

Chapter 9: Heredity And Evolution

Q1. If a trait X exists in 10% of a population of an asexually reproducing species and trait Y exists in 60% of the same population, which trait would have come earlier?

Ans. As the species is asexually reproducing, only minor differences will be generated due to minute inaccuracies during DNA copying. Thus, trait Y would have arisen earlier than trait X because trait Y is in 60% of the population and trait X is in 10% of the population.

Q2. How does the creation of variation in species enhance survival?

Ans. Natural selection selects the individuals with the aptest variations for their survival in the prevailing environmental conditions. Variant individuals that can adapt to the prevailing environmental conditions better have greater chances of surviving and producing offsprings.

Q3. How was Mendel's experiment successful in showing that traits could be dominant or recessive?

Ans. In his experiment, Mendel took tall and short pea plants. On cross-pollination, he got all tall plants for the F1 generation. Showing when tall and short genes combine, the tall always expresses itself (i.e. tall is dominant). Then he self-pollinated the F1 generation, from which he got tall and short plants in the ratio of 3:1, showing that the short gene is only expressed when short genes combine. Thus, he concluded that 'tall' traits were dominant while the 'short' traits were recessive.

Q4. How do Mendel's experiments show that traits are inherited independently?

Ans. A dihybrid cross was done by Mendel, from where he observed that when two pairs of traits were crossed, each trait expressed itself independently of the other. Thus, allowing Mendel to show that traits were independently inherited.

Q5. A blood group O woman and a blood group A man produce a child with blood group O. Can u tell from this information alone, which of the blood group, A or O is dominant?

Ans. This information alone is not sufficient to tell us which of the blood group is dominant. This is because we do not know of all the progeny and blood group A can be genotypically AA or AO.

Q6. How is the sex of a human child determined during fertilization?

Ans. A female carries two X chromosomes and produces gametes (eggs) with the same type of chromosomes (22+X). Males have X and Y chromosomes, half of their sperms carry X chromosomes (22+X) and half of their sperm carry Y chromosomes (22+Y). Now, if a sperm with Y chromosome fertilizes an egg, the zygote develops into male (XY condition). Or, if a sperm with X chromosome fertilizes an egg, the zygote develops into a female (XX condition).

Q7. Name the various ways in which individuals with particular trait grow in a population.

Ans. Natural selection, genetic drift (isolation) and natural selection.

Q8. Why are acquired traits not inherited?

Ans. Since acquired traits cannot change the genes of the gametes, they cannot be passed on to the next generation.

Q9. Why is the dwindling number of tiger population a reason to worry, sheerly from a genetics perspective?

Ans.

(i) Smaller numbers lead to lesser recombination and thus, lesser variation. They are both very important for better survival chances of a species.

(ii) If a calamity kills off the existing tigers, their genes will be lost forever.

Q10. What factors could lead to the rise of a new species?

Ans. Factors responsible for the rise of a new species are:

(i) Genetic variation

- (ii) Natural selection
- (iii) Genetic drift.
- (iv) Geographical isolation

Q11. Is geographical isolation a major factor in the speciation of self-pollinating plant species?

Ans. No it will not be an issue as pollination occurs in the same plant.

Q12. With the help of an example show how characteristics can be used to determine the closeness of two species in terms of evolution.

Ans. Vestigial organs, homologous organs and analogous organs can be used to determine the evolutionary closeness of species between species.

Q13. Could we consider the wings of a bat and a butterfly as homologous organs?

Ans. No, we cannot consider the wings of these two different organisms as homologous organs because they possess different basic structures.

Q14. What are fossils? What can we learn from them about the process of evolution?

Ans. Fossils are the remains or impressions of a prehistoric plant or animal embedded in rock and preserved in petrified form. Through fossils, we can understand the evolutionary relationships between different They provide a picture into the past and show us the different evolutionary stages of an animal or a plant.

Q15. Why are humans who look so different (physically) from each other said to belong to the same species?

Ans. Our different physical appearances is a result of our bodies adapting to different habitats, however, we all have the same number of chromosomes and we can breed among ourselves. Thus, we belong to the same species.

Q16. From an evolutionary point of view which of the following have the best body design?

A bacteria, spider, fish, monkey and dog.

Ans. All of them have bodies evolved to suit their habitats, thus we cannot pick one of them and say that this one has the best body design.

Q17. In a Mendelian experiment, tall pea plants bearing violet flowers were breed with short pea plants with white flowers. The next generation of flowers bore all white flowers but almost half of them were white. From here we can deduce its genetic makeup to be as:

(a) WWTT (b) Wwtt (c) TtWw (d) TtWW

Ans. (c) TtWw

Q18. Among the following, Homologous organs would be:

- 1. Our hands and mouse's fore-leg**
- 2. Our teeth and wolves fangs**
- 3. A monkey's tail and a cat's ears**
- 4. All of the above**

Ans. (d) Both the organs in the above examples have basic structural designs but different functions and appearances.

Q19. In terms of evolution, we are most similar to:

- 1. A chimp**
- 2. A wolf**
- 3. A monkey**
- 4. An ant**

Ans. A chimp.

Q20. According to a study, children with light colored eyes were likely to have parents with light colored eyes. From this observation can we say anything about light colored eye trait?

Ans. We can say that the light colored trait of the eye is a dominant trait, as only dominant traits are expressed in the first generation.

Q21. How is the study of evolution and classification interlinked?

Ans. Classification is the most important term to explain evolution since it is based on the similarities and differences between organisms. More the similarity, closer is the evolution of the concerned organisms and higher are the chances of them being classified together. Thus, classification of species is an overall picture of their evolutionary relationships.

Q22. Explain the term analogous and homologous organs with examples.

Ans. Analogous organs are those that perform the similar functions and possess similar appearances but have different basic structural designs. E.g. A bat's wings and a fly's wings.

Homologous organs are those that have the same basic structural designs but have different functions. E.g. Human teeth and an elephant's tusk.

Q23. Construct an experiment to find out the dominant coat colors in dogs.

Ans. A homozygous black female dog is bred with a homozygous white male dog and an F1 generation is produced. If white is the dominant color, 3 out of every 4 dogs will have a white coat. If black is the dominant color 3 out of every 4 dogs will have a black coat.

Q24. What evidence do we have to show that life originated from inanimate matter?

Ans. Two scientists, Stanley Miller and Harold C. set up an atmosphere similar to that which existed on early earth. Their atmosphere had methane, ammonia, hydrogen sulphide and water. The concoction was maintained just below 100°C and electric sparks were passed through it. At the end of a week, the compounds had formed into simple amino acids, the ones responsible for building protein. Thus, illustrating how life arose from inanimate

Q25. Describe how sexual reproduction gives rise to more variant offspring compared to asexual reproduction. How does this affect the evolution of those species that reproduce sexually?

Ans. Errors during DNA recombination and mutations is the only way, variations arise in asexually reproducing organisms. Thus the scope of variant off springs through asexual reproduction is really However in terms of sexual reproduction variation occurs through:

1) Separation of homologous chromosomes during gamete formation.

2) Recombination of chromosomes.

3) Fertilization of gametes to form zygotes.

Evolution is more in sexually reproducing organisms as they have greater variations in each succeeding generations and thus they can adapt themselves better to changing conditions.

Q26. How is the equal genetic contribution of female and male parents ensured in the progeny?

Ans. The genetic structure of such a progeny consists of pairs of chromosomes (diploid). One from the mother and one from the father. The zygote produced by the fusion of sperms and ovum have two sets of chromosomes with each set contributed by each parent. In diploids, a character is controlled by two genes. Both the father and the mother have equal contributions in terms of genetic material of the child.

Q27. Do you agree with this statement: "Only variations that confer an advantage to an individual organism will survive in a population."

Ans. No this is not necessarily true, there are numerous variations that have no function but yet persist in a For example, male nipples, free earlobes etc.