

# Heredity and Evolution

## Question 1:

Which of the processes, sexual reproduction or asexual reproduction, brings about maximum variations in the offsprings ?

## Solution :

Sexual Reproduction

## Question 2:

Name one variation in humans connected with ears.

## Solution :

Free Earlobes.

## Question 3:

What constitutes the link between one generation and the next ?

## Solution :

Gametes.

## Question 4:

If the 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 ?

## Solution :

B.

## Question 5:

Mendel said that the characteristics or traits of organisms are carried from one generation to the next by internal factors which occur in pairs. What is the modern name for these factors ?

## Solution :

Genes.

## Question 6:

Some plants occur in one of the two sizes : tall or dwarf. This characteristic is controlled by

one pair of genes. Tallness is dominant to dwarfness. Choose suitable letters for this gene pair.

## Solution :

Tt.

**Question 7:**

What are the chromosomes XY and XX known as ?

**Solution :**

Sex Chromosomes.

**Question 8:**

Which of the two, sperm or ovum, decides the sex of the child ?

**Solution :**

Sperm.

**Question 9:**

State whether the following statement is true or false :

The sex of an infant is not a case of inheritance of characteristics.

**Solution :**

False.

**Question 10:**

A new born child has an XY pair of chromosomes. Will it be a baby boy or a baby girl ?

**Solution :**

Baby boy

**Question 11:**

Which of the following combinations of sex chromosomes produce a male child : XX or XY ?

**Solution :**

XY.

**Question 12:**

Name the first scientist who studied the inheritance of traits from one generation to the next.

**Solution :**

Gregor Mendel

**Question 13:**

What type of plants were used by Mendel for conducting his experiments on inheritance ?

**Solution :**

Pea plants.

**Question 14:**

The gene for red hair is recessive to the gene for black hair. What will be the hair colour of a person if he inherits a gene for red hair from his mother and a gene for black hair from his father ?

**Solution :**

Black hair.

**Question 15:**

What are the four blood groups in humans ?

**Solution :**

A, B, AB and O.

**Question 16:**

Name one reptile in each case where higher incubation temperature leads to the development of : (a) male progeny, (b) female progeny.

**Solution :**

- (a) Lizard (*Agama agama*)
- (b) Turtle (*Chrysema Picta*)

**Question 17:**

Fill in the following blanks with suitable words : Fill in the following blanks with suitable words :

- (a) Genes always work in .....
- (b) In pea plants, the gene for dwarfness is..... whereas that for tallness is.....
- (c) Most people have..... earlobes but some have..... earlobes.
- (d) A human gamete contains..... chromosomes whereas a normal body cell has..... chromosomes in it.
- (e) All races of man have..... blood groups.
- (f) The..... chromosomes for a..... are XX whereas that for a..... are XY.

**Solution :**

- (a) Pairs.
- (b) Recessive; Dominant.
- (c) Free; attached.
- (d) 23; 46.
- (e) Four.
- (f) Sex; Female; male.

**Lakhmir Singh Biology Class 10 Solutions Page No:192****Question 18:**

Which of the following represent tall plants and which represent short plants (or dwarf plants) ? Which of the following represent tall plants and which represent short plants (or dwarf plants) ?

- (a) Tt
- (b) tt
- (c) TT

Give reason for your choice (The symbols have their usual meaning).

**Solution :**

- (a) Tall – Tt will have tall plants because of the presence of T which is dominant gene and t is recessive gene.
- (b) Dwarf plants: It is dwarf due to the presence of both the recessive genes.
- (c) Tall plants: These plants are tall due to the presence of both the dominant genes.

**Question 19:**

A man having blood group O marries a woman having blood group B and they have a daughter. What will be the blood group of the daughter ?

**Solution :**

Equal chance of having blood group O or blood group B.

**Question 20:**

- a) Name the scientist who gave the laws of inheritance.
- (b) Name an animal in which individuals can change sex. What does this indicate ?

**Solution :**

- (a) Gregor Mendel
- (b) Snails: This indicates that sex is not determined genetically in some animals.

**Question 21:**

Explain with an example, how genes control the characteristics (or traits).

**Solution :**

The characteristics or traits in animals and plants are controlled by genes. For example the transmission of color of hair from the parents to the child. If a mother has black hair and the father has blonde hair and the child has black hair then the transmission of genes for hair colour from the mother and father to the child is as follows: Mother's cell contains two genes HH for black hair. Both the genes HH are dominant genes, so the mother has black hair. Father's cell contains two genes (hh) for blonde hair. The two genes hh are recessive genes, so the father has blonde hair. Now, during the process of reproduction, the mother transmits one of the dominant genes H for black hair to the child and the father transmits one of his recessive genes h for blonde hair to the child. Due to this, the child has the genes Hh for her hair. Now the gene H for black hair is the dominant gene but the gene h for blonde hair is the recessive gene. The dominant gene H for black hair shows its effect due to which the child has black hair.

**Question 22:**

- (a) State one advantage of variation to a species.
- (b) What are sex chromosomes ? How many sex chromosomes are there ? Name them.

**Solution :**

- (a) The advantage of variation to a species is that it increases the chances of its survival in a changing environment.
- (b) The chromosomes which determine the sex of a person are called sex chromosomes. There are two types of sex chromosomes ? X and Y chromosomes.

**Question 23:**

Explain how, sex is determined in human babies.

**Solution :**

The sex of a child depends on what happens at fertilisation:

- (a) If a sperm carrying X chromosome fertilises an ovum (or egg) which carries X chromosome, then the child born will be a girl. This is because the child will have XX combination of sex chromosomes.
- (b) If a sperm carrying Y chromosome fertilises an ovum (or egg) which carries X chromosome, then the child born will be a boy. This is because the child will have XY combination of sex chromosomes.

**Question 24:**

What do the following symbols used in the topic on heredity represent ?

- (a) TT
- (b) tt
- (c) XX
- (d) XY

**Solution :**

- (a) Tall plant.
- (b) Dwarf plant.
- (c) Female.
- (d) Male.

**Question 25:**

- (a) What will you get in the F<sub>1</sub> and F<sub>2</sub> generations in the following cross ?  
Pure tall pea plant x Pure dwarf pea plant
- (b) Is it an example of monohybrid cross or dihybrid cross ?

**Solution :**

(a) In the  $F_1$  generation, all plants produced will be tall and in  $F_2$  generation three tall plants and one dwarf plant will be produced.

(b) It is an example of monohybrid cross.

**Question 26:**

In the  $F_2$  generation of a cross, progeny having different traits are produced in the ratio 3:1. State whether it is a monohybrid cross or a dihybrid cross ? Give one example of such a cross.

**Solution :**

It is a monohybrid cross. Example – when two hybrids tall Pea plants cross bred with each other, they will produce three tall plants and one dwarf plant in  $F_2$  generation.

**Question 27:**

(a) What is the genotype of dwarf plants which always produced dwarf offspring ?

(b) What is the genotype of tall plants which always produced tall offspring ?

(c) What is the genotype of

1. dwarf plants, and
2. tall plants, whose parental cross always produces tall offspring ?

**Solution :**

(a) tt.

(b) TT.

(c) (i) tt

(ii) TT.

**Question 28:**

(a) If a normal human cell has 46 chromosomes, how many chromosomes will be there in a human (i) sperm cell, and (ii) zygote ?

(b) What sizes of plants are produced if both parents have genes Tt ?

**Solution :**

(a) (i) 23.

(ii) 46.

(b) Three tall plants and one dwarf plant.

**Question 29:**

In a human, how many chromosomes are present in :

(a) a brain cell ?

(b) a sperm in the testes ?

(c) an egg which has just been produced by the ovary ?

(d) a skin cell ?

(e) a fertilised egg ?

**Solution :**

(a) 46.

(b) 23.

(c) 23.

(d) 46.

(e) 46.

**Question 30:**

Gregor Mendel's first law of genetics states "Of a pair of contrasted characters, only one can be represented in a gamete by its internal 'factor'".

- (a) Give the modern name for this 'factor'.
- (b) State where these factors are found in gametes.

**Solution :**

- (a) Genes.
- (b) Chromosomes.

**Question 31:**

Does genetic combination of mother play a significant role in determining the sex of a new born baby ?

**Solution :**

No, because mother has a pair of X chromosomes. All new born babies will inherit an X chromosome from mother whether they are baby boys or baby girls.

**Question 32:**

Give the contrasting traits of the following characters in pea plant and mention which is dominant and which is recessive :

- (a) Yellow seed (b) Round seed

**Solution :**

- (a) Green seed: Yellow is dominant: Green is recessive.
- (b) Wrinkled seed: round is dominant: wrinkled is recessive.

**Question 33:**

- (a) What is meant by 'heredity' ? What are the units of heredity.
- (b) State Mendel's first law of inheritance.

**Solution :**

- (a) The transmission of characters from parents to the offspring's is called heredity. The units of heredity are genes.
- (b) According to Mendel's first law of inheritance: The characteristics (or traits) of an organism are determined by internal 'factors' which occur in pairs. Only one of a pair of such factors can be present in a single gamete.

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**Question 34:**

- (a) Why did Mendel choose pea plants for conducting his experiments on inheritance ?
- (b) State Mendel's second law of inheritance.

**Solution :**

- (a) Mendel choose pea plants for studying inheritance because pea plants had a number of clear cut differences which were easy to tell apart. Another reason for choosing pea plants are they were self pollinating and many generations can be produced in a short time span.
- (b) According to Mendel's second law of inheritance: In the inheritance of more than one pair of traits in a cross simultaneously, the factors responsible for each pair of traits are distributed independently to the gametes.
- (c) How does the creation of variation in a species ensure its survival ?

**Question 35:**

- (a) What do you understand by the term 'variation' ?
- (b) Name two human traits which show variation.

**Solution :**

- (a) The differences in the characters among the individual of a species is called variation.
- (b) Human height and free ear lobe are the traits which show variation in humans.
- (c) Due to the creation of variations, a species can adjust to the changing environment around

it. And this promotes the survival of the species in the changing environment. Example: The accumulation of 'heat resistant' variation (or trait) in some bacteria will ensure its survival even when the temperature in its environment rises too much due to a heat wave or some other reasons. On the other hand, the bacteria which did not have this variation to withstand heat would not survive under these circumstances and die.

**Question 36:**

- (a) What are genes ? Where are they located in our body ? (a) What are genes ? Where are they located in our body ?
- (b) What is meant by dominant genes and recessive genes ? Give one example of each.
- (c) Explain how, characteristics (or traits) are inherited through genes.

**Solution :**

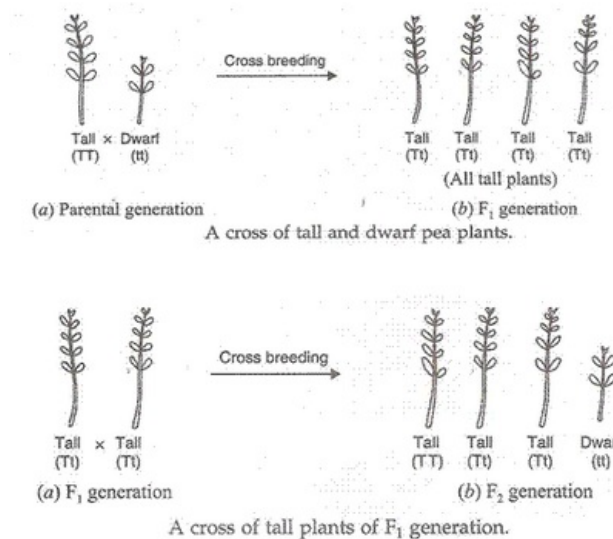
- (a) Genes are the units of heredity which transfer characteristic from parents to their offspring's during reproduction. Genes are located on the chromosomes.
- (b) The gene which decides the appearance of an organism even in the presence of an alternative gene is known as dominant gene. The gene which can decide the appearance of an organism only in the presence of another identical gene is called a recessive gene. The dominant gene is represented by a capital letter and the corresponding recessive gene is represented by the corresponding small letter. For example, in pea plants, the dominant gene for tallness is T and the recessive gene for dwarfness is t.
- (c) There is a pair of genes for each characteristic of an organism, one is dominant gene and the other is recessive gene. Each parent passes only one of the two genes of the pair for each characteristic to its progeny through gametes. Thus, the male gamete and the female gamete carry one gene for each characteristic from the gene pairs of the parents. When a male gamete fuses with a female gamete during fertilisation they make a new cell called zygote which grows and develops to form a new organism having characteristics from both the parents which it has inherited through genes.

**Question 37:**

- (a) How do Mendel's experiments show that traits may be dominant or recessive ?
- (b) How do Mendel's experiments show that traits are inherited independently ?

**Solution :**

- (a) Mendel first crossed pure bred tall pea plants with pure bred dwarf pea plants and found that only tall pea plants were produced in the first generation. No dwarf pea plants were obtained in F<sub>1</sub> generation. Mendel concluded that the first generation showed the traits of only one of the parent plants; tallness. The trait of other parent plant, dwarfness, did not show up in the progeny of first generation. Mendel then crossed the tall pea plants of the first generation (F<sub>1</sub> Generation) and found that tall plants and dwarf plants were obtained in the second generation (or F<sub>2</sub> generation) in the ratio of 3:1. Mendel noted that the dwarf trait of the parent pea plant which had seemingly disappeared in the first generation progeny reappeared in the second generation. In this way, Mendel's experiments with tall and dwarf pea plants showed that the traits may be dominant and recessive.



(b) When Mendel crossed pure-bred tall pea plants with pure-bred dwarf pea plants, he found that only tall pea plants were produced in the  $F_1$  generation. When Mendel further crossed the tall pea plants of the  $F_1$  generation, he found that the tall plants and dwarf plants were obtained in the ratio 3:1 in the  $F_2$  generation. Mendel noted that all the pea plants produced in the  $F_2$  generation were either tall or dwarf. There were no plants with intermediate height (or medium height) in-between the tall and dwarf plants. In this way, Mendel's experiment showed that the traits (like tallness and dwarfness) are inherited independently. This is because if the traits of tallness and dwarfness had blended (or mixed up), then medium sized pea plants would have been produced.

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##### Question 1:

What name is given to the sequence of gradual changes over millions of years in which new species are produced ?

**Solution :**

Evolution.

##### Question 2:

Name the scientist who gave the theory of evolution.

**Solution :**

Charles Robert Darwin.

##### Question 3:

State whether the following statement is true or false :

Human beings have evolved from chimpanzees.

**Solution :**

False.

##### Question 4:

State one characteristic which shows that the birds are very closely related to dinosaurs.

**Solution :**

The presence of feathers on birds and dinosaurs shows that they are closely related to each other.

##### Question 5:

Name an animal having rudimentary eyes.

**Solution :**



Planaria.

**Question 6:**

Name the ancestor of the following :

Broccoli, Kohlrabi, Kale

**Solution :**

Wild Cabbage.

**Question 7:**

Where did life originate on the earth ?

**Solution :**

Sea water.

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**Question 8:**

Write the names of at least three inorganic molecules which helped in the origin of life on the earth.

**Solution :**

Methane, Ammonia and Hydrogen Sulphide.

**Question 9:**

Name the famous book written by Charles Robert Darwin.

**Solution :**

The Origin of Species.

**Question 10:**

The forelimbs of a frog, a bird and a man show the same basic design (or basic structure) of bones. What name is given to such organs ?

**Solution :**

Homologous Organs.

**Question 11:**

Name two organisms which are now extinct and studied from their fossils.

**Solution :**

Dinosaurs and Archaeopteryx.

**Question 12:**

Out of the wing of a bird, wing of an insect and the wing of a bat :

(a) which two are homologous organs ?

(b) which two are analogous organs ?

**Solution :**

(a) Wings of bird and wings of bat.

(b) Wings of birds and wings of insects.

**Question 13:**

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 ?

**Solution :**

The human beings who look so different from each other in terms of size, color and looks are set to belong to the same species because they can inter breed to produce fertile offsprings.

**Question 14:**

Name five varieties of vegetables which have been produced from 'wild cabbage' by the process of artificial selection.

**Solution :**

Cabbage, Broccoli, Cauliflower, Kohlrabi and Kale.

**Question 15:**

Choose the one term from the following which includes the other three :  
broccoli, wild cabbage, cauliflower, cabbage

**Solution :**

Wild cabbage.

**Question 16:**

Fill in the following blanks with suitable words : Fill in the following blanks with suitable words :

- (a) The human forelimb and bat's forelimb are an example of .....organs whereas an insect's wing and a bat's wing are an example of .....organs.
- (b) The evolution of eye is an example of evolution by .....
- (c) The scientific name of all human beings is .....
- (d) Broccoli has evolved from .....by the process of artificial selection.
- (e) The theory of natural selection for evolution was proposed by .....

**Solution :**

- (a) Homologous: Analogous.
- (b) Stages.
- (c) Homo sapiens.
- (d) Wild Cabbage.
- (e) Darwin.

**Question 17:**

Match the terms given in column I with those given in column II :

<i>Column I</i>	<i>Column II</i>
(i) Fossil	(a) A famous evolutionist
(ii) A theory of evolution	(b) Survival of the fittest
(iii) Probable ancestor of birds	(c) Petrified remains of prehistoric life
(iv) Charles Darwin	(d) Father of genetics
(v) Gregor Mendel	(e) <i>Archaeopteryx</i>

**Solution :**

- (i) – c.
- (ii) – b.
- (iii) – e.
- (iv) – a.
- (v) – d.

**Question 18:**

What is meant by acquired and inherited traits ? Explain with one example each.

**Solution :**

A trait of an organism which is 'not inherited' but develops in response to the environment is called an acquired trait. Example – If a beetle does not get sufficient food for a considerable time, its weight will be reduced due to starvation. The low weight of the beetle is an example of acquired trait. A trait of an organism which is caused by a change in its genes (DNA) is called an inherited trait. Example – The change of colour from red beetle to green beetle is an example of inherited trait.

**Question 19:**

Why are the traits acquired during the lifetime of an individual not inherited ?

**Solution :**

For a trait of an organism to be inherited, it should bring about a change in the genes present in the reproductive cells or gametes of that organism. The traits acquired during the life time of a person do not bring about a change in the genes present in its reproductive cells or gametes and hence they are not inherited by the offsprings.

**Question 20:**

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

**Solution :**

The wings of a butterfly and the wings of a bat cannot be considered homologous because though the function of wings in both the cases is same but they have different basic design. The butterfly has a fold of membranes as wings which are associated with few muscles but has no bones whereas the wings of bat are supported by bones.

**Question 21:**

Name two animals having homologous organs and two having analogous organs. Name these organs.

**Solution :**

Forelimb of humans and forelimb of lizard are the homologous organs and the wing of insect and the wing of bird are analogous organs.

**Question 22:**

What are fossils ? Giving one example, explain how fossils provide evidence for evolution.

**Solution :**

The remains of dead animals or plants that lived in the remote past are known as fossils. The fossils provide evidence of evolution. For example, a fossil bird called Archaeopteryx looks like a bird but it has many features which are found in reptiles. This is because Archaeopteryx has feathered wings like those of birds but teeth and tail like those of reptiles. Therefore, Archaeopteryx is a connecting link between the reptiles and birds and suggests that birds have evolved from reptiles. Thus, fossils provide evidence that the present plants and animals have originated from the previously existing ones through the process of continuous evolution.

**Question 23:**

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

**Solution :**

The changes in DNA during reproduction are mainly responsible for evolution. The changes which take place in the DNA of species go on accumulating from one generation to the next. So, if the changes in the DNA of any two species are less, then the two species are quite close to one another in evolutionary terms. But if the changes in the DNA of two species are much more, then the two species will be far apart from one another in evolutionary terms. Thus, it is the characteristic of the extent of change in the DNA which is being used to determine how close two species are in evolutionary terms.

**Question 24:**

In what way are homologous organs evidence for evolution ?

**Solution :**

The presence of homologous organs in different animals provides evidence for evolution by telling us that they are derived from the same ancestor who had the 'basic design' of the organ

on which all the homologous organs are based.

**Question 25:**

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

**Solution :**

Sometimes a species may completely die out. It may become extinct. Once a species is extinct, its genes are lost forever, it cannot reemerge at all. The small numbers of surviving tigers are a cause of worry because if they all die out and become extinct, their genes will be lost forever. Our coming generations will not be able to see Tigers at all.

**Question 26:**

Will geographical isolation be a major factor in the speciation of an organism that reproduces asexually ? Give reason for your answer.

**Solution :**

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.

**Question 27:**

Name the various tools of tracing evolutionary relationships which have been used for studying human evolution.

**Solution :**

Human evolution has been studied by using the various tools of tracing evolutionary relationships like excavating (digging earth), carbon-dating, studying fossils and determining DNA sequences.

**Question 28:**

Out of bacteria, spider, fish and chimpanzee, which organism has a better body design in evolutionary terms ? Give reason for your answer.

**Solution :**

In evolutionary terms, we can say that bacteria has a 'better' body design than spiders, fish, and, chimpanzees. This is because though bacteria is one of the simplest and primitive life forms but it still inhabits and survives in some of the most inhospitable (most unfavourable) habitats such as hot springs, deep-sea thermal vents and ice in Antarctica. Most other organisms (including spider, fish and chimpanzees) cannot survive in such harsh environments.

**Question 29:**

With the help of an example, explain how variation leads to evolution.

**Solution :**

Some amount of variations are produced even during asexual reproduction but it is very small. The number of variations produced during sexual reproduction is, however, very large. It is due to these variations that no two human beings look alike. The number of successful variations is maximized by the process of sexual reproduction, so we can conclude that the variation is a necessity for organic evolution. Example: Animal reproduced by sexual reproduction show large number of variations.

**Question 30:**

- (a) What is meant by a species ? Give two examples of plant species and two of animals.
- (b) State the various factors which could lead to the formation of new species.

**Solution :**

- (a) A species is a population of organisms consisting of similar individuals which can breed

together and produce fertile offspring's. Plant species – Wheat, Paddy, Sunflower etc. Animal species – Cat, Dog, Tiger, etc.

(b) The important factors which could lead to the rise (or formation) 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 natural selection.

**Question 31:**

What evidence do we have for the origin of life from inanimate matter (lifeless matter) ?

**Solution :**

The evidence was given by Stanley L. Miller and Harold C. Urey in 1953. They assembled an apparatus to create an early earth atmosphere which was supposed to consist of gases like ammonia, methane and hydrogen sulphide, but no oxygen) over water. This was maintained by them at a temperature just below 100° C and electric sparks were passed through the mixture of gases to stimulate lightning. At the end of a week, they found that 15% of the carbon (from methane) had been converted to simple compounds of carbon including amino acids which make up protein molecules.

**Question 32:**

Does geographical isolation of individuals of a species lead to the formation of a new species ? Provide a suitable explanation for your answer.

**Solution :**

Geographical isolation is the major factor in the speciation of sexually reproducing animals because it interrupts the flow of genes between their isolated populations through the gametes.

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**Question 33:**

Bacteria have a simpler body plan when compared with human beings. Does it mean that human beings are more evolved than bacteria ? Explain your answer.

**Solution :**

Bacteria have simpler body plan when compared with human beings. Both of them have evolved differently. Bacteria can inhabit most of the unfavourable habitats such as hot springs, deep- sea thermal vents and the ice in Antarctica.

**Question 34:**

(a) Name the scientist who gave the theory of origin of life on earth. What is this theory ?

(b) How are those species which are now 'extinct' studied ?

**Solution :**

(a) The theory of origin of life on earth was given by J.B.S Haldane. He suggested in 1929 that life must have developed from the simple inorganic molecules (such as methane, ammonia, hydrogen sulphide, etc.) which were present on the earth soon after it was formed. He said that the conditions on earth at that time (including frequent lightning) could have converted simple inorganic molecules into complex organic molecules which were necessary for life. These complex organic molecules must have joined together to form first primitive living

organisms. Haldane also suggested from theoretical considerations that life (or living organisms) originated in the sea water.

(b) Those species which are now extinct are studied by studying their fossils which are found during the digging of earth.

**Question 35:**

What do you understand by the term 'evolution' ? State Darwin's theory of evolution.

**Solution :**

Evolution is the sequence of gradual changes that takes place in the primitive organisms over millions of year in which new species are produced. Darwin's theory of evolution is known as 'The Theory of Natural Selection'. It can be described as follows:

1. Within any population there is natural variation. Some individuals have more favourable variations than others.
2. Even though all species produce a large number of offspring's, populations remain fairly constant naturally.
3. This is due to the struggle between members of the same species and different species for food, space and mate.
4. The struggle for survival within populations eliminates the unfit individuals. The fit individuals possessing favourable variations survive and reproduce. This is called natural selection.
5. The individuals having favourable variations pass on these variations to their progeny from generation to generation.
6. These variations when accumulated over a long period of time, lead to the origin of a new species.

**Question 36:**

(a) Explain the terms 'analogous organs' and 'homologous organs' with examples.

(b) In what way are analogous organs evidence for evolution ?

**Solution :**

(a) Analogous Organs: Organs which performs similar function but are different in structure and origin. Example – wings of a bird and wings of an insect. Homologous Organ: Organs which have different functions but similar structure and origin. Example – fore arm of frog, lizard, bird and human.

(b) The presence of analogous organs indicates that even the organisms having organs with different structures can adapt to perform similar functions for their survival under hostile environmental conditions. Thus, the presence of analogous organs in different animals provide evidence for evolution by telling us that though they are not derived from common ancestors, they can still evolve to perform similar functions to survive, flourish and keep on evolving in the prevailing environment.

**Question 37:**

(a) Define 'speciation'. Explain how speciation occurs.

(b) Will geographical isolation be a major factor in the speciation of a self-pollinating plant species ? Give reason for your answer.

**Solution :**

(a) The process by which new species develop from the existing species is known as speciation. New species are formed when the population of same species splits into two separate groups which then get isolated from each other geographically by the barriers such as mountain ranges, rivers or the sea. The geographical isolation of the two groups of population leads to their reproductive isolation due to which no genes are exchanged between them. However, breeding continues within the isolated populations producing more and more

generations. Over the generations, the processes of genetic drift (random change in gene frequency), and natural selection operate in different ways in the two isolated groups of population and make them more and more different from each other. After thousands of years, the individuals of these isolated groups of population become so different that they will be incapable of reproducing with each other even if they happen to meet again. We then say that two new species have been formed.

(b) Geographical isolation will not be a major factor in the speciation of a self pollinating plant because it does not depend on other plants for its process of reproduction to be carried out.

**Question 38:**

(a) Define 'natural selection'.

(b) "Only variations that confer an advantage to an individual organism will survive in a population". Do you agree with this statement ? Give reason for your answer.

**Solution :**

(a) Natural selection is the process of evolution of a species whereby characteristics which help individual organisms to survive and reproduce are passed on to their offspring, and those characteristics which do not help are not passed on.

(b) Yes, only those variations that confer advantage to an individual organism will survive in a population. This will become clear from the following example. Suppose there is a population of red beetles in the green bushes and a colour variation arises during reproduction so that one beetle is now green in colour (instead of red). This variation offers advantage of survival because the green beetle can mix up with green bushes, it cannot be spotted and eaten up by a crow and hence its population will increase. If, however, the variation had produced a blue coloured beetle, then this colour could not offer any survival advantage because blue beetle in green bushes could be easily spotted by a crow and eaten by it.