Heredity

Improve your learning

Q. 1. What are variations? How do they help organisms? (AS1)

Answer :

Variation can be defined as the differences among individuals within a same species which develops due to the mixing and assortment of genes of the parents thatis passed onto the offspring's. This helps in the individualism of any organism from the other organisms of same species or within a community.

Q. 2. One student (researcher) wants to cross pure tall plant (TT) with pure dwarf (tt) plant, what would be the F1 and F2 generations? Explain. (AS1)

Answer :

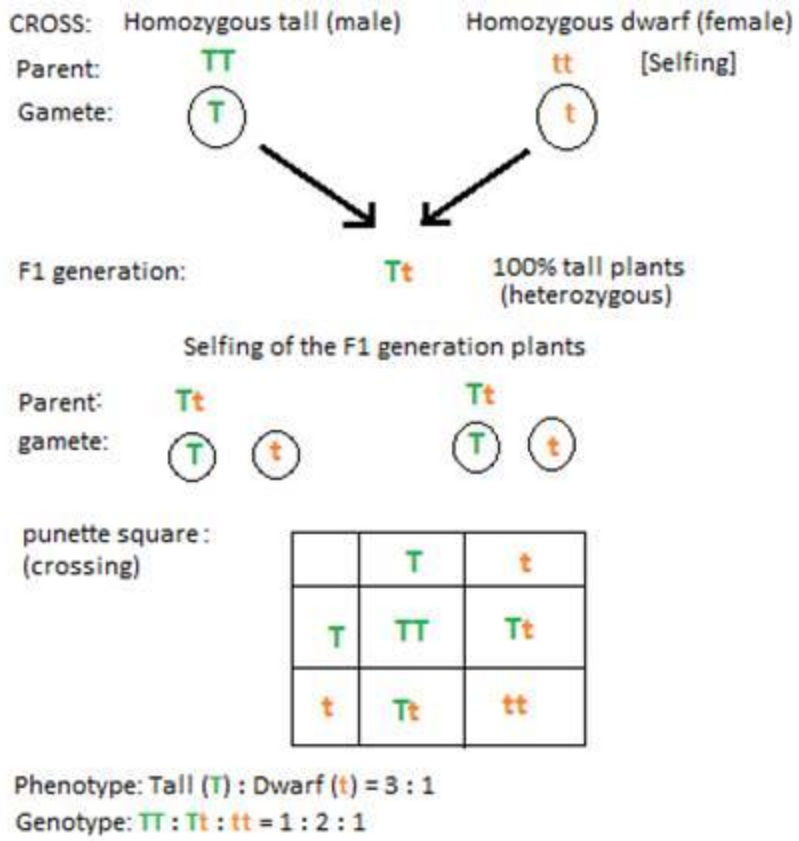
FIRST FILIAL GENERATION:

The features in the first filial generation after a cross between a homozygous female and a heterozygous male for a single locus, say height, produces all heterozygous tall plants.

SECOND FILIAL GENERATION:

In the second generation the heterozygous tall plants were crossed which produced 25% homozygous tall and dwarf plants each and the remaining 50% heterozygous tall plants.

This shows that the two alleles T and t can assort independently and the recessive trait appears back in the F2 generation whose expression had been masked in the F1 generation



Q. 3. One experimenter cut the tails of parent rats, what could be the traits in offsprings? Do the daughter rats contain tails or not? Explain your argument. (AS1)

Answer : Yes, the daughter rats would contain tails as the cut tails of the parents were acquired characters and not inherited. Thus, when the cut is introduced to a rat's tail the genetic information is not hampered neither it is changed so the daughter rats will be normal.

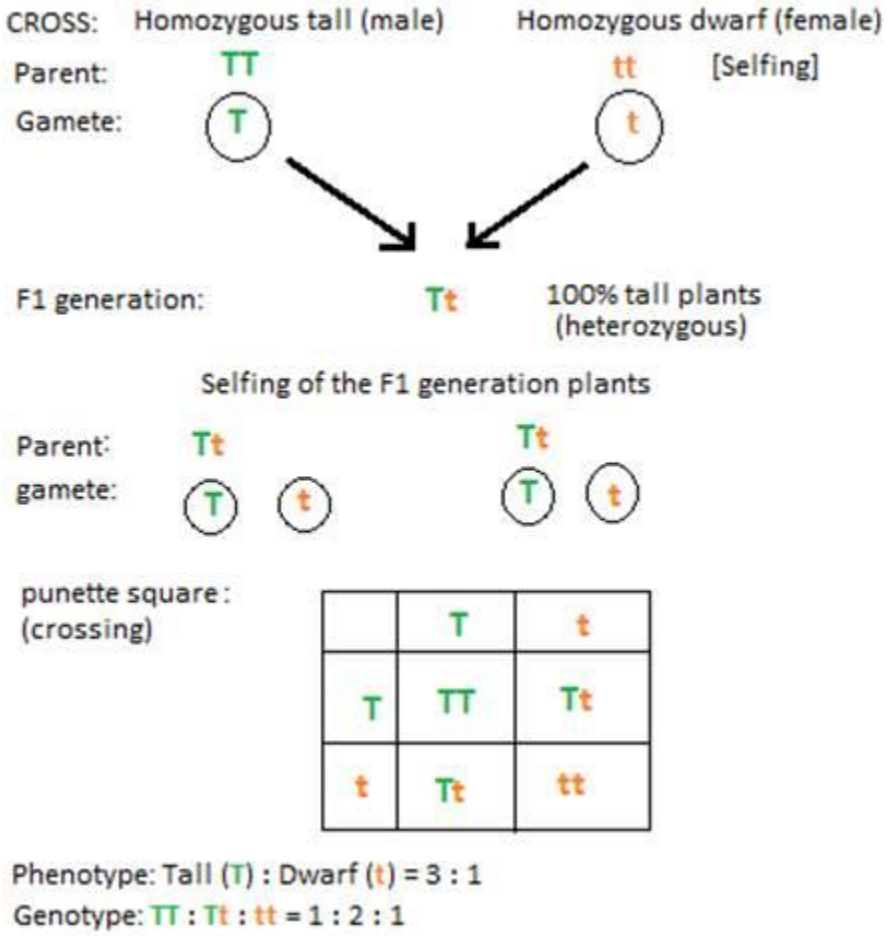
Q. 4. In a mango garden, a farmer saw one mango tree with full of mango fruits but with a lot of pests. He also saw another mango tree without pests but with few mangoes, But the farmer wants the mango tree with full of mango fruits and pest free. Is it possible to create new mango tree which the farmer wants? Can you explain how it is possible? (AS1)

Answer : Yes, it is possible to create a mango tree with full of mango fruits and pest free. This can be done by the process of production of the recombinant genome where the gene responsible for the prevention of pest attack can be isolated and incorporated in the genome of the plant producing a large number of mango fruits. This is the law of independent assortment. This type of plant can be produced by selectively cross-breeding the two parents producing a hybrid plant containing the features of both the plants.

Q. 5. Explain monohybrid experiment with an example, which law of inheritance can we understand? Explain. (AS1)

Answer : In a monohybrid cross, for any character, the F1 generation individual derived from crosses between the two different varieties having alternative characters, showed only one of the character and never the other. This feature was expressed as the dominance of one trait over the other. The trait which appeared in the F1 generation was called the dominant and the other which did not appear in the F1 population was called recessive. It is obvious that though, in an F1 generation the dominant phenotype appears, the recessive is not lost but re-appears in the F2 generation. This suggests that there is no blending of Mendelian factors in the F1 generation but they stay together and only one is expressed.

Therefore, two or more forms of a single character can exist in a single gene locus of a homologous chromosome within a species that may put different effects on the phenotype of an organism. In the hybrids between two individual displaying different phenotypes, only one character is observable. This phenotype or the character (allele) which is expressed in the hybrid is said to be dominant and the other to be recessive, whose phenotype remains masked in heterozygous condition, but is only expressed in homozygous condition. This is known as the law of dominance.



Q. 6. What is the law of independent assortment? Explain with an example? (AS1)

Answer : When there are two pairs of contrasting character, the distribution of the members of one pair into the gametes is independent of the distribution of the other pair as seen in the production of gametes of the first filial generation. For example: When a pea plant with yellow and round seeds (pure), were crossed with those having green and wrinkled seeds (pure). The F1 seeds were obtained yellow and round. When these F1 seeds were grown in plants, F2 seeds were obtained which showed all the four possible combinations i.e., yellow and round, yellow and wrinkled, green and round, green and wrinkled. These four kinds of seeds were obtained in the ratio of 9:3:3:1. The above results would be expected if the two pairs of characters are believed to behave independently of each other. Therefore, it can be concluded that the two characters under considerations are assorting in an independent fashion. The independent assortment holds good for two or more than two pairs of characters.

Q. 7. How sex determination takes place in human? Explain with an example? (AS1)

Answer : i. Humans have 46 chromosomes thus they have 23 pairs of chromosomes.

ii. Of these 23 pairs, 22 pairs are autosomes and the remaining 1 pair is the sex chromosome that determines the sex of the child. In humans, sex chromosome is of two types X and Y.

iii. The genetic composition of females is 44+XX whereas males have a genetic composition of 44+XY. As humans are diploid organisms and during fertilization, the child receives half of its chromosomes from one parent and the other half from another the diploid state is restored.

iv. Now, the gametes formed by the female is all 22+X whereas males produce two types of gametes, 22+X and 22+Y. During fertilization, if the female gamete with 22+X chromosome is fertilized by the sperm bearing 22+X chromosome the resulting zygote has the genetic composition as 44+XX thus giving rise to a female child.

v. But, if the female gamete with 22+X chromosome is fertilized by the sperm bearing 22+Y chromosome the resulting zygote has the genetic composition as 44+XY thus giving rise to a male child.

vi. Thus the sex of the child is determined by the type of sperm that fertilizes the ovum and not the other way round.

Q. 8. Explain Darwin's theory of evolution 'Natural selection' with an example? (AS1)

Answer : i. Darwin's theory of Natural selection in evolution states that only the fittest organism will be able to thrive in the world. Thus, the organism with useful traits will survive.

ii. The natural selection over-abundance of offspring leads to a constant struggle for their survival in any population. Individuals with variations that help them to survive and reproduce tend to live longer and have more offspring's than organisms with less useful features.

iii. The offspring of survivors inherit the useful variations and the same process happens with every new generation until the variation becomes a common feature. As the environment changes, the organism within the environment adapt and changes to the new living conditions. Over a long period of time, each species of organism can accumulate so many changes that it becomes a new species, similar to but distinctly different from the original species. All species on the earth arise in this way. Evolution is a slow and continuous process.

Q. 9. What are variations? Explain with a suitable example. (AS1)

Answer : Variation can be defined as the differences among individuals within the same species which develops due to the mixing and assortment of genes of the parents that is passed onto the offspring's. For example, we keep pets like dogs and cats. There are so many breeds of each one of them and even in the same breed; there are minor differences and variations among individuals.

Q. 10. What variations generally have you observed in the species of a cow? (AS1)

Answer : The variations generally observed in the species of cows are as follows:

i. Variation in colour

ii. Variation in horns

iii. Variation in height

iv. Variation in legs

v. Variation in hooves

vi. Variation in tail

Q. 11. What are the characters Mendel selected for his experiments on pea plant? (AS1)

Answer : The major advantages of selecting pea plant for the experiment by Mendel are as follows:

i. Pea plant has 7 contrasting characteristics which can be phenotypically distinguished.

ii. Every contrasting character has only 2 alleles and none of them are linked.

iii. The plant undergoes self-pollination thus easily produces the offspring's with same traits generation after generation.

iv. Due to self-pollination homozygous plants can be obtained easily.

v. Cross-pollination for experimentation can be easily performed by emasculating the stamen of the flower without affecting the flower.

vi. They have a short life span and produce many seeds at a time.

Q. 12. In what way Mendel used the word 'Traits'-explain with an example. (AS1)

Answer : Mendel hypothesized that characters were carried as traits from parents to offspring's and were always carried in form of pairs. He also hypothesized that variable traits of the same character were present in the population of an organism. He also assumed that the traits shown by the pea plants must be in the seeds that produced them and must have obtained these traits from the parents. Mendel crossed the pure bred 'dwarf' pea plants with pure-breed fall pea plants.

For example: In F1 generation no dwarf pea plants were obtained in the first generation of progeny. That means the first generation showed the traits of only one of the parent plants tallness. The trait of 'dwarfism' didn't show up in the progeny. Then Mendel crossed the F1 generation plants and obtained three tall plants and one dwarf plant. The dwarf trait of the parent plant which had seemingly disappeared in the first-generation progeny reappeared in the second generation. Mendel named this trait as 'recessive trait' and the expressed trait of tallness as the 'dominant trait'.

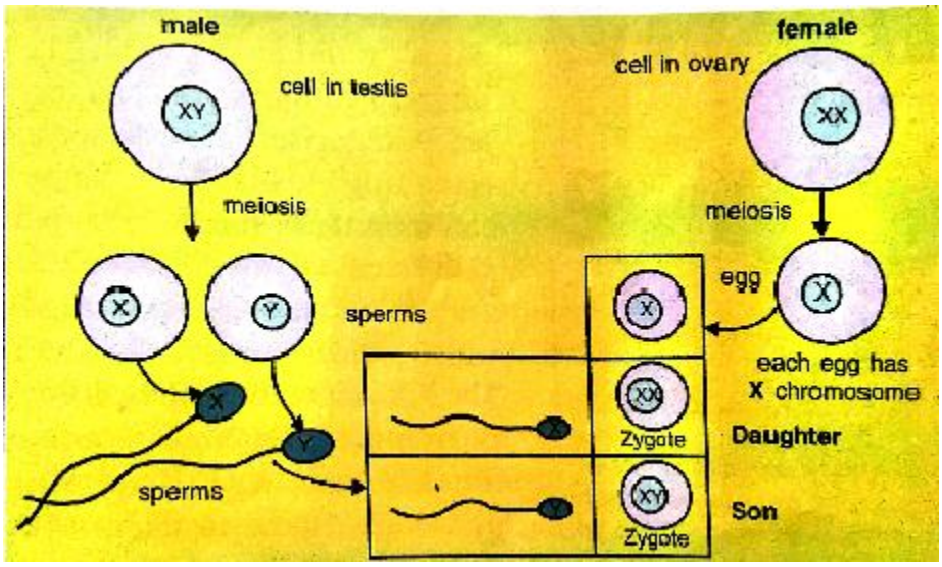
Q. 13. What differences Mendel identified between parent and F_2 generation. (AS1)

Answer :

Parent	F1 generation
• They are all pure breeds. • They are only of homozygous nature. • They have a fixed set of characters.	• They are mixed breeds. • They consist plants of both homozygous and heterozygous nature. • New combinations of characters are observed.

Q. 14. Is Male responsible for sex determination of baby-do you agree? If so write your answer with a flow chart. (AS1)

Answer : Yes male is responsible for sex determination of baby. The following diagram shows the process of segregation of sex chromosomes into gametes and the production of gamete.



Q. 15. Write a brief note on analogous organs. (AS1)

Answer : Analogous organs are those types of organs which conduct a similar type of functions in two organisms but have entirely different origins. For example the wing of a bird and wing of a bat.

Q. 16. How do scientists utilize the information about fossils? (AS1)

Answer : i. The remains of dead animals and plants that lived in the remote past are known as fossils.

ii. The scientists utilize the information acquired from fossil study as it provides evidence for evolution. For example, the fossil of the bird called 'Archaeopteryx' looks like a bird, but it has many other features which are found in reptiles.

iii. Archaeopteryx has feathered wings like those of birds but teeth and tail like those if reptiles. So, Archaeopteryx is known as the 'Connecting link' between reptiles and birds. It might suggest that birds have evolved from the reptiles.

iv. Thus, fossil provides the evidence that the present animals have originated from the previously existing ones through the process of continuous evolution.

Q. 17. Mendel selected a pea plant for his experiments. Mention the reasons in your point of view. (AS2)

Answer : The major advantages of selecting pea plant for the experiment by Mendel are as follows:

i. Pea plant has 7 contrasting characteristics which can be phenotypically distinguished.

ii. Every contrasting character has only 2 alleles and none of them are linked.

iii. The plant undergoes self-pollination thus easily produces the offsprings with same traits generation after generation.

iv. Due to self-pollination, homozygous plants can be obtained easily.

v. Cross-pollination for experimentation can be easily performed by emasculating the stamen of the flower without affecting the flower.

vi. They have a short life span and produce many seeds at a time.

Q. 18. If the theory of inheritance of acquired characters proposed by Lamark was true how will the world be? (AS2)

Answer : According to the theory of inheritance of acquired characters proposed by Lamarck was true the world will be like-

i. All the acquired characters of the parental generation will be carried forward to the next progeny. But it is not actually happening. If it had, then all the swimmer's sons will become swimmers or doctor's sons will become doctors, which is not the case.

ii. Pilots, Lawyer, Linguists, Singers, Musicians etc., all will pass on their acquired traits to their progeny and their progeny will also become the same just like their parents.

iii. The process of continuous evolution would have been disturbed.

Q. 19. Collect information on the inherited traits in your family members and write a note on it. (AS4)

Answer :

Characters	In me	In my mother	In my father	In my grandmother	In my grandfather

Note:

i. A character similar to you your mother and your grandmother should be written.

ii. A character similar to you your father and your grandfather should be written.

iii. A character similar to you your mother only.

iv. A character similar to you your father only.

v. A character similar to you your grandmother only.

vi. A character similar to you your grandfather only.

Q. 20. With the help of given information write your comment on evidence of evolution. (AS4)

Mammals have four limbs as do birds, reptiles, and amphibians. The basic structure of the limbs is similar, though it has been modified to perform different functions.

Answer : i. The organs which have the same basic structure but different functions are called homologous organs.

ii. The homologous organs of different animals provide evidence for evolution. The that internal structure of forelimb of a whale (swimmer), a wing of a bird (flyer) the leg leopard (runner), the claw of mole (digger) and hand of a man (grasping) has the same origin.

iii. If we carefully observe the anatomy of all these animals have a common pattern in the arrangement of bones even through their external from and functions are different.

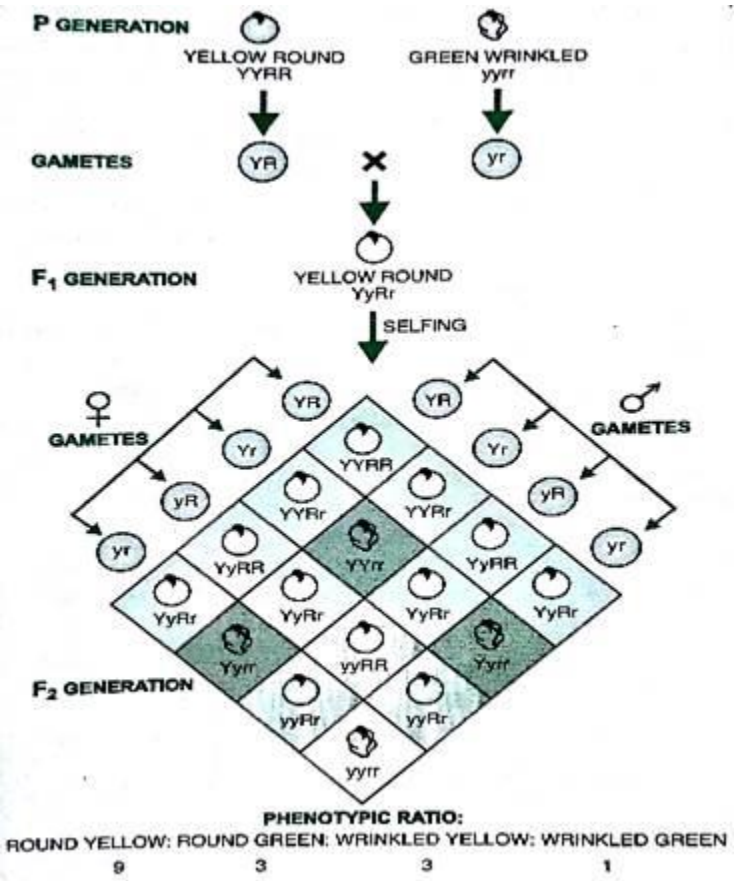
iv. This indicates that all the vertebrates have evolved from a common ancestor and these organs are called homologous organs and this type of evolution is known as divergent evolution.

Q. 21. Collect information about carbon dating method. Discuss with your physical science teacher. (AS4)

Answer : The study of fossils is known as paleontology. And the age of the fossil is determined by the paleontologists by the method of ‘carbon dating’. The fossils were organic living objects that had walked the earth surface in prehistoric times and are majorly composed of carbon (C_{14}) atoms which are radioactive in nature. In the method of carbon dating the age of the fossil is determined by the amount of C_{14} left in the fossil in the present day.

Q. 22. Draw a checker board to show the law of independent assortment with a flow chart and explain the ratio. (AS5)

Answer : When a pea plant with yellow and round seeds (pure), were crossed with those having green and wrinkled seeds (pure). The F1 seeds were obtained yellow and round. When these F1 seeds were grown in plants, F2 seeds were obtained which showed all the four possible combinations i.e., yellow and round, yellow and wrinkled, green and round, green and wrinkled. These four kinds of seeds were obtained in the ratio of 9:3:3:1.

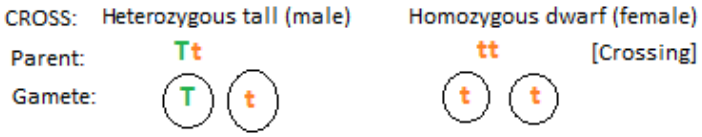


Q. 23. Explain the process to understand monohybrid cross of Mendel experiment with a checker board.(As5)

Answer : In a monohybrid cross, for any character, the F1 generation individual derived from crosses between the two different varieties having alternative characters, showed only one of the character and never the other. This feature was expressed as dominance of one trait over the other. The trait which appeared in the F1 generation was called the dominant and the other which did not appear in the F1 population was called recessive. It is obvious that though, in F1 generation the dominant phenotype appears, the recessive is not lost but re appears in the F2 generation. This suggests that there is no blending of Mendelian factors in the F1 generation but they stay together and only one is expressed.

Therefore, two or more forms of a single character can exist in a single gene locus of a homologous chromosome within a species that may put different effects on the

phenotype of an organism. In the hybrids between two individual displaying different phenotypes only one character is observable. This phenotype or the character (allele) which is expressed in the hybrid is said to be dominant and the other to be recessive, whose phenotype remains masked in heterozygous condition, but is only expressed in homozygous condition. The phenotypic features in the first filial generation after a cross between a homozygous female and a heterozygous male for a single locus, say height, is as follows:



F1 generation:
(Punette square)

	T	t
t	Tt	tt
t	Tt	tt

Genotype: Tt : tt = 1 : 1
Phenotype: Tall (Tt) : Dwarf (tt) = 1 : 1

Q. 24. Prepare a chart showing evolution of man through ages. (AS6)

Answer :

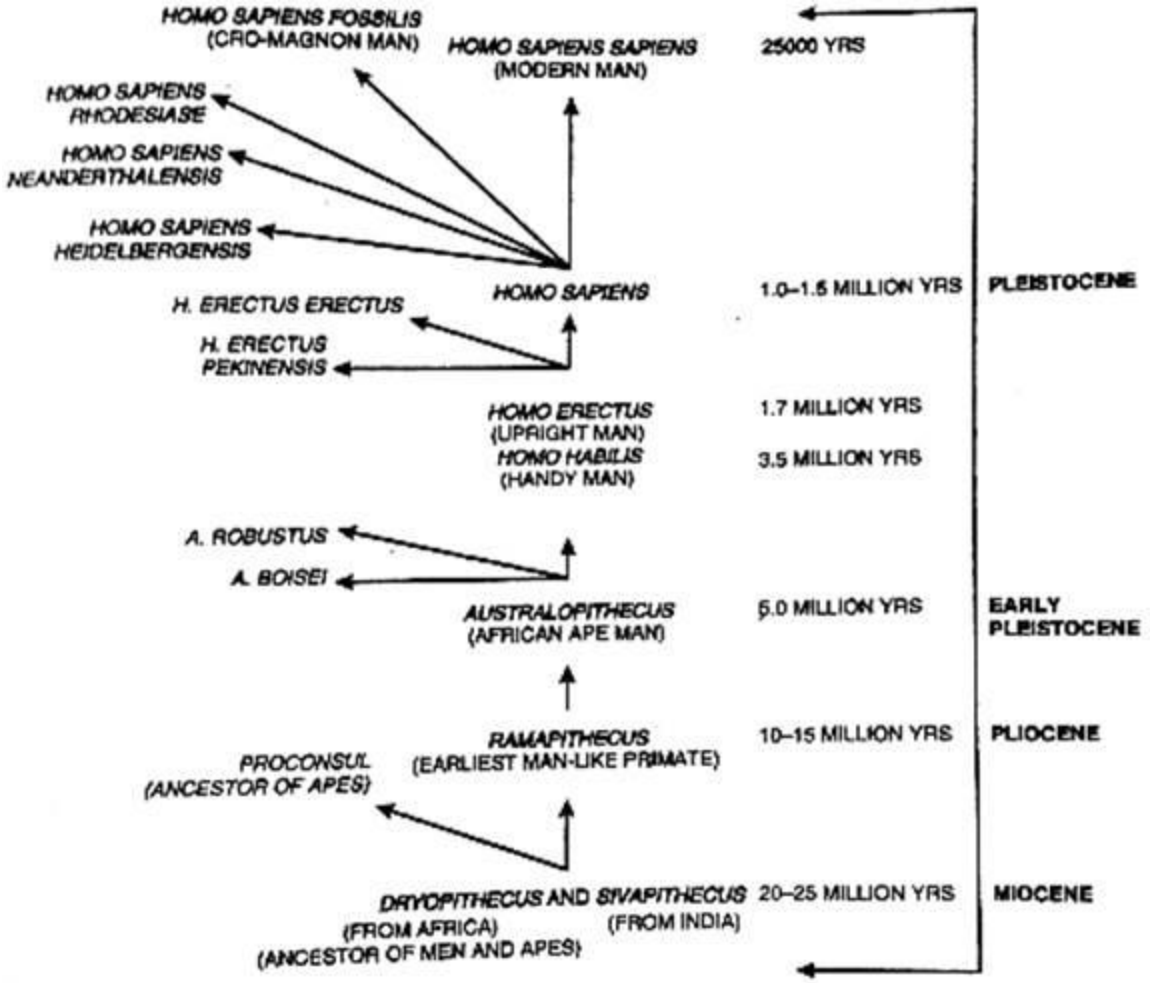
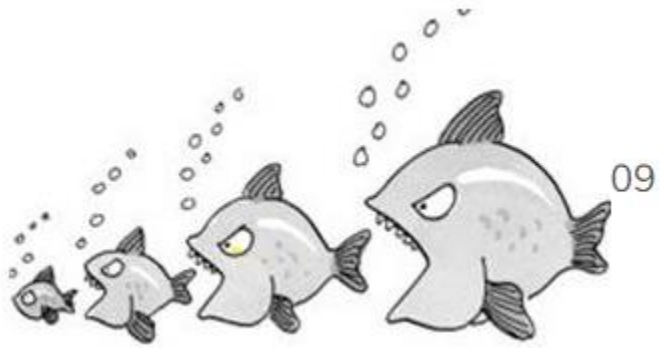


Fig. 3.9 Pedigree chart of human evolution

Q. 25. Nature selects only desirable characters. Prepare a cartoon. (AS6)

Answer : This diagram shows only the fiercest fish is fit for survival.



Q. 26. What is your understanding about survival of the fittest? Gives some situations or example that you observe in your surroundings? (AS7)

Answer : When we say survival of the fittest we can exemplify the following:

1. Two or more dogs surround a piece of meat; the strongest in the group will fight for the meat and threaten the others thus getting its reward as the piece of meat. Thus, the chance of survival of the strongest dog is more than the others.

2. When a cat chases two rats the one running faster than the other rate will survive from becoming the food for the cat. Thus, the speedier rat is the fittest in this case.

Q. 27. Write a monologue on the evolution of a man to perform a stage show on the theatre day in your school. (AS7)

Answer : I am the modern woman. But, you don't know my ancient history. I would like to provide you the evolutionary process leading up to this modern appearance.
An early man like forms appeared almost about 7.5 billion years ago. The scientific name for my species is '*Homo sapiens*'. My true appearance came on to the earth 2.5 billion years ago. My ancestral forms like Homo-habilus lived around 1.6 to 2.5 million years ago. Homo-erectus lived around 1-1.8 million years ago. *Homo sapiens* neanderthalensis lived around 2,30,000 – 3,00,000 thousand years ago.
My species (Homo-sapiens) appeared about 40,000 years ago.

There is a great diversity in forms and features across the planet although grouped under the same species. But I want peace between all those separated by the domestic walls like racism and terrorism. But I want peace and all the people of the world are nothing but brothers. I want them to live in peace and harmony. Friends! With this thought of unity, I conclude my monologue, have a nice day.

Thank you.

Fill in the blanks

Q. 1. Fill in the blanks

The process of acquiring change is called_____.

Answer : The process of acquiring change is called evolution.

Explanation: Evolution is the change in heritable characters of the biological population over successive generations. The process of evolution gives rise to biodiversity at any level of the biological organization including the levels of species, individuals, and even molecules.

Q. 2. Fill in the blanks

Mendel's experiment explains about_____.

Answer : Mendel's experiment explains about the inheritance of hereditary traits.

Explanation: Mendel's experiment explains the passing on of traits from parents to offspring's. He experimented with pea plants and provided three laws: the law of dominance, the law of segregation and the law of independent assortment.

Q. 3. Fill in the blanks

The four characters observed in the experiments on law of independent assessment are_____.

Answer : The four characters observed in the experiments on law of independent assessment are round and yellow seeds and wrinkled and green seeds.

Explanation: In the experiment for the law of independent assortment Mendel considered two contrasting characters. They were yellow and round seeds, and green wrinkled seeds were the four characters.

Q. 4. Fill in the blanks

If we cross pollinate red flower plant with white flower we will get _____ percent of recessive trait plants.

Answer : If we cross-pollinate red flower plant with white flower we will get 50 percent of recessive trait plants.

Explanation: The 4'O clock plant exhibits co-dominance which leads to the production of 25% white flower, 25% red flower and 50% pink flower.

Q. 5. Fill in the blanks

TT or YY, Tt or Yy are responsible for a _____character.

Answer : TT or YY, Tt or Yy are responsible for an allelic character.

Explanation: All T, t, Y and y are responsible for different allelic forms of two different characters.

Q. 6. Fill in the blanks

Female baby having 23 pairs of autosomes at the age of 18 years she has ____ pair autosomes and ___of sex chromosomes.

Answer : Female baby having 23 pairs of autosomes at the age of 18 years she has 22pair autosomes and 01 pairs of sex chromosomes.

Explanation: When a person has 23 pairs of chromosomes at birth then it will have 22 pairs of autosomes and 0i pair of sex chromosome during birth and even in adulthood.

Q. 7. Fill in the blanks

The population grows in _____progression where as food sources grow in _____progression.

Answer : The population grows in geometric progression where as food sources grow in arithmetic progression.

Explanation: In Malthus theory was written in 'An essay on principles of the population' influenced by Darwin. Malthus observed that the population grows in geometric progression whereas food sources grow in arithmetic progression.

Q. 8. Fill in the blanks

A goat which walks properly can't live for a long time. According to Darwin this represents _____.

Answer : A goat which walks properly can't live for a long time. According to Darwin this represents Survival of the fittest.

Explanation: According to Darwin, the goat which walks properly can't live for a long time this is because it is survival of the fittest.

Q. 9. Fill in the blanks

Forelimb of whale is for swimming where as in horse it is used for_____.

Answer : Forelimb of the whale is for swimming whereas in horse it is used for running.

Explanation: The organs which have the same basic structure but different functions are called homologous organs. The homologous organs of different animals provide evidence for evolution. The that internal structure of forelimb of a whale (swimmer), a wing of a bird (flyer) the foreleg of a horse (runner), claw of mole (digger) and hand of a man (grasping) has the same origin.

Q. 10. Fill in the blanks

The study of fossils is called_____.

Answer : The study of fossils is called paleontology.

Explanation: Geologists can tell the age of a fossil. The study of the fossil is called ‘paleontology’. Paleontologists determine the age of a fossil by using the method of carbon dating.

Choose the correct Answer

Q. 1. Which of the following is not a variation in the rose plant. ( )

A. Colored petals
B. Spines
C. Tendrils
D. Leaf margin

Answer : The rose plant produces flowers with bright colored petals. The plant does not contain tendrils and the leaf margin is dentate. The rose plant has thorns which are a modification for the defense of the flowers.

Q. 2. According to Mendel alleles have the following of a character. ( )

A. Pair of genes
B. Responsible for character
C. Production of Gametes
D. Recessive factors

Answer : Alleles of a character is Mendelian trait. Mendelian traits are responsible for the variations in the phenotypic characters of an organism.

Q. 3. Natural selection means ( )

A. Nature selects desirable characters
B. Nature rejects undesirable characters
C. Nature reacts with an organism
D. A,B

Answer : The ‘natural selection’ process of Darwin says survival of the fittest. This means nature selects desirable characters and rejects the undesirable characters.

Q. 4. Paleontologists deal with ( )

A. Embryological evidences
B. Fossil evidences
C. Vestigial organ evidences
D. all

Answer : Geologists can tell the age of a fossil. The study of fossil is called ‘paleontology’. Paleontologists determine the age of fossil by using the method of carbon dating.