

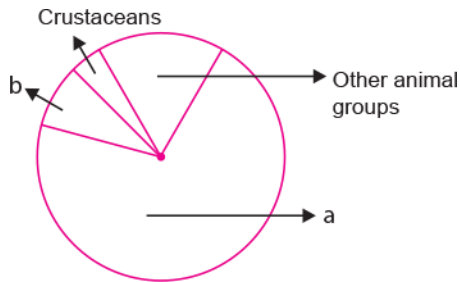
Very Short Answer Questions (PYQ)

[1 Mark]

Q.1. India has more than 50,000 strains of rice. Mention the level of biodiversity it represents.

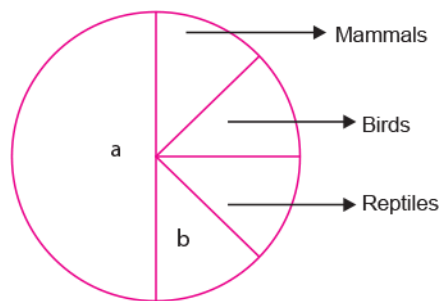
Ans. 50,000 strains of rice represent specific biodiversity.

Q.2. Name the unlabelled areas 'a' and 'b' of the pie chart (given alongside) representing the global biodiversity of invertebrates showing their proportionate number of species of major taxa.



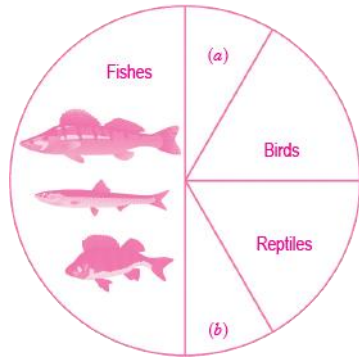
Ans. *a* → Insects; *b* → Molluscs

Q.3. Name the unlabelled areas 'a' and 'b' of the pie chart representing biodiversity of vertebrates showing the proportionate number of species of major taxa.



Ans. *a* → Fishes; *b* → Amphibians.

Q.4. Identify 'a' and 'b' in the figure given below representing proportionate number of major vertebrate taxa.



Ans. $a \rightarrow$ Mammals $b \rightarrow$ Amphibians

Q.5. Write the importance of cryopreservation in conservation of biodiversity.

Ans. By cryopreservation, the reproductive parts of rare species can be preserved.

Q.6. About 200 species of Cichlid fish became extinct when a particular fish was introduced in Lake Victoria of Africa. Name the invasive fish.

Ans. Nile perch.

Q.7. Name the type of biodiversity represented by the following:

- i. 1000 varieties of mangoes in India.
- ii. Variations in terms of potency and concentration of reserpine in *Rauwolfia vomitoria* growing in different regions of Himalayas.

Ans.

- i. Genetic diversity
- ii. Genetic diversity

Q.8. Name the type of biodiversity represented by the following:

- i. 50,000 different strains of rice in India
- ii. Estuaries and alpine meadows in India.

Ans.

- i. Genetic diversity
- ii. Ecological diversity

Very Short Answer Questions (OIQ)

[1 Mark]

Q.1. Define biodiversity

Ans. The occurrence of different types of genes, gene pools, species, habitats and ecosystems in a particular place and various parts of earth is called biodiversity.

Q.2. Name the socio-biologist who popularised the term biodiversity.

Ans. Edward Wilson

Q.3. What is genetic diversity?

Ans. It is the measure of variety in genetic information contained in the organisms.

Q.4. Name the two most biodiversity rich zones of India.

Ans. Western Ghats and North East region.

Q.5. Name any two threatened animal species of India.

Ans. Red panda, Black buck.

Q.6. Give two examples of extinction caused by indiscriminate hunting.

Ans. Dodo and cheetah.

Q.7. Name the alien fish species which is posing a threat to the indigenous catfishes in our rivers.

Ans. *Clarias gariepinus* (African catfish)

Q.8. What are endangered species?

Ans. The species which are in danger of extinction and whose number have been reduced to a critical level are called endangered species.

Q.9. What is mass extinction?

Ans. Due to natural calamities like volcanic eruptions, prolonged drought, heavy rains, earthquakes, asteroid collision, etc., a large number of species become extinct which is called mass extinction.

Q.10. What is meant by alien species?

Ans. Non-native powerful species which invade a new area are known as alien species.

Q.11. Which region in India has the maximum number of amphibian species?

Ans. Western Ghats

Q.12. Name any two sanctuaries in India.

Ans. Keoladeo Ghana bird sanctuary, Bharatpur (Rajasthan) and Periyar sanctuary (Kerala).

Q.13. What are seed banks?

Ans. The collection of seeds of many different genetic strains of commercially important plants, that are kept viable for longer periods in place are called seed banks.

Q.14. What is Red Data Book?

Ans. The Red Data Book is a compilation of data on species threatened with extinction and is maintained by IUCN.

Q.15. What is the expanded form of IUCN?

Ans. International Union for Conservation of Nature and Natural Resources.

Q.16. When was the Earth Summit held?

Ans. The Earth Summit was held at Rio de Janeiro (Brazil) between 3–14 June, 1992.

Q.17. What is cryopreservation?

Ans. It is a technique of preserving sperms, eggs, animal cells, tissues and embryos at very low temperature of around -196°C in liquid nitrogen.

Q.18. What is a national park?

Ans. A national park is a protected area reserved for wildlife where human activities are not permitted.

Q.19. Name any two national parks of India.

Ans. Jim Corbett National Park (Uttarakhand) and Kaziranga National Park (Assam).

Q.20. Which forest is named as the 'Lungs of the Planet'?

Ans. Amazon rainforest

Q.21. What is a hot spot?

Ans. A hot spot is an area having endangered endemic species with very high levels of species richness.

Q.22. Name the Indian hot spots that extend into other countries.

Ans.

- i. Western Ghats and Sri Lanka.
- ii. Indo-Burma and Himalaya.

Q.23. What are Ramsar sites?

Ans. Ramsar sites are conserved wetlands which are of international importance.

Q.24. Why is genetic variation important in the plant *Rauwolfia vomitoria*?

Ans. Genetic variation affects the variation in potency and concentration of the drug reserpine in the medicinal plant *Rauwolfia*.

Q.25. According to David Tilman, greater the diversity greater is the primary productivity. Can you think of a very low diversity man-made ecosystem that has high productivity.

Ans. Agricultural fields like wheat field or paddy field which are also examples of monoculture practices.

Q.26. What is the difference between endemic and exotic species?

Ans. Endemic species are native species restricted to a particular geographical region. Exotic species are species which are introduced from other geographical regions into an area.

Q.27. Western Ghats have a greater amphibian diversity than the Eastern Ghats. What do you infer from the above two statements?

Ans. It can be inferred that Western Ghats have a greater species diversity.

Short Answer Questions-I (PYQ)

[2 Marks]

Q.1. State the use of biodiversity in modern agriculture.

Ans. Biodiversity is a source of hybrids, GM plants, biopesticides, organic farming, bio fertilizer, improved varieties of plants, disease resistant plants. (*Any two*)

Q.2. In the biosphere immense biological diversity exists at all levels of biological organisation. Explain any two levels of biodiversity.

Ans. Biodiversity

- The occurrence of different types of genes, gene pools, species, habitats and ecosystems in a particular place and various parts of earth is called biodiversity.
- The term 'biodiversity' was given by Edward Wilson.
- Biodiversity is divided into three levels :
 - i. **Genetic diversity**
 - It is the measure of variety in genetic information contained in the organisms.
 - It enables a population to adapt to its environment.
 - For example, medicinal plant *Rauwolfia vomitoria* growing in Himalayan ranges shows variation in potency and concentration of the active chemical reserpine that it produces.
 - There are more than 50,000 genetically different strains of rice and 1,000 varieties of mango in India.
 - ii. **Species diversity**
 - It is a measure of the variety of species and their relative abundance present within a region.
 - For example, the Western Ghats have a greater amphibian species diversity than the Eastern Ghats.
 - iii. **Ecological diversity**
 - It is a measure of the diversity at community and ecosystem levels. They represent the local, unique habitat and regional components of species diversity.
 - For example, ecological diversity is greater in India due to presence of large number of ecosystems like deserts, rainforests, coral reefs, wetlands, estuaries and alpine meadows.

Q.3. Mention the kind of biodiversity of more than a thousand varieties of mangoes in India represent. How is it possible?

Ans. Thousand varieties of mangoes represent genetic diversity. This is possible because:

- i. Single species show high diversity at genetic level over its distributional range.
- ii. Different varieties grow in different geographical areas.
- iii. Mutations.

Q.4. List the features that make a stable biological community.

Ans. Features of a stable community are as follows:

- i. Communities should have greater biodiversity for greater stability.
- ii. It should be able to prevent invasion by alien species.
- iii. It should be able to restore itself in a short period of time.
- iv. Variations should be minimal in the community.

Q.5. “Stability of a community depends on its species richness.” Write how did David Tilman show this experimentally.

Ans. David Tilman found that plots with more species showed less year-to-year variation in total biomass. He also showed that in his experiments, increased diversity contributed to higher productivity.

Q.6. Biodiversity must be conserved as it plays an important role in many ecosystem services that nature provides. Explain any two services of the ecosystem.

Ans. The two ecosystem services are:

- i. Forest ecosystem purify air, mitigate droughts and floods.
- ii. The cycling nutrients generate fertile soil and maintains biodiversity.

Q.7. Explain, giving one example, how co-extinction is one of the causes of loss of biodiversity. List the three other causes also (without description).

Ans. When a species becomes extinct, the plant and animal species associated with it in an obligatory may also become extinct. This is called co-extinction. For example, when a host fish species becomes extinct, its unique assemblage of parasites also becomes extinct.

The three other causes are:

- i. Habitat loss and fragmentation
- ii. Over-exploitation
- iii. Alien species invasion.

Q.8. Narrowly utilitarian arguments are put forth in support of biodiversity conservation. Explain the other two arguments that are put forth in support of the same cause.

Ans.

1. Broadly utilitarian arguments

- Biodiversity plays a major role in maintaining and sustaining supply of goods and services from various species as well as ecological systems.

- The different ecological services provided are:
 - a. Amazon forest is estimated to contribute 20 per cent of the total oxygen in the atmosphere on earth.
 - b. Ecosystem provides pollinators like bees, bumble bees, birds and bats which pollinate plants to form fruits and seeds.
 - c. Aesthetic pleasures like bird watching, spring flowers in full bloom, walking through the thick forest, waking up to a bulbul's song, etc. are some other benefits of the ecosystem.

2. Ethical reasons

- There are thousands of plants, animals and microbes on this earth which are not useless. Every one has some intrinsic value even if it is not of any economic value to us.
- It is, therefore, our moral duty to ensure well-being of all the living creatures for the utilisation of future generations.

Q.9. State how does *ex-situ* conservation help in protecting biodiversity.

Ans. *Ex situ* conservation (Off-site conservation)

- This approach involves placing threatened animals and plants in special care units for their protection.
- India has 35 botanical gardens and 275 zoological parks where animals which have become extinct in wild are maintained.
- By using cryopreservation (preservation at -196°C) technique, sperms, eggs, animal cells, tissues and embryos can be stored for long period in genes banks, seed banks, etc.
- Plants are propagated *in vitro* using tissue culture methods (micropropagation).
- It is the desirable approach when urgent measures to save extinction are required.

S. No.	In situ conservation	Ex situ conservation
(i)	It is conservation and protection of biodiversity in its natural habitat.	It is conservation of selected threatened plant and animal species in places outside their natural habitat.
(ii)	Population is conserved in the surroundings where they have developed their distinctive features.	Population is conserved under simulated conditions that closely resemble their natural habitats.
(iii)	<i>E.g.</i> , national parks, biosphere reserves, wildlife sanctuaries, etc.	<i>E.g.</i> , botanical gardens, zoological parks, wildlife safari, gene banks, etc.

Q.10. Where would you expect more species biodiversity— in tropics or in polar regions? Give reasons in support of your answer.

Ans. More biodiversity is found in the tropics. This is because tropical regions remain undisturbed from frequent glaciations as in polar regions. Also, the tropics are less seasonal/more constant.

Q.11. Why are certain regions on the Earth called hot-spots? Name any two hot-spots in India.

Ans. Certain regions have been declared as “hot spots” for maximum protection of these regions which have high levels of species richness and high degree of endemism.

Western Ghats and Sri Lanka and Himalayas are two example of hot-spots.

Q.12. Justify with the help of an example where a deliberate attempt by humans has led to the extinction of a particular species.

Ans. When Nile perch, a large predator fish, was introduced in Lake Victoria, it started feeding on the native fish, cichlid fish. As a result, cichlid fish became extinct and Nile perch, not finding any food for itself, died too.

Q.13. Differentiate between in situ and ex situ approaches of conservation of biodiversity.

Ans.

S. No.	<i>In situ</i> approach	<i>Ex situ</i> approach
(i)	It involves protection of endangered species of plants and animals.	It involves protection of endangered species by removing them from the natural habitat
(ii)	This is done by protecting the natural habitat or ecosystem.	This is done by placing the species under special care.

Q.14. Why are sacred groves highly protected?

Ans. Sacred groves are highly protected because of religious and cultural traditions. These are refuges for large number of rare and threatened plants. They are ecologically unique and biodiversity rich regions.

Q.15. List any four techniques where the principle of *ex-situ* conservation of biodiversity has been employed.

Ans. Cryopreservation, in vitro fertilisation, micropropagation/tissue culture sperm bank/seed bank/gene bank.

Q.16. A particular species of wild cat is endangered. In order to save them from extinction, which is a desirable approach in-situ or ex-situ? Justify your answer and explain the difference between the two approaches.

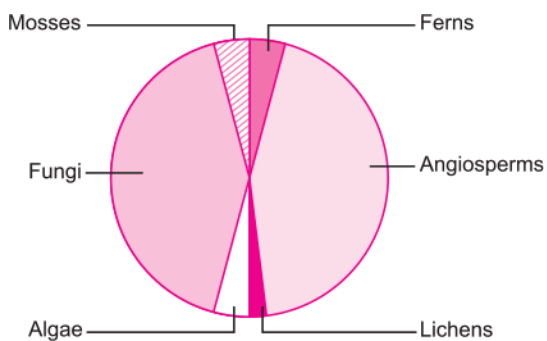
Ans. *Ex-situ* is a desirable approach to protect the wild cat. The organism is protected outside their natural habitat where special care is taken to protect them. By using

cryopreservation techniques, gametes of threatened species can also be preserved under very low temperature.

For difference, refer to Basic Concepts Point 8.

Q.17. Observe the global biodiversity distribution of major plant taxa in the diagram alongside and answer the questions that follow.

- Which group of plants are most endangered?
- Why are mosses/ferns so few? Give reason.
- How do fungi that are heterotrophs sustain themselves as a large population?
- Which group of plants is most advanced and which one is most primitive?



Ans.

- Lichens.
- Mosses and ferns are few as they need humid conditions in forests that are fast disappearing.
- Fungi are able to sustain themselves as a large population because of their wider adaptability to the changing environmental conditions.
- Most advanced group is of angiosperms and most primitive group is of fungi.

Short Answer Questions-I (OIQ)

[2 Mark]

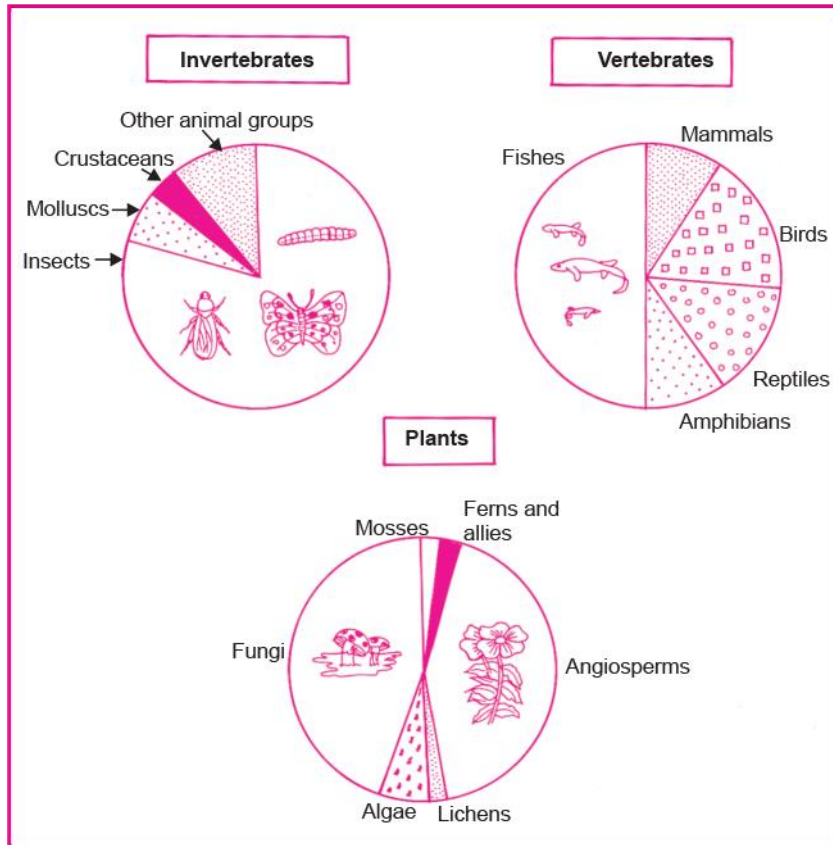
Q.1. What are the different levels of biodiversity?

Ans. There are three levels of biodiversity:

- Genetic diversity
- Species diversity
- Ecological diversity

Q.2. Represent diagrammatically the proportion of different groups of plants, invertebrates and vertebrates (Global biodiversity).

Ans.



Q.3. Among the ecosystem services are control of floods and soil erosion. How is this achieved by the biotic components of the ecosystem?

Ans.

Control of soil erosion: Plant roots hold the soil particles tightly and do not allow the top soil to be drifted away by winds or moving water. Plants increase the porosity and fertility of the soil.

Control of floods: It is carried out by retaining water and preventing run off of rain water. Litter and humus of plants function as sponges thus, retaining the water which percolates down and get stored as underground water. Hence, the flood is controlled.

Q.4. What is biodiversity? Why is it a matter of concern now?

Ans. Biodiversity is the occurrence of different types of genes, gene pools, species, habitats and ecosystems in a particular place and various parts of earth. It is a matter of concern because species are continuously lost, limiting the diversity and this will affect our survival and well-being on earth due to the changes in environment.

Q.5. What is fragmented habitat? Give one example.

Ans. When large sized habitats are broken into smaller parts due to human activities they are called fragmented habitat and it leads to population decline. Example, a small forest near an urban settlement.

Q.6. What is the ecological importance of biodiversity?

Ans. The ecological importance of biodiversity:

- i. Biodiversity is required for maintaining and sustainable use of goods and services from ecosystem.
- ii. Various insects help in pollination.
- iii. Various micro-organisms help in the decomposition of organic matter thereby increasing the soil fertility and cleaning the environment.
- iv. Various drugs and medicines are extracted from plants.

Q.7. What does the term genetic diversity refer to? What is the significance of large genetic diversity in a population?

Ans. Genetic diversity is the measure of variety in genetic information contained in the organisms. Significance of large genetic diversity are as follows:

- i. Larger genetic diversity provides adaptability at the time of environmental changes and helps the species in surviving.
- ii. Larger genetic diversity is also useful in the evolution of species.

Q.8. Describe with example the latitudinal gradients of biodiversity.

Ans. Latitudinal gradients

- a. Biodiversity increases from poles to equators, i.e., from high to low latitude.
- b. Tropics (23.5°N to 23.5°S) have more species than temperate or polar regions. For example, Columbia located near the equator has 1,400 species of birds while New York (41.5°N) has 105 species and Greenland (71°N) has only 56 species.

Q.9. List any four factors which may lead to loss of biodiversity.

Ans. Causes of Biodiversity Losses

There are four major causes of biodiversity loss. These are also known as 'The Evil Quartet'.

- i. **Habitat loss and fragmentation**
- ii. **Over-exploitation**
- iii. **Alien (exotic) species invasions**
- iv. **Co-extinctions**

Q.10. What is IUCN red list? Give any two uses of this list.

Ans. IUCN red list is a catalogue of species and subspecies that are facing the risk of extinction.

The two uses of this list are:

- i. Provides information and develops awareness about the importance of threatened species.
- ii. Identification and documentation of endangered species.

Q.11. Why are conventional methods not suitable for the assessment of biodiversity of bacteria?

Ans. Many bacteria are not culturable under normal condition in the laboratory. This becomes a problem in studying their morphological, biochemical and other characterisations which are useful for their assessment. Thus conventional methods are not suitable.

Q.12. Is it true that there is more solar energy available in the tropics? Explain briefly.

Ans. As one moves from the equator to the polar regions, the length of the day decreases and the length of the night increases. The length of day and night are same at the equator.

Therefore, it is true that there is more solar energy available in the tropics.

Q.13. How is the presently occurring species extinction different from the earlier mass extinctions?

Ans. Species extinction occurring at present is due to anthropogenic or man-made causes whereas the earlier extinction was due to natural causes.

Q.14. In an experiment, the slope of regression (Z) is 0.2 and in another experiment the value obtained is 1.2. Explain the two situations in respect of species area relationships.

Ans. 0.2 is obtained in studies regardless of the taxonomic group or the region 1.2 is obtained if species area relationship is analysed among very large areas like the entire continents.

Q.15. Discuss one example, based on your day-to-day observations, showing how loss of one species may lead to extinction of another.

Ans. In case a species becomes extinct, the plant and animal species associated within an obligatory way also become extinct. For example,

- i. When a fish species which is a host for a number of parasites becomes extinct, the parasite species which are uniquely dependent on the host fish will also become extinct.
- ii. The insects may be polyphagous (feed on more than one plant species) or monophagous (feed on only one particular plant species) in nature. The monophagous insect species are valuable and may become extinct if the plant species upon which it feeds becomes extinct.

Q.16. Would the extinction of one insect pollinator affect the ecosystem? Explain.

Ans. It would affect the ecosystem because insect pollinators form a part of food web. It may lead to co-extinction of species in the case of a co-evolved plant. It is a case of mutualism where extinction of one invariably leads to the extinction of the other.

Q.17. Seeds of different genetic strains are kept for long periods in seed banks. Explain the conservative strategy involved in this process.

Ans. The strategy is called *Ex-situ* conservation. In this technique, seeds are preserved in viable and fertile condition for long periods using cryopreservation techniques.

Q.18. *Lantana* and *Eichhornia* are examples of two weeds. How do they affect the ecosystem?

Ans. These are examples of Alien species invasions. They threaten the indigenous species and lead to their extinction.

Q.19. Assess the effects of loss of biodiversity in a region. Mention any four such effects.

Ans.

- i. Decline in plant production and animal species
- ii. Lowered resistance to environmental perturbations such as drought
- iii. Increased variability in certain ecosystem processes such as plant productivity/water use/pest and disease cycles.
- iv. Increased rate of species extinction.

Q.20. What is cryopreservation? Give its one use.

Ans. Cryopreservation is a preservation technique in which sperms, eggs, cells, tissues, etc., are stored at ultra-low temperature of -196°C under nitrogen. Cells and gametes of threatened species can be preserved by this method.

Q.21. Interpret two effects of loss of biodiversity in a region.

Ans.

- i. Decline in plant production.
- ii. Lowered resistance to environmental perturbations such as drought.

- iii. Increased variability in certain ecosystem processes such as plant productivity, water use, and pest and disease cycles. (*Any two*)

Q.22. Which region/biome in the world is considered as the 'Lungs of the planet'? Give two reasons for its degradation.

Ans. The Amazon rain forests are considered as the lungs of the planet. They are cut and cleared for cultivation of soya beans. Some part has been converted into grass lands for raising beef cattle.

Q.23. Which type of conservation measures, in situ or ex situ, will help the larger number of species to survive? Explain.

Ans. *In situ* conservation measures will help larger number of species to survive because this approach involves protection of species in their natural habitat, e.g., national parks, sacred groves, biodiversity hot spots, etc.

Short Answer Questions-II (PYQ)

[3 Marks]

Q.1. Why should biodiversity be conserved? List any two ethical arguments in its support.

Ans. The biodiversity should be conserved because of the following reasons:
(Any two)

- i. Narrowly utilitarian arguments for deriving direct economic benefit from nature.
- ii. Broadly utilitarian arguments as biodiversity plays a major role in many ecosystem services.
- iii. Ethical reasons: There is a need to realise that every species has an intrinsic value and we need to pass on our biological legacy to future generations.

Q.2. Alien species are highly invasive and are a threat to indigenous species. Substantiate this statement with any three examples.

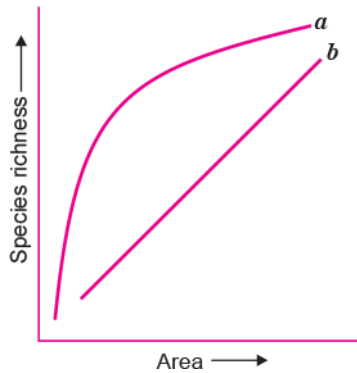
Ans. Exotic species are defined as species that have been introduced from another geographic region to an area outside its natural range. For example,

- i. *Parthenium*, *Lantana* and *Eichhornia* are the exotic species of plants that have invaded the native species of India and caused environmental damage.
- ii. Introduction of African catfish *Clarias gariepinus* for aquaculture purpose is posing threat to many indigenous catfish.
- iii. Nile perch introduced into lake Victoria in East Africa led to the extinction of cichlid fish.

Q.3. Explain 'rivet popper' hypothesis. Name the ecologist who proposed it.

Ans. Paul Ehrlich proposed the rivet popper hypothesis. This hypothesis states that in an airplane (ecosystem) all parts are joined together using thousands of rivet (species). If every passenger travelling in it starts popping a rivet to take home (causing a species to become extinct), it may not affect flight safety (proper functioning of the ecosystem) initially but as more and more rivets are removed, the plane becomes dangerously weak over a period of time. Also, which rivet is removed may also be critical like loss of rivets on the wings (key species) is more serious threat to flight safety than loss of few rivets on the seats or windows inside the plane.

Q.4. The given graph alongside shows species–area relationship. Write the equation of the curve 'a' and explain.



Ans. The equation of the curve 'a' is $S = CA^2$.

- i. Within a region, species richness increases with increasing explored area but only up to a limit.
- ii. Relationship between species richness and area for a wide variety of taxa turns out to be rectangular hyperbola.

Q.5. Compare narrowly utilitarian and broadly utilitarian approaches to conserve biodiversity, with the help of suitable examples.

Ans.

- i. **Narrowly utilitarian arguments :**
 - Human beings derive direct economic benefits from nature, like food, firewood, fibre, construction material, industrial products (resins, gums, dyes, tannins, etc.) and medicinally important products.
 - More than 25 percent of the drugs are derived from plants and about 25000 species of plants are used by native people as traditional medicines.
- ii. **Broadly utilitarian arguments :**
 - Biodiversity plays a major role in maintaining and sustaining supply of goods and services from various species as well as ecological systems.
 - The different ecological services provided are :
 - a. Amazon forest is estimated to contribute 20 percent of the total oxygen in the atmosphere on earth.
 - b. Ecosystem provides pollinators like bees, bumble bees, birds and bats which pollinate plants to form fruits and seeds.
 - c. Aesthetic pleasures like bird watching, spring flowers in full bloom, walking through the thick forest, waking up to a bulbul's song, etc. are some other benefits of the ecosystem.

Q.6. Many plant and animal species are on the verge of their extinction because of loss of forest land by indiscriminate use by the humans. As a biology student what method would you suggest along with its advantages that can protect such threatened species from getting extinct?

Ans. *Ex-situ* conservation method can be used.

Ex- situ conservation (Off- site conservation)

- This approach involves placing threatened animals and plants in special care units for their protection.
- India has 35 botanical gardens and 275 zoological parks where animals which have become extinct in wild are maintained.
- By using cryopreservation (preservation at -196°C) technique, sperms, eggs, animal cells, tissues and embryos can be stored for long period in genes banks, seed banks, etc.
- Plants are propagated *in vitro* using tissue culture methods (micropropagation).
- It is the desirable approach when urgent measures to save extinction are required.

Q.7. There are many animals that have become extinct in the wild but continue to be maintained in Zoological parks.

Q. What type of biodiversity conservation is observed in this case?

Ans. *Ex-situ* conservation

Q. Explain any two other ways which help in this type of conservation.

Ans.

- a. In-vitro fertilisation: Gametes of threatened species can be fertilised for their propagation.
- b. Cryopreservation techniques: Gametes of threatened species can be preserved in viable and fertile condition for long periods.

Q.8. Name and describe any three causes of biodiversity losses.

Ans. Causes of Biodiversity Losses

- i. **Habitat loss and fragmentation**
 - Destruction of habitat is the primary cause of extinction of species.
 - The tropical rainforests initially covered 14 per cent of the land surface of earth, but now cover only 6 per cent of land area.
- ii. **Over-exploitation**
 - When biological system is over-exploited by man for the natural resources, it results in degradation and extinction of the resources.
 - For example, Stellar's sea cow, passenger pigeon and many marine fishes.
- iii. **Alien (exotic) species invasions**
 - Some alien (exotic) species when introduced unintentionally or deliberately, become invasive and cause harmful impact, resulting in extinction of the indigenous species.
 - Nile perch, a large predator fish when introduced in Lake Victoria (East Africa) caused the extinction of an ecologically unique species of Cichlid fish in the lake.
- iv. **Co-extinctions**

- When a species becomes extinct, the plant and animal species associated with it in an obligatory manner, also become extinct.
- For example, if the host fish species becomes extinct, all those parasites exclusively dependent on it, will also become extinct; in plant–pollinator mutualism also, extinction of one results in the extinction of the other.

Q.9. Co-extinction and introduction of alien species too are responsible for the loss of biodiversity. Explain how.

Ans.

- i. **Alien (exotic) species invasions**
 - Some alien (exotic) species when introduced unintentionally or deliberately, become invasive and cause harmful impact, resulting in extinction of the indigenous species.
 - Nile perch, a large predator fish when introduced in Lake Victoria (East Africa) caused the extinction of an ecologically unique species of Cichlid fish in the lake.
- ii. **Co-extinctions**
 - When a species becomes extinct, the plant and animal species associated with it in an obligatory manner, also become extinct.
 - For example, if the host fish species becomes extinct, all those parasites exclusively dependent on it, will also become extinct; in plant–pollinator mutualism also, extinction of one results in the extinction of the other.

Q.10. 'In-situ' conservation can help endangered/threatened species. Justify the statement.

Ans. In '*in-situ*' conservation threatened organisms are conserved in their natural habitat or ecosystem, and such regions are legally protected. This has been carried out by identifying certain regions as hotspots, biosphere reserves, national parks, sanctuaries, sacred groves and Ramsar sites.

***In situ* conservation (On site conservation)**

This approach involves protection of species in their natural habitat.

- a. **Biodiversity hot spots**
 - These are regions of high levels of species richness and high degree of endemism.
- b. **Protected areas**
 - India has 14 biosphere reserves, 90 national parks and 448 wildlife sanctuaries.
- c. **Ramsar sites**
 - **Ramsar sites** are wetlands which are considered to be of international importance.
- d. **Sacred groves**
 - These are forest patches set aside for worship. All the trees and wildlife within are given total protection by tribal people.

Short Answer Questions-II (OIQ)

[3 Marks]

Q.1. What is meant by the term 'hot spots' in biodiversity? List two criteria used for determining a 'hot spot'. Name two hot spots of India.

Ans. A hot spot is an area having endangered endemic species with very high levels of species richness. Criteria used for determining a hot spot:

- i. Number of endemic species, *i.e.*, species which are not found anywhere else.
- ii. Degree of threat which is measured in terms of habitat loss.

Western Ghats and Eastern Himalayas are two hot spots in India.

Q.2. Differentiate between

Q. Keystone species and endangered species

Ans.

S. No.	Keystone species	Endangered species
(i)	It is a species of lower abundance that plays vital role in sustaining the community	It is a species of lower abundance that may or may not have a vital role in sustaining the community.
(ii)	The species is not threatened, <i>e.g.</i> , Ficus.	The species is at high risk of extinction in near future, <i>e.g.</i> , Red Panda.

Q. Genetic diversity and species diversity.

Ans.

S. No.	Genetic diversity	Species diversity
(i)	It represents the variety of genetic information present in an organism.	It is the variety of species and their relative abundance found within a region.
(ii)	It is trait of an organism.	It is trait of a biotic community.

Long Answer Questions (PYQ)

[5 Marks]

Q.1. Explain, giving three reasons, why tropics show greatest levels of species diversity.

Ans.

- i. Tropical latitude have remained relatively undisturbed and have had a long evolutionary time for species diversification.
- ii. Tropical environments have less seasonal variations, more constant and predictable environmental conditions. This promotes niche specialisation for greater species diversity.
- iii. There is more availability of solar energy which contributes to higher productivity.

Q.2. Answer the following questions:

Q. Why is there a need to conserve biodiversity?

Ans. Reasons for Biodiversity Conservation

- There are three main reasons for conserving the biodiversity which have been classified into the following categories:
 - i. **Narrowly utilitarian arguments**
 - Human beings derive direct economic benefits from nature, like food, firewood, fibre, construction material, industrial products (resins, gums, dyes, tannins, etc.) and medicinally important products.
 - ii. **Broadly utilitarian arguments**
 - Biodiversity plays a major role in maintaining and sustaining supply of goods and services from various species as well as ecological systems.
 - iii. **Ethical reasons**
 - There are thousands of plants, animals and microbes on this earth which are not useless. Every one has some intrinsic value even if it is not of any economic value to us.

Q. Name and explain any two ways that are responsible for the loss of biodiversity.

Ans. Habitat loss and fragmentation

- Destruction of habitat is the primary cause of extinction of species.
- The tropical rainforests initially covered 14 per cent of the land surface of earth, but now cover only 6 per cent of land area.

Over-exploitation

- When biological system is over-exploited by man for the natural resources, it results in degradation and extinction of the resources.
- For example, Stellar's sea cow, passenger pigeon and many marine fishes.

Q.3. Answer the following questions:

Q. Why should we conserve biodiversity? How can we do it?

Ans. Reasons for Biodiversity Conservation

- There are three main reasons for conserving the biodiversity which have been classified into the following categories:
 - Narrowly utilitarian arguments**
 - Human beings derive direct economic benefits from nature, like food, firewood, fibre, construction material, industrial products (resins, gums, dyes, tannins, etc.) and medicinally important products.
 - Broadly utilitarian arguments**
 - Biodiversity plays a major role in maintaining and sustaining supply of goods and services from various species as well as ecological systems.
 - Ethical reasons**
 - There are thousands of plants, animals and microbes on this earth which are not useless. Every one has some intrinsic value even if it is not of any economic value to us.

Q. Explain the importance of biodiversity hot-spots and sacred groves.

Ans. Biodiversity hot spots

- These are regions of high levels of species richness and high degree of endemism.
- Endemic species are species confined only to a limited region.
- There are 34 hot spots in the world.
- In India, the three hot spots are Western Ghats and Sri Lanka, Indo–Burma and Himalaya.
- These reduce mass extinction by 30%.

Sacred groves

- These are forest patches set aside for worship. All the trees and wildlife within are given total protection by tribal people.
- Large number of rare and threatened plants can be found in these regions.
- Some of the sacred groves in India are as follows:
 - Khasi and Jaintia Hills in Meghalaya
 - Western Ghat regions of Karnataka and Maharashtra
 - Aravalli Hills of Rajasthan
 - Sarguja, Chanda and Bastar areas of Madhya Pradesh.

Q.4. Answer the following questions:

Q. What are the two types of desirable approaches to conserve biodiversity? Explain with examples bringing out the difference between the two types.

Ans. In situ conservation

- i. It is conservation and protection of biodiversity in its natural habitat.
- ii. Population is conserved in the surroundings where they have developed their distinctive features.
- iii. *E.g.*, national parks, biosphere reserves, wildlife sanctuaries, etc.

Ex situ conservation

- i. It is conservation of selected threatened plant and animal species in places outside their natural habitat.
- ii. Population is conserved under simulated conditions that closely resemble their natural habitats.
- iii. *E.g.*, botanical gardens, zoological parks, wildlife safari, gene banks, etc.

Q. What is the association between the bumble bee and its favourite orchid *Ophrys*? How would extinction or change of one would affect the other?

Ans. Commensalism because *Ophrys* employs sexual deceit to get pollination by species of bee as petal of its flower bears resemblance to female of the bee in size, colour and markings and so male bee is attracted to what it perceives as female; *pseudo* copulates with the flower and thus pollinates it. If the female bee's colour patterns change even slightly due to any reason during evolution, pollination success will be reduced unless the orchid flower co-evolves to maintain the resemblance of its petal to the female bee.

Q.5. Answer the following questions:

Q. Taking one example each of habitat loss and fragmentation, explain how are the two responsible for biodiversity loss.

Ans.

- a. The Amazon rainforest (called the "**lungs of the planet**") is being cut and cleared for cultivation of soya beans and for conversion into grasslands for raising beef cattle.
- b. When large-sized habitats are broken or fragmented due to human settlements, building of roads, digging of canals, etc., the population of animals requiring large **territories and some animals with migratory habitats declines.**

Q. Explain two different ways of biodiversity conservation.

Ans. In situ conservation

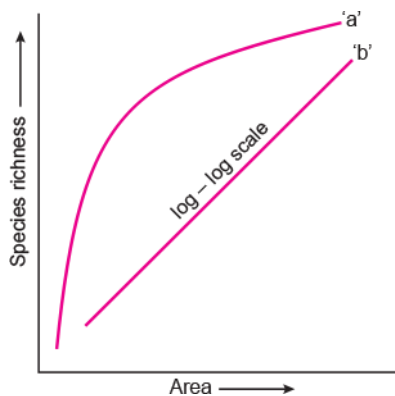
- i. It is conservation and protection of biodiversity in its natural habitat.
- ii. Population is conserved in the surroundings where they have developed their distinctive features.
- iii. *E.g.*, national parks, biosphere reserves, wildlife sanctuaries, etc.

Ex situ conservation

- i. It is conservation of selected threatened plant and animal species in places outside their natural habitat.
- ii. Population is conserved under simulated conditions that closely resemble their natural habitats.
- iii. *E.g.*, botanical gardens, zoological parks, wildlife safari, gene banks, etc.

Q.6. The following graph shows the species–area relationship. Answer the following questions as directed.

- a. Name the naturalist who studied the kind of relationship shown in the graph. Write the observations made by him.
- b. Write the situations as discovered by the ecologists when the value of 'Z' (slope of the line) lies between
 - i. 0.1 and 0.2
 - ii. 0.6 and 1.2
 What does 'Z' stand for?
- c. When would the slope of the line 'b' become steeper?



Ans.

- a. Alexander von Humboldt.
He observed that within a region, species richness increased with increasing explored area but only up to a limit.
- b.
 - i. The slopes regression lines are similar when unaffected distribution in an area is analysed.

- ii. The slope of regression is steeper when we analyse the species area relationship among very large areas like entire continent.
Z (slope of the line) is the regression co-efficient.
- c. If species richness is more, *i.e.*, in the range 0.62-1.2.

Long Answer Questions (OIQ)

[5 Marks]

Q.1. What are the reasons for biodiversity conservation?

Ans. Reasons for Biodiversity Conservation

- There are three main reasons for conserving the biodiversity which have been classified into the following categories:
 - i. **Narrowly utilitarian arguments**
 - Human beings derive direct economic benefits from nature, like food, firewood, fibre, construction material, industrial products (resins, gums, dyes, tannins, etc.) and medicinally important products.
 - More than 25 per cent of the drugs are derived from plants and about 25,000 species of plants are used by native people as traditional medicines.
 - ii. **Broadly utilitarian arguments**
 - Biodiversity plays a major role in maintaining and sustaining supply of goods and services from various species as well as ecological systems.
 - The different ecological services provided are:
 - a. Amazon forest is estimated to contribute 20 per cent of the total oxygen in the atmosphere on earth.
 - b. Ecosystem provides pollinators like bees, bumble bees, birds and bats which pollinate plants to form fruits and seeds.
 - iii. **Ethical reasons**
 - There are thousands of plants, animals and microbes on this earth which are not useless. Every one has some intrinsic value even if it is not of any economic value to us.
 - It is, therefore, our moral duty to ensure well-being of all the living creatures for the utilisation of future generations.

Q.2. Write notes on ex situ conservation of biodiversity

Ans. *Ex situ* conservation (Off-site conservation)

- This approach involves placing threatened animals and plants in special care units for their protection.
- India has 35 botanical gardens and 275 zoological parks where animals which have become extinct in wild are maintained.

- By using cryopreservation (preservation at -196°C) technique, sperms, eggs, animal cells, tissues and embryos can be stored for long period in genes banks, seed banks, etc.
- Plants are propagated *in vitro* using tissue culture methods (micropropagation).
- It is the desirable approach when urgent measures to save extinction are required.

Q.3. Explain the efforts for the conservation of biodiversity at international level.

Ans. The Earth Summit was held at Rio de Janeiro (Brazil) in which representatives of more than 170 countries were present. The summit promoted Convention on Biological Diversity (CBD). India became signatory to this convention in May 1994.

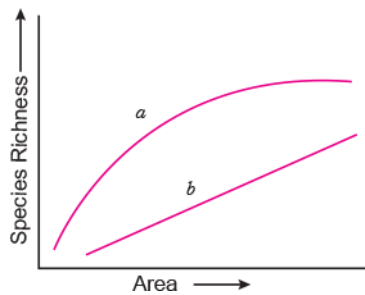
The major objectives were:

- Finding and supporting various methods to conserve biological diversity.
- Use of biodiversity only up to sustainable limit.
- The benefits derived from use of genetic resources should be fairly and equitably shared.

A second world summit on biological diversity was held in 2002 in Johannesburg, South Africa. In the Summit, 190 countries pledged to reduce the current rate of biodiversity loss at global, regional and local levels by 2010.

Q.4. The graph shows species-area relationship:

- If *b* denotes the relationship on log scale-
 - Describe *a* and *b*.
 - How is slope represented? Give the normal range of slope.
 - What kind of slope will be observed for frugivorous birds and mammals in a tropical forest?
- Species diversity of plants (22%) is much less than that of animals (72%). Analyze the reasons for greater diversity of animals as compared to plants.



Ans.

- a* is $S = CA^2$ *b* is $\log S = \log C + Z \log A$
 - Slope is *Z* (regression coefficient). Its normal value ranges from 0.6 to 1.2.

- iii. In frugivorous birds and mammals, value of $Z=1.15$
- b. Reasons for greater diversity of animals are:
 - i. Animals are mobile and can avoid predator or unfavourable event.
 - ii. Well developed nervous system to receive stimuli against external factors and respond to them.

Q.5. Answer the following questions:

Q. Biologists are not sure about how many prokaryotic species there might be. Give reasons.

Ans. Biologists are not sure about the number of prokaryotic species because:

- i. The conventional taxonomic methods are not sufficient for identifying these microbial species.
- ii. Many of the species cannot be cultured under laboratory conditions.
- iii. Biochemical and molecular biology techniques would put their diversity into millions.

Q. Would Western Ghats ecosystems be less functional if one of its tree frog species is lost forever? Substantiate your answer in the light of hypothesis proposed by Paul Ehrlich.

Ans. According to the hypothesis proposed by Paul Ehrlich, the “Rivet popper hypothesis”, each species is essential in the balance of nature. If one is lost that much imbalance is caused in the ecosystem.