



Attempt questions first; check the separate key afterward. Use labelled diagrams where asked. Give scientific reasons; answer key covers closed questions.

A. Very short answers - 1 mark each

1. Define an allele.
2. What is the phenotypic ratio of a standard $Tt \times Tt$ cross?
3. What is its genotypic ratio?
4. Name the cross used to test an unknown dominant genotype.
5. State the blood-group genotype showing codominance.
6. Name the female sex-chromosome combination in birds.
7. Name the chromosomal basis of Down syndrome.
8. Name the typical karyotype of Turner syndrome.

B. Short answers / practice - 2 marks each

9. Explain Mendel's choice of pea and contrasting characters.
10. Distinguish dominance and segregation.
11. Explain independent assortment using a dihybrid cross.
12. Compare incomplete dominance and codominance.
13. Explain multiple alleles using ABO blood groups.
14. Distinguish pleiotropy and polygenic inheritance.
15. Describe the chromosome theory of inheritance.
16. Explain linkage and recombination using Morgan's experiments.
17. How does recombination frequency relate to map distance for nearby genes?
18. Compare human, bird and honey-bee sex determination.
19. Explain why X-linked recessive traits are more frequent in males.
20. Differentiate Mendelian and chromosomal disorders.

C. Application / reasoning - 3 marks each

21. For $Aa \times aa$, find probability of a recessive phenotype.

22. For $AaBb \times AaBb$, find $aabb$ probability with independent assortment.

23. How many gamete types can $AaBbCc$ produce with independent assortment?

24. For $I^A i \times I^B i$, list possible blood groups and probabilities.

25. A carrier of X-linked haemophilia has children with an unaffected man. What fraction of sons are expected affected?

26. What fraction of all children are expected affected in that cross, assuming equal sex probability?

27. In incomplete dominance, $Rr \times Rr$ gives which phenotype ratio?

28. Among 200 offspring, 20 are recombinants. Find recombination frequency.

29. State the typical chromosome complement in Klinefelter syndrome.

30. Explain thalassaemia as a quantitative globin-production defect.

31. Why does a dominant allele need not be common or beneficial?

D. Extended practice - 5 marks each

32. Draw monohybrid and dihybrid crosses and explain the laws inferred.

33. Use Punnett squares to compare complete dominance, incomplete dominance and codominance.

34. An unaffected couple has a son with X-linked recessive haemophilia. Draw their pedigree, infer parental genotypes and predict risks for future sons and daughters.

35. Compare Down, Turner and Klinefelter syndromes by chromosomal cause and characteristic effects.

ANSWER KEY - Numerical / closed questions

- 2) 3:1 with complete dominance. 3) $1TT:2Tt:1tt$. 4) Test cross. 5) $I^A I^B$. 6) ZW. 7) Trisomy 21. 8) 45, X. 21) $1/2$. 22) $1/16$. 23) Eight. 24) A, B, AB, O; each $1/4$. 25) $1/2$. 26) $1/4$. 27) 1:2:1. 28) 10%. 29) 47, XXY. 34) Mother is a carrier; father unaffected. Each son: $1/2$ affected. Each daughter: $1/2$ carrier, none affected under this model.