

# CBSE Class 10 Science

## NCERT Solution

### Science Chapter 9 - Heredity and Evolution

#### In text Questions

Page Number: 143

**Question 1:-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?**

**Answer:**

Trait B, because it is present in more members of the population. It is likely to have arisen earlier and has now spread to 60% of the population. Trait A is new and has spread to only 10% of the population.

**Question 2:-How does the creation of variations in a species promote survival?**

**Answer:**

The variations provide stability to the population of various species by preventing them from getting wiped out during adverse conditions.

The natural environment also changes, and variations in species which become suited to the environment help it to survive.

Page Number: 147

**Question 1:-How do Mendel's experiments show that traits may be dominant or recessive?**

**Answer:**

Mendel took pea plants with contrasting characteristics tall plant and dwarf (or short) plant. On cross pollination, he got all tall plants in first generation ( $F_1$ ). But by the self-pollination of  $F_1$  tall plants, the plants of second generation consisted of tall and short plants in the ratio of 3 : 1. On the basis of these experiments, the characteristics appeared in first generation were called dominant (i.e. tall plants) and the characteristics that did not appear were called recessive (dwarf i.e. plants).

**Question 2:-How do Mendel's experiments show that traits are inherited independently?**

**Answer:**

Mendel took two pairs of alternate expression of two traits and carried out dihybrid crosses by crossing them. The traits appeared in first generation were termed as dominant. When he used these  $F_1$  progeny to generate  $F_2$  progeny by self-pollination plants of different types were produced. In some plants both the traits were dominant, while in some plants both were recessive and some plants exhibited mixed traits. This indicates that traits are inherited independently.

**Question 3:-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?**

**Answer:**

This information is not enough. This is because each individual is carrying two alleles. The recessive trait can occur only when who alleles are similar. If blood group A is dominant and O is recessive, then daughter can have blood group O only when both recessive alleles occur together in mother, and father has one allele of O and other of A.

**Question 4.**

**How is the sex of the child determined in human beings?**

**OR**

**“The sex of a newborn child is a matter of chance and none of the parents may be considered responsible for it.” Justify this statement with the help of a flow chart showing determination of sex of a newborn.**

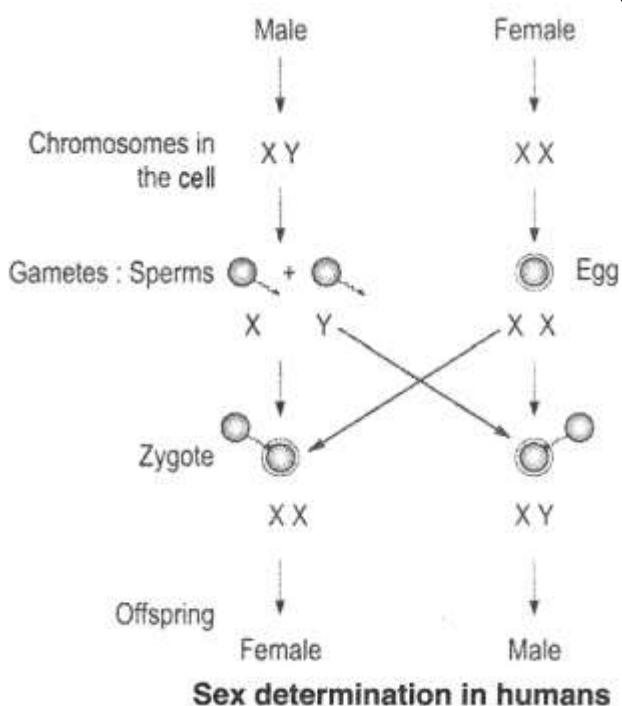
**Answer:**

Half of the male gametes (sperms) carry X chromosome and other half carry Y chromosomes. All the female gametes carry only X chromosomes. When a sperm fertilizes an egg, the following situations become possible.

1. (i) When a sperm carrying X chromosome fertilises an egg that contains only X chromosome), the resulting zygote develops into a female (XX condition).
2. (ii) When a sperm carrying Y chromosome fertilises an egg (that contains only X chromosome), the resulting zygote develops into a male (XY condition).

Thus there are 50 – 50 chances of a male or female child and none of the parents may Sex determination in humans be considered responsible for it.

The sex-determination mechanism is shown alongside.



**Question 1:-What are the different ways in which individuals with a particular trait may increase in a population?**

**Answer:**

Different ways in which individuals with a particular trait may increase in a population are as follow :

1. If it gives the benefit of survival through natural selection.
2. Due to a sudden increase in a particular trait in a population, i.e., by genetic drift.

**Question 2:-Why are traits acquired during the life-time of an individual not inherited?**

**Answer:**

The traits acquired during the life-time are changes in the non-reproductive cells of the organisms and are not capable of being passed on to the next generation.

**Question 3:-Why are the small numbers of surviving tigers a cause of worry from the point of view of genetics?**

**Answer:**

The small numbers of surviving tigers are a cause of worry from the point of view of genetics because in tigers there are negligible genetic variations. Due to this they are not well adapted. The rapid environmental changes cannot be favorable for them. If these changes are not controlled, tigers would be wiped out.

**Question 1:-What factors would lead to the rise of a new species?**

**Answer:**

The factors that would lead to the rise of a new species are the following :

1. Geographical isolation of a population caused by various types of barriers (such as mountain ranges, rivers and sea). The geographical isolation leads to reproductive isolation due to which there is no flow of genes between separated groups of population.
2. Genetic drift caused by drastic changes in the frequencies of particular genes by chance alone.
3. Variations caused in individuals due to a natural selection.

**Question 2:-Will geographical isolation be a major factor in the speciation of a self- pollinating plant species? Why or why not?**

**Answer:**

The geographical isolation cannot be major factor in the speciation of a self-pollinating plant species because it does not have to look the plants for its process of reproduction to be carried out.

**Question 3:-Will geographical isolation be a major factor in the speciation of an organism that reproduces asexually? Why or why not?**

**Answer:**

Geographical isolation cannot be a major factor in the speciation of an asexually reproducing organism because it does not require any other organism to carry out reproduction.

**Page Number: 156**

**Question 1:-Give an example of characteristics being used to determine how close two species are in evolutionary terms.**

**Answer:**

If similar characteristics are shown in different organisms, then these are considered to be inherited from the common ancestry. It also shows the closeness of the species.

For example, bats and birds have some similarity in their wings, so they are closely related, while lizard and squirrel do not have wings so these are not closely related to the birds and bats.

**Question 2:-Can the wing of a butterfly and the wing of a bat be considered homologous organs? Why or why not?**

**Answer:**

The wings of a butterfly and the wings of a bat cannot be considered to be homologous organs because they have different basic designs though they are used for the same purpose of flying. They are analogous organs.

**Question 3:-What are fossils? What do they tell us about the process of evolution?**

**Answer:**

Fossils : Fossils are the remains or traces of a dead organism. These are formed through the formation of sedimentary rocks. They provide following information on the process of evolution.

1. They tell about the changes that occurred on the earth's surface and the corresponding organisms.
2. They tell about the gradual development of complex structured organisms from simple structured organisms.
3. It is known through them that birds are evolved from reptiles.
4. They state that angiosperms are developed from pteridophytes and gymnosperms.
5. They exhibit the process of human evolution.

**Page Number: 158**

**Question 1:-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?**

**Answer:**

This is because although genetic make up of humans may be slightly different in different races of people, there is no reproductive isolation. Reproductive isolation differentiates one species from the other. Human beings different in size, colour and looks can marry among themselves and produce fertile offspring.

**Question 2:-In evolutionary terms, can we say which among bacteria, spiders, fish and chimpanzees have a 'better' body design? Why or why not?**

**Answer:**

Bacteria is a primitive organism as they came into being very early in evolution. But these organisms are still surviving in the present conditions after millions of years. This is because they have adapted well to the changing environment over these years. Same is the case for all other organisms like spiders, fishes and chimpanzees which have adapted to their environment and have survived. Therefore, all the organisms which exist have a body design which is better as it is suited to their environment.

## NCERT Solutions for Class 10 Science

# Chapter 9

### Textbook Chapter End Questions

**Question 1:-A Mendelian experiment consisted of breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bore 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

**Answer:**

- (c) TtWW

TtWW might be the genetic makeup of the tall parent. Since half the progenies are short, this implies that the parent plant also will have a collection of short genes; all progenies bore violet flowers, further suggesting that violet color is dominant over white.

**Question 2:-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 the above

**Answer:**

- (d) All of the above

Homologous organs have the same origin as each of the above organs, but different functions. Homologous organs can be defined as the organs of various animals having similar basic structure but different functions. For example, a whale's flippers, a frog's forelimbs, and man have the same basic structures but perform different functions, which is why they are called homologous organs.

**Question 3:-In evolutionary terms, we have more in common with:**

- (a) a Chinese school-boy
- (b) a chimpanzee
- (c) a spider
- (d) a bacterium

**Answer:**

- (a) A Chinese school-boy

Humans and chimpanzees are related since they belong to the identical order (Primates) and same family, (Hominidae). However, a school-boy, regardless of the ethnicity is still a Homo sapien

**Question 4:-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?**

**Answer:**

This information is not complete. On the basis of this, it cannot be decided light colour trait is dominant or recessive. So it cannot be said until one does not know the nature of this trait in the parents.

Knowledge of at least 3 generations is required for finding if an attribute is dominant or recessive. Hence, it is not possible to identify if the given trait is dominant or recessive.

**Question 5:-How are the areas of study-evolution and classification inter linked?  
OR**

**‘Two areas of study namely ‘evolution’ and ‘classification’ are interlinked”.**

**Justify this statement.**

**Answer:**

Classification of organisms is based on relative similarities and differences among organisms. Resemblances in organisms are because they have arisen from a common ancestor and differences in them are due to adaptations to different types of environment. Since the organisms can be graded in order of increasing complexity it indicates at the concept of evolution.

**Question 6:-Explain the terms analogous and homologous organs with examples.**

**Answer:**

**Analogous organs:** Those organs which have different basic structure (or different basic design) but have similar appearance and perform similar functions are called analogous organs.

For example, the wings of an insect and a bird are analogous organs.

**Homologous organs:** Those organs which have the same basic structure (or same basic design) but different functions are called homologous organs.

For example, the wing of a bat, flipper of a seal, front leg of a horse and arm of a man are homologous organs.

**Question 7:-Outline a project which aims to find the dominant coat colour in dogs.**

**Answer:**

Suppose a black homozygous male is mated with a white homozygous female. If the progeny has all black dogs then the dominant coat colour is black.

Dogs have a certain set of genes that govern coat color. There are a minimum of eleven known sequence series (A, B, C, D, E, F, G, M, P, S, T) that influence the colour of a dog. A dog inherits one copy from each of its parents. As an example, within the B series, a dog is genetically black or brown. Assume that one parent is homozygous black (BB), whereas the other parent is homozygous brown (bb).

	BB		
bb	B	B	
	b	Bb	Bb
	b	Bb	Bb

In this case, all the offsprings are going to be heterozygous (Bb).

Since black (B) is dominant, all the offsprings are going to be black. However, they are going to have each B and b alleles. If such heterozygous pups are crossed, they are going to produce 25 homozygous blacks (BB), 15 heterozygous black (Bb), and 25 homozygous brown (bb) offsprings.

	B	b
B	BB	Bb
b	Bb	bb

### Question 8:-Explain the importance of fossils in deciding evolutionary relationships.

#### Answer:

Fossils play important role in providing evolutionary evidences because by knowing the age of fossils we can know about the evolution process of an organism.

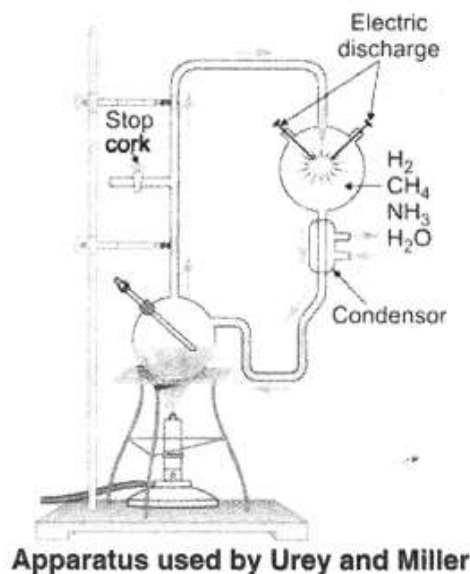
For example, a fossil bird called archaeopteryx that looked like a bird had many other features of reptiles. It had feathered wings like those of birds, but teeth and tail like those of reptiles.

Archaeopteryx is, therefore, a connecting link between the reptiles and birds, and hence suggests that the birds have evolved from the reptiles.

### Question 9:-What evidence do we have for the origin of life from inanimate matter?

#### Answer:

A British scientist J.B.S. Haldane at first in 1929 suggested that life is originated from inanimate matter. According to him life must have developed from the simple inorganic molecules which were present at that time. Later, Miller and Urey in 1953 presented its evidences. They assembled an apparatus to create an early earth atmosphere which was supposed to consist of gases like methane, ammonia and hydrogen sulphide, etc. over water. This was maintained at a temperature just below 100°C and electric sparks were then passed through the mixture of gases to stimulate lightning for about one week. At the end of one week, it was found that about 15 per cent of carbon (from methane) had been converted into simple compounds and amino acids which make up protein molecules formed in living organisms. This experiment provides the evidence that the life originated from inanimate matter (or lifeless matter) like inorganic molecules.



**Question 10:-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?**

**Answer:**

During sexual reproduction there is 'crossing over' of chromosomes, that gives rise to variations. These variations are inherited and increase the chances of survival of an organism.

1. In sexual reproduction variations may occur due to errors in DNA copying.
2. There may be variations due to interchange of homologous chromosomes during crossing over of male and female.
3. In sexual reproduction, it is not predetermined that which gamete would fuse with another gamete. It depends only on chance. It is also a reason of variation. These variations enable the organisms to adapt themselves to the changing conditions and also help to give rise to new species.

**Question 11:-How is the equal genetic contribution of male and female parents ensured in the progeny?**

**Answer:**

Genetic material in most organisms is present in pairs of chromosomes. Gametes in the sexually reproducing organisms are formed by the process of meiosis during which half of the genetic material goes into each gamete. When the gametes from male and female parents fuse with each other during sexual reproduction, the normal complement is restored. Half of the genetic material comes from the female and half from the male.

**Question 12:-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?**

**Answer:**

Yes, variations that confer an advantage to an individual organism are inherited. The organism can survive longer in an environment and maintain its existence in the population.