



NCERT SOLUTIONS

Heredity and Evolution

 eSaral हैं, तो सब सरल हैं।

IN CHAPTER QUESTIONS

PART - 1

Q1. If a trait A exists in 10% of a population of an asexually reproducing species and a trait B exists in 60% of the same population, which trait is likely to have arisen earlier?

Ans. The trait B has arisen earlier since it is in 60% population while trait A is merely in 10% which is newly arisen and not spread to large number.

Q2. How does the creation of variations in a species promote survival?

Ans. Creation of variation may be suitable for a population to fight against some new change in environment while those which do not have this variation will not be able to fight with such changing conditions and will die.

PART - 2

Q1. How do Mendel's experiments show that traits may be dominant or recessive?

Ans. Mendel found that in his monohybrid and dihybrid cross out of a pair of contrasting trait in F₁ generation only one trait is expressed and other remain hidden, the expressed trait is called dominant and the hidden trait is called recessive.

Q2. How do Mendel's experiments show that traits are inherited independently?

Ans. In dihybrid cross when a plant with round and yellow seeds were crossed with a plant with wrinkled and green seeded plant in F₂ generation he obtained four combinations instead of two parental varieties, this is possible only when the factors of each character is free to move with any other factor of other character. This is called law of independent assortment.

Q3. A man with blood group A marries a woman with blood group O and their daughter has blood group O. Is this information enough to tell you which of the traits – blood group A or O – is dominant? Why or why not?

Ans. No, because there is no information about the blood group of all the progenies. Blood group A can be genotypically AA or AO.

Q4. How is the sex of the child determined in human beings?

Ans. In female there are two X means (XX) chromosomes but in case of males these are one X and other Y means (XY).

PART - 3

Q1. What are the different ways in which individuals with a particular trait may increase in a population?

Ans. Individuals with a particular trait may increase in a population as a result of the following:

- (i) Natural selection: When that trait offers some survival advantage.
- (ii) Genetic drift: When some genes governing that trait become common in a population.
- (ii) When that trait gets acquired during the individual's lifetime.

Q2. Why are traits acquired during the life-time of an individual not inherited?

Ans. Acquired traits are those traits which are acquired by the organism in its life time. In these traits, genes of germ cells is not changed so they are not passed into next generation.

Q3. Why are the small numbers of surviving tigers a cause of worry from the point of view of genetics?

Ans. The small number of members in a population of tigers do not allow large number of variation to occur which are essential to survival of the species. A natural calamity may cause death of all the tigers, Resulting loss of these genes. of The small number of the species, lesser number of traits which reduces the chance of adaptability to change of environment.

PART - 4

Q1. What factors could lead to the rise of a new species?

Ans. Mutation, natural selection, geographical isolation.

Q2. Will geographical isolation be a major factor in the speciation of a self- pollinating plant species? Why or why not?

Ans. No, Because both male and female reproductive organs are present in same organism.

Q3. Will geographical isolation be a major factor in the speciation of an organism that reproduces asexually? Why or why not?

Ans. No, because geographical isolation does not affect much in asexually reproducing organisms. Asexually reproducing organisms pass on the parent DNA to offsprings that leaves no chance of speciation.

PART - 5

Q1. Give an example of characteristics being used to determine how close two species are in evolutionary terms.

Ans. Feathers in some ancient reptiles like dinosaurs, as fossils indicate, evolved to provide insulation in cold weather. However, they cannot fly with these feathers later on birds adapted the feathers to flight. This indicates that they are evolutionary related.

Q2. Can the wing of a butterfly and the wing of a bat be considered homologous organs? Why or why not?

Ans. Those organs which have different origin and structural plan but appear similar and perform similar functions are called analogous organs. So the wing of a butterfly and the wing of a bat can be considered homologous organs.

Q3. What are fossils? What do they tell us about the process of evolution?

Ans. Fossils are remains or impressions of the hard parts of the extinct organism preserved in the sedimentary rock or other media. They tell us about the development of the structures from simple structured to complex structured organisms. They tell us about the phases of evolutions through which they must have undergone in order to sustain themselves in the competitive environment, fossils provide evidences of evolution by revealing the characteristics of the past organism and the changes that have occurred in them to give rise to the present organism.

PART - 6

Q1. Why are human beings who look so different from each other in terms of size, colour and looks said to belong to the same species?

Ans. Because all human beings are a single species. A species is a group of organisms that are capable of interbreeding to produce a fertile offspring. Skin colour, looks, and size are all variety of features present in human beings. These features are genetic but also environmentally controlled. Various human races are formed based on these features. All human races have more than enough similarity as same species. Therefore, all human beings are a single species as humans of different colour, size, and looks are capable of reproduction and can produce a fertile offspring.

Q2. In evolutionary terms, can we say which among bacteria, spiders, fish and chimpanzees have a 'better' body design? Why or why not?

Ans. No, They all are of different branches of evolution. Evolution cannot always be equated with progress or better body designs. Evolution simply creates more complex body designs. However, this does not mean that the simple body designs are inefficient. In fact, bacteria having a simple body design are still the most cosmopolitan organisms found on earth. They can survive hot springs, deep sea, and even frozen freezing environment.

EXERCISES

Q1. A Mendelian experiment consisted of breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bear violet flowers, but almost half of them were short. This suggests that the genetic make-up of the tall parent can be depicted as:

- (A) TTWW (B) TTww
(C) TtWW (D) TtWw.

Ans. (C) TtWW

Q2. An example of homologous organs is:

- (A) our arm and a dog's fore-leg.
(B) our teeth and an elephant's tusks.
(C) potato and runners of grass.
(D) all of above.

Ans. (D) all of above.

Q3. In evolutionary terms, we have more in common with:

- (A) a Chinese school-boy. (B) a chimpanzee.
(C) a spider. (D) a bacterium.

Ans. (A) a Chinese school-boy.

Q4. A study found that children with light-coloured eyes are likely to have parents with light-coloured eyes. On this basis, can we say anything about whether the light eye colour trait is dominant or recessive ? Why or why not ?

Ans. Let us assume that children with light-coloured eyes can either have LL or Ll or ll genotype. If the children have LL genotype, then their parents will also be of LL genotype.

$$LL \times LL$$

↓

$$LL$$

If the children with light-coloured eyes have ll genotype, then their parents will also have ll genotype.

$$ll \times ll$$

↓

$$ll$$

Therefore, it cannot be concluded whether light eye colour is dominant or recessive.

Q5. How are the area of study-evolution and classification interlinked?

Ans. Classification is the arrangement of organisms into groups and subgroups on the basis of their similarities and dissimilarities. The more characteristics two species will have in common, the more closely they are related. The more closely they are related, the more recently they will have had a common ancestor. So, it can be said that, classification of species is infact a reflection of their evolutionary relationship.

Q6. Explain the terms analogous and homologous organs with examples.

Ans. Homologous organs are those organs having similar basic structure but has been modified to perform different functions, e.g., forelimbs of reptiles, frog, lizard, bird and human (amphibians and mammals) are homologous organs. Such homologous characteristic helps to identify an evolutionary relationship between apparently different species.

Analogous organs are those organs which are different in basic structure but perform same function, e.g., wings of bat and wings of birds.

Q7. Outline a project which aims to find the dominant coat colour in dogs.

Observation table			
The area visited	Number of grey colour	Number of black / brown	Number of white dogs
A			
B			
C			
D			
Total			

Ans. Project: To find out the dominant coat colour in dogs.

Material required: Notebook, pencil.

Procedure: Observe different colour of pet dogs kept by your friends and note their different coat colour.

You may be able to find different coat colours such as, grey, white, black, brown, etc. Note your reading in the observation table.

Make a survey of different populations to determine the frequency of different coat colours in dogs. Find the percentage distribution of each coat type, out of the total number of dogs studied for the coat colour.

Total number of dogs studied =.....

% of Grey dogs =.....

% of Black/brown dogs =.....

% of White dogs =.....

Conclusion : Draw conclusion on the basis of your data collected.

Let us assume in dogs, the coat/skin colour grey is found in more numbers, while black/brown are in less number. In dogs/cats, the gene for the coat colour is present on 'X' chromosomes, In dogs, for the recessive colour to express, both the 'X' chromosomes must carry the genes for the recessive coat colour which is possible in less number. Thus black/brown colour is a recessive character for coat colour in dogs, the dominant colour (with high % of individuals) can express both in homozygous and heterozygous form in dogs. Therefore dominant coat colour in dogs is grey.

Q8. Explain the importance of fossils in deciding evolutionary relationships.

Ans. Origin of life on this planet is a result of chemical evolution. It was followed by biological or organic evolution which gave rise to numerous type of living organisms over the age. Some of these organisms became fossilised and are helpful to trace the evolutionary relationship amongst living organisms.

The discovery of some fossils provide missing links between two different groups and indicating their evolutionary relationship. For example, the fossil Archaeopteryx looks like a bird and have teeth in jaws, finger ending into claws, long tail is the reptilian characters. On the other hand, the avian characters include presence of feathers, rounded cranium, forelimbs modified into wings. This fossil provide a strong clue that the birds have evolved from reptiles. Birds are called glorified reptiles.

Q9. What evidence do we have for the origin of life from inanimate matter ?

Ans. B.S. Haldane suggested that life must have developed from the simple inorganic molecules which were present on earth soon after it was formed. He speculated that the conditions on earth at that time could have given rise to more complex organic molecules that were necessary for life. The first primitive organisms would arise from further chemical synthesis.

Later on, Stanley L. Miller and Harold C. Urey conducted experiment to find out about the origin of organic molecules. They assembled an atmosphere similar to that thought to exist on early earth (this had molecules like ammonia, methane and hydrogen sulphide, but no oxygen) over water.

This was maintained at a temperature just below 100°C and sparks were passed through the mixture of gases to simulate lightning. At the end of a week, 15% of the carbon (from methane) had been converted to simple compounds of carbon including amino acids which make up protein molecules. This is how, life originated on earth from inanimate matter.

Q10. Explain how sexual reproduction gives rise to more viable variations than asexual reproduction. How does this affect the evolution of those organisms that reproduce sexually ?

Ans. Variations occurring during sexual reproduction may be due to :

- (i) Separation of homologous chromosomes (by chance only) during gamete formation,
- (ii) Crossing over (recombination) of homologous chromosomes.
- (iii) Fertilisation of gametes to form zygote.
- (iv) Errors during DNA copying or mutations.

In asexually reproducing organisms errors during DNA copying cause variations.

Since the extent of variations is much larger in sexually reproducing organisms therefore, the chances of evolution is also much higher in sexually reproducing organisms.

These variation enables the organism to adapt themselves to the changing conditions and also help to face the struggle for existence. Over the time, they accumulate and give rise to new species.

Q11. How is the equal genetic contribution of male and female parents ensured in the progeny ?

Ans. Genetically organisms are of two types :

- (i) **Haploid** : They have single set of chromosomes, where each chromosome is represented singly. As the chromosomes are the bearer of genes so haploids have single set of genes. A single gene determine the expression of character.
- (ii) **Diploid** : They have two set of homologous chromosomes, where the chromosome occur in pair, one maternal contributed by the mother through her ovum and the second chromosome of the pair is contributed by the male parent through his sperm. The resultant cell zygote produce by the fusion of male and female gametes have two sets of chromosomes, each set contributed by each parent. In diploids a character is controlled by two genes factors. Both the father and mother contribute practically equal amount of genetic material to the child. It means that each trait can be influenced by both paternal and maternal DNA.

Q12. Only variations that confer an advantage to an individual organism will survive in a population. Do you agree with this statement ? Why or why not ?

Ans. No, many of the times the variations are not advantageous to an individual organism but they still survive in a population, e.g., take the case of free ear lobe and attached ear lobe. Most of the other variations not only give survival advantage to an individual but also contribute to genetic drift. Thus we can say that most of the variations lead to better adaptation of an organism to the changing environment. In this way, it gives survival advantage to that organism and will also survive in the coming population.