Speed Test-85

1. **(a)** AaBB × aaBB on crossing gives 50% individuals having genotype AaBB and 50% individuals having genotype aaBB.

14. **(b)** Down's syndrome is due to trisomy of 21st chromosome and is an autosomal abnormality.

15. **(d)** A barr body is one of the X-chromosomes in somatic cells of females. If there are more X-chromosomes, then there will be more barr bodies.

16. **(b)** Down's syndrome develops due to trisomy of chromosome number 21. In Turner's syndrome, the effect appears due to fusion of a gamete without sex chromosome and a gamete with one X-chromosome (44 + X). Klinefelter individuals are phenotypically males. The defect appears due to fusion of egg having unreduced sex complement (A + X X) with a gamete carrying Y chromosome (44 + XXY). Gynandromorphism occurs among *Drosophila*. In such individuals one half of the body shows male characters and the other half shows female characters.

17. **(c)** Sex in *Drosophila* is a function of the ratio of the number of X chromosomes to the number of autosomal sets. Therefore a *Drosophila* with a X/A =1.0 will be a female whereas the one with a X/A ratio = 0.5 will be male. However, in humans the presence or absence of the Y chromosome determines sex.

18. **(c)** The lack of independent assortment in sweet pea and *Drosophila* is due to linkage.

19. **(c)** Baldness is a sex influenced trait. The dominance of alleles may differ in heterozygotes of the two sexes.

20. **(a)** Cri-du-chat/cat cry syndrome is due to the deletion of a large part of the small or one of the 5^{th} chromosome.

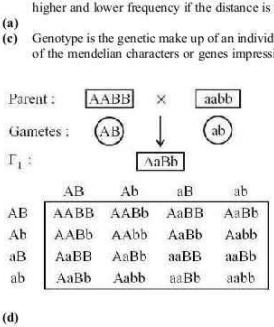
21. **(d)** Biometric genetics is the mathematical or statistical study of genetic phenomenon. In this branch, data of various genetic traits are analysed by applying the principles of statistics. It helps in the investigation of various genetic principles and checks their correctness and probability.

22. **(b)** In grasshopper the males lack a Y-sex chromosome and have only an X-chromosome. They produce sperm cells that contain either an X chromosome or no sex chromosome, which is designated as O.

23. **(d)** Linkage is the inheritance of genes of same chromosome together and capacity of these genes to retain their parental combination in subsequent generation. The strength of linkage between two genes is inversely proportional to the distance between the two. This means, two linked genes show higher frequency of recombination if the distance between them is higher and lower frequency if the distance is smaller.

24. **(a)**

25. **(c)** Genotype is the genetic make up of an individual irrespective of the mendelian characters or genes impressing.



26. **(d)**

27. **(c)**

28. **(d)** Phenylketonuria is a human genetic disorder in which the body does not contain the enzyme phenylalanine hydroxylase, necessary to metabolize phenylalanine to tyrosine, and converts phenylalanine instead to phenylpyruvic acid. As PKU is an autosomal recessive genetic disorder each parent must have at least one defective allele of the gene for PAH, and the child must inherit a defective allele from each parent. As such, it is possible for a parent with a PKU phenotype to have a child without PKU if the other parent possesses at least one functional allele of the gene for PAH. A child of two parents with the PKU phenotype will always receive two defective alleles so will always have PKU. The gene for PAH is located on chromosome 12.

29. **(a)** Chromosomes occur in homologous pairs. Somatic cells have diploid number of chromosomes. Humans have 23 pairs *i.e.* 46 chromosomes. 22 pairs of autosomes and 1 pair of sex chromosomes i.e. XX in females and XY in males.

30. **(a)**

31. **(d)** Given that recombinant percentage is 7% and 5% therefore, total recombinants would be 7 + 5 = 12%. It is known that one map unit is the distance that yields 1% recombinant chromosomes. Hence distance between two non-allelic genes = 12 map units.

32. **(b)** In the given cross, passing of disease is from carrier female to male progeny (criss-cross inheritance). Any trait that shows criss-cross inheritance is located on the sex chromosome. Presence of a single recessive gene i.e. X^c in carrier individuals (XX^c) does not cause the disease, thus the trait is recessive.

33. **(b)**

34. **(b)** A cross between heterozygous long-winged flies and (homozygous) vestigial winged flies represents an example of test cross, in which the exact Mendelian ratio of 1 : 1 is obtained. i.e., 96 long-winged flies and 96 vestigial winged flies.

35. **(b)** Incomplete dominance is the phenomenon of neither of the two alleles being dominant so that expression in the hybrid is intermediate between the expressions of the two alleles in homozygous state. F_2 phenotypic ratio is 1 : 2 : 1, similar to genotypic ratio.

36. **(a)** To determine the genotype of a tall plant of F_2 generation, Mendel crossed the tall plant from F_2 generation with a dwarf plant. He called this a test cross. In a typical test cross an organism (pea plants) showing a dominant phenotype whose genotype is to be determined is crossed with the recessive parent instead of self-crossing. The progenies of such a cross can easily be analysed to predict the genotype of the test organism. Normal test cross ratio for a monohybrid cross is 1 : 1 and for a dihybrid cross is 1 : 1 : 1 : 1.

37. **(a)** Quantitative inheritance (polygenic inheritance) is a type of inheritance controlled by one or more genes in which the dominant alleles have cumulative effect with each dominant allele expressing a part or unit of the trait, the full trait being shown only when all the dominant alleles are present. e.g., kernel colour in wheat, skin colour in human beings, human intelligence, height in human beings and several plants, etc.
The ability of a gene to have multiple phenotypic effects because it influences a number of characters simultaneously is known as pleitropy. The genes involved are called pleiotropic genes. It is not essential that all the traits are equally influenced. Sometimes the effect of a pleiotropic gene is more evident in case of one trait (major effect) and less evident in case of others (secondary effect). An example of this in humans is the disease

phenylketonuria, which also produces abnormal phenotypic traits such as mental retardation, widely placed incisors, pigmented patches on the skin and excessive sweating for multiple alleles.

38. (b) Chromosomal theory of inheritance believes that chromosomes are vehicles of hereditary information which possess Mendelian factors or genes and it is the chromosomes which segregate and assort independently during transmission from one generation to the next. Chromosomal theory of inheritance was proposed by Walter Sutton and Theodore Boveri independently in 1902. But it was later modified and expanded by Morgan, Sturtevant and Bridges.

39. (c) Linked genes are those genes which do not show independent assortment but remain together because they are present on the same chromosome. In linkage, there is a tendency to maintain the parental gene combination except for occasional crossovers.

40. (b) In ZW-ZZ type of sex determination, the male has two homomorphic sex chromosomes (ZZ) and is homogametic, and the female has two heteromorphic sex chromosomes (ZW) and is heterogametic. There are, thus, two types of eggs: Z and W, and only one type of sperms, i.e., each with Z. Fertilization of an egg with Z chromosome by a sperm with Z chromosome gives a zygote with ZZ chromosomes (male).
Fertilization of an egg with W chromosome by a sperm with Z chromosome yields a zygote with ZW chromosomes (female). This mechanism operates in some vertebrates (fishes, reptiles and birds).

41. (c) Since colourblindness is a sex-linked recessive trait and males just have one X chromosome, they can never be the carriers. Males will always express the disease/phenotype.

42. (d) In a stable population, for a gene with two alleles, 'A' (dominant) and 'a' (recessive), if the frequency of 'A' is p and the frequency of 'a' is q, then the frequencies of the three possible genotypes (AA, Aa and aa) can be expressed by the Hardy-Weinberg equation:
$p^2 + 2pq + q^2 = 1$
where p^2 = Frequency of AA (homozygous dominant) individuals q^2 = Frequency of aa (homozygous recessive) individuals
2pq = Frequency of Aa (heterozygous) individuals
so, p = 0.6 and q = 0.4 (given)
$\therefore$ 2pq (frequency of heterozygote) = $2 \times 0.6 \times 0.4 = 0.48$.

43. (b) The distance between genes is measured by map unit. 1% crossing over between two linked genes is known as 1 map unit or centi Morgan (cM). 100% crossing over is termed as Morgan (M) and 10% crossing over as deci Morgan (dm).

44. (d) Dominant autosomal traits are caused by dominance autosomal genes. Some of the dominantly autosomal inherited disorder in human beings are : Polydactyly– presence of extra fingers and toes . Huntington's disease or Huntington's chorea — a disorder in which muscle and mental deterioration occurs and there is gradual loss of motor control resulting in uncontrollable shaking and dance like movement (chorea), phenylthiocarbamide (PTC) tasting, etc.

45. (a) Most of the gene mutations involve a change in only a single nucleotide or nitrogen base of the cistron. These gene mutations are called point mutations. e.g. sickle cell anaemia in which polypeptide chain coding for hemoglobin contains valine, instead of glutanic acid due to substitution of T by A in second position of triplet codon.