



This chapter focuses on how various components in the environment interact with each other and how we are daily impacting the environment. But we can do our small part. For example, avoid using a car for short-distance travel, instead, you can make use of a bicycle to reduce air pollution.

Topic Notes

- *Ecosystem*
- *Food Chains and Webs*
- *Effect of our Activities on Environment*

ECOSYSTEM

The environment includes our physical surroundings like air, water, soil and all the organisms such as plants, animals, human beings and micro-organisms like bacteria and fungi (called decomposers).

An ecosystem is a self-contained unit of living things and their non-living environment. All the interacting organisms in an area together with the non-living constituents of the environment form an ecosystem. It therefore consists of biotic components and abiotic components.

There are two types of ecosystem:

- (1) **Terrestrial ecosystem:** These are land based ecosystems such as forest, grassland, desert, mountains etc.
- (2) **Aquatic ecosystem:** These are water based ecosystems such as ponds, lakes, river, sea, aquarium etc.

Ecosystems can also be classified as natural ecosystem and artificial ecosystem. Examples of natural ecosystem are forests, ponds etc whereas examples of artificial ecosystem are gardens, aquarium and crop-fields.

Components of an Ecosystem

Abiotic Components

The abiotic components of an ecosystem include the physical environment like air, water, soil alongwith the inorganic substances like carbon dioxide, nitrogen, oxygen, water, phosphorus, sulphur, sodium and other elements present in them. The physical factors which affect our climate such as light, temperature, pressure, humidity are also considered as abiotic components.

Biotic Components

The biotic components of an ecosystem is a community of organisms which is made up of many inter dependent populations. It includes three types of organisms:

- (1) **Producers:** These are the autotrophs which synthesize their own food such as green plants and certain blue green algae.
- (2) **Consumers:** These are the heterotrophs which depend on other organisms for food. These organisms consume the food produced either directly from producers or indirectly by feeding on other consumers. They can be further classified as herbivores, carnivores, omnivores and parasites.
- (3) **Decomposers:** These are the organisms which consume the dead remains of other organisms. The micro organisms comprising bacteria and fungi break down the dead remains and waste products of organisms which comprises of complex inorganic substances into simpler inorganic substances that go into the soil and are used up once more by the plants.

The Functioning of an Ecosystem

An ecosystem is a self sufficient unit. It involves input of energy and matter which are exchanged between the living and non living components in a cyclic process.

Importance of Decomposers

The decomposers help in decomposing the dead bodies of plants and animals and in this way act as cleansing agents of environment. The various nutrients which are initially taken by plants from the soil, air and water are returned to the soil, air and water (nutrient pool) after the death of plants and animals. They help in recycling the materials in the ecosystem.

Example 1. What is the role of decomposers in the ecosystem? [NCERT]

Ans. Decomposers feed on dead and decaying organisms and breakdown the complex organic compounds into simpler substances. In this way, they help in recycling nutrients to the soil and also help in cleaning the environment.

TOPIC 2

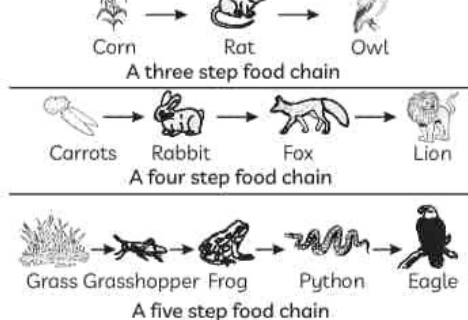
FOOD CHAINS AND FOOD WEBS

The food or energy can be transferred from one organism to the other by means of food chains. All the food chains begin with the autotrophs as they are the producers of food. Food chain is therefore the sequence of living organisms in a community in which one organism consumes another organism to transfer energy.

Examples of Food Chain

Following are a few examples of food chains:

- (1) Grass → Deer → Lion
- (2) Grass → Insects → Frog → Birds
- (3) Plants → Worms → Birds → Cat
- (4) Algae → Protozoa → Small Fish → Big Fish



Example 2. Which of the following constitute a food-chain?

- (a) Grass, wheat and mango
- (b) Grass, goat and human
- (c) Goat, cow and elephant
- (d) Grass, fish and goat

[NCERT]

Ans. (b) Grass, goat and human

Explanation: In a food chain, organism at the higher trophic level feeds on the organism at the lower trophic level. As goat feeds on grass and humans feed on goats, this is the correct option.

Trophic Levels

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 forms a trophic level.

- (1) The autotrophs or the producers are at the first trophic level. They fix up the solar energy and make it available for heterotrophs or the consumers.
- (2) The herbivores or the primary consumers come at the second trophic level.
- (3) Small carnivores or the secondary consumers are at the third trophic level.
- (4) Larger carnivores or the tertiary consumers form the fourth trophic level.

An example of trophic level: Consider the food chain in a grassland:

Grass → Insects → Frog → Birds

In this food chain, grass represents the 1st trophic level, insects represent the 2nd trophic level, frog represent the 3rd trophic level and birds are at the 4th trophic level.

Flow of Energy in a Food Chain

- (1) The green plants in a terrestrial ecosystem capture about 1% of the energy of sunlight that falls on their leaves and convert it into food energy.
- (2) When green plants are eaten by primary consumers, a great deal of energy is lost as heat to

tion and in doing work and the rest goes towards growth and reproduction.

- (3) **Ten percent law:** An average of 10% of the food eaten is turned into its own body and made available for the next level of consumers. Therefore, 10% can be taken as the average value for the amount of organic matter that is present at each step and reaches the next level of consumers.
- (4) **Number of trophic levels are limited:** Since so little energy is available for the next level of consumers, food chains generally consist of only three or four steps. The loss of energy at each step is so great that very little usable energy remains after four trophic levels. There are generally a greater number of individuals at the lower trophic levels of an ecosystem, the greatest number is of the producers.

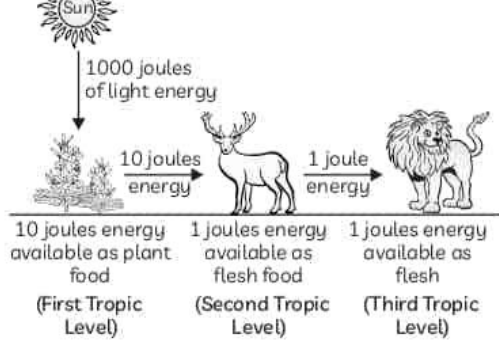
Example 4. Will the impact of removing all the organisms in a trophic level be different for different trophic levels? Can the organisms of any trophic level be removed without causing any damage to the ecosystem? [NCERT]

Ans. Yes, the impact of removing all the organisms in a trophic level be different for different trophic levels. As the largest number of organisms are at the producer level and least number at the highest trophic level in any food chain, removal of organisms at producer level will have an impact on the next higher level as those organisms will starve. On the other hand, if organisms belonging to a higher trophic level are removed, the organisms belonging to the lower trophic level will increase greatly in number. This will lead to an ecological imbalance.

No, whenever organisms of any trophic level are removed, it will adversely affect the ecosystem and our environment

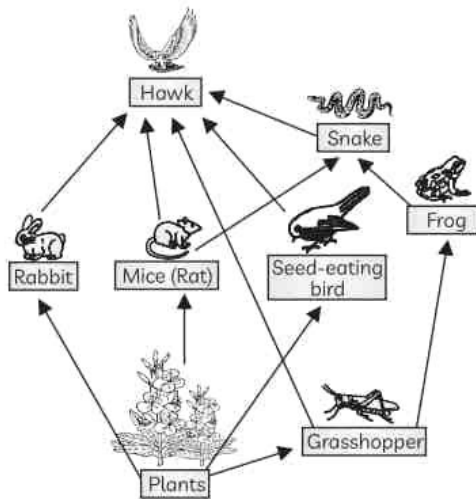
Illustration of the 10 percent law: Suppose 1000 joules of light energy emitted by the sun falls on the plants (called producers). We know that the plants convert only one per cent (1%) of the light energy falling on them into chemical energy of food. So, the energy which will be available in plant matter as food will be only 1% of 1000 Joules, which comes to 10 joules. The remaining 1000 – 10 = 990 joules of light energy or solar energy which is not utilized by the plants is reflected back into the environment (see Figure). The ten per cent law will not apply at this stage. It will apply only in the transfer of energy in a food chain.

According to the 10% law, only 10% of 10 joules of energy i.e., 1 Joule will be available for transfer to the next trophic level.



Food Web

The network of a large number of food chains existing in an ecosystem is called a food web. As the length and complexity of food chains vary greatly and each organism is generally eaten by two or more other kinds of organisms which in turn are eaten by several other organisms. So, instead of a straight line food chain, the relationship can be shown as a series of branching lines called a food web.



There are six food chains in the above food web, marked as 1, 2, 3, 4, 5 and 6.

- (1) In the 1st food chain, plants are eaten by rabbit and then rabbit is eaten by hawk:
Plants → Rabbit → Hawk

and the mice are eaten by hawks:

Plants → Mice → Hawk

- (3) In the 3rd food chain, plants are eaten by mice; mice are eaten by snakes and then snakes are consumed by hawks:
Plants → Mice → Snake → Hawk

- (4) In the 4th food chain, plants are eaten by seed-eating birds and the seed-eating birds are consumed by hawks:
Plants → Seed-eating Bird → Hawk

- (5) In the 5th food chain, plants are eaten up by grasshopper and the grasshopper is consumed by hawks:
Plants → Grasshopper → Hawk

- (6) In the 6th food chain, plants are eaten by grasshopper, grasshopper is eaten by frog; frog is eaten by snake and then snake is consumed by hawk:
Plants → Grasshopper → Frog → Snake → Hawk

Energy Flow Diagram

If we study the energy flow diagram in a food chain, we find that the flow of energy is unidirectional. The energy that is captured by the autotrophs does not revert back to the solar input and the energy which passes to the herbivores does not come back to the autotrophs.

Biological Magnification

The increase in concentration of harmful chemical substances like pesticides in the body of living organisms at each trophic level of a food chain is called biological magnification. These chemicals are absorbed from the soil by the plants and from the water bodies by the aquatic plants and animals. As these are non-biodegradable, they get accumulated progressively at each trophic level. This is also the reason why our food grains such as wheat and rice, vegetables and fruits contain varying amounts of pesticide residue.

TOPIC 3

EFFECT OF OUR ACTIVITIES ON ENVIRONMENT

Since we are an integral part of the environment, our activities also change the environment around us.

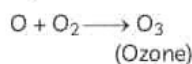
Ozone Layer and its Depletion

Ozone (O₃) is a deadly poisonous gas which is formed by three atoms of oxygen. It shields the surface of the earth from harmful ultraviolet (UV) rays of the sun, which are known to cause skin cancer in human

beings. They also damage the eyes and our immune system.

Formation of Ozone

Ozone is a product of UV radiation acting on oxygen (O₂) molecule, which splits apart some molecular oxygen (O₂) into free oxygen atoms (O) which combine with the molecular oxygen to form ozone.



Depletion of Ozone Layer

The amount of ozone in the atmosphere is getting depleted due to the use of synthetic chemicals like chlorofluorocarbons (CFCs), which are used as refrigerants and in fire extinguishers. The CFCs released into the air react with the ozone gas present and destroy it gradually due to which the ozone layer is becoming thinner leading to more UV rays entering the earth.

In 1987, the United Nations Environment Programme succeeded in forging an agreement to freeze CFC production at 1986 levels.

Managing the Garbage We Produce

Example 6. Case Based:

In the first activity, collect waste material from your homes. This could include all the waste generated during a day, like kitchen waste (spoilt food, vegetable peels, used tea leaves, milk packets and empty cartons), waste paper, empty medicine bottles/strips/bubble packs, old and torn clothes and broken footwear.

Bury this material in a pit in the school garden or if there is no space available, you can collect the material in an old bucket/flower pot and cover with at least 15 cm of soil.

Keep this material moist and observe at 15-days intervals.

In the second activity, use the library or internet to find out more about biodegradable and non-biodegradable substances. These days, new types of plastics which are said to be biodegradable are available. Find out more about such materials and whether they do or do not harm the environment.

[NCERT Activity 15.5, 15.6]

- (A) When the waste materials collected from home in the first activity was buried in a pit and kept moist and observed at intervals of 15 days, it is observed that:
- (I) Kitchen waste like spoilt food, vegetable peels, used tea leaves changed their form the fastest.
 - (II) Waste paper remained unchanged over a long time.
 - (III) Empty medicine bottles and strips changed their form and structure but not as fast as kitchen wastes.
 - (IV) Milk packets and bubble wraps did not change their form or structure during the period of observation.

- (a) Both (I) and (II)
- (b) Both (II) and (III)
- (c) Both (I) and (IV)
- (d) Both (III) and (IV)

- (B) Given below are names of some waste materials that changed and remain unchanged when buried in the soil.

Plastic box, Rubber tyre, Empty Carton, Vegetable peels, Bubble wrap, Waste paper

What materials are correctly classified biodegradable and non-biodegradable materials?

	Biodegradable	Non-Biodegradable
(a)	Empty carton, Waste paper, Vegetable peels	Bubble wrap, Plastic box, Rubber tyre
(b)	Vegetable peels, Bubble wrap, Empty carton	Plastic Box, Rubber tyre, Waste paper
(c)	Vegetable peels, Rubber tyre, Empty carton	Bubble wrap, Waste paper, Plastic Box
(d)	Rubber tyre, Empty carton, Waste paper	Vegetable peels, Plastic box

- (C) How long do you think plastic bottles will last in our environment?
- (D) These days, new types of plastics which are said to be biodegradable are available. Do such materials cause any harm to the environment?
- (E) Assertion (A): Man made materials such as glass persist in the environment for a very long time.

Reason (R): Bacteria and other saprophytes break down the organic matter in our environment.

- (a) Both (A) and (R) are true and (R) is the correct explanation of the assertion.
- (b) Both (A) and (R) are true, but (R) is not the correct explanation of the assertion.
- (c) (A) is true, but (R) is false.
- (d) (A) is false, but (R) is true.

Ans. (A) (c) Both (I) and (IV)

Explanation: Waste materials such as kitchen wastes (vegetable peels, used tea leaves etc), waste paper, cotton clothes are organic

naturally, whereas wastes such as empty medicine bottles and strips, bubble wrap, milk packets are made up of glass or plastic and are not degraded naturally.

(B) (a) *Biodegradable: Empty carton, Waste paper, Vegetable peels; Non-biodegradable: Bubble wrap, Plastic box, Rubber tyre.*

Explanation: The substances such as empty carton, waste paper and vegetable peels which are of plant or animal origin are degraded naturally and are said to be biodegradable materials. Whereas, materials such as plastic box, bubble wrap and rubber tyre are non-biodegradable materials.

(C) As plastic is non-biodegradable, it does not get degraded naturally in our environment but persists in our environment for a very long time. Eventually it gets broken down by physical conditions such as heat and pressure. It takes upto 450 years for plastic to be broken down.

(D) New types of plastics are made from plastics but some chemicals are added to them so that they break down faster when exposed to physical conditions such as air and light. But they also cause harm to the environment as eventually these plastics are broken down into small pieces which persist in our environment and also cause pollution.

(E) (b) *Both (A) and (R) are true, but (R) is not the correct explanation of the (A).*

Explanation: Man made materials such as plastic and glass persist in our environment for a very long time as they are not degraded naturally by the bacteria and other saprophytes present in our environment which act on organic matter only.

Example 8. How can you help in reducing the problem of waste disposal? Give any two methods.

[NCERT]

Ans. Problem of waste disposal can be reduced by disposing off of garbage in a scientific manner by first segregating them into biodegradable and non-biodegradable substances. As far as possible, we should use only biodegradable substances such as cloth and paper bags in place of plastic bags.

Improvement in our life styles and changes in our attitudes have led to greater amounts of waste generation, much of which is non-biodegradable. The disposal of waste should be done in a scientific way,

Biodegradable and Non-biodegradable Wastes

All the waste materials produced by the various activities of man and animals can be sub-divided into the following groups:

- (1) Biodegradable Wastes
- (2) Non-biodegradable Wastes

The waste materials which can be broken down to non-poisonous substances in nature in due course of time by biological processes like the action of micro-organisms are called biodegradable wastes.

Some examples of bio-degradable wastes are cattle dung, compost, animal bones, leather, tea-leaves, wool, paper, wheat, wood, hay, cotton, jute, grass, fruit and vegetable peels, leaves, flowers, cake etc. Bio-degradable wastes usually do not pollute the environment.

The waste materials which cannot be broken down into non-poisonous or harmless substances in nature are called non-biodegradable wastes.

Some examples of non-biodegradable wastes are DDT, plastics, polythene bags, synthetic fibres, glass, metal cans, iron nails, silver foils, radioactive wastes etc.

These are the major environmental pollutants as these cannot be decomposed by micro-organisms.

Example 9. What are the problems caused by the non-biodegradable wastes that we generate?

[NCERT]

Ans. Problems caused by the non-biodegradable wastes that we generate are:

- (1) They will persist in our environment for a very long time and hence make the environment harmful and unfit for survival of living organisms.
- (2) Their presence will block the flow and transfer of energy, minerals and nutrients in the ecosystem.

Example 10. Give any two ways in which biodegradable substances would affect the environment.

[NCERT]

Ans. The two ways in which biodegradable substances would affect the environment are:

- (1) Degradation of these substances by the saprophytes and other microorganisms may release foul smelling gases thus polluting the environment.
- (2) They may become breeding ground for mosquitoes, flies and other pests thus increasing the chances of diseases.

Search the internet or library to find out what hazardous materials have to be dealt with while disposing off electronic items. Find out how these materials affect the environment. Find out how plastics are recycled and whether the recycling process has any impact on the environment.

[NCERT Activity 15.9]

- (A) The hazardous materials to be dealt with while disposing off electronic items are:
- (I) cadmium
 - (II) lead
 - (III) mercury
 - (IV) iron
- (a) Both (I) and (II)
(b) Both (II) and (IV)
(c) (I), (II) and (III)
(d) (I), (III) and (IV)
- (B) Which of the following is not correct regarding the effect of hazardous materials present in electronic items on the environment?
- (a) They can contaminate the ground water.
 - (b) They release greenhouse gases.
 - (c) They are highly toxic and carcinogenic.
 - (d) Burning of these materials lead to depletion of ozone layer.
- (C) What is the environmental impact of using single use packaging materials made of plastic?
- (D) Does the recycling of plastic cause any damage to the environment?
- (E) Assertion (A) : Disposable plastic cups are preferred over disposable paper cups.
Reason (R) : Disposable paper cups are biodegradable.
- (a) Both (A) and (R) are true and (R) is the correct explanation of the assertion.

correct explanation of the assertion.

(c) (A) is true, but (R) is false.

(d) (A) is false, but (R) is true.

Ans. (A) (c) (I), (II) and (III)

Explanation: Electronic items contain some hazardous materials such as cadmium, lead, mercury, chromium, some compressed gases, PVCs etc. which can contaminate the environment once released by dumping, melting and burning of electronic wastes.

(B) (b) They release greenhouse gases.

Explanation: Some of the hazardous materials present in electronic items are cadmium, lead and mercury which are toxic and carcinogenic. They can contaminate the ground water and also enter the food chain through water or soil. Burning of these materials causes depletion of the ozone layer. However, as burning of these materials does not produce carbon dioxide or methane or any other greenhouse gas, it does not cause global warming.

(C) Single use packaging materials made up of plastic are non-biodegradable and hence cause environmental pollution and they persist in the environment for a very long time.

(D) Yes, recycling of plastic causes environmental damage as burning plastic and other wastes releases dangerous substances such as heavy metals, persistent organic pollutants (POP), and other toxic chemicals into the air and persist as ash waste residues.

(E) (d) (A) is false, but (R) is true.

Explanation: Disposable paper cups are preferred over disposable plastic cups as paper is biodegradable whereas plastic is non-biodegradable and hence persists in our environment for a very long time.

[1 mark]

Multiple Choice Questions

1. In the given food chain, suppose the amount of energy at the fourth trophic level is 5 kJ, what will be the energy available at the producer level?

Grass → Grasshopper → Frog → Snake → Hawk

- (a) 5 kJ (b) 50 kJ
(c) 500 kJ (d) 5000 kJ

[CBSE 2017, 12]

2. 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

[CBSE 2020]

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

- (a) heat energy (b) light energy
(c) chemical energy (d) mechanical energy

[NCERT Exemplar]

4. 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

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

- (a) food web (b) ecological pyramid
(c) ecosystem (d) food chain

[CBSE 2013]

Ans. (a) food web

Explanation: Organisms of a higher trophic level feeding on several types of organisms belonging to a lower trophic level constitute the food web.

6. Expand the abbreviation GAP:

- (a) Governmental Agency for Pollution Control
(b) Gross Assimilation by Photosynthesis
(c) Ganga Action Plan
(d) Governmental Agency for Animal Protection

Ans. (c) Ganga Action Plan

Explanation: GAP, 1985 came in existence to check water pollution in river Ganga.

7. Which of the following are biodegradable substances?

- (a) Glass bottle, Grass
(b) Jutebag, polythene bag
(c) Cotton cloth, vegetable peels
(d) DDT, Pen refill

8. Which of the statement is incorrect?

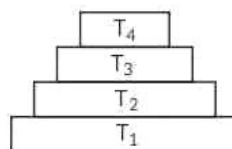
- (a) Producers form the first trophic level.
(b) Producers trap solar energy and transform it into chemical energy in food.
(c) All plants are producers.
(d) Nutrients and energy enter the living world through producers.

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

- (a) Decrease in energy at higher trophic levels
(b) Deficient food supply
(c) Polluted air
(d) Water

[CBSE 2016, 15, 13]

10. In the given figure, the various trophic levels are shown in a pyramid. At which trophic level is maximum energy available?



- (a) T₄ (b) T₂
(c) T₁ (d) T₃

[CBSE 2012]

used because:

- (a) they are made of materials with light weight
 - (b) they are made of toxic materials
 - (c) they are made of biodegradable materials
 - (d) they are made of non-biodegradable materials
- [CBSE 2014, 13]

12. Which one of the following stakeholders of forests causes the maximum damage to forest?

- (a) People who live in or around the forest
- (b) The forest department of the government
- (c) The wildlife and native enthusiasts
- (d) The industrialists

Ans. (d) *The industrialists*

[CBSE Marking Scheme 2019]

13. Food web is constituted by:

- (a) Relationship between the biotic and abiotic components of ecosystem.
- (b) Relationship between abiotic components and recycling of nutrients.
- (c) Relationship between biotic components and biogeochemical cycles.
- (d) Various interlinked food chains in an ecosystem.

14. Consider a terrestrial food chain: Grass → Grasshopper → Frog → Snake → Eagle

The energy transfer in the above food chain will be from:

- (I) Producer to decomposer
 - (II) Producer to primary consumer
 - (III) Primary consumer to secondary consumer
 - (IV) Tertiary consumer to Secondary consumer
- (a) Both (I) and (III)
 - (b) Both (I) and (IV)
 - (c) Both (II) and (III)
 - (d) Both (III) and (IV)

15. Which of the statements regarding food chain are correct?

- (I) All food chains are of equal length and complexity.
- (II) Food chains generally consist of only three or four steps.

food chain is of the producers.

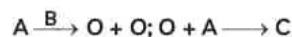
(IV) Relationships between organisms can be shown only by straight lines.

- (a) Both (I) and (II)
- (b) Both (II) and (III)
- (c) Both (III) and (IV)
- (d) (II), (III) and (IV)

16. Ozone-depleting substances are chiefly utilized in

- (I) chimneys
 - (II) cooling and refrigeration applications and in the manufacturer of foam products
 - (III) all of the human activities
 - (IV) burning fossil fuels
- (a) Only (I)
 - (b) Only (II)
 - (c) (I), (II) and (IV)
 - (d) (II), (III) and (IV)

17. Consider the chemical reactions taking place at upper atmosphere:

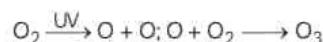


Select the row containing the correct naming of A, B and C.

	A	B	C
(a)	Molecular Oxygen	Ultraviolet radiations	Ozone molecule
(b)	Molecular Oxygen	Infrared radiations	Ozone molecule
(c)	Free Oxygen	Ultraviolet radiations	Molecular Oxygen
(d)	Ozone	Infrared radiations	Molecular Oxygen

Ans. (a) A: Molecular oxygen; B: Ultraviolet radiations; C: Ozone molecule

Explanation: Ozone at the higher levels of the atmosphere is a product of Ultraviolet radiation acting on oxygen (O_2) molecule. The higher energy UV radiations split apart some molecular oxygen (O_2) into free oxygen (O) atoms and these atoms then combine with the molecular oxygen to form ozone as shown below:



second and fourth trophic levels of a typical terrestrial are given in the table below.

Select the row containing the correct food habits:

	Food Habit of the Organisms at the Second Trophic Level	Food Habit of the Organisms at the Fourth Trophic Level
(a)	Herbivores	Parasites
(b)	Parasites	Saprophytes
(c)	Parasites	Carnivores
(d)	Herbivores	Carnivores

19. The protocol agreed upon in 1987 organized by the United Nations Environment Programme (UNEP) is related to:

- (a) Food security
- (b) Ozone layer depletion
- (c) Global warming
- (d) Sustainable development

Ans. (b) Ozone layer depletion

Explanation: In 1987, the United Nations Environment Programme (UNEP) succeeded in forging an agreement to freeze CFC production at 1986 levels in order to stop the depletion of ozone layer.

20. The formation of ozone in the stratosphere is powered by:

- (a) Ultraviolet radiation
- (b) Infrared radiations
- (c) Atmospheric oxygen
- (d) CFC

21. Which organism shown in the food chain above would contain the greatest concentration of chemical pollutants?

Phytoplankton → Krill → Small fish → Tuna → Shark

- (a) Phytoplankton
- (b) Krill
- (c) Tuna
- (d) Shark

Assertion-Reason Questions

For the following questions, two statements are given one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

explanation of assertion

(b) Both (A) and (R) are true and (R) is correct Explanation of the assertion.

(c) (A) is true, but (R) is false.

(d) (A) is false, but (R) is true.

22. Assertion (A) : Green plants of the ecosystem are the transducers.

Reason (R) : Producers trap the radiant energy of the sun and change it into chemical energy.

Ans. (a) Both (A) and (R) are true and (R) is the correct explanation of assertion.

Explanation: Green plants can make their own food. Hence, they are called producers. Since they capture the heat of the Sun to prepare their food, they are also called transducers. The plants prepare their food by trapping the energy of the Sun. They convert this light energy to chemical energy to form ATP molecules.

23. Assertion (A) : Food chains generally consist of only three to four steps.

Reason (R) : Autotrophs capture solar energy and convert it into chemical energy.

24. Assertion (A) : The maximum concentration of chemicals and pesticides occurs at the first trophic level.

Reason (R) : The chemicals and pesticides are not biodegradable.

25. Assertion (A) : Ozone shields the surface of the earth from ultraviolet radiation from the sun.

Reason (R) : Ozone at the higher levels of the atmosphere is a product of UV radiations acting on oxygen molecule.

Ans. (a) Both (A) and (R) are true and (R) is the correct explanation of assertion.

Explanation: Ozone is formed when the high energy UV radiations act on oxygen molecules (O_2) and split it into free oxygen atoms (O) which combine with the molecular oxygen to form ozone (O_3). Ozone thus shields the earth's surface from the harmful effects of UV radiations.

26. Assertion (A) : Improvements in our lifestyle have resulted in lesser amounts of waste material generation.

resulted in much of the waste generated to be non-biodegradable.

Ans. (d) (A) is false, but R is true.

Explanation: Improvements in our lifestyle have resulted in greater amounts of waste material generation due to changes in attitude and more and more things we use becoming disposable, which are also non-biodegradable.

27. Assertion (A): Frogs mostly occupy the second trophic level in food chains.

Reason : Frogs mostly feed on insects which depend on plants.

[Delhi Gov. 2021]

Ans. (d) A is false, but R is true.

Explanation: Frogs mostly occupy the third trophic level in the food chain since they feed on insects which depend on plants and plants are the primary producers thus they occupy the first trophic level in the food chain. Thus A is false, but R is true.

28. ④ Assertion(A): In the food chain third trophic level is occupied by Carnivores.

Reason(R) : Some of the carnivores are secondary consumers.

[Delhi Gov. 2021]

29. Assertion (A) : Each step or level of the food chain forms a trophic level.

Reason (R) : The organisms occupying the first trophic levels are called autotrophs.

[Delhi Gov. 2021].

Ans. (a) Both (A) and (R) are true, and (R) is correct explanation of the assertion.

30. ④ Assertion (A) : Each step or level of the food chain forms a trophic level.

Reason (R) : The various components of the ecosystem are interdependent.

31. ② Assertion (A): Polythene bags are non-biodegradable substances.

Reason (B): These bags cannot be broken down by microorganisms to simpler substances.

consist of only three or four steps.

Reason (B): Our food grains such as wheat and rice, vegetables and fruits and even meat contain varying amounts of pesticides. [Delhi Gov. 2021]

Ans. (b) Both (A) and (R) are true, but (R) is not the correct explanation of the assertion.

Explanation: The food chains generally consist of only three or four steps because after that the energy added to the biomass of each level is reduced and at the fourth trophic level it will be least. Thus Both A and R are true, but R is not the correct explanation of the assertion

33. Assertion (A): The amount of ozone in the atmosphere began to increase sharply in the 1980s.

Reason (R): The United Nations environment programme (UNEP) succeeded in forging an agreement to freeze CFC production in 1987.

[Delhi Gov. 2021]

Ans. (d) A is false, but R is true.

Explanation: The amount of ozone in the atmosphere began to decrease sharply in the 1980s because of the United Nations environment programme (UNEP) succeeded in forging an agreement to freeze CFC production in 1987. Thus A is false, but R is true.

Very Short Answer Type Questions

34. List two main components of an ecosystem. [CBSE 2019]

Ans. Two main components of an ecosystem are

- (1) Biotic component
- (2) Abiotic component

35. What is meant by 'biological magnification'? [CBSE 2017]

Ans. Biological magnification is the process by which the harmful and toxic substances enter the food chain and get concentrated in the body of living organisms at each successive level in food chain.

36. Name any two man-made ecosystems. [CBSE 2017]

Ans. Examples of man-made ecosystems are aquarium, crop-fields, zoo, botanical garden, Greenhouse.

Related Theory

- An ecosystem is a self-sustained unit which comprises of all the interacting living things together with their non-living environment.
- Manmade or artificial ecosystems that are carefully maintained in controlled environment.
- Biodiversity in man-made ecosystem will be very low as compared to natural ecosystem.

37. Why should biodegradable and non-biodegradable wastes be discarded in two different dustbins? [CBSE 2017]

38. What is meant by trophic level in a food chain? Construct a terrestrial food chain with four trophic levels. The energy flow in a food chain is always unidirectional. Why? [CBSE 2020]

Ans. Trophic level = Each step or level of the food chain forms a trophic level.

- The ultimate source of energy used by living organisms is the sun.
- Only 1% of solar radiations are captured by green plants in a terrestrial ecosystem and converted into food energy by photosynthesis. This energy is stored as chemical energy of food.
- When green plants (producers) are eaten by primary consumers (Herbivores) a lot of heat is lost as heat to the environment and other activities. Only 10% of the food eaten is turned into its new body and is available for the next level of consumers (Primary carnivores).
- Only 10% amount of organic matter reaches the next level of consumers (secondary carnivores).
- Since, amount of available energy goes on decreasing at each trophic level, food chains usually consists of only 3 to 4 trophic levels. For example grass receives 6000 J of energy from the sun. It will pass 10% of

600 J and so on.



39. What will be the amount of energy available to the organisms of the 2nd trophic level of a food chain, if the energy available at the first trophic level is 10,000 joules?

40. Why do producers always occupy the first trophic level on every food chain? [CBSE 2016]

41. Give 2 examples of each:

- Organisms occupying the first trophic level
- Abiotic factors of an ecosystem

Ans. (A) Organisms occupying the first trophic level: trees, shrubs, grass.



Related Theory

Green plants make their own food by the process of photosynthesis. The food or energy is transferred from one organism to the other through food chain. So the starting point of a food chain is producer i.e., plant occupy the first trophic level.

(B) Abiotic factors of an ecosystem: soil, water, light.



Related Theory

All the ecosystems are made of the main components biotic and abiotic components. The biotic component (living organisms) interact continuously with abiotic component (non-living component).

42. What are the advantages of cloth bags over plastic bags during shopping? [CBSE 2014]

COMPETENCY BASED Questions (CBQs)

[1, 4 & 5 marks]

43. 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 plastic waste collection and methods of its disposal.

Indore treated 15 lakh 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 the '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.

waste collection in your school.

- (B) Name any two uses of "single-use plastic" in daily life.
- (C) ④ If we discontinue the use of plastic, how can an environment-friendly substitute be provided?
- (D) Do you think microbes will work similarly in landfill sites as they work in the laboratory? Justify your answer.

[CBSE 2020]

Ans. (B) Uses of "Single-use plastic" in daily life.

- (1) In medical field: Plastic syringes, plastic gloves are made of single-use plastic and are used so that infection can be controlled.
 - (2) Single-use plastic is also used in food industry for packing, straws, wrappers, spoons etc.
 - (3) In emergency/disaster situations where food and water has to be transported, Plastic will be light in weight and this packaging will be helpful to transport.
(Any two)
- (D) No, the microbes will not work similarly in landfill sites as they work in laboratory. Microbes need suitable conditions like temperature, moisture etc. and nutrients to grow. In laboratory we provide this atmosphere artificially to microbes for their growth but landfill sites do not have suitable atmosphere to grow.

44. Prerna visited a farm along with her family. Her younger brother was interested in knowing what kind of food is eaten by animals such as cows, buffaloes and deers. She told her brother that all these animals are herbivores as these eat only grass and plants.



How much of the net primary productivity of a terrestrial ecosystem is eaten and digested by herbivores?

- (a) 100% (b) 10%
(c) 1% (d) 0.1% [CBSE 2020]

Ans. (b) 10%

productivity of terrestrial ecosystem is eaten and digested by herbivores. According to 10% law, only 10% of the energy entering a particular trophic level of organisms is available for transfer to the next higher trophic level.

45. 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.

- (A) Why is the maximum concentration of pesticides found in human beings?
- (B) Give one method which could be applied to reduce our intake of pesticides through food to some extent.
- (C) ④ Various steps in a food chain represent:
(a) Food web
(b) Trophic level
(c) Ecosystem
(d) Biomagnification
- (D) ④ 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


[CBSE 2020]

Ans. (A) As human beings occupy the top level in any food chain, the maximum concentration of these chemicals get accumulated in our bodies due to biological magnification.

Explanation: Pesticides are being used extensively for a high yield in the fields. These pesticides mix up with soil and water. From soil and water, these pesticides are absorbed by the plants along with water and minerals. When herbivores eat this plant food, these chemicals pesticides go into their bodies through the food chain. When the next

these pesticides get transferred to their bodies. As these chemicals are not biodegradable, they get accumulated progressively at each trophic level.

- (B) We can reduce our intake of pesticides through food to some extent:
 Wash fruits and vegetables before eating.
 Buy organic and locally grown fruits and vegetables.
 Use non-toxic methods for controlling insects in the kitchen garden. (Any one).

46.  Driving the Swachh Bharat Abhiyaan forward, several NGOs are working towards the installation of Blue and Green Dustbins for Municipal Corporations and schools in New Delhi. They are also carrying out a drive to educate children about the segregation of two different kinds of waste. The green is meant for wet waste and the blue one is for dry waste. This way they are separating biodegradable waste from non-biodegradable, thus providing various recycling and composting benefits and keeping the neighbourhood clean and healthy.



In the following groups of materials, which group(s) contain(s) only non-biodegradable items?



- (I) Wood, paper, leather
 (II) Polythene, detergent, PVC
 (III) Plastic, detergent, grass
 (IV) Plastic, Bakelite, DDT
 (a) (I) (b) (II)
 (c) (I) and (II) (d) (II) and (IV)

[CBSE 2014, 13]

47. Series of organisms taking part at various biotic levels form a food chain. Each step or level of the food chain forms a trophic level. The autotrophs or the producers are at the first trophic level. They fix up the solar energy and make it available for heterotrophs or the consumers.

come at the second, small carnivores or the secondary consumers at the third and larger carnivores or the tertiary consumers form the fourth trophic level.

The interactions among various components of the environment involve flow of energy from one component of the system to another.

- (A)  What are trophic levels?
 (B)  Give an example of a food chain.
 (C) What is the role of decomposers in the ecosystem?
 (D) Explain why the number of trophic levels in a food chain is limited?

Ans. (C) Decomposers are microorganisms which breakdown complex organic substances into simple inorganic substances and help in recycling of nutrients. They feed on the dead and decaying bodies of plants and animals. They return the nutrients back to the soil and thus help in making this ecosystem stable e.g. fungi, bacteria.

(D) Only 10% of the energy gets transferred from one trophic level to the next. So after 3 or 4 trophic levels, the energy available for passing on is too less to support another trophic level. Very little usable energy remains after 4 trophic levels. Hence the number of trophic levels in a food chain is limited.

48. Nitya observed her grandmother making compost which she used to give to her plants. Composting is the natural process of recycling organic matter, such as leaves and food scraps, into a valuable fertilizer that can enrich soil and plants. Anything that grows decomposes eventually; composting simply speeds up the process by providing an ideal environment for bacteria, fungi, and other decomposing organisms (such as worms, sowbugs, and nematodes) to do their work. The resulting decomposed matter, which often ends up looking like fertile garden soil, is called compost. Fondly referred to by farmers as "black gold," compost is rich in nutrients and can be used for gardening, horticulture, and agriculture.



- (a) convert inorganic material to simpler forms
 - (b) convert organic material to inorganic forms
 - (c) convert inorganic material to organic compounds
 - (d) do not breakdown organic compounds
- [CBSE 2014, 10]

Ans. (b) convert organic material to inorganic forms

Explanation: The microorganisms, comprising bacteria and fungi, break down the dead remains and waste products of organisms. These microorganisms are the decomposers as they break down complex organic substances into simple inorganic substances that go into the soil and are once more used up by the plants.

49. You might have seen an aquarium. In the first activity, let us try to design an aquarium. What are the things that we need to keep in mind when we create an aquarium? The fish would need a free space for swimming (it could be a large jar), water, oxygen and food. We can provide oxygen through an oxygen pump (aerator) and fish food which is available in the market. If we add a few aquatic plants and animals it can become a self sustaining system.

In the second activity, while creating an aquarium did you take care not to put an aquatic animal which would eat others? Write the aquatic organisms in order of who eats whom and form a chain of at least three steps. A → B → C [NCERT Activity 15.1, 15.2]

- (A) Identify the human-made ecosystems from the following:
- (I) Ponds
 - (II) Crop fields
 - (III) Aquarium
 - (IV) Lakes
- (a) Both (I) and (II)
 - (b) Both (II) and (III)
 - (c) (I), (II) and (IV)
 - (d) (II), (III) and (IV)
- (B) (a) The biotic and abiotic components in an aquarium are listed in the table below. Select the row containing the correct answer:

	Biotic components	Abiotic components
(a)	Aquatic plants and animals, water	Glass tank, aerator
(b)	Glass tank, aquatic plants and animals	Water, aerator
(c)	Aquatic plants and animals	Glass tank, water, aerator
(d)	Glass tank, water, aerator	Aquatic plants and animals

- (C) (a) Select the most appropriate answer:
 Aquariums have to be cleaned periodically whereas ponds and lakes do not need such cleaning as:
- (a) Ponds are natural ecosystems whereas aquariums are artificial ecosystems.
 - (b) There are less fishes in an aquarium as compared to a pond or lake
 - (c) The size of fishes is small in an aquarium as compared to a pond or lake
 - (d) Decomposers are absent in an aquarium whereas they are present in ponds or lakes.
- (D) (a) What would have happened if we had put predator fishes in the aquarium?
- (a) They would eat all the smaller fishes thereby generating lot of waste.
 - (b) They would eat away all the food available in the aquarium.
 - (c) They would compete with smaller fish for food and nutrition.
 - (d) They would not pose any problem in the aquarium.
- (E) (a) Consider the following aquatic food chain consisting of three steps:
- | | | | | |
|---|---|---|---|---|
| A | → | B | → | C |
|---|---|---|---|---|
- Identify the organisms at A, B and C:
- (a) A: Zooplankton; B: Phytoplankton; C: Large fish
 - (b) A: Phytoplankton; B: Zooplankton; C: Small fish
 - (c) A: Zooplankton; B: Phytoplankton; C: Small fish
 - (d) A: Phytoplankton; B: Zooplankton; C: Large fish

Explanation: Ponds and lakes are natural ecosystems, although there are some artificial or human made lakes too. Aquariums and crop fields are human made ecosystems as these have been made by humans.

50. Ritu went to the shopping mall to buy some gifts for her parents on their wedding anniversary. She was pleasantly surprised to see that all shop owners were giving the items purchased in beautiful and coloured paper bags instead of plastic bags.



Why is it better to use paper bags than plastic bags?

Ans. Paper is a biodegradable material, as it is obtained from wood whereas plastic is a non-biodegradable material. Therefore, paper is environment friendly whereas plastic causes environmental pollution.

51. In the first activity, find out what happens to the waste generated at home. Find out how the local body (panchayat, municipal corporation, resident welfare association) deals with the waste. Are there mechanisms in place to treat the biodegradable and nonbiodegradable wastes separately?

Calculate how much waste is generated at home in a day. How much of this waste is biodegradable? Suggest ways of dealing with this waste.

Next, find out how the sewage in your locality is treated. Are there mechanisms in place to ensure that local water bodies are not polluted by untreated sewage. Find out how the local industries in your locality treat their wastes.

[NCERT Activity 15.7, 15.8]

(A) In the following groups of waste generated at home, which group contains only biodegradable items?

- (a) Glass bottles, news paper, used tea leaves
(b) Polythene, detergent, Plastic packets

(d) Plastic packets, PVC, Glass bottles

(B) (a) Based on the study of how most local municipal authorities deal with the wastes generated at home, following statements are written. Select the incorrect statement.

- (a) The waste generated at home are differentiated into biodegradable and non-biodegradable materials.
(b) All types of wastes are placed in a single bin.
(c) Most of the "dry-waste" is processed at waste-to-energy plants.
(d) Most of the "wet-waste" is sent for composting

(C) (a) Which of the following is not the correct practice of dealing with biodegradable wastes?

- (a) Composting
(b) Anaerobic digestion of waste
(c) Landfills
(d) Burning

(D) (a) Select the correct statements regarding treatment of sewage in any locality:

- (I) Sewage is treated at sewage treatment plants.
(II) Sewage treatment is the process of removing contaminants from industrial wastewater only.
(III) Physical, chemical, and biological processes are used to remove contaminants and produce treated wastewater.
(IV) Sewage treatment is the process of removing contaminants from domestic and municipal wastewater.

- (a) Both (I) and (II)
(b) Both (II) and (III)
(c) Both (III) and (IV)
(d) Both (I) and (IV)

(E) (a) The best practice followed by local industries in treating their wastes is:

- (a) Source reduction and reuse

- (c) Dumping solid wastes in open drain
- (d) Dumping chemical wastes directly into water bodies

Ans. (A) (c) Vegetable peels, paper, flowers

Explanation: Biodegradable substances are those substances which are easily degraded by natural processes by the action of microorganisms. All materials of plant and animal origin are biodegradable whereas man made substances such as plastic, detergents, PVC, glass, etc are non-biodegradable.

52. ② Vijay's science teacher was once sharing experiences about his village life. He explained how as a child, he would often hear the sound of frogs during nights and especially during the rainy days. But the situation has changed now with lesser population of frogs even in villages.



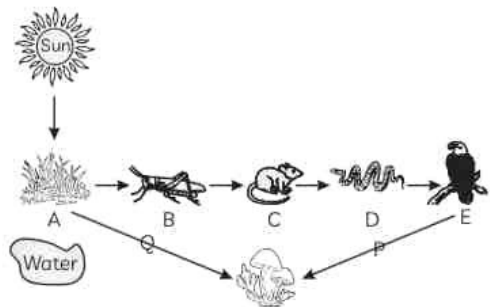
The number of malaria patients in a village increased tremendously when large number of frogs were exported from the village? What could be its cause?

	A	B	C	D
(a)	Autotrophs	Primary Consumer	Tertiary Consumer	Secondary Consumer
(b)	Autotrophs	Producer	Tertiary Consumer	Primary Consumer
(c)	Producer	Tertiary Consumer	Secondary Consumer	Primary Consumer
(d)	Producer	Primary Consumer	Secondary Consumer	Tertiary Consumer

- (C) ② Which of the following are functional components of an ecosystem?

- (I) Decomposers
- (II) Solar energy
- (III) Energy flow
- (IV) Air
- (a) Both (I) and (II)
- (b) Both (III) and (IV)

for planet Earth and sets in motion very large and complex systems that develop and sustain life. One such land-based ecosystem is the forest, supporting a biodiverse set of plants, which in turn provide food for other living things. Several distinct types of woodland habitats exist on Earth, such as conifer, deciduous and mixed. A study of the deciduous forest shows how a food chain functions within an ecosystem that experiences distinct seasonal changes.



- (A) In an ecosystem, the main source of energy is

- (a) heat released during transpiration
- (b) solar energy
- (c) heat released during respiration
- (d) water

- (B) Refer to the figure of food chain given above, identify A, B, C and D and select the correct combination of plots provided in the table below.

- (c) (I), (II) and (IV)

- (d) (I), (III) and (IV)

- (D) ② The correct identification of P and Q from the figure of food chain given is:

- (a) P: Decomposers, Q: Nutrients
- (b) P: Decomposers, Q: Soil
- (c) P: Producers, Q: Nutrients
- (d) P: Tertiary Consumers, Q: Soil

from the food chain would be:

- (a) Energy flow would be blocked
- (b) Movement of minerals back to soil will be blocked
- (c) Rate of decomposition would increase
- (d) No carbon dioxide will be available for herbivores for respiration

Ans. (A) (b) Solar energy

Explanation: Sun is the main source of energy for an ecosystem since green plants or producers are able to synthesize food only with the help of solar energy.

(B) (d) A: Producer; B: Primary Consumer; C: Secondary Consumer; D: Tertiary Consumer

Explanation: In all food chains, the green plants are the producers as they synthesize food by utilizing solar energy. The small insects marked 'B' or herbivores are the primary consumers as they feed on plants. Small animals marked 'C' are secondary consumers as they feed on small insects and similarly larger carnivores are tertiary consumers and marked 'D' and 'E'.

(E) (b) Movement of minerals back to soil will be blocked

Explanation: The organisms marked 'P' are the decomposers which help in cleansing our environment by feeding on dead and decaying organisms. They help in movement of minerals or nutrients back to the soil for the producers.

54. Sanket and his friends went to a nearby orchard to see how different fruits are cultivated. However, they observed that pesticides were being sprayed on the fruits without adhering to any guidelines.



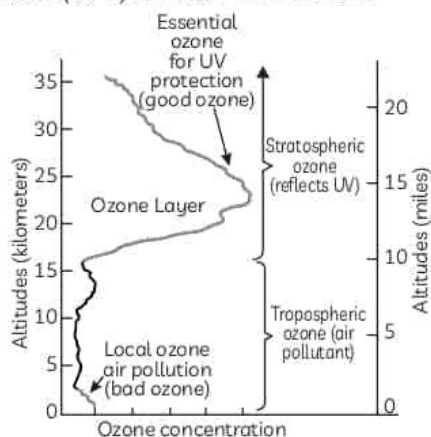
protect the crops from diseases cause long-term damage to mankind?

Ans. Pesticides are non-biodegradable chemicals which enter our food chain through the fruits we eat or are absorbed by the aquatic plants and animals. These concentration of these chemicals increases progressively at each trophic level and maximum concentration is found in human beings. This is known as biological magnification.

55. Ozone (O_3) is a gas which is present naturally within Earth's atmosphere and is formed of three oxygen atoms. In the figure we see a standard profile of ozone gas concentration through the Earth's atmosphere, extending from ground level up to 40 kilometres in altitude. Ozone plays a different role in atmospheric chemistry at different heights in the Earth's atmosphere. We can differentiate this profile into two key zones:

Tropospheric ozone is that which is present in the lower atmosphere. Throughout most of the troposphere, ozone concentrations are relatively low (as shown in the diagram). Ground-level ozone can have negative impacts on human health and is therefore commonly referred to as 'bad' ozone.

Stratospheric ozone is that which is present in the upper atmosphere. As shown in the diagram, concentrations of ozone are higher in the stratosphere than in the troposphere. The stratosphere includes the zone termed the 'ozone layer'. In the ozone layer, it is often referred to as 'good' ozone since it plays a crucial role in absorbing potentially dangerous ultraviolet (UV-B) radiation from the sun.



row containing the correct information:

	Good Ozone	Bad Ozone
(a)	Ionosphere	Mesosphere
(b)	Stratosphere	Ionosphere
(c)	Stratosphere	Troposphere
(d)	Mesosphere	Troposphere

(B) ☒ Ozone at higher atmosphere is a product of:

- (a) Ultraviolet radiation acting on free oxygen.
- (b) Infrared radiation acting on oxygen molecule.
- (c) Infrared radiation acting on free oxygen.
- (d) Ultraviolet radiation acting on oxygen molecule.

(C) Select the incorrect statements regarding ozone gas:

- (I) It is present only in troposphere.
- (II) It is present in very small quantities in stratosphere.
- (III) It can be beneficial or harmful, depending upon its location and concentration.
- (IV) It shields the surface of the earth from ultraviolet (UV) radiation from the Sun.

- (a) Both (I) and (II)
- (b) Both (II) and (III)
- (c) (I), (II) and (III)
- (d) (II), (III) and (IV)

(D) ☒ Which of the following products contain ozone-depleting substances?

- (a) Motorbike, car with AC, Pesticides, Fire extinguisher
- (b) Car with AC, refrigerator, fire extinguisher, aerosol sprays
- (c) Motorbike, aerosol sprays, Pesticides, Fire extinguisher
- (d) Heater, car with AC, Pesticides, Fire extinguisher

(E) ☒ Which of the following is not the consequence of ozone layer depletion?

- (a) Increased ultraviolet rays
- (b) Malignant melanoma-Another form of skin cancer
- (c) Cataracts and other eye damage
- (d) Tides

Troposphere

(C) (a) Both (I) and (II)

Explanation: Ozone is present in very low concentration in the lower atmosphere or troposphere. It is present in higher concentrations in the upper atmosphere or stratosphere. It is quite harmful when present in the lower atmosphere as it causes several diseases in humans. It is beneficial when present in upper atmosphere as it shields the surface of the earth from the harmful ultraviolet radiations of the sun.

56. Monty was travelling to Delhi by road from Chandigarh. He observed a huge mountain like structure on GT Karnal road upon entering Delhi. He came to know that it was actually a landfill site and that Delhi has three landfill sites, viz. at Okhla, Bhalswa and Ghazipur. One can find waste burning at any give time in these landfills. They have also run out of space nearly a decade ago. Although the permissible limit for a garbage dumping is set to 20 meters, these sites have turned into huge mountains well beyond the permissible limit.



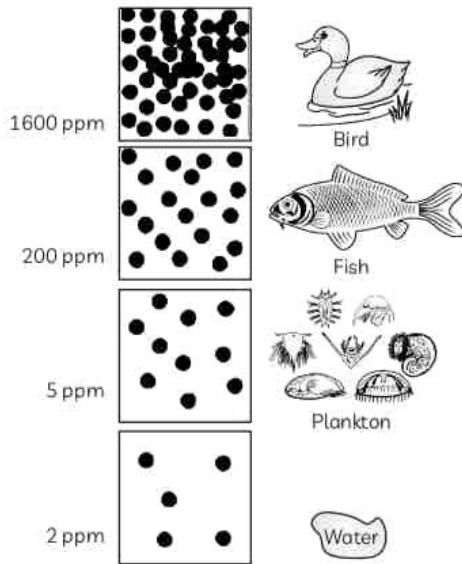
Suggest two measures to manage the garbage we produce.

Ans. Two measures to manage the garbage we produce are listed below:

- (1) Segregate the wastes and try to reuse as many items as possible.
- (2) Put wet and dry wastes in separate garbage bins so that they can be easily recycled.

57. Toxic substances move up the food chain and become more concentrated at each level. These substances are often pollutants from industries or pesticides from farming. Consider any small fish that eats plankton that has been tainted with mercury. Hundreds of small

mercury, not enough to cause major harm. A bird then might eat hundreds of the small fish, so that now instead of 200 ppm in a single fish, that bird has much higher levels of mercury. The toxin amplifies as it moves up the food chain. The amount of mercury is measured in ppm, which means "parts per million."



- (A) The phenomenon when concentrations of a harmful substance increases in organisms at higher trophic levels in a food chain or food web is:
- Artificial eutrofication
 - Biological accumulation
 - Biological magnification
 - Biological pollution
- (B) The table below gives the organism in a food web containing the lowest and highest concentration of harmful chemical pollutants.
- Select the row containing the correct answer.

	Lowest Concentration	Highest Concentration
(a)	Primary consumers	Secondary consumers
(b)	Tertiary consumers	Producers
(c)	Producers	Secondary consumers
(d)	Producers	Tertiary consumers

incorrect?

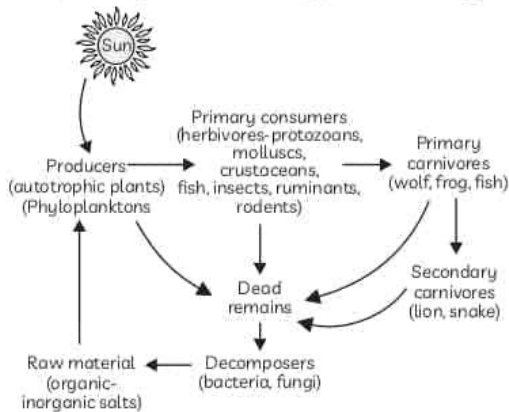
- Non-biodegradable wastes are biological in origin.
 - Biodegradable wastes are degraded by microorganisms such as bacteria and fungi.
 - Biodegradable wastes enter the food chain and get biologically magnified.
 - Non-biodegradable wastes are absorbed by plants from the soil.
- Both (I) and (II)
 - Both (I) and (III)
 - Both (II) and (III)
 - Both (III) and (IV)
- (D) It was observed that at places where DDT was used to control mosquitoes and other pests, the eggs of eagles would become fragile and break and the eagle almost became extinct. After DDT was banned by lawmakers, eagle population has recovered.
- The possible reason for this is:
- DDT is non-biodegradable and hence found in largest concentration in tertiary consumers.
 - DDT is non-biodegradable and found in largest concentration in producers.
 - Largest concentration of DDT is found in secondary consumers on which eagle feeds.
 - DDT is a strong chemical which makes the eggs fragile.
- (E) Biological magnification is a result of:
- climate change
 - food shortages
 - pollution
 - extinction

Ans. (B) (d) *Lowest Concentration: Producers*
Highest Concentration: Tertiary consumers

Explanation: The concentration of harmful chemical pollutants such as DDT and other pesticides increases progressively at each trophic level. Therefore, tertiary consumers which occupy the highest trophic level will have the highest concentration and producers which occupy the lowest trophic level will have the lowest concentration of harmful chemical pollutants.

Explanation: The biodegradable wastes are biological in origin whereas non-biodegradable wastes are plastic, metals etc. The non-biodegradable wastes enter the food chain and get biologically magnified as we higher up the food chain.

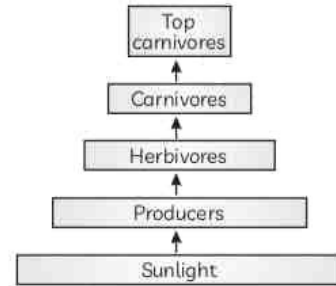
58. The chemical energy of food is the main source of energy required by all living organisms. This energy is transmitted to different trophic levels along the food chain. The energy flow in the ecosystem is one of the major factors that support the survival of such a great number of organisms. For almost all organisms on earth, the primary source of energy is solar energy.



- (A) The flow of energy in an ecosystem is:
- Omnidirectional
 - Unidirectional
 - Bidirectional
 - May be unidirectional or bidirectional
- (B) Non-biodegradable wastes enter the food chain through:
- Soil
 - Water
 - Air
 - Decomposers
- Both (I) and (II)
 - Both (II) and (IV)
 - Both (I) and (III)
 - Both (III) and (IV)
- (C) What happens to the solar energy incident on the autotrophs in a terrestrial ecosystem?
- It is completely captured and converted into food energy by the autotrophs.
 - A part of it is reverted to the solar input

the herbivores.

- (d) It moves progressively through the various trophic levels in both directions.



- (D) In the given food chain, suppose the amount of energy at fourth trophic level is 8 kJ.

Grass → Grasshopper → Frog → Snake → Hawk

Select the row containing the correct values of the energy available at the producer level and secondary consumer level?

	Energy Available at Producer level	Energy Available at Secondary Consumer Level
(a)	800 kJ	8 kJ
(b)	800 kJ	80 kJ
(c)	8000 kJ	72 kJ
(d)	8000 kJ	80 kJ

- (E) If only 10% of the energy from one trophic level passes up to the next level, what happens to the 90% energy that is not passed on?
- It is lost as heat to the environment
 - It is used in digestion of food and in doing work.
 - It is used for growth and reproduction.
 - All of the above

Ans. (B) (a) Both (I) and (II)

Explanation: The non-biodegradable pesticides 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 hence enter the food chain.

- (D) (d) Energy Available at Producer Level: 8000 kJ; Energy Available at secondary consumer level: 80 kJ

law, 90% of the energy captured from the previous trophic level is lost to the environment and only 10 percent is made available to the next trophic level.

In this food chain, at the 4th trophic level, 8 kJ energy is available to the snake. Therefore, we can calculate backwards to find energy available at the third, second and first trophic levels.

consumer) = 8 kJ = 10% of 80 kJ

⇒ Energy available to Frog (Secondary consumer) = 80 kJ = 10% of 800 kJ

⇒ Energy available to Grasshopper (Primary consumer) = 800 kJ = 10% of 8000 kJ.

⇒ Energy available to Grass (Producer) = 8000 kJ

SHORT ANSWER Type-I Questions (SA-I)

[2 marks]

59. Why are crop fields known as artificial ecosystems? [CBSE 2013]

60. Briefly describe the two types of ecosystem.

Ans. Natural ecosystem: These ecosystems operate in the nature by themselves without any human interference. They can be terrestrial or aquatic. The common examples of terrestrial ecosystem are forest, grassland and desert. The common examples of aquatic ecosystem are ponds, lakes, rivers, sea.

Man-made or artificial ecosystem: These are maintained by man and hence are called Man-made ecosystems or artificial ecosystem. Man maintains the natural balance by the addition of energy and planned manipulations. Example: crop field, aquarium, garden.

61. 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. [CBSE 2017]

SHORT ANSWER Type-II Questions (SA-II)

[3 marks]

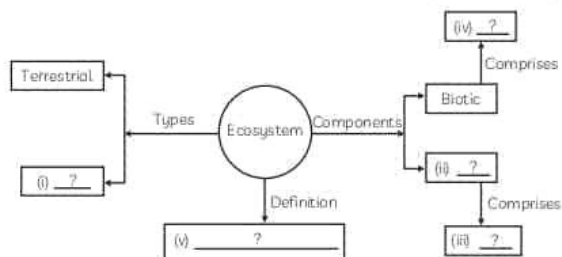
62. Why is improper disposal of waste a curse to environment? [CBSE 2014, 13]

63. (A) What is an ecosystem?

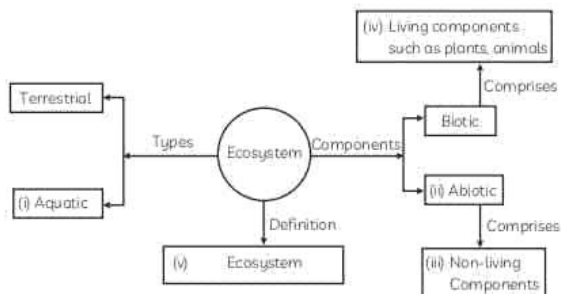
(B) List any two natural ecosystems.

(C) We do not clean ponds or lakes, but an aquarium needs to be cleaned regularly. Why? [CBSE 2020]

64. Complete the following flow chart based on ecosystem and its components. [CBSE 2020]



Ans.



Ecosystem: It is a structural and functional unit of the biosphere which comprises living and non-living components that interact by means of food chains and chemical cycles resulting in energy flow, biotic diversity and material cycling to form a stable and self supporting system.

comprising four trophic levels.

- (B) What will happen if we kill all the 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.

[CBSE 2020]

66. Complete the following table:

	Oxygen	Ozone
Formula	(A)	(B)
Benefits to biotic component	(C)	(D)

Ans. (A) O₂

(B) O₃

(C) Benefits of oxygen to biotic component.

Breathing: All biotic components inhale oxygen from the atmosphere and exhale CO₂.



Related Theory

Decomposition: The break down of complex food material (dead plants and animals) into simpler material requires oxygen.

Combustion: The burning of fossil fuels requires oxygen.

(D) Benefits of Ozone to biotic component—the ozone layer is important for the existence of life on earth because it absorbs most of the harmful ultra violet radiations coming from the sun and prevents them from reaching the earth.



Related Theory

O₃ gas is poisonous in nature if inhaled.

67. (A) Create a terrestrial food chain depicting four trophic levels.

(B) Why do we not find food chains of more than four trophic levels in nature?

Ans. A food chain showing I trophic level (½ mark), II trophic level (½ mark), III trophic level (½ mark) and IV trophic level (½ mark).

A flow chart or a diagrammatic representation showing all the four trophic levels would also be accepted.

According to the 10% law, the amount of energy available will not be sufficient for the survival of the organism in the 5th trophic level. [CBSE Marking Scheme 2019]

eco-system, which is self-sustainable?

69. List two main causes of the pollution of water of the river Ganga. State how pollution and contamination of river water prove harmful for the health of the people of neighbouring areas.

Ans. Causes:

- (1) Disposal of industrial effluents
- (2) Human activities like bathing, washing, it is religious practice and sentiment
- (3) Disposal of untreated sewage (any two)

Harmful effects on health:

- (1) Spreads water borne diseases,
- (2) Consumptions of contaminated fishes (or any other relevant affect)

[CBSE Marking Scheme 2015]

70. What is biological magnification? Will the levels of this magnification be different at different levels of the ecosystem?

Ans. **Biological magnification:** The increase in concentration of harmful chemical substances like pesticides in the body of living organisms at each trophic level of a food chain is called Biological magnification.

Several pesticides and harmful chemicals enter our body through food chain and remain there without being decomposed. The accumulation of these harmful chemicals increases towards the higher side of the food chain that is the level or concentration of the harmful chemicals increases with increasing trophic level. So, it is different at different levels of the ecosystem.

Explanation: There are different ways in which poisonous chemicals enter different food chains at producer level.

For example:

DDT in water → DDT in phytoplankton and zooplankton → DDT in egret

→ DDT in fish 0.02 ppm

5 ppm 1600 ppm 240 ppm

Biological magnification in food chain

If water bodies were found to contain 0.02 ppm (parts per million) of DDT (use of DDT is now banned). The phytoplankton and zooplankton which consume this water were found to contain 5 ppm concentration of DDT in their body. Fish feeding on such plankton had 240 ppm DDT in their body tissue. The level of DDT concentration reacted to 1600 ppm in birds feeding on these fish.

Humans which perhaps occupy the highest point in the food chain will face highest accumulation.

for concern? What steps are being taken to limit this damage?

72. ② Answer the following questions:

(A) To discard the household waste, we should have two separate dustbins, one for the biodegradable waste and the other for non-biodegradable waste. Justify the given statement and suggest the proper ways of disposal of such wastes.

(B) Classify the given waste into biodegradable and non-biodegradable waste used tea leaves, leather bag, plastic bag, jute bag.

73. ② How can we help in reducing the problem of waste disposal? Suggest any three methods. [CBSE 2019]

74. ② We often see domestic waste decomposing in the by lanes of our residential colony, besides many empty plastic bottles, wrappers etc. lying here and there. Suggest any two arguments to make the residents realise that the improper disposal of waste may be harmful to their own as well as community health. [CBSE 2017]

75. (A) State with reason the consequence of decrease in number of carnivores in an ecosystem.

(B) In a food chain, state the trophic level

chemicals is maximum. Why is it so?

[CBSE 2020]

Ans. (A) If there is decrease in number of carnivores in an ecosystem, then there will be no predator or very less predator control over the population of herbivores. One of this the population of herbivores will increase. Herbivores eat grass, so an increase in herbivore population will lead to excessive grazing of grass. The density of producers like grass will be much reduced. Overgrazing may eliminate the grass and other green plants completely and turn the forest into a desert area.

Explanation: (a) : Grass → Deer → Lion

If all lions are removed or their number reduces by killing or capturing the population of deer will increase. Increase in deer population will lead to excessive grazing of grass. Overgrazing will eliminate the grass and forest will become barren land.

(B) In a food chain, the highest trophic level will have the maximum concentration of harmful chemicals.

Explanation: (a) : Grass → Grasshopper → Frog → Snake.

In this food chain, snake will have the maximum concentration of chemicals in its body as it occurs at the highest trophic level.

LONG ANSWER Type Questions (LA)

[5 marks]

76. (A) ② Create a food chain of the following organisms:

Insect, Hawk, Grass, Snake, Frog

(B) ② Name the organism at the third trophic level of the created food chain.

(C) ② Which organism of this food chain will have the highest concentration of non-biodegradable chemicals?

(D) ② Name the phenomenon associated with it.

(E) ② If 10,000 joules of energy is available to frogs, how much energy will be available to snakes in this food chain. [CBSE 2020]

77. (A) ② A food chain generally has three or four trophic levels. Explain.

(B) ② What is biological magnification? Explain.

78. ② Suggest any four activities in daily life which are eco-friendly. [CBSE 2016, 14]

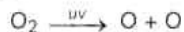
79. How is ozone formed in the upper atmosphere? State its importance.

What is responsible for its depletion? Write one harmful effect of ozone depletion.

[CBSE 2019]

Ans. Ozone is produced by the action of UV radiations on oxygen molecule.

molecular oxygen, O_2 , into free oxygen, O.



The free oxygen O combines with molecular oxygen O_2 to form Ozone, O_3 .



Importance of ozone: Ozone shields the earth's surface from the harmful ultraviolet (UV) radiations from sun.

Synthetic chemicals such as Chlorofluorocarbons (CFC) and aerosols are mainly responsible for depletion of ozone in the atmosphere.

Harmful effect of ozone depletion:

- (1) Ozone layer depletion causes increased UV radiation levels at the Earth's surface, which is damaging to human health as it causes certain types of skin cancers, eye cataracts and immune deficiency disorders.
- (2) UV radiation also affects terrestrial and aquatic ecosystems, altering growth, food chains and biochemical cycles.
- (3) UV rays also affect plant growth, reducing agricultural productivity.

(Any 1 of 3 points can be written to get full marks)

80. While teaching the chapter "Our Environment" the teacher stressed upon the harmful effects of burning of fossil fuels, plastic, paper etc. The students noticed the extensive use of plastic and polythene in daily life, which can be avoided and the surroundings can be kept clean. They decided to make their school "plastic and polythene" free and motivated each other for its minimum use.

- (A) Why should the use of polythene and plastic be reduced in daily life?
- (B) In what ways the students would have avoided the use of plastic and polythene in their school? [CBSE 2018]

81. Mr. Kumar, the incharge of "Eco-Club" of a school felt the need of organising an "Awareness Campaign" for the residents of the nearby areas to make them realise the necessity of segregating the biodegradable and non-biodegradable wastes. He went from door-to-door with his students and gave arguments to explain the people about the importance of disposal of their household

about the prosecutorial provisions in the cases where garbage is thrown at places other than the specified bins.

List two advantages of disposing the waste after segregating it in two categories.

[CBSE 2017]

82. Your mother always thought that fruit juices are very healthy for everyone. One day she read in the newspaper that some brands of fruit juices in the market have been found to contain certain level of pesticides in them. She got worried as pesticides are injurious to our health.

- (A) How would you explain to your mother about fruit juices getting contaminated with pesticides?
- (B) It is said that when these harmful pesticides enter our body as well as in the bodies of other organisms they get accumulated and beyond a limit cause harm and damage to our organs. Name the phenomenon and write about it.

[CBSE 2017]

83. 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.

Ans. **Biodegradable substances:** can be broken down into simpler substances by nature/decomposers/bacteria/saprophytes/saprobionts.

Ex.- Human Excreta/Vegetable peels, etc.

(any one)

Non-biodegradable substances: can't be broken down into simpler substances by nature/decomposers.

Ex.- Plastic/glass (or any other) (any one)

Habits:

- (1) Use of separate dustbins for biodegradable and non biodegradable waste.
- (2) Reuse of things such as poly-bags, etc.,
- (3) Recycle of waste
- (4) Use of cotton/jute bags for carrying vegetables etc. (any two)

[CBSE Marking Scheme 2015]



VERY SHORT ANSWER Type Questions

[1 mark]

1. In a food chain of frog, grass, insect and snake, assign trophic level to frog.

Ans.

$\left(\frac{3}{2}\right)$ Grass \rightarrow insect \rightarrow frog \rightarrow Snake.
Frog comes in the third trophic level.

[CBSE Topper 2016]

2. In the following food chain, 100 J of energy is available to the lion. How much energy was available to the producer?

Plants \rightarrow Deer \rightarrow Lion

Ans.

Energy available to producer \rightarrow 10,000 J

[CBSE Topper 2017]

3. Give one example each from your daily life where the domestic waste can be effectively reused and recycled.

Ans.

Old newspapers can be collected and sent to factories to be recycled.
Plastic and glass bottles/jars can be reused to store pickles and other food materials.

[CBSE Topper 2014]

4. List two examples of natural ecosystem.

Ans.

Green plants are considered to be producers of food. They convert simple inorganic raw materials to complex organic substances (sugar & starch) in the presence of sunlight and Chlorophyll. Hence, the green plants (capable of synthesising their own food) are placed in the first trophic level.

[CBSE Topper 2015]

SHORT ANSWER Type-I Questions (SA-I)

[2 marks]

5. What are decomposers? List two important roles they play in the environment.

Ans.

Decomposers are micro organisms, especially bacteria & fungi, that break down waste and dead remains of organisms. They convert complex organic substances into simple inorganic molecules, which go into the soil and are once again taken up by plants.

- * Decomposers ensure the cyclic movement of matter in nature.
- * They prevent pollution and makes sure that the earth is not covered with organic waste.

[CBSE Topper 2014]

6. The activities of man had adverse effects on all forms of living organisms in the biosphere. Unlimited exploitation of nature by man disturbed the delicate ecological balance between the living and non-living components of the biosphere. The unfavourable conditions created by man himself threatened the survival not only of himself but also of the entire living organisms on the mother earth. One of your classmates is an active member of 'Eco club' of your school which is creating environmental awareness amongst the school students, spreading the same in the society and also working hard for preventing environmental degradation of the surroundings.
- (A) Why is it necessary to conserve our environment?
 (B) Cstate the importance of green and blue dust-bins in the safe disposal of the household waste.
 (C) List two values exhibited by your classmate who is an active member of Eco-club of your school.

Ans. a) It is necessary to conserve the environment for Sustainable development
 * fulfill our needs from the resources that we are very much relied upon by fulfilling our requirements.
 * To make our future generation to use it for their material aspirations and to save our ecosystem.
 * To save biodiversity to avoid ecological imbalance.
 b) The segregation of waste such as biodegradable and non-biodegradable wastes for recycling is useful. It saves our time and energy. The various things can be appropriately disposed.
 c) sensitive towards environmental degradation.
 active citizen, aware of current issues related to environment.
 caring student.

[CBSE Topper 2016]

7. Students in a school listened to the news read in the morning assembly that the mountain of garbage in Delhi, suddenly exploded and various vehicles got buried under it. Several people were also injured and there was traffic jam all around. In the brain storming session the teacher also discussed this issue and asked the students to find out a solution to the problem of garbage. Finally they arrived at two main points: one is self management of the garbage we produce and the second is to generate less garbage at individual level.
- (A) Suggest two measures to manage the garbage we produce.
 (B) As an individual, what can we do to generate the least garbage? Give two points.
 (C) List two values the teacher instilled in his students in this episode.

Ans. (a) For managing garbage, first we must segregate it into biodegradable & non-biodegradable substances. Biodegradable substances like vegetable peels, domestic waste, animal excreta, cow dung etc. must be converted into manure. This not only helps in enriched growth of plants but also prevents dump of it in open, production of foul smells etc.
 (ii) For non-biodegradable substances, we must further segregate as recyclable & non-recyclable. All recyclable metals, plastic, glass must be sent to diff. factories which after proper cleaning, process them in new products.

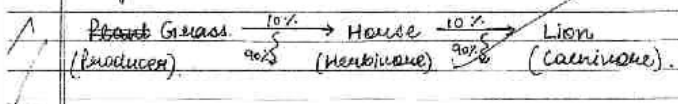
- (i) Landfill which can be converted into playground for children or incineration at places with proper management for it can be done.
- (b) As an individual,
- (i) We must follow the policy of reduce. We should try to switch of lights when unnecessary for our resources & for garbage, try using some sheet of blank paper not used from other side, try making registers with utilizing all the pages to reduce our demand for bought copies, reducing usage of plastic disposable cups.
- (ii) We must follow the policy of reuse. Using jam bottles, milk cartons, packaging boxes, Petting bottles is a good way to use resources already once used.
- (c) Teacher has instilled the values of 'environmental concern', 'eco friendliness', 'wise use of resources'.

[CBSE Topper 2018]

8. What is a food chain? Why is the flow of energy in an ecosystem unidirectional? Expl ain briefly.

Ans.

① Food Chain is a sequence of organisms in which one consumes the other to transfer energy.
 For eg.



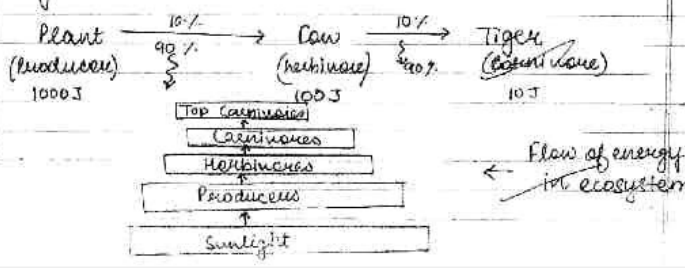
② The flow of energy in an ecosystem is always unidirectional as they cannot revert back the energy consumed or lost in environment.

③ For example, plants cannot revert back the chemical energy into solar energy.

④ Since they move progressively from one trophic level to the other, the energy content goes on decreasing according to 10% law.

⑤ They do not have that much energy to reverse the flow even if they want to.

For eg.



[CBSE Topper 2019]

