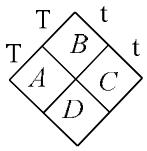
Alkaptonuria	Brachydactyly
Blue eyes	Brown eyes
Cystic fibrosis	Huntington disease
Tongue Non roller's	Tongue roller's
Duchenne muscular dystrophy	Morphan syndrome
Lesch-Nyhan syndrome	Phenylthiocarbamide **(PTC)** tasting
Fused ear lobes	Free ear lobes
Tay-Sach's disease	Widow's peak

IMPORTANT PRACTICE QUESTION SERIES FOR NEET EXAM – 1

1. A condition characterized by not having an exact number of chromosomes in a multiple of haploid set is called
   a) Polyploidy b) Synploidy c) aneuploidy d) None of these
2. Choose correct option for A, B, C and D

   TT × Tt

   a) A-tt, B-TT, C-TT, D-TT b) A-Tt, B-Tt, C-Tt, D-Tt
   c) A-TT, B-TT, C-Tt, D-TT d) A-Tt, B-Tt, C-Tt, D-TT
3. When a cross is conducted between black feathered hen and a white feathered cock, blue feathered fowls are formed. When these fowls are allowed for interbreeding, in F_2- generation, there are 20 blue fowls. What would be the number of black and white fowls?
   a) Black 20, white 10 b) Black 20, white 20 c) Black 10, white 10 d) Black 10, white 20
4. Chromosomes are made up of
   a) DNA are protein b) RNA and DNA c) DNA and histone d) Only histones
5. In pedigree analysis, the square, blackened and horizontal lines represents

a) Female, healthy individual, parents
b) Female, affected individual, parents
c) Male, affected individual, parents
d) Male, affected individual, progeny

6. Following pedigree chart shows

a) Character is carried by Y-chromosome
b) Character is sex-linked recessive
c) Character is sex-linked dominant
d) Character is recessive autosomal

7. Mr. Sidd is suffering from hypertrichosis and phenylketonuria. His father is heterozygous for phenylketonuria. The probability of Sidd's sperm having one recessive autosomal allele and holandric gene is

a) $\frac{1}{2}$ b) $\frac{1}{8}$ c) $\frac{1}{10}$ d) $\frac{1}{4}$

8. F_3-generation is obtained by

a) Selfing of F_1 b) Selfing of F_2 c) Crossing of F_1 and F_2 d) None of these

9. In which one of the following, complementary gene interaction rato of 9 : 7 is observed?

a) Fruit shape in Shepherd's purse
b) Coat colour in mouse
c) Feather colour in fowl
d) Flower colour in pea

10. Starch synthesis gene in pea plant is the example of

a) Single gene produce more than one effects
b) Multiple genes produce more than one effects
c) Two genes produce more than one effects
d) Multiple genes produce less than one effects

11. In *Drosophila* , the sex is determined by

a) The ratio of pairs of X-chromosomes to the pairs of autosomes
b) Whether the egg is fertilized or develops parthenogenetically
c) The ratio of number of X-chromosomes to the set of autosomes
d) X and Y-chromosomes

12. The 1 : 2 : 1 ratio with the pink flower in the F_2-generation indicate the phenomenon of

a) Dominance
b) Codominance
c) Incomplete dominance
d) Segregation

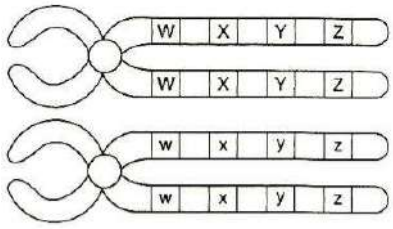
13. Sexual reproducation leads to

a) Genetic recombination
b) Polyploidy
c) Aneuploidy
d) Euploidy

14. Husband has blood group-A and wife has blood group-B. What is the blood group of children?

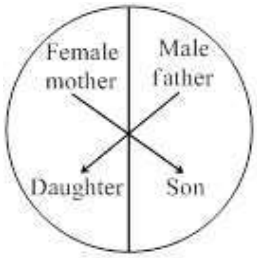
a) A b) B c) AB d) A, B, AB and O

15. Study the following figure and find out the most probable position at which the crossing over takes place



a) w and W b) X and y c) y and Z d) w and z

16. Given diagram shows certain type of traits in human. Which one of the following option could be an example of this pattern?



a) Haemophilia b) Anaemia c) Phenylketonuria d) Thalassaemia

17. In case of incomplete dominance, what will be the phenotypic ratio of F_2 generation?
    a) 3 : 1 b) 1 : 2 : 1 c) 1 : 1 : 1 : 1 d) 2 : 2
18. Haemophilia, a X-linked recessive disease is caused due to deficiency of
    a) Blood plasma and vitamin–K b) Blood platelets and haemoglobin
    c) Lack of clotting material and vitamin-K d) All of the above
19. All of this obeys Mendel's laws except
    a) Codominance b) Independent assortment
    c) Dominance d) Purity of gametes
20. in β-thalassaemia, the affected chromosome is
    a) 16th b) 14th c) 13th d) 19th
21. In pea plants, yellow seeds are dominant to green. If a heterozygous yellow seeded plant is crossed with a green seeded plant, what ratio of yellow and green seeded plants would you expect in F_1 generation?
    a) 50 : 50 b) 9 : 1 c) 1 : 3 d) 3 : 1
22. Who was fly men of genetics?
    a) Sutton b) Pasteur c) Robert Hooke d) TH Morgan
23. Mendel's contribution for genetic inheritance was
    a) The idea that genes are found on chromosomes
    b) Providing a mechanism that explains patterns of inheritance
    c) Describing how genes are influenced by the environment
    d) Determining that the information contained in DNA codes for proteins
24. The genotypic ratio of a monohybrid cross in F_2-generation is
    a) 3 : 1 b) 1 : 2 : 1 c) 2 : 1 : 1 d) 9 : 3 : 3 : 1
25. Baldness is more common in men than in woman. It could be explained on the basis that
    a) Genes of baldness are located on X-chromosomes only
    b) Baldness genes are located on Y-chromosomes
    c) Genes of baldness are autosomal but influenced by androgens
    d) None of the above
26. How many pairs of contrasting characters in pea pod were chosen by Mendel?
    a) 3 b) 5 c) 7 d) 9
27. A mutagen pollutant is
    a) Organophosphates b) Resins
    c) Chlorinated hydrocarbons d) Nitrogen oxides
28. Both chromosome and gene (Mendelian factors) whether dominant or recessive are transmitted from generation to generation in which form
    a) Changed b) Unaltered form c) Altered form d) Disintegrated
29. Pedigree analysis is very important in human beings because
    a) It helps genetic counselers to avoid disorders
    b) It shows origin of traits
    c) It shows the flow of traits in family
    d) All of the above
30. Genes when present in homozygous condition results in non – viable progeny, the factor

responsible for such conditions are

a) Polygenes b) Linked genes c) Lethal genes d) Epistatic genes

31. Turner's syndrome caused due to the absence of
    a) One X-chromosome (44 with XO) b) One Y-chromosome
    c) One X-and Y-chromosome d) Two X-chromosome
32. The recessive genes located on X-chromosome in humans are always
    a) Lethal b) Sub-lethal c) Expressed in males d) Expressed in females
33. Strength of the linkage between the two genes is
    a) Proportionate to the distance between them
    b) Inversely proportionate to the distance between them
    c) Depend on the chromosomes
    d) Depend upon the size of chromosomes
34. Fruitfly is excellent model for genetics because of
    I. Small life cycle (two week)
    II. Can be feed on simple synthesis medium
    III. Single mating produce large number of progeny
    IV. Clear differentiation of sexes
    V. Many heredity variation can be seen with low power microscopes
    Choose the correct option
    a) I, II and III b) III, IV and V c) I, IV and V d) All of these
35. In Guinea pigs, black short hair (BBSS) is dominant over white long hair (bbss). During a dihybrid cross, the F_2-generation individuals with genotypes BBSS, BbSS, BBSs and BbSs are in the ratio of
    a) 9 : 3 : 3 : 1 b) 4 : 2 : 1 : 2 c) 1 : 2 : 1 : 2 d) 1 : 2 : 2 : 4
36. When both parents are of blood type AB, they can have children with
    a) A, B, AB and O blood types b) A, B, and AB blood types
    c) A and B blood types d) A, B and O blood types
37. Test cross is
    a) Recessive F_1-plant crosses with dominant F_2-plant
    b) Recessive F_2-plant crosses with dominant F_3-plant
    c) Dominant F_2-plant crosses with recessive parent plants
    d) Dominant F_2-plant crosses with heterozygous parent plants
38. The phenomenon of a single gene regulating several phenotypes is called
    a) Multiple allelism b) epistasis
    c) Incomplete dominance d) Pleiotropism
39. If two pea plants having red (dominant) coloured flowers with unknown genotypes are crossed, 75% of the flowers with unknown genotypes are crossed, 75% of the flowers are red and 25% are white. The genotypic constitution of the parents having red coloured flowers will be
    a) Both homozygous b) One homozygous and other heterozygous
    c) Both heterozygous d) Both hemizygous
40. A woman has a haemophilic son and three normal children. Her genotype and that of her husband with respect to this gene would be
    a) XX and X^hY b) X^hX^h and X^hY c) X^hX^h and XY d) X^hX and XY
41. The proportion of plants that were dwarf and tall in F_2- generation ofo Mendel experiment
    a) $\frac{1}{4}$th and $\frac{3}{4}$th b) $\frac{3}{4}$th and $\frac{1}{4}$th c) $\frac{2}{3}$rd and $\frac{1}{3}$rd d) $\frac{1}{3}$rd and $\frac{4}{3}$rd
42. Night blindness is
    a) Genetic disease b) Nutritional deficiency disease
    c) Generally found in male d) Generally found in female
43. Two genes R and Y are located very close on the chromosomal linkage map of maize plant. When RRYY and rryy genotypes are hybridized, then F_2-segregation wii show

a) 1 : 2 : 1 b) 3 : 1 c) 9 : 3 : 3 : 1 d) 1 : 1 : 1

44. Who argued that pairing and separation of chromosomes would lead to the segregation of a pair of factor they carried?
a) Sutton b) Boveri c) Both (a) and (b) d) Morgan

45. Sex chromosomes of male are
a) Homozygous b) Heterozygous c) Hemizygous d) autosomes

46. Trisomy of which chromosome is involved in Down's syndrome?
a) 15th b) 21st c) 20th d) 19th

47. Which of the following symbols are used for representing chromosome of birds?
a) ZZ-ZW b) XX-XY c) XO-XX d) ZZ-WW

48. Sudden and heritable change in a character of an organism is called
a) Mutation b) Heterosis c) Inbreeding d) selection

49. Heterozygous purple flower is crossed with recessive white flower. The progeny has the ratio
a) All purple b) All white
c) 50% purple, 50% white d) 75% purple, 25% white

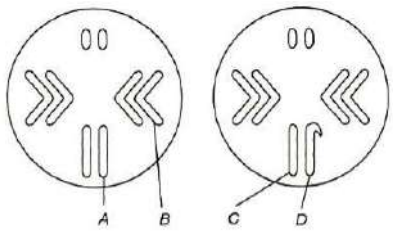
50. The Mendel crossed true breeding tall and dwarf plant varieties in his experiment. The tall character was dominant and recessive character was dwarf. The recessive character was appeared in
a) F_1 b) F_2 c) F_3 d) F_2 and F_3

51. In order to find out the different types of gametes produced by a pea plant having the genotype AaBb, it should be crossed to a plant with the genotype
a) aaBB b) AaBb c) AABB d) aabb

52. The lowest number of chromosomes is found, in which of the following?
a) *Haplopappus gracilis* b) *Poa litorosa* c) *Salix tetrasperma* d) *Ageratum coigzoides*

53. The genes for seven characters of pea plant that were considered in Mendel hybridisation experiment are present on
a) 4 chromosome b) 5 chromosome c) 7 chromosome d) 8 chromosome

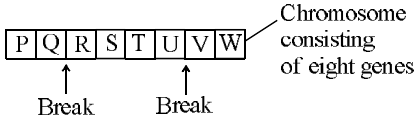
54. Chromosome diagram of the given fruitfly tick the correct choice for autosome labelled



a) A b) C c) D d) B

55. Identify the wrong statement.
a) In male grasshoppers, 50% of the sperms have no sex chromosome
b) Usually , female birds produce two types of gametes based on sex chromosome
c) The human males have one of their sex chromosomes much shorter than other
d) In domesticated fowls, the sex of the progeny depends on the type of sperm rather than the egg

56. The chromosome shown in the diagram below is broken at the points which are indicated by the arrows and the genes between these points became inverted

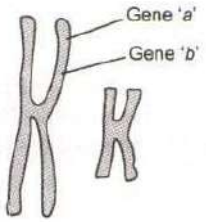


The resulting order of the genes will be
a) PQUTSRVW b) WVUTSRQP c) PQTURSVW d) VWUTSRPQ

57. Which of these is a dominant factor?

a) Rh factor b) Haemophilia c) Albinism d) Colour blindness

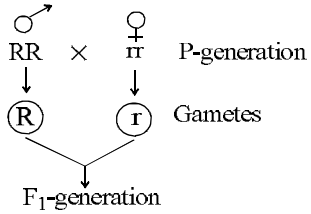
58. A person with unknown blood group under ABO system, has suffered much blood loss in an accident and needs immediate blood transfusion. His one friend who has a valid cerificate of his own blood type, offers for blood donationwithout delay. What would have been the type of blood group of the donor friend?
    a) Type AB b) Type O c) Type A d) Type B
59. If Mendel had studied 7 traits using a plant of 12 chromosomes instead of 14
    Choose the correct option for probable result
    a) He would have discovered crossing over
    b) He would have discovered blending
    c) He would have not discovered independent assortment
    d) All of the above
60. In thalassaemia, the affected chain of a haemoglobin is
    a) α-globin chain b) β-globin chain c) Both (a) and (b) d) None of these
61. Sex chromosomes in male of silkworm is
    a) X b) Y c) XX d) No X no Y
62. A hereditary disease, which is never passed on from father to son is
    a) Autosomal linked disease b) X-chromosomal linked disease
    c) Y-chromosomal linked disease d) None of the above
63. Two genes R and Y are located very close on the chromosomal linkage map of maize plant. When RRYY and rryy genotypes are hybridized, then F_2-segregation wii show
    a) Higher number of the recombinant types b) Segregation in the expected 9 : 3 : 3 : 1 ratio
    c) Segregation in 3 : 1 ratio d) Higher number of the parental types
64. During ...A... both members of chromosome pair as well as ...B... separate and pass to different gametes. Choose the correct option for A and B
    a) A-mitosis; B-allele pair b) A-meiosis; B-allele pair
    c) A-allele pair; B-meiosis d) A-allele pair; B-mitosis
65. Genetic map is one that
    a) Shows the stages during the cell division
    b) Shows the distribution of various species in a region
    c) Establishes sites of the genes on a chromosome
    d) Establishes the various stages in gene evolution
66. Given below is a highly simplified representation of the human sex chromosomes from a karyotype. The gene 'a' and 'b' could be of



    a) Colour blindness and body height b) Attached ear lobe and rhesus blood group
    c) Haemophilia and red–green colourblindness d) Phenylketonuria and haemophilia
67. Human females have
    a) 22 pairs of autosomes and one pair of sex chromosome
    b) 21 pairs of autosomes and two pairs of sex chromosome
    c) 23 pairs of autosomes and one pair of sex chromosome
    d) 20 pairs of autosomes and one pair of sex chromosome
68. The progenies are found to be male sterile after crossing two plants. This is due to some genes, which are present in

a) Mitochondria b) Cytoplasm c) Nucleus d) chloroplast

69. Mutation may results in the
    a) Change in genotype b) Change in phenotype
    c) Change in metabolism d) All of these
70. In cross between yellow round (YYRR) and pure breeding pea plants having green wrinkled (yyrr) find out the total seeds (plants) having yellow colour in F_2-generation
    a) 12 b) 10 c) 14 d) 11
71. A cross in which parents differ in a single pair of contrasting character is callled
    a) Monohybrid cross b) Dihybrid cross c) Trihybrid cross d) Tetrahybrid cross
72. Calvin bridges demonstrated sex determining factor is the ratio of number of
    a) X-chromosome to autosome b) Autosome to X-chromosome
    c) Y-chromosome to X-chromosome d) Y-chromosome to autosome
73. Find out the genotype and phenotype of F_1-generation (R = dominant and red, r = recessive and white) from the given cross



    a) Rr and white b) Rr and red c) Rr and pink d) Can not predict

74. Which one of the following conditions correctly describes the manner of determining the sex in the given example?
    a) XO type of sex chromosomes determine male sex in grasshopper
    b) XO condition in humans as found in Turner's syndrome, determines female sex
    c) Homozygous sex chromosomes (XX) produce male in *Drosophila*
    d) Homozygous sex chromosomes, (ZZ) determine female sex in birds.
75. Ratio observed in dihybrid cross (phenotypically)
    a) 3 : 1 b) 1 : 2 : 1 c) 9 : 7 d) 9 : 3 : 3 :1
76. Trisomy stands for
    a) $2n-1$ b) $2n+2$ c) $2n+3$ d) $2n+1$
77. Klinefelter's syndrome results from
    a) XX egg of Y sperm b) XX egg and XY sperm
    c) X egg and YY sperm d) XY egg and X sperm
78. A couple whose sons are colourblind with AB blood group, identify the parents from the following.
    a) Mother colourblind with A blood group, and father normal with blood group-B
    b) Mother normal with blood group-A, and father colourblind with blood group-B
    c) Mother colourblind with blood group-B, and father normal with blood group-B
    d) Mother normal with blood group-A, and father colourblind with blood group-B
79. Which of the following chromosomal mutation are most likely to take place when homologous chromosomes are undergoing synapsis?
    a) Inversion and translocation b) Deletion and duplication
    c) Inversion and deletion d) Translocation and duplication
80. What percentage of homozygous Rh^- will be born amongst four children of a couple where the husband is heterozygous for Rh^+ and wife is homozygous for Rh^-gene?
    a) 25% b) 50% c) 75% d) 100%
81. Mendel could not find out linkage because
    I. some genes are linked but they are too far apart for crossing over to be distinguished from

independent assortment
II. linked genes, were never tested for the same time in same cross
III. all seven genes, were present on the same chromosomes
IV. all seven genes were present on 4 chromosome but they were present far apart
Find out the correct option
a) I and II b) II and III c) III and IV d) IV only

82. Haemophilia is also called
a) Bleeders disease b) Blood disease c) RBC disease d) All of these
83. The genes located in the same chromosome do not separate and are inherited together over its generations due to the phenomenon of
a) Complete linkage b) Incomplete linkage
c) Incomplete recombination d) Complete recombination
84. Universal donor is
a) O Rh^+ b) O Rh^- c) AB Rh^+ d) AB Rh^-
85. Persons with Klinefelter's syndrome have chromosomes
a) XX b) XY c) XXY d) XYY
86. Mendel crossed tall and dwarf plant. In F_2-generation both the tall and dwarf plants were produced. This shows
a) Blending of characters b) Atavism
c) Non-blending of characters d) Intermediate characters
87. Sex- limited and sex- linked genes are located on
a) Autosomes b) X-chromosome c) Y-chromosome d) Both (b) and (c)
88. How many different types of gametes can be formed by F_1 progeny, resulting from the following cross?
AA BB CC × aa bb cc
a) 3 b) 8 c) 27 d) 64
89. Point mutation involves
a) Insertion b) Change in single base pair
c) Duplication d) deletion
90. A person with type A blood group may safely receive a transfusion of
a) Type-AB b) Type-A and type –O
c) Type-A and type –AB d) Type-AB and type –O
91. In which cross will you get most pink flowers?
a) Red × red b) Red × pink c) Pink × pink d) Red × white
92. *Triticale* has been produced by the intergenic hybridization of
a) Wheat and rice b) Wheat and rye c) Wheat and aegilops d) Rice and maize
93. Which one of the following characters studied by Mendel in garden pea was found to be dominant?
a) Green seed colour b) Terminal flower position
c) Green pod colour d) Wrinkled seed
94. Mendel's experimental material was
a) *Pisum sativum* b) *Lathyrus odoratus* c) *Oryza sativa* d) *Mirabilis jalappa*
95. Which of the following is not considered as mutagen?
a) Lower temperature b) X-rays
c) Higher temperature d) UV rays
96. The physical expression or appearance of a character is called as
a) Morphology b) Genotype c) Phenotype d) Ecotype
97. Carrier organism refers to an individual, which carries a
a) Dominant gene, that is not expressed b) Recessive gene, that is not expressed

c) Recessive gene, that is expressed d) Dominant gene, that is expressed

98. In previous question, find out which alphabete (A-D) labelled for X and Y-chromosome
X Y
a) A D b) A,C D
c) C D d) B D

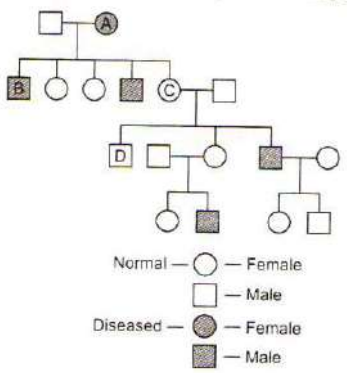
99. In amniocentesis of a pregnant woman, it is found that the embryo contains both, Barr body and F-body. The syndrome likely to be associated with the embryo is
a) Edward' syndrome b) Down's syndrome
c) Klinefelter's syndrome d) Patau's syndrome

100. In the previous question, find out the chances of fifth child to be albino
a) 1 in 2 b) 1 in 4 c) 1 in 3 d) 1 in 5

IMPORTANT PRACTICE QUESTION SERIES FOR NEET EXAM – 2

1. Three children in a family have blood types O, AB and B respectively. What are the genotypes of their parents?
a) I^Ai and I^Bi b) I^AI^B and i i c) I^BI^B and I^AI^A d) I^AI^A and I^B i

2. The chromosomal arrangement results in
a) Euploidy b) Aneuploidy c) Duplication d) polyploidy

3. 

In the above pedigree, assume that no outsider marrying in, carry a disease. Write the genotypes of C and D.
a) X^CY and X^CX^C b) XX^C and XY c) XY and X^CX^C d) X^CX^C and X^CX

4. The specific pair of chromosomes which determine the sex of the individual called
a) Sex chromosomes b) Allosomes c) Heterosomes d) All of these

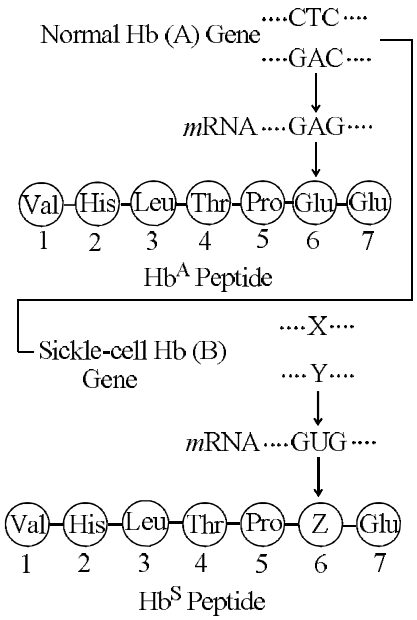
5. The 'Cri-du-chat' syndrome is caused by change in chromosome structure involving
a) Deletion b) Duplication c) Inversion d) translocation

6. During his experiments, Mendel used the term factor for
a) Genes b) Traits c) Characters d) Qualities

7. In a monohybrid cross involving incomplete dominance, the phenotypic ratio equals the genotypic ratio in F_2 - generation. The ratio is

a) 3 : 1 b) 1 : 2 : 1 c) 1 : 1 : 1 : 1 d) 9 : 7

8. The genome of *Caenorhabditiselegans* consists of
   a) 3 million base pairs and 30,000 genes b) 180 million base pairs and 13,000 genes
   c) 4.7 million base pairs and 4,000 genes d) 97 million base pairs and 18,000 genes
9. Albinism is caused by the deficiency of
   a) Amylase b) Tyrosinase c) Phenylalanine d) Xanthene oxidase
10. The ABO blood grouping in human beings is an example for
    I.Dominance
    II.Incomplete dominance
    III.Codominance
    IV.Multiple alleles
    a) I and II b) II , III and IV c) I , III and IV d) III and II
11. Sickle-cell anaemia is an autosomal linked recessive trait can be transmitted from parents to the offspring when both the partners are carrier for all the genes or heterozygous. The disease is controlled by a single pair of allele, Hb^A and Hb^S. Identify X, Y and Z



    a) GTG GAC Val (GUG) b) CAC CTC val (GUG)
    c) GTA GAG val (GUG) d) GTC GAC val (GUG)
12. Diploid cells have
    a) Two chromosomes b) One set of chromosomes
    c) Two pairs of homologous chromosomes d) Two sets of chromosomes
13. Single gene can produce more than one effect. Like starch synthesis in pea plant. It has two alleles (B and b) for starch synthesis the phenotypes of which are also given below
    B B, b b, B b
    I. BB – round seed, large starch synthesis
    II. bb – wrinkle seed, less starch synthesis
    III. Bb – intermediate size seed, intermediate less starch synthesis
    Choose the correct option
    a) I and II b) II and III c) III and I d) I, II and III
14. After examining the blood groups of husband and wife, the doctor advised them not to have more than one child, the blood group of the couple are likely to be
    a) male$Rh^-$and female Rh^+ b) Female$Rh^-$and male Rh^+
    c) Male and female Rh^+ d) Male and female Rh^-
15. A person with blood group-A has

a) Antigen-A and antibody-b
b) Antigen-B and antibody-a
c) Both antibodies
d) No antibody and no antigen

16. Which of the following is not a correct match?
a) Sex determination – A chromosomal phenomenon
b) Y-chromosome – Autosomal
c) Red–green colour blindness in human – A sex-linked character
d) An abnormal chromosome number in each cell – A case of polyploidy

17. In law of independent assortment. How many factors are involved? (for a dihybrid cross)
a) 2 b) 3 c) 4 d) 1

18. Mother B homozygous, father A unknown, therefore, possible blood group in progeny is
a) AB and B possible b) AB and A possible c) A and B possible d) O possible

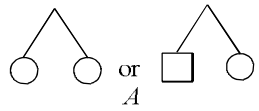
19. Consider the following four statements I, II, III and IV and select the correct statements
I. Mendelian experiments has a large sampling size, which gave greater credibility to the data that he collected
II. Recessive allele influences the appearance of the phenotype even in the presence of a dominant allele
III. Multiple alleles can be found only when population studies are made
IV. In F_2-generation of a Mendelian monohybrid cross, the tall and dwarf traits were identical to their parental types and shows blending inheritance
The correct statements are
a) I and III b) III and IV c) II and IV d) II and III

20. When released from ovary, human egg contain
a) One Y-chromosome b) Two X-chromosome c) One X-chromosome d) XY-chromosome

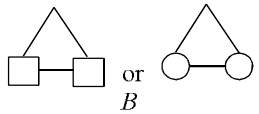
21. The tendency of offsprings to differ from their parents is called
a) Variation b) Heredity c) Inheritance d) Resemblance

22. The gene, which controls many characters, is called
a) Codominant gene b) Polygene c) Pleiotropic gene d) Multiple gene

23. The given diagram *A* and *B* indicates



A



B

a) A-Zygotic twins; B-Dizygotic twins
b) A-Dizygotic twins; B-Identical twins
c) A-Zygotic twins; B-Identical twins
d) A-Identical twins; B-Dizygotic twins

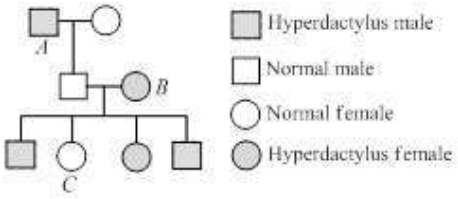
24. Which of the following statement is/are correct regarding law of segregation?
a) Alleles separate with each other during gametogenesis
b) The segregation of factors is due to the segregation of chromosomes during meiosis
c) Law of segregation is called as law of purity of gametes
d) All of the above

25. Which of the following discoveries resulted in a Nobel Prize?
a) Recombination of linked genes
b) Genetic engineering
c) X-rays induce sex-linked recessive lethal mutations
d) Cytoplasmic inheritance

26. When alleles of two contrasting characters are present together, one of the character expresses itself during the cross while the other remains hidden. This is the
a) Law of purity of gametes
b) Law of segregation
c) Law of dominance
d) Law of independent assortment

27. In which phase of meiosis-I the two chromosome can align at the metaphase plate independently of each other
    a) Metaphase-II b) Metaphase-I c) Anaphase-I d) Telophase-I
28. When a mutation is limited to the substitution of one nucleotide for another, it is called
    a) Translocation b) Point mutation
    c) Base inversion d) Sugar phosphate deletion
29. Types of genotype observed in a dihybrid cross are
    a) 9 b) 12 c) 4 d) 6
30. In Morgan's experiments on linkage, the percentage of white eyed, miniature-winged recombinants in F_2-generation is
    a) 1.3 b) 37.2 c) 62.8 d) 73.2

31. Which cross was used to study the independent assortment?
    a) Monohybrid cross b) Dihybrid cross c) Trihybrid cross d) Tetrahybrid cross
32. Hyperdactyly (the possession of more than 12 finger) is determined by the dominant allele (H) and normal condition by recessive allele (h).
    The diagram shows a family tree in which some members of the family are hyperdactylus

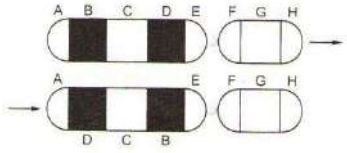


    Find out the genotype of *A*, *B* and *C*
    a) A-Hh, B-Hh, C-hh b) A-HH, B-Hh, C-hh c) A-Hh, B-HH, C-hh d) A-Hh, B-HH, C-hh
33. Which of the following statements about mutation are true?
    I. Mutations are the source of new alleles for genes
    II. Organisms are able to create mutations to meat their specific needs
    III. Mutations are random events and can happen in any cell at any time
    IV. Most mutations tend to be harmful or have no effect on an organisms
    a) I, II and III b) I, II, III and IV c) I, III and IV d) I and III
34. Centromere is also called
    a) Chromomere b) Secondary constriction
    c) Primary constriction d) chromocentre
35. Which of the following statements are false?
    I. Specific mutations are acquired because they are needed
    II. Recessive alleles follows different laws of inheritance than dominant alleles do
    III. Offspring get two copies of each gene from each parent
    IV. Gametes fuses without regard to which alleles they carry
    a) II and III b) II and IV c) II, III and IV d) I, II and IV
36. Which contributed to Mendel's success?
    I. Selection of pea plant
    II. Knowledge of history
    III. One character at one time
    IV. His statistical knowledge
    Choose the correct option
    a) I, II, III and IV b) II and III c) I, III and IV d) IV, III and II
37. In XX and XO chromosomal sex determination there is absence of one chromosome in
    a) Male b) Female c) Both (a) and (b) d) None of these
38. Which of the following is true about linkage
    I. It is phenomenon in which more recombinants are produced in F_2-generation

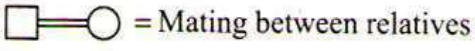
II. More parental combination are produced in F_2-generation
III. Genotype which are present in F_1 hybrid. Reappear in high frequency in F_2-generation
IV. It is a phenomenon in which two chromosome are linked

a) Only I b) Only II c) I and III d) III and IV

39. The total number of progeny obtained through dihybrid cross of Mendel is 1280 in F_2-generation. How many are recombinants?
a) 240 b) 360 c) 480 d) 720
40. A child of blood group-O cannot have parents of blood groups
a) A and A b) AB and O c) A and B d) B and B
41. Rh factor is present in
a) All vertebrates b) All mammals
c) All reptiles d) Man and rhesus monkey only
42. Which of the following condition is called monosomic?
a) $2n+1$ b) $2n+2$ c) $n+1$ d) $2n-1$
43. A man of blood group–A marries woman of blood group-AB, which type of progeny would indicate that man is heterozygous?
a) O b) B c) A d) AB
44. The children of a haemophilic man and a normal women are
a) All haemophilic
b) Only daughters are haemophilic
c) Only sons are haemophilic
d) Neither sons nor daughter are haemophilic
45. In man, four phenotypes of blood groups are due to the presence of antigen-A and antigen-B on the RBC. The chromosome that has the gene to control these antigens is
a) X-chromosome b) 21^{st} chromosome c) 9^{th} chromosome d) 7^{th} chromosome
46. More men suffer from colourblindness than women because
a) Women are more resistant to disease than men
b) The male sex hormone testosterone causes the disease
c) The colourblind gene is carried on the 'Y' chromosome
d) Men are hemizygous and one defective gene is enough to make them colourblind
47. 'Cri-du–chat' syndrome in humans is caused by the
a) Fertilization of an XX egg by a normal Y-bearing sperm
b) Loss of half of the short arm of chromosome 5
c) Loss of half of the long arm of chromosome 5
d) Trisomy of 21st chromosome
48. Given below is representation of a kind of chromosomal mutation. What is the kind of mutation represented?



a) Deletion b) Duplication
c) Inversion d) Reciprocal translocation

49. Which of the following symbols and its representation, used in human pedigree analysis is correct?
a)  = Mating between relatives b) ○ = Unaffected male

c)  = Unaffected female

d)  = Affected male

50. Ischihara chart is used to detect

a) Tuberculosis b) Eye sight c) Colour blindness d) Diabetes

IMPORTANT PRACTICE QUESTION SERIES FOR NEET EXAM – 1 (ANSWERS)

1)	**c**	**2)**	**b**	**3)**	**c**	**4)**	**c**
5)	**c**	**6)**	**a**	**7)**	**a**	**8)**	**b**
9)	**d**	**10)**	**a**	**11)**	**c**	**12)**	**c**
13)	**a**	**14)**	**d**	**15)**	**d**	**16)**	**a**
17)	**b**	**18)**	**c**	**19)**	**a**	**20)**	**d**
21)	**a**	**22)**	**a**	**23)**	**b**	**24)**	**b**
25)	**c**	**26)**	**a**	**27)**	**c**	**28)**	**b**
29)	**d**	**30)**	**c**	**31)**	**a**	**32)**	**c**
33)	**b**	**34)**	**d**	**35)**	**d**	**36)**	**b**
37)	**c**	**38)**	**d**	**39)**	**c**	**40)**	**d**
41)	**a**	**42)**	**b**	**43)**	**a**	**44)**	**c**
45)	**b**	**46)**	**b**	**47)**	**a**	**48)**	**a**
49)	**c**	**50)**	**d**	**51)**	**b**	**52)**	**a**
53)	**a**	**54)**	**c**	**55)**	**d**	**56)**	**a**
57)	**a**	**58)**	**b**	**59)**	**c**	**60)**	**c**
61)	**c**	**62)**	**b**	**63)**	**d**	**64)**	**b**
65)	**c**	**66)**	**c**	**67)**	**a**	**68)**	**a**
69)	**d**	**70)**	**a**	**71)**	**a**	**72)**	**a**
73)	**b**	**74)**	**a**	**75)**	**d**	**76)**	**d**
77)	**a**	**78)**	**a**	**79)**	**b**	**80)**	**b**
81)	**a**	**82)**	**a**	**83)**	**a**	**84)**	**b**
85)	**c**	**86)**	**c**	**87)**	**a**	**88)**	**b**
89)	**b**	**90)**	**b**	**91)**	**d**	**92)**	**a**
93)	**c**	**94)**	**a**	**95)**	**a**	**96)**	**c**
97)	**b**	**98)**	**b**	**99)**	**c**	**100)**	**b**

1 **(c)**

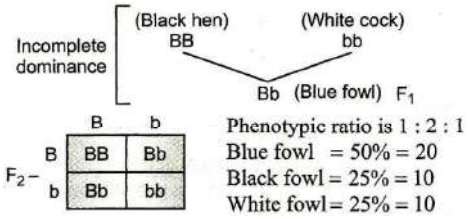
Aneuploidy is the variations in individual chromosomal number. Actually, loss or gain of individual chromosomes upsets the balance and, hence normal development is not possible.

3 **(c)**

Black feathered hen = BB

White feathered cock = bb

Blue feathered fowl = Bb



4 **(c)**

Histones are special type of basic protein associated with DNA and form chromosome. RNA, protein, carbohydrate, fat, doesn't find in chromosomes

5 **(c)**

In pedigree

Square represents male blackened square or circle represents affected individual.

Horizontal line represents-parents

The study of inheritance of genetic traits in several generations of a human family in the form of a family tree diagram is called **pedigree analysis**.

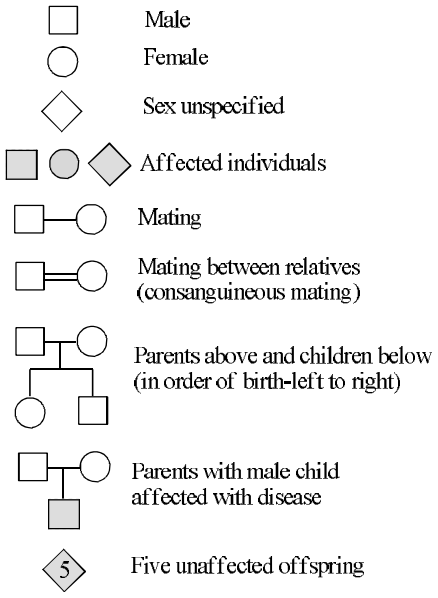
Advantages

(i) It helps in genetic counselling to avoid disorders

(ii) It shows the origin of a trait and flow of a trait in a family

(iii) It is important to know the possibility of a recessive allele that can cause genetic disorders like colour blindness, haemophilia, etc.

Signosed in the pedigree are



6 **(a)**

In the given pedigree chart only males are affected. So, it can be easily inferred that the given trait is connected to Y-chromosome. The genes, which are present on the Y-chromosome are called holoandric genes

7 **(a)**

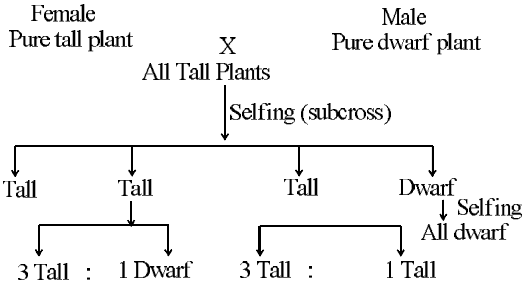
In the gametogenesis meiosis occur. The diploid chromosome become haploid, so the probability of side is sperm lacking one recessive autosomal allele and holandric gene is half

8 **(b)**

F_3-generation obtained by selfing of F_2-generation.

Mendel cross-pollinated a pure tall pea plant (100-120 cm hight) and a pure dwarf pea plant. (only 22 to 44 cm hight). He called them parental generation, expressed now-a-days by symbol P.

This hybridization popularly called as monohybrid cross



This three generations of pea plants after crossing a pure tall plant with a dwarf one. The plants of F_1-generation are all tall, of F_2-generation three tall and one dwarf. One third of the tall plants are pure, while the remaining behave as hybrids

F_1-generation Seeds collected from the parental generation called first filial generation or F_1-generation

F_2-generation F_1-plants pollinated among them self (self breeding or inbreeding) and seed produced by F_1-plants called F_2-generation. They were in ratio 3:1 (three tall and one dwarf).

F_3-generation Mendel allowed F_2-plant to form seed by self-pollination called F_3-generation. Mendel observed that tall and dwarf plant behave differently

(i) Dwarf plant produced dwarf plant on self-pollinated

(ii) In tall plants one third plants breed true so they were pure

(iii) Other two third plant behave like parents and give tall to dwarf plants 3 : 1 indicate that their parents have dwarf genes also

9 **(d)**

W Bateson and **R C Punnett**observed complementary gene interaction for flower colour in sweet pea (*Lathyrusodoratus*). In complementary interaction, two separate pairs of genes interact to produce the phenotype in such a way that neither of the dominant genes is expressive unless the other one is present. In F_2 generation, complementary genes produce a ratio of 9 : 7.

10 **(a)**

Occasionally a single gene product may produce more than one effect. For example starch synthesis in pea seeds is controlled by one gene. It has two allele (B and b). Starch is synthesized effectively by BB and have bigger grains. In contrast bb homozygous have lesser efficiency in starch synthesis and produce smaller grains

11 **(c)**

In *Drosophila*, sex is determined by the ratio number of X-chromosomes to the set of autosomes.

12 **(c)**

The genotypic and phenotypic ratio of **1 : 2 :1** with **red, pink** and **white** flowers are produced in *Mirabilisjalapa*, when red flowered plants (RR) are crossed with white flowered (rr). It occurs due to allelic gene interactions, called, **incomplete dominance**. In which, both of the allelomorphic genes will have partial or incomplete dominance and F_1-hybrid will show mixture of characters of two parents.

13 **(a)**

Meiosis is an important stage in sexual reproduction. During meiosis, genetic recombination occurs as a result of crossing over.

14 **(d)**

Blood group of children may be A, B, AB and O.

15 **(d)**

The genes, which are present very far from each other tend to get unlinked and they arethe most chances for crossing over

16 **(a)**

Given diagram depicits the sex linked inheritance in given options haemophilia is the sex-linked character

17 **(b)**

Incomplete dominance or blending inheritance is the phenomenon, in which the two genes of allelomorphic pair are not related as dominant or recessive but each of them expresses itself partially, thus the F_1 hybrids exhibit a mixture or blending of characters of both the parents. In F_2 generation, the phenotypic ratio obtained is 1 : 2 : 1.

18 **(c)**

Haemophilia is a disease, which is caused due to lack of blood clotting factor. It appears only in human male which can be transferred to their grandson through his carrier daughter.

19 **(a)**

In the given option only codominance does not obey Mendel's laws.

The phenomenon of expression of both the alleles in heterozygote is called codominance. As the result the phenotype is different from both homozygous genotype.

Examples

1. Blood group is the good example codominance
2. ABO blood groups are controlled by gene I. The gene (l) has three allele I^A, I^B, i, I^A, I^B produce slilghtly different form of sugar while i does not produce any kind of sugar.
3. I^A, I^B are dominant alleles where as i is recessive alleles
4. Since, there are three different allele, there are six different combination of these three alleles are possible and four phenotypes (A, B, AB and O)

Genetic Basis of Blood Groups in Human Population

Allele from Parent 1	Allele from Parent 2	Genotype of Offspring	Blood Types of Offspring
I^A	I^A	I^AI^A	A
I^A	I^B	I^AI^B	AB
I^A	i	I^Ai	A
I^B	I^A	I^AI^B	AB
I^B	I^B	I^BI^B	B
I^B	i	I^Bi	B
i	i	ii	O

When I^A and I^B are present together they both express their own types of sugars this is because of co-dominance. ABO blood grouping also provides a good example of multiple alleles.

Here, you can see that there are more than two, *i.e.,* three alleles governing the same character. Since, in an individual only two alleles can be present multiple alleles can be found only when population studies care made. Dominance is not an autonomous features of a gene. It depends on much on the gene product

20 **(d)**

11th.

Thalassaemia

(i) It is an autosome-linked recessive disesase

(ii) It occurs due to either mutation or deletion resulting in reduced rate of synthesis of one of globin chains of haemoglobin

(iii) Anaemia is the characteristic of this disease

(iv) Thalassaemia is classified into two types

5. **α-thalassaemia** Production of α-globin chain is affected. It is controlled by the closely linked genes HBA1 and HBA2 on chromosome 16. It occurs due to mutation or deletion of one or more of the four genes.
6. **β-thalassaemia** Production of β-globin chain is affected. It occurs due to mutation of one or both HBB genes on chromosome 11

22 **(a)**

TH Morgan.

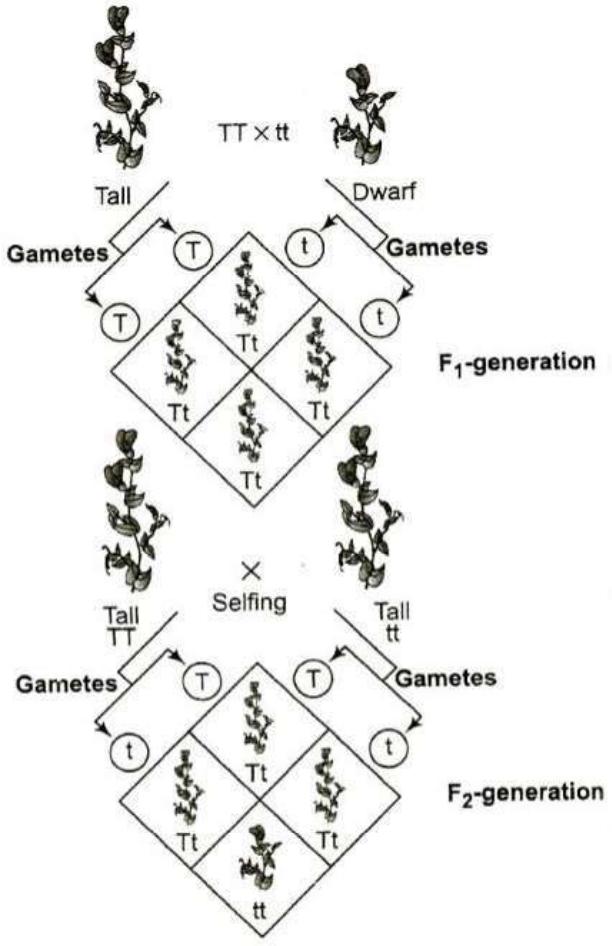
Father of experimental genetics is TH Morgan. He is also called the fly man of genetics because of selecting fruit fly (*Drosophila melanogaster*) as research material in experimental genetics

23 **(b)**

Mendel gave the laws of inheritance, which provides the mechanism that explains the pattern of inheritance

24 **(b)**

The genotypic ratio can be find out of a dominant phenotype by test cross or by simply Punnett square.

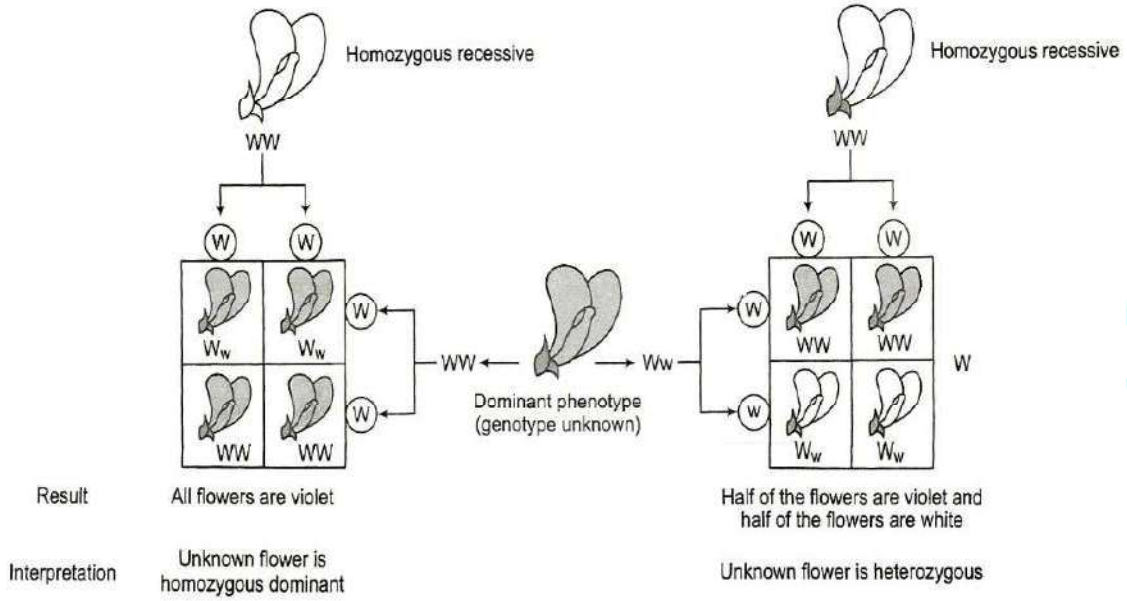


Phenotypic ratio Tall : Dwarf

Genotypic ratio TT : Tt : tt

1 : 2 : 1

A Punnett square used to understand to typical monhybrid cross conducted by Mendal between true-breeding tall plants and true-breeding dwarf plants
Crossing of F_1 (dominant phenotype) to any one of the parent called back cross and when phenotype of crossing parent is recessive than this is called test cross. The progeny of such cross can easily be analysed to predict the genotype of test organism



25 **(c)**
Genes for baldness are located on autosomes and influenced by androgens, thus, this is more common in men than in women.

26 **(a)**
The number of characters studied by Mendel was seven which were present on four chromosomes. Three contrasting characters with respect to pea pod are (i) pod shape,(ii) pod colour, (iii)pod position.

27 **(c)**
Chlorinated hydrocarbons are mutagen pollutants which can cause mutation in gene.

28 **(b)**
Both genes and chromosomes (Mendelian factors) whether dominant or recessive are transmitted from generation to generation in the pure or unaltered form. It is also called law of purity of gametes

29 **(d)**
The study of inheritance of genetic traits in several generations of a human family in the form of a family tree diagram is called **pedigree analysis**.
Advantages
(i) It helps in genetic counselling to avoid disorders
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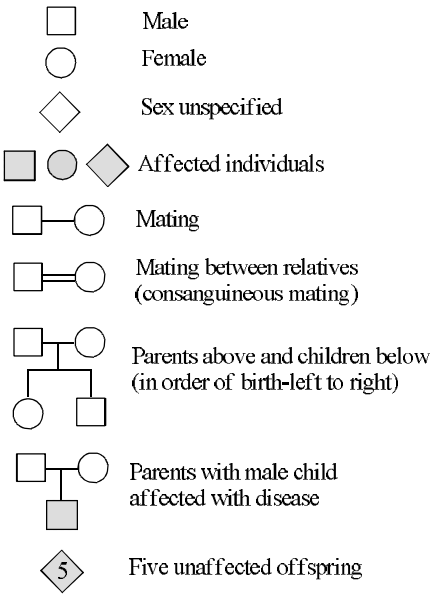


30 **(c)**

Some genes control phenotypic traits and at the same time they also influence the viability of the individuals. The influence of these genes on viability is such that it may cause death of individual carrying them. Such genes are called **lethal genes**.

31 **(a)**

Absence of one X-chromosome (44 with XO).

Disorders	**Autosomal/Sex Linked**	**Symptoms**	**Effects**
Down's syndrome	Autosomal aneuploidy (trisomy, +21)	Mongolian eyefold (epicanthus), open mouth, protruded tongue, projected lower lip, many loops on finger tip, palm crease	Retarded mental development IQ (below
Turner's syndrome	Sex chromosomal monosomy 44 + XO	Short stature females (<5'), webbed neck, body hair absent menstrual cycle absent. Sparse pubic hair, underdeveloped breasts narrow lips puffy fingers	Sterile hearing problem
Klinefelter's syndrome	Sex chromosomal aneuploidy (tri/tetrasomy of X chromosome) 44+XXY 44+XXXY	The males are tall with long legs, testes small, sparse body hair, Barr body present, breast enlargement	Gynaecomastia azospermia sterile

Some Examples of Aneuploidy

(i) **Down's syndrome**-21 trisomy

Symptoms

(a) Short statured with small round head

(b) Partially open mouth with protruding furrowed tongue

(c) Palm is broad with characteristic palm crease

(d) Slow mental development

(ii) **Turner's syndrome**

Cause Absence of one of the X-chromosomes, resulting in the karyotype 44+XO

Symptoms

(a) Sterile female with rudimentary ovaries

(b) Shield-shaped thorax

(c) Webbed neck

(d) Poor development of breasts

(e) Short stature, small uterus, puffy fingers

(iii) **Klinefelter's syndrome**

Cause Presence of an additional copy of X-chromosome resulting in the karyotype 44+XXY

Symptoms

(a) Sex of the individual is masculine but possess feminine characters

(b) Gynaecomastia, *i.e.*, development of breasts

(c) Poor beard growth and often sterile

(d) Feminine pitched voice

32 **(c)**

The recessive genes located on X-chromosome in humans are always expressed in males because a female may be homozygous or heterozygous, while male is always hemizygous (*i.e.*, only one allele is present).

33 **(b)**

Strength of linkage between two genes inversely proposed to the distance of two gene means if two genes are closely placed then they have high percentage of linkage and if they placed for then there is low percentage of linkage.

Linkage and recombination are two opposite phenomena. In linkage two genes remains united and in recombination the two get apart due to crossing over during gametogenesis (meiosis)

34 **(d)**

Fruitfly is excellent model for genetics because

(i) Life cycle is very short (14 days)

(ii) Can be feed on simple synthesis medium

(iii) Single mating produces large number of progeny

(iv) Clear differentiation of sexes

(v) Variation can be seen simply by hand lens or simple microscope

(vi) They (fruitfly) are easy to handle

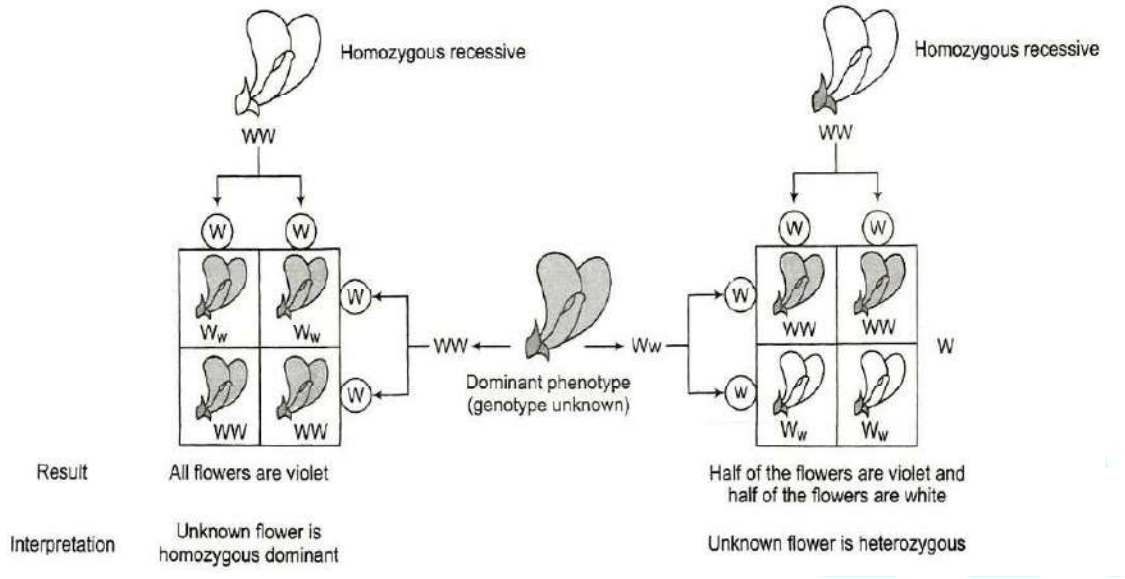
36 **(b)**

If both parents have blood group-AB then the possible blood groups of children are A, B and AB.

37 **(c)**

Test cross is a cross in which the dominant F_1-plant crosses with the homozygous recessive parents plant.

Crossing of F_1 (dominant phenotype) to any one of the parent called back cross and when phenotype of crossing parent is recessive than this is called test cross. The progeny of such cross can easily be analysed to predict the genotype of test organism

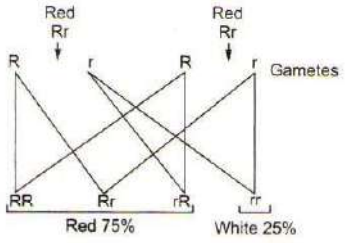


38 **(d)**

The ability of a gene to have multiple effects is known as **pleiotropy** and this phenomenon pleiotropism. The basis of pleiotropy is the interrelationship between the metabolic pathways that may contribute towards different phenotypes.

39 **(c)**

When two pea plants having red (dominant) coloured flowers with unknown genotype are crossed, the 75% red and 25% white flowered plants will be produced by following the law of Mendel. This is possible only if the parents are heterozygous.



41 **(a)**

$\frac{1}{4}$th and $\frac{3}{4}$th.

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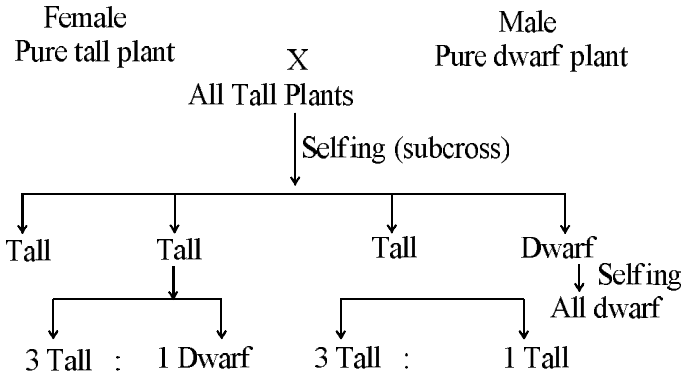
This hybridization popularly called as monohybrid cross



This three generations of pea plants after crossing a pure tall plant with a dwarf one. The plants of F_1-generation are all tall, of F_2-generation three tall and one dwarf. One third of the tall plants are pure, while the remaining behave as hybrids

F_1-generation Seeds collected from the parental generation called first filial generation or F_1-generation

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F_3-generation Mendel allowed F_2-plant to form seed by self-pollination called F_3-generation. Mendel observed that tall and dwarf plant behave differently

(i) Dwarf plant produced dwarf plant on self-pollinated

(ii) In tall plants one third plants breed true so they were pure

(iii) Other two third plant behave like parents and give tall to dwarf plants 3 : 1 indicate that their parents have dwarf genes also

42 **(b)**

Night blindness is nutritional deficiency disease generally happens due to deficiency of vitamin-A

43 **(a)**

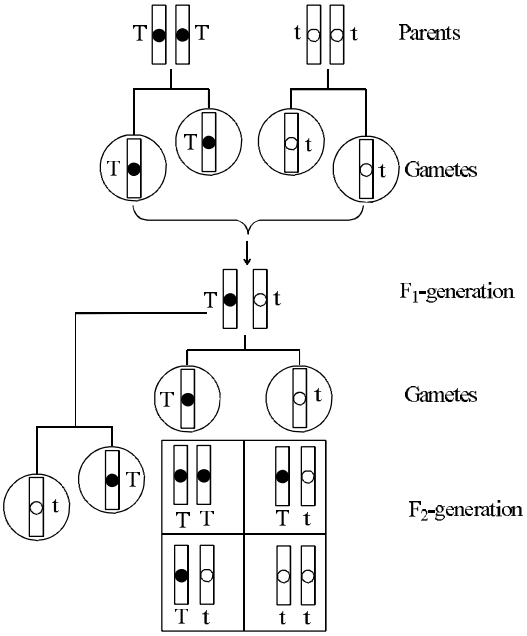
The genotypic ratio of monohybrid cross is 1 : 2 : 1, whereas the phenotypic ratio is 3 : 1.

9 : 3 : 3 : 1 is the phenotypic ratio of dihybrid cross (the cross made to study the inheritance of two pairs of factors or alleles of two genes).

44 **(c)**

Chromosomal Theory of Inheritance

Walter Sutton and Theodore Boveri noted that the behavior of chromosomes was parallel to the behaviour of genes and used chromosome movement to explain Mendel's laws.



Law of segregation interpreted on the basis of genes or factors (solid and hollow) situated on two homologous chromosomes.

Comparison between the Behaviour of Chromosomes and Genes

Chromosomes	Genes
Segregate at the time of gamete formation such that only one of each pair is transmitted to a gamete	Segregate of gamete formation and only one of each pair is transmitted to a gamete
Independent pairs segregate independently of each other	One pair segregates independently of another pair

Sutton and Boveri argued that the pairing and separation of a pair of chromosomes would lead to the segregation of a pair of factors they carried. Sutton united the knowledge of chromosomal segregation with Mendelian principles and called it the chromosomal theory of inheritance.

Experimental verification of chromosomal theory of inheritance was given by Thomas Hunt Morgan. Morgan worked with tiny fruitfly (*Drosphila melanogaster*)

45 **(b)**

The females have **homozygous** XX sex chromosomes, while males have **heterozygous** XY-chromosome. Y-chromosome is shorter than X-chromosome.

46 **(b)**

The **Down's syndrome** (Mongolian idiocy) arises due to **trisomy** of **21st chromosome**, *i.e.*, total 47 chromosomes will present in such person. The main features are mental deficiency, short stature, round face, flaccid muscles, protruding tongue, etc.

47 **(a)**

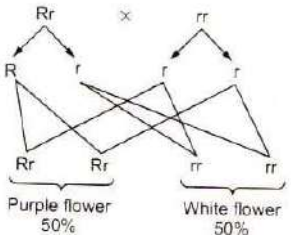
ZW-ZZ system of sex determination occurs in certain insects (gypsy moth) and vertebrates such as fishes, reptiles and birds and plants such as *Fragaris elatior*.

48 **(a)**

The Sudden and heritable change in the genetic make up of an individual is called **mutation**. The term mutation was introduced by Hugo de Vries.

49 **(c)**

According to law of purity of gametes, when the gametes are formed, they carry only one allele of the gene considered.

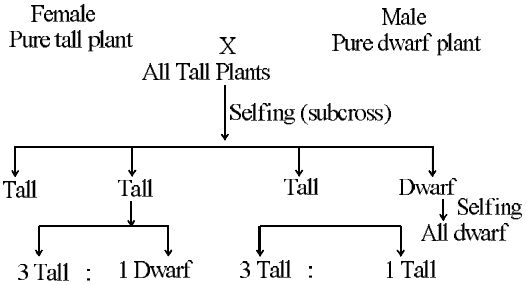


50 **(d)**

The recessive trait shown by F_2 and F_3 generation both but firstly it was observed in F_2 generation.

Mendel cross-pollinated a pure tall pea plant (100-120 cm hight) and a pure dwarf pea plant. (only 22 to 44 cm hight). He called them parental generation, expressed now-a-days by symbol P.

This hybridization popularly called as monohybrid cross



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51 **(b)**

Selfing of F_1 hybrids in dihybrid cross gives 9 : 3 : 3 : 1 ratio of progeny. The gametes

produced by Aa, Bb are of four types (AB, aB, Ab, ab).

52 **(a)**
*Haplopappus gracilis*has lowest number of chromosomes out of the given options.

53 **(a)**
Scientist later discovered or found that the gene for seven characters that were took by Mendel in his experiment is present on four chromosome but Mendel was Lucky because seven gene were not linked

54 **(c)**
Drosophila have 3 pairs of autosome and one pair sex chromosome. Sex determination in *Drosophila* is exactly similar to the human beings, *i.e.*, female is homogenetic and male is heterogametic. In the given diagrams, 'A' belongs to the female *Drosophila* and 'B' belongs to the male *Drosophila*
1 indicates = X-chromosomes in female *Drosophila*
2 indicates = Autosome
3 indicates = X-chromosomes in male *Drosophila*
4 indicates = Y-chromosome in male *Drosophila*

55 **(d)**
In domesticated fowls, the sex of progeny depends on the type of egg rather than sperm, as two different types of gametes are produced by females (ZW), while males have a same pair of sex chromosome (ZZ).

56 **(a)**
Given example is the example of inversion mutation in which the order of genes in a chromosome get inverted

57 **(a)**
Persons having Rh factor is called $Rh^+$and without Rh factor Rh^-. $Rh^+$is **dominant** over Rh^-.

58 **(b)**
Blood type 'O' has no igen but both types of antibodies 'a' and 'b'. The person with blood type 'O' is universal donor.

59 **(c)**
Law of independent assortment discovered by Mendel because all of his selected traits were present on the different chromosomes. None of his trait present on the same chromosome. If Mendel had studied 7 traits using plant of 12 chromosome instead of 14 then it is most probable that he would have not discovered the law of independent assortment

60 **(c)**
Thalassaemia have two major kinds
α-thalassaemia and β-thalassaemia.
According to defective gene in α or β-chain of haemoglobin.
Thalassaemia
(i) It is an autosome-linked recessive disesase
(ii) It occurs due to either mutation or deletion resulting in reduced rate of synthesis of one of globin chains of haemoglobin
(iii) Anaemia is the characteristic of this disease
(iv) Thalassaemia is classified into two types

7. **α-thalassaemia** Production of α-globin chain is affected. It is controlled by the closely linked genes HBA1 and HBA2 on chromosome 16. It occurs due to mutation or deletion of one or more of the four genes.
8. **β-thalassaemia** Production of β-globin chain is affected. It occurs due to mutation of

one or both HBB genes on chromosome 11

61 **(c)**
In silkworm (insect), **female** has **XY** and **male** has **XX** type of sex chromosomes. This is essentially opposite to that of mammals.

62 **(b)**
The X-chromosome linked disease never passed on from father to son because the X-chromosome of father go to the daughter during inheritance.

63 **(d)**
Law of independent assortment does not applicable when the gene of different character occupy on the same homologous chromosome, *i.e.*, linked gene.

64 **(b)**
A-Meiosis; B-Allele pair

65 **(c)**
Genetic map is a diagram, which shows the relative position of genes on a chromosome. **Strutevant** in 1911 prepared the first genetic map of two chromosomes of fruitfly.

66 **(c)**
Haemophilia and red green colour blindness, both are sex linked recessive gene on 'X' chromosome.

Body height is an example of polygenic inheritance.

Rhesus blood group is based on the presence or absence of

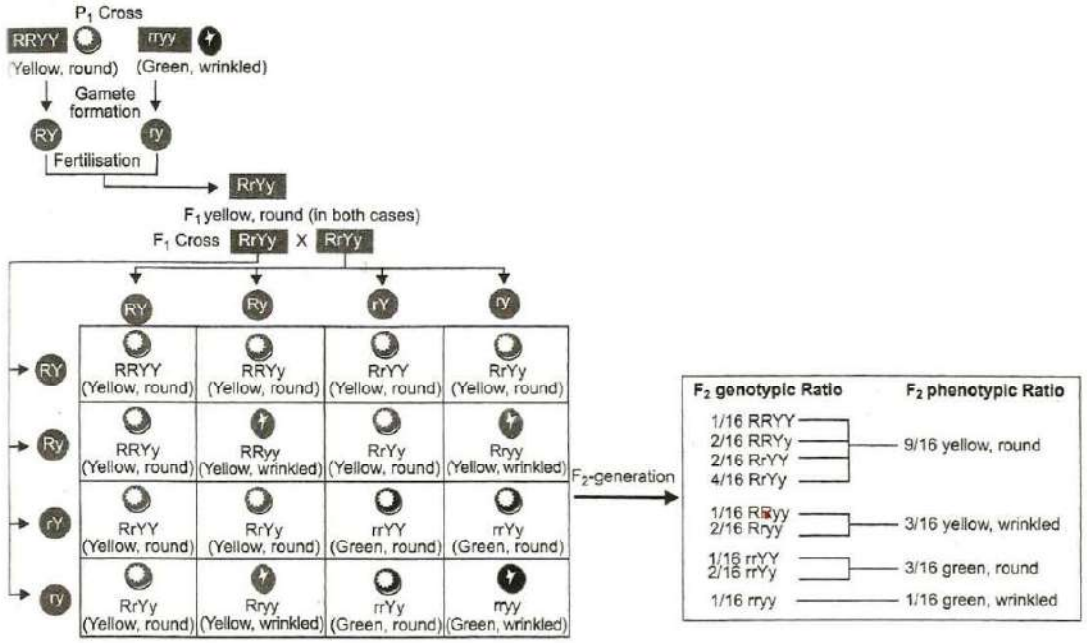
Rh-protein on the surface of RBC. Phenylketonuria (PKU) is a recessive autosomal variation.

67 **(a)**
Human's have 22 pairs of autosomes and one pair of sex chromosome

68 **(a)**
There are evidences that the gene for cytoplasmic male sterility particularly in maize reside in **mitochondria**.

69 **(d)**
In most cases if there is a change in genotype than it ultimately leads to change in phenotype also.

70 **(a)**



A dihybrid cross in pea plant between yellow round (smooth) seeded and green wrinkled seeded plant. The cross proves the principle of independent assortment

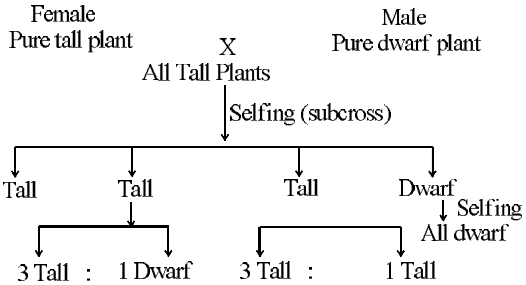
71 **(a)**

A cross in which parents differ in a single pair of contrasting character is called monohybrid cross. From the monohybrid cross the Mendel gave law of segregation, law of paired factor and law of dominance.

Law or Principle of Dominance

In heterozygous individuals or hybrids a character is represented by two contrasting factors called alleles or allelomorphs. Out of the two contrasting alleles. Only one is able to express its effect in the individual. It is called dominant factor or dominant allele.

The other which does not show its effect in the heterozygous individual is called recessive factor or recessive allele. The cross between the pure tall and pure dwarf gives all progeny (F_1)tall.



The character shown by F_1 called dominant character

72 **(a)**

Genic Balance Theoryof Sex The theory of genic balance given by Calvin Bridges (1926) states that instead of XY-chromosomes sex is determined by the genic balance or ratio between X-chromosomes and autosome genomes

The theory is basically applicable to *Drosophila melanogaster* over, which bridges worked. He found that the genic ratio X IA of 1.0 produces fertile females whether the files have XX + 2A or XXX + 3A chromosome complement. A genic ration (X I A) of 0.5 forms a male fruitfly. This occurs in XY + 2A as well as XO + 2A

Chromosome	X/A Ratio	Sexual

Complement		Morphology
X X X + 2A	3/2 or 1.5	Metafemale
X X X + 3A	3/3 or 1.0	Female
X X + 2A	2/2 or 1.0	Female
X X + 3A	2/3 or 0.67	Inter sex
X X X +4A	3/4 or 0.75	Inter sex
X O + 2A	1/2 or 0.5	Male
X Y +2A	1/2 or 0.5	Male
X Y +3A	1/3 or 0.33	Metamale

73 **(b)**

Rr and red because the R is dominant r so, the F_1-hybrid will be red

74 **(a)**

Grasshopper is an example of XO type of sex determination in which the male have only one X-chromosome besides the autosomes, whereas females have a pair of X-chromosomes (2A + XX).

75 **(d)**

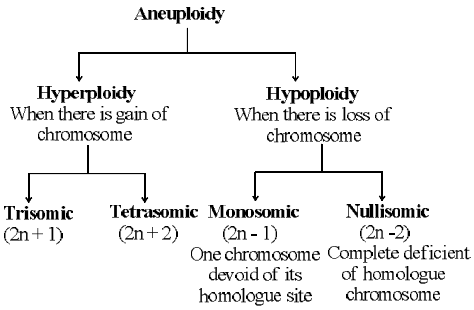
9:3:3:1.

Law of Independent Assortment

Mendel also worked with and crossed pea plants that different in two characters/factor.
He crossed between pea plant that has seeds with yellow colour and round shape and other that has seeds of green colour and wrinkled shaped.
Ratio appeared as 9 : 3 : 3 : 1 such ratio appeared for several character that Mendel studied
$9/16$ = Yellow round $3/16$ = Yellow wrinkled
$3/16$ = Green yellow $1/16$ = Green wrinkled
Based on such observation Mendel concluded second law of inheritance called law of independent assortment.
According to this principle or law the two factors of each character assort or separate independent of the factors of other characters at the time of gamete formation and get randomly re-arranged in the offspring producing both parental and new combination of traits.
Thus, the phenotypic ratio of a dihybrid cross is 9 : 3 : 3 : 1. The occurrence of four types of plants (more than parental types) in the F_2 generation of dihybrid cross shows that the factors of each of the two characters assort independent of the others as if the other pair of factors are not present. It can also be proved by studying the individual characters of seed colour and seed texture sepraterly.
Seed colour Yellow (9+3 = 12) : Green (3+1 = 4) or 3 : 1
Seed Texture Round (9+3 = 12) : Wrinkled (3+1 = 4) or 3 : 1
The result of each character similar to monohybrid ratio. Generally, the dihybrid cross used to study the independent assortment of genes

76 **(d)**

Trisomy stands for $2n+1$.
Chromosomal disorders are caused due to excess, absence or abnormal arrangement of one or more chromosomes.
Sometimes the chromatids fail to segregate during cell division, resulting in gain or loss of a chromosome. This is called **aneuploidy**
Aneuploidy is also called heteroploidy
Aneuploidy is of two kinds
(i) Hyperploidy (ii) Hypoploidy



77 **(a)**

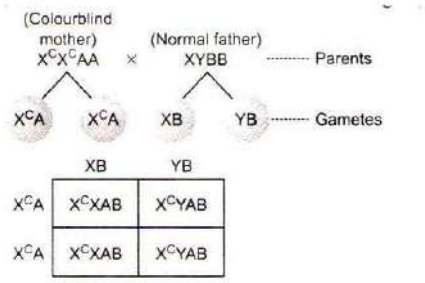
The genotype of Klinefelter syndrome is XXY. In this there is one extra X-chromosome. This extrachromosome comes when there is non-disjunction of X-chromosome in ova-or-sperm fuses with Y or X-chromosome of sperm or ova resulting XXY genotype

78 **(a)**

Colour blindness is caused by recessive sex-linked gene carried by X-chromosome. So, in male, one recessive gene is sufficient for its expression, *i.e.*, (X^cY) but female needs two recessive gene(X^cX^c) for the expression of colour blindness.

Mother will colourblind with A blood group and father normal with blood group-B as–

So, all the sons will be colourblind with AB blood group.



79 **(b)**

Deletion and duplication occurs in homologous chromosomes usually during meiosis. In deletion, some part of chromosome is lost while in duplication a piece of chromosome is copied next to an identical section, thus, increasing chromosome length.

80 **(b)**

The husband is heterozygous for Rh^+so, it will (Rh rh) and wife is homozygous of Rh^- so, it will have genetic alleles (rh rh) :

So, 50% homozygous Rh^- children will be born.

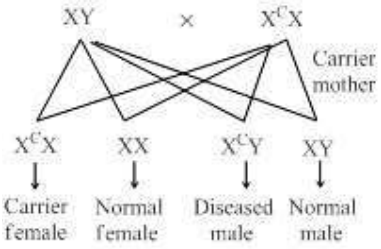
81 **(a)**

Mendel could not find out linkage because all of his experimental characters of pea were not linked. They were present far apart from each other

82 **(a)**

Bleeder's disease.

Haemophilia is also called Bleeder's disease. It is a sex linked recessive disorder. It transmit from carrier female to male progeny



83 **(a)**

Complete linkage.

Linkage and Recombination

Morgan carried out several dihybrid crosses in *Drosophila* to study genes that were sex linked. The crosses were similar to the dihybrid crosses carried out by Mendel in peas.

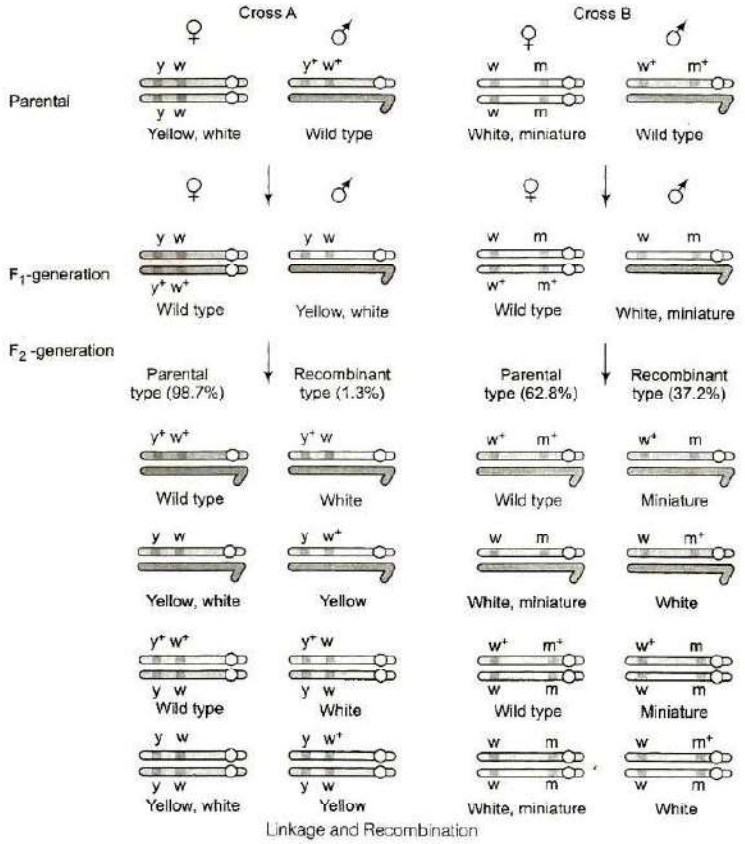
He observed that when two genes were grouped on the same chromosome, same genes are highly linked of associated and show low recombination.

When the genes are clearly present linked they show higher recombination.

Morgan attributed this due to the physical association or linkage of the two genes and coined the term linkage to describe this physical association of genes on a chromosome and the term recombination to describe the generation of non-parental gene combinations.

His student Alfred Sturtevant used the frequency of recombination between gene pairs on the same chromosome as a measure of the distance between genes and 'mapped' their position on the chromosome.

Morgan hybridized yellow bodied and white eyed females with brown bodied and red eyed male (wild type) (cross-A) and inter-crossed their F_1-progeny



Linkage and Recombination

In the incomplete linkage we get some recombinant progeny but in complete linkage the recombinant progeny percentage is very less as compared to incomplete linkage

84 **(b)**

With regard to transfusions of whole blood or packed red blood cells, individuals with O type negative blood are often called universal donors, and those with type AB positive blood are universal recipients, however, these terms are only generally true with respect to possible reactions of the recipients anti-A and anti-B antibodies to transferred red blood cells.

85 **(c)**
The individuals suffering from Klinefelter's syndrome disease show trisomy of X-chromosomes,*i.e.*, they contain 47 chromosomes in total with 22 autosomes (XXY).

86 **(c)**
Dominant and recessive were expressed or appeared together separately. This shows that there is no mixing of characters means non-blending of character

87 **(a)**
Sex-limited and sex-linked genes are located on autosomes.

88 **(b)**
Types of gametes $= 2^n$

n=Number of heterozygotes considered, i.e., monohybrid cross($n=1$), dihybrid cross ($n=2$), trihybrid cross ($n=3$) and so on. AA BB CC × aa bb cc is a trihybrid cross, therefore, different types of gametes are

$$= 2^n$$

$$= (2)^3$$

$$= 2 \times 2 \times 2 = 8$$

89 **(b)**
The **point mutations** involves alterations in the structure of gene by altering the structure of DNA. Point mutations are of two types- (i) base pair substitution and (ii) frameshift mutation.

90 **(b)**
Type A blood group receive blood A and O type.

91 **(d)**
Pink colour flower is the intermediate character. It is obtained maximum by crossing of homozygous red and white flower
Example (Red) (White)
RR × rr
Rr (pink) – All progeny have pink colour

92 **(a)**
Triticale is the hybrid variety, which is obtain by crossing between wheat and rye.
'*Triti*' is for wheat and 'cale' is for rye together it is called *Triticale*. Its production value is higher than both wheat (*Triticum*) and rye (*Secale*)

93 **(c)**
Mendel found that tallness, round shape of seed, yellow colour of seed, purple colour of flower, green colour of pod,inflated nature of pod and axial position of flower were domianant over dwarfness, wrinkled seed, green colour of seed, white colour of flower, yellow colour of pod , constricted nature of pod and terminal position of flower.

94 **(a)**
Garden pea is the common name for *Pisum sativum* which was the experimental material of Mendel's experiments

95 **(a)**
Mutations can be induced by a number of agents called mutagens.

Physical mutagen- UV rays, X-rays, cosmic rays, high temperature.

Chemical mutagens- 5 bromouracil, proflavin.

96 **(c)**
The observable characteristics of an organism is called phenotype. These are determined by its genes

97 **(b)**
Carrier organism refers to an individual, which carries a recessive gene that is not expressed.

98 **(b)**
$X = 1$, 3 $Y = 4$.
Drosophila have 3 pairs of autosome and one pair sex chromosome. Sex determination in *Drosophila* is exactly similar to the human beings, *i.e.*, female is homogenetic and male is heterogametic. In the given diagrams, 'A' belongs to the female *Drosophila* and 'B' belongs to the male *Drosophila*
1 indicates = X-chromosomes in female *Drosophila*
2 indicates = Autosome
3 indicates = X-chromosomes in male *Drosophila*
4 indicates = Y-chromosome in male *Drosophila*

99 **(c)**
In the given case, embryo contains one Barr body and one F-body, which corresponds to XXY related to Klinefelter's syndrome.

100 **(b)**
The chances of fifth child to be albino in previous question would be one in four

1)	**a**	**2)**	**b**	**3)**	**b**	**4)**	**d**
5)	**a**	**6)**	**a**	**7)**	**b**	**8)**	**d**
9)	**b**	**10)**	**c**	**11)**	**a**	**12)**	**d**
13)	**d**	**14)**	**b**	**15)**	**a**	**16)**	**b**
17)	**a**	**18)**	**a**	**19)**	**a**	**20)**	**c**
21)	**a**	**22)**	**c**	**23)**	**b**	**24)**	**d**
25)	**c**	**26)**	**c**	**27)**	**b**	**28)**	**b**
29)	**a**	**30)**	**b**	**31)**	**b**	**32)**	**d**
33)	**c**	**34)**	**c**	**35)**	**d**	**36)**	**c**
37)	**a**	**38)**	**a**	**39)**	**c**	**40)**	**b**
41)	**d**	**42)**	**d**	**43)**	**b**	**44)**	**d**
45)	**c**	**46)**	**d**	**47)**	**b**	**48)**	**c**
49)	**a**	**50)**	**c**				

1 **(a)**

Genotypes of the parents shall be I^Ai and I^Bi.

2 **(b)**

Aneuploidy is the deletion or addition of few chromosomes from the original genomes.

3 **(b)**

Genotypes of C and D are XX^c and XY respectively.

4 **(d)**

Allosomes, heterosomes are the synonymous used for sex chromosomes

5 **(a)**

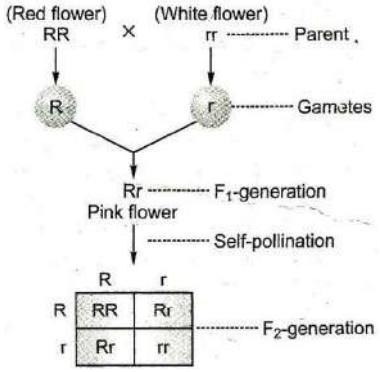
Cri-du-chat syndrome also known as chromosome 5p deletion syndrome, 5p minus syndrome or Lejeune's syndrome is a rare genetic disorder due to a missing part of chromosome-5. This syndroms is associated with malformation of the larynx.

6 **(a)**

During his experiments, Mendel called factors something unchanged that pass from parent to offspring through the gametes over successive generation

7 **(b)**

In case of incomplete dominance, when pink flowers of F_1-generation, are self-pollinated, they develop red(RR), pink (Rr) and white(rr) flowers in the ratio 1 : 2 : 1, respectively, genotypically as well as phenotypically.



Genotypic ratio—RR : Rr : rr

1 : 2 : 1

Phenotypic ratio—Red : Pink : White

1 : 2 : 1

8 **(d)**

Genome of model organisms

Organism	**Number of Bass Pair**	**Number of Gene**
Bacteriophage	10 thousand	-
Escherichia coli	4.7 million	4,000
Saccharomyces	12 million	6,000
cerevisiae		
Caenohabditis	97 million	18,000
elegans		
Drosophila	180 million	13,00
melanogaster		
Human	3 million	30,000
Lily	106 billion	-

9 **(b)**

Albinism is caused by the absence of enzyme **tyrosinase**, which is necessary for the synthesis of melanin.

10 **(c)**

In human beings, ABO blood grouping is an example of dominance, codominance and multiple alleles.

11 **(a)**

In sickle-cell anaemia only one nucleotide substitution takes place from T to A.
Genetic or chromosomal symbol used for person who is having sickle-cell anaemia
Ps — Hb^s Hb^s.

Sickle-cell Anaemia

(i) It is an autosome-linked recessive trait
(ii) The disease is controlled by a single pair of allele Hb^s and Hb^s
(iii) Only the homozygous individuals for Hb^s, *i.e.*, Hb^sHb^s show the diseased phenotype
(iv) The heterozygous individuals are carriers (Hb^AHb^S)
(v) Due to point mutation, glutamic acid (Glu) is replaced by valine (Val) at the sixth position of β-globin chain of haemoglobin molecule
(vi) A single base substitution at sixth codon of the beta globulin gene from GAG to GUG. GAG code for glutamic acid and GUG code for valine.
(vii) Hb^S behaves as normal haemoglobin except under the oxygen stress where erythrocytes lose their circular shape and become sickle-shaped. As a result, the cells cannot pass through narrow capillaries. Blood capillaries are clogged and thus, affect blood supply to different organs

12 **(d)**

A cell or an organism having two copies of a single genome (with chromosome number $2x$) is called **diploid.**

13 **(d)**

All the given statements are correct.

Occasionally a single gene product may produce more than one effect. For example starch synthesis in pea seeds is controlled by one gene. It has two allele (B and b). Starch is synthesized effectively by BB and have bigger grains. In contrast bb homozygous have lesser efficiency in starch synthesis and produce smaller grains

In starch synthesis gene following condition to seen

BB – rounded (due to more starch synthesis)

bb – wrinkled (due to less starch synthesis)

Bb – in between rounded of wrinkled size. It produce starch of intermediate quantity between BB to bb homozygous condition. So, it is incomplete dominance.

Therefore, dominance is not an autonomous feature of a gene or the product that it has information for. It depends as much on the gene product and the production of a particular phenotype from this product as it does on the particular phenotype that we choose to examine, in case more than one phenotype is influenced by the same gene

14 **(b)**

When Rh^-mother carries Rh^+ foetus, in the first pregnancy no serious problem occurs because Rh^+antigen arises in child's blood and the concentration of antibodies produced in mother's blood due to immunization by child's Rh^+ antigen will be rather low.

15 **(a)**

Blood group-A has antigen-A and antibody-b.

16 **(b)**

Chromosomes are of two type, **autosomes** and **sex chromosomes** (allosomes). Y-chromosome is the sex chromosome.

17 **(a)**

Law of Independent Assortment

Mendel also worked with and crossed pea plants that different in two characters/factor. He crossed between pea plant that has seeds with yellow colour and round shape and other that has seeds of green colour and wrinkled shaped.

Ratio appeared as 9 : 3 : 3 : 1 such ratio appeared for several character that Mendel studied

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Based on such observation Mendel concluded second law of inheritance called law of independent assortment.

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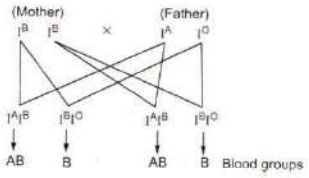
Thus, the phenotypic ratio of a dihybrid cross is 9:3:3:1. The occurrence of four types of plants (more than parental types) in the F_2 generation of dihybrid cross shows that the factors of each of the two characters assort independent of the others as if the other pair of factors are not present. It can also be proved by studying the individual characters of seed colour and seed texture sepraterly.

Seed Colour Yellow (9+3 = 12) : Green (3+1 = 4) or 3 : 1

Seed Texture Round (9+3 = 12) : Wrinkled (3+1 = 4) or 3 : 1

The result of each character similar to monohybrid ratio. Generally, the dihybrid cross used to study the independent assortment of genes

18 **(a)**



Thus, possible groups are :**AB** and **B**.

19 **(a)**

Recessive alleles influence the appearance of the phenotype only when they are in homozygous condition.

Mendel did not find the blending inheritance in F_2-generation of a Mendelian monohybrid cross the tall and dwarf traits were identical to their parental types and doesn't show blending

20 **(c)**

The eggs are produced by meiosis, *i.e.*, reduction division. So, the egg contains one X-chromosome when released from ovary.

21 **(a)**

Variation.

Variation is the degree of difference in the progeny and between the progeny and the parents. The term variation is also used for a single difference in a trait

22 **(c)**

Pleiotropic gene is one which produces or controls more than one effects or characters. In other words, we can say that pleiotropic gene produces a major phenotypic trait and with that also influences some other phenotypic traits, *e.g.*, lethal genes, which are known to control the menifestation of some phenotypic trait alongwith affecting the viability of organism.

23 **(b)**

A-Dizygotic twins are the twins, which results from the fusion of two sperm with two ova. It is very rare in case of human beings.

B-Monozygotic twins are the twins, which results from the fusion of one sperm with one ova leads to zygote. This zygote later on divide and give rise to two or more zygote. In this cells of all progeny have the identical genome

25 **(c)**

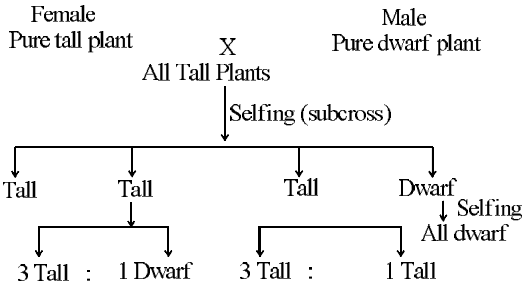
H J Muller was awarded Nobel Prize in 1946 for his discovery of the production of mutations by X-ray irradiation.

26 **(c)**

Law or Principle of Dominance

In heterozygous individuals or hybrids a character is represented by two contrasting factors called alleles or allelomorphs. Out of the two contrasting alleles. Only one is able to express its effect in the individual. It is called dominant factor or dominant allele.

The other which does not show its effect in the heterozygous individual is called recessive factor or recessive allele. The cross between the pure tall and pure dwarf gives all progeny (F_1)tall.



The character shown by F_1 called dominant character

27 **(b)**

It is metaphase

28 **(b)**

When heritable alterations occur in a very small segment of DNA molecule, *i.e.*, a single nucleotide or nucleotide pair then this type of mutations are called **point mutations**.

29 **(a)**

Dihybrid genotype ratio. 1 : 2 : 1 : 2 : 4 : 2 : 1 : 2 : 1 total nine types of genotype and four types of phenotype

30 **(b)**

In Morgan's experiment on linkage, the percentage of white eyed, miniature-winged recombinants in F^2 generation is 37.2%. It is due to incomplete linkage, where two linked genes are sufficiently apart and the chances of their separation are quite good.

31 **(b)**

Dihybrid cross.

Law of Independent Assortment

Mendel also worked with and crossed pea plants that different in two characters/factor. He crossed between pea plant that has seeds with yellow colour and round shape and other that has seeds of green colour and wrinkled shaped.

Ratio appeared as 9 : 3 : 3 : 1 such ratio appeared for several character that Mendel studied

9/16 = Yellow round 3/16 = Yellow wrinkled

3/16 = Green yellow 1/16 = Green wrinkled

Based on such observation Mendel concluded second law of inheritance called law of independent assortment.

According to this principle or law the two factors of each character assort or separate independent of the factors of other characters at the time of gamete formation and get randomly re-arranged in the offspring producing both parental and new combination of traits.

Thus, the phenotypic ratio of a dihybrid cross is 9 : 3 : 3 : 1. The occurrence of four types of plants (more than parental types) in the F_2 generation of dihybrid cross shows that the factors of each of the two characters assort independent of the others as if the other pair of factors are not present. It can also be proved by studying the individual characters of seed colour and seed texture sepraterly.

Seed colour Yellow (9+3 = 12) : Green (3+1 = 4) or 3 : 1

Seed Texture Round (9+3 = 12) : Wrinkled (3+1 = 4) or 3 : 1

The result of each character similar to monohybrid ratio. Generally, the dihybrid cross used to study the independent assortment of genes

32 **(d)**

Dominant allele shows its effect in homozygous or heterozygous condition and recessive allele shows its effect only in homozygous condition. Given pedigree chart possible only when the male parent in heterozygous for hyperdactyle. If it is homozygous for

hyperdactyle then its son would also be the hyperdactyle as well

33 **(c)**

Mutation happens by itself. It is the spontaneous phenomena

34 **(c)**

The **centromere** lies within a thinner segment of chromosome, the **primaryconstriction.**

35 **(d)**

Mutations are not acquired. They are selected by the nature. Gametes fuse with regard to which alleles they carry

36 **(c)**

Mendel's knowledge background was mathematics and physics. In Vienna university he studied botany and physics. Later he became the teacher of physics and natural sciences.
Main reasons for Mendel's success were.
(i) Mendel took those traits, which were not linked
(ii) Mendel choose distinctive contrasting pairs
(iii) Mendel took one or two character at a time
(iv) Pea plant is ideal for controlled breeding
(v) Mendel kept complete record of every cross
(vi) Mendel used statistical method and law of probability (vi) Mendel used statistical method and law of probability

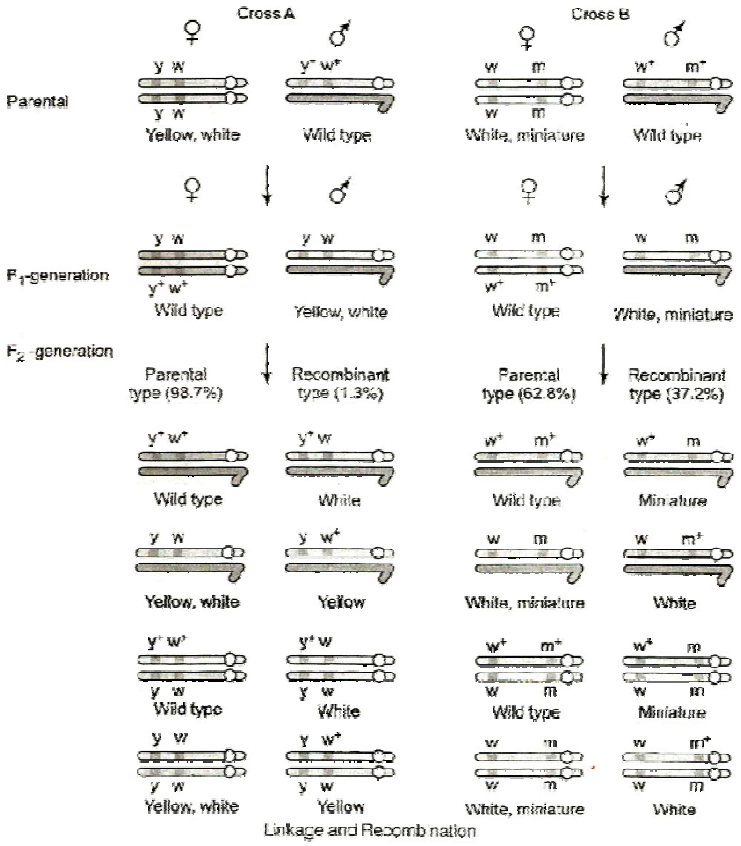
37 **(a)**

Insect, grasshopper, cockroaches and bugs have XX and XO type of sex determination in which XO happens to be male and XX happens to be female

38 **(a)**

Linkage and Recombination

Morgan carried out several dihybrid crosses in *Drosophila* to study genes that were sex linked. The crosses were similar to the dihybrid crosses carried out by Mendel in peas.
He observed that when two genes were grouped on the same chromosome, same genes are highly linked of associated and show low recombination.
When the genes are clearly present linked they show higher recombination.
Morgan attributed this due to the physical association or linkage of the two genes and coined the term linkage to describe this physical association of genes on a chromosome and the term recombination to describe the generation of non-parental gene combinations.
His student Alfred Sturtevant used the frequency of recombination between gene pairs on the same chromosome as a measure of the distance between genes and 'mapped' their position on the chromosome.
Morgan hybridized yellow bodied and white eyed females with brown bodied and red eyed male (wild type) (cross-A) and inter-crossed their F_1-progeny



39 **(c)**

In Mendel's dihybrid cross out of 16 progenies, 6 are recombinants so in case of 1280 progenies, the recombinants are

$$=\frac{1280\times6}{16}=480 \text{ progenies.}$$

40 **(b)**

A child of blood group-O cannot have parents of AB and O blood groups.

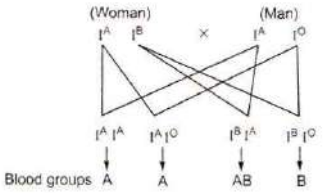
41 **(d)**

Rh factor was discovered by Landsteiner and Wiener (1940) in Rhesus monkey (*Macacarhesus*). It is found in man and rhesus monkey only. Erythroblastosis foetails occurs when the mother is Rh^-, father is Rh^+ and foetus is Rh^+.

42 **(d)**

Monosomics $(2n-1)$ one chromosome less then diploid set of somatic chromosome number.

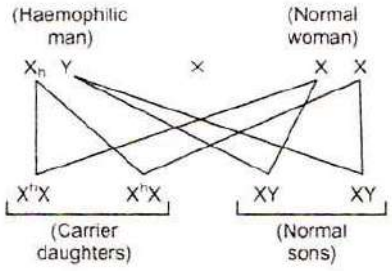
43 **(b)**



In this case, progeny with blood group-B is produced only when man is heterozygous, *i.e.*,I^AI^O.

44 **(d)**

The children of a haemophilic man and normal woman will be all normal. Neither sons nor daughters (only carrier) will be haemophilic



45 **(c)**

A set of three alleles present on chromosome number 9 is responsible for the four blood groups.

46 **(d)**

The gene for colour blindness is present on X-chromosome. If one X-chromosome of female have gene for colour blindness, this will be carrier (normal) but if a male have gene on X-chromosome it will be colourblind (since only one X-chromosome is present in male).

47 **(b)**

Cri-du–chat syndrome is caused by a conspiuous deletion in the short arm of 5^{th} chromosome. These individuals asre severly impaired and their cat-like crying give the syndrome its name.

48 **(c)**

Inversion invoves a reverse order of genes in part of chromosome. ABCDEFGH has been shown in figure, where breaks occur between A and E. Reunion at broken ends may leads to inversion of the segment BCD into DCB. Indeletion, a section of chromosome is lost.

50 **(c)**

Ischihara chart is used to detect colour blindness.