



CBSE NCERT Based Chapter wise Questions (2025-2026)

Class-XII

Subject: Biology

Chapter Name : *Principles of Inheritance and Variation* (Chap : 4)

Total : 9 Marks (expected) [MCQ-(2)-2 Mark, A/R(1)-1 Marks, SA (1)-2 Mark, CBQ (1)-4 Marks]

Level - 2 [Higher Order]

I. MCQ (One correct Answer)

1. Conditions of karyotype $2n + 1$, $2n - 1$ and $2n + 2$, $2n - 2$ are called
- (A) aneuploidy (B) polyploidy
(C) allopolyploidy (D) monosomy

[Hints : Chromosomal disorders]

2. If a genetic disease is transferred from a phenotypically normal but carrier female to only some of the male progeny, the disease is
- (A) autosomal dominant (B) autosomal recessive (C) sex-linked dominant (D) sex-linked recessive
3. In sickle cell anaemia, glutamic acid is replaced by valine. Which one of the following triplets codes for valine?
- (A) GGG (B) AAG (C) GAA (D) GUG
4. What can never be the father's blood group if the mother has blood group B and child has blood group O?
- (A) A (B) B (C) AB (D) O

[Hints : Inheritance of blood group]

5. Mendel's law of independent assortment holds good for genes on—
- (A) non homologous chromosomes (B) homologous chromosomes
(C) extra nuclear genetic element (D) same chromosome

[Hints : Crossing over]

6. In a certain taxon of insects, some have 17 chromosomes and the others have 18 chromosomes. The 17 and 18 chromosomes bearing organisms are
- (A) males and females, respectively (B) females and males, respectively
(C) all males (D) all females

[Hints : Sex determination in insects]

7. The inheritance pattern of a gene over generation, among humans, is studied by the pedigree analysis character studied in the pedigree analysis is equivalent to—
- (A) quantitative trait (B) Mendelian trait
(C) polygenic trait (D) maternal trait

[Hints : Pedigree analysis basic knowledge]

8. Two genes 'A' and 'B' are linked. In a dihybrid cross, using these two genes, the F₁ heterozygote is crossed with homozygous recessive parental type (aabb). What would be the ratio of offsprings in the next generation?
- (A) 1:1:1:1 (B) 9:3:3:1 (C) 3:1 (D) 1:1

[Hints : Linkage]

II. Assertion (A) and Reason (R). Of the two statements, mark the correct answer from the options given below:

- A) Both A and R are true and R is the correct explanation of A.
 B) Both A and R are true but R is not the correct explanation of A.
 C) A is true but R is false.
 D) A is false but R is true.

9. **Assertion (A) :** ABO blood group system is a good example of pleiotropic genes.

Reason (R) : In ABO blood group system, when I^A and I^B alleles are present together, both express themselves.

- (A) A (B) B (C) C (D) D

[Hints : Inheritance of blood group in humans.]

10. **Assertion (A) :** In birds, females are heterogametic and males are homogametic.

Reason (R) : In birds, females have ZW sex chromosomes and males have ZZ sex chromosomes.

- (A) A (B) B (C) C (D) D

[Hints : Sex determination in birds]

11. **Assertion (A) :** The maximum frequency of recombination that results from crossing over of linked genes is 50%.

Reason (R) : If distance between linked genes is longer, they show higher frequency of crossing over.

- (A) A (B) B (C) C (D) D

[Hint : Linkage and crossing over during meiosis.]

12. **Assertion (A) :** Down's syndrome is caused due to absence of X or Y chromosomes.

Reason (R) : Such individuals show mental retardation and broad head with characteristic features.

- (A) A (B) B (C) C (D) D

13. **Assertion (A) :** The genetic complement of an organism is called genotype.

Reason (R) : Genotype is the type of hereditary properties of an organism.

- (A) A (B) B (C) C (D) D

14. **Assertion (A) :** Honey bees show haplodiploid sex determination system.

Reason (R) : Unfertilised eggs, developed by parthenogenesis, form males.

- (A) A (B) B (C) C (D) D

III. Short Answer Questions

15. A haemophilic son was born to normal parents. Give the phenotypes of the parents and son.

[Hints : Inheritance pattern of haemophilia]

16. A human being suffering from Down's syndrome, shows trisomy of 21st chromosome. Mention the cause of this chromosomal abnormality.

[Hints : Characteristics of Down's syndrome]

17. With the help of a Punnett square, find the percentage of homozygous tall in a F₂ population, involving a true breeding tall and a true breeding dwarf pea plant.

[Hints : Checker board of the F₂ generation of monohybrid cross.]

18. In a particular plant species, majority of the plants bear purple flowers. Very few plants bear white flowers. No intermediate colours are observed. If you are given a plant bearing purple flowers, how would you ascertain that it is a pure breed for that trait. Explain.

[Hints : Back cross]

19. How does a test cross help to determine the genotype of an individual? Show with the help of an example.
20. Linkage and crossing over of genes are alternatives of each other. Justify with the help of an example.

[Hints : Morgan's experiment on eye colour of *Drosophila* deviated from Mendel's 9:3:3:1]

IV. Long Answer Questions

21. When snapdragon plants bearing pink colour flower was selfed, it was found that 69 plants were having red coloured flowers. What would be the number of plants bearing pink flower and white flower? Show with the help of a Punnett square. Identify the principle of inheritance involved in this process.

[Hints : Find out the number of pink flowers according to the ratio 1 : 2 : 1]

22. For flower colour in pea, the allele for purple flower (P) is dominant over the allele for white flower (p). A purple flowered plant, therefore could be of genotype PP or Pp. What genetic cross would you make to determine the genotype of a purple flowered plant? Explain how your cross gives you the correct genotype of the purple flowered plant.

[Hints : The genotype of the purple flowered plant can be determined by conducting a test cross.]

23. One of the twins born to parents having normal colour vision was Down's blind, whereas the other twin had normal vision. Work out the cross. Give two reasons how it is possible.

[Hints : Parents

Normal vision

×

Normal vision]

XY

XX^c

24. What is the inheritance pattern observed in the size of starch grains and seed shape of *Pisum sativum*? Work out the monohybrid cross showing the above traits. How does this pattern of inheritance deviate from that of Mendelian law of inheritance?
25. (a) You are given tall pea plants with yellow seeds whose genotypes are unknown. How would you find the genotype of these plants?
- (b) Identify 'a', 'b' and 'c' in the table given below:

S. No.	Pattern of inheritance	Monohybrid F1 phenotypic expression
(i)	Co dominance	a
(ii)	b	The progeny resembled only one of the parents
(iii)	Incomplete dominance	c

[Hints : (a) Test cross]

26. Thalassaemia and haemophilia are both Mendelian disorders related to blood. Write the symptoms of the diseases. Explain with the help of crosses the difference in the inheritance pattern of the two diseases.

[Hints : Cross to show the difference in inheritance pattern.]

Case based Question:

27. Marriage between a normal couple resulted in a son who had haemophilia and a normal daughter. In course of time, when the daughter was married to a normal man, the grandson was also haemophilic.

- Represent this cross in the form of a pedigree chart. Give the genotypes of the daughter and her husband.
- What conclusion would you draw from the inheritance pattern of this disease?
- Give reasons which explain that haemophilia is caused by X-linked gene.

[Hints : Inheritance pattern of haemophilia]

28. A cross is made between different homozygous pea plants for contrasting flower positions.

- What will be the position of flowers in F₁ generation on the basis of genotypes?
- Work out the cross upto F₂ generation.
- Compute the relative fraction of various genotypes in the F₂ generation?

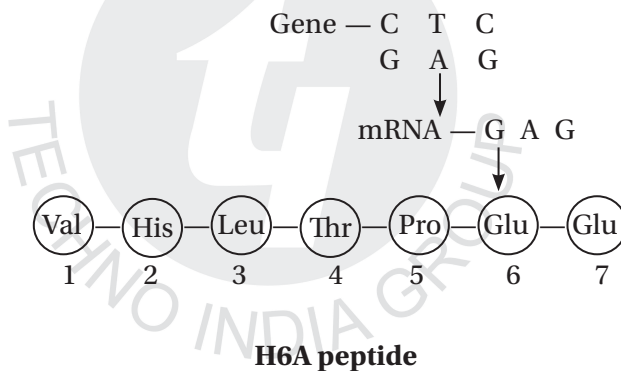
[Hints : 7 pairs of contrasting characters selected by Mendel, monohybrid cross with flower positions in pea]

29. When snapdragon plant bearing pink flowers was selfed, it was found that 69 plants were having red coloured flowers.

- What would be the number of plants bearing pink flower and white flower?
- Draw a punnett square to support your answer.
- Identify the principle of inheritance involved in this case.

[Incomplete dominance, number of pink and white flowers can be computed from the number of red flowers and the ratio between all the three types]

30. Given below is a representation of amino acid composition of the relevant translated portion of β chain of haemoglobin, related to shape of human RBCs



- Is this representation representing a normal human or a sufferer of a genetic disease? Give reasons to support your answer.
- What difference would be noticed in the phenotype of the normal and sufferer related to this gene?
- Who are likely to suffer more from the defect related to the gene represented, males, females or both males and females equally? Why?

ANSWER

- | | | |
|--------|---------|---------|
| 1. (A) | 6. (A) | 11. (B) |
| 2. (D) | 7. (B) | 12. (A) |
| 3. (D) | 8. (D) | 13. (A) |
| 4. (C) | 9. (D) | 14. (B) |
| 5. (B) | 10. (A) | |