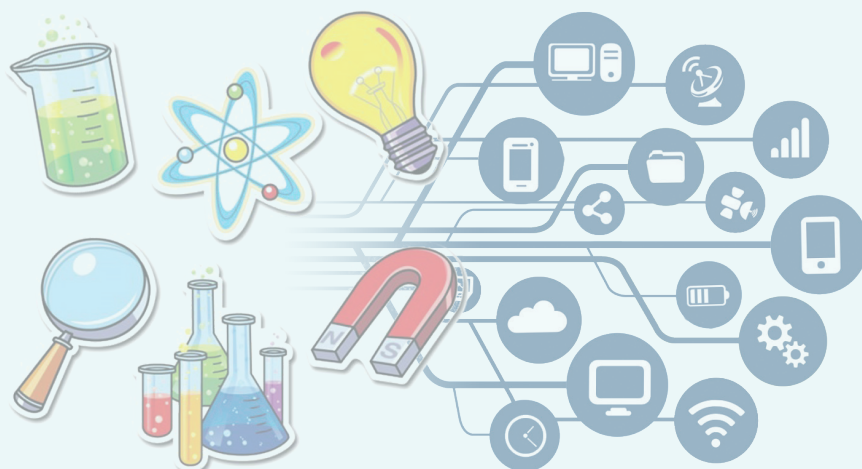




Environment & General Knowledge

FIRST STEP

NCERT Based Course for CSE
after **Class 11**





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Contents

Environment & General Knowledge

PART



Environment

01 – 112

CHAPTER-1

Basics of Environment

2

1.1	Introduction	2
1.2	Ecology.....	2
1.3	Levels of Ecology	4
1.4	Principles of Ecology	5
1.5	Hibernation and Aestivation	7
1.6	Ecological Footprint	8
1.7	Ecological Succession	8
1.8	Population Growth.....	9
1.9	Population Interactions.....	10
1.10	Habitat and Niche	11
1.11	Events/International Days Related to Environment.....	11

CHAPTER-2

Ecosystem

13

2.1	Ecosystem	13
2.2	Structure of the Ecosystem	13
2.3	Types of Ecosystem.....	13
2.4	Functions of Ecosystem.....	15
2.5	Ecosystem Interactions	27
2.6	Keystone and Flag Species.....	28
2.7	Ecotone	28
2.8	Edge Effect	29
2.9	Biological Spectrum	29
2.10	Biome.....	29

CHAPTER-3

Biodiversity

30

3.1	Biodiversity	30
3.2	Levels of Biodiversity.....	30
3.3	Faunal Diversity.....	31

3.4	Floral Diversity	32
3.5	Patterns of Biodiversity.....	32
3.6	Endemism	32
3.7	Biodiversity Hotspots.....	33
3.8	Megadiverse Countries	34
3.9	Conservation of Biodiversity	35
3.10	Biodiversity Protected Areas	36
3.11	UNESCO's Natural World Heritage Sites in India.....	41
3.12	Wetlands.....	41
3.13	Mangroves	45
3.14	Corals Reefs.....	46
3.15	Social Forestry.....	48
3.16	Coastal Regulation Zone (CRZ).....	49
3.17	Loss of Biodiversity	49
3.18	Government Initiatives.....	50
3.19	Important Environmental Organizations in India.....	52
3.20	Important Legislative Steps.....	53
3.21	Wildlife Conservation Projects in India.....	56
3.22	International Conventions/Organisations on Biodiversity	61

CHAPTER-4

Environmental Issues

50

4.1	Pollution.....	66
4.2	Greenhouse Gases	84
4.3	Global Warming	86
4.4	Ozone Layer Depletion.....	87
4.5	International Protocols/Conventions Related to Ozone Layer Depletion	89
4.6	Climate Change.....	90
4.7	Land Degradation and Desertification	100
4.8	Deforestation	101
	Practice Questions	103

PART II General Knowledge 113 – 171

CHAPTER-1

International Organizations 92

- 1.1 The United Nations (UN) 114
- 1.2 Programmes and Funds of UN 117
- 1.3 Specialised Agencies of the UN 118
- 1.4 Other International Organizations 121
- 1.5 International Treaties and Agreements 133

CHAPTER-2

National Symbols 114

- 2.1 National Flag 136
- 2.2 National Emblem 136
- 2.3 National Anthem 136
- 2.4 National Song 137
- 2.5 National Animal 137
- 2.6 National Calendar 137

CHAPTER-3

First Among Indians 139

- First Among Indians 139

CHAPTER-4

Awards and Honours 146

- 4.1 Bharat Ratna 146
- 4.2 Padma Awards 149
- 4.3 Indian Gallantry Awards 149
- 4.4 Important Awards & Honours 151

CHAPTER-5

Youth and Sports 155

- 5.1 Sport Awards 155
- 5.2 Games 156
- 5.3 Flagship Schemes of Union Government 162
- Practice Questions* 168

PART I

Environment

1.1 Introduction

The word 'environment' has been derived from French word "*Environner*" which means "*to encircle*" or "*to surround*", whereas the word "Nature" is derived from Latin word "*Natura*" which refers to characteristics of plants, animals and other creatures.

All organisms (from virus to man) are obligatorily dependent on the environment for food, energy, water, oxygen, shelter and other basic needs.

Environment is defined as the total planetary inheritance and the totality of all resources. It includes all the biotic and abiotic factors that influence each other.

The living elements like- birds, animals and plants etc. are biotic elements, whereas the abiotic elements include air, water, land etc.

The study of the environment is known as Ecology. It is the study of the relationships between living organisms, including humans, and their physical environment; it seeks to understand the vital connections between plants and animals and the world around them.

1.2 Ecology

As a branch of biology, Ecology is the study of the relationships of living organisms with the abiotic (physio-chemical factors) and biotic components (other species) of their environment. Therefore, Ecology is a subject which studies the interactions among organisms and between the organism and its physical (abiotic) environment.

Ecology at the organismic level is essentially physiological ecology which tries to understand how different organisms are adapted to their environments in terms of not only survival but also reproduction.

Under ecology, the study of three features of ecosystem is done:

- Interaction of organism as a whole with their physical environment.
- Interaction among members of different species.
- Interaction among members of a particular species.

The word 'Ecology' is derived from Greek word "Oikos" which means habitation and "logos" means study.

Ecology was first described as a separate field of knowledge in 1866 by German zoologist Ernst Haeckel. He invented the word "Oecologie" for the relation of animal to its organic as well as inorganic environment.



Taxonomy means classification, naming and description of organisms.

Significance of Ecology

Ecology basically provides insight about

- Life processes, interaction and adaptation.
- The movement of material and energy through living communities.

- Successional development of ecosystem in environment.
- Extent of biodiversity can be analysed.

Temperature, light, water and soil are the most important physical factors of the environment to which the organisms are adapted in various ways.

Components in Environment	
Abiotic	Biotic
<ul style="list-style-type: none"> • Energy • Radiation • Temperature and heat flow • Water • Atmospheric gases and wind • Fire • Gravity • Topography • Soil • Geological substratum 	<ul style="list-style-type: none"> • Green plants • Non-green plants • Decomposers • Parasites • Symbionts • Animals • Man

Abiotic Components

Abiotic components are the inorganic and non-living parts of an ecosystem. These consist of soil, water, air, light energy, etc. They also involve a large number of gases like oxygen, nitrogen, etc. and physical processes including volcanoes, earthquakes, floods, forest fires, climate and weather conditions.

Abiotic factors are the most important determinants of where and how well an organism exists in its environment.

Some of the important abiotic factors are:

- **Energy (Sunlight):** Sunlight is the primary source of energy in nearly all ecosystems.
- **Water:** Water is essential for all living beings. It helps to regulate body temperature.
- **Temperature:** Temperature is a critical factor of the environment which greatly influences survival of organisms.

- **Atmospheric gases:** Atmospheric gases like oxygen, nitrogen and carbon dioxide are imperative for the survival of flora and fauna of this planet.
- **Soil (Edaphic factors):** These factors include soil texture, soil temperature, soil water, soil solution and pH, together with soil organisms and decaying matter.
- **Climate:** Climate of a region includes the average rainfall, temperature and the patterns of winds that occur. Climate is one of the most important abiotic factors of an ecosystem.

Biotic Components

Biotic components are classified according to their functional attributes into producers and consumers.

Producers

Producers are also known as autotrophs, or self-feeders. Producers manufacture the organic compounds that they use as sources of energy and nutrients. Most producers are green plants or algae that make organic compounds through photosynthesis.

Consumers

Consumers are incapable of producing their own food. These are also known as Heterotrophs or phagotrophs (other nourishing). Consumers depend on organic food derived from plants, animals or both.

Macro Consumers

- **Herbivores (Primary Consumers)**
The consumers or organisms that feed on autotrophs are called herbivores. Examples: Deer, rabbit, cow, goat, grasshopper, rat, etc. All the herbivorous animals which directly consume the plants are called primary consumers.

- **Carnivores (Secondary Consumers)**

Carnivores are further subdivided into First, Second and Third order. These animals predate on herbivorous animals.

- **Omnivores (Tertiary Consumers)**

Omnivorous animals eat herbivorous animals as well as plants. Examples: Sparrow, crow, fox, wolves, cat, dogs, snakes etc. belong to this category. Human being is the best example of omnivores because they can take their food from any stage of food chain i.e. they are dependent on autotrophs as well as on heterotrophs.

Micro Consumers

Micro consumers are popularly known as decomposers or detritus. They breakdown complex compound of dead remnants of flora and fauna. They also decompose tissues of plants and animals into micro-nutrients. These are also known as Saprotrophs.



There are regular change in the activities of plants and animals, caused by factors such as light and heat from the sun, the tides, season and phases of the moon and the rotation of the earth. These regular, rhythmic changes are called biorhythms.

1.3 Levels of Ecology

The various ecological levels of organization are described below.

Individual

They make the basic unit of study in ecology. It is the basic unit of ecological hierarchy. Ex: plant, animal, etc. At each level, the biological unit has a specific structure and function. At this level the form, physiology, behaviour, distribution and adaptations in relation to the environmental conditions are studied.

Population

It is a group of individuals of a plant or animal species inhabiting a given area at a particular time.

For example, all individuals of the common grass, Cynodon, in a given area constitute its population. Similarly, the individuals of elephants or tigers in an area constitute their population.

The interaction between populations is generally studied. These interactions may be a predator and its prey, or a parasite with its host. Competition, mutualism, commensalism, parasitism and predation are various types of interactions.

Biological Community

Biotic community results from interdependence and interactions amongst population of different species in a habitat. This is an assemblage of populations of plants, animals, bacteria and fungi that live in an area and interact with each other.

A biotic community is a higher ecological category next to population. These are three types of biotic community, they are: animals, plants and decomposers (i.e., bacteria and fungi). A biotic community also has a distinct species composition and structure.

Ecosystem

The ecosystems are parts of nature where living organisms interact amongst themselves and with their physical environment. An ecosystem is composed of a biotic community, integrated with its physical environment through the exchange of energy and recycling of the nutrients.

An ecosystem has two basic components: (i) Abiotic (non-living), and (ii) Biotic (living organisms).

Abiotic components comprise inorganic materials, such as carbon, nitrogen, oxygen, CO₂, water etc., while biotic components include producers, consumers. and decomposers.

Landscape

It is a heterogeneous area composed of a cluster of interacting ecosystems that are repeated in a similar manner throughout. A watershed is a convenient landscape level unit for large scale study and management because it usually has identifiable natural boundaries.

Biome

This is a large regional unit characterised by a major vegetation type and associated fauna found in a specific climate zone. The biome includes all associated developing and modified communities occurring within the same climatic region, e.g., forest biomes, grassland and savanna biomes, desert biome, etc.

On a global scale, all the earth's terrestrial biomes and aquatic systems constitute the biosphere.

Biosphere

The entire inhabited part of the earth and its atmosphere including the living components is called the biosphere. The global environment consists of three main sub-divisions:

- The hydrosphere which includes all the water components,
- The lithosphere comprises the solid components of the earth's crust, and
- The atmosphere formed of the gaseous envelope of the earth.

So, the biosphere consists of the lower atmosphere, the land and the oceans, rivers and lakes, where living beings are found.



Biosphere has also been divided in different Bio-geographical realms at sub-global levels. Bio-geographic realms are large spatial regions within which ecosystems share a broadly similar biological evolutionary history.

1.4 Principles of Ecology

Adaptation

Adaptation is the process by which a species becomes fitted to its environment; it is the result of natural selection's acting upon heritable variation over several generations. Organisms are adapted to their environments in a great variety of ways: in their structure, physiology, and genetics, in their locomotion or dispersal, in their means of defense and attack, in their reproduction and development, and in other respects.

Allen's Rule

This refers to an ecogeographical rule which states that significant differences exist in the size of limbs and other external organs of animals, even within the same species, depending on the geographical region in which they live. Animals living in colder regions of the world, for instance, have shorter limbs than those living in warmer regions as an adaptation to control the dissipation of heat. A smaller body surface area helps animals in colder regions stay warm by slowing down the loss of body heat.

Types of Adaptation

- **Morphological:** This involves the physical characteristics of an organism that assist it in surviving in its environment, which includes many types of terrestrial habitat. The changes in the physical environment are linked to physical changes.

For instance, consider camouflage, which is the coloration that helps an organism blend in with its surroundings. This keeps them safe from predators and improves their chances of surviving.

- **Physiological:** This adaptation, like morphological adaptations, entail physical changes in the species. However, they are not usually visible in the organism's appearance. This form of adaptation might be caused by environmental changes or by the behaviour of other species.

For example, a fish living in water that becomes more acidic abruptly must adjust its body chemistry.

- **Behavioural:** This is a change that impacts an organism's behaviour.

This could be due to changes in the surrounding environment or other species' actions. For example, if a rabbit perceives that it is being watched by a predator, it will freeze.

Behavioral adaptations include changes in reproductive strategy, dietary habits, migration, hibernation, and communication mechanisms, to name a few.

Variation

The changes in genetic makeup caused by the addition or deletion of certain genes cause variations. Variations over time are caused by mutations, climatic change, geographical barriers, and other factors. The variance in skin colour, hair type (curly or straight), eye colour, and blood type among ethnic groups shows variation within the human species.

Adaptive Radiation

When the environment presents new difficulties or opens new environmental niches, organisms spread from their ancestral species into a variety of new forms, known as adaptive radiation. It is evolution of an animal or plant group into a wide variety of types adapted to specialized modes of life. The evolution of diverse Australian Marsupials from a single ancestral stock in the Australian subcontinent is an example of adaptive radiation.

Speciation

A species is a collection of creatures that share similar traits and can interbreed to produce fertile offspring.

Speciation is the evolutionary process by which new and unique species emerge. The Genetic alteration is how species evolve. The new species is reproductively isolated from the preceding species, which means they can't breed with each other.

Types of Speciation

- **Allopatric Speciation:**

Allopatric is a type of speciation caused by geographic isolation. The individuals that are isolated are literally in an "other place."

The most common mechanism for geographic isolation is an actual physical barrier that gets between members of a population. This can be something as small as a fallen tree for small organisms or as large as being split by oceans.

- **Peripatric Speciation:**

Peripatric speciation is actually a special type of allopatric speciation. There is still some sort of geographic isolation, but there is also some sort of instance that causes very few individuals to survive in the isolated population compared to allopatric speciation.

In peripatric speciation, it may be an extreme case of geographic isolation where only a few individuals are isolated, or it could follow not only a geographic isolation but also some sort of disaster that kills off all but a few of the isolated population. With such a small gene pool, rare genes are passed down more often, which causes genetic drift. The isolated individuals quickly become incompatible with their former species and become a new species.

- **Parapatric Speciation:**

In this case, the populations are not isolated by a physical barrier and are instead "beside" each other. Even though there is nothing stopping the individuals in the entire population

from mixing and mating, it still does not happen in parapatric speciation. For some reason, individuals within the population only mate with individuals in their immediate area.

Some factors that could influence parapatric speciation include pollution or an inability to spread seeds for plants. However, in order for it to be classified as parapatric speciation, the population must be continuous with no physical barriers. If there are any physical barriers present, it needs to be classified as either peripatric or allopatric isolation.

- **Sympatric Speciation:**

The individuals in the population are not separated at all and all live in the "same place." The most common cause of sympatric speciation is reproductive isolation. Reproductive isolation may be due to individuals coming into their mating seasons at different times or preference of where to find a mate. In many species, choice of mates may be based on their upbringing. Many species return to where they were born to mate. Therefore, they would only be able to mate with others who were born in the same place, no matter where they move and live as adults.

Other reasons could be that different populations become dependent on different needs in the environment, such as food sources or shelter.

Mutation

New genes emerge in a population as a result of mutation (a change in genetic material caused by an error in DNA replication). Furthermore, meiosis and fertilisation produce a new mix of genes every generation in a sexually reproducing population, which is known as recombination.

As a result, members of the same species differ and are not identical.

Natural Selection

Darwin and Wallace proposed the mechanism of natural selection. The Natural selection describes

how creatures adapt to their surroundings. It's an evolutionary force that chooses between variants, or genes that assist the organism adapt to its surroundings better. Natural selection causes such genes to reproduce more frequently in a population. For instance, children that are adapted to their immediate environment have a better chance of surviving, reaching reproductive age, and passing on the appropriate adaptations to their offspring.

1.5 Hibernation and Aestivation

Aestivation is a natural condition of dormancy in animals that is similar to hibernation but occurs in the summer rather than the winter.

Aestivation is characterised by inactivity and a decreased metabolic rate, as well as a low percentage of hunting, and is a stage that occurs in reaction to hot temperatures and dry conditions.

On the other hand, despite the fact that it is a different phrase, there isn't much of a distinction between the two. Hibernation is a state of low activity and metabolic depression that most animals experience. Hibernation is a type of seasonal heterothermy marked by a low body temperature, sluggish breathing and heart rate, and a low metabolic rate. The most common time for it to happen is in the winter.

Hibernation isn't merely sleeping like you would on any other day. The brain rests for a greater portion of the time while sleeping than it does in any other state. Hibernation is defined as a state of body temperature, metabolism, and breathing rate that lasts for a long time. It's also recognised as a state that's almost like a coma and can't be readily woken up from. This mood will significantly raise your temperature and make you feel less hungry than on a normal day.



Environment

PRACTICE QUESTIONS

- Q.1** How much forest % is good for ecological balance?
(a) 33% (b) 66%
(c) 35% (d) 38%
- Q.2** In lake ecosystem, pyramid of biomass is
(a) upright
(b) inverted
(c) anything is possible
(d) None of them
- Q.3** Which one of the following is a top carnivore of grassland food chain?
(a) snake (b) deer
(c) vulture (d) frog
- Q.4** Consider the following statements regarding productivity:
1. Primary productivity of ecosystem is the rate at which plants and other photosynthetic organisms produce organic compounds.
2. Secondary productivity is the rate at which energy is stored at different levels in consumers.
Which of the above statements is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2
- Q.5** Which of the following is the nature's cleaner?
(a) Producers (b) Consumer
(c) Decomposers (d) Man
- Q.6** Pyramid of energy in a pond ecosystem is always
(a) inverted (b) upright
(c) irregular (d) linear
- Q.7** Xerosere succession is related to
(a) land (b) rocks
(c) pond (d) desert
- Q.8** With reference to the food chains in ecosystems, which of the following kinds of organism is/are known as decomposer organism/organisms?
1. Virus
2. Fungi
3. Bacteria
Select the correct answer using the codes given below.
(a) 1 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3
- Q.9** When an ecosystem is considered to be healthy?
(a) When ecosystem is sustainable.
(b) All elements of ecosystem are living in balance.
(c) All elements of ecosystem are capable of reproducing themselves.
(d) All of the above
- Q.10** Consider the following statements:
1. Energy flow through the trophic levels from producers to subsequent trophic level is bi-directional.
2. Energy level increases from the first trophic level upwards due to addition of energy in the form of heat at each trophic level.
Which of the above statements is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2
- Q.11** Snowfall is a
(a) biotic factor (b) abiotic factor
(c) Both of them (d) None of them
- Q.12** Microbes are a
(a) biotic factor (b) abiotic factor
(c) edaphic factor (d) None of them

Q.94 Consider the following statements regarding mangroves:

1. Mangroves are found only in the locations where abundant silt is brought down by rivers.
2. They require high solar radiation and have the ability to absorb fresh water from saline or brackish water.
3. Mangroves protect coastal inland from Tsunami, hurricanes and floods.

Which of the above statements is/are correct?

- (a) 1 and 2 only (b) 3 only
(c) 1 and 3 only (d) 2 and 3 only

Q.95 Consider the following statements:

1. Sundarbans mangrove forest cover is fast depleting.
2. Sundarbans mangrove forest is located in Karnataka.

Which of the above statements is/are correct?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q.96 The term 'eutrophication' refers to

- (a) symbiotic relationship with other organisms
(b) directional change in vegetation in an ecosystem
(c) how pollutants enter a food chain
(d) enrichment of nutrients in lake ecosystem

Q.97 The term 'biomagnification' is referred to as:

- (a) increase in the body weight
(b) uncontrolled growth of harmful organisms
(c) accumulation of increasing amount of non-degradable pollutant through food chain
(d) increase in number of bacteria in culture medium

Q.98 Consider the following statements:

1. Aphotic zone is the upper layer of the aquatic ecosystems, up to which light penetrates and within which photosynthetic activity is confined.
2. With the increase in the temperature of a water body, the rate at which oxygen is depleted from water also increases.

Which of the above statements is/are correct?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q.99 Snowfall is a

- (a) biotic factor (b) abiotic factor
(c) Both of them (d) None of them

Q.100 Microbes are a

- (a) biotic factor
(b) abiotic factor
(c) edaphic factor
(d) None of them

Environment

ANSWER KEY

- | | | | | | | | |
|---------|---------|---------|----------|---------|---------|---------|---------|
| 1. (a) | 2. (b) | 3. (c) | 4. (c) | 5. (c) | 6. (b) | 7. (d) | 8. (b) |
| 9. (d) | 10. (d) | 11. (b) | 12. (a) | 13. (c) | 14. (b) | 15. (d) | 16. (a) |
| 17. (a) | 18. (b) | 19. (d) | 20. (a) | 21. (a) | 22. (c) | 23. (c) | 24. (b) |
| 25. (a) | 26. (d) | 27. (d) | 28. (c) | 29. (c) | 30. (a) | 31. (d) | 32. (d) |
| 33. (c) | 34. (c) | 35. (a) | 36. (a) | 37. (a) | 38. (c) | 39. (c) | 40. (b) |
| 41. (d) | 42. (d) | 43. (d) | 44. (a) | 45. (a) | 46. (c) | 47. (b) | 48. (b) |
| 49. (c) | 50. (c) | 51. (c) | 52. (d) | 53. (a) | 54. (d) | 55. (a) | 56. (a) |
| 57. (d) | 58. (c) | 59. (d) | 60. (c) | 61. (c) | 62. (c) | 63. (d) | 64. (a) |
| 65. (b) | 66. (a) | 67. (d) | 68. (b) | 69. (d) | 70. (c) | 71. (d) | 72. (b) |
| 73. (c) | 74. (d) | 75. (b) | 76. (b) | 77. (b) | 78. (d) | 79. (b) | 80. (d) |
| 81. (b) | 82. (c) | 83. (b) | 84. (b) | 85. (a) | 86. (d) | 87. (c) | 88. (a) |
| 89. (d) | 90. (d) | 91. (c) | 92. (d) | 93. (d) | 94. (d) | 95. (a) | 96. (d) |
| 97. (c) | 98. (b) | 99. (b) | 100. (a) | | | | |