

**GRADE XII**

**PRINCIPLES OF INHERITANCE AND VARIATION**

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1. Name the pattern of inheritance where F1phenotype  
(i) resembles only one of the two parents.  
(ii) Does not resemble either of the two parents and is in between the two. (All India 2019)  
Or  
Name the respective pattern of inheritance, where F1 phenotype  
(i) does not resemble either of the two parents and is in between the two.  
(ii) resembles only one of the two parents. (All India 2012)  
Answer:  
(i) Dominance  
(ii) Incomplete dominance

2. British geneticist RC Punnett developed a graphical representation of a genetic cross called ‘Punnett Square’. Mention the possible result this representation predicts of the genetic cross carried. (Delhi 2019)  
Answer:  
Punnett square helps to predict the probability of all the possible genotypes of offspring in a genetic cross.

3. Name the type of cross that would help to find the genotype of a pea plant bearing violet flowers. (All India 2017)  
Answer:  
To find the genotype of a pea plant bearing violet flowers, test cross would be carried out in which the plant with dominant trait, i.e. violet flowers, will be crossed with its recessive parent.

4. State a difference between a gene and an allele. (All India 2016)  
Answer:  
A unit of inheritance which is passed down from parent to offspring through the gametes over successive generations is known as gene. Genes consist of a pair of contrasting forms for a character that are known as alleles.

5. Give an example of polygenic trait in humans. (Delhi 2016C)  
Or  
On what basis is the skin colour in humans considered polygenic? (Delhi 2016)  
Answer:  
An example of a polygenic trait in humans is skin colour.  
Or  
Skin colour is considered to be a polygenic trait because it is under the control of many genes.

6. A geneticist interested in studying variations and patterns of inheritance in living beings prefers to choose organisms for experiments with shorter life cycle. Provide a reason. (Delhi 2015)  
Answer:  
A geneticist interested in studying variations and patterns of inheritance in living beings prefers to choose organisms with shorter life cycle, because it enables the geneticist to study many generations of the organism in a short time period.

7. Mention any two contrasting traits with respect to seeds in pea plant that were studied by Mendel. (All India 2014)  
Answer:  
Two contrasting seed traits studied by Mendel are

* Seed shape Round and wrinkled.
* Seed colour Yellow and green.

8. What are ‘true-breeding lines’ that are used to study inheritance pattern of traits in plants. (Delhi 2014)  
Answer:  
True-breeding lines are those plants, which have undergone continuous self-pollination and show stable trait inheritance and expression for several generations.

9. How many kinds of phenotype would you expect in F2-generation in a monohybrid cross exhibiting codominance? (All India 2014)  
Answer:  
In codominance, alleles are able to express themselves independently when present together. Thus, in a monohybrid cross there would be three kinds of phenotype in the F2-generation showing codominance.

10. Name the stage of cell division where segregation of an independent pair of chromosomes occurs. (All India 2014)  
Or  
Name the event during cell division cycle that results in the gain and loss of chromosomes. (Delhi 2011)  
Answer:  
During meiotic anaphase-I of cell division, the separation of independent pair of chromosomes occurs.  
Or  
Non-disjunction of chromosomes during anaphase-I of meiosis results in the gain or loss of chromosomes.

11. A garden pea plant (A) produced inflated yellow pod and another plant (B) of the same species produced constricted green pods. Identify the dominant traits. (Delhi 2012)  
Answer:  
The dominant trait in the pea plant is inflated green pods while the recessive trait is constricted yellow pod?

12. A garden pea plant produced axial white flowers another of the same species produced terminal violet flowers. Identify the dominant traits. (All India 2012)  
Answer:  
The dominant trait in the pea plant is axial violet flowers, while the recessive trait is terminal white flowers.

13. In a dihybrid cross, when would the proportion of parental gene combinations be much higher than non-parental types, as experimentally shown by Morgan and his group? (All India 2012)  
Answer:  
The proportion of parental gene combination is much higher than non-parental types, when the two genes show linkage and are inherited together.

14. Write possible genotypes Mendel got when he crossed F1 tall plant with a dwarf pea plant. (Foreign 2012)  
Answer:  
Tt and tt (in ratio of 1:1) genotypes were obtained on crossing F1 tall plant with a dwarf parent plant. It is a test cross.

15. Garden pea plant produced round, green seed. Another of same species produced wrinkled yellow seeds. Identify dominant traits. (Foreign 2012)  
Answer:  
The dominant trait in pea plant is round and green seeds, while the recessive trait is wrinkled and yellow seeds.

16. Mention two contrasting flower related traits studied by Mendel in pea plant experiments. (All India 2011C)  
Answer:  
The two contrasting flower traits in pea plant are

* Violet flowers and white flowers.
* Axial flowers and terminal flowers.

17. Name the contrasting pod related traits studied by Mendel in his pea plant experiment. (All India 2011C)  
Answer:  
The two contrasting pod related traits in pea plant are

* Inflated/Constricted shape.
* Green/Yellow colour.

18. Mention the type of allele that expresses itself only in homozygous state in an organism. (Foreign 2011)  
Answer:  
Recessive allele expresses itself only in homozygous condition because in the presence of a dominant allele its effect is masked.

19. Pea flowers produce assured seed sets. Give a reason. (All India 2010)  
Answer:  
Pea flowers produce assured seed sets because they have cleistogamous flowers, which undergo natural self-pollination.

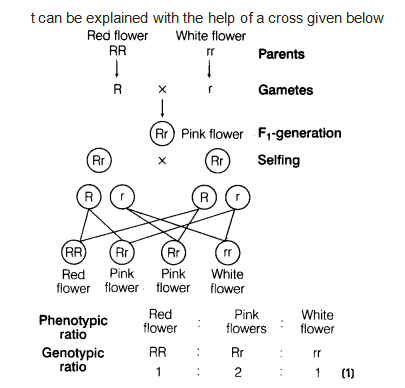
20. When does a geneticist need to carry a test cross? (Foreign 2015)  
Or  
How would you find the genotype of an organism exhibiting a dominant phenotype? (Delhi 2012C)  
Answer:  
A geneticist needs to carry a test cross when he/she wants to determine the genotype of an organism, with a dominant phenotype trait, whether it is homozygous or heterozygous.  
Or  
Genotype of the dominant phenotype is determined by a test cross. In it, the F1 progeny is crossed to its recessive parent. When F1 progeny (heterozygous) crossed with dwarf plant, the monohybrid test cross ratio is 1 : 1. But, all tall plants are obtained when both homozygous parents are crossed.

21. Why did TH Morgan select Drosophila melanogaster to study sex-linked genes for his lab experiments. (Foreign 2015)  
Or  
Write the scientific name of the fruitfly. Why did Morgan prefer to work with fruit flies for his experiments? State any three reasons. (All India 2014)  
Answer:  
The scientific name of fruitfly is Drosophila melanogaster.  
TH Morgan preferred this organism for his study because of the following reasons

* It has fast and short life cycle.
* It has’only four pairs of chromosomes.
* It reproduces quickly.

22. Give an example of a gene responsible for multiple phenotypic expressions. What are such genes called? State the cause that is responsible for such an effect. (Foreign 2015)  
Or  
Explain pleiotropy with the help of an example. (Foreign 2014)  
Answer:  
Pleiotropy is the phenomenon in which a single gene exhibits multiple phenotypic expressions. The genes exhibiting pleiotropy are called pleiotrppic genes. Pleiotropism occurs mainly because of mutation in a particular gene, e.g. phenylketonuria which is a disorder caused by mutation in the gene coding for the enzyme phenylalanine hydroxylase. In the absence of this enzyme, phenylalanine is not converted into tyrosine and accumulation of phenylalanine takes place. The affected individual shows hair and skin pigmentation and mental problems.

23. The F2 progeny of a monohybrid cross showed phenotypic and genotypic ratio as 1 : 2 : 1, unlike that of Mendel’s monohybrid F2 ratio. With the help of a suitable example, work out a cross and explain how it is possible. (All India 2015)  
Or  
Why are F2 phenotypic and genotypic ratios are same in a cross between red flowered snapdragon and white flowered snapdragon plants? Explain with the help of cross. Delhi 2010  
Answer:  
The given condition represents the case of incomplete dominance. In snapdragon, the inheritance of flower colour shows incomplete dominance. Neither of the alleles of gene for flower colour is completely dominant over the other and hybrid shows an intermediate phenotype. Therefore, F2 phenotypic and genotypic ratios are same in a cross between red flowered snapdragon and white flowered snapdragon plants.

It can be explained with the help of a cross given below  


24. With the help of one example, explain the phenomena of codominance and multiple allelism in human population. (All India 2014)  
Answer:  
In human population, the phenomena of codominance and multiple allelism can be explained by the inheritance pattern of ABO blood groups which are controlled by three alleles, i.e. IA,IB and I.

* Codominance IA and IB both are codominant as both of them express themselves independently in blood group AB (IA IB). There is no mixing of the effects of two alleles and the expressed phenotype is the combination of two phenotypes. They do not follow Mendelian inheritance.
* Multiple allelism In this phenomenon, genes exist in more than two allelic forms or combinations. For example, the gene for blood group exists in three allelic forms IA, IB and i. These alleles are produced due to repeated mutation of the same gene in different direction. They do not follow Mendelian pattern of inheritance.

25. Linkage and crossing over of genes are alternatives of each other. Justify with the help of an example. (All India 2014)  
Answer:  
Linkage is the tendency of certain loci or alleles (genes) to be inherited together. While crossing over in the segregation of genes. The former helps to preserve parental characters in offsprings whearas the latter produces new combination of characters. The genes on a chromosome either follow linkage path or crossing over to form the gametes during gametogenesis in human. Therefore, linkage and crossing over of genes are alternatives of each other.