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| | **INDIAN SCHOOL AL WADI AL KABIR** | |
| **Class: XII** | **Department: SCIENCE 2026 – 2027**<br>**SUBJECT: BIOLOGY** | **Date: 03/11/2026** |
| **Worksheet:11 with answers** | **UNIT- X- ECOLOGY**<br>**CHAPTER: 11 ORGANISMS AND POPULATIONS** | **Note:**<br>**A4 FILE FORMAT** |
| **CLASS & SEC:** | **NAME OF THE STUDENT:** | **ROLL NO.** |

## I. MULTIPLE CHOICE QUESTIONS (1M)

1. Many freshwater animals cannot live for long in seawater and vice versa because they would face severe:
   A. Thermoregulatory problems
   B. Osmotic problems
   C. Hypoxic problems
   D. Toxicity problems
2. Which of the following is a classic behavioural adaptation shown by the desert lizard to manage its body temperature?
   A. Thick, fatty blubber insulation beneath the skin layer
   B. Physiological biochemical modifications inside the cell matrix
   C. Basking in the sun when body temperature drops and moving to shade when it rises
   D. Minimizing water loss by excreting highly concentrated solid uric acid pellets
3. According to evolutionary ecology, which of the following pairs of organisms correctly matches those that breed only once in their lifetime with those that produce a large number of small-sized offspring?
   A. Pacific salmon fish & Bamboo; Oysters & Pelagic fishes
   B. Birds & Mammals; Pacific salmon fish & Oysters
   C. Bamboo & Oysters; Pelagic fishes & Mammals
   D. Mammals & Birds; Bamboo & Pelagic fishes
4. The interaction where one species is harmed or inhibited while the other species remains completely unaffected (-, 0) is known as:
   A. Commensalism
   B. Parasitism
   C. Amensalism
   D. Competition
5. Organisms that can tolerate and thrive in a wide range of salinities are classified as _____, whereas those restricted to a narrow range of salinities are called _____.
   A. Eurythermal; Stenothermal
   B. Stenohaline; Euryhaline
   C. Euryhaline; Stenohaline

D. Conformers; Regulators

Two statements are given: one labelled as **Assertion (A)** and the other labelled as **Reason (R)**. Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

A. Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

C. Assertion (A) is true, but Reason (R) is false.

D. Assertion (A) is false, but Reason (R) is true.

6. **Assertion(A):** Mammals from colder climates generally have shorter ears and limbs.
   **Reason(R):** Shorter extremities help minimize heat loss from the body according to Allen's rule.
7. **Assertion(A):** An individual organism exhibits a birth rate and a death rate.
   **Reason(R):** Birth rates and death rates are calculated as per capita changes in a population over a specific period.
8. **Assertion(A):** Two closely related species competing for the same limiting resources can coexist indefinitely in the same ecological niche.
   **Reason(R):** Gause's Competitive Exclusion Principle states that the competitively inferior species will eventually be eliminated if resources are limited.

## II. VERY SHORT ANSWER TYPE QUESTIONS(2M)

9. State Allen's Rule. Provide an example showing how it helps animals adapt to their environment.
10. Write the Verhulst-Pearl logistic growth equation and define what the variable 'K' represents.
11. What is Gause's Competitive Exclusion Principle? State one workaround species use to avoid it.
12. Differentiate between Commensalism and Amensalism using population interaction signs (+, -, 0). Give one example of Amensalism.

## III. SHORT ANSWER TYPE QUESTIONS (3M)

13. An orchid plant is growing on the branch of a mango tree. How do you describe this interaction between the orchid and the mango tree?
14. If a population grows exponentially and doubles in size in 3 years, what is the intrinsic rate of increase (r) of the population?

## IV. CASE STUDY BASED QUESTIONS (4M) (BOARD 2025-26)

15. Ecologists conducting a long-term field study in a tropical biodiversity reserve documented two unique biological phenomena. First, they investigated a specialized Mediterranean orchid species growing in a meadow. This orchid produces no nectar or other rewards, yet it still attracts a specific species of male bumblebee. One petal of the orchid flower mimics the exact color, shape, and unique markings of a female bee, causing the male bee to attempt mating with it and inadvertently transferring pollen from flower to flower.

Deep within the same forest, researchers analyzed the root networks of higher vascular trees growing in nutrient-deficient soil. They discovered that the roots were completely enveloped by a fungal network. The fungal filaments absorb essential moisture and inorganic nutrients (especially phosphorus) from the surrounding soil matrix and transfer them to the tree, while the tree provides the fungus with energy-rich carbohydrates produced during photosynthesis.

A. Identify the specific reproductive strategy used by the Mediterranean orchid (*Ophrys*) to secure pollination and describe how the male bee acts as a vector.

B. Name the symbiotic association formed between the fungus and plant roots, and state its standard ecological notation (+, -, 0).

C. Explain the long-term evolutionary impact on the orchid population if its specific bumblebee pollinator goes extinct.
D. In the mycorrhizal relationship, identify the specific primary nutrient that the fungal partner absorbs from the soil matrix for the plant's benefit.

## V. LONG ANSWER TYPE QUESTIONS (5M)

16. Write a short note on
    (a) Adaptations of desert plants and animals
    (b) Adaptations of plants to water scarcity
    (c) Behavioral adaptations in animals
    (d) Importance of light to plants
    (e) Effect of temperature or water scarcity and the adaptations of animals

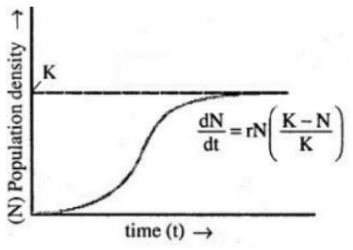
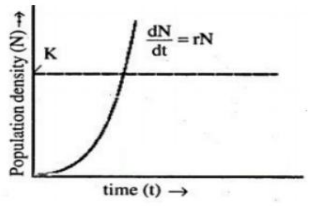
## VI. BOARD QUESTIONS

17. Explain Gause's 'Competitive Exclusion Principle' with the help of a suitable example. (CBSE 2026)
18. Draw a graph for a population whose population density has reached the carrying capacity. Out of the two population growth curves, which one is considered a more realistic for most populations? Why? Draw a growth curve where resources are not limiting for the growth of a population and give its equation. (CBSE 2024)

**Answer Key**

| Q. No. | Answer |
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| 1 | B. Osmotic problems |
| 2 | C. Basking in the sun when body temperature drops and moving to shade when it rises |
| 3 | A. Pacific salmon fish & Bamboo; Oysters & Pelagic fishes |
| 4 | C. Amensalism |
| 5 | C. Euryhaline; Stenohaline |
| | **ASSERTION & REASONING** |
| 6. | A. Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of the Assertion (A). |
| 7. | D. Assertion (A) is false, but Reason (R) is true. |
| 8. | D. Assertion (A) is false, but Reason (R) is true. |
| **II** | **VERY SHORT ANSWER TYPE QUESTIONS(2M)** |
| **9.** | Allen's Rule states that mammals living in colder climates generally evolve shorter ears and limbs (extremities).<br>Significance/Example: Shorter extremities reduce the overall surface-area-to-volume ratio of the body, which effectively minimizes heat loss to the freezing surroundings. |
| 10. | The mathematical expression for logistic growth is:<br>$\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$<br>K represents the Carrying Capacity, which is the absolute maximum population size that a specific habitat's limited resources can sustainably support over time |
| 11. | It states that two closely related species competing for the same limiting resources cannot coexist |

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| | indefinitely; the competitively inferior species will eventually be eliminated.<br><br>Species evolve resource partitioning to achieve coexistence, where they minimize direct rivalry by choosing different feeding times or unique foraging behaviors (e.g., MacArthur's warblers) |
| 12. | Commensalism is a (+, 0) interaction where one species benefits and the other is unaffected. Amensalism is a (-, 0) interaction where one species is harmed, and the other remains entirely unaffected.Example: The mold *Penicillium* secretes penicillin, which kills surrounding bacteria, but the mold itself is neither helped nor harmed |
| **III** | **SHORT ANSWER TYPE QUESTIONS (3M)** |
| 13. | The interaction between the orchid plant and the mango tree is an example of commensalism. In this type of relationship, one organism benefits while the other is neither helped nor harmed. The orchid, which is an epiphyte, grows on the branch of the mango tree. Epiphytes, like orchids, do not take nutrients from the host plant; instead, they derive moisture and nutrients from the air, water, and rain. In this case, the orchid benefits from the physical support provided by the mango tree, allowing it to grow and access more sunlight. However, the mango tree is not affected by the presence of the orchid, as it does not lose any nutrients or energy in the process. Therefore, the interaction is beneficial for the orchid but neutral for the mango tree. |
| 14. | If an adequate quantity of food resources is available to individuals in a population, it grows exponentially. The integral form of the exponential growth equation can be used to estimate exponential growth, which is as follows: $N_t = N_o e^{rt}$ ———— equation (1) Where $N_t$ is the population density after 't' time. $N_o$ is the population density at time zero. e is the base of the natural logarithm = 2.71828; r is the intrinsic rate of natural increase. Let the current population density be 'x'. ∴ The population density after two years will be 2x, and the t given is 3 years. Substituting these values in the equation<br>➔ $2x = x\, e^{3r}$<br>➔ $2 = e^{3r}$<br>Applying log on both the sides, we get<br>➔ $\log 2 = 3r \log e$<br>➔ $r = \frac{\log 2}{3 \log e}$<br>➔ $r = \frac{0.301}{3 \times 0.434}$<br>➔ $r = 0.2311$ |
| **IV** | **CASE STUDY BASED QUESTIONS (4M)** |
| 15. | A. The strategy is called sexual deceit, where the orchid petal mimics a female bee to attract a male bee for pseudocopulation. During this process, pollen grains are dusted onto the bee's body and subsequently transferred to the next flower it visits, achieving pollination. |
| | B. This mutually beneficial symbiotic association between a fungus and the roots of higher plants is called Mycorrhiza. Because both participating organisms derive vital reciprocal benefits from each other, it is represented by the **(+, +)** notation. |
| | C. Due to tight co-evolution, the extinction of the specific pollinator will lead to the reproductive failure and eventual co-extinction of the orchid. To survive, the orchid must evolutionarily modify its flower structure to mimic and attract a different insect pollinator. |
| | D. The fungal filaments specialize in absorbing phosphorus from the surrounding soil matrix and transferring it to the plant roots. The plant compensates for this by providing the fungus with energy-rich carbohydrates produced during photosynthesis. |
| **V** | **LONG ANSWER TYPE QUESTIONS (5M)** |
| 16. | **(a) Adaptations of desert plants and animals** |

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| | • **Desert Plants:** Adaptations include deep root systems, sunken stomata, and thick cuticles to minimize water loss. Some plants, like Opuntia, have spines instead of leaves, and their green stems carry out photosynthesis.<br>• **Desert Animals:** Animals like kangaroo rats can concentrate urine to conserve water, while desert lizards regulate their body temperature by basking in the sun in the morning and burrowing to escape heat during the day.<br>**(b) Adaptations of plants to water scarcity**<br>Plants in arid conditions develop features like deep roots, sunken stomata, and thick cuticles to reduce transpiration and efficiently use limited water.<br>**(c) Behavioral adaptations in animals**<br>Animals adapt behaviorally through migration, hibernation, or aestivation. Cold-blooded animals like reptiles adjust their activity patterns to control their temperature, while warm-blooded animals hibernate or aestivate to escape extreme temperatures.<br>**(d) Importance of light to plants**<br>Light is crucial for photosynthesis, which is the process by which plants convert light into energy. Plants also rely on light for photoperiodic responses that regulate flowering.<br>**(e) Effect of temperature or water scarcity and the adaptations of animals**<br>Temperature and water availability significantly affect animal distribution. Animals in cold climates have thick fur and fat to conserve heat, while desert animals like kangaroo rats conserve water by not drinking and adapting to extreme heat. |
| **VI** | **BOARD QUESTIONS** |
| 17. | Gause's competitive exclusion principle states that two closely related species competing for the same resource cannot coexist indefinitely, and the competitively inferior one will be eliminated eventually by the superior one. For example, after the introduction of goats in the Galápagos Islands, the Abingdon tortoise became extinct within a decade due to the greater browsing efficiency of the goats. |
| 18. | (a)<br><br><br>(b) Logistic growth model is considered realistic in animals because each area has a carrying capacity beyond which environmental resistance grows and restricts their growth. It decreases natality and increases mortality.<br>(b)<br><br> |

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