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SECTION – I

ECOLOGY

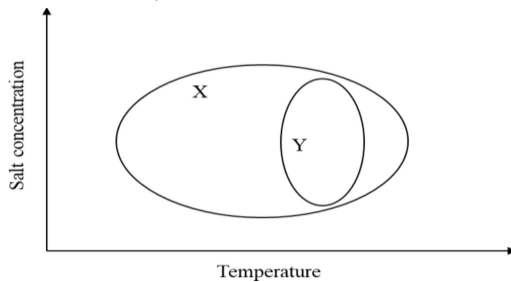
Section-I: Ecology: No. of questions asked from year 2014-2023

Chapters	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1 Fundamental Concepts	5	5	1	1	4	2	3	3	-	5
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PREVIOUS YEAR EXAM QUESTIONS / PRACTICE QUESTIONS

(GATE 2023)

- In the figure below, ellipse X represents the combinations of salt concentrations and temperatures that a marine invertebrate species can tolerate. Ellipse Y represents the combinations of salt concentrations and temperatures that this species is actually found in.



Which one or more of the following statements about X and Y is/are correct?

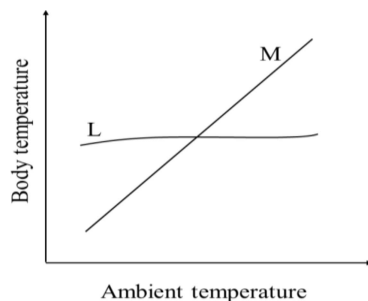
- X is the fundamental niche of the species, whereas Y is the realized niche.
- The difference between X and Y can result from biotic interactions.
- The difference between X and Y can result from dispersal limitation.
- The difference between X and Y results from the species' tolerance to salt concentrations.

(GATE 2023)

- Which one or more options is/are example(s) of niche partitioning between species?
 - Temporal separation of activity
 - Diet specialization
 - Hybridization
 - Vertical stratification of foraging heights

(GATE 2023)

- The figure depicts how body temperature changes for two species (L and M) as a function of ambient temperature.



Which one of the following statements about how L and M regulate temperature is correct?

- L and M are both homeotherms.
- L and M are both poikilotherms.
- L is a homeotherm, whereas M is a poikilotherm.
- L is a poikilotherm, whereas M is a homeotherm.

(GATE 2023)

- Which one of the following options represents the correct order with respect to levels of organization? B – biomes; E – ecosystems; P – populations; I – individuals; C – communities

- $I < P < C < E < B$
- $I < C < P < E < B$
- $I < E < C < P < B$
- $I < P < E < C < B$

(GATE 2023)

- Which one of the following options describes the difference between abiotic resources and abiotic conditions?

- Resource levels can fluctuate but conditions do not.
- Conditions can fluctuate but resource levels do not.
- Resources can be used up by organisms, whereas conditions cannot.
- Conditions can be used up by organisms, whereas resources cannot.

(GATE 2021)

- Which one of the following makes a species most vulnerable to extinction?

- Low density throughout a large geographic range and in several habitat types
- Locally common in a restricted geographic range and in several habitat types
- Low density throughout a large geographic range and in a specific habitat type
- Locally common in a restricted geographic range and in a specific habitat type

(GATE 2021)

- The probability of local extinction increases with body size when there is forest degradation, loss, and fragmentation. Consider the following hypothesis for the vulnerability of larger-bodied species:

- Larger-bodied species tend to have smaller population sizes.

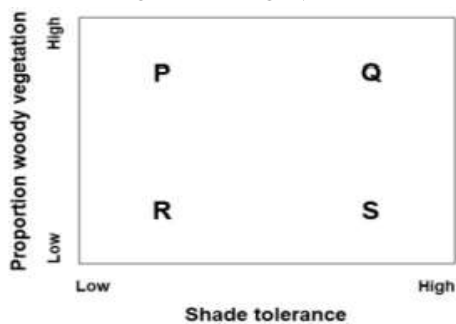
- (Q) Larger-bodied species require larger territories/home ranges.
 (R) Larger-bodied species have higher absolute resource and energy requirements

which one of the following options correctly lists all potential reasons for the vulnerability of larger-bodied species?

- (A) P and Q only (B) P only
 (C) P and R only (D) P, Q, and R

(GATE 2021)

8. Shifting cultivation is a form of agricultural practice in the hills of Northeast India, where a forest patch is cleared and cultivated for a few years, after which it is left fallow and allowed to regenerate. Succession occurs on such previously cultivated plots. Over time, the plant community should move towards which region in the graph?



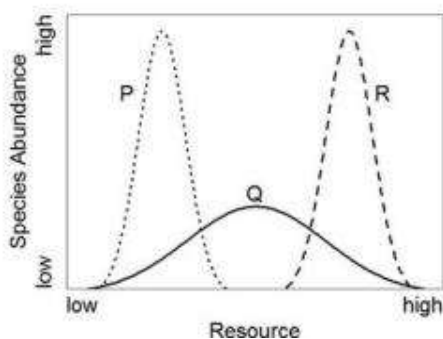
- (A) P (B) Q
 (C) R (D) S

(GATE 2020)

9. Which of the following criteria is used to define species under the biological species concept?
 (A) Niche partitioning
 (B) Reproductive isolation
 (C) Morphological divergence
 (D) Genetic distance

(GATE 2020)

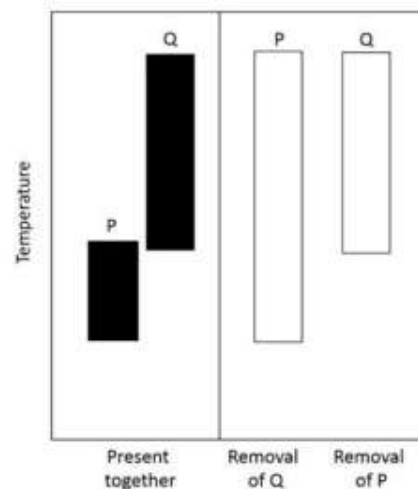
10. The abundances of three species (P, Q, and R) were measured along a resource gradient. The resultant pattern is summarized in the figure. Which of the following statements can be inferred from niche theory?



- (A) P is a generalist; Q and R are specialists.
 (B) Q is a generalist; P and R are specialists.
 (C) P and Q are generalists; R is a specialist.
 (D) P and Rare generalists; Q is a specialist.

(GATE 2020)

11. Two species of snails, P and Q, are found in rivers across a range of temperatures that vary from upstream to downstream. An experiment was conducted in which P was removed from a river and the distribution of Q was measured after a few weeks. In another similar river, the reciprocal experiment was conducted in which Q was removed, and the distribution of P was measured after a few weeks. In the graph below, the filled bars plot the distribution of P and Q when both species are present in a river. The open bars plot the distribution of P when Q is removed, and Q when P is removed. Which of the following statements is true?



- (A) The realised niche of P is smaller than its fundamental niche.
 (B) The realised niche of Q is smaller than its fundamental niche.
 (C) The realised niche is smaller than the fundamental niche for both species.
 (D) The realised niches of both species are equal.

(GATE 2020)

12. A researcher wants to sample ant diversity in a landscape consisting of riverine valleys and plateaus. Which among the following is the best sampling strategy for her to employ?
 (A) Once an ant is located, lay quadrats in that area.
 (B) Lay equal number of quadrants in valleys and plateaus.
 (C) Lay quadrats in areas of high ant abundance.
 (D) Lay quadrats in both habitats in proportion to their areas.

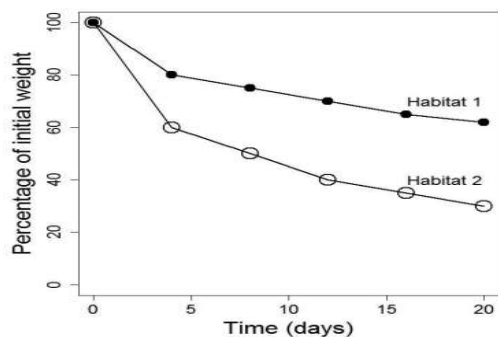
(GATE 2019)

13. Which of the following habitats is best suited for infrasound (low frequency)

(A) Coral leaf (B) Open ocean
(C) Rainforest (D) Urban Area

(GATE 2019)

14. Which of the following statements best explains the patterns of leaf-litter decomposition over time shown in the figure below?



- (A) Habitat 1 is cold and wet; Habitat 2 is warm and arid
(B) Habitat 1 is warm and arid; Habitat 2 is cold and wet
(C) Habitat 1 is cold and arid; Habitat 2 is warm and wet
(D) Habitat 1 is warm and wet; habitat 2 is cold and arid

(GATE 2018)

15. The value of the resting membrane potential of a typical neuron is closest to the equilibrium potential of which of the following ions?

(A) Ca^{++} (B) K^+
(C) Mg^{++} (D) Na^+

(GATE 2018)

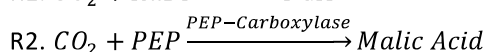
16. For a species, assuming a relatively short time scale and no evolution, increased interspecific competition will result in a

(A) Larger fundamental niche
(B) larger realized niche
(C) Smaller fundamental niche
(D) smaller realized niche

(GATE 2018)

17. The reactions below (R1 and R2) represent different carbon fixation pathways in photosynthesis.

RuBP represents Ribulose bisphosphate.
Rubisco represents RuBP carboxylase-oxygenase.
PGA represents Phosphoglyceric acid.
PEP represents Phosphoenolpyruvate.



Which of the following is CORRECT?

- (A) R1 and R2 both occur in C-3 and CAM photosynthesis
(B) R1 occurs in C-4 photosynthesis; R2 occurs in C-3 photosynthesis
(C) R1 occurs in C-3 photosynthesis; R2 occurs in C-4 photosynthesis
(D) R1 occurs in C-4 and CAM photosynthesis; R2 occurs in C-3 photosynthesis

(GATE 2017)

18. Which of the following combinations of leaf traits is most likely to be observed in terrestrial plant communities that occur in low-nutrient environments with herbivory?

- (A) High levels of protein and high levels of chemical defences
(B) High levels of protein and low levels of chemical defences
(C) Low levels of protein and high levels of chemical defences
(D) Low levels of protein and low levels of chemical defences

(GATE 2016)

19. Assume that the abundance of a species in a community is proportional to the size of its niche. A search new species colonises this community, an existing niche is split. The resultant relative abundances of species in this community will be most uneven if:

- (A) The largest niche is always split when a new species colonises
(B) The niches are split at random, independent of their size
(C) The probability of a niche being split is proportional to its size
(D) The smallest niche is always split when a new species colonises

(GATE 2015)

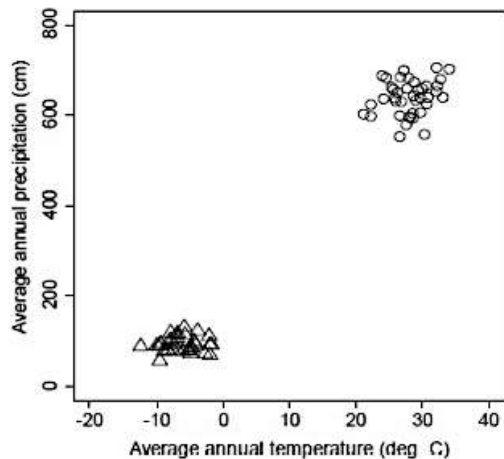
20. In India, *Parthenium hysterophorus*, *Lantana camara*, and *Prosopis juliflora* are examples of which of the following types of species?

P) Endangered species,
Q) Endemic species,
R) Invasive species,
S) Keystone species.

- (A) P only (B) P and Q
(C) R only (D) S only

(GATE 2015)

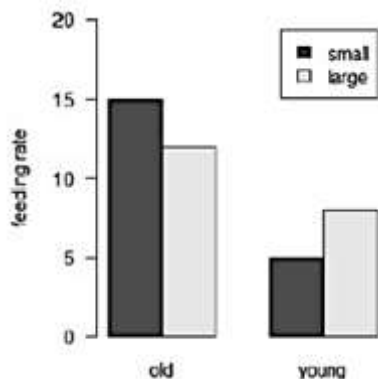
21. In the schematic below, the circles and triangles represent climatic zones occupied by two different biomes along gradients of precipitation and temperature. Which of the following is an accurate description of these biomes?



- (A) Circles = Tropical Rainforest; Triangles = Temperate Rainforest
 (B) Circles = Subtropical Desert; Triangles = Tropical grassland
 (C) Circles = Tropical Rainforest, Triangles = Tundra
 (D) Circles = Tundra; Triangles = Subtropical Desert

(GATE 2015)

22. The figure below shows how feeding rate varies with age (old/young) and with body size (small/large) in males of a deer species. Based on this figure, which of the statements below is FALSE?



- (A) Large old males have higher feeding rates than large young males
 (B) Large young males have higher feeding rates than small young males
 (C) Regardless of size, feeding rate is higher in old males than in young males
 (D) Regardless of age, feeding rate is higher in small males than in large males

(GATE 2015)

23. Which of the following factors contribute to INCREASING beta diversity of tree species in atypical landscape?

- (P) Habitat heterogeneity
 (Q) Dispersal limitation
 (R) Random mortality among trees
 (S) Differences in physiological tolerance among species
 (A) Only P
 (B) P and R
 (C) P, Q, and S
 (D) P, Q, R, and S

(GATE 2015)

24. Three sanctuaries X, Y and Z have the same number of mammal species but different species compositions. The list of mammals reported from these sanctuaries is given below.

Sanctuary X: Langur, tiger, spotted deer, leopard, bison, wild dog, elephant

Sanctuary Y: Lion, spotted deer, leopard, hyena, langur, blackbuck, wild boar

Sanctuary Z: Gibbon, tiger, spotted deer, leopard, bison, rhinoceros, elephant

which of the following options best describes the order-level diversity in these sanctuaries?

- (A) $X = Y = Z$
 (B) $X > Y > Z$
 (C) $Y < X < Z$
 (D) $X = Y < Z$

(GATE 201)

25. The pyramidal structure of decreasing biomass with increasing trophic level in terrestrial ecosystems is a consequence of

- (A) the second law of thermodynamics
 (B) bio-magnification
 (C) conservation of energy
 (D) increasing competition at higher trophic levels

(GATE 2014)

26. Christian Bergmann, a 19 century biologist, observed that related taxa showed increasing body size with increasing latitude. One explanation for this pattern, also called 'Bergmann's Rule', is

- (A) lower body mass in the tropics is a result of lower mass-specific metabolic rates
 (B) species at higher latitudes have greater access to resources and therefore, have larger sizes
 (C) greater competition at higher latitudes results in larger organisms
 (D) lower surface area to volume ratios in larger animals help conserve heat

(GATE 2014)

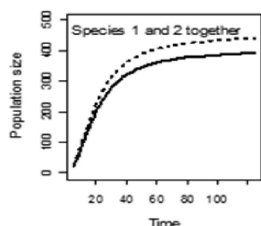
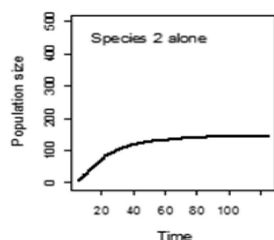
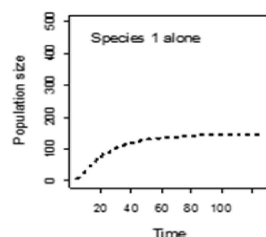
27. Temperate organisms have wider tolerance ranges for temperature than do tropical organisms. If temperatures increase across the globe by 2°C , which of the following is possible?
- Temperate organisms will be more negatively affected than tropical organisms
 - Tropical organisms will be more negatively affected than temperate organisms
 - The effects on tropical and temperate organisms will be the same
 - This will have no effect on temperate or tropical organisms

(GATE 2014)

28. The length of Henle's loop in the kidneys of rodents is longest in
- hot desert habitats
 - cool temperate habitats
 - tropical moist habitats
 - wetland habitats

(GATE 2014)

29. The figure panels below show population growth in two species, when they are grown alone, and also when they are grown together. From the nature of their growth curves, one can infer that the interaction between these species is an example of



- Mutualism
- commensalism
- predator-prey
- competition

Practice Questions

30. Three forest habitats A, B, and C have the same number of bird species but different species compositions. The list of bird species reported from these habitats is given below.

Habitat A: Sparrow, robin, blue jay, cardinal, woodpecker, hummingbird
Habitat B: Blue jay, cardinal, crow, sparrow, finch, hawk
Habitat C: Woodpecker, hummingbird, robin, finch, crow, eagle

Which of the following options best describes the order-level diversity in these habitats?

- $A = B = C$
- $A > B > C$
- $B < A < C$
- $A = B < C$

31. What is the term for the role or position of a species within an ecosystem?

- Niche
- Habitat
- Trophic level
- Guild

32. Which of the following best describes the term "ecological succession"?

- The process of gradual change in the structure and composition of a community over time.
- The movement of individuals from one area to another.
- The process by which energy flows through an ecosystem.
- The interactions between different species in a community.

33. Which of the following best defines the concept of carrying capacity?

- The maximum number of species that can coexist in an ecosystem.
- The total amount of energy available in an ecosystem.
- The maximum population size an environment can sustainably support.
- The average lifespan of individuals in a population.

34. Organisms in a freshwater ecosystem A have a narrow tolerance range for salinity, while organisms in a freshwater ecosystem B have a wide tolerance range for salinity. If the salinity of both ecosystems increases, which of the following is possible?

- Organisms in ecosystem A will be more negatively affected than organisms in ecosystem B.

- (B) Organisms in ecosystem B will be more negatively affected than organisms in ecosystem A.
- (C) The effects on organisms in both ecosystems will be the same.
- (D) This will have no effect on organisms in either ecosystem.
35. Plants in desert ecosystem X are adapted to survive with minimal water availability, while plants in rainforest ecosystem Y require abundant water. If a severe drought occurs, which of the following is possible?
- (A) Plants in ecosystem X will be more negatively affected than plants in ecosystem Y.
- (B) Plants in ecosystem Y will be more negatively affected than plants in ecosystem X.
- (C) The effects on plants in both ecosystems will be the same.
- (D) This will have no effect on plants in either ecosystem.
36. What is the role of decomposers in an ecosystem?
- (A) They produce energy through photosynthesis.
- (B) They convert organic matter into inorganic nutrients.
- (C) They regulate the population of other organisms.
- (D) They consume primary consumers.
37. In a plant community, the availability of sunlight is a crucial factor for species survival. As new plant species colonize the community, the existing sunlight resource is divided among them. The resultant relative abundances of species in this community will be most uneven if:
- (A) The species with the highest sunlight requirement colonizes first.
- (B) The species with the lowest sunlight requirement colonizes first.
- (C) The sunlight resource is divided randomly among the species.
- (D) The sunlight resource is divided proportionally based on species' requirements.
38. In an aquatic ecosystem, the availability of dissolved oxygen is a crucial factor for the survival of aquatic species. As new species colonize the ecosystem, the existing dissolved oxygen resource is divided among them. The resultant relative abundances of species in this ecosystem will be most uneven if:
- (A) The species with the highest oxygen requirement colonizes first.
- (B) The species with the lowest oxygen requirement colonizes first.
- (C) The dissolved oxygen resource is divided randomly among the species.
- (D) The dissolved oxygen resource is divided proportionally based on species' requirements.
39. What is the term for the full range of environmental conditions and resources that a species can tolerate and use?
- (A) Ecological niche (B) Habitat
- (C) Territory (D) Ecosystem
40. In a forest ecosystem, the availability of tree hollows is a crucial resource for certain bird species. As new bird species colonize the forest, the existing tree hollows are divided among them. The resultant relative abundances of bird species in this ecosystem will be most uneven if:
- (A) The largest tree hollows are always divided when a new bird species colonizes.
- (B) The tree hollows are divided randomly, independent of their size.
- (C) The probability of a tree hollow being divided is proportional to its size.
- (D) The smallest tree hollows are always divided when a new bird species colonizes.
41. What term describes the number of individuals of a species that a given area or habitat can support?
- (A) Carrying capacity
- (B) Density-dependent factor
- (C) Limiting factor
- (D) Population density
42. Which of the following factors is an example of density-dependent regulation of population size?
- (A) Earthquake (B) Flood
- (C) Disease outbreak (D) Habitat destruction
43. What term describes the process by which new species arise and evolve?
- (A) Succession (B) Evolution
- (C) Speciation (D) Migration

44. Which of the following is an example of mutualism?
 (A) A lion preying on a zebra
 (B) A bee pollinating a flower
 (C) A deer eating grass
 (D) A fox scavenging on a carcass
45. What term describes the gradual and predictable changes in the species composition of a community over time?
 (A) Succession (B) Disturbance
 (C) Fragmentation (D) Immigration
46. What is the primary cause of the greenhouse effect?
 (A) Deforestation
 (B) Pollution
 (C) Carbon dioxide emissions
 (D) Ozone depletion
47. Which term describes the variety of species within a particular ecosystem or on Earth as a whole?
 (A) Biodiversity (B) Endemism
 (C) Conservation (D) Extinction
48. What is the main cause of habitat destruction and loss of biodiversity?
 (A) Climate change
 (B) Pollution
 (C) Urbanization and land development
 (D) Invasive species
49. Which of the following is an example of an invasive species?
 (A) Native birds in a forest
 (B) Local grass species in a meadow
 (C) Non-native plants introduced to a new ecosystem
 (D) Endangered species in a protected area
50. What term refers to the practice of using natural resources in a way that meets the needs of the present generation without compromising the ability of future generations to meet their own needs?
 (A) Sustainable development
 (B) Environmental protection
 (C) Conservation
 (D) Restoration
51. Which international agreement aims to address climate change by reducing greenhouse gas emissions?
 (A) Kyoto Protocol
 (B) Montreal Protocol
 (C) Paris Agreement
 (D) Copenhagen Accord
52. What term refers to the process of restoring a degraded ecosystem to its original state?
 (A) Conservation (B) Preservation
 (C) Restoration (D) Remediation
53. Which of the following is an example of a renewable resource?
 (A) Fossil fuels (B) Water
 (C) Natural gas (D) Minerals
54. What term describes the process of converting waste materials into reusable materials?
 (A) Recycling (B) Composting
 (C) Incineration (D) Landfilling
55. What is the main objective of conservation biology?
 (A) Protecting and managing ecosystems and natural resources
 (B) Studying the interactions between organisms and their environment
 (C) Understanding evolutionary processes and speciation
 (D) Investigating the impacts of human activities on the environment

ANSWER KEY									
1	2	3	4	5	6	7	8	9	10
A,B,C	A,B,D	C	A	C	D	D	B	B	B
11	12	13	14	15	16	17	18	19	20
A	D	B	C	B	D	C	C	D	C
21	22	23	24	25	26	27	28	29	30
C	D	C	C	A	D	B	A	A	C
31	32	33	34	35	36	37	38	39	40
A	A	C	A	A	B	B	A	A	A
41	42	43	44	45	46	47	48	49	50
A	C	C	B	A	C	A	C	C	A
51	52	53	54	55					
C	C	B	A	A					

EXPLANATIONS

1. **Correct Answer is (A, B, C):-****Explanation:**

- The fundamental niche is the theoretical range of conditions that a species can tolerate. X is in fundamental niche because in the presence of Y, X is not changes it's niche. The realized niche is the actual range of conditions that a species is found in and Y in the presence of X, restricted to his niche.
- The difference between X and Y can result from biotic interactions. Such as competition, predation, and parasitism, can limit the range of conditions that a species can occupy.
- The difference between X and Y can result from dispersal limitation. Dispersal limitation is the inability of a species to reach all of the habitats that it could potentially occupy.
- The statement that the difference between X and Y results from the species' tolerance to salt concentrations is not correct. The fundamental niche and the realized niche both represent the range of conditions that a species can tolerate. The difference between the two is due to factors that limit the species' ability to occupy all of the habitats that it could potentially occupy.

2. **Correct Answer is (A,B,D):-****Explanation:**

- **Temporal separation of activity** - This is an example of niche partitioning between species. When different species in an ecosystem have different activity patterns or are active during different times of the day or year, they can coexist more effectively by reducing direct competition for resources.
- **Diet specialization** - This is another example of niche partitioning between species. When different species have specialized diets and feed on different types of resources or prey items, they can reduce competition for limited food resources, allowing them to coexist in the same ecosystem.
- **Vertical stratification of foraging heights** - This is also an example of niche partitioning between species. When different species in a community use different vertical layers of the habitat to forage for food, they can reduce competition for resources and coexist more effectively.
- **Hybridization** - Hybridization is not an example of niche partitioning between species. It refers to the interbreeding between different species or

subspecies, and it does not necessarily reduce competition or resource overlap between the parent species.

3. **Correct Answer is (C):-**

Explanation: In the figure, species L maintains a relatively constant body temperature across a range of ambient temperatures, indicating that it is regulating its temperature and is a homeotherm. On the other hand, species M's body temperature varies with the ambient temperature, showing that it does not regulate its temperature and is a poikilotherm. Therefore, statement (C) accurately describes how L and M regulate temperature.

4. **Correct Answer is (A):-****Explanation:**

- Individual is the smallest unit of ecological organization. It is a single organism.
- Population is a group of individuals of the same species that live in the same area.
- Community is a group of populations that interact with each other in a particular area.
- Ecosystem is a community of organisms and the abiotic environment that they interact with.
- Biome is a large region of Earth that is characterized by its climate and the plants and animals that live there.

Therefore, the correct order is: (A) I < P < C < E < B.

5. **Correct Answer is (C):-**

Explanation: Abiotic resources are the non-living components of an ecosystem that can be used by organisms, such as water, sunlight, and nutrients. Abiotic conditions are the non-living physical and chemical factors of an ecosystem that affect the organisms living there, such as temperature, pH, and salinity. The key difference between resources and conditions is that resources can be used up by organisms, whereas conditions cannot.

6. **Correct Answer is (D):-** Locally common in a restricted geographic range and in a specific habitat type.

Explanation: Species that are locally common in a restricted geographic range and specific habitat type are more vulnerable to extinction. When a species is limited to a small geographic range and occupies a