RASHTRIYA MILITARY SCHOOL BENGALURU

CHAPTER-WISE TEST CH 5 PRINCIPLES OF INHERITANCE AND VARIATION

Class 12 - Biology

Time Allowed: 3 hours **Maximum Marks: 70**

General Instructions:

1. All questions are compulsory.
2. The question paper has five sections and 33 questions. All questions are compulsory.
3. Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
4. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
5. Wherever necessary, neat and properly labeled diagrams should be drawn.

Section A

1. Which of the following is not a Mendelian disorder? **[1]**

   a) Hemophilia b) Down's syndrome

   c) Thalassemia d) Colour blindness

2. Conditions of a karyotype 2n + 1, 2n - 1 and 2n + 2, 2n - 2 are called: **[1]**

   a) Aneuploidy b) Polyploidy

   c) Monosomy d) Allopolyploidy

3. Segregation of homologous chromosomes occurs during: **[1]**

   a) Gametes formation b) During gene expression

   c) During mitosis division d) During equational division

4. XY chromosome that determines the sex in human beings are: **[1]**

   a) Heterologous b) Heteromorphic

   c) Homomorphic d) Genologous

5. Two genes R and Y are located very close on the chromosomal linkage map of the maize plants. When RRYY and rryy genotypes are hybridized, the F2 segregation will show: **[1]**

   a) Segregation in 3:1 ratio b) A higher number of parental types

   c) A higher number of the recombinant types d) Segregation in the expected 9:3:3:1 ratio

6. ZZ/ZW type of sex determination is seen in: **[1]**

   a) Cockroach b) Platypus

   c) Peacock d) Snails

7. Which genetic disorder is caused due to the presence of an additional copy of X-chromosome resulting in a karyotype of 47, XXY. **[1]**

a) Down's Syndrome
b) Anemia
c) Turner's Syndrome
d) Klinefelter's Syndrome

8. It is said that Mendel proposed that the factor controlling any character is discrete and independent. His proposition was based on the: **[1]**

a) results of F_3 generation of a cross.
b) observations that the offspring of a cross made between the plants having two contrasting characters shows only one character without any blending.
c) cross pollination of F_1 generation with recessive parent
d) self pollination of F_1 offsprings

9. Three genes R, S and T are located on the same chromosome. If the recombinant percentage between R and S is 20%, R and T is 35% and S and T is 15% respectively, can you predict the correct order of these genes on the chromosome? Which of the following shows the correct sequence of the genes on the chromosome? **[1]**

a) R-S-T
b) S-T-R
c) S-R-T
d) R-T-S

10. In birds, the female has been designed to be the Z and W chromosomes. In these organism female have: **[1]**

a) One Z and one W chromosome
b) Two Z and 1 one W chromosome
c) One Z and two W chromosomes
d) One Z and 0 W chromosomes

11. Henking X-body present in 50% of sperms is now known as: **[1]**

a) Lamp brush chromosomes
b) Autosomes
c) Y-chromosome
d) X-chromosome

12. Linkage is the: **[1]**

a) Generation of non-parental gene combination
b) Generation of parental gene combination
c) Physical association of two genes present on a different chromosome
d) Physical association of two genes present on the same chromosome

13. **Assertion (A):** A geneticist crossed two plants, he got 50% tall and 50% dwarf progenies. **[1]**
Reason (R): It follows Mendelian law and one of the parent plant might be heterozygous.

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.

14. **Assertion (A):** The progenies of a test cross can be easily analysed to predict the genotype of the test organism. **[1]**
Reason (R): In a typical test cross, an organism showing a recessive phenotype is crossed with a recessive parent instead of self-crossing.

a) Both Assertion and Reason are true, and
b) Both Assertion and Reason are true, but

Reason is the correct explanation of the Assertion.

Reason is **not** the correct explanation of the Assertion.

c) Assertion is true but Reason is false.

d) Both Assertion and Reason are false.

15. **Assertion (A):** Y chromosome causes maleness. **[1]**

Reason (R): If the number of the X chromosomes is more than one, femaleness dominates.

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.

16. **Assertion (A):** In humans, the gamete contributed by the male determines whether the child produced will be male or female. **[1]**

Reason (R): Sex in humans is a polygenic trait depending upon a cumulative effect of some genes on the X-chromosome and some on the Y-chromosome.

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.

Section B

17. What is point mutation? Give one example. **[2]**

OR

The human male never passes the gene for haemophilia to his son? Why is it so?

18. The following table shows the genotypes for ABO blood grouping and their phenotypes. Fill in the gaps left in the table. **[2]**

S.No.	Genotype	Blood Group
1	$I^A I^A$	A
2	_____	A
3	$I^B I^B$	B
4	_____	B
5	$I^A I^B$	_____
6	_____	O

19. Which of Mendel's law of inheritance is universally acceptable and without exception? State the law. **[2]**

20. When a red flowered. Antirrhinum plant was crossed with a white flowered Antirrhinum plant, the F_1 offspring had pink flowers. Mention (a) the genotype of F_1 plant, and (b) the reason why it did not bear the parental red or white flower colours? **[2]**

21. Name the respective pattern of inheritance where F_1 phenotype: **[2]**

(a) does not resemble either of the two parents and is in between the two

(b) resembles only one of the two parents.

Section C

22. It is said, that the harmful alleles get eliminated from population over a period of time, yet sickle cell anaemia is persisting in human population. Why? **[3]**

23. Rohit meets an accident. Iqbal his schoolmate takes him to hospital where Rohit (AB blood group) needs blood transfusion. Iqbal also has AB blood group and is willing to donate his blood but Rohit's mother object by saying "Iqbal belongs to different community so has different type of blood." In your opinion Rohit's mother is wrong or right? Give your opinion by explaining the allelic composition of blood group AB. **[3]**

24. A plant with red flowers was crossed with another plant with yellow flowers. If F_1 showed all flowers orange in colour, explain the inheritance. **[3]**

OR

Ravi was rushed to a nearby hospital after an accident which caused a lot of blood loss. The hospital failed to supply O negative blood for transfusion. Rahman who was attending a patient learned about the situation and agreed to donate blood being of the same blood group. Ravi's mother initially refused but was later convinced by her daughter.

a) What values do you find in Ravi's sister and Rahman?

b) Why can't O positive blood be transfused into Ravi's body?

c) What is the genetic basis of blood group inheritance?

25. In a cross between two tall pea plants some of the offsprings produced were dwarf. Show with the help of Punnett square how this is possible. **[3]**

26. i. How does mutation occur? **[3]**

ii. Differentiate between point mutation and frameshift mutation.

27. In peas, tallness is dominant over dwarfness, and red colour of flowers is dominant over the white colour. When a tall plant bearing red flowers was pollinated by a dwarf plant earing white flowers, the different phenotypic groups were obtained in the progeny in numbers mentioned against them. **[3]**

Tall, Red = 138

Tall, White =132

Dwarf, Red = 136

Dwarf, White =128

Mention the genotypes of the two parents and of the types of four offspring.

28. How does a chromosomal disorder differ from a mendelian disorder? **[3]**

OR

Mention any two autosomal genetic disorders with their symptoms.

Section D

29. **Read the text carefully and answer the questions:** **[4]**

Haemophilia is a sex linked disease which is also known as bleeder's disease as the patient will continue to bleed even from a minor cut since he or she does not possess the natural phenomenon of blood clotting due to absence of anti-haemophilic globulin or factor VIII and plasma thromboplastin factor IX essential for it. As a result of continuous bleeding the patient may die of blood loss. Colour blindness is another type of sex linked trait in which the eye fails to distinguish red and green colours. Vision is however, not affected and the colour-blind can, lead a normal life, reading, writing and driving (distinguishing traffic lights by their position).

(i) If a haemophilic man marries a woman whose father was haemophilic and mother was normal then what percent of the progeny will be normal.

(ii) A man whose father was colour blind and mother was normal marries a woman whose father was haemophilic and mother was normal then what percent of the progeny will be normal.

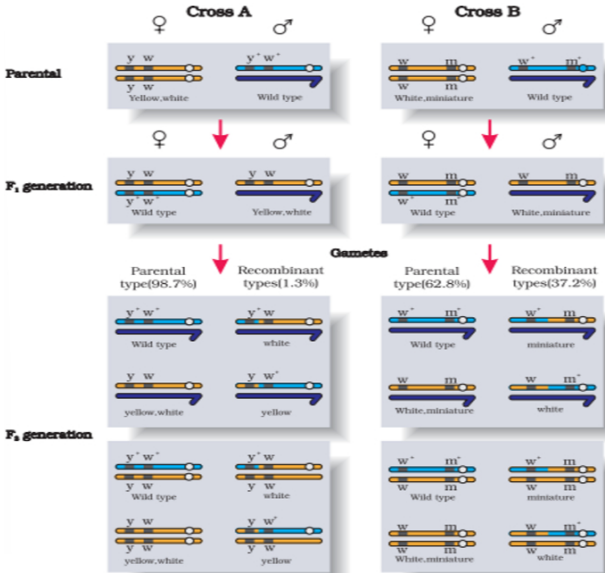
(iii) Name a famous personality in whose family haemophilia is there?

(iv) Anup is having colour blindness and is married to Soni who is normal. What is the chance that their son

will have the disease?

30. **Read the text carefully and answer the questions:** **[4]**

During a study of the inheritance of two genes, the teacher asked students to perform an experiment. The students crossed white-eyed, yellow-bodied female Drosophila with a red-eyed, brown-bodied male Drosophila (i.e., wild). They observed that progenies in F_2 generation had 1.3 percent recombinants and 98.7 percent parental type combinations. The experimental cross with results is shown in the given figure. [**Note**: Dominant wild-type alleles are represented with (+) sign in superscript.]



(i) What is your conclusion about the pattern of inheritance of genes in this case.

(ii) Why was the Teacher asked to conduct an experiment on Drosophila?

(iii) What is the relation between distance between map distance and linkage.

(iv) What is the relation between distance between recombination and linkage?

Section E

31. **[5]**

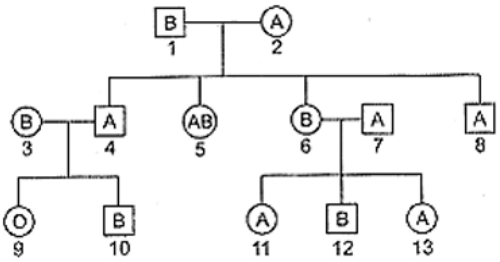
a. You are given tall pea plants with yellow seeds whose genotypes are unknown. How would you find the genotype of these plants? Explain with the help of cross.

b. Identify a, b and c in the table given below:

	Pattern of Inheritance	**Monohybrid F_1 Phenotypic expression**
1	Co-dominance	a
2	b	The progeny resembled only one of the parents
3	Incomplete dominance	c

OR

Study the pedigree chart given below, showing the inheritance pattern of blood groups in a family and answer the given questions.

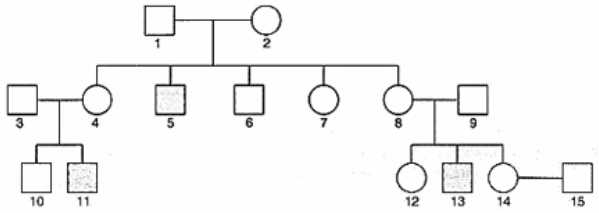


i. Give the possible genotypes of the individuals 1 and 2.

ii. Which antigen will be present on the plasma membrane of RBCs of individuals 5 and 9?

iii. Give the genotypes of the individuals 3 and 4.

32. Haemophilia is a sex-linked recessive disorder of humans. The pedigree chart given below shows the inheritance of haemophilia in one family. Study the pattern of inheritance and answer the questions given. **[5]**



i. Give all the possible genotype of the members 4, 5 and 6 in the pedigree chart.

ii. A blood test shows that the individual 14 is a carrier of haemophilia. The member numbered 15 has recently married the member numbered 14. What is the probability that their first child will be a haemophilic male?

OR

Compare in any three ways the chromosomal theory of inheritance as proposed by Sutton and Bovery with that of experimental results on pea plant presented by Mendel.

33. A homozygous tall pea plant with green seeds is crossed with a dwarf pea plant with yellow seeds. **[5]**

i. What would be the phenotype and genotype of F_1 generation?

ii. Work out the phenotypic ratio of F_2 generation with the help of a Punnett square.

OR

List the three different allelic forms of gene ‘I’ in humans. Explain the different phenotypic expressions, controlled by these three forms.