

**Class: XII**  
**Subject: Biology**  
**Topic: Principles of inheritance and variation**  
**No. of Questions: 20**

Q1. Which terms have been used for the hereditary units and by whom ?

Ans. Term factor was used for hereditary units by Correns, elements by Mendel and gene by Johannsen.

Q2. How can a dihybrid ratio be derived from monohybrid ratio in simple dominant-recessive crosses ?

Ans. By multiplying the monohybrid ratio of 2 traits ( $3 : 1 \times 3 : 1 = 9 : 3 : 3 : 1$ ).

Q3. Define codominant and complementary genes.

Ans. The allelic genes which, when present together in an individual, express their traits independently instead of showing dominance-recessive relationship are called codominant genes. Two independent pairs of genes, which interact to produce a trait together, but dominant gene alone does not show its effect, are termed complementary genes.

Q4. How do the back cross and test cross differ ?

Ans. A back cross is between a hybrid organism and any one of the parents, a test cross is between a hybrid organism and a recessive parent.

Q5. What is a test cross ? how does it differ from a reciprocal cross ?

Ans. A test cross is a cross between an organism of an unknown genotype and a homozygous recessive organism. A reciprocal cross involves the same traits but carried by sexes opposite to those in the original cross.

Q6. Under which condition, does the law of independent assortment hold good and why ?

Ans. The law of independent assortment holds good only if the different gene pairs lie in the different chromosome pairs, because it is the chromosomes that segregate during meiosis and not individual genes.

Q7. Cite a case of incomplete dominance. Which trait in such a case has no gene ?

Ans. A cross between pure red-flowered and pure white-flowered 4-O'Clock plants shows incomplete dominance, producing pink-flowered hybrids, pink flower colour has no specific gene.

Q8. Why Mendel selected pea plant for his experiments ?

Ans. Mendel selected pea plant because it is normally self-pollinated but can be easily cross-pollinated and has 7 traits with distinctly contrasting forms.

Q9. Name the animal in which sex is determined by number of chromosomes. Who produced the first induced mutation ?

Ans. Honeybee, H.J. Muller.

Q10. How do the cross over and noncross over chromatids differ ? Give alternative terms for them also.

Ans. chromatids resulting from interchange of segments of segments are cross over or recombinant chromatids, those that remain intact are noncross over parental chromatids.

Q11. Define linkage.

Ans. tendency of the genes present in the same chromosome to stay together in hereditary transmission is called linkage.

Q12. The human male never passes on the gene for haemophilia to his son. Why ?

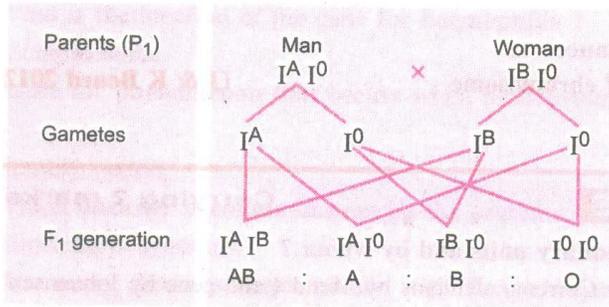
Ans. male sex is determined by Y- chromosome which does not bear the gene for haemophilia.

Q13. A mother with blood group O has a foetus with blood group B. will there be any problems in the mother or foetus ? if so, specify the problems.

Ans. no RBCs of mother with blood group O lack antigens A and B . Therefore, the plasma factor a of foetus with blood group B will not cause any reaction.

Q14. A man with blood group A married a woman with B group. They have a son with AB group and a daughter with blood group O. work out the cross and show the possibility of such inheritance.

Ans.



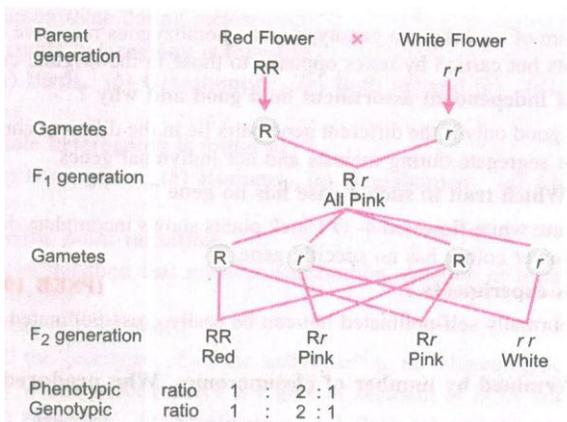
In this type of cross the possibility of occurrence of AB, A, B and O groups in F<sub>1</sub> generation.

Q15. The male fruit fly and female fowl are heterogametic while the female fruit fly and the male fowl are homogametic. Why are they called so ?

Ans. male fruit fly has sex chromosomes XY and female fowl has sex chromosomes ZW. These chromosomes are heteromorphic (i.e. XY and ZW), therefore, they are examples of heterogamety. On the other hand, female fruit fly (having sex chromosomes XX) and male fowl (having sex chromosomes ZZ) have similar chromosomes. Therefore, they are the examples of homogamety.

Q16. A plant of antirrhinum majus with red flowers was crossed with another plant of the same species with white flowers. The plants of the F<sub>1</sub> generation bore pink flowers. Explain the pattern of inheritance with the help of a cross.

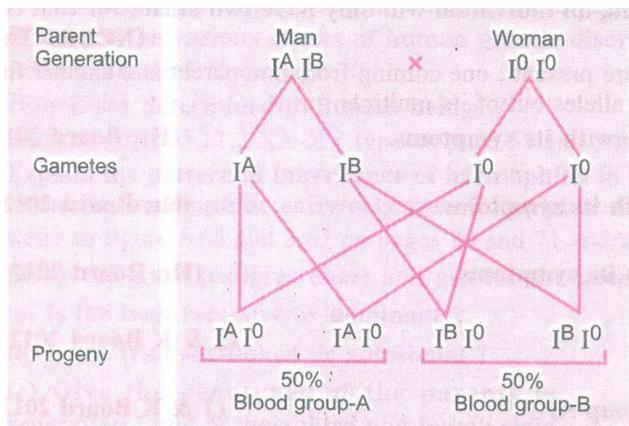
Ans.



It is an example of incomplete dominance.

Q17. A woman with blood group O married with a man with AB group. Show the possible blood groups of the progeny. List the alleles involved in this inheritance.

Ans.



Q18. Very briefly explain the following :

1. Alleles
2. Dominant/recessive
3. Homozygous/heterozygous
4. Test cross
5. Back cross
6. Pleiotropy
7. Multiple alleles
8. Incomplete dominance
9. Epistasis/hypostasis
10. Genotype
11. Linkage
12. Sex-limited characters
13. Sex-influenced traits
14. Chromosomal aberrations
15. Gene mutation.

- Ans.
1. There are two alternative forms of a gene for each character, one controlling each of its two contrasting expressions. A pair of genes that control the two alternative expressions of the same character and have the same loci in the homologous chromosome are called alleles.
  2. An allele that influences the appearance of the phenotype even in the presence of an alternative allele is called dominant. The alternative allele is called recessive.
  3. When the two alleles of a gene are similar and so two same allele exist, they are said to be in homozygous combination. When the two alleles in a pair are different they are in heterozygous state.
  4. It is a cross between an organism of an unknown genotype and a homozygous recessive organism.
  5. A genetic cross between a hybrid organism and one of the original parental types is called a back cross.
  6. The multiple effect of a gene is called pleiotropy.
  7. More than two alternative form (alleles) of a gene in a population occupying the same locus on a chromosome or its homologue are known as multiple alleles.
  8. The expression of the traits of two pure parents as an intermediate condition or a mixture in  $F_1$  hybrids is known as incomplete dominance.
  9. A pair of genes at one locus may prevent the expression of a pair of genes at another locus. Such genes are called epistatic genes. The prevention of the expression of one pair of

genes by another pair of genes is called epistasis.. The expression of which is prevented by epistatic genes are called hypostatic genes and the phenomenon as hypostasis.

10. genotype of an individual refers to the sum total of genes inherited from both the parents irrespective of whether they are expressed or not.

11. the tendency of the genes present in the same chromosome to stay together in hereditary transmission is known as linkage.

12. certain genes produce characters in one sex only. But not in both even though they are present in both the sexes. Such characters are called sex – limited characters.

13. the autosomal traits in which the dominant expression depends on the sex hormones of the individuals are called sex-influenced traits.

14. chromosomal alterations are often called chromosomal aberrations. These mutations affect large portions of the chromosomes and are observable under a microscope. They may involve a modification in the morphology of the chromosomes or a change in the number of chromosomes.

15. it is a sudden, stable, inheritable alteration in the base sequence of a gene capable of changing the phenotype of an organism.

Q19. Do you think Mendel's laws of inheritance would have been different if the characters that be close were located on the same chromosome ?

Ans. Mendel could not note linkage because the seven character he studied in garden pea, had their genes located on different (nonhomologous) chromosomes or so far apart on the same chromosome that they got separated by crossing over. The genes for plant height and pod form lie close by on the same chromosome and should have shown linkage. However. Mendel's work indicates that he perhaps never made a cross with this combination. It has been found by S. Blixt that Mendel's seven selected characters lie on four chromosomes.

Q20. In our society a woman is often blamed for not bearing for not bearing a male child. Do you think it is right ? justify.

Ans. In our society a woman is often blamed for not bearing a male child.