

# Heredity And Evolution

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## Check Point 01

**Q. 1. State the unit of hereditary material found in all living organisms.**

**Answer:** The unit of hereditary material found in all living organisms is gene; Genes are the proteinaceous part present on the DNA (deoxyribonucleic acid - genetic material) and codes for all the characters expressed in any living organism.

**Q. 2. What is meant by variations found in a population?**

**Answer:** Genetic variations are the differences which are found in a population of sexually reproducing organisms. The degree by which the progeny differs from its parents generation is known as variation. These differences are caused when two sets of chromosome combined together to form a new set.

**Q. 3. Name the plant Mendel selected for his experiments on genetics.**

**Answer:** The plant selected by Mendel for his experiments on Genetics was **Pisum sativum**. The common name for this plant is sweet pea.

**Q. 4. What is meant by pair of contrasting characters?**

**Answer:** The pea plant studied by the Mendel has two contrasting traits of each and every character. Tall and dwarf are two contrasting traits of the character plant size similarly purple and white colour of the flower are the contrasting traits of the character flower colour. There were total 7 pairs of contrasting traits given by Mendel in Pisum sativum.

**Q. 5. Where are genes located in an organism?**

**Answer:** Genes are the smallest unit of inheritance. They contain the information which is required to express a particular trait. They are present on the chromosomes inside the nucleus of the cell.

**Q. 6. How is variation brought in the progeny in the sexually reproducing organisms?**

**Answer:** Progenies which are formed in sexually reproducing organisms by fertilisation of male & female gamete. As these gametes contains genetic information of two distinct individual organisms (one male & one female), their fertilisation will produce progenies with varied genome. This is how variations are produced in sexually reproducing organisms.

## Check Point 02

### Q. 1. What is the parameter which decides inheritance?

**Answer:** The process by which different characters are passed on from the parent to the progeny is known as inheritance.

The rule of inheritance of such traits in human being are related to the fact that both father and the mother contribute practically equal amounts of genetic material to the child. This means that each trait can be influenced by both paternal and maternal DNA. Thus, for each trait there will be two versions in each child

### Q. 2. Name two human traits which show variation?

**Answer:** As humans are sexually reproducing organisms all the traits show variation.

1. Different colour of eyes.



2. Free and attached earlobes are two variants found in human populations.



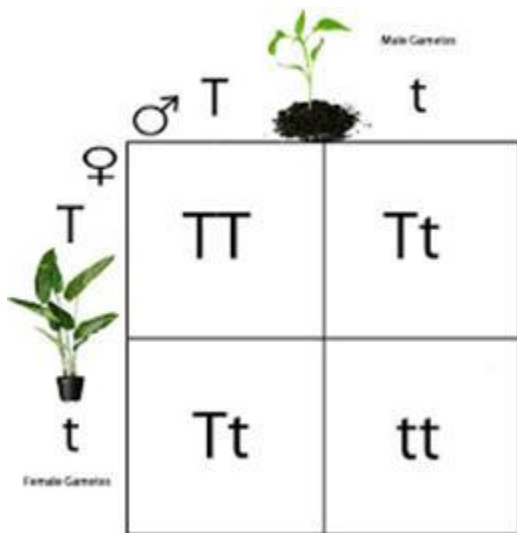
### Q. 3. Who is considered as the father of genetics?

**Answer:** Gregor Mendel is considered as the father of genetics as he gave various laws and explained the concept of inheritance and variation.

**Q. 4. What is a monohybrid cross?**

**Answer:** When a cross is conducted between dominant and recessive traits of only one character, then it is known as a monohybrid cross.

**Example:** The cross conducted between Dominant trait tall (TT) and recessive trait (tt), it resulted into all four heterozygous tall (Tt) in the F1 generation.



**Q. 5. Parent pea plants were crossed for contrasting traits, i.e. round and wrinkled seeds. The progeny obtained in F1 generation is Rr, RR, Rr and rr. Which of these are dominant and recessive traits?**

**Answer:** Tall plant (RR): dominant trait

Wrinkled seed (rr): recessive trait

From the above given progeny obtained in the F1 generation:

1 RR: dominant

2 Rr: dominant

1 rr: recessive

The ratio would be - 1:2:1

**Q. 6. How are traits expressed?**

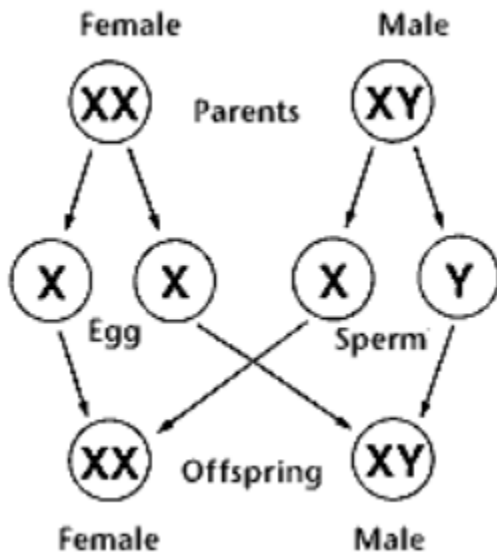
**Answer:** The trait are present on a single long thread of DNA, but as separate independent pieces, each called as chromosome. Thus each cell have two copies of each chromosome, one from male and female parent. It was observed that when two pairs of trait or characters were considered, each trait expressed itself independent of the other. Thus, Mendel was able to propose the law of independent assortment which says about independent inheritance of trait.

**Q. 7. Why do mice whose tails were surgically removed just after birth for generations, continue to produce mice with tails?**

**Answer:** The mice even after the removal of the tail after the birth is an acquired rate but the tail in the mouse is an example of inherited trait which means that even after cutting the tail inherited trait cannot be removed thus the mice continue to produce mice with tails.

**Q. 8. Write the sex of the baby that inherits Y-chromosome from the father.**

**Answer:**



The mother can only contribute one X chromosome to the sex of the baby while the father may contribute either an X or Y chromosome.

When the father contributes Y chromosome, the offspring has the chromosome set of XY which means the baby born is a boy.

### Check Point 03

**Q. 1. Give the difference between acquired and inherited traits with an example. How will you explain organic evolution?**

**Answer:**

<b>Acquired Trait</b>	<b>Inherited trait</b>
Acquired traits are the characters or traits which we acquire over our lifetime	inherited traits are the one we get from our parents.
Acquired traits can be altered.	Inherited traits are lifetime traits which cannot be changed (as it depends on our genome),

**Example:** If we cut the tail of the mice after the birth the trait acquired by the mice is the acquired trait but if the mouse is allowed to reproduce the offspring of the no tail mice will still have tail is an example of inherited trait.

**Q. 2. Evolution indicates the forever evolving life on the Earth. Give a statement supporting the above claim.**

**Answer:** Evolution is the process in all forms of life over generations and evolutionary occurs. Biological populations develop through genetic changes that correspond to changes in the organism observable traits.

Evolution indicates the forever evolving life on earth. Evolution assures the continuity of various species & organisms on earth.

The accumulation of variations over a period of time is evolution.

Example: In a field there are red and green beetle. The crows are flying over the field found red beetles in the field to be eaten which give green beetle an advantage over red beetles and more the proportions of green beetles in the population would be in the population will eventually results in evolution of species to fit the environment better.

Thus, Evolution indicates the forever evolving life on the earth

**Q. 3. How variation in a population leads to a survival advantage?**

**Answer:** Variation refers to the difference in the characteristic or traits among the individuals of a species.

Variation is beneficial to the species because:

1. It enables the organism to adapt themselves in changing environment.
2. It forms the basis of heredity.

3. It forms the raw materials for evolution and development of new species.

Thus accumulation of variations in a population led to population to adapt to the changes and the new needs. This provide survival advantage to the species

**Q. 4. Explain the term genetic drift.**

**Answer:** Genetic drift is a phenomenon more common in the small population which may lead to the accumulation of different changes which lead to the formation of different species.

The accidental survival of the beetles of one colour that changed the common characteristics of the resultant population So accidental change in the small population can change the frequency of some gene in the population example accidental red beetles get crushed by elephant while green survived led to genetic drift which change the colour of the population to green.

**Q. 5. Out of the following the traits like eye colour, height and physical strength which are genetically acquired.**

**Answer:** Genetically acquired traits are the ones which we inherit from our previous generation. They depend upon the genetic material. Of the given traits in the question **eye color and height are the genetically inherited traits** whereas **physical strength is the acquired trait**, the one acquired over a course of time.

**Q. 6. If your mother has pierced ears, will you inherit the trait? If not, why?**

**Answer:** In India almost all the girls have their ears pierced still we never see any girl born with her ears pierced already. It happens because the piercing is done on the body of the organism and no effect is caused on the genetic material. The traits we inherit depends solely on the genetic material of the parents and not on the physical features. Piercing is an acquired trait, not inherited one.

**Q. 7. What are the two causes of speciation between two population?**

**Answer:** The two causes of speciation are-

**(i) Genetic drift** -: If the DNA changes are severe enough, such as a change in the number of chromosomes, eventually the germ cells of the two groups cannot fuse with each other.

**(ii) Natural selections**:-If a new variation emerges in which females are only able to mate with few males due to their specific trait. This allow natural selection.

**Check Point 04**

**Q. 1. Define evolution.**

**Answer:** Evolution is the process by which newer types of organism are developed from the pre-existing ones through modification in them due to certain factors like environmental change.

**Example:** Humans evolved from the great apes.

**Q. 2. State the basis of classification of the organisms.**

**Answer:** Classification of organism is the arrangement of organisms into a series of group based on physiological, biochemical, anatomical or other relationships.

The more closely two species are related, the more characteristics they will have in common. And the more closely they are related the more recently they will have had their common ancestors.

There are various categories of classification. These are:-

kingdom, phylum/division, class, order, genus, species.

**Q. 3. Describe the phenomenon of homology.**

**Answer:** According to Darwin, more closely related species have evolved from a common ancestor. The characteristics and fundamentally similar structures suggest the possibility of a common ancestor.

Such a phenomenon of similarity of structures due to common ancestry is known as homology. Example the forelimbs of vertebrates.

**Q. 4. Describe the phenomenon of homology.**

**Answer:** The homologous organs are the two organs which have the same origin but perform a different function and the phenomenon is known as homology.

Characteristics of Homologous organs are given below:

1. Similar in basic structure and have the same developmental origin.
2. Have different functions in different organisms.
3. Their similarity is due to common ancestry.

Examples of homologous organs are the arm of a human, the wing of a bird or a bat, the leg of a dog and the flipper of a dolphin or whale. They all have the same origin but perform a different function.

**Q. 5. Give examples of analogous organs.**

**Answer:** Analogous organs are the organs which have a different origin but perform the same function.

Examples of analogous organs are wings of insects and the wings of birds. Both originate from different parts but perform the same function i.e. flying.

**Check Point 05**

**Q. 1. How are evolutionary relations between organisms traced?**

**Answer:** The evolutionary relationship can be traced by observing the following things:-

(i) Homologous organs:- homologous organs are the one which have same structure performing different functions. It shows the same ancestral history.

(ii) Analogous organs:- organs which have different structures performing the same function. It shows convergent evolution

(iii) Fossils:- fossils are dead remnants of plants & animals living on earth far back. Fossils provide us with a way to peep into the window of history and to learn a lot about them. Fossils play a major role in tracing evolutionary relationships.

**Q. 2. In terms of evolution, what is the significance of homology between a human hand and a wing of a bird?**

**Answer:** Homologous organs are the organs which have the same origin but different function.

Hand of a human being and the wing of a bird originate from the same part of the body but perform a different function. The human hand is used for various functions like holding, writing, etc while the wing of a bird is used for flying.

**Q. 3. 'Older fossils are found closer to the surface of deep in the Earth strata'**

**Answer:** Fossils are formed when dead organisms get buried inside the earth crust or in deep sea levels. During this long course of time, a great number of layers will be formed over them. So the organisms who died earlier will be buried deeper than the newer ones.

**Q. 4. Evolution of cauliflower, broccoli, cabbage, red cabbage has occurred from wild cabbage. Is this an example of natural selection or artificial selection?**

**Answer:** Evolution of cauliflower, broccoli, cabbage red cabbage has occurred from wild cabbage. It is an example of artificial selection.



It is so because the evolution of all these varieties from wild cauliflower was largely dependent on the choice of a farmer who was growing it. If a farmer wants to grow short leaf plant, he opted cabbage. If they wanted to grow a flower shaped plant, they opted broccoli or cauliflower.

**Q. 5. What is molecular phylogeny?**

**Answer:** Phylogeny is a branch of biology that deals with the study of evolutionary relationships of various organisms.

MOLECULAR PHYLOGENY is that sub-branch of phylogeny that deals with the study & detailed analysis of molecular composition of organisms (the study of various DNA sequences) i.e. their genetic material to trace evolutionary relationships.

**Q. 6. To where can the earliest members of the human species be traced to?**

**Answer:** Homo erectus was considered as the first human type species which has an origination in Africa.

**Q. 7. Which tools can be used for tracing the evolutionary relationships of human evolution?**

**Answer:** Evolutionary relationships of humans can be traced by observing the following things:-

**(i) Homologous organs:-** homologous organs are the one which has the same structure performing different functions. It shows the same ancestral history.

**(ii) Analogous organs:-** organs which have different structures performing the same function. It shows convergent evolution

**(iii) Fossils:-** fossils are dead remnants of plants & animals living on earth far back. Fossils provide us with a way to peep into the window of history and to learn a lot about them. Fossils play a major role in tracing evolutionary relationships.

**(iv) Molecular structure:-** by studying the molecular structure of organism i.e. its DNA sequences one can trace its relationships with other organisms. This is known as molecular phylogeny.

**Q. 8. Write the scientific name imparted to the human species.**

**Answer:** The scientific name given to human species is Homo sapiens.

## Chapter Exercise

**Q. 1. Variations are the basis of heredity. Explain.**

**Answer:** Variation is the basis of heredity.

When an organism reproduce through sexual reproduction copying of DNA take place which is not accurate, thereby causing variations. If these variations are favourable they help individuals to survive and pass these variations to their progeny. Variation acquires any trait in its genome, during a large course of time, it gets transmitted to its progeny. This forms heredity.

**Q. 2. Write the scientific term for 'Science of heredity and variation.'**

**Answer:** Evolution is the scientific term used for 'Science of heredity and variation.'

**Q. 3. Name two human traits which show variation.**

**Answer:** Almost all the human traits show variation. Variations occur in the generations of sexually reproducing organisms. The two human traits that show variation are as follows:

- i) Ear lobes: free and attached earlobes, is closely attached to the side of the head in some of us and not in others. Free and attached are two variants found in human being.
- ii) Eye color: from black to brown to blue to hazel brown, there are so many shades of eye colours found in the human population.

**Q. 4. Give the scientific name of the plant used by Mendel in his genetical experiments.**

**Answer:** The plant used by Gregor Mendel for his experiments on genetic was a sweet pea. The scientific name of the plant is **Pisum sativum**.

**Q. 5. When is a recessive trait able to show up?**

**Answer:** When di-Hybrid cross is conducted between two heterozygous parents with contrasting traits then it produces offspring which are 3 dominant and 1 recessive.

**Tt × Tt = TT, Tt, Tt, tt**

The ratio would be - 1:2:1

**Q. 6. What is the human being with XY pair of chromosomes called?**

**Answer:** The human being with XY pair of chromosomes is called a male. The sex of the human offspring is determined by the set of chromosomes inherited from father.

**Q. 7. Which among the males and females are homogametic?**

**Answer:** XX: female

XY: male

Human females have two X chromosomes whereas the human male has one X and one Y chromosome.

Thus females are homogametic

**Q. 8. Define the term 'Natural Selection' given by Charles Darwin.**

**Answer:** Natural selection is a nature's phenomenon in which the species which inherits variations and has better chances of survival are allowed to reproduce and produce a large number of offsprings. The term was given by Charles Darwin.

**Q. 9. According to the evolutionary theory, what leads to the formation of a new species?**

**Answer:** According to the evolutionary theory, the new species are formed as a result of variation.

Variation is a process in which a progeny differs from its parent generations. The ability to adapt to the external environment come because of variation and also help in the formation of new species.

**Q. 10. Choose the one term from the following which differs from the other three.**

**Broccoli, wild cabbage, Cauliflower, and Kale.**

**Answer:** Wild cabbage is the odd term of the given four terms.

Wild cabbage is the ancestral plant from which after artificial selection gives broccoli, cauliflower, and kale.

**Q. 11. Which organs in two animals indicate that they are derived from a common ancestor?**

**Answer:** When different animals which have organs originated from the same part of the body but function differently then they are known as homologous organs.

**Example:** wings of a bat, wings of birds, dolphin, flipper and human arm are the homologous organs. They all are derived from the same set of bones which are humerus, radius, ulna, carpals, metacarpals, and phalanges. But all of them function differently.

**Q. 12. In which animals, the feathers do not fulfill the purpose of flying?**

**Answer:** Penguin. In penguin, the feathers present are mainly for the purpose of keeping the body of the animal warm. They can jump with the help of their feathers but cannot fly.

**Q. 13. Give a paleontological evidence of evolution.**

**Answer:** Paleontology is the study of fossils. Fossils can be anything from teeth, bones, shells to even the footprints of animals or outline marks of leaves.

**Q. 14. (i) Name the carrier of heredity.**

**(ii) Mention the practical utility of genetics.**

**Answer: i)** Gene is the carrier of heredity. Genes are present on the chromosomes which code for different characters. Genes play a very important role in passing the information from one generation to another.

**ii)** Genetics is used for sex determination in humans. E.g.- It is important in finding the parent of the child as the child will have one set of similar genes as that of parents.

**Q. 15. Genes and chromosomes have similar behaviour. Justify.**

**Answer:** Genes and chromosomes function similarly as genes are a part of the chromosomes. Chromosomes are the coiled DNA (deoxyribonucleic acid) and are proteinaceous in nature. Gene is the smallest unit of inheritance.

**Q. 16. Among all the chromosomes, what is different about a sex chromosome?**

**Answer:** The 22 pair of chromosomes except for the pair of sex chromosomes are known as autosomal chromosomes or autosomes.

They are passed on to the progeny and determine various characters such as height, eye colour, complexion, bone structure etc where as the sex chromosomes help to determine the sex of the baby. In humans, the XX chromosome codes for a baby girl where as the XY chromosome codes for a baby boy. All other chromosomes are identical in a human but sex chromosomes are different from one another.

**Q. 17. Write down the four ways in which an individual with a particular trait may increase in a population?**

**Answer:** A population accepts those traits which are helpful for the survival of that specific population. Whenever a new trait gets introduced in a population which can help them increase their number, they try to adapt to that particular trait.

There are four ways in which this can do. These are:-

(i) Natural selection: Natural selection may work differently in different location. Due to this, variations may occur which lead to the formation of a new species.

(ii) Geographical isolation: is the isolation of population by physical barriers such as stretches of water, mountain, etc.

(iii) Dna changes: variations during DNA copying often leads to the formation of a new species

(iv) genetic drift: Over generations, genetic drift may lead to the accumulation of different changes which leads to the formation of a new species.

**Q. 18. Define variation in relation to a species.**

**Answer:** Variation is the degree by which offspring differs from its parent generations.

**Q. 19. How does environment determine the sex of a newborn in some organisms?**

**Answer:** In almost all the organisms like humans, birds, lizards etc the sex of the newborn depends upon the chromosomes inherited from the parents. But in few species of reptiles like turtles and crocodiles, the sex of the new born depends upon the environment just after fertilization has taken place. In these organisms, the temperature at which the eggs are incubated determines the sex of the offspring. Low temperature after fertilization produces one sex and slightly high-temperature results in another.

**Q. 20. Give the role of genes in evolution.**

**Answer: Evolution** is a result of a change in the genetic material from generation to generation. These changes can occur in many ways, one of which can be a mutation.

Mutations are the random changes in the genetic codes of an organism. No genes mean no mutations and no mutations means no evolution. Hence, genes are very important in the process of evolution.

**Q. 21. Give reasons, why the hybrids are generally found to be superior to their parents.**

**Answer:** During hybridization, the two parents taken are of the superior class i.e. they are healthy, physically as well as genetically, we have the best genes so that the hybrid produced has the best characters of the two parents of different species.

**Q. 22. (i) A gene can express more than one trait. What gives rise to different expressions?**

**(ii) When a true breeding pea plant which has yellow seeds is pollinated by a plant that has green seeds, all the F<sub>1</sub> plants have yellow seeds. What might have been the allele for yellow seeds (tell whether it was dominant or recessive / heterozygous or homozygous)?**

**Answer: i)** A gene codes for a character which has two or more contrasting traits. If we see in the sweet pea plant taken by Mendel for his experiments on genetics, a single gene codes for the height of the pea plant. It has two different traits governed by two different alleles T and t. The combination of these two alleles codes for the different type of height of the pea plant. TT or Tt codes for tall plant whereas tt codes for the dwarf plant.

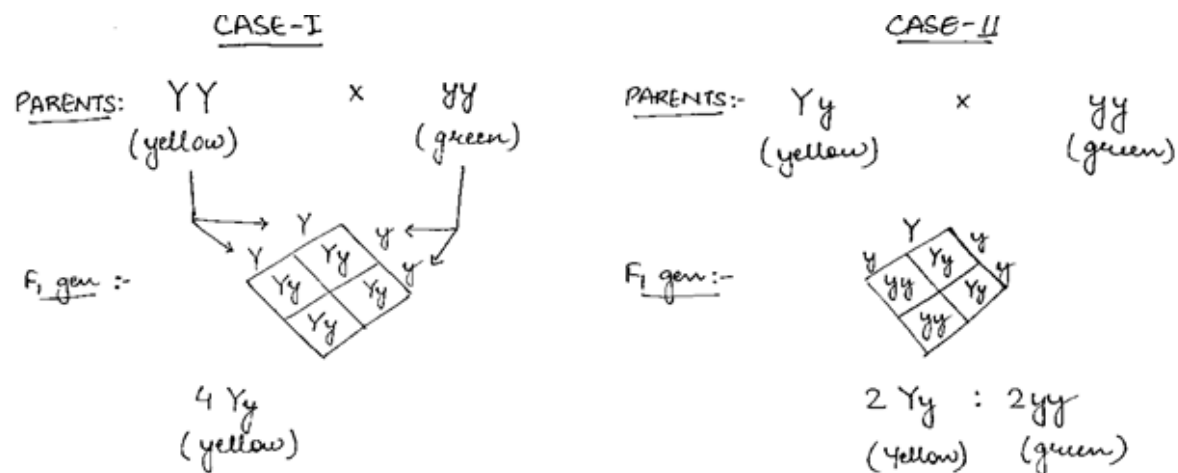
**ii)** To determine the alleles of the yellow seed. To show whether it is homozygous or heterozygous, dominant or recessive.

YY/Yy codes for yellow seeds of the true breeding pea plant

yy codes for green seeds of another pea plant

When a cross is conducted between true breeding pea plant which has yellow seeds and another pea plant which has green seeds and the first generation produced has yellow seeds. The test conducted to determine the allele of the parent plant is known as test cross.

Below given are the crosses to check the two possibilities.



By seeing the cases we can say that the yellow colour of the seed of the pea plant is homozygously dominant i. e. YY.

**Q. 23. What do you understand about the independent inheritance of traits?**

**Answer:** It is explained by Mendel in the form of Law of Independent Assortment. This law states that when two pairs of traits are combined in a hybrid, segregation of one pair

of characters is independent of the other pair of characters. It was based upon the observation in the dihybrid cross.

**Q. 24. An animal (guinea pig) having black colour is crossed with guinea pig having the same colour. They produced 100 offsprings, of which 75 were black and 25 were white.**

**Find out**

**(i) What is the possible genotype?**

**(ii) Which trait is dominant and which is recessive?**

**Answer:** Let BB/ Bb be the dominant color (black) of guinea pig and bb be the recessive trait which codes for white color of guinea pig.

**i)** The possible genotype of the parent pigs is Bb i.e. the animals are heterozygously dominant as they produced offspring in the ratio of **3: 1**. The 25 of the black pigs have the gene BB whereas the rest 50 of the black pigs have genes Bb and the white pigs have bb.

**ii)** The trait coding for black color is dominant while the one coding for white is recessive.

**Q. 25. A cross was made between pure-breeding pea plants one with round and green seeds and the other with wrinkled and yellow seeds.**

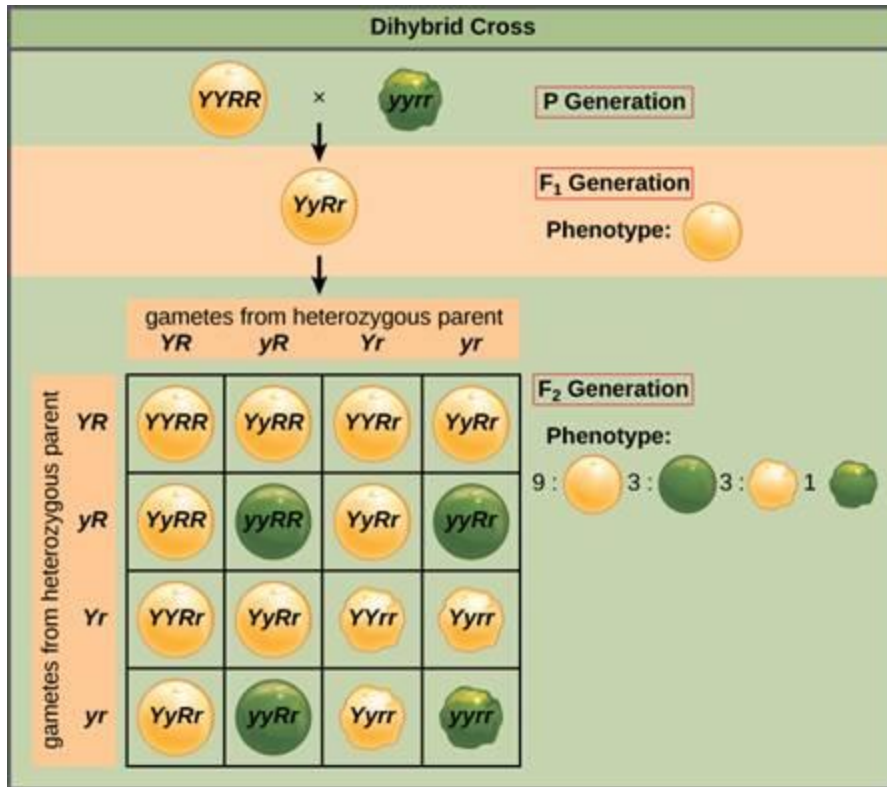
**(i) Write the phenotype of F 1 progeny. Give a reason for your answer.**

**(ii) Write the different types of F 2 progeny obtained along with their ratio when F 1 progeny was selfed.**

**Answer: i)** On crossing pure-breeding pea plants one having round and green seeds and the other having wrinkled and yellow seeds we observe that all the F1 generation plants have round and yellow seeds with the genotype RrYy.

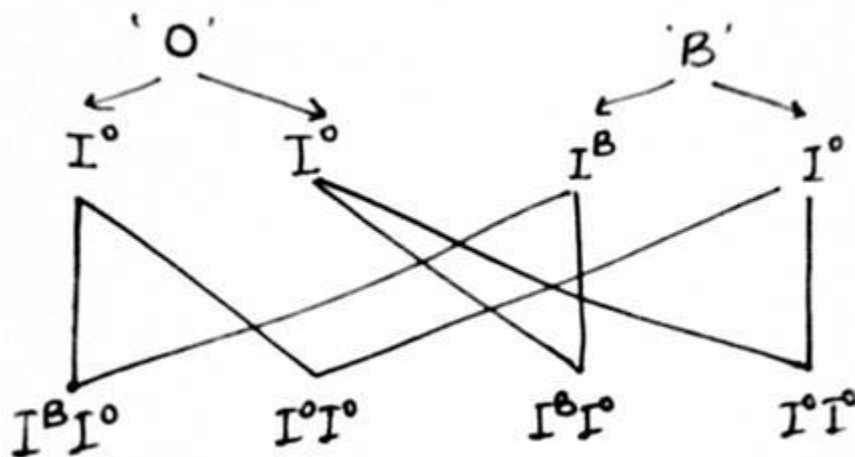
**ii)** On selfing the plants obtained on the F1 generation i.e. the plant with the genotype RrYy we obtain 16 type of offsprings in the F2 generation. Their phenotypic ratio is as follows:

9:3:3:1 (round yellow 9: round green 3: wrinkled yellow 3: wrinkled green 1)



**Q. 26.** A man having blood group 'o' (I<sup>o</sup> I<sup>o</sup>) marries a woman with blood group 'B' (I<sup>B</sup> I<sup>o</sup>). What will be the blood group of their children?

**Answer:** When a man having blood group A marries a woman having blood group B, two types of blood groups can be observed in their children. The possible blood group options are B and O in the ratio 1:1



**Q. 27.** How are contributions of Darwin different from that of Mendel?



**Answer:** Mendel learned about genetics. He figured out how traits carried by a parent would be passed onto their offspring. He didn't figure out that all organisms come from a single source through evolution and the formation of new species.

Darwin learned that where certain traits are passed from the parents to offspring. This results in variations in individuals that are passed onto the succeeding generations.

**Q. 28. Explain the development/origin of the theory of the chemical origin of life.**

**Answer:** Miller & Urey has performed an experiment to the proof chemical origin of life. They postulated that first organic cell would have been produced from inorganic (chemicals) substances.

They took a glass jar and tried to create an internal environment same as that of earth's environment billions of trillions year ago.

In a sterile jar they insert methane ( $\text{CH}_4$ ), hydrogen( $\text{H}_2$ ), water ( $\text{H}_2\text{O}$ ) & ammonia( $\text{NH}_3$ ). They heat the jar to increase its temperature to match up the earth's temperature million years back & also increases the pressure. They even provided some electric current to that jar. After some days, the solution starts turning pink because of the formation of some organic compounds.

**Q. 29. (i) How do we get an idea about the extinct or previously existing organisms?**

**(ii) What are connecting links? Give one example.**

**Answer: i)** To know about the extinct or previously existing animals we can look at the fossils. Fossils and not just the buried teeth, skull and bones but can also be the footprints of any animal are the outlines of the fallen leaves or plants which under the pressure of the layers of soil becomes preserved as fossils. The study of fossils is known as paleontology.

**ii)** Connecting links are the organisms which behave as a link or connection to two different classes or species.

**Example:** One very common example is of Archaeopteryx. It is a connecting link between

Aves (birds) and reptiles. It has common features of both the classes. Some features of birds include that they can fly but they also have teeth and tail like the ones present in the reptiles.

# Archaeopteryx

Reptiles & Birds



**Q. 30. How do homologous organs help in determining the evolutionary trend?**

**Answer:** Homologous organs are the organs present in different organisms which have the same origin but perform different functions. Examples of Homologous organs include wings of bat, wings of birds, dolphin, flipper and human arm. By observing them we can conclude that they all have the same origin and during the course of evolution they started performing different functions as per their needs and requirements. They all are derived from the same set of bones which are humerus, radius, ulna, carpals, metacarpals and phalanges but now all of them function differently.

**Q. 31. (i) Give an example which shown that organs of features may be adapted to new functions during the course of evolution.**

**(ii) What is the essence of the idea of evolution?**

**Answer: (i) A.** Organs or features can be adopted to new functions during evolution Example-Feathers were developed from providing insulation in cold Weather (in Dinosaurs) but in birds they were adopted for flight.

**B.** "Older body design are not efficient". Example-simplest form like Bacteria, which inhabits most inhospitable habitat like, hot springs, deep sea, thermal vents and ice in antarctica.

**(ii)** The study of classification of various organisms gives us an idea about the evolutionary history of the organisms, which have certain similar characteristics are placed in one group. It can be thus concluded that the organisms placed in one group may have evolved from common ancestors and may have a common evolutionary history.

**Q. 32. How do variations occur in offspring? Explain.**

**Answer:** The variation are produced when the new generation reproduces, The second generation produced will have variations that they inherit from the first generation.

The organism can reproduce through two mode of reproduction

(i) Asexual reproduction.

(ii) Sexual reproduction.

In Asexual reproduction is found by the division of parent organism into daughter nuclei. In case of bacteria, bacteria get divided into two individuals, each of them will divide again and give rise to two other organism. The four individual bacteria generated would be very similar with minor difference that occurred due to small inaccuracies in copying of DNA.

In Sexual reproduction involves the fusion of gametes. The offsprings show variations from their parents due to crossing over and exchange of gene segments. They are not exact copies of their parents, due to environmental factors certain favourable variations are also produced. Due to production of variations, sexually reproducing animals show very quick evolution.

**Q. 33. How do genes control the traits? Explain in detail.**

**Answer:** Gene is that active part of DNA which can express itself by forming proteins. All the traits found in any organism is because of the proteins produced by genes. Thus genes are very important in controlling the traits of an organism. The total appearance of an organism is controlled by its genes. A gene is the one which decides whether the organism will be tall or short, what is going to be its skin color or eye color, presence or absence of body hairs is also decided by the genes only.

**Q. 34. Explain how the variations get accumulated.**

**Answer:** The accumulation is the variations of gradual changes which takes places in primitive organisms over millions of years and new organisms are formed.

There are four ways in which this can do. These are:-

(i) Natural selection: Natural selection may work differently in different location. Due to this, variations may occur which lead to the formation of a new species.

(ii) Geographical isolation: is the isolation of population by physical barriers such as stretches of water, mountain, etc.

(iii) Dna changes: variations during DNA copying often leads to the formation of a new species

(iv) Genetic drift: Over generations, genetic drift may lead to the accumulation of different changes which leads to the formation of a new species.

**Q. 35. Give an account of the experiment performed Miller and Urey in 1953.**

**Answer:** Miller & Urey has performed an experiment to prove chemical origin of life. They postulated that first organic cell would have been produced from inorganic (chemicals) substances.

They took a glass jar and tried to create an internal environment same as that of earth's environment billions of trillions year ago.

In a sterile jar they insert methane ( $\text{CH}_4$ ), hydrogen ( $\text{H}_2$ ), water ( $\text{H}_2\text{O}$ ) & ammonia ( $\text{NH}_3$ ). They heat the jar to increase its temperature to match up the earth's temperature million years back & also increases the pressure. They even provided some electric current to that jar. After some days, the solution starts turning pink because of the formation of some organic compounds.

This experiment gave some evidences of formation of life from some inorganic/chemical sources.

**Q. 36. Is it true that evolutionary relationship is linked to classification? Explain with an example.**

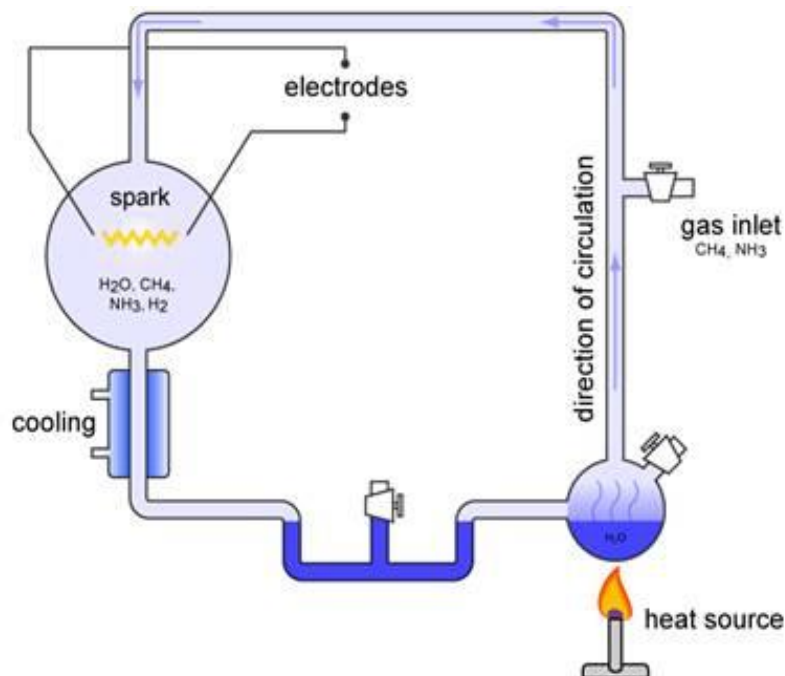
**Answer:** Yes, evolutionary relationship is linked with classification. Organisms which are more closely related i.e., they have some ancestral history are placed comparatively more closer than species which are not related.

For e.g.- humans & apes are placed in the same family-

Hominidae during classification.

Similarly, lion, cat & tigers are also placed in the same family- Felidae.

It is so because humans & apes and cat; lion & Tigers have common ancestral histories. They all are inter-related. But there is no relation between humans, apes & cat, lion & tigers that is why they are placed in different families.



**Q. 37. Give a brief idea of the formation of the fossil.**

**Answer:** Fossils are remaining parts of organisms found in deep Earth's crust who died million years ago.

Formation of the fossil is a very complicated yet interesting process. When an organism dies due to any reason (may be some calamity like earthquake or tsunami or flood or even natural death), its body gets buried inside the earth's crust or even deep sea level. The soft tissues of that organism get decomposed by various bacteria or other organisms but its hard tissues like bones/teeth etc remained un-degraded. Moreover, due to the high pressure inside the crust, they become more hard and tough. Over a long period of time, a lot of layers will get formed over them and they will get deeper & deeper. During paleological researches when these layers are deep drugged, these remnants were discovered in the form of fossils.

So this is how fossils are formed.



**Q. 38. How does comparing DNA of different species help in tracing evolutionary relationship?**

**Answer:** Tracing evolutionary relationships between organisms is called as phylogeny while studying structures of various DNAs to establish evolutionary relationships between them is called as, while studying structures of various DNAs to establish evolutionary relationships between them is called as molecular phylogeny.

The sequence of base pairs in a DNA molecule decides the characteristics of an organism. A slight change in this sequence can bring very large changes in certain organisms.

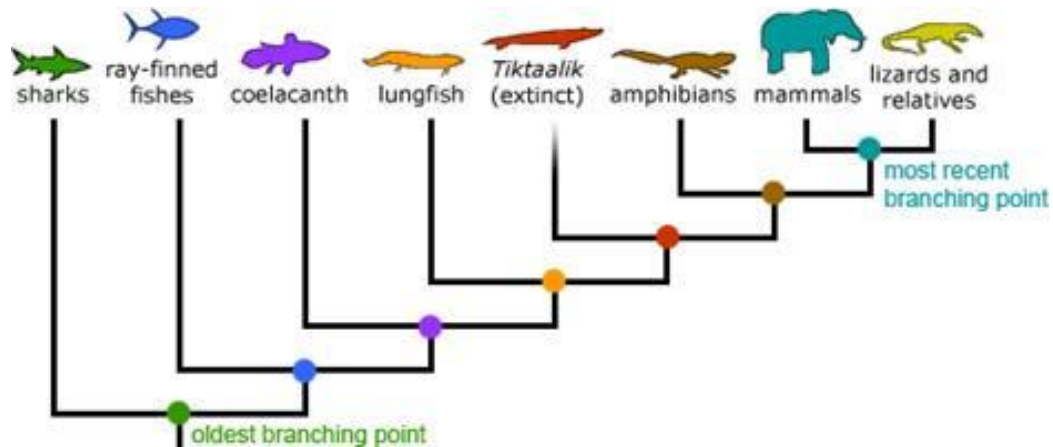
For e.g. - DNA of Homo sapiens (i.e. humans) are 99.9% same. That is, only a 0.1 % difference in humans' DNA can create so many variations. Similarly, population of different unrelated species is very different in their molecular organization too.

DNA of humans has some similarity with DNA of apes, and due to this reason, it is assumed that they might have some common ancestors.

**Q. 39. 'There is no real progress occurring in the concept of evolution. 'Explain.**

**Answer:** Evolution is shaping of various diversities into its best form. It should not be equated with progression. Evolution is a different concept from progression. Let us take an example of a big tree with lots of branches in it. Each branch has a sub-branch. Similarly, diversity is like that tree, which has a lot of organisms in it. All these are inter-related because one is evolved from other and will further evolve to form a new species. But just like in that tree, as all the branches are special & equal, all these species or organism are special and unique in its own way.

It is not like that if species B gets evolved from species A, organisms of species A will become extinct or they weren't good enough. It's just that species A was unique in its own way & organisms of species B are good in its own way.



All these species are totally different & all of them are evolved in different time courses. But all of them are considered equal & are placed on same level irrespective of their evolutionary time.

Thus we can say that evolution & progression are two unrelated terms.

**Q. 40. During a science lecture on evolution and inheritance, Amit got confused and went to clear his doubts. He asked, if characters can be passed to the future generation, then why does not he have the tattoo that his mother has on her arm. The teacher smiled and told him about inherited and acquired characters.**

- (i) What are inherited and acquired characters?
- (ii) The tattoo on the arm of Amit's mother was not present on Amit's arm. Give a scientific reason.
- (iii) What values are shown by Amit?

**Answer: (i) INHERITED TRAITS:-** characters which an organism get through its parents in his genome. They are lifetime traits & cannot be altered.

**ACQUIRED TRAITS:-** traits which we acquire or generates in our whole life time. They are inheritable because they are not related to our genome.

**(ii)** the tattoo is an acquired trait which Amit's mother has done in during her lifetime. This trait hasn't affected her genome & thus is inheritable. Due to this reason, Amit doesn't have that tattoo which her mother had.

**(iii)** Amit is a curious child, who doesn't hesitate in asking his doubts. It is a very good quality of Amit which will help him in taking decisions without any doubt or unclarity.



Moreover, he used to be a keen observer who has noticed the presence to tattoo on his mother's arm and absence of that tattoo on his arm.

**Q. 41. After attending a class lecture on evolution, Katy came home and gathered photographs of all her possible relatives and grandparents. Afterward she made a family tree using those photographs in which she was surprised to see her resemblance to most of her relatives and grandparents.**

- (i) Why was there resemblance seen by Katy to most of her relatives?**
- (ii) What are the laws of inheritance? Name them.**
- (iii) What values are shown by Katy?**

**Answer: (i)** There is a resemblance in most of the photos of her relatives because they had inherited the same genes with slight variations from their parents.

**(ii)** Gregor Mendel has given laws of inheritance which explains the passing of characters from parents to their progenies.

There are 3 laws of inheritance. These are:-

- a) The **law** of dominance
- b) The **law** of segregation
- c) The **law** of independent assortment

**(iii)** Katy is a practical girl. She believes more on practical approaches that is why, after studying evolution & inheritance, she tried to find out its reality by observing it in her own family.

## **Challengers**

**Q. 1. According to the evolutionary theory, the formation of a new species is generally due to**

- A. Sudden creation by nature**
- B. Accumulation variations over several generations**
- C. Clones formed during asexual reproduction**
- D. movement of individuals from one habitat to another**

**Answer:** Charles Darwin has given a theory of Natural selection & survival of the fittest which states that evolution is a slow process in which organisms get adapted to the present day environmental conditions.

**Q. 2. What determines the sex of a child?**



- A. Chromosome content of the ovum
- B. Chromosome content of the sperm
- C. Number of days between ovulation and fertilization
- D. Number of days between fertilization and implantation

**Answer:** XX: mother

XY: father

The mother always contributes one X chromosome to the sex of the baby while the father may contribute either an X or Y chromosome. When the father contributes Y chromosome, the baby born is a boy as the set of chromosome he will have would be XY and, if the father contributes X chromosome, the progeny will be a baby girl.

**Q. 3. When a breed of cattle with red coats is crossed with the same breed with coats, the offspring all have coats with a mixture of red and white hairs, a condition called roan. If roan cows were crossed with a red-coated bull, the theoretical ratio of the offspring would be**

- A. all red
- B. all roan
- C. 1-red: 1 roan
- D. 3 red: 1 roan

**Answer:** Let red coat be RR (dominant) & white coat be rr (recessive).

In F1 generation: - RRx rr = Rr (roan)

In F2 generation: - when roan (Rr) is mated with red (RR)

Rr x RR

RR	RR
Rr	Rr

Therefore the ratio will be - RR: Rr (Red: roan) = 1:1

**Q. 5. Which statement about the genotypes of organisms is correct?**

- A. Dominant alleles are only found in homozygotes
- B. One recessive allele always causes a recessive phenotype.
- C. Recessive phenotypes must be homozygous
- D. The dominant phenotype must be heterozygous

**Answer:** Allele which can express themselves in heterozygous conditions are dominant alleles while which does not are recessive allele.

Due to this reason, recessive allele is able to express themselves in a homozygous condition only.

TT has a phenotype of tall height & Tt also has a phenotype of tall height but tt is for short height.

**Q. 6. A farmer saves the seeds from his best maize crop plants to sow for next year's crop.**

**This is an example of**

- A. artificial selection**
- B. genetic engineering**
- C. natural selection**
- D. variation**

**Answer:** In this situation, the farmer has chosen the best crop seeds on its own and because of this next year a greater production will be of those seeds. So it is an example of artificial selection.

**Q. 7. What is a result of natural selection?**

- A. Dogs that are friendly to humans**
- B. Grapes that contain no seeds**
- C. Mosquitoes that are resistant to insecticides**
- D. Onion crops that have a pleasant taste**

**Answer:** It is a general observation that when we start using insecticides against mosquitoes, initially their population diminishes but later on they become resistant to it and there is no effect of those chemicals on them. It is because of Natural selection in which the resistant mosquitoes are selected by nature & thus are able to produce more progenies.

**Q. 8. Which statement describes an example of artificial selection?**

- A. It has been found that some strains of bacteria produce antibiotics**
- B. It is common practice to mate bulls with cows that produce the most milk**
- C. It is possible to control caterpillars on food crops by releasing small wasps which lay their eggs on caterpillars and kill them**
- D. Mosquitoes have developed strains that are resistant to insecticides**

**Answer:** Options A, C & D are an example of natural selection, where the organisms have adapted themselves to the changing environmental condition.

While option B is an example of artificial selection where good milk producing progenies are developed after human interference.

**Q. 9. A recessive homozygote is crossed with a heterozygote of the same gene. What will be the phenotype of the F<sub>1</sub> -generation?**

- A. All dominant**
- B. 75% dominant, 25% recessive**
- C. 50% dominant, 50% recessive**
- D. 25% dominant, 50% heterozygous, 25% recessive**

**Answer:** Let us take  $tt$  as homozygous recessive &  $Tt$  as heterozygous dominant. So the cross will be  $Tt \times tt$ .

The progenies in F<sub>1</sub> generation are –

Tt	tt
Tt	tt

So  $Tt$  (dominant phenotype):  $tt$  (recessive phenotype) = 1:1

**Therefore, 50% dominant & 50% recessive.**

**Q. 10. The genotype of the height of an organism is written as  $Tt$ . What conclusion may be drawn?**

- A. The allele for height has at least two different genes**
- B. There are at least two different alleles for the gene for height**
- C. There are two different genes for height, each having a single allele**
- D. There is one allele for height with two different forms**

**Answer:** Allele are different forms of same gene. If genotype is showing  $Tt$ , it means that there are at least 2 allele for the gene of height.

'T' for tall height & 't' for short height.