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- Please check that this question paper contains **5** printed pages.
- Code number given on the right-hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains 33 questions.

# **BIOLOGY** (Theory)

## CHAPTER: EVOLUTION

## Time allowed: 3 hours

## Maximum Marks: 70

Code No. 57/1/1

#### General Instructions:

(i) There are total 33 questions and five sections in the question paper. All questions are compulsory.

(ii) Section A contains questions number 1 to 16, multiple choice type questions of one mark each.

(iii) Section B contains questions number 17 to 21, very short answer type-I questions of two marks each.

(iv) Section C contains questions number 22 to 28, short answer type-II questions of three marks each.

(v) Section D contains question number 29 to 30, case-based questions of four marks each. Each question has subparts with internal choice in one subpart.

(vi) Section E contains question number 31 to 33, long answer type questions of five marks each.

(vi) There is no overall choice in the question paper, however, an internal choice is provided in one question of two marks, one questions of three marks and all the three questions of five marks. In these questions, an

examinee is to attempt any one of the two given alternatives.

(vii) Wherever necessary, the diagram drawn should be neat and properly labelled.

## SECTION A

Questions no. 1 to 16 are Multiple choice (MCQ) type Questions, carrying 1 mark each.  $16 \times 1 = 16$ 

- **1.** Genetic Drift occurs due to:
  - 1. Natural selection
    - 3. Continuous gene migration
- 2. Sudden population migration
- 4. Mutation
- 2. Select the correct match regarding adaptive radiation of Australian marsupials corresponding to placental mammals.
  - Numbat-Flying Squirrel
    Marsupial mouse- Mole

- 2. Tasmanian Wolf Bobcat
- 4. Spotted Cuscus Lemur
- **3.** Natural selection where more individuals acquire specific character value other than the mean character value, leads to:
  - 1. Random change
  - 3. Directional change
- 2. Stabilising change
- 4. Disruptive change

- **4.** The factor that leads to Founder effect in a population is:
  - 1. Mutation

3. Natural selection

Genetic drift
 Genetic recombination

2. Homo neanderthalensis

- **5.** A scientist studied wild birds that lived by a lake. He observed that one bird species had a beak that was adapted to extract small insects from the water. Which process would have occurred in the development of this specialised beak?
- 6. 1. Genetic 2. Natural 3. Selective 4. Fossilisation breeding
- **7.** Which of the following hominin species is considered to be the earliest known member of the Homo genus?
  - 1. Homo erectus
    - 3. Homo habilis4. Homo sapiens

8. Which scientific theory proposes a possible mechanism for the origin of life on Earth?

- 1. Panspermia2. Big Bang Theory
- 3. Theory of Evolution4. Plate Tectonics Theory
- 9. Adaptive radiation is most likely to occur in a scenario where:
  - 1. Ecological niches are limited and resources are scarce.
  - 2. Environmental conditions remain constant over long periods of time.
  - 3. Genetic variations within a population are minimal.
  - 4. A new habitat or resource becomes available to a group of organisms.
- **10.** According to the theory proposed by Jean-Baptiste Lamarck, which of the following statements accurately reflects his view on the role of mutations in evolution?
  - 1. Mutations are the primary driving force behind evolutionary changes in species.
  - 2. Mutations are not relevant in the process of evolution and have no impact on inherited traits.
  - 3. Mutations contribute to acquired characteristics that can be inherited by offspring.
  - 4. Mutations only occur as a response to changes in the environment and have no hereditary effects.
- **11.** The Oparin and Haldane experiment aimed to investigate the possibility of the origin of life by simulating early Earth conditions. Which of the following statements accurately describes their experiment?
  - 1. They successfully synthesized organic molecules, including amino acids, under controlled laboratory conditions.
  - 2. They demonstrated the spontaneous generation of living organisms from non-living matter.
  - 3. They discovered the existence of self-replicating RNA molecules in a simulated primordial soup.
  - 4. They observed the formation of complex proteins and enzymes in a simulated volcanic environment.
- **12.** The Hardy-Weinberg law describes the genetic equilibrium in populations under certain conditions. Which of the following statements accurately reflects one of the assumptions of the Hardy-Weinberg law?
  - 1. Mutations occur frequently and introduce new alleles into the population.
  - 2. Genetic drift has a significant impact on allele frequencies in the population.
  - 3. Migration, or gene flow, is occurring between the population in question and other populations.

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4. Natural selection acts on specific alleles, leading to changes in their frequencies over time. For Questions No. 13 to 16, two statements are given – one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer 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 Assertion (A).
- b) Both Assertion (A) and Reason (R) are true and Reason (R) is **not** the correct explanation of Assertion (A).
- c) Assertion (A) is true but Reason (R) is false.
- d) Assertion (A) is False but Reason (R) is true.
- **13.** Assertion (A): Homo sapiens have evolved from chimpanzee like ancestors.
  - *Reason (R):* There is no difference between the two in the amino acid sequence of the protein Cytochrome-C
- **14.** *Assertion (A):* Homologous organs are structures that share a similar basic structure and origin but may have different functions in different organisms.

**Reason** (**R**): Homologous organs are derived from a common ancestor and undergo modifications over time to adapt to the specific needs of different species.

- **15.** Assertion (A): Adaptive radiation is a process in which a single ancestral species rapidly diversifies into multiple different species, each occupying distinct ecological niches.
  - **Reason (R):** Adaptive radiation occurs when a new ecological opportunity arises, leading to the rapid evolution of various species with specialized adaptations to exploit different resources or habitats.
- **16.** *Assertion (A):* Natural selection is the primary mechanism by which species adapt to their environments and evolve over time.
  - **Reason** (**R**): Natural selection acts on the heritable variations within a population, favoring traits that increase an organism's survival and reproductive success, while reducing the prevalence of less advantageous traits.

## **SECTION B**

17.	How would the gene flow or genetic drift affect the population in which either of them	2
	happens to take place?	
18.	Wings of birds and wings of butterflies contribute to locomotion. Explain the type of	2
	evolution such organs are a result of.	
19.	Provide two examples of fossil evidence that support the theory of evolution.	2
20.	Provide an example of an analogous organ and explain its function.	2
21.	Define industrial melanism and describe its relationship with environmental changes.	2
	SECTION C	
22.	i. Write two differences between Homo erectus and Homo habilis.	3
	ii. Rearrange the following from early to late geologic periods:	
	Carboniferous, Silurian, Jurassic.	
23.	Explain the Hardy-Weinberg principle with the help of an algebraic equation.	3
24.	What is adaptive radiation? How did Darwin explain it?	3
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- State Oparin and Haldane hypothesis. How did S.L. Miller experimentally prove it? 3 Explain.
- 26. In a population of finches on an isolated island, a severe drought occurs, leading to a significant reduction in the availability of large seeds. As a result, smaller seeds become the dominant food source for the finches. Describe how natural selection could act on the finch population during this drought, leading to evolutionary changes. Discuss the potential impact on beak size and the role of genetic variation.
- 27. Explain why the streamlined bodies and wing-like flippers in dolphins and penguins are 3 considered examples of convergent evolution.
- 28. Evaluate the concept of evolution by natural selection as a driving force in the development 3 of life on Earth, considering its strengths and weaknesses.

#### **SECTION D**

- 29. The evolution of plants throughout geological periods has witnessed significant 4 transformations and adaptations. From simple aquatic algae to complex land-dwelling plants, the process has shaped the Earth's flora over millions of years. One key transition was the colonization of land by plants, which required adaptations such as the development of roots, vascular tissues, and reproductive structures.
  - i. Identify one major transition in the evolution of plants mentioned in the passage.
  - ii. List three adaptations that plants underwent during the transition mentioned in question i.

30. Read the following case study on the evolution history of vertebrates through 4 geological periods and answer the questions that follow:

## **Case Study: The Evolutionary Journey of Vertebrates**

Vertebrates, a diverse group of animals with backbones, have undergone remarkable evolutionary changes throughout geological periods. Let's explore the evolutionary journey of vertebrates through key milestones.

## Milestone 1: Early Fishes (Cambrian Period)

During the Cambrian Period, the first vertebrates appeared as primitive fishes. These fishes had jawless mouths and were mostly small and simple in structure. They relied on filter feeding and lacked developed fins.

## Milestone 2: Rise of Jawed Fishes (Silurian Period)

In the Silurian Period, jawed fishes emerged, marking a significant milestone in vertebrate evolution. These fishes possessed hinged jaws, which allowed for more efficient feeding and diversified their dietary habits. This evolutionary innovation played a crucial role in the subsequent diversification of vertebrates.

#### Milestone 3: Invasion of Land (Devonian Period)

The Devonian Period witnessed a monumental event in the history of vertebrates the invasion of land. Fishes evolved adaptations to survive in terrestrial environments, such as sturdy fins that could support their body weight. These adaptations paved the way for the emergence of amphibians, the first vertebrates to colonize land.

## Milestone 4: Reptiles and the Age of Dinosaurs (Mesozoic Era)

The Mesozoic Era saw the dominance of reptiles and the rise of dinosaurs. Reptiles evolved key features such as scaly skin, amniotic eggs, and more efficient respiratory systems. Dinosaurs, with their diverse sizes and shapes, became the dominant terrestrial animals.

- i. Describe the characteristics of early fishes during the Cambrian Period.
- ii. Explain the significance of the emergence of jawed fishes in the Silurian Period.
- iii. Discuss the adaptations that facilitated the invasion of land by vertebrates during the Devonian Period.
- iv. Highlight the key evolutionary innovations of reptiles during the Mesozoic Era.

## **SECTION E**

- 31. i. Describe the observations made on collection of white winged moths and dark 5 winged moths in England between the years 1850 and 1920. What did these observations lead to?
  - ii. How is the use of herbicides, pesticides and antibiotics by humans for various purposes, comparable with the observations made on moths in the above question? What is this type of phenomenon called?
- **32.** The frequency of the recessive allele (q) in a population is 0.3. If the population is in Hardy-Weinberg equilibrium, calculate the following:
  - i. The frequency of the dominant allele (p).
  - ii. The expected frequency of homozygous dominant individuals (AA) in the population if the population size is 1000 individuals.
  - iii. The expected frequency of heterozygous individuals (Aa) in the population.
  - iv. The expected frequency of individuals carrying the recessive allele (aa) in the population.
- 33. i. Apply the principles of evolution to explain the development of antibiotic resistance in 5 bacteria and its implications for human health.
  - ii. How does the study of anthropological evolution contribute to our understanding of human cultural diversity?