

Heredity and Evolution

Basic Concepts of Heredity (Questions 1-5)

1. What is heredity? Explain the importance of variation in organisms for species survival.
2. Define the following terms: gene, allele, dominant trait, recessive trait, genotype, and phenotype.
3. What are inherited and acquired traits? Give two examples of each. Which type of traits are passed on to offspring and why?
4. Explain Mendel's contribution to understanding inheritance. Why did he choose pea plants for his experiments?
5. State Mendel's laws of inheritance. Explain the law of dominance with a suitable example.

Monohybrid and Dihybrid Crosses (Questions 6-10)

6. What is a monohybrid cross? Explain with the help of a cross between tall and dwarf pea plants. What is the phenotypic ratio in F_2 generation?
7. Draw a Punnett square to show the inheritance of flower color in pea plants (red is dominant over white). What will be the genotype and phenotype ratios in F_2 generation?
8. What is a dihybrid cross? Explain Mendel's dihybrid cross experiment with round-yellow and wrinkled-green pea seeds.
9. A man with blood group A marries a woman with blood group B. Their first child has blood group O. What are the genotypes of the parents? What are the possible blood groups of their children?
10. Explain the inheritance of sex in humans. Why is the male responsible for determining the sex of the child?

Molecular Basis of Inheritance (Questions 11-13)

11. How do traits get expressed? Explain the relationship between genes, proteins, and traits.
12. What is the role of DNA in inheritance? How does DNA carry genetic information from parents to offspring?
13. Explain how the sex of a child is determined in human beings. Draw a cross to show sex determination.

Evolution (Questions 14-18)

14. What is evolution? Explain Darwin's theory of evolution by natural selection.
15. What are fossils? How do fossils provide evidence for evolution? Explain the significance of fossil records.
16. Explain how new species are formed. What factors contribute to speciation?
17. What is natural selection? Explain with suitable examples how natural selection leads to evolution.
18. How do homologous and analogous organs provide evidence for evolution? Give examples of each.

Human Evolution and Speciation (Questions 19-20)

19. Trace the evolutionary relationship of humans with other primates. What evidence suggests that humans and apes have common ancestors?
20. Explain the concept of "survival of the fittest" with examples. How does environmental change affect evolution?

Additional Application-Based Questions:

Higher Order Questions:

- A cross between red-flowered and white-flowered plants produces all pink-flowered offspring. What type of dominance is this? What will happen in F_2 generation?
- Why are human males more likely to suffer from color blindness than females? Explain the genetic basis.
- How does geographical isolation lead to speciation? Explain with examples.
- What would happen if there were no variations in a population of organisms when environmental conditions change drastically?

Analytical Questions:

- Two parents, both with normal vision, have a color-blind son. Explain how this is possible. What are the chances of their daughter being color-blind?
- Explain why acquired characteristics are not inherited, using Lamarck's theory and modern understanding of genetics.
- How do pesticide-resistant insects develop? Explain this as an example of evolution occurring in present times.
- What is the significance of Mendel's law of independent assortment? When does this law not apply?

Comparative Questions:

- Compare Lamarck's theory of evolution with Darwin's theory. Why is Darwin's theory more accepted?
- How does artificial selection differ from natural selection? Give examples of both.
- Compare the evolutionary significance of sexual reproduction versus asexual reproduction.

Applied Questions:

- A farmer wants to develop a new variety of wheat that is both disease-resistant and high-yielding. How can principles of heredity help him achieve this goal?
- Explain why it is important to conserve biodiversity from an evolutionary perspective.
- How has the overuse of antibiotics led to the evolution of antibiotic-resistant bacteria?