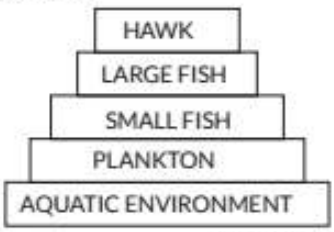
2. **Assertion (A) :** Greater number of individuals are present in lower trophic levels.
   Reason (R) : The flow of energy is unidirectional.
   (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
   (b) Both (A) and (R) are true and (R) is not the correct explanation of (A).
   (c) (A) is true but (R) is false.
   (d) (A) is false but (R) is true. *(2020-21)* U

VSA (1 mark)

3. Give reason why a food chain cannot have more than four trophic levels. *(2020-21)*

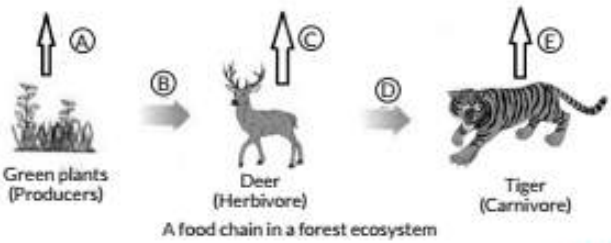
SA I (2 marks)

4. DDT was sprayed in a lake to regulate breeding of mosquitoes. How would it affect the trophic levels in the following food chain associated with a lake? Justify your answer.



(Term II, 2021-22) An

5. In the following food chain, vertical arrows indicate the energy lost to the environment and horizontal arrows indicate energy transferred to the next trophic level. Which one of the three vertical arrows (A, C and E) and which one of the two horizontal arrows (B and D) will represent more energy transfer? Give reason for your answer.



A food chain in a forest ecosystem

(Term II, 2021-22) Ap

13.2 How do Our Activities Affect the Environment?

VSA (1 mark)

6. Explain how ozone being a deadly poison can still perform an essential function for our environment. *(2020-21)*

SA I (2 marks)

7. A lot of waste is generated in neighborhood. However, almost all of it is biodegradable. What impact will it have on the environment or human health? *(2022-23)* U

8. Plastic cups were used to serve tea in trains in early days- these could be returned to the vendors, cleaned and reused. Later, *Kulhads* were used instead of plastic cups. Now, paper cups are used for serving tea. What are the reasons for the shift from plastic to *Kulhads* and then finally to paper cups? *(2020-21)*

SA II (3 marks)

9. Why is damage to the ozone layer a cause for concern? What are its causes and what steps are being taken to limit this damage? *(2022-23)*

10. Gas A, found in the upper layers of the atmosphere, is a deadly poison but is essential for all living beings. The amount of this gas started declining sharply in the 1980s.
    (a) Identify gas A. How is it formed at higher levels of the atmosphere?
    (b) Why is it essential for all living beings? State the cause for the depletion of this gas.

(Term II, 2021-22) Ap

Detailed SOLUTIONS

Previous Years' CBSE Board Questions

1. (c) : The ecosystem is self regulatory under natural conditions without any major interference by man, then it is called a natural ecosystem, e.g., Ponds, lake, desert, grassland, forest. Aquarium and crop fields are artificial ecosystem, maintained by man.

2. (c) : If deer are missing in the given food chain, then tiger will eventually die.

3. (a) : The inter-dependent food chains, operating within an ecosystem formed a network called food-web.

4. (i) The pesticides are not biodegradable, they get accumulated progressively at each trophic level. As human beings occupy the topmost level in food chain, their concentration becomes maximum in our bodies.
(ii) Biological methods can be used for controlling insects in fields and by washing fruits and vegetables before eating could help to reduce our intake of pesticides through food to some extent.
(iii) (b)
(iv) (a) : Man is a secondary consumer as they are dependent on plants (directly or indirectly) for their food needs.

Answer Tips

- Minimum Biomagnification = Lowest trophic level
- Maximum Biomagnification = Highest trophic level

5. (c)

6. An ecosystem is defined as a structural and functional unit of the biosphere. It comprises of living organisms and their non-living environment that interact by means of food chains and biogeochemical cycles resulting in energy-flow, biotic diversity and material cycling to form stable self-supporting system.

7. Lake is an ecosystem where living organisms grow, reproduce and interact among each other as well as with abiotic components and carry out other activities in nature by themselves without any human interference, therefore it is referred to as a natural ecosystem.

8. In an ecosystem, only 10% of energy is transferred from one trophic level to next, *i.e.*, 10 percent law and rest is dissipated into the environment. Therefore, if plants (being producers-1st trophic level)-transfer 500 J of energy to rats (2nd trophic level) then rats would transfer 50 J of energy to snakes (3rd trophic level) which in turn will transfer only 5 J of energy to hawks (4th or last trophic level) in a food chain.

Plants	→	Rats	→	Snakes	→	Hawks
5000 J		500 J		50 J		5 J

Concept Applied

- Lindeman's 10 percent law

9. As per 10% law of flow of energy in an ecosystem, only 10% of energy is received by the next trophic level. Hence, in the given food chain :
If 100 J of energy is available to lion, the plants or producers have 10,000 J of energy available to them.

Plants	→	Deer	→	Lion
10, 000 J		1000 J		100 J

10. Two biotic components of a biosphere are:
(i) Producers – Include organisms which can produce their food using simple inorganic compounds, *e.g.*, all green plants, blue green algae (cyanobacteria).
(ii) Consumers – Include organisms which are unable to synthesise their food, therefore, utilise materials and energy stored by the producers or eat other organisms, *e.g.*, all the animals.

Concept Applied

- Biotic components comprises of living organisms.

11. Green plants are called producers because they manufacture their own food with the help of CO_2 and H_2O in the presence of sunlight and chlorophyll.

Concept Applied

- Photosynthesis

12. In the given food chain, frog belongs to the third trophic level (T_3) as shown here :

Grass	→	Insect	→	Frog	→	Snake
T_1		T_2		T_3		T_4

13. Producers are the green plants that can manufacture food using CO_2 and H_2O in the presence of sunlight, *i.e.*, they are autotrophs. They serve as a source of food for all non-producers or consumers directly or indirectly. Hence, producers occupy the first trophic level in a food chain.

14. Environment can be defined as the physical or biological world where an organism lives. An organism's immediate surrounding constitutes its environment which includes both biotic and abiotic components.

15. Herbivores always occupy the second trophic level of food chains.

16. Among the following organisms of the food chain, hawk being top consumer is present at topmost trophic level, hence will have the highest concentration of non-biodegradable chemicals due to a phenomenon known as biomagnification.

Answer Tips

- Non-biodegradable chemicals get accumulated at each trophic level.

17. The two examples of natural ecosystem are : (i) Forest ecosystem and (ii) River ecosystem.

18. The use of several pesticides results in accumulation of pesticides in rivers and ponds. These chemicals are either washed down into the soil or into the water bodies. From the soil, these are absorbed by the plants along with water and minerals, and from the water bodies these are taken up by aquatic plants and animals and enters the food chain. As these chemicals are not degradable, these get accumulated progressively at each trophic level. As human beings occupy the top level in any food chain, the maximum concentration of these chemicals get accumulated in our bodies *i.e.*, biological magnification. Our food grains such as wheat and rice, vegetables and fruits, and even meat, contain varying amounts of pesticide residues cannot always be removed by washing or other means and causes health hazards.

19. (i) Crop fields are the artificial ecosystems because in crop fields, both biotic (living) and abiotic (non-living) components are manipulated by human beings. Humans can change edaphic factors by adding fertilisers, water, etc. Biotic components may be changed using biocides or adding useful organisms like earthworms etc.
(ii) A food chain consists of various organism at various trophic levels. In terrestrial ecosystem, a common food chain is

Grass → Grasshopper → Frog → Snake

20. (i) The two human made ecosystems are aquarium and garden.
(ii) We do not clean pond as we do in an aquarium because the waste generated in a pond is acted upon by the decomposers which convert them into simple soluble substances, whereas, in aquarium, the waste gets mixed with water and left untreated due to absence of decomposers.

Key Points

- Decomposers are best environmental cleaner.

21. In the given food chain, 20,000 J of energy must have been present in grass. This is because, as per the 10% law of energy transfer, only 10% of energy is transferred to the next trophic level.

$$\underset{\text{Grass}}{20{,}000\ \text{J}} \xrightarrow{10\%} \underset{\text{Grasshopper}}{2000\ \text{J}} \xrightarrow{10\%} \underset{\text{Frog}}{200\ \text{J}} \xrightarrow{10\%} \underset{\text{Snake}}{20\ \text{J}}$$

$$\xrightarrow{10\%} \underset{\text{Peacock}}{2\ \text{J}}$$

Key Points

- 90% of energy is lost when it moves from one trophic level to the next.

22. Decomposers are microorganisms including bacteria and fungi which decompose or breakdown the complex organic compound present in dead plants and animals into simpler substances.
Role of decomposers in environment are –
(i) They help in decomposing dead bodies of plants and animals and hence act as cleansing agents of environment.
(ii) They help in recycling of materials in the ecosystem to maintain its stability.

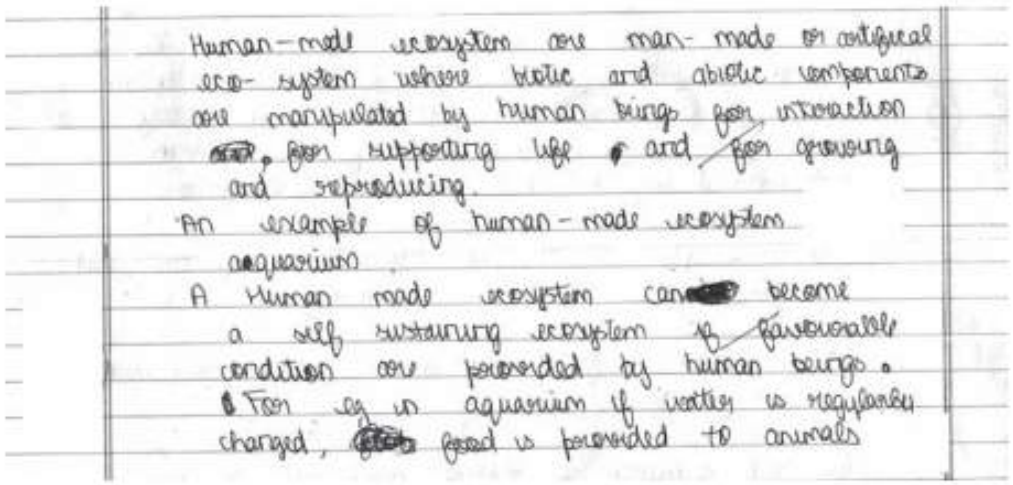
23. The existence of decomposers in an ecosystem is essential because:
(i) If there were no decomposers, then the dead bodies of plants and animals would keep lying as such and the elements constituting plant and animal bodies would never be returned to their original pools like soil, air and water. In such case, the organic wastes go on accumulating and the cyclic process of life and death would be disrupted.
(ii) Decomposers make the soil fertile by providing/ replenishing nutrients to it, thus forming the integral part of ecosystem.

Concept Applied

- Decomposers breakdown the dead remains and waste products of organisms.

24. Consequences of elimination of decomposers are :
(i) There would be no recycling of nutrients and therefore, raw materials to produce food will not be available to producers. Hence, the food chains will get affected.
(ii) The dead bodies of plants and animals will go on accumulating in the absence of decomposition thereby polluting the environment.

25.



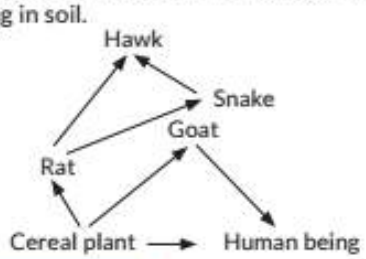
Human-made ecosystem are man-made or artificial eco-system where biotic and abiotic components are manipulated by human beings for interaction for supporting life and for growing and reproducing.
An example of human-made ecosystem aquarium.
A human made ecosystem can become a self sustaining ecosystem if favourable condition are provided by human beings.
For eg in aquarium if water is regularly changed, food is provided to animals

[Topper's Answer, 2022]

26. (a) Producers form the first trophic level of all food chains. They are called producers because they are autotrophic organisms which alone are able to manufacture organic food from inorganic raw materials by the process of photosynthesis. They capture sun's energy and convert it into chemical energy. The chemical energy is used in combining raw materials into organic food. This food is used up by themselves and rest enters the food chains as food for consumers.
(b) Human beings are most adversely affected by biomagnification because they occupy the highest trophic level in any food chain. As in biomagnification, successive concentration of non-biodegradable substances increases in the trophic level of food chains, so, it leads to most toxicity at highest trophic level. Hence, maximum concentration of chemicals get accumulated most in their body.
(c) Absence of decomposers will lead to the accumulation of dead remains and waste products of organisms in our natural ecosystem. The decomposers breakdown complex organic substances into simple inorganic substances, so, that it can go into the soil and can be used up by plants.

27. Consumers are the organisms which are unable to synthesise their own food. Therefore, they utilise materials and energy stored by the producers or eat other organisms. They are known as the heterotrophs. The consumers are of following categories:
(i) Primary or first-order consumers: These include the animals which eat plants or plant products. They are called herbivores or primary (first order) consumers. *E.g.*, Cattle, deer, goat, rabbit, hare, rats, mice, grasshoppers etc
(ii) Secondary or second order consumers: These include the animals which depend on primary consumers for their food. They are called primary carnivores or secondary (second order) consumers. Secondary consumers can be carnivores or omnivores. *E.g.*, Cats, dogs, foxes, small fish, etc.
(iii) Tertiary or third order consumers: These are large carnivores (or top carnivores) which feed on primary and secondary consumers. These are termed as secondary carnivores or tertiary (third order) consumers. Common examples include shark and crocodile, wolves, lion, etc.
(iv) Quaternary or fourth order consumers: These are even larger carnivores which feed on secondary carnivores (tertiary consumers). *E.g.*, Tigers, lions and eagles/hawks etc.

28. (a) A food chain which is most advantageous for human beings in terms of energy is:
Cereal plant → Human being
(b) If the cereal plant is growing in soil rich in pesticides, these pesticides are absorbed by growing plants along with water and minerals, when animals eat these cereal plants, these poisonous chemical pesticides go into their bodies through food. This causes increase in concentration of harmful pesticides in the body of living organisms at each trophic level of a food chain is called biological magnification. Pesticides are lethal to non-target species also. The extensive use of pesticides in agriculture can change the community of microorganisms living in soil.
(c)



Concept Applied
➲ Biological magnification

29. (a) Grass → Insect → Frog → Snake → Hawk
(b) Frog is present in the third trophic level of above created food chain.

(c) Hawk is the top consumer of the food chain, so, it will have high concentration of non-biodegradable chemicals.

(d) Biological magnification

(e) As per 10% law of flow of energy in an ecosystem, only 10% of energy is received by the next trophic level. Hence, in the given food chain, if 10,000 Joules of energy is available to frog, then the energy available to snakes will be 1000 Joule.

Grass	→	Insect	→	Frog	→	Snake	→	Hawk
10,00000 J		10,0000 J		10,000 J		1000 J		100 J

30. (a) An ecosystem is defined as a structural and functional unit of the biosphere comprising of living organisms and their non-living environment.

(b) Two examples of natural ecosystem are : pond ecosystem and grassland ecosystem.

(c) *Refer to answer 20 (ii).*

Answer Tips

- Remember the difference between natural and artificial ecosystem.

31. The various steps representing organisms in a food chain at which the transfer of food and energy takes place are called trophic levels.

Four trophic levels in a terrestrial food chain:

Grass → Rabbit → Wild cat → Tiger

There is a unidirectional flow of energy from sun to producers and subsequently to series of different types of consumers, *i.e.*,

Solar radiations → Producers → Herbivores → Carnivores

It cannot pass in reverse direction. There is always a decrease in the flow of energy and content with rise in trophic level. Large quantity of energy is lost at each step in the form of heat and is also used up in various metabolic activities.

32. (i) Aquatic
(ii) Abiotic
(iii) Inorganic substances
(iv) Producers
(v) Structural and functional unit of biosphere

33. (a) A terrestrial food chain with four trophic levels is :

Grass → Insect → Frog → Eagle

(b) Removal of the organisms of any trophic level will always adversely affect the ecosystem, *e.g.*, the removal of lions and tigers (top carnivores) will cause rapid increase in deer population, which leads to rapid consumption of vegetation resulting in scarcity of vegetation and population crash of deer.

(c) According to ten percent law, only 10% of the energy is received by the next trophic level.

Producers	→	Primary consumer	→	Secondary consumer	→	Tertiary consumer
T_1		T_2		T_3		T_4
20,000 J		2000 J		200 J		20 J

If the energy available at second trophic level (T_2) is 2000 J, so the 20 J of energy will be at fourth trophic level (T_4).

34. (a) The number of trophic levels in a food chain are limited because at each trophic level only 10% of energy is utilised for the maintenance of organism which occur at that trophic level and the remaining large portion is lost as heat. As a result, organisms at each trophic level pass on lesser energy to the next trophic level, than they receive. The longer the food chain, the lesser is the energy available to the final member of food chain.

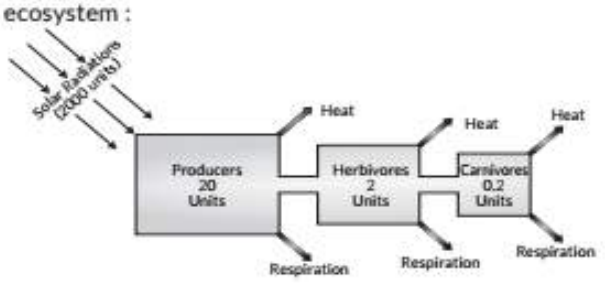
(b) Biological magnification is characterised by the increase in the non-biodegradable substances (DDT, Hg, etc.) in successive trophic levels of a food chain.

The level of such toxic substances will be different in different trophic levels of a food chain because these substances are accumulated more in higher trophic levels.

35. An ecosystem is defined as a structural and functional unit of the biosphere. It comprises of living organisms and their non-living environment that interact by means of food chains and biogeochemical cycles resulting in energy-flow, biotic diversity and material cycling to form stable self-supporting system.

Green plants capture about 1% of the solar energy incident on the earth to carry out the process of photosynthesis. A part of this trapped energy is used by plants in performing their metabolic activities and some energy is released as heat into the atmosphere. The remaining energy is chemical energy stored in the plants as photosynthetic products. When these green plants are eaten up by herbivores, the chemical energy stored in the plants is transferred to these animals. These animals (herbivores) utilise some of this energy for metabolic activities and some energy is released as heat while the remaining energy is stored in their body. This process of energy transfer is repeated till top carnivores. In an ecosystem, transfer of energy follows 10 per cent law, i.e., only 10 per cent of the energy is transferred to each trophic level from the lower trophic level.

The given block diagram shows unidirectional flow of energy at different trophic levels in a freshwater ecosystem :



Key Points

- Flow of energy is always unidirectional.

36. The sequential interlinking of organisms involving transfer of food energy from the producers, through a series of organisms with repeated eating and being eaten is called the food chain. A food chain involves a nutritive interaction between the living organisms of an ecosystem. There is a unidirectional flow of energy from sun to producers and subsequently to series of different types of consumers, *i.e.*,

Solar radiations → Producers → Herbivores → Carnivores

It cannot pass in reverse direction. There is always a decrease in the flow of energy and content with rise in trophic level. Large quantity of energy is lost at each step in the form of heat and is also used up in various metabolic activities.

37. There is a unidirectional flow of energy from sun to producers and subsequently to series of different types of consumers, *i.e.*,

Solar radiations → Producers → Herbivores → Carnivores

It cannot pass in reverse direction. There is always a decrease in the flow of energy and content with rise in trophic level. Large quantity of energy is lost at each step in the form of heat and is also used up in various metabolic activities.

Some harmful non-biodegradable chemicals (pesticides, *e.g.*, D.D.T.) enter the bodies of organisms through the food chains and get concentrated at each trophic level. This phenomenon is called biomagnification or biological magnification. For example, in a food chain operating in a pond, river or lake, the water contains a small amount — 0.02 ppb (parts per billion) of harmful pesticides, *i.e.*, D.D.T. When this water is consumed by phytoplanktons and zooplanktons, the concentration of these chemicals increases to 5 ppm. Fishes feeding on these, accumulate 240 ppm. Birds and humans feeding on these fishes were found to contain 1600 ppm of these chemicals. Thus, there is an increase in the concentration of the chemicals at each trophic level.

Key Points

Water (DDT 0.003 ppb) → Zooplankton (DDT 0.04 ppm) → Small fish (DDT 0.5 ppm) → Large fish (DDT 2ppm) → Fish eating birds (DDT 25 ppm)

38. Pesticides are poisonous chemical substances which are sprayed over crop plants to protect them from pests and diseases. These chemical pesticides mix up with soil and water. From soil and water, these pesticides are absorbed by the growing plants along with water and other minerals. When herbivorous animals feed on these plants the poisonous pesticides enter their bodies through the food chain. Similarly, when the carnivorous animals eat these herbivores, the pesticides get transferred to their bodies. Therefore, the plant products such as food grains, vegetables and fruits as well as meat of animals contain varying amounts of pesticide residues in them depending upon the trophic level they occupy in a food chain.

Concept Applied

- Organisms can occupy more than one trophic level or diverse trophic level.

39. The sequence of living organisms in a community in which one organism consumes or feeds upon another organism to transfer food energy, is called a food chain. The various steps in a food chain at which the transfer of food (or energy) takes place are called trophic levels. In a food chain, each step representing an organism forms a trophic level.

The number of trophic levels in a food chain are limited because at each trophic level only 10% of energy is utilised for the maintenance of organism which occur at that trophic level and the remaining large portion is lost as heat. As a result, organisms at each trophic level pass on lesser energy to the next trophic level, than they receive. The longer the food chain, the lesser is the energy available to the final member of food chain.

40. (d): Ozone shields the surface of the earth from UV radiations from the sun. The depletion of ozone layer will lead to global warming and some serious health issues such as damage of skin cells that leads to skin cancer, snow blindness or inflammation of cornea, increased fatality of young animals, mutations and reduced immunity.

In 1980s, the production of CFCs increased which releases active chlorine in the atmosphere. The active chlorine then reacts with ozone molecules present there to convert them to oxygen. This results in thinning of ozone layer. CFCs are used as refrigerants and in fire extinguishers. That is why, amount of ozone in the atmosphere dropped sharply.

41. Ozone layer is the ozone rich area in the stratospheric layer of atmosphere which acts as a protective shield by preventing harmful UV radiations from entering the earth surface. Hence, the depletion of ozone layer is a cause of concern.

42. CFCs or chlorofluorocarbons are potent compounds that release active chlorine in the atmosphere which reacts with ozone molecules present there to convert them to oxygen. This results in thinning of ozone layer. Hence, excessive use of CFCs is a cause of concern.

43. Ozone (O_3) gas forms a protective shield in the upper atmosphere that absorbs most of the harmful ultraviolet radiations coming from sun that can harm human beings, animals and plants. It protects us from various health hazards.

44. Chlorofluorocarbons (CFCs) are the group of compounds mainly responsible for ozone depletion.

Key Points

- Chlorine atom converts ozone into oxygen.

45. Ozone (O_3) is a molecule formed by three atoms of oxygen. It is formed in the stratosphere layer of atmosphere when high energy UV rays act on O_2 molecule splitting it into free oxygen (O) atoms. These atoms then combine with molecular oxygen (O_2) to form ozone (O_3).

$$O_2 \xrightarrow{UV} O + O$$

$$O + O_2 \longrightarrow \underset{\text{(Ozone)}}{O_3}$$

Ozone shields the surface of the earth from UV radiations from the sun. The depletion of ozone layer will lead to global warming and some serious health issues such as damage of skin cells that leads to skin cancer, snow blindness or inflammation of cornea, increased fatality of young animals, mutations and reduced immunity.

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Hence, depletion of ozone layer is a cause of concern.

47. (a) *Refer to answer 20 (ii).*
(b) The ozone layer is getting depleted at the higher levels of the atmosphere due to use of chlorofluorocarbons (CFCs) which are used in refrigerator. Other ozone depleting substances include carbon tetrachloride, hydrofluorocarbons used in fire extinguisher, air conditioners, etc.
Due to the ozone layer depletion, humans will be directly exposed to the ultraviolet radiations of sun. This will result in serious health issues like skin cancer, sunburns, quick ageing, mutations and weak immune system.

48. When high energy ultraviolet radiations react with oxygen present in stratosphere (the higher level of atmosphere) it splits into its constituent atoms. Since these atoms produced are very reactive, they react with molecular oxygen (O_2) to form ozone (O_3).

$$\underset{\substack{\text{(Oxygen}\\\text{molecule)}}}{O_2} \xrightarrow[\text{From sun}]{\text{UV radiation}} \underset{\substack{\text{(Oxygen}\\\text{atom)}}}{O} + \underset{\substack{\text{(Oxygen}\\\text{atom)}}}{O}$$

$$\underset{\substack{\text{(Oxygen}\\\text{molecule)}}}{O_2} + \underset{\substack{\text{(Oxygen}\\\text{atom)}}}{O} \longrightarrow \underset{\text{(Ozone)}}{O_3}$$

Ozone shields the surface of the earth from UV radiations from the sun. The depletion of ozone layer will lead to global warming and some serious health issues such as damage of skin cells that leads to skin cancer, snow blindness or inflammation of cornea, increased fatality of young animals, mutations and reduced immunity.
In 1980s, the production of CFCs increased which releases active chlorine in the atmosphere. The active chlorine then reacts with ozone molecules present there to convert them to oxygen. This results in thinning of ozone layer. CFCs are used as refrigerants and in fire extinguishers. That is why, amount of ozone in the atmosphere dropped sharply.

49. (a) The ozone layer is very important for the existence of life on earth because it forms a protective shield around earth by absorbing most of the harmful ultraviolet (UV) radiations coming from the Sun and prevents them from reaching the earth.
The UV radiations have extremely harmful effects on human beings, animals and plants as well, *i.e.*, cause mutations, skin cancer, cataract, damage immune system, etc. So, ozone layer must be protected to save the environment.
(b) The two ways which can help in protection of ozone layer and environment are :
(i) The use of chemicals like chlorofluorocarbons (CFCs) which are widely used in refrigerators and air conditioners (as a coolant), in fire extinguishers and in aerosol sprayers destroy the ozone layer gradually. We can protect our ozone layer by avoiding the use of such objects which releases CFCs.
(ii) Nitrous oxide is the largest ozone depleting substance as well as greenhouse gas released by human activities, such as from motor vehicles, fertilisers. People should be encouraged to use more public transport, car pooling, using hybrid or electric cars and use of fertiliser formulations to reduce emission of nitrous oxide.

50. Ozone is a form of oxygen. It is a made up of three atoms of oxygen. It is highly poisonous. However, good amount of ozone is present in upper part of the atmosphere called stratosphere. In the stratosphere, ozone is being photodissociated and generated simultaneously by absorption of harmful ultraviolet (UV) radiations coming from sun.

$$O_3 \underset{}{\overset{UV}{\rightleftharpoons}} O_2 + [O]$$

The two reactions are in equilibrium, thereby maintaining a steady concentration of ozone in the stratosphere. Ozone layer is commonly called ozone blanket. It acts as a protective shield to protect all types of life from the harmful effect of UV radiation. Therefore, any thinning or depletion of ozone layer allows entry of high energy UV radiations into the earth's surface, thereby causing harmful effects on plants, animals and human beings.

The harmful effects of ozone depletion on man, animals and plants includes :

(i) Incidences of skin cancer.

(ii) Damage to eye sight, photoburning as well as increased incidences of cataract in eyes.

(iii) Damage to immune system and hence lowering the body's resistance to disease.

(iv) Increased embryonic mortality.

(v) 10-25% decline of photosynthesis in plants.

(vi) Global warming.

Key Points

- Ozone shields against UV radiations.

51. (a): Disposable plastic plates are made of non-biodegradable materials. Disposable plastic plates generate huge amount of wastes, so these plates should not be used.

52. (i) Two methods of effective plastic waste collection :

(a) Reusing the plastic containers by making flower pots and use them as decoration.

(b) Reusing the plastic containers to form a dustbin and distribute it in various places.

(ii) Single use plastic, often also referred to as disposable plastics are commonly used for plastic packaging and include items intended to be use only once before they are thrown away or recycled. These include grocery bags, food packaging, bottles, straws, containers, cups and cutlery.

(iii) Best alternatives is use of stainless steel, glass and platinum, Silicone storage containers. Cloth bags can be used in place of plastic bags. Use of wooden cleaning brushes, kitchen utensils and cutting board, pottery and other ceramics products, etc.

(iv) Microbes may not work exactly the same way in landfill sites as they work in laboratories because it is difficult to replicate the exact ambient conditions required for the microbes to thrive in these two conditions. But due to same downstream processing and other mechanism, they will work similarly in landfill sites.

53. Affluent lifestyle of few persons leads to exploitation and over consumption of resources leading to their scarcity and generation of greater amount of waste materials which causes imbalance in environment.

54. Biodegradable wastes are decomposed naturally by the action of microbes which degrade them to their simple constituents enabling their nutrients to recycle among the biotic and abiotic components of ecosystem. However, non-biodegradable wastes cannot be disposed off naturally since they cannot be decomposed by microbes. Such wastes are either recycled, incinerated or put in landfills, etc. As the disposal methods of the two types of wastes is different, it is advisable to discard the two types of waste in two separate dustbins.

55. In a garden, various plants like grasses, trees, flower bearing plants such as jasmine, sunflower, rose, and animals like insects, frogs and birds are found. All these living organisms interact with each other and their growth, reproduction and other activities are affected by the abiotic components such as light, water, wind, soil, minerals, etc. of ecosystem. Thus, a garden is considered to be an ecosystem.

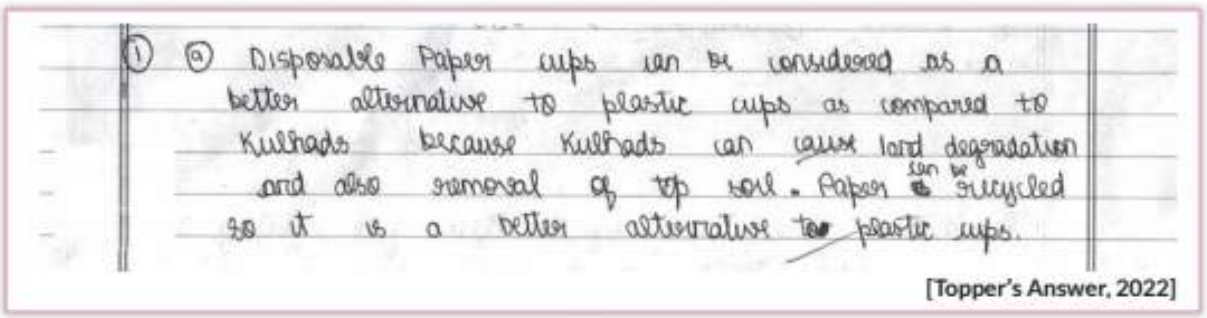
56. Differences between biodegradable and non-biodegradable substances are as follows :

Biodegradable substances	Non-biodegradable substances
These are biological in origin and are degraded by microorganisms such as bacteria and fungi.	These are mostly man-made and are not degraded by microorganisms.

Domestic waste can be safely disposed off by composting. In composting, biodegradable domestic wastes, such as left-over food, fruit, vegetable peels, etc., can be buried in pit, dug into ground. They are converted into compost and used as manure.

In landfill a huge pit is made in an open low lying area and wastes are dumped into the pits. Once the pits are full, they are covered with soil and left for decomposition.

57.



[Topper's Answer, 2022]

58. (a) Garbage is the waste material (rubbish) especially of domestic refuse. The two classes into which garbage is classified are
(i) Biodegradable
(ii) Non-biodegradable.
(b) Enzymes are specific in their action. For example, enzyme maltase acts on sugar maltose but not on lactose or sucrose. Different enzymes may act on the same substrate but give rise to different products. Similarly an enzyme may act on different substrates producing different end products.

59. Industrialisation has deteriorated our environment in the following ways :
(i) Rapid industrialisation has increased the demand of more land area for setting up of new factories. This demand is being fulfilled by clearing up of forest area. Deforestation is one of the major causes of ecological imbalance, biodiversity loss and ecosystem unstability.
(ii) Industries release various harmful gases in the environment which pollute the air. These gases when inhaled by people around, cause various respiratory diseases in them.
(iii) A lot of effluent and liquid waste is discharged from various industries which is mostly dumped into nearby water bodies. This causes water pollution. Polluted water causes death of various aquatic organisms and consumption of this polluted water causes various diseases in humans.
(iv) The solid waste released from factories is dumped on open land and not treated properly to ensure their proper decomposition. This leads to land pollution that degrades quality of soil and also causes various kinds of diseases in humans and animals.

60. Government of India is imposing a ban on the use of polythene bags because these are non-biodegradable substances which are not acted upon by the microbes. So, they cannot be decomposed and therefore persist in the environment for a long time thereby causing harm to the ecosystem. Polybags choke drains which results in water logging, that allows breeding of mosquitoes and hence leads to various diseases like malaria, dengue, etc. Jute bags and cloth bags are the alternatives to the polythene bags. More use of paper or jute bags and completely ban on polythene bags will enhance the ambient quality of environment. Paper or jute bags are the biodegradable as they are easily broken down and their rate of degradation in high. So they do not pollute the environment.

61. *Refer to answer 60.*
The three advantages of using jute or cloth bags over polythene bags are :
(i) They are made of biodegradable material.
(ii) They can be reused.
(iii) They do not pollute our environment.

62. With the advancement in technology over time, there has been improvement in lifestyle of people. Such changes in people's lives have also changed their attitudes. When people have more resources at their end they tend to overuse and misuse it thereby generating huge amounts of waste material. For example, the affluent lifestyle has forced people to start using more of disposable articles, *e.g.*, plastic cups, bags, etc., which keep on accumulating in the environment and lie undecomposed, thereby negatively affecting the environment.
Similarly, excessive use of refrigerators and air conditioners, plastic foams, etc., also releases high quantities of CFCs which are responsible for ozone depletion.

63. We can reuse plastic and glass jars of jams and pickles, etc, for the purpose of storage of things like salt, sugar, tea, etc., whereas we can recycle newspapers, plastic of some types, broken glass and metal wares for making fresh paper, plastic, glass and metal objects.

64. "To discard the household waste we should have two separate dustbins, one for the biodegradable waste and the other for the non-biodegradable waste." Segregation of biodegradable and non-biodegradable waste is utmost important for their proper disposal, as different methods are adopted for their disposal. Biodegradable wastes can be composted whereas non-biodegradable wastes can be recycled or landfilled.

Key Points

- Non-biodegradable wastes are not degraded by microbes.

65. Some of the ways to make people realise that the improper disposal of waste is harmful to the environment includes making people aware of negative impacts of waste disposal. They can be made aware by :
(i) Conducting seminars about the negative effects of the wastes on environment.
(ii) Usage of pamphlets and posters for providing information.
(iii) Forming an eco-club in the society for spreading awareness about the ill effects of waste on the surroundings such as :
- Improper disposal of waste will release harmful gases in the environment that make it unclean and unhygienic for the living organisms.
- The waste will flow to water bodies along with rain water and become a threat to aquatic life and pollute the water bodies.
- It provides space for breeding of the mosquitoes and which results in spread of malaria, filariasis, dengue, etc.
- Hazardous chemicals from wastes get into the soil and can harm the plants when they take up the

contamination through their roots. This will affect the health of other animals and humans and will have negative impact on environment.

66. Biodegradable wastes such as plant and animal based wastes can be degraded by microorganisms such as bacteria and fungi and do not get biologically magnified in food chains. Whereas non biodegradable wastes such as plastic, DDT, metal are not degraded by microorganisms and can enter into food chains and get biologically magnified.
If biodegradable waste are not disposed properly, then it can have an adverse impact on climate change, especially through methane emission and it also leads to vector borne diseases among the people residing nearby.
Accumulation of non biodegradable wastes such as pesticides make the soil acidic and unfit for cultivation and toxic substances like DDT can enter the food chain due to improper disposal that cause various health ailments.

67. (a) Two harmful effects of using plastic bags on the environment:
(i) Plastic bags are non-biodegradable substances which are not acted upon by microbes. So, they cannot be decomposed and therefore persist in the environment for a long time causing harm to the soil fertility and quality.
(ii) Plastic bags choke drains which result in waterlogging, that allows breeding of mosquitoes and hence leads to various diseases.
Jute bags and cloth bags are the alternatives to the polyethene bags.
(b) Practices that can be followed to dispose off the waste produced in our homes:
(i) Separation of biodegradable and non-biodegradable wastes.
(ii) The biodegradable waste can be converted to manure.
(iii) Non-biodegradable waste should be disposed off at suitable places from where municipal authorities can pick them up and dispose properly and scientifically.
(iv) Use discarded bottles and jars to store food items.

Alternative Method

Paper bags are 100% biodegradable

68. (a) No, burning plastic is not an eco-friendly method of waste disposal. Burning plastics can produce toxic fumes and cause air pollution. Plastic, being non-biodegradable cannot be dumped (land filled), so the best way to dispose plastic items is to recycle them. Recycling is a less polluting and more sustainable option.
Rakesh segregated left over food items, fruit peels, *i.e.*, biodegradable waste and plastic material, *i.e.*, non-biodegradable waste. The biodegradable waste can be converted to manure whereas non-biodegradable waste can be recycled. This contributes in decreasing the level of pollution and easy disposal and treatment of waste.
(b) We can contribute to keep our roads and parks clean by adopting following habits:
(i) We should recycle non-biodegradable waste products instead of dumping it in garbage.
(ii) We should use carry bags made of natural fibre as jute, cloth, instead of plastic bags.
(iii) We should make compost of biomass collected from park such as food waste, leaf litters, etc,.
(iv) We should stop littering, throwing garbage and spitting on road sides, parks, etc.

Key Points

- Green coloured dustbins are meant for biodegradable wastes and blue ones are for non-biodegradable wastes.

69. Differences between biodegradable and non-biodegradable wastes are as follows:

S. No.	Biodegradable wastes	Non-biodegradable wastes
(i)	These are biological in origin.	These are mostly man-made.
(ii)	These are degraded by microorganisms such as bacteria and fungi.	These are not degraded by microorganisms.
(iii)	These do not get biologically magnified in food chains.	These enter into the food chains and get biologically magnified.
(iv)	These can be converted into resource.	Some of these can be recycled.

People should adopt the following changes in their habit to dispose off non-biodegradable waste, so as to save the environment.
(i) Non-biodegradable household wastes should be disposed in separate dustbins and should not be mixed with biodegradable wastes.
(ii) Recyclable non-biodegradable wastes like glass, paper, metal, various types of plastics etc., can be sent to local recycling units.
(iii) People should try to reuse items as much as possible instead of disposing them as this reduces need of new materials and keeps ecological impact down.
(iv) Use of cloth bags/gunny bags/paper bags instead of polythene /plastic bags.
(v) Use of compost, vermicompost instead of fertilisers.

Key Points

- Example of biodegradable wastes - sewage, cattle dung, household garbage, etc
- Examples of non-biodegradable wastes plastic objects, synthetic fibres, glass objects, etc.

CBSE Sample Questions

1. (b): Some harmful chemicals enter our bodies through the food chain. Several chemicals and pesticides are either washed down into soil or into the water bodies. From here, these are absorbed by the plants along with water and minerals.
From the plants, these pesticides reach into the body of animals and humans. The length and complexity of food chains vary greatly. Each organism is generally eaten by two or more so instead of a straight line food chain, the relationship can be shown as a series of branching line. (1)

2. (b): Producers (autotrophs) have generally greater number of individuals present at the lower trophic level of an ecosystem.
The flow of energy is unidirectional from sun to producers and subsequently to series of different types of consumers. (1)

3. The loss of energy at each step is so great that very little usable energy remains after four trophic levels. (1)

4. Pesticides like DDT, are non-biodegradable pesticides which enter the food chain from the first trophic level, *i.e.*, planktons (producers).
Non-biodegradable chemicals accumulate into the body of organisms through the food chain which go on increasing in its concentration at each trophic level by the phenomenon called biomagnification. (1)
In the given food chain, hawk will have the highest level of pesticides because hawk is present on the top of food chain and is a top carnivore. (1)

5. According to the given food chain, A will represent more energy transfer as compared to C and E. (½)
B will represent more energy transfer as compared to D. (½)
When green plants are eaten by primary consumers, a great deal of energy is lost as heat to the environment, some amount goes into digestion and in doing work and the rest goes towards growth and reproduction. An average of 10% of the food eaten is made available for the next level of consumers. This loss of energy takes place at every trophic level. (1)

6. Ozone shields the surface of the earth from harmful effects of UV radiations coming from the sun. (1)

7. Excess generation of biodegradable wastes can be harmful as its decomposition is a slow process leading to production of foul smell and gases. Piles of biodegradable wastes can be the breeding ground for germs that create unhygienic conditions. (2)

8. Use of plastic cups raised the concern towards hygiene, thus they were replaced by disposable plastic cups.
Plastic cups are non-biodegradable and harm the environment. They were thus replaced by *Kulhads*. Making *Kulhad* made of clay on a large scale resulted in the loss of top fertile soil. (1)
Now, disposable paper cups are used because - the paper can be recycled, it is biodegradable and is eco-friendly material which does not cause environmental pollution. (1)

9. Damage to the ozone layer is a cause for concern because the ozone layer shields the surface of earth from harmful UV radiations from the sun which cause skin cancer in human beings. (1)
Synthetic chemicals like chlorofluorocarbons (CFCs) which are used as refrigerants and in the fire-extinguishers are the main reason for the depletion of the ozone layer. (1)
Many developing and developed countries have signed and are obeying the directions of UNEP (United Nations Environment Programme) to freeze or limit the production and usage of CFCs at 1986 levels. (1)

10. (a) Gas A is ozone which is found in stratosphere layer of the atmosphere. (½)
Ozone in the earth's atmosphere is formed by ultraviolet light striking oxygen molecules (O_2), creating two single oxygen atoms (O). The atomic oxygen (O) then combines with a molecule of O_2 to create ozone, O_3.

$$O_2 \xrightarrow{UV} O + O$$

$$O_2 + O \longrightarrow O_3 \text{ (Ozone)}$$ (1)

(b) Ozone layer is a protective shield around earth which absorbs most of the UV- radiations of sun protecting the living beings of the earth from health hazards. (1)
Chloroflurocarbons (CFCs) used as referigerants and fire extinguishers lead to depletion of the ozone layer. (½)