

# 13 Our Environment

## Fastrack Revision

- **Ecosystem:** It is a structural and functional unit of biosphere. An ecosystem consists of biotic components comprising living organisms and abiotic components comprising physical factors like temperature, water, air, soil and minerals.

### MNEMONICS

**Concept :** Abiotic components

**Mnemonic:** WASTE

**Interpretation:** W – Wind      A – Air      S – Soil  
Te – Temperature

The ecosystem is of the following two types:

- (i) **Natural Ecosystems:** These are the ecosystems which develop in nature without human support. Depending upon the habitats, natural ecosystem may be **terrestrial**, i.e., present on land, e.g., desert, grassland and forest or **aquatic**, i.e., found in water bodies, e.g., ponds, lakes and marine.
- (ii) **Artificial Ecosystems:** These are the ecosystems which have been created and are maintained by human beings. The artificial ecosystems are also called man-made or anthropogenic ecosystems, e.g., aquarium, botanical gardens, parks, etc.
- The biotic components of an ecosystem are primarily made up of three kinds of organisms: (i) Producer, (ii) Consumer and (iii) Decomposers.
- **Producers:** These are organisms which can make organic compounds (sugar and starch) from inorganic substances by photosynthesis, e.g., all green plants and certain bacteria.
- **Consumers:** These are organisms which depend upon the producers for food, either directly or indirectly by feeding on other consumers for their sustenance. They are also called heterotrophs.

Herbivores, carnivores, omnivores and parasites are the various types of consumers.

Herbivores—eat only plants, e.g., goat, sheep, deer, rabbit etc.

Carnivores—eat only other animals, e.g., lion, tiger etc.

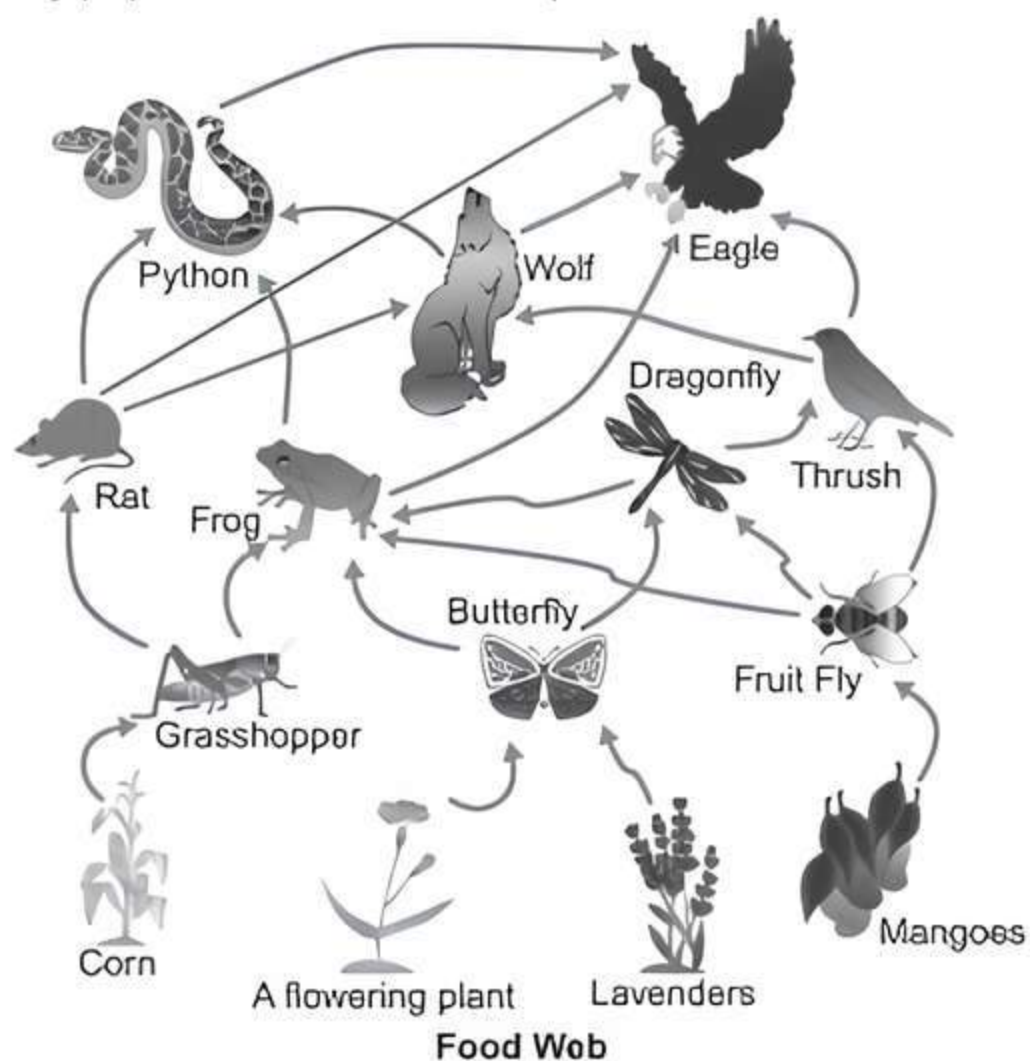
Omnivores—eat both plants and animals, e.g., man, dog, bear, crow etc.

Parasites are organisms that live on or inside the body of another organism, i.e., host from which it obtains its nutrients, e.g., parasites of man include fleas and lice.

- **Decomposers:** These are micro-organisms that obtain energy from the chemical breakdown of dead remains and waste products of animals or plants. Decomposers break down the complex organic substances into simple inorganic substances that go into the soil and are used up once more by the plants. Decomposers act as cleansing agents of environment.

- **Food Chain:** It is a sequence of living organisms in a community in which one organism eats other and is itself eaten by another organism to transfer energy. It helps to understand the food relationship and interactions among various organisms in an ecosystem. Each step of food chain is called trophic level. Flow of energy in a food chain is unidirectional.

- **Food Web:** The various food chains operating within an ecosystem cannot function in isolation. They form a network having intercrosses and linkages. A network of interconnected food chains is called a food web. It has many populations of different species.



- **10 Per cent Law:** 10 per cent law states that, 'only 10 per cent of the total energy entering a particular trophic level is available for transfer to the next trophic level.' Thus, there is a gradual decline in the amount of energy available as we move from producer level to the next trophic level.

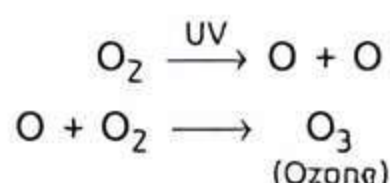
For Example,

Grass (10,000 J) → Grasshopper (1,000 J) → Frogs (100 J) → Snakes (10 J)

- **Biological Magnification:** It is an increase in the concentration of harmful chemicals like pesticides in the body of an organism per unit mass at each successive trophic level in a food chain.
- **Ozone Layer:** Ozone ( $O_3$ ) is a molecule consisting of three atoms of oxygen whereas molecules of oxygen ( $O_2$ ) contain only two atoms. Major part of it is present in higher levels of the atmosphere (stratosphere). Ozone has a characteristic pungent smell and is deadly poisonous.



It shields the surface of the Earth from ultraviolet (UV) radiations of the Sun.



- **Ozone Depletion:** It refers to thinning of ozone layer. Ozone layer gets depleted due to the use of chemicals called aerosol, spray propellants like chlorofluorocarbons, oxides of nitrogen, methane, carbon tetrachloride, etc.
- **Biodegradable Wastes:** The waste materials which can be broken down to non-poisonous or harmless substances by the action of certain microorganisms (like bacteria and fungi) are called biodegradable wastes. The enzymes

released by microorganisms help to break them. They are generally organic wastes, e.g., garbage, sewage, livestock waste etc.

- **Non-biodegradable Wastes:** The waste materials which cannot be broken down to non-poisonous substances by the action of microorganisms are called as non-biodegradable wastes.

Some non-biodegradable wastes are—plastic, polythene bags, synthetic fibres, glass, aluminium, iron nails and radioactive (nuclear) wastes.

Some methods of waste disposal may be Biogas plant, sewage treatment plant, composting, recycling and reuse. Landfill and incineration (means reducing to ashes) are also the methods of waste disposal.



## Practice Exercise



### Multiple Choice Questions

Q 1. An ecosystem includes: (NCERT EXEMPLAR)

- a. all living organisms.
- b. non-living objects.
- c. both living organisms and non-living objects.
- d. sometimes living organisms and sometimes non-living objects.

Q 2. 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)
- d. (i), (ii) and (iv)

Q 3. Which of the following is an artificial ecosystem? (NCERT EXEMPLAR)

- a. Pond
- b. Crop field
- c. Lake
- d. Forest

Q 4. The decomposers in an ecosystem: (NCERT EXEMPLAR)

- a. convert inorganic material to simpler forms.
- b. convert organic material to inorganic forms.
- c. convert inorganic materials into organic compounds.
- d. do not breakdown organic compounds.

Q 5. Which group of organisms are not constituents of a food chain? (NCERT EXEMPLAR)

- (i) Grass, lion, rabbit, wolf
  - (ii) Plankton, man, fish, grasshopper
  - (iii) Wolf, grass, snake, tiger
  - (iv) Frog, snake, eagle, grass, grasshopper
- a. (i) and (iii)
  - b. (iii) and (iv)
  - c. (ii) and (iii)
  - d. (i) and (iv)

Q 6. Which of the following limits the number of trophic levels in a food chain? (NCERT EXEMPLAR)

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

Q 7. 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.

Q 8. How much of the net primary productivity of a terrestrial ecosystem is eaten and digested by herbivores? (CBSE 2020)

- a. 100%
- b. 10%
- c. 1%
- d. 0.1%

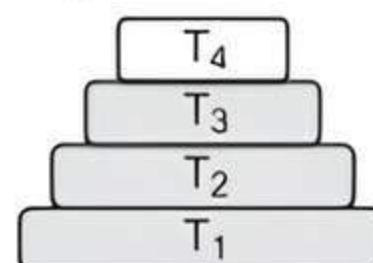
Q 9. In an ecosystem, 10% of energy available for transfer from one trophic level to the next is in the form of:

- a. heat energy
- b. chemical energy
- c. mechanical energy
- d. light energy

Q 10. First link in any food chain is usually green plants because:

- a. they are widely distributed.
- b. they are fixed at one place in the soil.
- c. they alone have the capacity to synthesise food using sunlight.
- d. there are more herbivores than carnivores.

Q 11. In the given figure, the various trophic levels are shown in a pyramid. At which trophic level is maximum energy available? (NCERT EXEMPLAR)



- a. T<sub>4</sub>
- b. T<sub>2</sub>
- c. T<sub>1</sub>
- d. T<sub>3</sub>



Q 12. Match the animals in column (A) with column (B).

Column (A)	Column (B)
A. Grass	1. Primary carnivore
B. Grasshopper	2. Secondary carnivore
C. Frog	3. Producer
D. Hawk	4. Primary consumer

- |            |            |
|------------|------------|
| A B C D    | A B C D    |
| a. 3 4 1 2 | b. 2 1 4 3 |
| c. 4 2 3 1 | d. 3 4 2 1 |

Q 13. A system of inter-dependent food chains represents:

- a. food web                      b. trophic levels  
c. ecosystem                    d. community

Q 14. Food web is constituted by: (CBSE 2020)

- 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.

Q 15. Choose the incorrect statement from the following:

- a. Ozone is a molecule formed by two atoms of oxygen.  
b. Ozone shields the surface of the Earth from ultraviolet radiations.  
c. Ozone layer is protected by CFCs.  
d. Ozone gets decomposed by UV radiations.

Q 16. In 1987, an agreement was formulated by the United Nations Environment Programme (UNEP) to freeze the production of 'X' to prevent depletion of 'Y'. 'X' and 'Y' respectively referred here are:

(CBSE SQP 2023-24)

- a. Ozone; CFCs                      b. CFCs; UV rays  
c. CFCs; Ozone                      d. UV rays; Diatomic oxygen

Q 17. Which of the following features relates to biodegradable substances? (CBSE SQP 2023-24)

- a. Broken down by biological processes  
b. Remain inert  
c. Persist in environment for long time  
d. May harm the ecosystem

Q 18. Replacing of plastic cups by the paper cups for selling tea on train is preferred because:

- a. paper cups are more aesthetic.  
b. paper cups are more hygienic.  
c. paper cups are cheaper.  
d. paper cups are biodegradable and eco-friendly.

Q 19. In the following groups of materials, which group(s) contains only non-biodegradable items?

- (i) Wood, paper, leather  
(ii) Polythene, detergent, PVC

(iii) Plastic, detergent, grass

(iv) Plastic, bakelite, DDT

- a. (iii)                                  b. (iv)  
c. (i) and (iii)                      d. (ii) and (iv)

Q 20. Burning to waste products at high temperature to form ash, reduces waste considerably. This method of waste disposal is called:

- a. composting                      b. sewage treatment  
c. recycling                        d. incineration



## Assertion & Reason Type Questions

**Directions (Q. Nos. 21-25):** Each of the following questions consists of two statements, one is Assertion (A) and the other is Reason (R). Give answer:

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

Q 21. **Assertion (A):** Aquariums are known as the man-made ecosystems.

**Reason (R):** Aquariums are created and maintained by humans.

Q 22. **Assertion (A):** The energy flow through different steps in the food chain is unidirectional.

**Reason (R):** The energy which is captured by autotrophs does not revert back to the solar input and passes to the herbivores.

Q 23. **Assertion (A):** Biological magnification is the process in which harmful chemicals enter a food chain and get accumulated progressively at each trophic level.

**Reason (R):** Biological magnification affects organisms belonging to different trophic levels particularly the tertiary consumers.

Q 24. **Assertion (A):** Ozone layer is getting depleted at the higher levels of the atmosphere.

**Reason (R):** Chlorofluorocarbons affect the ozone layer which are used as refrigerants and in fire extinguishers.

Q 25. **Assertion (A):** Biodegradable substances result in the formation of compost and natural replenishment.

**Reason (R):** It is due to breakdown of complex inorganic substances into simple organic substances. (CBSE SQP 2023-24)

## Answers

- (c) both living organisms and non-living objects.
- (c) (i) and (ii)
- (b) Crop field



## TIP

Learn a few examples of artificial ecosystems.

- (b) convert organic material to inorganic forms.

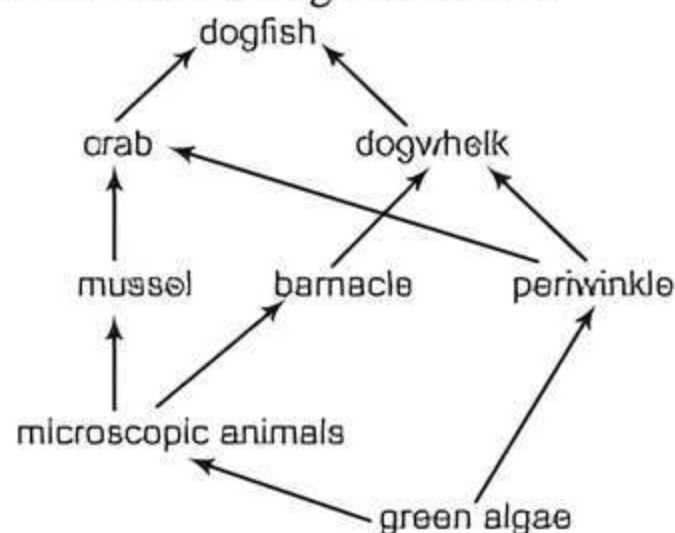


5. (c) (II) and (III)
6. (a) Decrease in energy at higher trophic levels
7. (c) The tigers will die.
8. (b) 10%
9. (b) chemical energy
10. (c) they alone have the capacity to synthesise food using sunlight.
11. (c) T<sub>1</sub>  
A B C D
12. (a) 3 4 1 2
13. (a) food web
14. (c) various interlinked food chains in an ecosystem.
15. (c) Ozone layer is protected by CFCs.
16. (c) CFCs; Ozone
17. (a) Broken down by biological processes.
18. (d) paper cups are biodegradable and eco-friendly.
19. (d) (II) and (IV)
20. (d) incineration
21. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
22. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
23. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
24. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
25. (c) Assertion (A) is true but Reason (R) is false.

## Case Study Based Questions

### Case Study 1

Observe the food web given below:



(CBSE Question Bank)

Study the above diagram carefully and give the answer of the following questions:

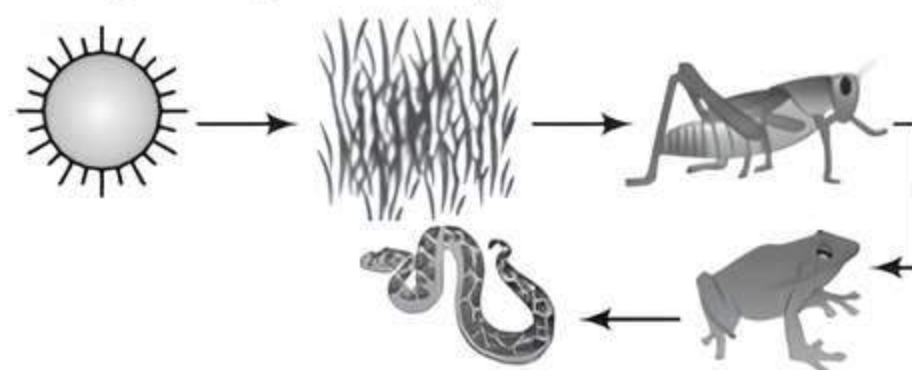
**Q 1. The mussel can be described as:**

- a. producer
- b. primary consumer
- c. secondary consumer
- d. decomposer

**Q 2. Which trophic level is incorrectly defined?**

- a. Carnivores – secondary or tertiary consumers
- b. Decomposers – microbial heterotrophs
- c. Herbivores – primary consumers
- d. Omnivores – moulds, yeast and mushrooms

**Q 3. The given figure best represents:**

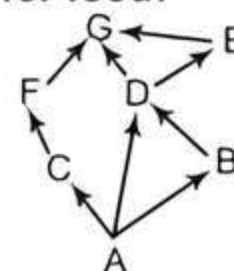


- a. grassland food chain
- b. parasitic food chain
- c. forest food chain
- d. aquatic food chain

**Q 4. Why do all food chains start with plants?**

- a. Because plants are easily grown.
- b. Because plants are nutritious.
- c. Because plants can produce their own energy.
- d. Because plants do not require energy.

**Q 5. In the food web, which two organisms are competing for food?**



- a. A and B
- b. A and C
- c. D and F
- d. B and D

## Answers

1. (c) secondary consumer
2. (d) Omnivores – moulds, yeast and mushrooms
3. (a) grassland food chain
4. (c) Because plants can produce their own energy.
5. (d) B and D

### Case Study 2

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.

(CBSE 2020)



Read the given passage carefully and give the answer of the following questions:

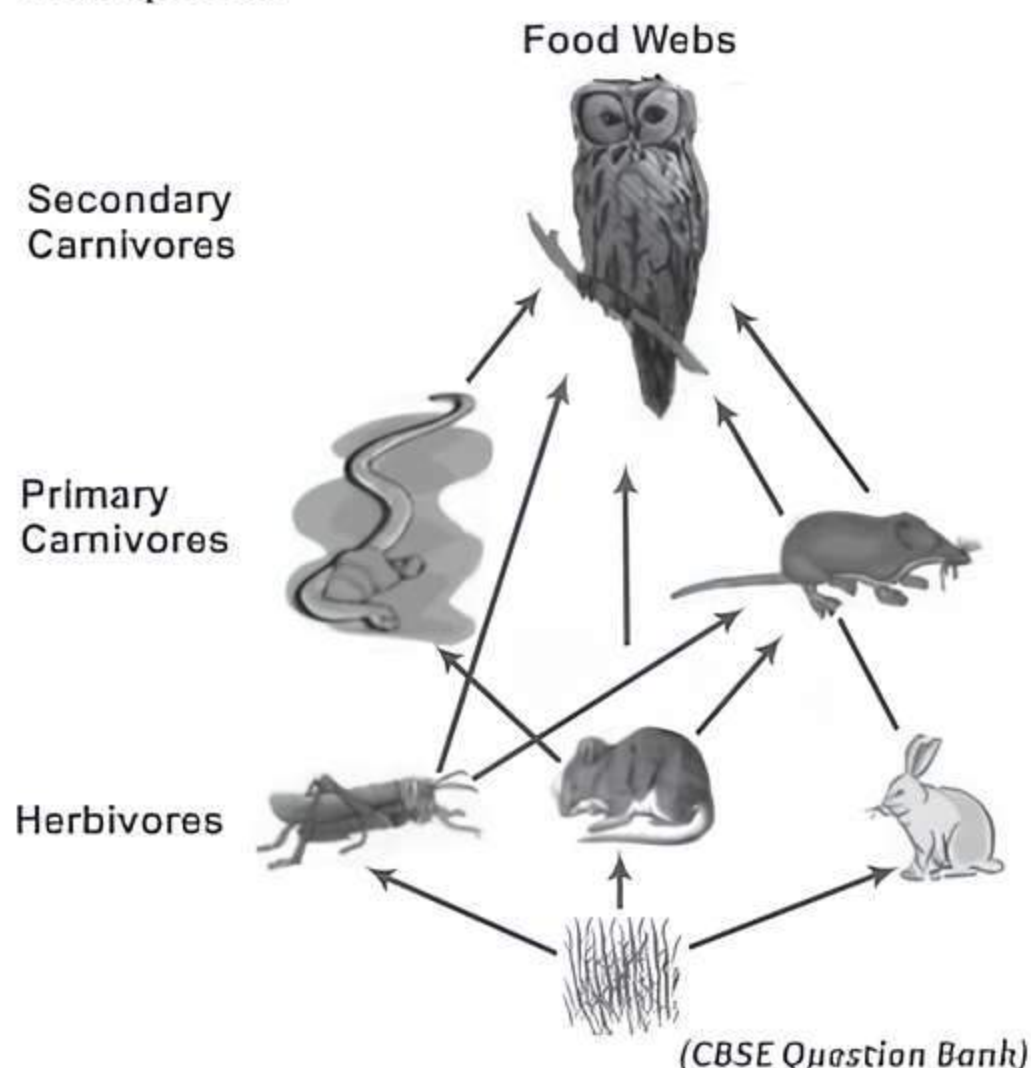
- Q 1. Why is the maximum concentration of pesticides found in human beings?
- Q 2. Give one method which could be applied to reduce our intake of pesticides through food to some extent.
- Q 3. Various steps in a food chain represent:  
 a. food web                      b. trophic level  
 c. ecosystem                    d. biomagnification
- Q 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
- Q 5. The decomposers are not included in any food chain. Why?

### Answers

- The maximum concentration of pesticides is found in human beings because of biological magnification as human beings are at the top of the food chain.
- Methods that can be used to reduce our intake of pesticides through food to some extent are as follows:  
 (i) We can avoid the usage of chemical pesticides.  
 (ii) Organic farming should be done.
- (b) trophic level
- (a) consumer
- Decomposers consume the dead matter of all organisms at each trophic level. So, it is impossible to place the decomposers at a specific trophic level as they act at every trophic level of the food chain.

### Case Study 3

Food chains are very important for the survival of most species.



Study the given diagram carefully and give the answer of the following questions:

- Q 1. If 10,000 J solar energy falls on green plants in a terrestrial ecosystem, what percentage of solar energy will be converted into food energy?  
 a. 10,000 J  
 b. 100 J  
 c. 1000 J  
 d. It will depend on the type of the terrestrial plant.
- Q 2. If Mr. Ravi is consuming curd/yogurt for lunch, which trophic level in a food chain he should be considered as occupying?  
 a. First trophic level  
 b. Second trophic level  
 c. Third trophic level  
 d. Fourth trophic level
- Q 3. The decomposers are not included in the food chain. The correct reason for the same is because decomposers:  
 a. act at every trophic level of the food chain.  
 b. do not breakdown organic compounds.  
 c. convert organic material to inorganic forms.  
 d. release enzymes outside their body to convert organic material to inorganic forms.
- Q 4. Matter and energy are two fundamental inputs of an ecosystem. Movement of:  
 a. energy is bidirectional and matter is repeatedly circulating.  
 b. energy is repeatedly circulating and matter is unidirectional.  
 c. energy is unidirectional and matter is repeatedly circulating.  
 d. energy is multi-directional and matter is bidirectional.
- Q 5. Which of the following limits the number of trophic levels in a food chain?  
 a. Decrease in energy at higher trophic levels  
 b. Less availability of food  
 c. Polluted air  
 d. Water

### Answers

- (b) 100 J
- (c) Third trophic level
- (a) act at every trophic level of the food chain.
- (c) energy is unidirectional and matter is repeatedly circulating.
- (a) Decrease in energy at higher trophic level

### Case Study 4

An ecosystem may be defined as a structural and functional unit of the biosphere comprising living organisms and their non-living environment which interact by means of food chains and biogeochemical cycles resulting in energy-flow, biotic diversity and



material cycling to form a stable, self-supporting system.

Read the above passage carefully and give the answers of the following questions:

**Q 1. What are the two basic process involved in an ecosystem?**

**Q 2. Out of orchard, lake, aquarium and cropland, which is not an artificial ecosystem?**

**Q 3. What is the role of fungi and bacteria in an ecosystem?**

**Q 4. What would one of the likely result if all decomposers in a particular ecosystem were wiped out?**

**Q 5. Write any four examples of abiotic factors.**

### Answers

1. Cycling of materials and flow of energy.
2. Lake is not an artificial ecosystem.
3. Fungi and bacteria are decomposers which recycle natural wastes and dead animal and plant matter. They also produce many of the nutrients that plants need to grow.
4. The earth would be covered with dead organisms and their excrement.
5. Four examples of abiotic factors are:  
(i) temperature, (ii) rain, (iii) soil and (iv) wind.

### Very Short Answer Type Questions

**Q 1. We often use the word 'environment'. What does it mean?** (CBSE 2016)

**Ans.** The sum total of all physical, chemical and biological conditions that influence the growth and survival of an organism is referred to as environment.

**Q 2. What is an ecosystem?** (CBSE 2017)

**Ans.** An ecosystem is defined as an area where biotic (living) and abiotic (non-living) components interact with each other.

**Q 3. List two main components of an ecosystem.** (CBSE 2019)

**Ans.** Two components of an ecosystem are biotic components, comprising of living organisms and abiotic components, comprising of physical factors.

**Q 4. List any two biotic components of an ecosystem.** (CBSE 2016)

**Ans.** Two biotic components of an ecosystem are plants and animals.

**Q 5. List any two abiotic components of an ecosystem.** (CBSE 2019)

**Ans.** Abiotic components include soil, water, temperature, air and sunlight. (Any two)

**Q 6. List any two natural ecosystems.** (CBSE 2017)

**Ans.** Deserts and forests are natural ecosystems.

**Q 7. List any two man-made ecosystems.** (CBSE 2017)

**Ans.** Aquarium and garden are man-made ecosystems.

**Q 8. Why is forest considered a natural ecosystem?** (CBSE 2017)

**Ans.** Forest is considered a natural ecosystem because it is naturally sustainable and grows without human intervention.

**Q 9. Generally, we do not clean natural ponds or lakes but an aquarium needs periodic cleaning. Why?** (CBSE 2019)

**Ans.** Pond is a self-sustained and complete ecosystem which due to the presence of decomposers cleans itself while aquarium is an artificial ecosystem which is incomplete due to absence of decomposers and thus requires continuous monitoring and cleaning.

**Q 10. Bacteria and fungi are called decomposers. Why?**

**Ans.** Bacteria and fungi are called decomposers as they break down the complex organic substances into simple inorganic substances that go into the soil and are used up once more by the plants.

**Q 11. Define trophic level.**

**Ans.** The various steps in a food chain at which the transfer of food takes place are called trophic levels.

**Q 12. Autotrophs are at the first level of food chain. Give reason.** (CBSE 2015, 20)

**Ans.** Only green plants (autotrophs) have the ability to trap solar energy to manufacture their own food by photosynthesis. Hence, green plants always acquire the first trophic level in a food chain.

**Q 13. Which of the following are always at the second trophic level of the food chains?**  
**Carnivores, autotrophs, herbivores.** (CBSE 2015)

**Ans.** Herbivores are always at the second trophic level.

**Q 14. Write various steps of a terrestrial food chain of four trophic levels.** (CBSE 2019)

**Ans.** A food chain starts at trophic level 1 with primary producers such as plants, then moves to herbivores at level 2, carnivores at level 3, and typically finishes with top carnivores at level 4.

**Q 15. 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** (CBSE 2015)

**Ans.** Hawk will have the highest concentration of non-biodegradable chemicals. This phenomenon is called biological magnification.

**Q 16. 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

(CBSE 2017)



**Ans.** Plants  $\xrightarrow{500\text{ J}}$  Rats  $\xrightarrow{\quad}$  Snake  $\xrightarrow{\quad}$  Hawks

In the given food chain, energy provided by plants to rats = 500 J

According to 10% law,

energy available to snakes by rats = 10% of 500 J

$$= \frac{10}{100} \times 500 = 50 \text{ J}$$

Similarly, energy available to hawks from snakes

= 10% of 50 J

$$= \frac{10}{100} \times 50 = 5 \text{ J}$$

Thus, hawks get 5 J energy from snakes.

**Q 17. In the following food chain, 100J of energy is available to the lion. How much energy was available to the producer?**

Plants  $\xrightarrow{\quad}$  Deer  $\xrightarrow{\quad}$  Lion (CBSE 2017)

**Ans.** Let the amount of energy available to plants and deer be xJ and yJ respectively.

Given food chain is:

Plants (Producer)  $\xrightarrow{x \text{ J}}$  Deer (Primary consumer)  $\xrightarrow{y \text{ J}}$  Lion (Secondary consumer) 100J

According to 10% law, energy available to deer is:

10% of y = 100 J

$$\Rightarrow \frac{10}{100} \times y = 100 \text{ J}$$

$$\therefore y = 1000 \text{ J}$$

$\therefore$  Energy available to deer = 1000 J

Similarly, energy available to plants (producer) is:

10% of x = 1000 J

$$\Rightarrow \frac{10}{100} \times x = 1000 \text{ J} \Rightarrow x = 10,000 \text{ J}$$

So, energy available to producer is 10,000 J.

**Q 18. Name the product formed when high energy UV radiations acts on oxygen molecules at the higher level of atmosphere.**

**Ans.** The high energy UV radiations split apart some molecules of oxygen ( $\text{O}_2$ ) into free oxygen (O) atoms. These atoms then combine with the molecular oxygen to form ozone.

**Q 19. Write the name and formula of a molecule made up of three atoms of oxygen.**

**Ans.** Ozone, and its chemical formula is  $\text{O}_3$ .

**Q 20. What is the function of ozone in the upper atmosphere?**

**Ans.** Ozone protects the Earth from harmful radiations such as ultraviolet rays.

**Q 21. Which class of chemicals is linked to the decrease in the amount of ozone in the upper atmosphere of the Earth?**

Or

**Write the full name of the group of compounds mainly responsible for the depletion of ozone layer.**

(CBSE 2015)

**Ans.** The chemical compound, chlorofluorocarbon, is mainly responsible for decrease in the amount of ozone in the upper atmosphere of the Earth or the depletion of ozone layer.

**Q 22. The depletion of ozone layer is a cause of concern. Why?** (CBSE 2016)

**Ans.** If ozone layer gets depleted, the harmful UV rays from Sun will reach the Earth. These radiations are highly damaging to organisms as they can cause skin cancer in human beings and several other diseases in animals too.

**Q 23. Select two non-biodegradable substances from the following wastes generated in a kitchen:**

**Spoiled food, paper bags, milk bags, vegetable peels, tin cans, used tea leaves.**

**Ans.** Milk bags and tin cans are non-biodegradable substances.

**Q 24. Why should biodegradable and non-biodegradable wastes be discarded in two separate dustbins?**

**Ans.** Biodegradable and non-biodegradable wastes should be discarded in two separate bins as this helps in effective treatment and disposal of these wastes.

**Q 25. Name any two items which can be easily recycled but are generally thrown in the dustbin by us.**

**Ans.** The two items are newspaper and plastic cans of cold drinks.



## Short Answer Type-I Questions

**Q 1. State with reason any two possible consequences of the elimination of decomposers from the Earth.**

**Ans.** The possible consequences of elimination of decomposers from the Earth are:

- Dead remains and organic waste would continue to accumulate in the environment. This would pollute the water bodies and soil ecosystem.
- As the organic compounds would not be degraded, nutrient cycle would be disturbed and soil will not become fertile.

## COMMON ERROR

Usually students get confused between the role of decomposers and consequences of elimination of decomposers.

**Q 2. (i) What is meant by trophic level?**

(ii) On an average, what percentage of energy is transferred to the second trophic level from the first trophic level? Which categories of consumers do the organisms of the second trophic level belong to? (CBSE 2023)



- Ans. (i) The various steps in a food chain at which the transfer of food (or energy) takes place are called trophic levels.
- (ii) 10% energy is transferred to second trophic level from the first trophic level.
- Herbivores constitute the second trophic level.

Q 3. Give any two examples of each:

- (i) **Organisms occupying the first trophic level**
- (ii) **Carnivores**

Ans. (i) Trees, Shrubs (ii) Lion, Cheetah

Q 4. Consider the food chain:

Grass → Deer → Lion

What will happen if all the:

- (i) **Lions are removed?** (ii) **Deers are removed?**

- Ans. (i) If all the lions are removed, the population of deer will increase exponentially. Thus, deers and other plant-eaters will be present in abundance which will lead to overgrazing of grass and soil erosion.
- (ii) If all the deer are removed, then there will be no sufficient food available to the tigers. Some of the tigers will die due to starvation and their population will decrease. Since the deer are herbivorous, their absence will increase the grassland area also.

Q 5. What is the difference between the organisms belonging to the first and the third trophic levels? Give one example each of the organisms belonging to these two trophic levels.

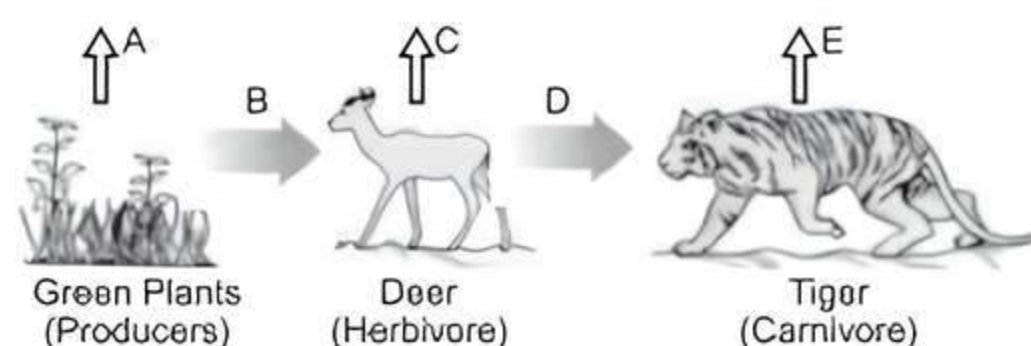
Ans. Difference between first trophic level and third trophic level organisms.

S.No	Basis of Difference	First Trophic Level	Third Trophic Level
1.	1. Organisms category	The <u>organisms of this trophic level are called producers.</u>	The <u>organisms of this trophic level are called carnivores or secondary consumers.</u>
2.	2. Feeding habit	They <u>prepare their own food by photosynthesis.</u> For example, <u>green plants.</u>	They <u>feed upon herbivores.</u> For example, <u>lions.</u>

### COMMON ERROR

Some students write wrong examples of third trophic level such as goat.

Q 6. 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

Ans. Given food chain is Plants → Deer → Tiger

Let plants have 20,000 J energy available.

According to 10% law, energy transferred to deer

$$= \frac{10}{100} \times 20,000 = 2000 \text{ J(B)}$$

Thus, 18000 J(A) of energy is lost in the form of heat to the environment.

$$\text{Similarly, energy transferred to tiger} = \frac{10}{100} \times 2000 = 200 \text{ J(D)}$$

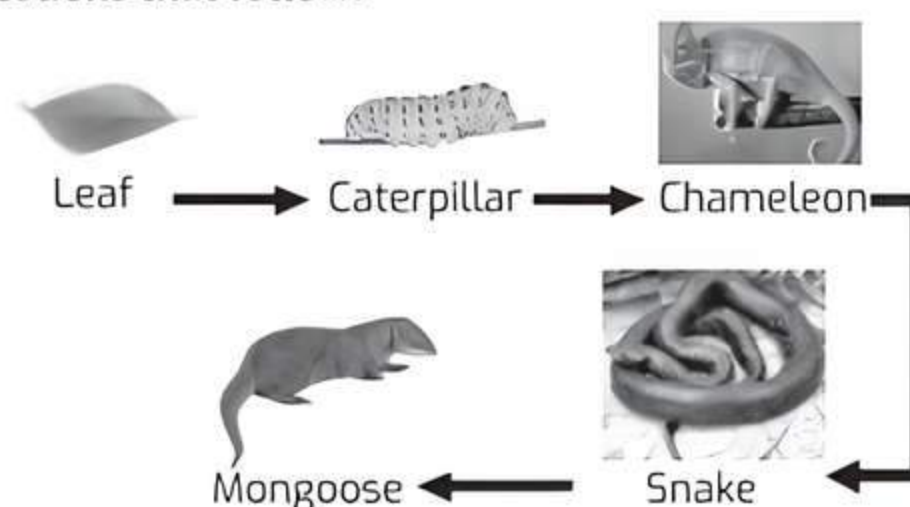
Thus, 1800 J(C) of energy is lost.

Now, out of 200 J, 90% will be lost.

$$\text{So, } E = \frac{90}{100} \times 200 = 180 \text{ J (E)}$$

Thus, out of the three vertical arrows A will represent more energy transfer and out of the two horizontal arrows B will represent more energy transfer.

Q 7. Study the food chain given below and answer the questions that follow:



(i) If the amount of energy available at the third trophic level is 100 joules, then how much energy will be available at the producer level? Justify your answer.

(ii) Is it possible to have 2 more trophic levels in this food chain just before the fourth trophic level? Justify your answer. (CBSE SQP 2023-24)

Ans. (i) Leaf (xJ) → Caterpillar (yJ) → Chameleon (100J)

Mongoose ← Snake

According to 10% law, energy level at 2<sup>nd</sup> trophic level is:

$$10\% \text{ of } y = 100 \text{ J}$$

$$\Rightarrow y = 1000 \text{ J}$$

Similarly, energy available at producer level is:

$$10\% \text{ of } x = 1000 \text{ J}$$

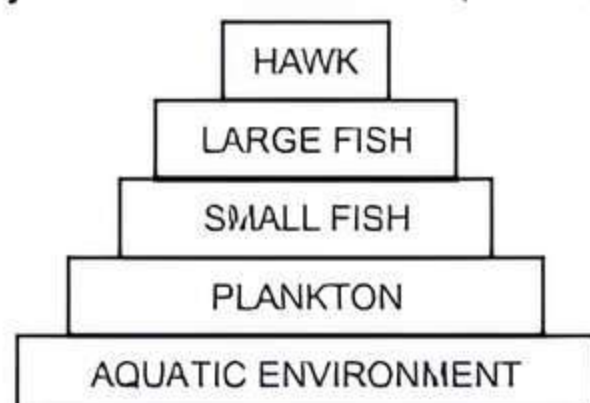
$$\Rightarrow x = 10,000 \text{ J}$$

Thus, energy available at producer level is 10,000 J.



- (ii) No, since the loss of energy at each level is so much that very little usable energy will remain after 4 trophic levels.

**Q 8. 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. (CBSE SQP 2022 Term-2)**



**Ans.** DDT being a non-biodegradable pesticide will enter the food chain from the first trophic level. As DDT is non-biodegradable, it gets accumulated in organisms body and its concentration keeps on increasing at each trophic level. The maximum concentration of DDT gets accumulated in Hawk. This is because Hawk have occupied the top most place in the given food chain.

**Q 9. Food web increases the stability of an ecosystem. Justify.**

**Ans.** Food web is a network of food chains which are interconnected at various trophic levels. In a food web, each predator has a choice to feed on different types of preys. Reduction in population of one type of prey will not affect the predator because it can switch over to some other animals. Hence, in a food web, the supply of food never ends. Therefore, it increases the stability of an ecosystem.

**Q 10. What is biological magnification? Will the levels of this magnification be different at different levels of the ecosystem?**

**Ans.** The accumulation of harmful chemicals in the body of living organisms at different trophic levels in a food chain is called biological magnification.

### COMMON ERROR

*Many students write improper definition of biological magnification.*

Yes, the concentration of these harmful chemicals will be different at different trophic levels. It is maximum at highest trophic levels and minimum at lowest trophic levels. For example, it is highest in humans and lowest in autotrophs like plants.

**Q 11. (i) State the essential function performed by ozone at the higher levels of the atmosphere.**

**(ii) Why was there a sharp drop in the amount of ozone in the atmosphere in 1980's? (CBSE 2023)**

**Ans.** (i) Ozone layer shields the surface of the Earth from ultraviolet (UV) radiation from the Sun.

- (ii) There was a sharp drop in the amount of ozone in the atmosphere in 1980s due to the use of synthetic chemicals like chlorofluorocarbons (CFCs) which are used as refrigerants and in fire extinguishers.

**Q 12. (i) What is meant by garbage? List two classes into which garbage is classified.**

**(ii) What do we actually mean when we say that the "enzymes are specific in their action"? (CBSE 2022 Term-2)**

**Ans.** (i) The household waste produced in our day-to-day life is called garbage. It includes vegetable peels, dried leaves, plastic materials, etc. The garbage is classified into biodegradable waste and non-biodegradable waste.

(ii) The given statement means that specific enzymes are needed for the breakdown of a particular substance. For example, plastic is not broken down by the action of bacteria or other saprophytes.

**Q 13. A lot of waste is generated in neighbourhood. However, almost all of it is biodegradable. What impact will it have on the environment or human health? (CBSE SQP 2022-23)**

**Ans.** Excess generation of biodegradable wastes can be harmful as:

- (i) Its decomposition is a slow process leading to production of foul smell and gases.
- (ii) It can be the breeding ground for germs that create unhygienic conditions.

**Q 14. What are the problems caused by the non-biodegradable wastes that we generate? (NCERT)**

**Ans.** The problems caused by non-biodegradable wastes are:

- (i) Biological magnification.
- (ii) Non-biodegradable materials like plastics on burning releases toxic chemicals into the environment which leads to air pollution.
- (iii) Non-biodegradable wastes like pesticides reduce the fertility of soil that leads to soil pollution.
- (iv) It also causes water and land pollution.
- (v) Clogging of drains. (Any four)

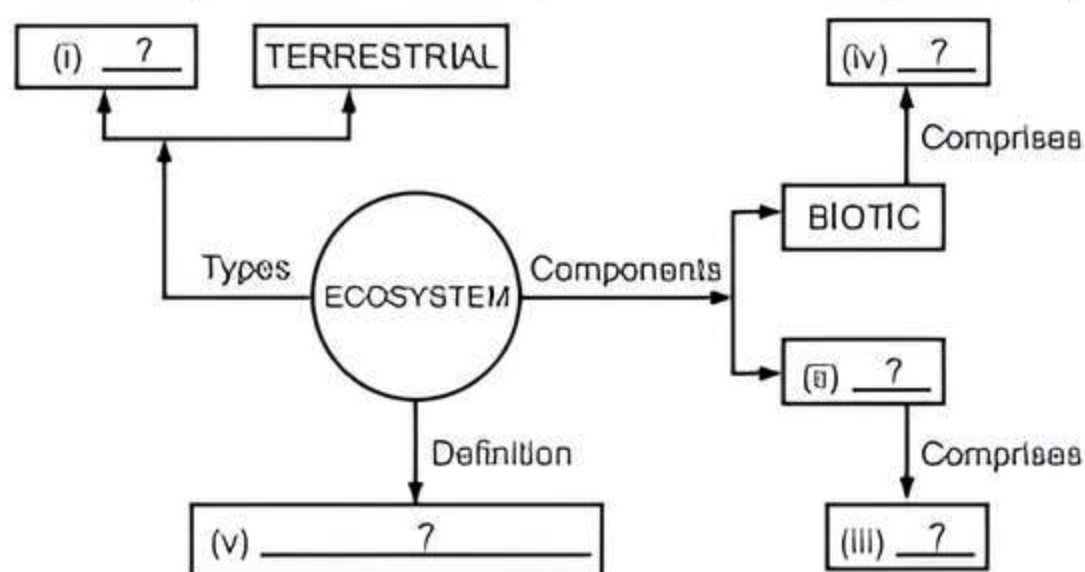
**Q 15. Kulhads (disposable cups made of clay) and disposable paper cups both are used as an alternative for disposable plastic cups. Which one of these two can be considered as a better alternative to plastic cups and why? (CBSE 2022 Term-2)**

**Ans.** Disposable paper cups are considered a better alternative to plastic cups because they are biodegradable, can be recycled and do not pollute the environment.



## Short Answer Type-II Questions

Q 1. Complete the following flow chart based on ecosystem and its components. (CBSE 2020)



Ans.

**TiP** Understand the concept of ecosystem, types of ecosystems and its components.

- (i) Aquatic (ii) Abiotic  
(iii) Temperature, rainfall, wind, soil (Any one)  
(iv) Living organisms (plants and animals)  
(v) An ecosystem is the structural and functional unit of biosphere, comprising of all the living organisms in an area together with the non-living constituents of the environment.

Q 2. (i) What are decomposers? State the role of decomposers in the natural replenishment of the soil.  
(ii) Why are decomposers not helpful in decomposing the plastic waste?

- Ans. (i) Decomposers are micro-organisms, comprising bacteria and fungi, that break-down complex organic substances into simple organic substances.  
They play a vital role in natural replenishment of soil as these decomposed organic substances provide nutrients and minerals to the soil for replenishment.  
(ii) Decomposers are not helpful in decomposing plastic waste because plastic is not an organic substance. Thus, decomposers cannot break them down.

Q 3. What is a food chain? Why is the flow of energy in an ecosystem unidirectional? Explain briefly. (CBSE 2019)

- Ans. A food chain is the series of organisms that take part at various biotic levels.  
In a food chain, the energy moves progressively through the various trophic levels and is no longer available to the organisms of the previous trophic level. The energy which is captured by the autotrophs does not revert back to the solar input. So, the energy flow in food chains is said to be unidirectional.

Q 4. (i) Construct a terrestrial food chain comprising four trophic levels.  
(ii) What will happen if we kill all the organisms in one trophic level?  
(iii) 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)

- Ans. (i) A terrestrial food chain comprising four trophic levels is shown as follows:  
Grass → Grasshopper → Frog → Snake or  
Grass → Rabbit → Wolf → Tiger  
(ii) If we kill all the organisms in one trophic level, there will be no food for the organisms of the next trophic level, and they will die of starvation. Also, the organisms of the previous trophic levels will increase in number as there will be no organism to consume them as food. It will create an imbalance in the ecosystem as every trophic level is interdependent on each other.  
(iii) According to 10% law, only 10% of energy is transferred to next level.  
Hence, if energy available at second trophic level is 2000 J then energy available to third trophic level = 10% of 2000 J =  $(10/100) \times 2000 \text{ J} = 200 \text{ J}$   
Therefore, energy available to third level = 200 J  
Similarly, energy available to fourth trophic level = 10% of 200 J  
=  $(10/100) \times 200 \text{ J} = 20 \text{ J}$   
Hence, energy available at fourth trophic level is 20 J.

**TiP** Practice numericals based on 10% law, i.e., calculating the amount of energy available at different trophic levels.

Q 5. (i) Create a food chain of the following organisms: Insect, Hawk, Grass, Snake, Frog  
(ii) Name the organism at the third trophic level of the created food chain.  
(iii) Which organism of this food chain will have the highest concentration of non-biodegradable chemicals?  
(iv) Name the phenomenon associated with it.  
(v) If 10,000 joules of energy is available to frogs, how much energy will be available to snakes in this food chain? (CBSE 2020)

- Ans. (i) Grass → Insect → Frog → Snake → Hawk  
(ii) Frog  
(iii) Hawk  
(iv) Biological Magnification  
(v) Energy available to snakes = 10% of 10,000 J  
=  $(10/100) \times 10,000 \text{ J} = 1000 \text{ J}$

Q 6. (i) Draw a block diagram to show the flow of energy in an ecosystem.  
(ii) In a food chain of frogs, grass, insects and snakes assign trophic level to frogs. To which category of consumers do they belong to?



Ans. (i) Flow of energy in an ecosystem:



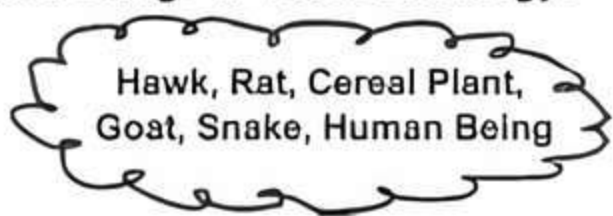
(ii) Frogs belong to the third trophic level and are secondary consumers.

Q 7. Explain how some harmful chemicals enter our bodies through the food chain. Why is the concentration of these harmful chemicals found to be maximum in human beings? (CBSE 2023)

Ans. Pesticides are harmful chemicals which are sprayed over crop plants to protect them from diseases and pests. These chemicals are either washed down into the soil or into the water. From the soil and water, these pesticides are absorbed by growing plants along with water and other minerals. When herbivorous animals eat plant food, then these harmful chemicals go into their bodies through the food chain and when the carnivorous animals eat herbivores, then these chemicals get transferred to their bodies. Man being an omnivore, eat plant food as well as carnivores. So, the harmful chemicals present in plant food as well as in carnivores also get transferred to men's body through the food chain.

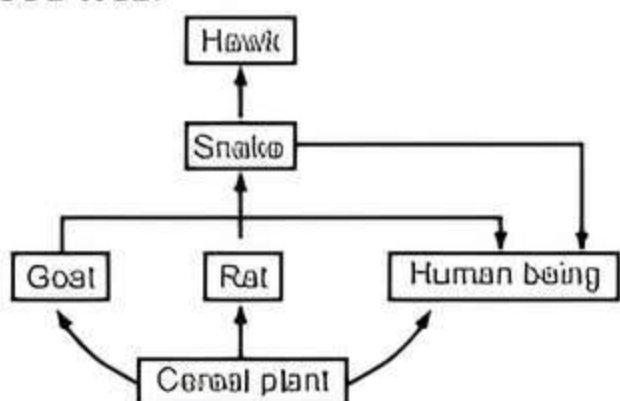
As human beings occupy the top level in any chain, the maximum concentration of these harmful chemicals are found in our bodies.

Q 8. (i) From the following group of organisms, create a food chain which is the most advantageous for human beings in terms of energy:



(ii) State the possible disadvantage if the cereal plant is growing in soil rich in pesticides.  
(iii) Construct a food web using the organisms mentioned above. (CBSE 2020)

Ans. (i) The food chain most advantageous for human being is:  
Cereal plant → Human being  
(ii) When human beings consume this cereal plant, then the pesticides would go in their body with the food and leads to biological magnification.  
(iii) Food web:



COMMON ERROR

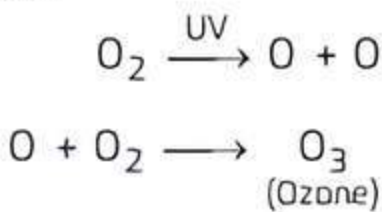
Many students fail to construct the correct food web.

Q 9. (i) Complete the following table:

Formula	Oxygen	Ozone
	(i) .....	(ii) .....
Benefits to biotic component	(iii) .....	(iv) .....


(ii) How is ozone formed at the higher levels of atmosphere? (CBSE 2020)

Ans. (i) (a) O<sub>2</sub> (b) O<sub>3</sub>  
(c) Oxygen is necessary for breathing or external respiration.  
(d) Ozone protects us from harmful ultraviolet (UV) rays produced by the Sun.  
(ii) Oxygen molecule splits into atomic oxygen (O) at higher levels of atmosphere because of higher energy UV radiations. These atoms then combine with the molecular oxygen to form ozone as shown below:



Q 10. Write the essential function performed by ozone at the higher levels of the Earth's atmosphere? How is it produced? Name the synthetic chemicals mainly responsible for the drop of amount of ozone in the atmosphere. How can the use of these chemicals be reduced?

Ans.

**TiP**  
Learn the concept of ozone layer, its formation and depletion carefully.

The ozone layer acts as a protective blanket around the Earth which shields the entire earth from harmful ultraviolet radiations that come from the Sun.

Ozone is formed in the upper atmosphere when the UV rays act on an oxygen molecule (O<sub>2</sub>). As a result, molecular oxygen gets split into free oxygen atoms (O). These atoms then combine with the molecular oxygen to form ozone.

Chlorofluorocarbons (CFCs) which are used in refrigerators, fire extinguishers, aerosol sprays etc. are responsible for the drop of amount of ozone in the atmosphere.

The use of CFCs can be reduced by:

- (a) minimizing leakage through air conditioners and refrigerators.
- (b) finding substitute chemicals that are ozone friendly.



**Q 11. How can we help in reducing the problem of waste disposal? Suggest any three methods. (CBSE 2019)**

**Ans.** We can reduce the problem of waste disposal in the following ways:

- By segregating and disposing biodegradable and non-biodegradable substances separately.
- By converting domestic wastes such as fruit and vegetable peels, left over food, dry leaves etc. into compost by burying them into a pit in the ground.
- By recycling plastic, paper, glass and metal items to make required things instead of synthesising or extracting fresh plastic, paper, glass or metal.

**Q 12. 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. (CBSE 2023)**

**Ans.** Difference between biodegradable and non-biodegradable substances:

S. No.	Basis of Difference	Biodegradable Substances	Non-Biodegradable Substances
1.	Definition	Substances that can be broken down into simpler substances in due course of time by the action of micro-organisms such as certain bacteria.	Substances that cannot be broken down into harmless substances by the action of micro-organisms.
2.	Examples	Cattle dung, wool, paper, compost.	Plastics, polythene bags, glass objects.

**Two impacts of accumulated biodegradable waste on environment:**

- Incomplete degradation will result in the breeding ground for flies causing the spread of diseases.
- Air will be polluted with strong smell of rotting and decomposition.

**Two impacts of accumulated non-biodegradable waste on environment:**

- Biological magnification.
- Non-biodegradable materials like plastics on burning releases toxic chemicals into the environment which leads to air pollution.
- Non-biodegradable wastes like pesticides reduce the fertility of soil that leads to soil pollution.
- It also causes water and land pollution.
- Clogging of drains. (Any two)



## Long Answer Type Questions

- Q 1. (i) Differentiate between producers, consumers and decomposers and give one example of each.**
- (ii) Pesticides like DDT which are sprayed to kill pests on crops are found to be present in ground water, water bodies etc. Explain how do they reach these places.**

**Ans. (i) Producers:** These are organisms which can make their own food from inorganic substances by photosynthesis, e.g. all green plants and certain bacteria.

**Consumers:** These are organisms which depend upon the producers for food, either directly or indirectly by feeding on other consumers for their sustenance. They are also called heterotrophs, e.g. lion, man etc.

**Decomposers:** These are organisms which break down the complex organic substances present in the dead remains of plants and animals into simple inorganic substances, e.g. bacteria and fungi.

**(ii) Groundwater:** Through irrigation in the fields, these pesticides present in soil pass into lower layers of soil and reach groundwater.

**Water Bodies:** Movement of pesticides into water bodies occurs when runoff, after rainfall, moves through areas that have been sprayed with them.

**Q 2. (i) Give two differences between food chain and food web.**

**(ii) Why are smaller food chains better?**

**(iii) What is 10% law?**

**(iv) Choose one organism each that belongs to the second and third trophic levels from the organisms given below:**

**Eagle, frog, tiger, rabbit, fox**

**Ans. (i) Difference between food chain and food web:**

S. No.	Basis of Difference	Food Chain	Food Web
1.	Definition	Food chain is a series of organisms feeding on one another.	Food web consists of a number of interlinked food chains.
2.	Feeding habit of organisms	Members of higher trophic level feed upon a single type of organism of the lower trophic level.	Members of higher trophic level can feed upon organisms of the lower trophic levels of other food chains.

**(ii) The smaller food chains are better because the loss of energy at each step of food chain is so big that very little usable energy is left after three or four trophic levels to support the next trophic level. Thus, smaller size gives it more stability.**

**(iii) 10 percent law states that, 'only 10 percent of the total energy entering a particular trophic level is available for transfer to the next trophic level'.**



## TIP

Remember statement of 10 per cent law of energy transfer.

**(iv) Second trophic level** → Rabbit

**Third trophic level** → Frog and fox

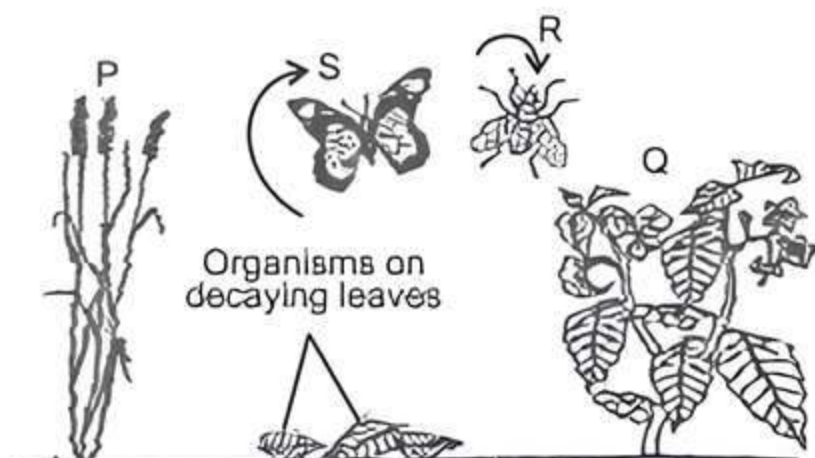




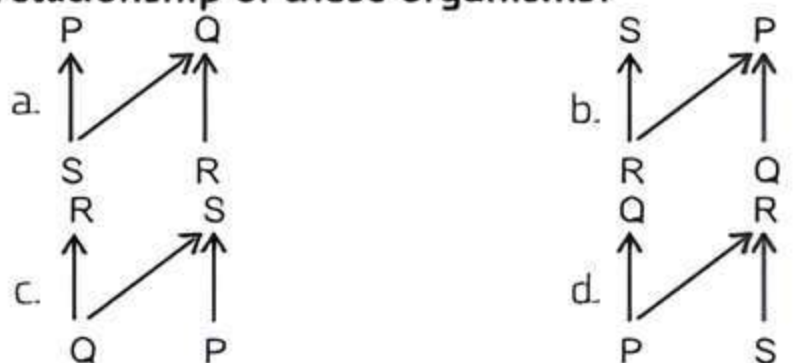
## Chapter Test

### Multiple Choice Questions

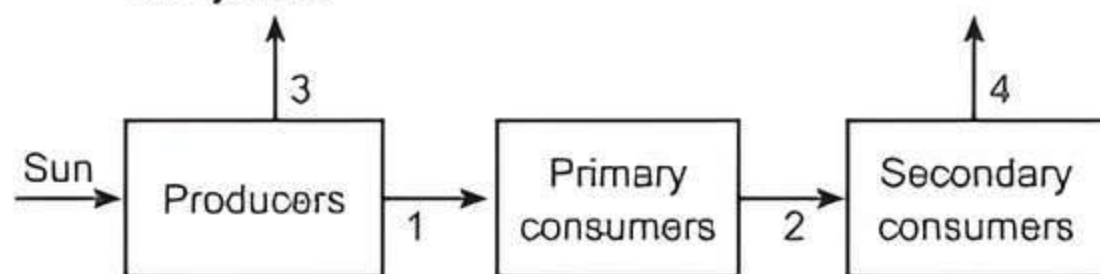
Q 1. The diagram shows the organisms in a habitat.



Which of the following indicates the feeding relationship of these organisms?



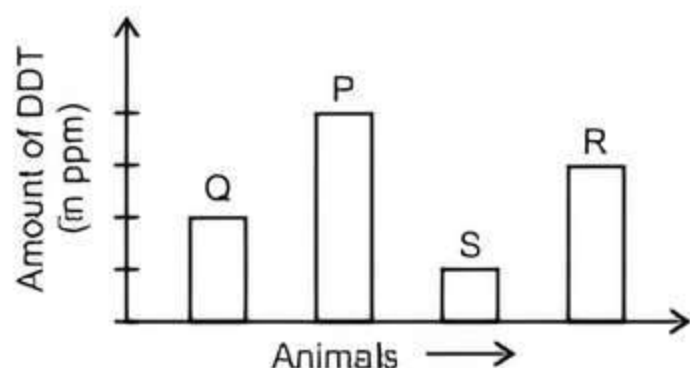
Q 2. The diagram shows the flow of energy through an ecosystem.



The smallest amount of energy transferred between organism and the largest amount of energy lost to the ecosystem is represented by which arrows?

	Smallest energy transfer	Largest energy loss
a.	4	3
b.	2	1
c.	2	3
d.	1	4

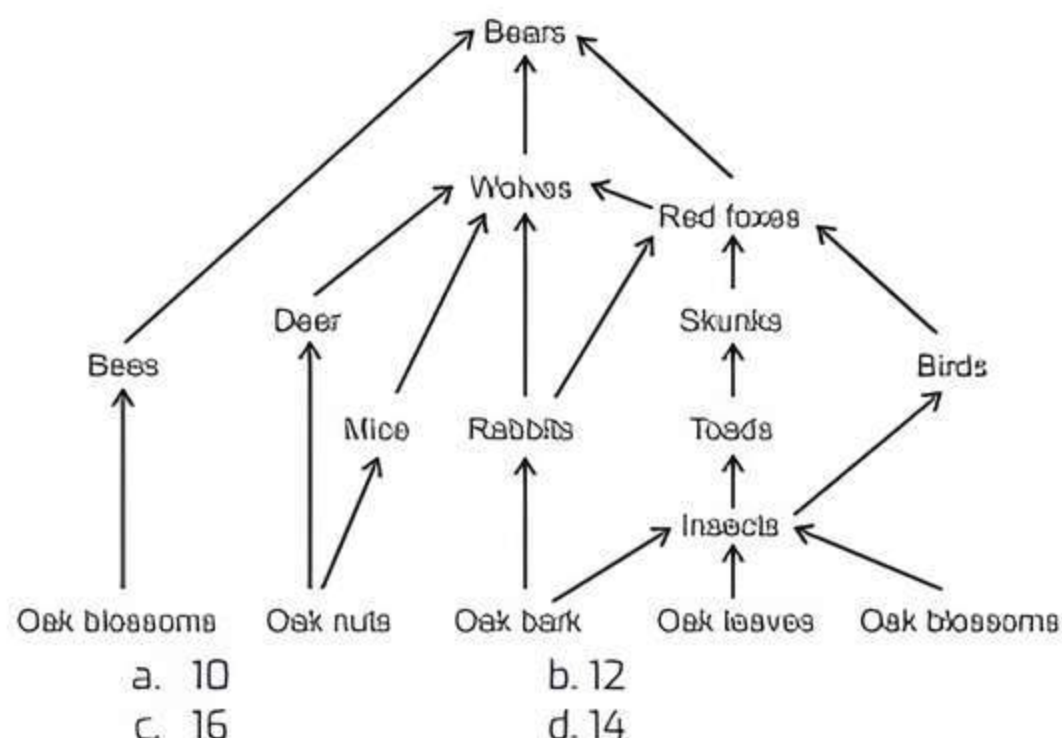
Q 3. A group of scientists analysed samples of five different animals from a river for possible accumulation of DDT in their body due to bio-magnification. The result obtained is shown in the given graph.



The correct order of the food chain operating in a river is:

- a.  $S \rightarrow P \rightarrow Q \rightarrow R$     b.  $S \rightarrow Q \rightarrow R \rightarrow P$   
c.  $P \rightarrow R \rightarrow Q \rightarrow S$     d.  $P \rightarrow Q \rightarrow S \rightarrow R$

Q 4. How many food chains are operating in the given food web?



### Assertion and Reason Type Questions

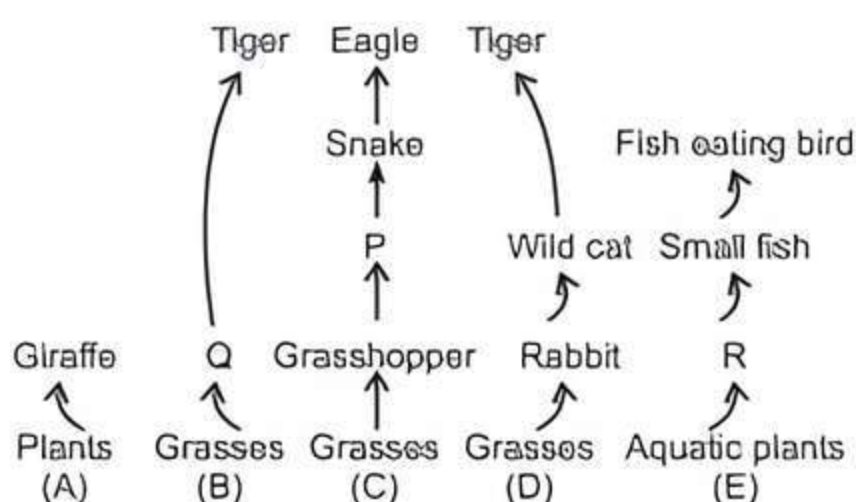
**Directions (Q. Nos. 5-6):** Each of the following questions consists of two statements, one is Assertion (A) and the other is Reason (R). Give answer:

- a. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).  
b. Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).  
c. Assertion (A) is true but Reason (R) is false.  
d. Assertion (A) is false but Reason (R) is true.
- Q 5. **Assertion (A):** DDT can pass along food chain from crops to man or other animals and harm them.  
**Reason (R):** DDT is non-biodegradable and cannot be metabolised within bodies of living organisms and accumulates in their bodies.
- Q 6. **Assertion (A):** Decomposers keep the environment clean.  
**Reason (R):** They recycle matter by breaking down the organic remains and waste products of plants and animals.

### Case Study Based Question

- Q 7. Grazing food chains are directly dependent upon solar radiations as the primary source of energy. Green plants (or producers) form the first trophic level of the food chain. They synthesise their food by the process of photosynthesis. Herbivores or primary consumers feed upon the producers and form the second trophic level. Herbivores are eaten by carnivores of different categories. These are longer food chains. Given below are 5 grazing food chains operating in the nature.





Read the above passage carefully and give the answers of the following questions:

(i) Select the option that correctly identifies P, Q and R.

P	Q	R
a. Frog	Deer	Aquatic insect
b. Frog	Elephant	Phytoplankton
c. Tadpole	Deer	Zooplankton
d. Dog	Elephant	Algae

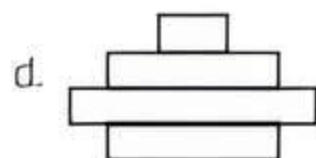
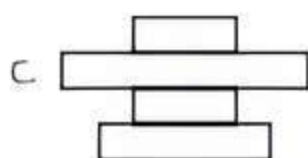
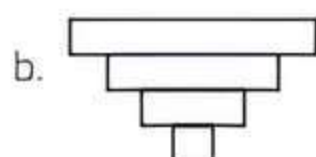
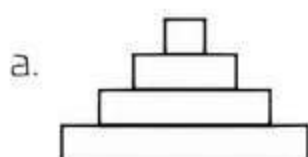
(ii) According to the given food chains which of the following animals is both secondary and tertiary consumer?

- |           |               |
|-----------|---------------|
| a. Rabbit | b. Tiger      |
| c. Eagle  | d. Small fish |

(iii) Top consumer in which of the following food chains will have the maximum energy?

- Food chain A
- Food chain B
- Food chain C
- Food chain D

(iv) What will be the shape of pyramid of biomass of food chain E?



### Very Short Answer Type Questions

Q 8. Why is forest considered a natural ecosystem?

Q 9. What happens during the first step of ozone formation in the atmosphere?

### Short Answer Type-I Questions

Q 10. Look at the following figures. Choose the correct one and give reason for your answer.

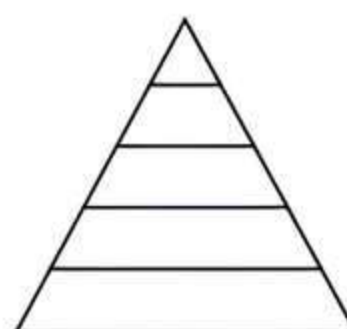


Fig. 'A'

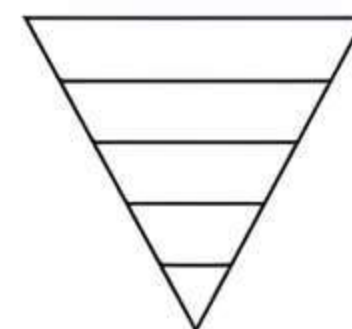


Fig. 'B'

Q 11. Give any two ways in which biodegradable substances would affect the environment.

Q 12. What are trophic levels? Give an example of a food chain and state the different trophic levels in it.

### Short Answer Type-II Questions

Q 13. (i) We do not clean ponds or lakes, but an aquarium needs to be cleaned regularly. Why?

(ii) Why is ozone layer getting depleted at the higher levels of the atmosphere? Mention one harmful effect caused by its depletion.

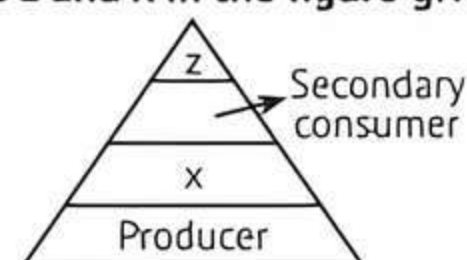
Q 14. Explain the reason why in a food chain

- the number of individuals decreases as we move from lower trophic level to higher trophic level, and
- the flow of energy is unidirectional.

Q 15. (i) Gas A, found in 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.

Identify Gas A. How is it formed at higher levels of the atmosphere?

(ii) Write the appropriate names of the trophic levels z and x in the figure given below:



### Long Answer Type Questions

Q 16. Define the following:

- |                                  |                |
|----------------------------------|----------------|
| (i) Food chain                   | (ii) Food web  |
| (iii) Producers                  | (iv) Parasites |
| (v) Non-biodegradable substances |                |

Q 17. (i) "Our food grains such as wheat and rice, the vegetables and fruits and even meat are found to contain varying amounts of pesticide residue". State the reason to explain how and why it happens?

(ii) Write the harmful effects of using plastic bags on the environment. Suggest alternatives to plastic bags.