74. The twenty third pair of chromosomes in man is known as **[MP PMT 2002]**
(a) Chromatid (b) Heterosome
(c) Autosome (d) Gene

75. In recent past human chromosomes have been studied by a technique using specific, often fluorescent dyes, known as **[MP PMT 2002]**
(a) Dyeing technique (b) Banding technique
(c) Ultra dyeing technique (d) Karyotyping technique

76. The chromosomes as thread like structures in nucleus was first described by **[MP PMT 2002]**
(a) Mendel (b) Strasburger
(c) Darwin (d) Levitzky

77. The function of chromosomes of carrying the genetic information from one cell generation to another is performed by **[MP PMT 2002]**
(a) RNA (b) DNA
(c) Histones (d) Calcium

78. The chromosomes which determine the somatic characters are called **[MH CET 2002]**
(a) Sex chromosomes (b) Heterosomes
(c) Autosomes (d) None of the above

79. The linkage map of X-chromosome of fruit fly has 66 units with yellow body gene (y) at one end and bobbed hair (b) gene at the other end. The recombination frequency between these two genes (y and b) should be **[CBSE PMT 2003]**
(a) 100 % (b) 66 %
(c) 50 % (d) 5.50 %

80. Chromosome number is **[MP PMT 2003]**
(a) Fixed for a species (b) Fixed for an ecosystem
(c) Fixed for a community (d) Fixed for a biosphere

81. Science which links heredity with environments is **[MP PMT 2004]**
(a) Genetics (b) Gene ecology
(c) Ecology (d) Ecophysiology

82. In man sexlinked characters are mainly transmitted through **[MP PMT 2004]**
(a) Y-chromosome
(b) Autosomes
(c) X-chromosome
(d) X-chromosome, Y-chromosome and Autosomes

83. A male human is heterozygous for autosomal genes *A* and *B* and is also hemizygous for hemophilic gene *h*. What proportion of his sperms will be *abh* **[CBSE PMT 2004]**
(a) $\frac{1}{16}$ (b) $\frac{1}{4}$
(c) $\frac{1}{8}$ (d) $\frac{1}{32}$

84. The recessive genes located on X-chromosome in humans are always **[CBSE PMT 2004]**
(a) Expressed in males (b) Expressed in females
(c) Lethal (d) Sub-lethal

85. The total number of nitrogenous bases in human genome is estimated to be about **[AIIMS 2004, 08]**
(a) 3.5 million (b) 35 thousand
(c) 35 million (d) 3.1 billion

86. In order to calculate map distance of genes on a chromosome, one must know the **[AIEEE Pharmacy 2004]**
(a) Number of mutant genes
(b) Cross over percentage
(c) Recombination frequency of each gene locus
(d) Non-cross over percentage

87. At a particular locus, frequency of 'A' allele is 0.6 and that of 'a' is 0.4. What would be the frequency of heterozygotes in a random mating population of equilibrium **[CBSE PMT 2005]**
(a) 0.16 (b) 0.48
(c) 0.36 (d) 0.24

88. Polytene chromosomes are formed by **[Kerala PMT 2004; CPMT 2005]**
(a) Endoreduplication of chromosomes
(b) Somatic pairing of homologous chromosomes
(c) Somatic pairing of non-homologous chromosomes
(d) Germinal pairing of non-homologous chromosomes

89. Telomerase is an enzyme which is a **[CBSE PMT 2005]**
(a) Repetitive DNA (b) RNA
(c) Simple protein (d) Ribonucleoprotein

90. Percentage of recombination between *A* and *B* is 9% and C is 17%, *B* and *C* is 26%, then the arrangement of genes is **[Odisha JEE 2004]**
(a) ABC (b) ACB
(c) BCA (d) BAC.

91. Chromosome complement with 2n-1 is called as **[BHU 2005, 08; WB JEE 2008]**
(a) Monosomy (b) Nullosomy
(c) Trisomy (d) Tetrasomy

92. A gene is said to be dominant, if **[CBSE PMT 1992, 2002]**
(a) It is never expressed in any condition
(b) It is expressed only in heterozygous condition
(c) It expresses its effect only in homozygous stage
(d) It is expressed both in homozygous and heterozygous conditions

93. Chromosomes were seen first time by **[RPMT 2003]**
(a) Waldeyer (b) Flemming
(c) Hofmeister (d) Strasburger

94. Genes located at the same locus of chromosomes are called **[CBSE PMT 1997; AIPMT (Cancelled) 2015]**
(a) Polygenes (b) Oncogenes
(c) Multiple alleles (d) None of these

95. Jumping genes are found in **[MP PMT 2003]**
(a) Eukaryotes
(b) Bacteriophage
(c) Bacteria
(d) Eukaryotes and prokaryotes

96. Some genes in bacteria and virus may code for more than one polypeptide, they are called as **[Odisha JEE 2011]**
(a) Overlapping genes (b) Jumping gene
(c) Split gene (d) None of these

97. The person who discovered 'Y' chromosomes was
(a) Mc Carthy (b) Mc Clung
(c) Gregor Mendel (d) Netti Stevens

98. "Nu body" was shown by **[BVP 2003]**
(a) Darlington (b) Johanssen
(c) Woodcock (d) Temin and Baltimore

99. "Cytochimeras" means
(a) Cells having haploid number of chromosomes
(b) Cells having two nuclei
(c) Cells having different chromosomes other than vegetative cells
(d) None of the above

100. Genes carried on chromosomes was first proved by **[VITEEE 2006]**
(a) Mendel (b) Watson
(c) Crick (d) Bridges

101. In *Pisum sativum* there are 14 chromosomes. How many pairs with different chromosomal composition can be prepared **[BHU 2005]**
(a) 14 (b) 7
(c) 2^{14} (d) 2^7

102. Which of the following is incorrectly paired **[Kerala CET 2005]**
(a) Sry-gene–X-chromosome
(b) 2n-2-nullisomic
(c) Nucleoid prokaryote
(d) Polytene chromosome-*Drosophila*
(e) Trisomy-Down's syndrome

103. Gene controls **[MP PMT 2010]**
(a) Heredity but not protein synthesis
(b) Protein synthesis but not heredity
(c) Both heredity and protein synthesis
(d) Biochemical action of some enzymes

104. Smallest structure having the power of replicating itself is

Or

The factor responsible for expression of character transmitted from parents to offsprings **[MH CET 2006]**
(a) Chloroplast (b) Gene
(c) Mitochondria (d) Ribosome

105. The core of nucleosome is made up of **[AFMC 2000; MH CET 2007]**
(a) H_1, H_2A, H_2B, H_3 (b) H_1, H_2A, H_2B, H_4
(c) $H_1, H_2A, H_2B, H_3, H_4$ (d) H_2A, H_2B, H_3, H_4

106. Nucleosome consists of **[MP PMT 1999, 2012]**
(a) Nucleolus (b) Genes
(c) Microfilaments (d) Histones

107. Structural element of chromatin is **[WB JEE 2011]**
(a) Histone (b) Acid protein and DNA
(c) Nuclear matrix (d) Nucleosome

108. The salivary gland chromosomes in the dipteran larvae, are useful in gene mapping because **[CBSE PMT 2005]**
(a) These are fused
(b) These are much longer in size
(c) These are easy to stain
(d) They have endoreduplicated chromosomes

109. Nucleosomes are **[MP PMT 2003]**
(a) Units of DNA (b) Units of RNA
(c) Units of proteins (d) Units of chromosomes

110. Carrier of hereditary is **[MP PMT 2005]**
(a) Gene (b) DNA
(c) Chromosome (d) All of above

111. Plant A is having chromosome no. $2n = 12$ and B having $2n = 16$ Both are crossed to form allotetraploid C What is the chromosome number of C **[Odisha JEE 2010]**
(a) 32 (b) 14
(c) 28 (d) 7

112. Holandric genes are **[DPMT 1993; BHU 2000; AIIMS 2010; MP PMT 2013]**
(a) Carried by 'X' chromosomes
(b) Carried by different parts of 'Y' chromosomes
(c) Carried by 'X' and 'Y' chromosomes
(d) Carried by autosomes

113. Which organism was used by Beadle and Tatum to proposed one gene-one enzyme hypothesis **[CPMT 2004; BVP 2004; CBSE PMT 2007; MP PMT 2007]**
(a) *E.coli* (b) Nostoc
(c) Drosophila (d) Neurospora

114. A gene is made up of **[MP PMT 1996, 2011; BVP 2002]**
(a) DNA (b) RNA
(c) Either DNA or RNA (d) Amino acids

115. Which one of the following conditions of the zygotic cell would lead to the birth of a normal human female child **[CMC Vellore 1993; CBSE PMT (Mains) 2011]**
(a) Only one *X* chromosome
(b) One *X* and one *Y* chromosome
(c) Two *X* chromosomes
(d) Only one *Y* chromosome

116. Separation of the two chromatids of a chromosome takes place in mitosis during **[DPMT 1993; AMU (Med.) 2006]**
(a) Prophase (b) Anaphase
(c) Metaphase (d) Telophase

117. The modern concept of gene is **[CPMT 1994]**
(a) A segment of DNA capable of crossing over
(b) A functional unit of DNA
(c) A segment of DNA
(d) A segment of chromosome

118. "One gene one enzyme" theory was proposed by **[NCERT; CPMT 1994, 2006; BHU 1995, 2008; AMU (Med.) 2000; DPMT 2001, 04; MP PMT 2003, 06; BVP 2004; RPMT 2006; CBSE PMT 2006]**
(a) G.W. Beadle and E.L. Tatum
(b) O.T. Avery and M. McCarthy
(c) J.H. Tijo and A. Levan
(d) C.E. Ford and J.H. Tijo

119. One functional unit of gene which specifies synthesis of one polypeptide is known as **[NCERT; MP PMT 2001; J & K CET 2008]**

Or

The equivalent of a structural gene **[NEET (Phase-II) 2016]**
(a) Recon (b) Clone
(c) Codon (d) Cistron

120. The theory of jumping genes was propounded by or Noble prize for the concept of jumping gene was given to **[MHCET 2001; BVP 2001, 03, 04; MP PMT 2002; CPMT 2003; BHU 2006, 12]**
(a) Mendel (b) Morgan
(c) Barbara Mc Clintock (d) Sanger

121. The terms *cistron*, *recon* and *muton* were proposed by **[NCERT; MP PMT 2009]**
(a) W. Ingram (b) Bateson
(c) J. Lederberg (d) S. Benzer

122. A normal spontaneous rate for a single gene is one mutation in every.....replication **[Odisha JEE 2004]**
(a) 10^3 to 10^5 (b) 10^5 to 10^7
(c) 10^6 to 10^9 (d) 10^7 to 10^{10}

123. Genes are **[MP PMT 2005, 12]**
(a) Morphological units (b) Hereditary units
(c) Basic units (d) All of these

124. The eukaryotic chromosomes are made up of **[MP PMT 1994, 2011; WB JEE 2010]**
(a) DNA (b) RNA
(c) DNA and proteins (d) DNA and lipids

125. Chromosome *Y* is **[VITEEE 2006]**
(a) Acrocentric (b) Metacentric
(c) Telocentric (d) Submetacentric

126. Nucleosomes are bounded by
(a) RNA (b) Histone H_4
(c) Histone H_3 (d) DNA

127. Who postulated the 'Chromosome Theory of Inheritance' **[MP PMT 1997; Kerala PMT 2007]**
Or
The behaviour of the chromosomes was parallel to the behaviour of genes during meiosis was noted by **[Keral PMT 2012]**
(a) De Vries (b) Mendel
(c) Sutton and Boveri (d) Morgan

128. In split genes, the coding sequences are called **[NCERT; CBSE PMT 1995]**
(a) Cistrons (b) Operons
(c) Exons (d) Introns

129. Which one of the following true **[MP PMT 2005]**
(a) One gene one protein
(b) One gene one polypeptide
(c) One gene many polypeptide
(d) All of the above

130. The bacterial genome refers to the total number of genes located upon a **or** The term 'genome' refers to the total number of genes combined in a **[CPMT 1994, 2010; AIIMS 1994; MP PMT 1994, 95, 98; Manipal 1995; Odisha JEE 2009]**
(a) Haploid set of chromosomes
(b) Diploid set of chromosomes
(c) Tetraploid set of chromosomes
(d) Hexaploid set of chromosomes

131. Different types of chromosomes can be recognised by the position of the following separating the two arms **[KCET 1994]**
(a) Centromere (b) Genes
(c) Spindle (d) Nucleus

132. Nucleosome core is intimately associated with **[WB-JEE 2016]**
(a) 160 bp of DNA (b) 210 bp of DNA
(c) 250 bp of DNA (d) 100 bp of DNA

Multiple allelism

1. Usually the recessive character is expressed only when present in a double recessive condition. However, a single recessive gene can express itself in human beings when the gene is present on **[NCERT; AIIMS 1992]**
(a) Any autosome
(b) *X* chromosome of female
(c) *X* chromosome of male
(d) Either on autosome or *X* chromosome

2. In humans, height and skin colour shows a lot of variation. They are example of **[CBSE PMT 2006, 07; AIIMS 2008, 13; VITEEE 2008; MH CET 2015]**
(a) Multiple alleles
(b) Pleiotropic inheritance
(c) Polygenic / Quantitative inheritance
(d) Pseudoalleles

3. In human beings, the colour of skin is controlled by **[CPMT 1995; Kerala CET 1999, 2002; CBSE PMT 2007]**
(a) Multiple alleles (b) Lethal genes
(c) Polygenic effect (d) None of these

4. Which of the following is genetically dominant in man **[MP PMT 2007]**
(a) Colour blindness (b) Rh positive
(c) Haemophilia (d) Albinism

5. Which of the following genotypes does not produce any sugar polymer on the surface of the RBC **[Kerala PMT 2010]**
(a) I^AI^A (b) I^Bi
(c) I^AI^B (d) i i
(e) I^BI^B

6. ABO blood grouping is controlled by gene *I* which has three alleles and show co-dominance. There are six genotypes. How many phenotypes in all are possible **[KCET 2007; CBSE PMT (Pre./Mains) 2010; Kerala PMT 2012]**
(a) Six (b) Three
(c) Four (d) Five

7. Inheritance of ABO blood grouping is an example of **[J & K CET 2008; Kerala PMT 2010]**
(a) Dominance (b) Co-dominance
(c) Incomplete dominance (d) Both (a) & (b)

8. The most popularly known blood grouping is the ABO grouping. It is named ABO and not ABC, because "O" in it refers to having **[CBSE PMT 2009]**
(a) Other antigens besides A and B on RBCs
(b) Overdominance of this type of the genes for A and B types
(c) One antibody only-either anti-A or anti-B on the RBCs
(d) No antigens A and B on RBCs

9. Inheritance of blood group is a condition of
(A) Co-dominance (B) Incomplete dominance
(C) Multiple allelism (D) Multiple gene
[CBSE PMT 1990; AFMC 2006; Kerala PMT 2008, 09]
(a) A, B (b) B, D
(c) B, C (d) A, D
(e) A, C

10. A woman with blood group 'O' has a child with blood group 'O'. She claims that a man with blood group 'A' as the father of her child. What would be the genotype of the father, if her claim is right **[BHU 2008; EAMCET 2009]**
(a) I^OI^O (b) I^AI^B
(c) I^AI^O (d) I^BI^O

11. The condition of erythroblastosis foetalis occurs only when **[KCET 2012]**
(a) The husband is Rh^+ and wife is Rh^-
(b) The husband is Rh^- and wife is Rh^+
(c) The mother is Rh^+ and foetus is Rh^-
(d) The mother is Rh^- and foetus is Rh^+

12. The offspring produced from a marriage have only O or A blood groups. Of the genotypes given below, the possible genotypes of the parents would be **[KCET 2009]**
(a) I^AI^A and I^AI^O (b) I^OI^O and I^OI^O
(c) I^AI^A and I^OI^O (d) I^AI^O and I^OI^O

13. Blood stains are found at the site of a murder. If DNA profiling technique is to be used for identifying the criminal, which of the following is ideal for use **[KCET 2009]**
(a) Serum (b) Erythrocytes
(c) Leucocytes (d) Platelets

14. A person with blood group 'A' can be given blood of which group **[MP PMT 1993, 2005; RPMT 2006]**
(a) *A* and *B* (b) *B* and *O*
(c) *A* and *O* (d) *A*, *B*, *AB* and *O*

15. Antisera used to detect Rh blood group **[MP PMT 1993]**
(a) Anti A (b) Anti B
(c) Anti C (d) Anti D

16. Human blood groups are example of a **[MP PMT 2010]**
(a) Gradualism (b) Cline
(c) Gradient of diploidy (d) Polymorphism

17. Who was the scientist to introduce ABO blood groups **[CBSE PMT 1993; CPMT 1994; BCECE 2005]**
(a) Wiener (b) Levine
(c) Fisher (d) Landsteiner

18. One of the following is *not* the types of blood groups or blood factors **[KCET 2004]**
(a) Lewis and Duffy (b) Buffs and Kips
(c) ABO and Rh (d) Rh and MN

19. Mating among close relations is referred **[CBSE PMT 1994]**
(a) Permanent marriage (b) Line breeding
(c) Inbreeding (d) Cross breeding

20. Genes exhibiting multiple effects phenotype are known as **[NCERT; MP PMT 2009; Odisha JEE 2012]**
(a) Complementary genes (b) Pleiotropic genes
(c) Cistrons (d) Pseudogenes

21. For a child having blood group B, if father has blood group A, what may be the blood group of the mother
(a) *O* or *A* (b) *O*
(c) *B* or *AB* (d) *A*

22. If a child has O type of blood group and the father B type, the genotype of the father will be **[CBSE PMT 1992; MP PMT 2009]**
(a) I^OI^O (b) I^AI^B
(c) I^OI^B (d) I^BI^B

23. Person with blood group AB is considered as universal recipient because he has **[MP PMT 1992, 96, 99, 2003, 06; CPMT 1995; CBSE PMT 2014]**
(a) No antigen on RBC and no antibody in the plasma
(b) Both A and B antigens in the plasma but no antibodies
(c) Both A and B antigens on RBC but no antibodies in the plasma
(d) Both A and B antibodies in the plasma

24. Rh factor may be responsible for **[MP PMT 1992; WB JEE 2010]**
(a) Turner's syndrome (b) AIDS
(c) Sickle-cell anaemia (d) Erythroblastosis foetalis

25. Parents of blood groups *O* and *AB* cannot have a child of group AB because **[MP PMT 1992]**
(a) Gene *O* is dominant over gene *A*
(b) Gene *O* is dominant over gene *B*
(c) Gene *A* or *B* is absent in one of the parents
(d) Gene *A* and *B* are absent in one of the parents

26. Identify the wrong statement **[KCET 2015]**
(a) Alleles b and c also produce sugar
(b) Alleles I^A and I^B produce sugar
(c) When I^B and b or I are present only I^B is expressed
(d) Both I^A and I^B are present together and they express because of co-dominance

27. Which of the following is the number of alleles for blood group in an individual **[J & K CET 2012]**
(a) 1 (b) 2
(c) 3 (d) 4

28. Rh factor is named after
(a) Man (b) Rat
(c) Monkey (d) Chimpanzee

29. A person with antigens *A* and *B* and no antibodies belongs to blood group **or** In which blood group antibodies are absent **[CBSE PMT 1991; CPMT 1993, 94; MP PMT 1996, 98, 99,2011; Odisha JEE 2010]**
(a) *A* (b) *B*
(c) *AB* (d) *O*

30. If a man Rh^+ marries a lady Rh^-, then
(a) First child will die (b) First child will survive
(c) No child will be born (d) None of these

31. Universal donors have no antigens in RBC and have both *a* and *b* antibodies. They belong to blood group **[CPMT 1994; JIPMER 1994; MP PMT 1994, 96, 99, 09, 12; Pb PMT 2004]**
Or
Which blood group can be given to patients of any blood group **[J & K CET 2005; Odisha JEE 2008; MP PMT 2010]**
(a) *A* (b) *B*
(c) *AB* (d) *O*

32. Four children belonging to the same parents have the following blood groups A, B, AB and O. Hence, the genotypes of the two parents are **[KCET 2011]**
(a) Both parents are homozygous for 'A' group
(b) One parent is homozygous for 'A' and another parent is homozygous for 'B'
(c) One parent is heterozygous for 'A' and another parent is heterozygous for 'B'
(d) Both parents are homozygous for 'B' group

33. When red blood corpuscles containing both A and B antigens are mixed with your blood serum, they agglutinate. Hence your blood group is ..... type **[KCET 2010]**
(a) AB (b) O
(c) A (d) B

34. Persons of blood group *A* contain **[MP PMT 1994]**
(a) Antigen *A* and antibodies *b*
(b) Antigen *A* and antibodies *a*
(c) Antigen *A* and *B* and no antibodies
(d) No antigens and both *a* and *b* antibodies

35. Blood group agglutinogen is **[CPMT 2009]**
(a) Glycoprotein (b) Phosphoprotein
(c) Haemoprotein (d) Phospholipid

36. The animal which has oval RBCs **[Manipal 2005]**
(a) Humans (b) Camel
(c) Dog (d) Fish

37. Blood groups are named because of the agglutinogen *A* and *B* present in **[CPMT 1992, 93]**
(a) Plasma (b) RBC
(c) WBC (d) Platelet

38. 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 certificate of his own blood type, offers for blood donation without delay. What would have been the type of blood group of the donor friend **[NCERT; Odisha JEE 2005; CBSE PMT (Pre.) 2011, 12]**
(a) Type A (b) Type B
(c) Type AB (d) Type O

39. The second pregnancy of a woman terminates due to anaemia of the foetus. She has never had a blood transfusion. On the basis of this, which of the following is correct **[MP PMT 1994]**
(a) Child from the first pregnancy is *Rh+ve*
(b) The husband of the woman is *Rh+ve*
(c) The woman is *Rh−ve*
(d) All the above

40. With regard to the ABO blood typing system, if a man who has type B blood and a woman who has type O blood were to have children, what blood types could the children have **[KCET 2012]**
(a) A or O (b) B or O
(c) AB or O (d) A, B, AB or O.

41. If two persons with 'AB' blood group marry and have sufficiently large number of children, these children could be classified as 'A' blood group : 'AB' blood group 'B' blood group in 1 : 2 : 1 ratio. Modern technique of protein electrophoresis reveals presence of both 'A' and 'B' type proteins in 'AB' blood group individuals. This is an example of **[NEET 2013]**
(a) Complete dominance (b) Co-dominance
(c) Incomplete dominance (d) Partial dominance

42. The probablity of having a child with blood group *O* to parents with blood groups *A* and B is **[CPMT 1995]**
(a) 4 out of 4 (b) 3 out of 4
(c) 2 out of 4 (d) 1 out of 4

43. Example of qualitative inheritance is **[CPMT 1995]**
(a) Colour of skin
(b) Colourblindness
(c) Klinefelter's syndrome
(d) Alkaptonuria

44. The father has blood group *AB* and mother 'O'. The child is supposed to have which of the following bloodgroups **[AFMC 1995]**
(a) 'A' or 'B' (b) 'A' only
(c) 'B' or 'O' (d) *B* only

45. A child of a mother with blood group A and a father with blood group AB may have any one of the following blood groups except **[NCERT; Manipal 1995; CPMT 2005; MHCET 2005]**
(a) *A* (b) *B*
(c) *AB* (d) *O*

46. Donors and recipients in a blood transfusion process can be **[MP PMT 1995]**
(a) Only father and son
(b) Only brother and sister
(c) Only maternal uncle and niece
(d) All the above

47. Which of the following substances, if introduced into the blood stream, would cause coagulation of blood at the site of its introduction **[CBSE PMT 2005]**
(a) Fibrinogen (b) Prothrombin
(c) Heparin (d) Thromboplastin

48. Detection of blood group is done by agglutinisation test using antiserum. According to this **[KCET 1994]**
(a) If the blood shows coagulation with antiserum *B*, the blood group is *B*
(b) If the blood shows coagulation with both antiserum *A* and *B*, the blood group is *O*
(c) If the blood shows coagulation with antiserum *A*, the blood group is *AB*
(d) None of these

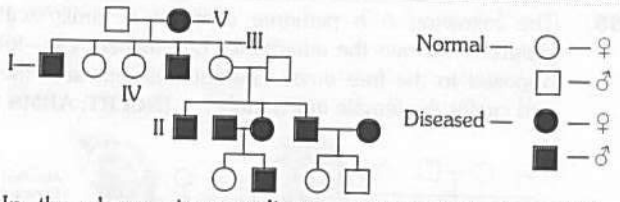
49. Mother homozygous B, and father is A. What will be the possible blood group in their progeny **[DPMT 2007]**
(a) AB & B possible (b) AB & A possible
(c) A and B possible (d) O possible

50. *Rh-ve* person donated blood to *Rh+ve* person for the second time. Then **[KCET 2007]**
(a) *Rh-ve* person will die
(b) Nothing happens to *Rh+ve* person
(c) *Rh+ve* blood starts reacting to *Rh-ve* blood
(d) *Rh+ve* person will die

51. Rh factor is present in **[BHU 2006]**
(a) All vertebrates
(b) All mammals
(c) All reptiles
(d) Man and rhesus monkey only

52. If the foetus is Rh^+ and mother is Rh^- then **[BVP 2004]**
(a) Foetus will transmit antigen to mother blood
(b) Foetus will transmit antibody to mother blood
(c) Foetus is attacked by antibodies to mother blood
(d) Foetus is attacked by antigen to mother blood

11.



In the above given pedigree, assume that no outsider marrying in, carry a disease. Write the genotypes of II and III **[EAMCET 2009]**

(a) All X^dY (b) X^DY and X^DX^d
(c) X^dXX^dY and X^dY^D (d) X^dX^d and X^dY

12. Which one of the following is a genetically transmitted character **[Kerala PMT 2004]**

(a) Colour blindness (b) Hydrocephalus
(c) Hemophilia (d) Muscular dystrophy
(e) All of these

13. A normal-visioned man whose father was colour-blind, marries a woman whose father was also colour-blind. They have their first child as a daughter. What are the chances that this child would be colour-blind **[NCERT; CBSE PMT 1990; KCET 2009; CBSE PMT (Pre.) 2012]**

(a) 50% (b) 100%
(c) 0% (d) 25%

14. A man who is suffering from a recessive X- linked disease marries a normal women. Then what is true about its progeny **[CPMT 2009]**

(a) All sons are diseased
(b) All daughter's are diseased
(c) All sons are normal
(d) None of the above

15. Person whose father is colourblind marries a lady whose mother is daughter of a colourblind man. Their children will be **[DPMT 1993; AIIMS 2013]**

(a) All normal
(b) All colour blind
(c) All sons colour blind
(d) Some sons normal and some colour blind

16. Which one of the following symbols and its representation, used in human pedigree analysis is correct **[CBSE PMT (Pre.) 2010]**

(a) ◆ = male affected
(b) □═○ = mating between relatives
(c) ○ = unaffected male
(d) □ = unaffected female

17. Pick out the correct statements **[NEET (Phase-I) 2016]**

(A) Haemophilia is a sex-linked recessive disease
(B) Down's syndrome is due to aneuploidy
(C) Phenylketonuria is an autosomal recessive gene disorder
(D) Sickle cell anaemia is a X-linked recessive gene disorder

(a) (A) and (D) are correct
(b) (B) and (D) are correct
(c) (A), (C) and (D) are correct
(d) (A), (B) and (C) are correct

18. The most common type of haemophilia results from the congenital absence of **[CPMT 2004; MP PMT 2007; WB JEE 2008]**

(a) Factor II (b) Factor V
(c) Factor VIII (d) Factor XI

19. Which of the following diseases belongs to the same category as colourblindness in man **[AIEEE Pharmacy 2003; BHU 2005; Odisha JEE 2011]**

(a) Nightblindness (b) Presbyopia
(c) Diabetes incipidus (d) Haemophilia

20. X-linked recessive gene is **[MP PMT 2007]**

(a) Always expressed in male
(b) Always expressed in female
(c) Lethal
(d) Sub lethal

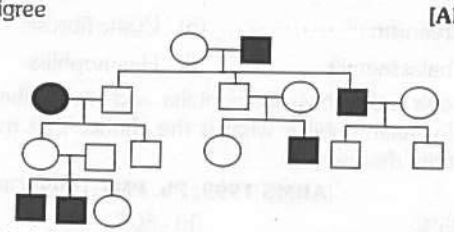
21. If a colourblind woman marries and a normal visioned man, their sons will be **[CBSE PMT 1994, 99, 2006; BHU 1996; MP PMT 2000, 05; CPMT 2005]**

(a) Three-fourths colourblind and on-fourth normal
(b) All colourblind
(c) All normal visioned
(d) One-half colourblind and one-half normal

22. A man known to be victim of haemophilia marries a normal woman whose father was known to be a bleeder. Then it is expected that **[Pb. PMT 1999; CBSE PMT 2000]**

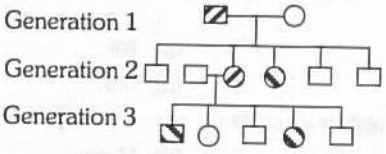
(a) All their children will be bleeders
(b) Half of their children will be bleeders
(c) One fourth of their children will be bleeders
(d) None of their children will be bleeder

23. In the following human pedigree, the filled symbols represent the affected individuals. Identify the type of given pedigree **[AIPMT 2015]**



(a) X- linked recessive (b) Autosomal recessive
(c) X- linked dominant (d) Autosomal dominant

24. Given below is a pedigree chart showing the inheritance of a certain sex-linked trait in humans



Key : **[NCERT; AIIMS 2005]**

□ Unaffected male
▨ Affected male
○ Unaffected female
⊘ Affected female

The trait traced in the above pedigree chart is

(a) Dominant X-linked (b) Recessive X-linked
(c) Dominant Y-linked (d) Recessive Y-linked

25. Which of the following statement about colour blindness is correct **[AMU (Med.) 2010]**

(a) 2% men are red colour blind, 6% are green colour blind

(b) 6% men are red colour blind, 2% are green colour blind

(c) 10% men are red colour blind, 5% are green colour blind

(d) 5% men are red colour blind, 10% are green colour blind

26. Sex linked disease is **[NCERT; CPMT 1993, 99, 2003; MP PMT 1994, 98; AFMC 1996, 2001; Pb. PMT 2000; MHCET 2000; J & K CET 2002; BHU 2004; Kerala PMT 2010; WB-JEE 2016]**

(a) Haemophilia (b) Colourblindness

(c) Sickle-cell anaemia (d) Both (a) and (b)

27. A woman with normal vision, but whose father was colour blind, marries a colour blind man. Suppose that the fourth child of this couple was a boy. Thus boy **[CBSE PMT 2005]**

(a) Will be partially colour blind since he is heterozygoustor for the colour blind mutant alble

(b) Must have normal colour vision

(c) Must be colour blind

(d) May be colour blind or may be of normal vision,

28. A man and a woman, who do not show any apparent signs of a certain inherited disease, have seven children (2 daughters and 5 sons). Three of the sons suffer from the given disease but none of the daughters are affected which of the following mode of inheritance do you suggest for this disease **[CBSE PMT 2005]**

(a) Autosomal dominant (b) Sex-linked dominant

(c) Sex-limited recessive (d) Sex-linked recessive

29. Which of the following is not a hereditary disease **[CBSE PMT 2005]**

(a) Cretinism (b) Cystic fibrosis

(c) Thalassaemia (d) Haemophilia

30. If a boy's father has haemophilia and his mother has one gene for haemophilia; what is the chance that the boy will inherit the disease **[AIIMS 1999; Pb. PMT 1999; CPMT 2000]**

(a) 25% (b) 50%

(c) 75% (d) 100%

31. A colour blind man marries a woman with normal sight who has no history of colour blindness in her family.What is the probability of their grandson being colour blind **[AIPMT 2015]**

(a) 1 (b) Nil

(c) 0.25 (d) 0.5

32. Sickle cell anaemia is due to **[CBSE PMT 1990]**

(a) Hormones (b) Viruses

(c) Genes (d) Bacteria

33. Sex linked inheritance was discovered by

(a) McClung (b) Mendel

(c) Landsteiner (d) Morgan

34. Colour blindness is caused by a single **[RPMT 2006]**

(a) Dominant gene in woman (b) Dominant gene in man

(c) Recessive gene in man (d) Recessive gene in woman

35. The following is a pedigree chart of a family with five children. It shows the inheritance of attached, ear - lobes as opposed to the free ones. The squares represent the male and circles the female individuals **[NCERT; AIIMS 2004]**

Which one of the following conclusions drawn is correct

(a) The parents are homozygous dominant

(b) The parents are homozygous recessive

(c) The parents are heterozygous

(d) The trait is Y - linked

36. Female rarely experience the physiologic defect of haemophilia because they do so only when they are

(a) Heterozygous for the defect

(b) Homozygous for the defect

(c) Carrier for the defect

(d) Wives of haemophilic husbands

37. A colour blind son will born when **[CPMT 1993]**

(a) Mother is normal and father normal

(b) Mother is colour blind and father normal

(c) Mother is normal and father is colour blind

(d) All the cases are correct

38. Sex influenced characters are due to **[MH CET 2004]**

(a) Y-linked genes

(b) X-linked genes

(c) Autosomal genes

(d) Y-linked gene modification

39. A colourblind man has a colourblind sister but a normal brother than phenotype of its parents is **[CPMT 1993]**

(a) Father colourblind and mother normal

(b) Father normal and mother colourblind

(c) Father and mother both are colourblind

(d) Father and mother both are normal

40. The frequency of a character is found to be increasing when **[CPMT 1993; MP PMT 2001]**

(a) It is dominant

(b) It is recessive

(c) It is adaptable

(d) It is inheritable

41. The female children of a haemophilic man and a carrier woman are likely to be **[MP PMT 1992]**

(a) All haemophilic

(b) Half haemophilic and half carriers

(c) All carriers

(d) Half normal and half carriers

42. The daughter born to haemophilic father and normal mother could be **[AIIMS 1992]**

(a) Normal (b) Carrier

(c) Haemophilic (d) None

43. Haemophilia is caused due to lack of **[AIIMS 1992]**

(a) ADH (b) AHF

(c) STH (d) ACTH

44. A marriage between normal visioned man and colourblind woman will produce which of the following types of offsprings **[BHU 2004]**
(a) Normal sons and carrier daughters
(b) Colourblind sons and carrier daughters
(c) Colourblind sons and 50% carrier daughters
(d) 50% colourblind sons and 50% carrier daughters

45. Sex-linked genes of man are **[Wardha 2005]**
(a) Present on X-chromosome
(b) Present on autosomes
(c) Present on short arm (p) of Y-chromosome
(d) Present on long arm (q) of Y-chromosome

46. If a normal woman marries a colourblind man, their **[MP PMT 2002; Kerala PMT 2004; RPMT 2006]**
(a) All sons will be colourblind and daughters normal
(b) All daughters will be colourblind and sons normal
(c) All children will be normal
(d) All children will be colourblind

47. A girl of normal vision whose father was colourblind marries a man of normal vision whose father was also colourblind. Their sons would be (of total number of sons) **[MP PMT 1995]**
(a) All colourblind
(b) 50% colourblind
(c) All normal
(d) 25% colourblind

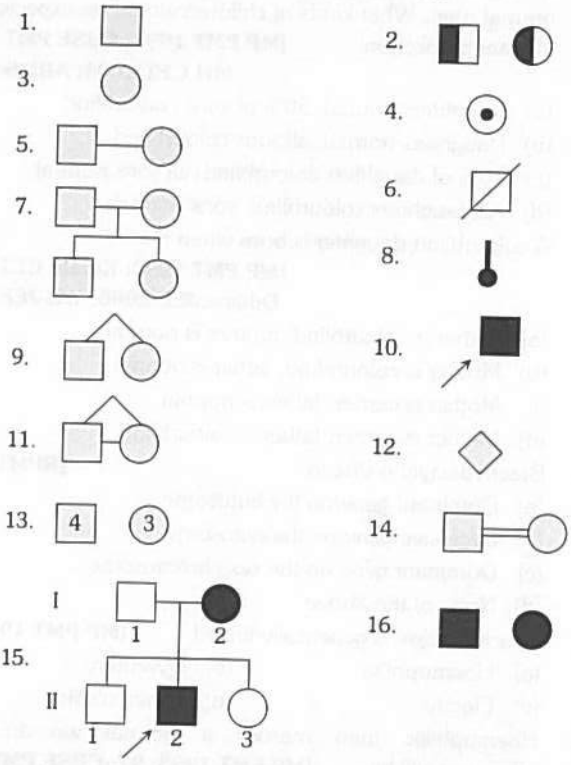
48. All the sons are haemophilic and daughter are normal of a haemophilic father and normal mother. This character is **[CBSE PMT 1996]**
(a) X–linked recessive
(b) Y–linked recessive
(c) X–linked dominant
(d) Y–linked dominant

49. In human the inheritance of sex linkage takes place through **[MP PMT 2003]**
(a) Autosome (b) Y - chromosome
(c) X – chromosome (d) Both (b) and (c)

50. Haemophilia is more commonly seen in human males than in human females because **[NCERT; CBSE PMT 2005; WB JEE 2008; NEET (Phase-I) 2016]**
(a) This disease is due to an X-linked dominant mutation
(b) A grater proportion of girls die in infancy
(c) This disease is due to an X-linked recessive mutation
(d) This disease is due to a Y-linked recessive mutation

51. What are all the chances of colour blind daughter and sons being born in a marriage of normal man marrying a normal woman, whose father was colour blind **[Kerala CET 2003]**
(a) All sons are normal and all daughters are colourblind
(b) Both the sons and daughters are colourblind
(c) All the sons are colourblind and all daughters are normal
(d) 50% sons are colourblind and all daughters are phenotypically normal

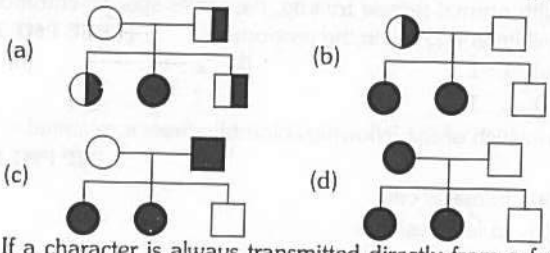
52. Match the symbol with associated statement



A. Heterozygous individuals with autosomal recessive
B. Diseased (or death)
C. Female carrier of an X - linked recessive gene
D. Individuals with normal trait
E. Consanguineous mating (marriage of blood relatives)
F. Unknown sex
G. Mating
H. Male
I. Female
J. Affected individual
K. Abortion or still birth
[NCERT]

	B	C	E	F
(a)	6	4	14	12
(b)	16	13	2	11
(c)	3	1	2	7
(d)	16	1	2	7

53. If husband is PTC taster and wife is PTC non taster. Their daughters are non tasters but their son is taster. This is not related with a sex-linked trait. Out of four a, b, c, d which pedigree is correct **[NCERT]**



54. If a character is always transmitted directly from a father to all his sons and from their sons to all their sons, then which chromosome carries the gene for the character **[MP PMT 1997, 2000]**
(a) Autosomes (b) X chromosome
(c) Y chromosome (d) None of the above

55. A normal woman whose father was colourblind marries a normal man. What kinds of children would be expected and in what proportion **[MP PMT 1997; CBSE PMT 2004; MH CET 2004; AIIMS 2008]**

(a) Daughters normal, 50% of sons colourblind
(b) Daughters normal, all sons colourblind
(c) 50% of daughters colourblind, all sons normal
(d) All daughters colourblind, sons normal

56. A colourblind daughter is born when **[MP PMT 1998; Kerala CET 2002; Odisha JEE 2005; WB-JEE 2016]**

(a) Father is colourblind, mother is normal
(b) Mother is colourblind, father is normal
(c) Mother is carrier, father is normal
(d) Mother is carrier, father is colourblind

57. Brachydactyly is due to **[RPMT 2006]**

(a) Dominant gene on the autosome
(b) Recessive gene on the autosome
(c) Dominant gene on the sex chromosome
(d) None of the above

58. Which disease is genetically linked **[MP PMT 1996, 99]**

(a) Haemophilia (b) Dysentery
(c) Plague (d) Tuberculosis

59. Haemophillic man marries a normal woman. Their offsprings will be **[MP PMT 1993, 97; CBSE PMT 1999; CPMT 1999; Haryana PMT 2005]**

(a) All girls (b) All normal
(c) All haemophillic (d) All boys haemophillic

60. When an allele fails to explain itself in presence of the other allele, the former is said to be **[CBSE PMT 1991]**

(a) Recessive (b) Dominant
(c) Codominant (d) Complementary

61. A woman with two genes for haemophillia and one gene for colourblindness on one of the X chromosomes marries a normal man. How will the progeny be **[NCERT; CBSE PMT 1998; KCET 2012]**

(a) All sons and daughters haemophillic and colourblind
(b) Haemophillic and colourblind daughters
(c) 50% haemophillic colourblind sons and 50% normal sons
(d) 50% haemophillic daughters and 50% colourblind daughters

62. A fruit fly is heterozygous for sex-linked genes when meted with normal female fruit fly, the males specific chromosome will enter egg cell in the proportion **[CBSE PMT 1997]**

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

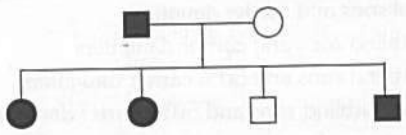
63. In which of the following colourblindness is inherited **[MP PMT 2000]**

(a) In males only
(b) In females only
(c) In both males and females
(d) In none of the above

64. Persons who are colour blind cannot distinguish **[KCET 2000]**

(a) Red and green (b) Black and yellow
(c) Green and blue (d) Yellow and white

65. Study the pedigree chart of a certain family given below and select the correct conclusion which can be drawn for the character **[NCERT; CBSE PMT (Mains) 2010]**



(a) The female parent is heterozygous
(b) The parents could not have a normal daughter for this character
(c) The trait under study could not be colour-blindness
(d) The male parent is homozygous dominant

66. Expected children of a blue-eyed (recessive) woman and brown-eyed (dominant) man who had a blue-eyed mother are likely to be **[CBSE PMT 1991]**

(a) All brown-eyed
(b) One blue-eyed and one brown-eyed
(c) All blue-eyed
(d) Three blue-eyed and one brown-eyed

67. Gene for colourblindness is located on **[MH CET 2002; MP PMT 2003, 07; Odisha JEE 2011]**

(a) Homologous part of X-chromosome
(b) Non-homologous part of X-chromosome
(c) Homologous part of Y-chromosome
(d) Non-homologous part of Y-chromosome

68. Which of the following conditions is not X-linked **[MP PMT 2010]**

(a) Colour blindness (b) Haemophilia
(c) Down's syndrome (d) Myopia

69. A diseased man marries a normal woman. They get three daughters and five sons. All the daughters were diseased and sons were normal. The gene of this disease is **[CBSE PMT 2002; BVP 2002]**

(a) Autosomal dominant (b) Sex linked recessive
(c) Sex limited character (d) Sex linked dominant

70. Pattern baldness, moustaches and beard in human males are examples of **[CBSE PMT 2003]**

Or

The traits which are expressed in only a particular sex though their genes occurs in the opposite sex too are known as **[Odisha JEE 2012]**

(a) Sex-determining traits (b) Sex linked traits
(c) Sex limited traits (d) Sex differentiating traits

71. One of the genes present exclusively on the X-chromosome in humans is concerned with **[AIIMS 2003]**

(a) Baldness
(b) Red-green colour blindness
(c) Facial hair/moustaches in males
(d) Night blindness

72. One of the following is not true to haemophilia **[Kerala CET 2003]**

(a) Royal disease (b) Bleeder's disease
(c) X-linked disease (d) Y-linked disease

73. Which one is the **incorrect** statement with regards to the importance of pedigree analysis **[NEET (Karnataka) 2013]**
(a) It confirms that DNA is the carrier of genetic information
(b) It helps to understand whether the trait in question is dominant or recessive
(c) It confirms that the trait is linked to one of the autosome
(d) It helps to trace the inheritance of a specific trait

74. If a colour-blind man marries a woman who is homozygous for normal colour vision, the probability of their son being colour-blind is **[NEET (Phase-II) 2016]**
(a) 1 (b) 0
(c) 0.5 (d) 0.75

Twins & I.Q., Eugenics, Euthenics and Euphenics

1. Fraternal twins are produced when **[CMC Vellore 1993]**
(a) A fertilized egg divided into two
(b) An egg is fertilized by two sperms
(c) A divided egg has two set of chromosomes
(d) Two eggs are fertilized simultaneously

2. Identical twins are **[Odisha JEE 2010]**
(a) Heterozygous (b) Homozygous
(c) Monozygotic (d) Dizygotic

3. An organism which receives identical alleles of a particular gene from both parents is **[CBSE PMT 1993]**
(a) Heterozygote (b) Holometabolous
(c) Homosapiens (d) Homozygote

4. Study of improvement of human race by providing ideal nature is **[CBSE PMT 1990; MP PMT 1998]**
Or
Improvement of genetic characters and present day generation on the basis of best nutrition and training is called **[MP PMT 1995]**
(a) Eugenics (b) Euphenics
(c) Euthenics (d) None of these

5. The best method to improve the genetic quality of mankind is
(a) Marriage restrictions
(b) Sterilizations
(c) Control of immigrations
(d) Sexual separation of defectives

6. Study of human race is called **[AFMC 1997; Haryana PMT 2005; MP PMT 2005]**
(a) Eugenics (b) Entomology
(c) Ecology (d) Pathology

7. 'Eugenics' pertains to **[CBSE PMT 1990]**
(a) Improvement of mankind by improving his heredity
(b) Preservating human sperms for artificial insemination
(c) Study of human genetics
(d) Controlling size of a human family

8. Sometimes the separation of twins is incomplete and these are born attached or remain so even after. Such twins are known as **[MH CET 2002]**
Or
Conjoint twins are also known as
(a) Fraternal (b) Dizygotic
(c) Identical (d) Siamese

9. Genetically identical progeny is produced when an individual **[AFMC 1994]**
(a) Practices self-fertilization
(b) Produces identical gametes
(c) Practices reproduction
(d) Practices in breeding without meiosis

10. Twin is **[Haryana PMT 2005]**
(a) Developed from same zygote
(b) Developed from different zygote
(c) Two different sperm
(d) Two different ovum

11. Two offspring developed in the same uterus but from fertilization of two different ova are **[AFMC 2002]**
(a) Dizygotic twins (b) Monozygotic twin
(c) Fraternal twins (d) Both (a) and (c)

NCERT Exemplar Questions

1. All genes located on the same chromosome **[NCERT]**
(a) Form different groups depending upon their relative distance
(b) Form one linkage group
(c) Will not form any linkage groups
(d) Form interactive groups that affect the phenotype

2. Conditions of a karyotype $2n + 1$, $2n - 1$ and $2n + 2$, $2n - 2$ are called **[NCERT]**
(a) Aneuploidy (b) Polyploidy
(c) Allopolyploidy (d) Monosomy

3. Distance between the genes and percentage of recombination shows **[NCERT]**
(a) A direct relationship (b) An inverse relationship
(c) A parallel relationship (d) No relationship

4. If a genetic disease is transferred from a phenotypically normal but carrier female to only some of the male progeny, the disease is **[NCERT]**
(a) Autosomal dominant (b) Autosomal recessive
(c) Sex-linked dominant (d) Sex-linked recessive

5. In sickle cell anaemia glutamic acid is replaced by valine. Which one of the following triplets codes for valine **[NCERT]**
(a) G G G (b) A A G
(c) G A A (d) G U G

6. Person having genotype $I^A I^B$ would show the blood group as AB. This is because of **[NCERT]**
(a) Pleiotropy (b) Co-dominance
(c) Segregation (d) Incomplete dominance

7. Z Z / ZW type of sex determination is seen in **[NCERT]**
(a) Platypus (b) Snails
(c) Cockroach (d) Peacock

8. A cross between two tall plants resulted in offspring having few dwarf plants. What would be the genotypes of both the parents **[NCERT]**
(a) TT and Tt (b) Tt and Tt
(c) TT and TT (d) Tt and tt

9. In a dihybrid cross, if you get 9:3:3:1 ratio it denotes that **[NCERT]**
(a) The alleles of two genes are interacting with each other
(b) It is a multigenic inheritance
(c) It is a case of multiple allelism
(d) The alleles of two genes are segregating independently

10. Which of the following will not result in variations among siblings **[NCERT]**
(a) Independent assortment of genes
(b) Crossing over
(c) Linkage
(d) Mutation

11. Mendel's Law of independent assortment holds good for genes situated on the **[NCERT]**
(a) Non-homologous chromosomes
(b) Homologous chromosomes
(c) Extra nuclear genetic element
(d) Same chromosome

12. Occasionally, a single gene may express more than one effect. The Phenomenon is called **[NCERT]**
(a) Multiple allelism (b) Mosaicism
(c) Pleiotropy (d) Polygeny

13. In a certain taxon of insects some have 17 chromosomes and the others have 18 chromosomes. The 17 and 18 chromosome-bearing organisms are **[NCERT]**
(a) Males and females, respectively
(b) Females and males, respectively
(c) All males
(d) All females

14. The inheritance pattern of a gene over generations among humans is studied by the pedigree analysis. Character studied in the pedigree analysis is equivalent to **[NCERT]**
(a) Quantitative trait (b) Mendelian trait
(c) Polygenic trait (d) Maternal trait

15. It is said that Mendel proposed that the factor controlling any character is discrete and independent. His proposition was based on the **[NCERT]**
(a) Results of F_3 generation of a cross
(b) Observations that the offspring of a cross made between the plants having two contrasting characters shows only one character without any blending
(c) Self pollination of F_1 offsprings
(d) Cross pollination of F_1 generation with recessive parent

16. Two genes 'A' and 'B' are linked. In a dihybrid cross involving these two genes, the F_1 heterozygote is crossed with homozygous recessive parental type (aa bb). What would be the ratio of offspring in the next generation **[NCERT]**
(a) 1 : 1 : 1 : 1 (b) 9 : 3 : 3 : 1
(c) 3 : 1 (d) 1 : 1

17. In the F_2 generation of a Mendelian dihybrid cross the number of phenotypes and genotypes are **[NCERT]**
(a) Phenotypes – 4; genotypes - 16
(b) Phenotypes – 9; genotypes - 4
(c) Phenotypes – 4; genotypes - 8
(d) Phenotypes – 4; genotypes – 9

18. Mother and father of a person with 'O' blood group have 'A' and 'B' blood group, respectively. What would be the genotype of both mother and father **[NCERT]**
(a) Mother is homozygous for 'A' blood group and father is heterozygous for 'B'
(b) Mother is heterozygous for 'A' blood group and father is homozygous for 'B'
(c) Both mother and father are heterozygous for 'A' and 'B' blood group, respectively
(d) Both mother and father are homozygous for 'A' and 'B' blood group, respectively

Critical Thinking

Objective Questions

1. Which is Gynandromorph type of animal **[GUJCET 2015]**
(a) Drosophila (b) Beetles
(c) Silk works (d) All of the above

2. The segregation of paired hereditary factors that Mendel postulated occurs during **[CBSE PMT 1993]**
(a) Anaphase of first meiotic division
(b) Metaphase of second meiotic division
(c) During interphase between two meiotic divisions
(d) Prophase of first meiotic division

3. A cell at telophase stage is observed by a student in a plant brought from the field. He tells his teacher that this cell is not like other cells at telophase stage. There is no formation of cell plate and thus the cell is containing more number of chromosomes as compared to other dividing cells. This would result in **[NEET (Phase-I) 2016]**
(a) Aneuploidy (b) Polyploidy
(c) Somaclonal variation (d) Polyteny

4. Match the terms in column-I with their description in column-II and choose the correct option **[NEET (Phase-I) 2016]**

	Column I		Column II
(a)	Dominance	(i)	Many genes govern a single character
(b)	Codominance	(ii)	In a heterozygous organism only one allele expresses itself
(c)	Pleiotropy	(iii)	In a heterozygous organism both alleles express themselves fully
(d)	Polygenic inheritance	(iv)	A single gene influences many characters

	(a)	(b)	(c)	(d)
(a)	(ii)	(i)	(iv)	(iii)
(b)	(ii)	(iii)	(iv)	(i)
(c)	(iv)	(i)	(ii)	(iii)
(d)	(iv)	(iii)	(i)	(ii)

1. A selection that acts to eliminate one extreme from an aray of phenotypes is **[EAMCET 2009]**
(a) Disruptive (b) Directional
(c) Stabilizing (d) Coevolution

2. A tobacco plant which is heterozygous for albinism (a recessive character) is self pollinated if 1200 seeds are subsequently germinated, how many of the seedlings would have the parental genotype **[Manipal 1995; BHU 2008]**
(a) 300 (b) 600
(c) 900 (d) 1200

3. Match the column I, II, and III

Column I		Column II		Column III	
(A)	Sickle Cell Anaemia	(i)	Due to recessive PP genes	(P)	Arrangement of valine in place of Glutamic acid
(B)	Phenyl Ketonuria	(ii)	Due to absence of homogentisic oxidase enzyme	(Q)	Inborn error of metabolism
(C)	Alkaptonuria	(iii)	Follows Mendelian Principles	(R)	Urine turns black when exposed to air
(D)	Thalassaemia	(iv)	Characters caused by homoszygous recessive genes	(S)	The required haemoglob in is not generated in the blood

[GUJCET 2015]
(a) (A - ii - S) (B - iii - R) (C - i - Q) (D - iv - P)
(b) (A - iv - P) (B - i - Q) (C - ii - R) (D - iii - S)
(c) (A - iv - P) (B - iii - R) (C - i - S) (D - ii - R)
(d) (A - iii - R) (B - i - Q) (C - iv - P) (D - ii - S)

4. Find the odd one out, with respect to X-linkage **[MHCET 2015]**
(a) Haemophilia (b) Myopia
(c) Nephritis (d) Night blindness

5. In case of incomplete dominance in F_2 generation **[BHU 1995, 2008]**
(a) Genotypic ratio is 3 : 1
(b) Phenotypic ratio is 3 : 1
(c) Genotypic ratio = phenotypic ratio
(d) Nothing can be concluded

6. One of the parents of a cross has a mutation in its mitochondria. In that cross, that parent is taken as a male. During segregation of F_2 progenies that mutation is found in **[CBSE PMT 2004]**
(a) All the progenies
(b) Fifty percent of the progenies
(c) One-third of the progenies
(d) None of the progenies

7. When a cell with 40 chromosomes undergoes meiosis, each of the four resulting cells has **[BHU 2001; CPMT 2003]**
(a) 20 chromosomes (b) 40 chromosomes
(c) 80 chromosomes (d) 10 chromosomes

8. Chromosomal number in a cell of a flowering plant is
(a) Only haploid (b) Only diploid
(c) Many types (d) None of these

9. How many genome types are present in a typical green plants cell **[CBSE PMT 1998]**
(a) Two (b) Three
(c) More than five (d) More than ten

10. Find out the correct statement **[Kerala PMT 2007]**
(a) Monosomy and nullisomy are the two types of euploidy
(b) Polyloidy is more common in animals than in plants
(c) Polyploids occur due to the failure in complete separation of sets of chromosomes
(d) $2n$-1 condition results in trisomy
(e) Non-homologous chromosomal duplication results in autopolyploidy

11. Match the items in Column – I with Column – II and choose the correct alternative

	Column – I		Column – II
A.	Sickle-cell anaemia	1.	7^{th} chromosome
B.	Phenylketonuria	2.	4^{th} chromosome
C.	Cystic fibrosis	3.	11^{th} chromosome
D.	Huntington's disease	4.	X-chromosome
E.	Colur blindness	5.	12^{th} chromosome

[NCERT; Kerala PMT 2006, 07, 08; VITEEE 2006; AMU (Med.) 2009]
(a) A – 1, B – 3, C – 4, D – 2, E – 5
(b) A – 2, B – 3, C – 4, D – 5, E – 1
(c) A – 2, B – 1, C – 3, D – 5, E – 4
(d) A – 4, B – 5, C – 3, D – 2, E – 1
(e) A – 3, B – 5, C – 1, D – 2, E – 4

12. Which of the following statement is correct **[GUJCET 2014]**
(a) In honey - bee, functional male does not undergo meiosis during gamatic formation
(b) In flagellaria, male is heterogametic
(c) In Bonellia, a hormone - like substance secreted by the proboscis is responsible for femaleness
(d) Due to the addition of one extra 'X' chromosome in Drosophila in uninucleated state gynandromorphy is observed

13. If an inheritable mutation is observed in a population at high frequency, it is referred to as **[KCET 2015]**
(a) Sequence annotation (b) DNA polymorphism
(c) Linkage (d) Expressed sequence Tag

14. The cause of Cat-cry syndrome is due to **[RPMT 2006]**
(a) Loss of a segment of X-chromosome
(b) Loss of a segment of 5^{th} chromosome
(c) Loss of segment of Y-chromosome
(d) None of the above

15. When two genes are situated very close to each other in a chromosome
(a) The percentage of crossing over between them is very high
(b) Hardly any cross over are detected
(c) No crossing over can take place between them
(d) Only double cross overs can take place between them

20. Who is known as father of physiological genetics or father of biochemical genetics **[Haryana PMT 2001; MHCET 2001; AIIMS 2009]**

(a) Slatyer (b) Charles Elton
(c) Taylors (d) Archibald Garrod

21. When a cluster of genes shows linkage behaviour they **[CBSE PMT 2003]**

(a) Induce cell division
(b) Do not show a chromosome map
(c) Show recombination during meiosis
(d) Do not show independent assortment

22. Which of the following best illustrates FEEDBACK in development **[NEET (Karnataka) 2013]**

(a) Tissue (X) secretes RNA which changes the development of tissue (Y)
(b) As tissue (X) develops, it secretes enzymes that inhibit the development of tissue (Y)
(c) As tissue (X) develops, it secretes something that induces tissue (Y) to develop
(d) As tissues (X) develops, it secretes something that shows down the growth of tissue (Y)

23. Match the column I with column II and choose the correct option

Column I		Column II
A. Incomplete dominance	i	Hershey and Chase
B. Linkage	ii.	*Antirrhinum sp*
C. Transforming principle	iii.	Griffith
D. Proved that DNA is the Genetic material	iv.	Morgan

[Kerala PMT 2012]

(a) A-i; B-iv; C-iii; D-ii (b) A-iv; B-ii; C-iii; D-i
(c) A-ii; B-iii; C-iv; D-i (d) A-ii; B-iv; C- i; D-iii
(e) A-ii; B-iv; C-iii; D-i

24. The fruit fly *Drosophila melanogaster* was found to be very suitable for experimental verification of chromosomal theory of inheritance by Morgan and his colleagues because **[CBSE PMT (Mains) 2010]**

(a) It reproduces parthenogenetically
(b) A single mating produces two young flies
(c) Smaller female is easily recognisable from larger male
(d) It completes life cycle in about two weeks

25. The exchange of one part of a chromosome to the other part of same or another chromosome is called **[AFMC 2002]**

Or

The movement of gene from one linkage group to another is called **[AIPMT 2015; AIPMT (Cancelled) 2015; NEET (Phase-II) 2016]**

(a) Inversion (b) Mutation
(c) Translocation (d) Linkage

26. If the number of chromosomes in most body cells of a mammal is 40, the cells in the seminiferous tubule will have

(a) 40 chromosomes
(b) 20 chromosomes
(c) 10 chromosomes
(d) While some other will have 20

27. How many nucleosomes are found in helical coil of 30 *nm* chromatin fibre **[RPMT 2000]**

(a) 10 (b) 12
(c) 06 (d) 09

28. Biological marriage of one of the following should be avoided **[AFMC 1995, 2001]**

Or

After examining the blood groups of a couple, the doctor advised them not to have more than one child. The blood group of the couple are likely to be **[CBSE PMT 1990, 2002; MP PMT 1995, 2000, 03, 06; AIEEE Pharmacy 2003; RPMT 2005; AFMC 2006; BHU 2008]**

Or

In which of the following situations, is there a risk factor for children of incurring erythroblastosis foetalis **[KCET 2010]**

(a) Rh^+ male and Rh^- female
(b) Rh^+ male and Rh^+ female
(c) Rh^- male and Rh^+ female
(d) Rh^- male and Rh^- female

29. Primary source of allelic variation is **[AIIMS 2005]**

(a) Independent assortment (b) Recombination
(c) Mutation (d) Polyploidy

30. Persons with the following syndrome have a tendency of tall structure, mental defects and a strong antisocial behaviour **[KCET 1994]**

(a) XYY syndrome
(b) Down's syndrome
(c) Klinefelter's syndrome
(d) Turner's syndrome

31. Recessive characters are expressed **[AFMC 1995]**

(a) Only when they are present on X chromosomes of male
(b) Only when they are present on X chromosomes of female
(c) On any autosome
(d) On both the chromosomes of female

32. Marriages between close relatives and cousins is not advisable because

(a) More mutations can occur
(b) More recessive defects are likely to appear
(c) More chances are there for *Rh* blood group anomalies
(d) More chances are there for multiple births

33. In a medico–legal case of accidental interchange between two babies in a hospital, the baby of blood group A could not be rightly given to a people

(a) With both husband and wife of group O
(b) Husband of group O and wife of group A
(c) Husband of group A and wife of group O
(d) Both husband and wife of group A

34. 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 **[CBSE PMT 2005]**

(a) aaBB (b) AaBb
(c) AABB (d) aabb

35. Each chromosome at the anaphase stage of a bone marrow cell in our body has **[CBSE PMT 1995]**
(a) Two chromatids (b) No chromatids
(c) Only one chromatid (d) Several chromatids

36. A child's blood group is 'O'. The parents blood groups cannot be **[CBSE PMT 1994; Kerala PMT 2005]**
(a) AB and O (b) B and O
(c) A and B (d) A and A

37. Identical twins are produced when **[MP PMT 2001]**
(a) One fertilized egg divided into 2 blastomeres and both separate
(b) One sperm fertilizes two eggs
(c) One egg fertilized with two sperms
(d) Two eggs are fertilized

38. The process of genetic mutation is **[MP PMT 2002]**
(a) Reversible (b) Irreversible
(c) Partially reversible (d) Continuous

39. Allelic sequence variations where more than one variant (allele) at a locus in a human population with a frequency greater than 0.01 is referred to as **[Kerala PMT 2011]**
(a) Incomplete dominance (b) Multiple allelism
(c) SNP (d) EST
(e) DNA polymorphism

40. A man with blood group 'AB' marries a woman with 'O' blood group. In this situation **[MP PMT 1994]**
(a) The blood groups of their children will be the same as that of the mother
(b) The blood group of the children differs from both the parents
(c) While 50% of children will have father's blood group, the remaining will have mother's blood group
(d) None of the above

41. Knowing that albinism is determined by a recessive gene in man; presence of albinism in children born to a couple proves that **[AIIMS 1992]**
(a) Both the father and the mother are heterozygous for albinism
(b) The father is homozygous normal but the mother is heterozygous or vice versa
(c) The father is homozygous for albinism but the mother is heterozygous or vice versa
(d) (a) and (c) are correct

42. A woman of blood group 'O' presented a baby of blood group 'O' which she claimed as her child. She brought a suit against a man of `AB' group as the father of the child. Which statement is correct as per your judgement
(a) The father and mother claimed are the true persons
(b) Father is true and mother is not the true person
(c) Both the parentage claims are false
(d) Mother is the true person and father claimed is not true

43. A normal woman whose father was albino marries a man who is albino. What proportion of normal and albino can be expected among their offsprings **[CBSE PMT 1994]**
(a) 1 normal : 1 albino (b) All albino
(c) 2 normal : 1 albino (d) All normal

44. As a result of marriage of curly hair mother and straight hair father, 8 children are born. The ratio of curly and straight haired will be **[MP PMT 2001]**
(a) 6 : 2 (b) 2 : 6
(c) 4 : 4 (d) 3 : 5

45. Transition type of gene mutation is caused when **[MP PMT 1997]**
(a) GC is replaced by TA (b) CG is replaced by GC
(c) AT is replaced by CG (d) AT is replaced by GC

46. Euploidy is best explained by **[Pb. PMT 1999]**
(a) Exact multiples of a haploid set of chromosomes
(b) One chromosome less than the haploid set of chromosomes
(c) One chromosome more than the haploid set of chromosomes
(d) One chromosome more than the diploid set of chromosomes

47. Match list I with List II and select the correct answer using code given below
List I (syndrome)
(1) Patau's syndrome (2) Kline-Felter's syndrome
(3) Down's syndrome (4) Turner's syndrome
List II (Chromosomal abnormality)
(A) 44 + XXY = 47
(B) 44 + X = 45
(C) 46 + 1 = 47, Chromosome 13th
(D) 46 + 1 = 47, Chromosome 21st
Code **[MP PMT 2001]**

(a)	1	2	3	4	(b)	1	2	3	4
	A	B	C	D		D	C	B	A
(c)	1	2	3	4	(d)	1	2	3	4
	C	B	D	A		C	A	D	B

AR Assertion & Reason

Read the assertion and reason carefully to mark the correct option out of the options given below :
(a) If both the assertion and the reason are true and the reason is a correct explanation of the assertion
(b) If both the assertion and reason are true but the reason is not a correct explanation of the assertion
(c) If the assertion is true but the reason is false
(d) If both the assertion and reason are false
(e) If the assertion is false but reason is true

1. Assertion : Somaclonal variations may be present in plants produced from callus.
Reason : Somaclonal variations are caused due to recombination during meiosis. **[EAMCET 2009]**

2. Assertion : In humans, the gamete contributed by the male determines whether the child produced will be male or female.
Reason : Sex in humans is a polygenic trait depending upon a cumulative effect of some genes on X-chromosome and some on Y-chromosome. **[AIIMS 2005, 08]**

3. Assertion : Persons suffering from haemophilia fail to produce blood clotting factor VIII.
Reason : Prothrombin producing platelets in such persons are found in very low concentration. **[AIIMS 2005]**

4. Assertion : Mustard gas acts as a mutagen.
Reason : It transfers alkyl groups to the bases in DNA.

5. Assertion : The DNA fingerprint is the same for every cell, tissue and organ of a person.
Reason : DNA fingerprint is used for treatment of inherited disorders like Huntigton's disease, Alzheimer's and Sickle cell anaemia. **[GUJCET 2015]**

6. Assertion : Among the primates, chimpanzee is the closest relative of the present day humans.
Reason : The banding pattern in the autosome numbers 3 and 6 of man and chimpanzee is remarkably similar. **[AIIMS 2004]**

7. Assertion : If pollen mother cells has 42 chromosomes. The pollen has only 21 chromosomes.
Reason : Pollens are formed after meiosis in pollen mother cell. **[AIIMS 1997]**

8. Assertion : Clones are produced by sexual reproduction and same sexual process.
Reason : These are prepared by group of cells descended from many cells or by inbreeding of a heterozygous line. **[AIIMS 2002]**

9. Assertion : Hybrids are generally back crossed.
Reason : Back cross is done to increase the traits of the parent.

10. Assertion : A gene may have several allelomorphs.
Reason : Wild form can mutate in more than one ways.

11. Assertion : Phenylketonuria is a recessive hereditary disease caused by body's failure to oxidise an amino acid phendylanine to tryrosine, because of a defective enzyme.
Reason : It results the presence of phenylalanine acid in urine. **[AIIMS 2000]**

12. Assertion : The genetic complement of an organism is called genotype.
Reason : Genotype is the type of hereditary properties of an organism. **[AIIMS 1999, 2007]**

13. Assertion : Holandric genes are found on Y chromosome.
Reason : Inheritance of Holandric genes are always from father to son. **[AIIMS 1996]**

14. Assertion : Haemophilia never occurs in women.
Reason : Gene for haemophilia is located on X chromosome. **[AIIMS 1994, 96]**

15. Assertion : Haploids are used to study mutation.
Reason : Most of the mutations are recessive.

16. Assertion : The shape of chromosomes is based on the position of centromere.
Reason : During anaphase, the chromosome bends in the region of centromere.

17. Assertion : Heterochromatin is genetically inactive.
Reason : It lacks genes.

18. Assertion : Kinetochore helps in the movement of chromosomes.
Reason : It has points for attachment of microtubules.

19. Assertion : Restriction endonuclease recognize short palindromic sequence and cut at specific sites.
Reason : When a restriction endonuclease acts on Palindrome, it cleaves both the strands of DNA molecules. **[GUJCET 2015]**

20. Assertion : The lampbrush chromosomes are called diplotene chromosomes bivalents.
Reason : The number of loops is maximum during diplotene.

21. Assertion : In humans, most sex-linked genes are present on the X chromosome.
Reason : X-chromosome contains a large number of genes with major effects on phenotype.

22. Assertion : Human chromosomes have been studied through banding technique.
Reason : Banding technique is useful in studying chromosomal aberrations.

Answers

Mendelism

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

53. A woman is married for the second time. Her first husband was *ABO* blood type *A*, and her child by that marriage was type *O*. Her new husband is type *B* and their child is type *AB*. What is the woman's *ABO* genotype and blood type **[AIIMS 2009]**

(a) I^AI^O; Blood type *A* (b) I^AI^B; Blood type *AB*
(c) I^BI^O; Blood type *B* (d) I^OI^O; Blood type *O*

54. Who discovered Rh factor **[MP PMT 1998]**

(a) Huxley (b) Landsteiner
(c) Landsteiner and Weiner (d) Weiner

55. If one parent has blood group *A* and the other parent has blood group B, the offsprings have which blood group **[MP PMT 1998; AIPMT (Cancelled) 2015]**

(a) *AB* (b) *O*
(c) *BO* (d) *A, B, AB, O*

56. The problem due to Rh^- factor arises when the blood two (Rh^+ and Rh^-) mix up **[CBSE PMT 1999]**

(a) In a test tube (b) Through transfusion
(c) During pregnancy (d) Both (a) and (c)

57. Which of the following are most abundant types of antibodies **[CBSE PMT 1999; VITEEE 2008; Odisha JEE 2011; BHU 2012]**

(a) *IgA* (b) *IgE*
(c) *IgG* (d) *IgM*

58. When dominant and recessive alleles express themselves together, it is called **[CBSE PMT 2001]**

(a) Dominance (b) Co-dominance
(c) Amphidominance (d) Pseudodominance

59. In erythroblastosis foetalis, which factors of the mother pass through placenta into the foetus **[JIPMER 2002]**

(a) *Rh* antigens (b) *Rh* antibodies
(c) ABO antibodies (d) Agglutinins

60. Which one of the following is hereditary character of blood **[AFMC 2003]**

(a) Blood group (b) Haem
(c) Nucleus (d) None of the above

61. You are required to draw blood from a patient and to keep it in a test tube for analysis of blood corpuscles and plasma. You are also provided with the following four types of test tubes. Which of them will you ***not*** use for the purpose. **[CBSE PMT 2004]**

(a) Test tube containing heparin
(b) Test tube containing sodium oxalate
(c) Test tube containing calcium bicarbonate
(d) Chilled test tube

62. A man with blood group *B* marries a women with blood group *A* and their first child is having blood group *B*. What is the genotype of child **[CPMT 2004]**

(a) I^aI^b (b) I^aI^o
(c) I^bI^o (d) I^bI^b

63. Marriage between persons having AB blood groups would produce **[WB-JEE 2016]**

(a) Offsprings with AB blood group only
(b) Offsprings with A, B and AB blood groups
(c) Offsprings with A and B blood groups only
(d) Offsprings with A, B, AB and O blood groups

64. Among the following characters, which one was not considered by Mendel in his experiments on pea **[NEET 2017]**

(a) Stem – Tall of Dwarf
(b) Trichomes – Glandular or non-glandular
(c) Seed – Green or Yellow
(d) Pod – Inflated or Constricted

Genetic variation

1. A person affected by disease having chromosome complement XXX is called/having **[Odisha JEE 2008]**

(a) Klinefillter's syndrome
(b) Down's syndrome
(c) Super female
(d) Turner's syndrome

2. With respect to phenylketonuria identify which statement is not correct **[KCET 2015]**

(a) It is a case of aneuploidy
(b) It is an example of pleiotropy
(c) Caused due to autosomal recessive trait
(d) It is an error in metabolism

3. Mating between two individuals differing in genotype to produce genetic variation is called **[J & K CET 2005]**

(a) Domestication (b) Introduction
(c) Hybridisation (d) Mutation

4. Sickle cell anaemia is most resistant to which disease **[Odisha JEE 2008]**

(a) Malaria (b) Filaria
(c) Dengue (d) Chicken pox

5. If an albino man marries with a normal woman and 50 offsprings are albino and 50 are normal, the woman is **[MP PMT 1998]**

(a) Heterozygous normal (b) Homozygous normal
(c) Heterozygous carrier (d) None of these

6. Occurrence of cell containing multiples of 2n genomes in diploid organisms is known as **[VITEEE 2008]**

(a) Aneuploidy (b) Alloploidy
(c) Amphiploidy (d) Endopolyploidy

7. The genetic defect-adenosine deaminase (ADA) deficiency may be cured permanently by **[CBSE PMT 2009; Kerala PMT 2012]**

(a) Periodic infusion of genetically engineered lymphocytes having functional ADA cDNA
(b) Administering adenosine deaminase activators
(c) Introducing bone marrow cells producing ADA into cells at early embryonic stages
(d) Enzyme replacement therapy

8. The hereditary disease in which the urine of a person turns black on exposure to air due to the presence of homogentisic acid is known as **[BPV 2001; BHU 2012]**
(a) Ketonuria (b) Phenylketonuria
(c) Haematuria (d) Alkaptonuria

9. Which is the most common mechanism of genetic variation in the population of a sexually-reproducing organism **[AIPMT (Cancelled) 2015]**
(a) Chromosomal aberrations
(b) Genetic drift
(c) Recombination
(d) Transduction

10. To be evolutionary successful, a mutation must be **[MP PMT 1996]**
(a) Germplasm DNA (b) Somatoplasm DNA
(c) Cytoplasm (d) RNA

11. Which of the chromosomal formulation is responsible for the expression of meta-male character in *Drosophila* **[Kerala PMT 2007; WB-JEE 2016]**
(a) $2A+3X$ (b) $3A+3X$
(c) $4A+3X$ (d) $3A+XY$
(e) $2A+XY$

12. Sickle cell anaemia is **[CBSE PMT 2009]**
(a) An autosomal linked dominant trait
(b) Caused by substitution of valine by glutamic acid in the beta globin chain of haemoglobin
(c) Caused by a change in a single base pair of DNA
(d) Characterized by elongated sickle like RBCs with a nucleus

13. Alzhimer disease in humans is associated with the deficiency of **[CBSE PMT 2009]**
(a) Dopamine
(b) Glutamic acid
(c) Acetylcholine
(d) Gamma aminobutyric acid (GABA)

14. Industrial melanism as observed in peppered moth proves that **[CBSE PMT 2007]**
(a) The true black melanic forms arise by a recurring random mutation
(b) The melanic form of the moth has no selective advantage over lighter form in industrial area
(c) The lighter-form moth has no selective advantage either in polluted industrial area or non-polluted area
(d) Melanism is a pollution-generated feature

15. Mongoloid condition is related to **or** In mongolism a patient shows **[MP PMT 1995; CBSE PMT 2001]**
(a) Monosomy (b) Trisomy
(c) Nullisomy (d) None of the above

16. Which of the following is a genetic disease **[CBSE PMT 1990; JIPMER 1993]**
(a) Phenylketonuria (b) Blindness
(c) Cataract (d) Leprosy

17. Which one of the following conditions in humans is correctly matched with its chromosomal abnormality/linkage **[CPMT 1994; MP PMT 1994, 98, 2000, 02; Kerala CET 2003; BVP 2003; CBSE PMT 2008; J & K CET 2012]**
Or
An abnormal human male phenotype involving an extra X-chromosome is a case of **[CBSE PMT 1995, 96; CPMT 1996; MP PMT 1997, 2003, 04]**
(a) Erythroblastosis foetalis - X-linked
(b) Down syndrome – 44 autosomes + XO
(c) Klinefelter's syndrome – 44 autosomes +XXY
(d) Colouor blindness – Y-linked

18. Mutation is **[NCERT; MP PMT 1993]**
(a) Sudden change in morphology
(b) Change in characters
(c) Change in heritable characters
(d) None of these

19. A person who is trisomic for twenty first pair of chromosomes is **[CPMT 1993, 2000; DPMT 1993; MP PMT 1993; WB JEE 2008; J & K CET 2012; NEET (Karnataka) 2013]**
Or
Number of sex chromosomes is normal in **[MP PMT 1992]**
(a) Klinefelter's syndrome (b) Down's syndrome
(c) Turner's syndrome (d) None of these

20. The monosomic condition in human beings depicted as XO is referred to as **[CPMT 1994; MP PMT 1994, 98, 2002, 03; AIIMS 1999; Pb. PMT 2000; JIPMER 2002; DPMT 2007; BHU 2008]**
(a) Criminal syndrome (b) Down's syndrome
(c) Klinefelter's syndrome (d) Turner's syndrome

21. Point (Gene mutation) mutation involves **[MP PMT 1995; JIPMER 2001; AMU (Med.) 2009; CBSE PMT 2009]**
(a) Insertion (b) Change in single base pair
(c) Duplication (d) Deletion

22. The number of chromosomes in Turner's syndrome is **[CBSE PMT 1993]**
(a) 45 (b) 43
(c) 44 (d) 42

23. Which of the following disorders is not hereditary **[J & K CET 2005]**
(a) Haemophilia (b) Cataract
(c) Sickle-cell anaemia (d) Colour blindness

24. Disorders of amino acid metabolism results in **[CBSE PMT 1993; Kerala PMT 2004]**
(a) Alkaptonuria (b) Phenylketonuria
(c) Albinism (d) All the above

25. The **incorrect** statement with regard to haemophilia is **[NEET 2013]**
(a) A single protein involved in the clotting of blood is affected
(b) It is a sex-linked disease
(c) It is a recessive disease
(d) It is a dominant disease

26. The point mutations A to G, C to T, C to G and T to A in DNA are **[JIPMER 1993]**
(a) Transition, transition, transversion and transversion respectively
(b) Transition, transversion, transition and transversion respectively
(c) Transversion, transversion, transition and transition respectively
(d) All four are transition

27. Genomic mutation is **[AFMC 2008]**
(a) Change in number genes
(b) Change in number of chromosomes
(c) Change in shape of chromosomes
(d) All of these

28. Haploids are more suitable for mutation studies than the diploids. This is because **[CBSE PMT 2008]**
(a) Haploids are more abundant in nature than diploids
(b) All mutations, whether dominant or recessive are expressed in haploids
(c) Haploids are reproductively more stable than diploids
(d) Mutagens penetrate in haploids more effectively than is diploids

29. The number of chromosomes in Down's syndrome is **[MP PMT 1992, 98, 2005; CPMT 2002; BVP 2002; MHCET 2002; CBSE PMT 2002, 05; DPMT 2003, 06; AFMC 2005; RPMT 2006; BHU 2006; WB JEE 2009]**
(a) 23rd pair with one less = 45
(b) 21st pair with one more = 47
(c) 17th pair with one more = 47
(d) One extra sex chromosome = 47

30. When a mutation is limited to the substitution of one nucleotide for another, it is called **[Kerala PMT 2008; MP PMT 2010]**
(a) Translocation
(b) Point mutation
(c) Base inversion
(d) Sugar phosphate deletion
(e) Frame shift

31. A man having Klinefelter's syndrome is **[J & K CET 2005; MP PMT 2005]**
(a) Intersex with secondary sexual characters on the side of female
(b) Male with secondary sexual characters of female
(c) Female with secondary sexual characters of male
(d) Normal fertile male

32. An abnormal human baby with 'XXX' sex chromosomes was born due to **[AIPMT (Cancelled) 2015]**
(a) Formation of abnormal ova in the mother
(b) Fusion of two ova and one sperm
(c) Fusion of two sperms and one ovum
(d) Formation of abnormal sperms in the father

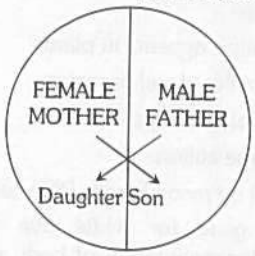
33. Edward's syndrome, Patau's syndrome and Down's syndrome are due to **[MP PMT 1997, 2003; CPMT 1999; Odisha JEE 2005]**
(a) Mutation due to malnutrition
(b) Change in sex chromosomes
(c) Change in autosomes
(d) Change in both sex chromosomes and autosomes

34. Which of these is not a Mendelian disorder **[Kerala PMT 2008, 10]**
(a) Cystic fibrosis (b) Sickle cell anaemia
(c) Colour blindness (d) Haemophilia
(e) Turner's syndrome

35. Moody describes the mutation as **[MP PMT 2010]**
(a) Sports (b) Saltation
(c) Factors (d) Shotgun

36. Which of the following mutations is not hereditary **[MP PMT 2012]**
(a) Genetic (b) Gametic
(c) Somatic (d) Germinal

37. Represented below is the inheritance pattern of a certain type of traits in humans. Which one of the following conditions could be an example of this pattern **[NCERT; CBSE PMT (Mains) 2012]**



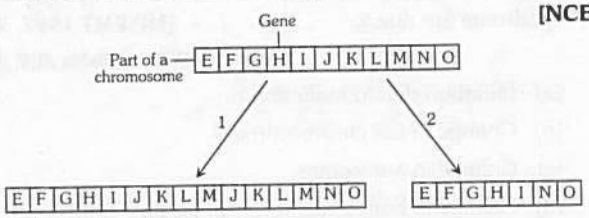
(a) Phenylketonuria (b) Sickle cell anaemia
(c) Haemophilia (d) Thalassemia

38. What would be the number of chromosomes in the ovum (fertilized by a normal sperm) that resulted in the appearance of Klinefelter's syndrome in the offspring
(a) 23 (b) 22
(c) 21 (d) 24

39. A man whose father was colour blind marries a woman who had a colour blind mother and normal father. What percentage of male children of this couple will be colour blind **[CBSE PMT 2014]**
(a) 50% (b) 75%
(c) 25% (d) 0%

40. Trisomic condition of Down's syndrome arises due to **[CBSE PMT 1991; MP PMT 2003; DUMET 2009]**
(a) Triploidy
(b) Translocation
(c) Non-disjunction
(d) Dicentric bridge formation

41. The given figure shows two types of chromosome mutation **[NCERT]**



These are called

(a) 1 - Inversion, 2 - Substitution
(b) 1 - Inversion, 2 - Deletion
(c) 1 - Duplication, 2 - Substitution
(d) 1 - Duplication, 2 - Deletion

42. Hugo de Vries formulated the "Mutation Theory" based on the experiments he conducted on **[NCERT; CPMT 1993; MP PMT 1994; CBSE PMT 2005; Odisha JEE 2005, 08; RPMT 2006; VITEEE 2006]**

(a) *Althea rosea*
(b) *Pisum sativum*
(c) *Drosophila melanogaster*
(d) *Oenothera lamarckiana*

43. A hereditary disease which is never passed on from father to son is **[J & K CET 2005]**

(a) Autosomal linked disease
(b) X-chromosomal linked disease
(c) Y-chromosomal linked disease
(d) None of these

44. Somaclonal variation appears in plants **[DUMET 2009]**

(a) Growing in polluted soil or water
(b) Exposed to gamma rays
(c) Raised in tissue culture
(d) Transformed by recombinant DNA technology

45. In *Drosophila*, gene for white eye mutation is also responsible for depigmentation of body parts. Thus a gene that controls several phenotypes is called **[Kerala CET 2005]**

(a) Oncogene (b) Epistatic gene
(c) Hypostatic gene (d) Pleiotropic gene
(e) Sex-linked gene

46. The functional unit of mutation is **[JIPMER 1994; MP PMT 1994; AFMC 1995]**

(a) Gene (b) Muton
(c) Recon (d) Cistron

47. The most striking example of point mutation is found in a disease called **[CBSE PMT 1995]**

Or

In which of the following disorders, blood has a defective haemoglobin **[KCET 2006]**

(a) Night blindness (b) Thalassemia
(c) Down's syndrome (d) Sickle-cell anaemia

48. Which following pair of diseases is caused by two genes located on human X-Chromosome **[WB JEE 2012]**

(a) Colour blindness and phenylketonuria
(b) Colour blindness and haemophilia
(c) Colour blindness and albinism
(d) Colour blindness and hypertrichosis

49. Which of the following is not related to chromosomal aberration **[MP PMT 1995]**

(a) Euploidy (b) AIDS
(c) Aneuploidy (d) Klinefelter's syndrome

50. Sickle cell anaemia is **[DUMET 2009; WB JEE 2011]**

(a) Autosomal dominant inheritance
(b) X-linked recessive inheritance
(c) Autosomal recessive inheritance
(d) X-linked dominant inheritance

51. The frequency of a mutant gene in a population is expected to increase, if the gene is **[CBSE PMT 1994]**

(a) Recessive (b) Dominant
(c) Sex linked (d) Favourably selected

52. Albinism is a congenital disorder (non synthesis of melanin) resulting from the lack of the enzyme **[CBSE PMT 1994; BHU 2003, 12]**

(a) Catalase (b) Fructokinase
(c) Tyrosinase (d) Xenthine oxidase

53. Sometimes chromosome number increase or decrease due to **[AFMC 1996]**

(a) Non-disjunction of chromosome
(b) Genetic repete
(c) Mutation
(d) All of these

54. Match the following

List-I		List-II	
(A)	XX-XO, method of sex determination	(I)	♀ Heterogametic
(B)	1.5 X/A ratio	(II)	Turner's syndrome
(C)	Karyotype 45	(III)	Hemiptera
(D)	ZW-ZZ method of sex determination	(IV)	Metafemale

The correct match is **[EAMCET 2009]**

	A	B	C	D
(a)	I	IV	III	II
(b)	III	IV	II	I
(c)	IV	I	II	III
(d)	I	IV	II	III

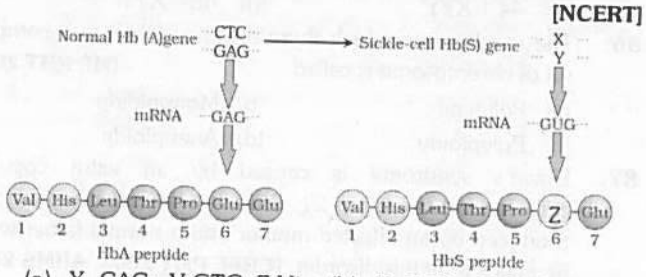
55. The idea of mutations was brought forth by **[NCERT; DPMT 2006; Kerala PMT 2009; CBSE PMT (Mains) 2012]**

(a) **Hugo do Vries**, who worked on evening primrose
(b) **Gregor Mendel**, who worked on *Pisum sativum*
(c) **Hardy Weinberg**, who worked on allele frequencies in a population
(d) **Charles Darwin**, who observed a wide variety of organisms during sea voyage

56. Edward syndrome is on account of ..... **[MP PMT 1994, 99, 2000, 04]**

(a) 45 chromosomes instead of 46
(b) Presence of three chromosomes on 18th pair of autosome
(c) Presence of three chromosomes on 21st pair of autosome
(d) Presence of three pair of sex chromosomes

57. Sickle- cell anaemia is an autosome linked recessive trait that can be transmitted from parents to the offspring when both the partners are carrier for all the gene (or heterozygous). The disease is controlled by a single pair of allele, Hb^A & Hb^S. Out of the three possible genotypes only homozygous individuals for HbS (Hb^S Hb^S) are lethal. Select the right option in which X, Y and Z are correctly identified **[NCERT]**



(a) X- CAC; -Y GTG; Z His (b) X- GTG; -Y CAC; Z Val
(c) X- CAC; -Y GTG; Z Phe (d) X- CAC; -Y GTG; Z Val

58. Pick out the correct statements
(i) Haemophilia is a sex-linked recessive disease
(ii) Down's syndrome is due to aneuploidy
(iii) Phenylketonuria is an autosomal dominant gene disorder
(iv) Phenylketonuria is an autosomal recessive gene disorder
(v) Sickle-cell anaemia is an X-linked recessive gene disorder **[Kerala CET 2005; Kerala PMT 2008, 09]**
(a) (i), (iii) and (v) are correct
(b) (i) and (iii) are correct
(c) (ii) and (v) are correct
(d) (i), (iv) and (v) are correct
(e) (i), (ii) ad (iv) are correct

59. Match column I with column II and find the correct answer

Column I		Column II	
(A)	Monoploidy	(1)	$2n-1$
(B)	Monosomy	(2)	$2n+1$
(C)	Nullisomy	(3)	$2n+2$
(D)	Trisomy	(4)	$2n-2$
(E)	Tetrasomy	(5)	n
		(6)	$3n$

[DPMT 2003, 06; Kerala PMT 2009; WB JEE 2010]
(a) (A) — (5), (B) — (1), (C) — (4), (D) — (2), (E) — (3)
(b) (A) — (5), (B) — (2), (C) — (4), (D) — (1), (E) — (3)
(c) (A) — (6), (B) — (5), (C) — (3), (D) — (4), (E) — (2)
(d) (A) — (2), (B) — (1), (C) — (3), (D) — (6), (E) — (5)
(e) (A) — (1), (B) — (5), (C) — (3), (D) — (2), (E) — (4)

60. Height is **[CPMT 2005]**
(a) Somatogenic variation (b) Discontinuous variation
(c) Continuous variation (d) Blastogenic variation

61. Which one of the following is not a mutagen **[MP PMT 1995, 97; 2000]**
(a) Ethyl methane sulphonate
(b) Acetic acid
(c) Nitrous acid
(d) Ethylene oxide

62. Mutation rates are affected by **[MP PMT 1997; Bihar CECE 2006; CBSE PMT (Pre.) 2011]**
(a) Temperature
(b) *X*–rays
(c) Gamma and beta radiation
(d) All of the above

63. A mutation is most likely to have a selective advantage in evolution if **[CPMT 2005]**
(a) It affects dominant genes
(b) It affects recessive genes
(c) It affects whole chromosomes
(d) The environment remains stable

64. Which one of the following is a wrong statement regarding mutations **[CBSE PMT (Mains) 2012]**
(a) Deletion and insertion of base pairs cause frame-shift mutations
(b) Cancer cells commonly show chromosomal aberrations
(c) UV and Gamma rays are mutagens
(d) Change in a single base pair of DNA does not cause mutation

65. The gene for diabetes mellitus is **[BHU 2012]**
(a) Autosomal dominant (b) Autosomal recessive
(c) Sex-linked dominant (d) Sex linked recessive

66. Gynaecomastia is the symptom of **[DPMT 2004; Kerala PMT 2007, 08, 10]**
(a) Down syndrome (b) SARS
(c) Turner's syndrome (d) Klinefelter's syndrome

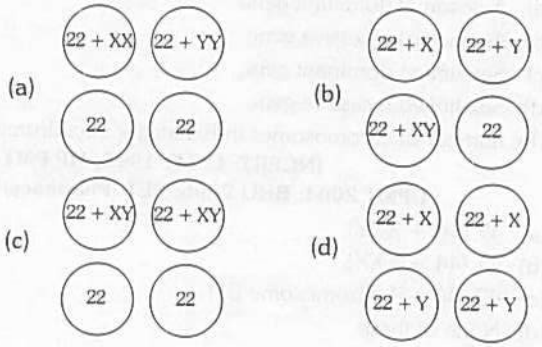
67. Which of the following is the main category of mutation **[CBSE PMT 1999]**
(a) Genetic mutation (b) Zygotic mutaion
(c) Somatic mutaion (d) All of these

68. In human beings, multiple genes are involved in the inheritance of **[CBSE PMT 1999]**
(a) Colourblindness (b) Phenylketonuria
(c) Sickle-cell anaemia (d) Skin colour

69. The formation of multivalents at meiosis in diploid organism is due to **[CBSE PMT 1998]**
(a) Monosomy (b) Inversion
(c) Deletion (d) Reciprocal translocation

70. Mental retardation in man, associated with sex chromosomal abnormality is usually due to **[CBSE PMT 1998]**
(a) Reduction in *X* complement
(b) Increase in *X* complement
(c) Moderate increase in *Y* complement
(d) Large increase in *Y* complement

71. If chromosome complement 44+XY of a gamete mother cell suffers a non-disjunction at the time of first meiotic division. Which sets of gametes will be correct **[NCERT]**



72. If haploid chromosome number in a cell is 12. The monosomic number will be **[MP PMT 1997, 2000]**
(a) 24 (b) 21
(c) 25 (d) 23

73. Normally DNA molecule has A-T, G-C pairing. However, these bases can exist in alternative valency status, owing to rearrangements called **[BHU 2000; WB JEE 2009]**
(a) Point mutation (b) Analogue substitution
(c) Frame-shift mutation (d) Tautomerisational mutation

74. Who reported that Down's syndrome is due to extra 21st chromosome **[BVP 2000]**
(a) J.L. Down (1866) (b) Lejeune (1959)
(c) Klinefelter (1942) (d) Huntington (1872)

75. In agriculture mutation caused by a mutagen is **[NCERT; BVP 2001]**
(a) Natural (b) Chemical
(c) Spontaneous (d) Induced

76. Discontinuous variations are **[AIIMS 2001]**

Or

The reason of fault in gene duplication is **[RPMT 1999]**
(a) Mutations (b) Acquired characters
(c) Essential features (d) Nonessential features

77. Epicanthal skin fold and simian crease are characteristics of **[KCET 2001; MH CET 2015]**
(a) Haploidy (b) Heteroploidy
(c) Turner's syndrome (d) Down's syndrome

78. UV radiations cause **[BHU 2012]**
(a) Formation of thymine dimers
(b) Deletion of base pairs
(c) Methylation of bases
(d) Addition of base pairs

79. A person may have one gene for normal haemoglobin and one gene for sickle cell haemoglobin. This heterozygous condition is called **[BHU 2002]**
(a) Genome (b) Anaemia
(c) Gene trait (d) Sickle cell trait

80. If a diploid cell is treated with colchicine, then it becomes **[CBSE PMT 2002]**
(a) Tetraploid (b) Diploid
(c) Triploid (d) Monoploid

81. Which one of the following mutation partially or fully reverses the harmful effects of previous mutation **[MP PMT 2002]**
(a) Indirect suppression (b) Intergenic mutation
(c) Intragenic mutation (d) Suppressor mutation

82. Polydactyly in man is due to **[J & K CET 2002]**
(a) Autosomal dominant gene
(b) Autosomal recessive gene
(c) Sex-linked dominant gene
(d) Sex-linked recessive gene

83. The number of chromosomes in Klinefelter's syndrome is **[NCERT; CPMT 1995; MP PMT 2003; DPMT 2004; BHU 2006; PET (Pharmacy) 2013]**
(a) 47 (44 + XXY)
(b) 47 (44 + XXX)
(c) 47 (46 + 1 chromosome 21)
(d) None of these

84. Philadelphia chromosome is **[MH CET 2002]**
(a) 13th chromosome (b) 22nd chromosome
(c) 17th chromosome (d) 21st chromosome

85. Which of the following chromosomal constitution refers to Jacob's syndrome in human **[BHU 2012]**
(a) $44+XO$ (b) $44+XXY$
(c) $44+XYY$ (d) $45+XYY$

86. The condition in which there are more than two complete set of chromosome is called **[MP PMT 2003]**
(a) Polytene (b) Monoploidy
(c) Polyploidy (d) Aneuploidy

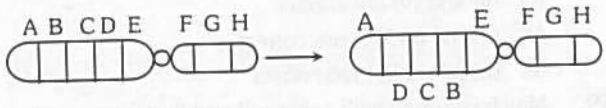
87. Down's syndrome is caused by an extra copy of chromosome number 21. What percentage of offspring produced by an affected mother and a normal father would be affected by this disorder **[CBSE PMT 2003; AIIMS 2007]**
(a) 25% (b) 100%
(c) 75% (d) 50%

88. Polyploidy can be induced by the application of **[MP PMT 2009]**
(a) Auxin (b) Kinetin
(c) Colchicine (d) Ethylene

89. Given below is the representation of a kind of chromosomal mutation
What is the kind of mutation represented **[AFMC 1997; AIIMS 2004]**

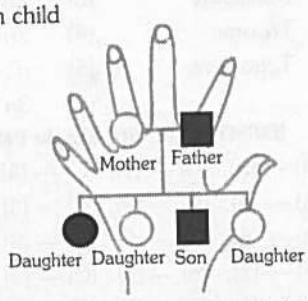
Or

When a segment of a chromosome breaks and later rejoins after 180^0 rotation, it is known as **[Keral PMT 2009]**



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

90. In the given human hand pedigree which character is represented and what is the probability of disease occurrence in fifth child **[NCERT]**



(a) Polydactyly (X- linked recessive disorder), 50%
(b) Polydactyly (X- linked dominant disorder), 50%
(c) Polydactyly(autosomal recessive disorder),50%
(d) Polydactyly (autosomal dominant disorder),50%

91. A recessive mutant is one which **[Odisha JEE 2004]**
(a) Is not expressed
(b) Is rarely expressed
(c) Is expressed only in homozygous and hemixygous state
(d) Is expresesed only in heterozygous state.

92. Frequency of Down's syndrome increases when the maternal age is **[Odisha JEE 2004]**
(a) Above 35 years
(b) Below 35 years
(c) During 1st pregnancy
(d) In mothers of at least 3 children

93. Addition or deletion of a single nucleotide results in which type of mutation **[BHU 2012; Odisha JEE 2012]**
(a) Deficiency (b) Duplication
(c) Frameshift mutation (d) None of these

94. Change in the number of body parts is called **[MP PMT 2009]**
(a) Continuous variation (b) Discontinuous variation
(c) Meristic variation (d) Substantive variation

95. Turner's syndrome is an example of **[Kerala PMT 2004]**
(a) Monosomy (b) Bisomy
(c) Trisomy (d) Polyploidy
(e) Translocation

96. In man, which of the following genotypes and phenotypes may be the correct result of aneuploidy in sex chromosomes **[CPMT 2004]**
(a) 22 pairs + XXY males
(b) 22 pairs + XX females
(c) 22 pairs + XXXY females
(d) 22 pairs + Y females

97. The "cri-du-chat" syndrome is caused by change in chromosome structure involving **[AIIMS 2005; Kerala PMT 2007, 08]**

Or

The loss of a chromosomal segment is due to **[Kerala PMT 2011]**
(a) Deletion (b) Duplication
(c) Inversion (d) Translocation

98. Somaclonal variation appears in **[AIIMS 2005]**
(a) Organism produced through somatic hybridization
(b) Plants growing in highly polluted conditions
(c) Apomictic plants
(d) Tissue culture raised plants

99. Mutation cannot change **[KCET 2007]**
(a) *RNA* (b) Environment
(c) Enzyme (d) *DNA*

100. Turner's syndrome in human is caused by
(a) Autosomal aneuploidy
(b) Sex chromosome aneuploidy
(c) Polyploidy
(d) Point mutation

101. Which of the following corresponds to mutagens **[Odisha JEE 2012]**
(a) Chemicals and radiations which cause changes in the genetic material of a cell
(b) Various archaebacteria that produce methane
(c) Chemicals which react with ozone molecules and destroy them
(d) RNA molecules that infect plant cells and cause diseases

102. Both sickle cell anaemia and Huntington's chorea are **[CBSE PMT 2006]**
(a) Pollutant-induced disorders
(b) Virus-related diseases
(c) Bacteria-related diseases
(d) Congenital disorders

103. Albinism is known to be due to an autosomal recessive mutation. The first child of a couple with normal skin pigmentation was an albino. What is the probability that their second child will also be an albino **[CBSE PMT 1998]**

Or

If both parents are carriers for thalessemia, which is an autosomal recessive disorder, what are the chances of pregnancy resulting in an affected child **[NEET 2013]**
(a) 100% (b) 25%
(c) 50% (d) 75%

104. Loss or gain of one or more complete set of chromosomes along with the diploid complement is known as **[Odisha JEE 2012]**
(a) Aneuploidy
(b) Euploidy
(c) Reverse tandem duplication
(d) Substitution mutation

105. Addition of one or more haploid set of its own genome in an organism results in **[VITEEE 2006]**
(a) Autopolyploidy (b) Allopolyploidy
(c) Aneuploidy (d) Diploid

106. Autosomal mutant allele *HbS* causes **[VITEEE 2006]**
(a) Thalassemia (b) Albinism
(c) Sickle cell anaemia (d) Agammaglobuliema

107. Due to nondisjunction of chromosomes during spermatogenesis, sperms carry both sex chromosomes (22A+XY) and some sperms do not carry any sex chromosome (22A+0). If these sperms fertilize normal eggs (22A+X), what types of genetic disorders appear among the offsprings **[KCET 2010]**
(a) Turner's syndrome and Klinefelter's syndrome
(b) Down's syndrome and Klinefelter's syndrome
(c) Down's syndrome and Turner's syndrome
(d) Down's syndrome and cri-du-chat syndrome

108. Genetic variation in a population arises due to **[NEET (Karnataka) 2013]**
(a) Recombination only
(b) Mutations as well as recombination
(c) Reproductive isolation and selection
(d) Mutations only

109. The chromosomal condition in Turner' syndrome is **[Kerala PMT 2011; MP PMT 2011; KCET 2012]**

Or

A human female with Turner's syndrome **[CBSE PMT 2014]**
(a) 21 Trisomy with XY (b) 44 Autosomes + XXY
(c) 44 Autosomes + XYY (d) 44 Autosomes + XO
(e) 18 Trisomy with XY

110. The change in single base pair **[Odisha JEE 2011]**
(a) Results in new species
(b) Always changes the polypeptide chain
(c) May not change the phenotype
(d) Always changes the phenotype

111. Which is correct for Turner's syndrome **[NCERT; AMU (Med.) 2012]**
(a) It is a case of monosomy
(b) It causes sterility in females
(c) Absence of Barr body
(d) All of the above

112. Sickle cell anaemia is caused by the substitution of **[AFMC 1997; Kerala CET 2004, 05; Kerala PMT 2012]**
(a) Valine by glutamic acid at sixth position of alpha chain of haemoglobin
(b) Valine by glutamic acid at sixth position of beta chain of haemoglobin
(c) Glutamic acid by valine at sixth position of alpha chain of haemoglobin
(d) Glutamic acid by valine at sixth position of beta chain of haemoglobin
(e) Glutamic acid by methionine at sixth position of alpha chain of haemoglobin

113. If a colour blind man marries a woman who is normal but carries this trait, the progeny will be **[MP PMT 2013]**
(a) All normal females but carrier of the trait
(b) All males and 50% females colour blind
(c) All females and 50% males colour blind
(d) 50% males and 50% females colour blind

114. Thalassemia and sickle cell anemia are caused due to a problem in globin molecule synthesis. Select the correct statement **[NEET 2017]**
(a) Both are due to a qualitative defect in globin chain synthesis
(b) Both are due to a quantitative defect in globin chain synthesis
(c) Thalassemia is due to less synthesis of globin molecules
(d) Sickle cell anemia is due to a quantitative problem of globin molecules

115. A disease caused by an autosomal primary non-disjunction is **[NEET 2017]**
(a) Down's Syndrome (b) Klinefelter's Syndrome
(c) Turner's Syndrome (d) Sickle Cell Anemia

Sex determination

1. Sex chromosomes of a female bird are represented by **[Kerala PMT 2008]**
(a) XO (b) XX
(c) XY (d) ZZ
(e) ZW

2. When released from ovary human egg contain **[AFMC 2006]**
(a) One *Y* chromosome (b) Two *X* chromosome
(c) One *X* chromosome (d) *XY* chromosome

3. Barr bodies (seen in saliva test in Olympic games) are found in human and are associated with **[CBSE PMT 1992; MP PMT 1997, 98; KCET 1998; BHU 1999, 2002; RPMT 2005]**
(a) Male autosome (b) Female autosome
(c) Female sex chromosome (d) Male sex chromosome

4. The chromosomes responsible for the determination of sex are called
(a) Autosomes (b) Allosomes
(c) Multiple alleles (d) Heterosis

5. Sex chromosomes for the first time was discovered in which plant **[DPMT 2006]**
(a) *Sphaerocarpus* (b) *Pisum sativum*
(c) *Neurospora* (d) *Lathyrus odoratus*

6. *XO* type of sex determination is seen in **[CPMT 2010; Kerala PMT 2011]**
(a) Man (b) Grasshopper
(c) *Drosophila* (d) Birds
(e) Horses

7. The barr body is observed in **[Kerala CET 2005]**
(a) Basophils of males (b) Neutrophils of females
(c) Eosinophils (d) Neutrophils of males

8. In *Drosophila*, the sex is determined by **[MP PMT 1994; 95; CBSE PMT 2003; AIEEE Pharmacy 2004; AIIMS 2011]**
(a) Whether the egg is fertilized or develops parthenogenetically
(b) The ratio of number of X-chromosomes to the sets of autosomes
(c) X and Y chromosomes
(d) The ratio of pairs of X-chromosomes to the pairs of autosomes

9. In XO type of sex determination **[Kerala PMT 2012]**
(a) Females produce two different type of gametes
(b) Males produce two different types of gametes
(c) Females produce gametes with Y chromosomes
(d) Males produce single type of gametes
(e) Males produce gametes with Y chromosomes

10. Which type of gene regulate sex-determination in Spinach plant **[GUJCET 2015]**
(a) Homozygous genes (b) Heterozygous genes
(c) Single gene (d) Multiple genes

11. The sex determination pattern in honeybee is called **[MP PMT 1993, 2005; AIIMS 1993]**
(a) Female haploidy (b) Haplodiploidy
(c) Gametic diploidy (d) Gametogony

12. Sex of a human child is determined by **[MP PMT 1993, 2001, 03]**
(a) Size of the egg at the time of fertilization
(b) Size of the sperm at the time of fertilization
(c) Sex chromosome of father
(d) Sex chromosome of mother

13. Lyon hypothesis deals with **[DPMT 1993]**
(a) Centromere position (b) Genetic compatibility
(c) Genetic incompatibility (d) Number of Barr bodies

14. Meta–females have **[DPMT 1993]**
(a) *XX* (b) *XO*
(c) *XXXX* (d) *XXXXXX*

15. Animal which remains male initially, then changes to female (*Tapeworm proglottides*) is called **[CBSE PMT 1993]**
(a) Protandrous (b) Apomixis
(c) Profixation (d) None of these

16. Barr bodies and drumsticks are of what significance to genetists and biologists **[AFMC 1993]**
(a) They indicate the presence of abnormal sex cells
(b) They indicate the presence of more than one X chromosome in the cells
(c) They indicate male calls
(d) They signify the presence of sex linked traits

17. A family has five girls and no son. Probability of son as the 6th child will be **[NCERT; AFMC 2000; CPMT 2005]**
(a) 50% (b) 75%
(c) Full (d) No chance

18. Barr bodies are **[CBSE PMT 1993]**
(a) Chromatin negative (b) Not influenced by stains
(c) Chromatin positive (d) Poorly staining

19. Chromosomal abnormality of an unborn baby (while in mother's womb) can be found out by a technique called **[MP PMT 1995]**
(a) Amniocentesis (b) CAT scanning
(c) Ultrasound (d) Tissue culture

20. In our society women are blamed for producing female children. Choose the correct answer for the sex-determination in humans **[NEET (Karnataka) 2013]**
(a) Due to some defect like aspermia in man
(b) Due to the genetic make up of the particular sperm which fertilizes the egg
(c) Due to the genetic make up of the egg
(d) Due to some defect in the women

21. Foetal sex can be determined by examining cells from amniotic fluid looking for **[CBSE PMT 1991]**
(a) Barr bodies (b) Chiasmata
(c) Sex chromosomes (d) Kinetochores

22. Chromosomes that determine male sex in *Melandrium* plant is **[DPMT 2004]**
(a) *Y* chromosome (b) *X* chromosome
(c) *XX* chromosome (d) None of these

23. Male child will be born if **[CPMT 1993, 95; BHU 1995]**
(a) Father is sexually more excited
(b) Sperm of male with *Y* chromosome fertilizes the egg
(c) Sperm of male with *X* chromosome fertilizes the egg
(d) None of the above

24. Barr body in mammals represents **[CBSE PMT 1995]**
(a) All the heterochromatin in female cells
(b) One of the two *X* chromosomes in somatic cells of females
(c) All the heterochromatin in male and female cells
(d) The *Y* chromosome in somatic cells of male

25. Based on Lyon's hypothesis, what will be the number of Barr bodies found in a human female suffering from Down's syndrome **[AIEEE Pharmacy 2004]**
(a) 0 (b) 1
(c) 2 (d) 3

26. *Drosophila* flies with one half of the body male and other half female is referred to as **[CBSE PMT 1994]**

Or

Loss of a X chromosome in a particular cell during its development, results into **[CBSE PMT 1998]**
(a) Gynandromorph (b) Hermaphrodite
(c) Super female (d) Intersex

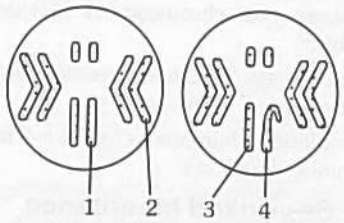
27. In human female, barr bodies are formed by **[CBSE PMT 1996]**
(a) Inactivation of mother's *X* chromosome
(b) Inactivation of father's *X* chromosome
(c) Inactivation of both mother's and father's *X* chromosomes
(d) Inactivation of either mother's or father's *X* chromosome

28. Gynandromorphs develop in *Drosophila* when the two cells in the two-celled proembryo will have one of the following chromosomal sets **[MP PMT 1997]**
(a) $2A + XX$ in one cell and $2A + X$ in the other
(b) $2A + X$ in both the cells
(c) $2A + XXX$ in both the cells
(d) All of the above

29. Genic balance theory of sex determination was proposed by **[MP PMT 1997, 99, 2000; KCET 2004]**
(a) Morgan (b) Bridges
(c) Boveri (d) Wilkins

30. A medical technician while observing a human blood smear under the microscope notes the presence of barrbody close to the nuclear membrane in the WBC. This indicates that person under investigation is **[Kerala CET 2003]**
(a) Colour blind (b) Haemophilic
(c) Normal female (d) Normal male

31. The following figure refer to the chromosome complement of each sex of fruit fly **[NCERT]**



By which number is a Y chromosome labelled
(a) 4 (b) 3
(c) 2 (d) 1

32. Genetic identity of a human male is determined by **[CBSE PMT 1997; Pb. PMT 1999; KCET 2000; CPMT 2000]**
(a) Autosome (b) Nucleolus
(c) Sex chromosome (d) Cell organelles

33. The theory where ratio between the number of X-chromosomes and number of complete sets of autosomes will determine the sex is known as **[MP PMT 2002]**
(a) Chromosome theory of sex determination
(b) Genic balance theory of sex determination
(c) Hormonal balance theory of sex determination
(d) Environmental sex determination theory

34. If somatic cells of a human male contain single barrbody, the genetic composition of the person would be **[JIPMER 1993; MP PMT 2001]**

Or

The genotype of a boy having sexual characters of a girl is
(a) XYY (b) XXY
(c) XO (d) XXXY

35. Chromosome theory of sex determination was propounded by **[MP PMT 2002; BVP 2002]**
(a) Bridges (b) Balbiani
(c) Goldschmidt (d) None of the above

36. Identify the wrong statement **[Kerala PMT 2010]**
(a) In male grasshoppers 50% of the sperms have no sex chromosome
(b) Usually female birds produce two types of gametes based on sex chromosomes
(c) The human males have one of their sex chromosomes much shorter than the other
(d) The male fruit fly is heterogametic
(e) In domesticated fowls the sex of the progeny depends on the type of sperm that fertilizes the egg

37. Random genetic drift in a population probably results from **[CBSE PMT 2002, 03]**
(a) Large population size
(b) Highly genetically variable individuals
(c) Interbreeding within small isolated population
(d) Constant low mutation rate

38. In melandrium the sex determination type is **[Kerala CET 2003]**
(a) XX-XY type (b) XX-XO type
(c) ZZ-ZW type (d) XY-XO type

39. Which one of the following conditions correctly describes the manner of determining the sex in the given example **[NCERT; CBSE PMT (Pre.) 2011; KCET 2015]**
(a) Homozygous sex chromosomes (XX) produce male in *Drosophila*
(b) Homozygous sex chromosomes (ZZ) determine female sex in birds
(c) XO type of sex chromosomes determine male sex in grasshopper
(d) XO condition in humans as found in Turner Syndrome, determines female sex.

Sex linked Inheritance

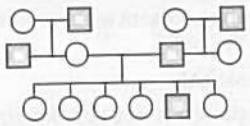
1. A colour blind man marries the daughter of a colour blind person. Then in their progeny **[AIIMS 1992; MP PMT 1994; JIPMER 2002; BHU 2008]**
(a) None of their daughters are colour blind
(b) All the sons are colour blind
(c) All the daughters are colour blind
(d) Half of their sons are colour blind

2. Given is : X is the chromosome with gene for haemophilia and X is the chromosome with normal gene. Which of the following individuals will act as carrier for haemophilia **[MP PMT 1992]**
(a) X^hY (b) XY
(c) X^hX^h (d) X^hX

3. More men suffer from colour blindness than women because **[MP PMT 1992; KCET 2011]**
(a) Women are more resistant to disease than men
(b) The male sex hormone testosterone causes the disease
(c) The colour blind gene is carried on the 'Y' chromosome
(d) Men are hemizygous and one defective gene is enough to make them colour blind

4. Sex–linked characters are **[CPMT 1993]**
(a) Dominant (b) Recessive
(c) Lethal (d) Not inherited

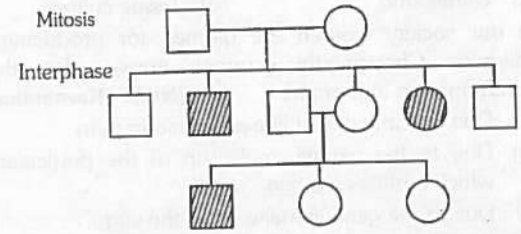
5. This pedigree is of a rare trait, in which children have extra fingers and toes. Which one of the following patterns of inheritance is consistent with this pedigree **[AIIMS 2009]**



(a) Autosomal recessive (b) Autosomal dominant
(c) Y-linkage (d) Sex linked recessive

6. If mother is a carrier for colour blindness and father is normal, then in the offsprings this disease may be seen in **[CPMT 1992; DPMT 1993; CBSE PMT 1999]**
(a) All the sons
(b) All the daughters
(c) 50% sons and 50% daughters (carrier)
(d) All the sons and not in daughters

7. Study the pedigree chart given below



What does its show **[CBSE PMT 2009]**
(a) Inheritance of a sex-linked inborn error of metabolism like phenylketonuria
(b) Inheritance of a condition like phenylketonuria as an autosomal recessive trait
(c) The pedigree chart is wrong as this is not possible
(d) Inheritance of a recessive sex-linked disease like haemophilia

8. A man can inherit his X chromosome from **[Kerala PMT 2008]**
(a) His maternal grand mother or maternal grand father
(b) His father
(c) His maternal grand father only
(d) His paternal grand father
(e) His paternal grand mother

9. In a pedigree analysis, □ = 0 represents **[Kerala PMT 2008; KCET 2015]**
(a) Unrelated mating
(b) Consanguinous mating
(c) Affected parents
(d) Siblings
(e) Non-identical twins

10. Select the incorrect statement from the following **[CBSE PMT 2009]**
(a) Linkage is an exception to the principle of independent assortment in heredity
(b) Galactosemia is an inborn error of metabolism
(c) Small population size results in random genetic drift in a population
(d) Baldness is a sex-limited trait

101	c	102	b	103	b	104	a	105	a
106	a	107	b	108	d	109	a	110	d
111	c	112	a	113	d	114	c	115	b
116	b	117	d	118	c	119	a	120	d
121	a	122	b						

Interaction of gene and cytoplasmic inheritance

1	c	2	d	3	a	4	a	5	b
6	c	7	d	8	c	9	a	10	d
11	b	12	b	13	b	14	c	15	c
16	d	17	b	18	d	19	a	20	b
21	b	22	a	23	b	24	b	25	b
26	a	27	d	28	a	29	d	30	c
31	a	32	b	33	c	34	d		

Linkage and Crossing over

1	a	2	d	3	b	4	d	5	d
6	a	7	c	8	b	9	d	10	c
11	b	12	b	13	d	14	a	15	a
16	b	17	a	18	d	19	c	20	b
21	c	22	d	23	e	24	d	25	c
26	a	27	b	28	a	29	c	30	b
31	b	32	b	33	c	34	c		

Chromosomes and Genes

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

96	a	97	d	98	c	99	c	100	d
101	d	102	a	103	c	104	b	105	d
106	d	107	d	108	d	109	d	110	d
111	c	112	b	113	d	114	c	115	c
116	b	117	b	118	a	119	d	120	c
121	d	122	c	123	b	124	c	125	a
126	d	127	c	128	c	129	b	130	a
131	a	132	a						

Multiple allelism

1	c	2	c	3	a	4	b	5	d
6	c	7	d	8	d	9	e	10	c
11	d	12	d	13	c	14	c	15	d
16	d	17	d	18	b	19	c	20	b
21	c	22	c	23	c	24	d	25	d
26	a	27	c	28	c	29	c	30	b
31	d	32	c	33	b	34	a	35	a
36	b	37	b	38	d	39	d	40	b
41	b	42	d	43	a	44	a	45	d
46	d	47	d	48	a	49	a	50	b
51	d	52	a	53	a	54	c	55	d
56	d	57	c	58	b	59	b	60	a
61	c	62	c	63	b	64	c		

Genetic variation

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

91	c	92	a	93	c	94	c	95	a
96	a	97	a	98	a	99	b	100	b
101	a	102	d	103	b	104	b	105	a
106	c	107	a	108	b	109	d	110	c
111	d	112	d	113	d	114	c	115	a

Sex determination

1	e	2	c	3	c	4	b	5	a
6	b	7	b	8	b	9	b	10	c
11	b	12	c	13	d	14	c	15	a
16	b	17	a	18	c	19	a	20	b
21	a	22	a	23	b	24	b	25	b
26	a	27	a	28	a	29	b	30	c
31	a	32	c	33	b	34	b	35	d
36	e	37	c	38	a	39	c		

Sex linked Inheritance

1	d	2	d	3	d	4	b	5	c
6	c	7	b	8	a	9	b	10	d
11	c	12	e	13	c	14	c	15	d
16	b	17	d	18	c	19	d	20	a
21	b	22	b	23	b	24	a	25	a
26	d	27	d	28	d	29	a	30	b
31	c	32	c	33	d	34	c	35	c
36	b	37	b	38	c	39	a	40	d
41	b	42	b	43	b	44	b	45	a
46	c	47	b	48	d	49	d	50	c
51	d	52	a	53	d	54	c	55	a
56	d	57	a	58	a	59	b	60	a
61	c	62	a	63	c	64	a	65	a
66	b	67	b	68	d	69	d	70	c
71	b	72	d	73	a	74	b		

Twins & I.Q, Eugenics, Euthenics and Euphenics

1	d	2	c	3	d	4	c	5	d
6	a	7	a	8	d	9	b	10	a
11	d								

NCERT Exemplar Questions

1	b	2	a	3	a	4	d	5	d
6	b	7	d	8	b	9	d	10	c
11	a	12	c	13	a	14	b	15	b
16	d	17	d	18	c				

Critical Thinking Questions

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

Assertion and Reason

1	c	2	c	3	c	4	a	5	c
6	a	7	a	8	d	9	a	10	a
11	a	12	a	13	a	14	c	15	a
16	a	17	c	18	a	19	b	20	b
21	a	22	a						

Answers and Solutions

Mendelism

1. (a) Gregor Johann Mendel was the first to formulate clear cut laws of heredity.

2. (c) Genetics is the study of principles and mechanism of heredity and variations.

3. (c) Term genetics was first used by W.Bateson (1905).

4. (b) Gregor Johann Mendel (1822–1884 Austria) is known as father of genetics, because he was the first to demonstrate the mechanism of transmission of character from one generation to the other.

5. (c) Mendel born in 1822 and died in 1884.

6. (d) He was an abbort (head) of Augustinian monastery of St. Thomas at Brunn, Austria in 1847.

12. (a) Mendel died before his work could be appreciated by the rest of the scientific community. In 1900, three botanists, Correns of Germany, De Vries of the Netherlands and Tschermak of Austria rediscovered his work after reaching similar conclusions independently.

19. (b) The cross of heterozygous dominant with its recessive parent is called test cross. The test cross gives 1 : 1 ratio in monohybrid condition whereas 1 : 1 : 1 : 1 in dihybrid condition.

22. (c) Number of gene pair (n) = 2

The number of F_2 genotype $= 3^n = 3^2 = 9$

Number of kinds of gamete $= 2^n = 4$

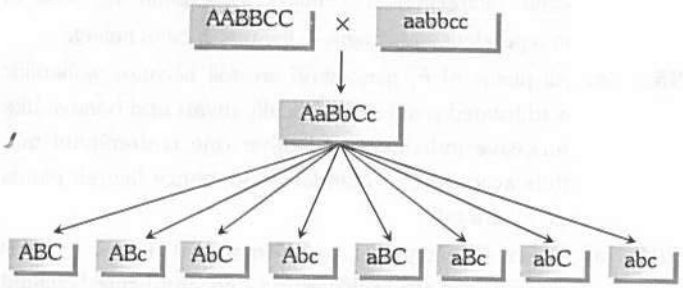
23. (b) Kinds of gametes may be calculated by following formula:

Number of gametes $= (2)^n$

n is number of alleles

Example : D/d : E/e : F/f have trihybrid cross *i.e.*, $n = 3$ than

Kind of gametes $= (2)^3 = 2 \times 2 \times 2 = 8$



24. (a) Pod length did not use by mendel for his experiment.

28. (b) Mendel selected these 7 characters –

(1) Stem length (2) Flower position

(3) Pod shape (4) Pod colour

(5) Seed shape (6) Seed colour (7) Seed coat colour

29. (a) According to Hardy Weinberg principle

$p^2 + 2pq + q^2 = 1; (p+q)^2 = 1$

(AA) $p^2 = 360$ out of 1000 individual or $p^2 = 36$ out of 100

$q^2 = 160$ out of 1000 or $q^2 = 16$ out of 100

so, $q = \sqrt{.16} = .4$. As $p + q = 1$

so, p is 0.6.

32. (d) The genotype is the genetic constitution of an organism. Term 'gene' was given by Johannsen (1909) for any particle to which properties of Mendelian factor or determiner can be given.

35. (a) $RrYy$

$2 \times 2 = 4$ gametes

(In heterozygous condition 2 gametes and in homozygous condition 1 gamete is produced)

$R \begin{cases} Y - RY \\ y - Ry \end{cases}$: $r \begin{cases} Y - rY \\ y - ry \end{cases}$

38. (b) Individuals having a pair of contrasting characters are known as allelomorph.

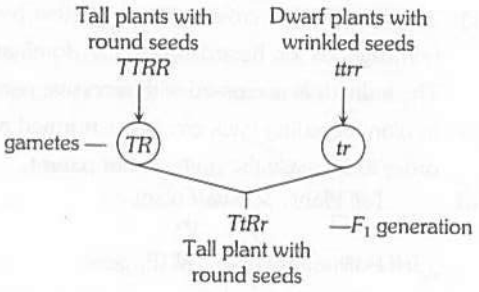
39. (a) Allele is an alternative form of a gene for example, T and t alleles represent tall and short stem height of pea plant.

40. (b) In codominance, both the genes of an allelomorphic pair express themselves equally in F_1 hybrids, 1:2:1 ratio both genotypically as well as phenotypically in F_2 generation.

43. (b) Dominant factor : It is one of a pair of alleles which can express itself whether present in homozygous or heterozygous state.

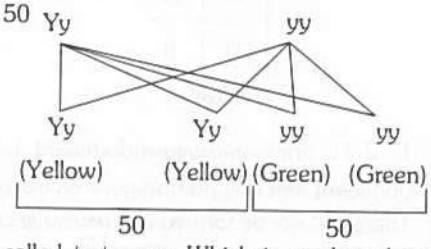
45. (a) The homozygote is pure for the character and breeds true, that is, it gives rise to offspring having the same character on self breeding. *e.g.*, TT or tt.

48. (c)



Therefore, the proportion of dwarf plants with wrinkled seed is zero.

49. (a) 50 : 50



It is called test cross. Which is used to determine the genotype of given offspring.

50. (a) The factor of an allelic pair which is unable to express its effect in the presence of its contrasting factor in a heterozygote is called recessive factor.

54. (a) Genes controlling seven traits in pea studied by mendel are located on 4 chromosome cotyledon and seed coat colour on chromosome-1; of pod form, flower position and stem length on chromosome 4; of pod colour on chromosome 5 and of seed form on chromosome 7.

55. (d) Yellow coloured pod and wrinkled seed is recessive character according to Mendel.

59. (c) Germplasm can be selected as seed or plantlets for their superior traits.

60. (b) He enunciated three major principles of inheritance *i.e.*, Law of dominance, law of segregation and law of independent assortment.

62. (d) Mendel gave only two laws of genetics. First law is segregation and second law is Independent assortment.

63. (d) Linkage is the tendency of two or more genes to inherit together. Mendel's law are true only in absence of linkage and gene interaction.

65. (d) As allele pairs separate or segregate during gamete formation and the paired condition is restored by random fusion of gametes during fertilization.

67. (b) Because in meiosis chromosomes and DNA amount are transmited to daughter cell from the parental cell.

68. (a) In this cross $YYRR$ is responsible for dominant yellow and round seeds and $yyrr$ for recessive green and wrinkled seeds. Thus in F_1 generation yellow and round seeds are formed.

70. (a) Mendel in his experiment considered total 7 characters (3 characters of seed i.e., seed shape, seed colour, cotyledon colour, 2 characters of pod i.e., pod shape and pod colour and 2 characters of plant i.e., plant height and position of pods on the stem).

71. (c) Test cross include cross of F_1 of the recessive parents i.e.,$(Tt \times tt)$

73. (c) Test cross : It is a cross to know whether an individual is homozygous or heterozygous for dominant character. The individual is crossed with recessive parent.

78. (c) In plant breeding back cross is performed a few times in order to increase the traits of that parent.

80. (a) Tall Plant × Dwarf plant
TT ↓ tt
(Self Pollination) Tt → Tall (F_1 gen)

♀ \ ♂	T	t
T	TT	Tt
t	Tt	tt

F_2 gen.
All Tall

81. (c) 1 : 2 : 1; one homozygous dominant, two heterozygous dominant and one homozygous recessive.

82. (d) There will not be formed any recessive combination.
Tt × TT

	T	T
T	TT	TT
t	Tt	Tt

83. (c) A dihybrid test cross give a 1:1:1:1 ratio indicating that two pairs of factors are segregation and assorting independently.
Tt Rr × tt rr

	TR	Tr	tR	tr
tr	TtRr	Ttrr	ttRr	ttrr

TtRr – Tall Round
Ttrr – Tall wrinkle
ttRr – Dwarf Round
ttrr – Dwarf wrinkle
1 : 1 : 1: 1 Phenotypic ratio

84. (b) 9 : 3 : 3 : 1 is dihybrid phenotypic ratio of progeny.

87. (c) 1/8; because in F_2 generation by dihybrid cross 16 hybrids are formed in which only 2 are homozygous for dominant and recessive character. The genotypic ratio for homozygous and heterozygous sets of gene is 2 : 14. It is 1/8 of the 16 hybrids.

88. (b) RR × rr
↓
F1 – Rr
Gametes – R, r

90. (c) RR (Red flower) × rr (White flower) ⟶ F_1 = Rr

	R	r
R	RR	Rr
r	rR	rr

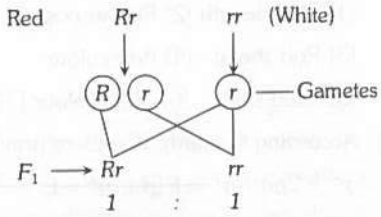
After selfing
RR = Homozygous for red flower
Rr and rR = Heterozygous for red flower
rr = homozygous for white flower
3 Red and 1 White = 3 : 1

93. (b) All red flowered plants; according to Mendel's law of dominance.
RR (Red dominance) × rr (Recessive white) ⟶ Rr (Red)

94. (c) In this experiment, Mendel stated that each character is governed by a single gene and there is no linkage and gene interaction. He failed to explain his law of independent assortment in the presence of linkage.

95. (d) All plants of F_1 generation are tall because gibberellic acid treated plant is genetically dwarf and behave like recessive individual and other one is dominant tall, thus according to Mendel's dominance law all plants of F_1 are tall.

98. (a) When heterozygous red (dominant) flower (Rr) is crossed with white flower (rr), red and white flowered plants will be produced in equal ratios. The cross can be given as -



99. (a) In F_2 gen. of dihybrid cross, the expected genotypic proportion of individuals having both the dominant alleles in homozygous condition is 1/16 and genotypic proportion of individual having both recessive alleles in homozygous condition is 1/16.
TTRR × ttrr
↓
TtRr – F_1

♂ \ ♀	TR	Tr	tR	tr
TR	TTRR	TTRr	TtRR	TtRr
Tr	TTRr	TTrr	TtRr	Ttrr
tR	TtRR	TtRr	ttRR	ttRr
tr	TtRr	Ttrr	ttRr	ttrr

In F_2 generation (TTrr is 1/16)

100. (d) CcPp × Ccpp
Purple White

♀ \ ♂	CP	Cp	cP	cp
Cp	CCPp Purple	CCpp White	CcPp Purple	Ccpp White
cp	CcPp Purple	Ccpp White	ccPp White	ccpp White

Phenotypic ratio– 3 purple : 5 white

103. (b) $Tt \times Tt$
Tall Tall

♀ / ♂	T	t
T	TT	Tt
t	Tt	tt

In F_2 –3 tall : 1 dwarf
This is the law of segregation.
1 Homozygous tall
1 Homozygous dwarf
2 Heterozygous tall

104. (a) *TT* is homozygous tall plant, *Tt* is heterozygous tall plant and *tt* is homozygous dwarf plant.

105. (a) $AaBB \times aaBB$
Gametes for $F_1 = AB, aB$ and aB, aB
After crossing $= AaBB, aaBB$
Ratio = 1 : 1

111. (c) AA × aa – P
↓
Aa – F_1

114. (c) The offsprings shows 27 : 9 : 9 : 9 : 3 : 3 : 3 : 1 ratio is found in trihybrid cross.

116. (b) It is the test cross.

117. (d) Which can transmit independently not linked to genes.

Interaction of gene and cytoplasmic Inheritance

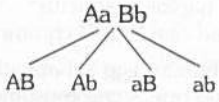
1. (c) The skin shade has to vary from very dark in AABBCC individual to very light in aabbcc individual.

2. (d) Dominant epistasis is the phenomenon of masking or supressing the expression of a gene by a dominant non-allelic gene.
Eg, fruit colour in *Cucurbita pepo* (Summer squash)

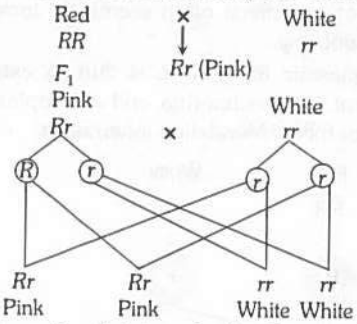
3. (a) The inheritance due to the genes found in cytoplasm (mitochondria and chloroplast) is called cytoplasmic inheritance or non-Mendelian inheritance. The leaves of *Mirabilis jalapa* may be green, white or variegated. This is due to plastid inheritance.

5. (b) $CCpp \times ccPP$
White ↓ White
$CcPp$
Red
In complementary gene action, 9 : 7 ratio is obtained in F_2 in which two dominant genes are responsible for red flower colour.

9. (a) By the rule of 2^n where n = Number of Heterozygus pairs of genes
Thus $2^2 = 4$ type of combinations are formed



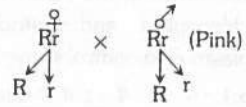
11. (b) *Mirabilis jalapa* shows incomplete dominance.



So, the ratio of pink and white flower will be 1 : 1.

14. (c) Here, both type of traits are transmitting in a single individuals. It means both are dominant at a time or codominant. *e.g.*, blood groups of human being and roan colour in cattles.

15. (c) **Parents**(Pink)
Gametes



	R	r
R	RR	Rr
r	Rr	rr

1 : 2 : 1
Red : Pink : White

16. (d) In epistasis, an allele of one gene suppressed or masked the phenotypic expression of a gene at another locus. The gene which is masked is called hypostatic gene.

17. (b) It is an example of Incomplete dominance.

18. (d) Pink colour is due to incomplete dominance.

19. (a) The complementary genes are two pairs of non allelic genes which interact to produce only one phenotypic trait, but neither of them if present alone produces the phenotypic trait in the absence of other.

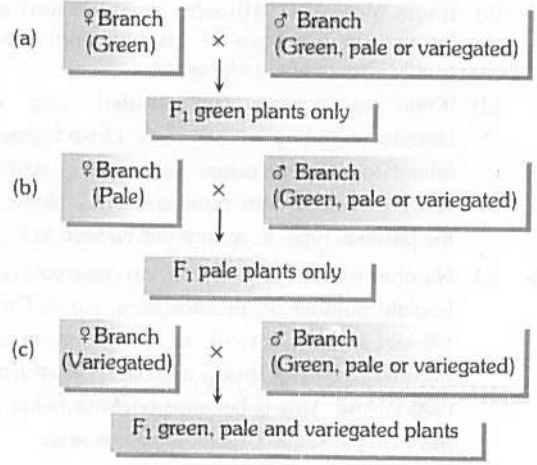
20. (b) Incomplete dominance is found in *Antirrhinum majus* (snapdragon) and *Mirabilis jalapa* (4 O'clock plant).

21. (b) *Mirabilis jalapa* shows incomplete dominance.

22. (a) The phenotypes of the offspring in this plant depend on the phenotype of the branch that contributes the female gametes.

23. (b) The transmission of traits from parents to offspring by means of plasmagenes is known as cytoplasmic inheritance.

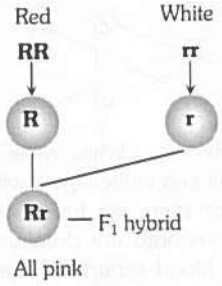
24. (b)



25. (b) Responsibility of a single gene for more than one phenotypic effect, often seemingly unrelated is known as pleiotropy.

27. (d) Cytoplasmic inheritance is due to extranuclear genes present in mitochondria and chloroplasts. These genes do not follow Mendelian inheritance.

29. (d)



30. (c) Certain genes present outside the nucleus or chromosomes in the semiautonomous organelles, such as chloroplast and mitochondria, located in the cytoplasm also control some traits.

32. (b) Ratio 1 : 4 : 6 : 4 : 1 it is due to two pairs of genes. But if it is due to 3 pairs of genes, the size ratio shall be 1 : 6 : 15 : 20 : 15 : 6 : 1.

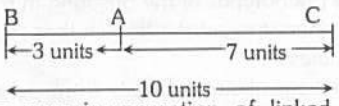
33. (c) Plasmid is an extra chromosomal circular DNA molecule which replicates independently in the host chromosome.

Linkage and Crossing over

1. (a) In *Neurospora* it produces 4 types of ascospores two of one parental type, two of other parental type, two of one recombinant and another two of second recombinant type.

3. (b) The tendency of parental combinations to remain together, which is expressed in terms of low frequency of recombinations is called linkage.

4. (d) From the recombination frequencies between different genes A, B and C, it is clear that distance between A and B genes is 3 units, between B and C 10 units and C and A 7 units. Hence linear order of genes on chromosomes is :



5. (d) Crossing over is separation of linked genes (T. H. Morgan).

6. (a) It was Morgan (1910) who clearly proved and defined linkage on the basis of his breeding experiments in fruitfly Drosophila melanogaster.

9. (d) When two genes are located very closely on chromosome they are called as "Linked genes" and they inherit together therefore two types of gametes will be formed in maximum numbers. Thus higher number of the parental type off springs will be seen in F_2 generation.

10. (c) Number of linkage groups in an organism is equal to its haploid number of chromosomes. e.g. in *Drosophila* the haploid number is $n=4$, so linkage group is 4. But the number of linkage group is prokaryotes (bacteria, like *E. coli*) is one. This is because bacteria being prokaryotes have only a single circular chromosome.

11. (b) Crossing over occurs at pachytene sub-stage of prophase I of meiosis.

12. (b) Mendel's law of independent assortment is not universally accepted and is applied only to genes present on different chromosomes and not to genes present on the same chromosome.

13. (d) Crossing over is a process by which chromatids of homologous exchange portions of genetic material, usually during tetrad formation of meiosis. Crossing over occurs at pachytene sub stage of prophase I of meiosis but visible at diplotene substage of prophase I.

14. (a) T.H. Morgan (1911) proposed the 'chromosome theory of linkage' along with W.E. Castle based on his experiments in *Drosophila*.

17. (a) Because distance between the linked genes is the major factor which controls the frequency of crossing over.

18. (d) During crossing over non-sister homologous chromosome exchange genes.

20. (b) In sweet Pea linkage was firstly discovered.

21. (c) Recon – Unit of recombination
Muton – Unit of mutation
Cistron – Unit of function

25. (c) The garden pea plant has seven pairs of chromosome and the same number of linkage groups.

27. (b) Homologous chromosomes moves apart they remain attached to one another at specific points called chiasmata.

30. (b) The synapsis, pairing of homologous chromosomes takes place during zygotene. Synapsis results in the formation of bivalents during zygotene. The formation of special proteinaceous structure called synaptonemal complex occur. After zygotene stage cell enters in pachytene stage in which the bivalents become spiralled, shortened and thickened.

31. (b) In maize n= 10, hence linkage groups = 10.

33. (c) Morgan proposed that chiasmata lead to crossing over by breakage and reunion of homologous chromosomes.

Chromosomes and Genes

3. (c) Polytene chromosome were discovered by Balbiani (1881) in salivary gland cells of larvae of Chironomus tantans.

4. (c) Telocentric are rod shaped chromosomes having sub-terminal centromere. Its terminal end is called telomere.

6. (c) Centromere joins the microtubules of chromosomal spindle fibres and helps in the movement of chromosome during cell division. Centromere also plays an important role in the polymerization of tubulin protein used in the formation of microtubules. Hence it is helpful in attaching the chromosome with spindle fibres.

9. (b) Sperm is haploid structure inwhich twenty two autosome and one X or Y chromosome are present.

12. (d) Unfertilized human egg is haploid structure in which 22 autosome and one X chromosome are present.

13. (b) Centromere is a region of chromosomes which holds sister chromatids together and the area where chromosome are attached to spindle fibres during cell division.

18. (d) The gene pool can be defined, "as the aggregation of all gene in a mendelian population". Mendelian population is an inter breeding group of population which occurs as a community in an area.

19. (b) The cross over percentage differ for different pairs of genes because the amount of crossing over depend on the frequency with which breaks in the chromatids occur between the two genes. This frequency further depends specially on the distance of these genes which are apart on the chromatids.

22. (b) Polytene chromosomes contain several dark stained regions called bands seperated by lighter or less stained area called interbands. These dark bands are heterochromatin (geneticaly inert) area.

23. (a) In eukaryotes DNA is tightly bound to histones which form a DNA protein particles called nucleosome. Each nucleosome contains 2 copies of each H_{2A}, H_{2B}. H_3 and H_4 histone protein bounded on 146 BP of DNA. Each nucleosome bead is linked to next nucleosome bead by linker DNA.

24. (a) Each chromosome has a centromere (primary construction) but in some cases secondary construction is also present, more specifically called as 'secondary construction-II'. Its position is constant for particular chromosome heterochrmatin is condensed in this region. In man 'secondary construction-II' is present in chromosome number 1, 10, 13, 16 and Y. Nuclear organizer is called 'secondary construction-I'.

25. (a) The behaviour of homologous chromosomes during meiosis (their, segregation and independent assortment) and their reunion in fertilization confirmed that the genetic material occurs in the chromosomes and formed the basis of **chromosomal theory** of **inheritance**.

28. (a) Tizo and Levan (plant cytologists) in 1956 enabled the human geneticists to ascertain the correct chromosome number.

29. (c) Depending upon the position of centromere and relative length of two arms, human chromosomes are of three types- metacentric, submetacentric and acrocentric. The photograph of chromosomes are artifically arranged in the order of descending length is seven group (A to G).

38. (c) Aleurone is triploid and root tip is diploid.

39. (c) The genes present on the differential part of Y chromosome are passed directly from father to son and are called as Holandric genes.

40. (b) The crossing overs occurs in the homologous chromosomes only during the four stranded or tetrad stage in between pachytene and diplotene phase of meiosis.

42. (a) Polytene chromosomes were first observed in the salivary glands of *Chironomous* larva and hence called salivary gland chrom.

48. (c) Idiogram is a composite photograph or diagram of metaphasic chromosomes of haploid or diploid set of an organism arranged in a series of decreasing size, thickness position of centromere and shape.

50. (a) In metacentric chromosome centromere is present in the middle so, these chromosomes are isobrachial. In anaphase the chromosome appear V shaped.

52. (d) The character of the chromosomal complement with reference to the comparative size, shape and morphology of different chromosomes.

59. (d) Polytene chromosomes are multistranded giant chromosomes which are formed by somatic pairing of homologous chromosomes and their repeated replication or endoduplication to form 1000 (e.g. salivary of gland of Drosophila) to 16000 (e.g. chironomous) chromonemata.

61. (b) Linkage is the pattern of assortment of genes that are located on the same chromosome. It is important because, if the genes are located relatively far apart, crossing over is more likely to occur between them than in they are located close together. In sex linkage, the speciality is criss-cross inheritance.

63. (c) The lampbrush chromosomes are found in oocytes of many vertebrates (Amphibian, reptiles birds) and some invertebrates (insects). They also occur in the giant nucleus of the unicellular algae Acetabulasia.

64. (a) Euchromatin or dynamic chromatin is relatively expended and open. It has the potential of being actively transcribed.

65. (a) Number of linkage groups in an organism is equal to the haploid number of chromosomes. In Drosophila melanogastor, $2n = 8$, hence $n = 4$ linkage groups.

66. (b) Centromere (Kinetochore) lies in the region of primary constriction where two chromatids are connected at the centromere.

67. (c) Polytene chromosomes was described by Kollar (1882) and first reported by Balbiani (1881). They are found in salivary glands of insects (Drosophila) and called as salivary gland chromosomes.

68. (d) Carmine is a dye extracted from the cochineal insect (coccuscacti).

70. (c) Crossing over always takes place between nonsister chromatids of two homologous chromosomes.

71. (a) The reduction of DNA content does not occur in meiosis-I. Truely haploid nuclei in terms of DNA contents as well as chromosomes number are formed in meiosis-II. When the chromatids of each chromosome are separated into different nuclei. Thus meiosis-II is necessary.

72. (c) Human male has 44 autosomes and two different sex chromosomes *viz* X & Y.

73. (a) DNA is the hereditary material, which is located inside the chromosome.

74. (b) Man is heterogametic because it has X and Y chromosomes.

75. (b) Casperson (1970), stained chromosomes with a fluorescence dye it gives different banding patterns helpful to know various types of chromosomal aberrations.

76. (b) E. strasburger (1875) discovered these distinct structures during cell division.

77. (b) DNA is known as genetic material.

79. (b) The actual distance between two genes is said to be equivalent to the percentage of crossing over between these genes *i.e.* 66%. Crossing over chances between y and b genes suggest that these are to be placed on the chromosome at a distance of 66 units.

80. (a) Chromosome number is fixed for a species. The lowest number is seen in *Haplopappas gracilis i.e.* $2n = 4$ and maximum in ophioglossum species *i.e.* $2n = 1656$.

82. (c) Because males have only one X chromosome, Y being without alleles. Therefore, even single recessive allele expresses its effect in males.

87. (b) Allele frequency is the relative proportion of a particular allele among individuals of a population. According to Hardy-weinberg equation, the frequency of dominant and recessive alleles in a population will remain constant from generation to generation if there is no mutation, selection, random drift and migration. As per Hardy-weinberg equation.

$p^2 + 2pq + q^2 = 1$

p = dominant allele frequency

q = recessive allele frequency

p^2 = homozygous dominant genotype

$2pq$ = heterozygous genotype

q^2 = homozygous recessive genotype

Here, $p = 0.6$ and $q = 0.4$

Therefore, heterozygotes frequency is

$= 2pq = 2 \times 0.6 \times 0.4 = 0.48$

93. (c) Hofmeister discovered nuclear filaments in the nuclei of the pollen mother cells of the plant, *Tradescantia*, in 1848.

94. (c) Multiple alleles being located on the same locus do not show crossing over.

95. (d) Jumping genes or transposons genes are found in both prokaryotes and eukaryotes. These were discovered by Mc clintock in case of maize.

98. (c) Wood cock (1973) observed the structure of chromatin under electron microscope. He termed each beaded structure on chromosome as nucleosome.

99. (c) Chimeras are the individual having the different genotypes in its different parts.

103. (c) Gene control protein synthesis through controlling the synthesis of a specific protein and it controls heredity through transmission of heredity characters from one generation to another.

104. (b) Gene is capable of duplication of its genetic material by faithful replication and its precise distribution among new cells by cell division.

105. (d) These are small proteins responsible for coiling DNA in to nucleosome.

106. (d) Histones are main structural protein found in eukaryotic cells.

109. (d) Woodcock termed each beaded structure on chromosome as nucleosome. So nucleosome are units of chromosomes.

112. (b) Holandric genes are the Y-linked genes. The Y- linked type sex-linked inheritance is performed by those genes which are localized in the non-homologous sections of Y chromosome and that have no alleles in X-chromosome.

113. (d) *Neurospora* (ascomycetes fungus) which is also called *Drosophila* of plant kingdom.

114. (c) In viruses of animals, DNA is present and in viruses of plants, RNA is present as genetic material.

116. (b) Both the chromatids move towards opposite poles due to repulsive force called anaphasic movement.

117. (b) A gene is a segment of DNA which contains the information for one enzyme or one polypeptide chain coded in the language of nitrogenous bases or the nucleotides.

118. (a) This theory was given by Beadle and Tatum (1958), while they were working on red mould or neurospora.

120. (c) Jumping genes are also called '*Transposons*'.

121. (d) Cistron, muton and recon were given by Seymour Benzer to explain the relation between DNA length and gene.

123. (b) Genes determine the physical as well as physiological characteristics. These are transmitted from parents to the offsprings generation after generation.

124. (c) DNA and proteins (Polynucleotides and histone proteins).

128. (c) Unwanted portion (introns) of genes is spliced off and remaining part *i.e.*, exons get joined by ligase.

129. (b) According to this theory one gene controls the synthesis of one polypeptide chain and not of the complete enzyme or protein molecule.

131. (a) Based on the location of centromere the chromsomes are categorised in to (i) Telocentric (ii) Acrocentric (iii) Submetacentric (iv) Metacentric.

Multiple allelism

3. (a) The skin colour of a person is the result of an interaction between two pairs of genes.

4. (b) The difference between Rh positive and Rh negative depend on a single pair of genes (rr) with the gene responsible for the Rh positive condition dominant (RR, Rr)

6. (c) *ABO* system is one of the most important human "blood group systems. The system is based on the presence or absence of antigens *A* and *B* on the surface of red blood cells and antibodies against these in blood serum. A person whose blood contains either or both of these antibodies cannot receive a transfusion of blood containing the corresponding antigens as this would cause the red cells to clump.

Phenotypes and genotypes of *ABO* blood groups are

Phenotype	Genotype
A	I^AI^A or I^Ai
B	I^BI^B or I^Bi
AB	I^AI^B
O	*ii*

9. (e) ABO blood groups are controlled by a series of three multiple alleles. Different combination of these alleles produce four blood types A, B, AB and O.

15. (d) Antisera D (also called D Antigen) is used for testing to the blood group of Rh, because Antisera D containing antibody against protein D.

17. (d) Karl Landsteiner of USA. He was awarded Nobel prize for the same in 1930.

19. (c) The process of mating among closely related individuals is known as inbreeding.

21. (c) Alleles for blood group *B* (of child) are absent in father (blood group *A*), therefore they should come from mother and they are present in persons having blood group *B* or *AB*.

23. (c) Person with blood group AB has both A and B antigens on RBC but no antibodies in the plasma.

24. (d) Erythroblastosis foetalis disease is related to the birth of a child related with Rh factor. It cause the death of the foetus within the womb or just after birth.

25. (d) Hetrozygous I^A/I^B individual are blood group AB. Both the A antigen (Product of the I^A alleles) and the B antigen (Product of the I^B alleles) are produced by them.

28. (c) Rhesus monkey (*Macaca rhesus*).

29. (c) A person with blood group AB possess both the antigen A and B but their blood plasma does not possess any of the antibodies.

30. (b) Rh^- woman married with Rh^+ man, become sensitized simply by carrying a Rh^+ child within her body. Some of the cells from the embryo may mix into her own blood stream during development. The first child of the parents with this genetic back ground is nearly always normal.

31. (d) O individuals produce neither A or B antigen, but have both type of antibodies, So their blood can be transfused into any recipient.

37. (b) Agglutinogen A and B is a specific antigen present normally at surface of R.B.C.

38. (d) The person with blood group O is said to universal donor, because in this, there are no antigens on the surface of RBC.

42. (d) Since the blood groups of parents are *A* and *B*, therefore their genotypes are *AO* and *BO* so the possible genotypes of their children are *AO*, *BO*, *AB* and *OO* *i.e.* the possible blood groups are *A*, *B*, *AB* and *O*.

44 (a) When the blood group of one parent is *AB* and that of other is *O* then the child may have blood group either '*A*' or '*B*' as blood group '*O*' has no dominant genes for antigens.

45. (d) Since the blood group of father is *AB* (genotype *AB*), therefore one of the two antigens *i.e.* *A* or *B* has to be present in child's blood *i.e.* he can have any other blood group but not '*O*' (genotype *OO*).

47. (d) Stage I of blood cloting is concerned with the formation of thromoplastin released from damaged tissue or platelets. Thromboplastin helps in the formation of the enzyme thrombokinase.

51. (d) Rh factor was first of all reported in RBCs of *Macaca rhesus* (rhesus monkey) by Landsteiner and Wiener in 1940. It is found only in man and rhesus monkey and is not reported from other animals.

52. (a) The Rh factor causes erythroblastosis foetalis, when a woman who is Rh^- develops antibodies against her foetus, which is Rh^+. The symptoms of the disease are caused by agglutination of the baby's red blood cells.

57. (c) IgG is the most abundant long-acting antibody representing about 80 percent of the antibody. It is able to pass across the placenta from mother of child.

58. (b) Codominance is a condition in which heterozygote where both members of an allelic pair contribute to phenotype, which is then a mixture of the phenotypic traits produced in either homozygous condition. In cattle the cross of red X white produces roan offspring whose coat consist of both red and white hair.

59. (b) In erythroblastosis foetalis, the antibodies in the blood stream of the mother, pass through the placenta and cause damage to the red cells of the foetus.

60. (a) Blood group in human are inheritable trait and are inherited from parents to offsprings on the basis of mendel's law.

62. (c) If a man with blood B, marries a woman with blood group A then, genotype will be of B blood group child.

♀ \ ♂	I^B	I^O
I^A	$I^A I^B$	$I^A I^O$
I^O	$I^B I^O$	$I^O I^O$

63. (b)

♀ gametes \ ♂ gametes	I^A	I^-
I^A	$I^A I^A$	$I^A I^B$
I^B	$I^A I^B$	$I^B I^B$

Genetic variation

5. (c) Albinism is an autosomal recessive trait. The genotype of such mother would be '*Aa*' *i.e.* one recessive gene '*a*' responsible for the absence of melanin and one dominant gene responsible for the presence of melanin would be present. So the mother would be heterozygotic carrier.

9. (c) Chromosomal aberrations, genetic drift and recombination all play role in bringing genetic variations but recombination is more common.

10. (a) Because germplasm DNA is inherited from one generation to another.

16. (a) Phenylketonuria is homozygous autosomal recessive disorder.

18. (c) Mutation are sudden stable inheritable/transmissible discontinuous variations which appear in organism due to permanent change in their genotypes.

20. (d) Individuals with Turner syndrome have one *X* chromosome (*HH* + *XO*) due to non-disjunction of sex chromosome in their parents.

22. (a) The chromosome number in Turner's syndrome is $2n = 45$ due to fusion of $(ZZ + O)$ ovum with gynosperm $(ZZ + X)$.

26. (a) In transition, purine replaces purine and pyrimidine replaces pyrimidine and in transversion, a purine is replaced by pyrimidine or vice versa.

29. (b) The individuals with this syndrome are trisomic for chromosome 21. Chromosomal complement is 46 + additional chromosome 21 = 47.

31. (b) Phenotypically these individuals are males, but they can show some female secondary sexual characteristics and are usually sterile.

33. (c) There is a large scale possibility of autosomal aneuploidy in human beings.

40. (c) Meiotic non-disjunction.

42. (d) De Vries observed a number of mutation in his experimental plant evening primrose, *oenothera lamarckiana.*

43. (b) Because father can give only Y-chromosome to their son.

45. (d) White eye mutation in drosophila, result in depigmentation in many other parts of the body giving a pleiotropic effect.

47. (d) Sickle cell Anaemia is a hereditary disorder of autosomal nature which is caused by mutation of the gene controlling β – chain of haemoglobin.

49. (b) Because AIDS is caused by Virus HIV. HIV also known as LAV = Lymphadenopathy associated virus.

51. (d) Natural selection will preserve the adaptive mutations.

52. (c) In man, enzyme tyrosinase (also inhibited) by excess phenylalanine) is absent due to homozygous recessive autosomal alleles. Melanin or pigment formation from dihydrophenylalanine is stopped. There is lack of pigment in skin, hair and iris.

55. (a) The idea of mutations was brought forth by Hugo do Vries, who worked on evening primrose.

56. (b) It has an abnormal karyotype of 10 $2n + 1$ (18) = 47

60. (c) Continuous variation are small and graded these include variation in colour, shape size, weight and structure of body parts, Height. These variations may be somatogenic or blastogenic.

64. (d) Change in single base pair of DNA is also a type of mutations called point mutations

69. (d) Multivalents is an association of more than two homologous chromosomes. The number of multivalents depends upon the degree of synapsis and chiasmata formation among similar chromosomes.

74. (a) Down's syndrome is due to trisomy of 21st chromosome was first reported in 1866 by Langdon Down.

75. (d) Mutation induced by a mutagen are called as induced mutations.

76. (a) Mutation causes discontinuous variations. Gene duplication is a type of chromosomal mutation and it has been noticed in giant chromosomes of salivary glands of *Drosophila.*

77. (d) Epicanthus is the symptom of Down's syndrome characterised by folding of skin (epicanthus) at the inner part of the eyes.

79. (d) Sickle cell trait is a heterozygous condition in which an organism may have one gene for normal haemoglobin and other gene for sickle cell haemoglobin.

80. (a) Colchicine inhibits the cell division or mitosis, but duplication of chromosomes is continue, as a result, diploid becomes tetraploid.

81. (d) Suppressor mutation totally or partially restores a function lost by a primary mutation and is located at a genetic site different from the primary mutation.

82. (a) Polydactyly or extra fingers is caused due to autosomal dominant gene.

83. (a) Klinefelter's syndrome is a human sex abnormality, arises due to non-disjunction of sex chromosomes during meiosis. It is characterised by the chromosome number. $2n = 47$, the chromosomal formula is 44A + XXY.

Klinefelter's syndrome is a male in general appearance; testes are underdeveloped, enlarged breast (gynaeco mastia), Mentally defective and abnormally tall. Mental retardation increases with X complement. The karyotypes of extreme Klinefelter's syndrome are $44A + XXXY$, $44A + XXXXY$, $44A + XXXYY$ etc.

In Turner syndrome, chromosome number is $2n = 45$. The chromosomal formula is $44A + XO$. She is a sterile female.

$22A + XY$ is chromosome constitution of normal male individuals which are heterogametic.

$22A + XX$ is chromosome constitution of normal female individuals, are homogenetic.

84. (b) Philadelphia chromosome is 22nd chromosome. It is so called because in 1960 investigation in philadelphia found that patients with chronic myeloid leukaemia have an abnormal chromosome later found to be 22nd.

86. (c) Polyploidy is the phenomenon of having more than two genomes or set of chromosomes *e.g.* $3n$, $4n$, $5n$ etc.

89. (c) In inversion a piece of chromosome is removed and rejoined in reverse order.

92. (a) They occur in 1/700 births in women aged 25 years or under. The frequency increases with age to about 1/100 for women of age 40 and 1/10 for women of age 45.

96. (a) The condition of chromosomal change which involve the loss or gain of single chromosome is called aneuploidy. Genotype "22 pairs + *XXY* males" show the condition of Klinefelter's syndrome.

97. (a) "Cri-du-chat" syndrome condition is due to a deletion in the short arm of the chromosome number 5.

100. (b) Turner's syndrome is 23 monosomic (Aneuploidy) conditions, in which only one *X* chromosome is present no *Y* chromosome.

103. (b) On the basis of principles of simple recessive inheritance, the probability that their second child will also be an albino is 100%.

109. (d) Turner's syndrome is caused due to the absence of one of the X chromosomes i.e. 45 with XO (or 44 + XO).

112. (d) The sixth amino acid in β–chain of normal haemoglobin is glutamic acid. In sickle cell haemoglobin this amino acid is replaced by valine.

Sex determination

2. (c) The female contain two *X* chromosomes. The eggs are produced by the meiosis *i.e.*, reduction division. So the egg contains one *X* chromosome when released from ovary. After fertilization the diploid phase is restored.

3. (c) According to the British geneticist Mary Lyon (1961), One of the two X-chromosomes of a normal female becomes heterochromatic and appears as Barr body.

4. (b) Also called sex chromosome or heterosomes.

5. (a) Most flowering plants are monoecious and so do not have sex chromosomes. Sex chromosome has been reported in two plant species namely *Melandrium* (*Lychnis*) and *Sphaerocarpus*.

7. (b) The barr body is present in the neutrophil (polymorphonuclear leucocytes) of 3 to 5% cells in females, but not in males.

8. (b) The ratio of *X* and *A* chromosomes responsible for determination of sex in drosophila *e.g.* Superfemale – Number of X chromosome XXX/Set of autosome *AA*.

Sex index ratio (X/A) $= \frac{3}{2} = 1.5$ Super female.

11. (b) Haplodiploidy is a type of sex determination in which the male is haploid while female is diploid. It occurs in some insects like honey bees, ants and wasps.

14. (c) Super or meta females have 47 (44 + *XXX*), 48 (44 + *XXXX*) or 49 (44 + *XXXXX*) chromosomes.

16. (b) More than one *X*-chromosome in females is transformed into Barr bodies and drumsticks.

19. (a) Amniocentesis is the most widely used method for prenatal detection of many genetic disorders.

20. (b) Sex is determined at fertilization by the nature of the sperm that fertilizes the egg.

23. (b) Y-bearing sperms produce male embryo *X*-bearing sperms produce female.

24. (b) Barr body is nothing but 'X' chromosome which has become heterochromatic, thus appear as deeply stained body. Of the two 'X' chromosomes are remains normal while the other appears as a Barr body.

25. (b) Down's syndrome is a chromosomal abnormality in humans and is associated with an extra chromosome 21 (i.e. chromosomal formula is 45 + *XX* = 47), while one of the two *X*-chromosomes becomes genetically inert and heteropycnotic and forms the Barr body. Hence human female suffering from Down's syndrome contains (2X – 1 = 1) one Barr body.

26. (a) In *Drosophila*, occasionally flies are obtained in which a part of the body exhibits female characters end the other part exhibits male as gynandromorphs. These are formed due to misdivision of chromosomes and start as female with 2A + 2X chromosomes.

28. (a) Gynandromorphs are formed due to misdivision of chromosomes and start as female with 2A + 2X chromosomes. One of the *X*-chromosomes is lost during the division of the cell with the result that one of the daughter cells possesses 2A + 2X chromosomes and the other 2A + X.

30. (c) Barr body is characteristic feature of female.

34. (b) Human male has 44 + XY and without barrbody; It is associated with X chromosome of female, if male has one barrbody then it has XXY.

35. (d) Chromosomal theory of sex determination was proposed by an american Mc clung (1902) based on chromosome study of grasshopper.

37. (c) Random genetic drift in a population probably result from interbreeding within the small isolated population.

38. (a) In *Melandrium* (the garden pink) a variety of garden flower, sex is determined by *XX-XY* type or lygaeus type of chromosomes just as in animals.

39. (c) X/A ratio determines sex in Drosophila; ♀ is heterogametic (ZW) in birds. In 'XO type' the 'O' determines maleness.

Sex linked inheritance

1. (d) Since daughter of a colourblind person will be a carrier of the disease and only one of the two *X* chromosomes will bear the recessive gene for disease, so half of their sons will be colourblind.

2. (d) When both the chromosomes bear genes for disease *i.e.* in homozygous condition, only then the character will be expressed otherwise the individual will act as a carrier.

3. (d) Because colour blindness is a recessive sex-linked disease, genes of which are present exclusively on non-homologous segment of *X* chromosome, so males need only one affected chromosome to express the character whereas females need both the affected chromosomes to exhibit the same.

4. (b) Genes for sex linked characters occurs in both segments of *X* and *Y*-chromosomes. Many sex linked characters (about 120) are found in man. Such character are mostly recessive.

5. (c) *Y*-linked disorders are caused by mutations on the *Y*-chromosome. Bacause males inherit a *Y*-chromosome from their fathers, every son of an affected father will be affected. Because females inherit an *X*-chromosome from their fathers, female offspring of affected fathers are never affected.

6. (c) Carrier mother is heterogametic for recessive colour blindness gene.

15. (d) A person whose father is colourblind i.e. person is normal because colour blind genes located on *X*-chromosome of father and it is transferred into only its daughters. This person marry with a lady whose mother is daughter of colour blind father i.e. lady is carrier for colour blind. Thus normal man marries with a carrier lady and their sons will be some normal and some colour blind.

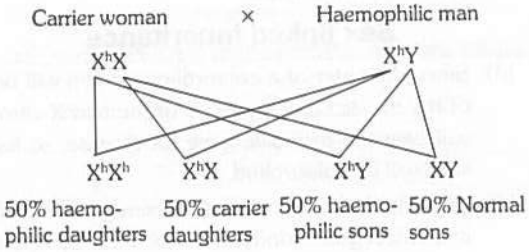
18. (c) Haemophilia is more prevalent in men as compared to women. Its recessive gene is located on *X*-chromosome. This gene suppresses synthesis of factor VIII, necessary for the normal blood clotting.

19. (d) Both are recessive sex linked diseases.

22. (b) Since woman is normal and her father was a bleeder means she is a carrier and as she marries a victim of haemophilia so only half of their children will be diseased.

29. (a) Cystic fibrosis, Thalassaemia and haemophilia are the hereditary disease.

30. (b) Chance of a boy inheriting haemophilia solely depends upon the mother's nature irrespective of his father's nature. If mother is heterozygous for disease, chances are 50% and if she is homozygous similarly, then all his sons will inherit the disease.



31. (c) XX — Normal women; X^cY — Colourblind man

♀ \ ♂	X^c	Y
X	XX^c	XY
X	XX^c	XY

The daughters of this couple will normal eye sight and carrier if one of the carrier daughter marries with normal eyed man.

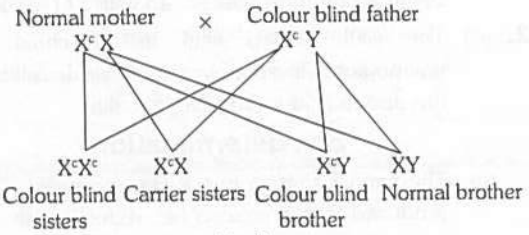
32. (c) Sickle-cell anaemia is a genetic disease reported from negroes due to a molecular mutation of gene Hb^A on chromosome 11 which produces the β chain of adult haemoglobin.

33. (d) The concept of sex-linked inheritance was introduced by Tomas H. Morgan in 1910, while working on *Drosophila melanogaster*.

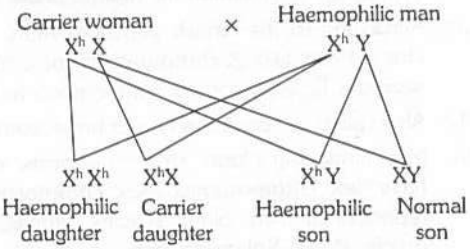
37. (b) All the sons of a colourblind mother are colourblind.

38. (c) Sex influenced genes and sex limited genes are located on autosomes. While sex linked genes are located on *X* and *Y* chromosomes.

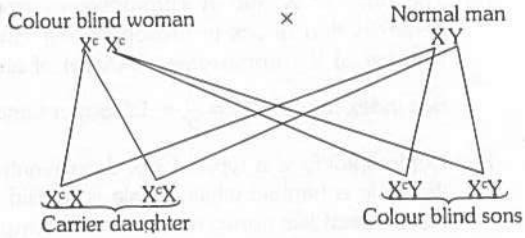
39. (a) Father colour blind and mother normal.



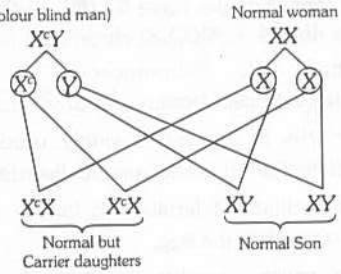
41. (b) Half Haemophilic and half carriers.



44. (b) The marriage between normal visioned man and colourblind woman will produce colour blind sons and carrier daughters.



46. (c)

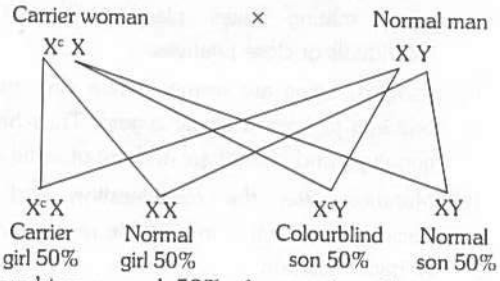


So all sons in the progeny will be normal.

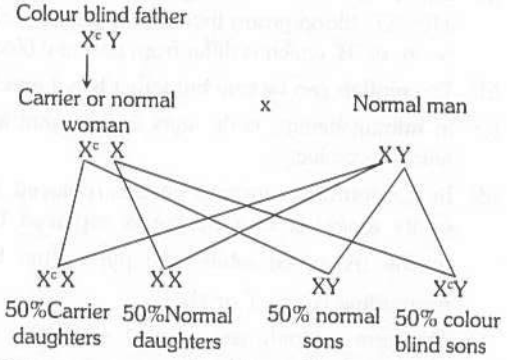
47. (b) Infact the girl with normal vision is carrier because her father is colourblind (daughter of colourblind father are either colourblind or carrier) and when she marries a normal man the possibility of their sons being colourblind is 50% because the genotype of parents is *X'X* and *XY*, so only half of the possible combinations of *XY* have the *X*-linked recessive genes which exhibit the disease.

49. (d) Sex linkage is the transmission of characters and their determining genes alongwith sex determining genes which are found on the sex chromosomes. Y chromosome of male carries a few genes but X chromosome which is common to male and female carries a number of genes.

51. (d) A woman whose father was colourblind is actually normal phenotypically but carrier of colourblindness if this woman marrying with normal man. Then



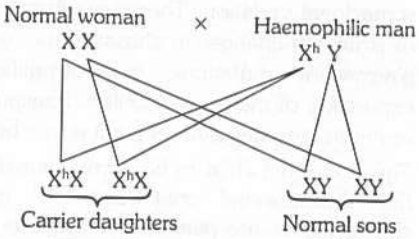
55. (a) Daughters normal, 50% of sons colour blind.



56. (d) For a woman to be colourblind both her *X* chromosomes should bear genes for the disease; which is possible only when her father is colourblind and her mother is either colourblind or a carrier of disease.

57. (a) Brachydactyly is a disease characterized by small sized finger and is due to dominant gene on the autosome.

59. (b) All offsprings will be normal.



63. (c) Colour blindness is X linked recessive disease, influencing man in heterozygous condition and woman in homozygous condition.

64. (a) Colour blind person is unable to distinguish primary colour *viz* red and green.

65. (a) aa — (Aa)

67. (b) Gene for colour blindness is located on the nonhomologous part of *X*-chromosome. It is a sex linked recessive disease.

70. (c) Sex limited genes express their effects in only one sex and their action is clearly related to the sex hormones. For *e.g.* beard and moustaches development in human beings is a sex limited character.

71. (b) Colourblindness is known as X linked recessive disease.

72. (d) Haemophilia is X linked recessive disease, clotting factor of blood is mutated and found in Royal family of England.

73. (a) In the pedigree analysis the inheritance of a particular trait is represented in the family tree over generation.

Twins & I.Q. Eugenics, Euthenics and Euphenics

1. (d) They are also known as dizygotic twins.

2. (c) Identical twins are produced when one fertilized egg divides into two blastomeres and both give rise to young ones.

3. (d) Homozygotic individuals are 'true-breeder' when crossed with each other they produce only one type of gametes because they possess two of the same alleles for a particular trait.

4. (c) Euthenics is the improvement of human race by improving the environmental conditions i.e., by subjecting them to better nutrition, better unpolluted ecological conditions, better education etc.

5. (d) The defective or undesirable persons who possess inherited defects or diseases (haemophilia, colourblindness etc. and epilepsis, feeble, idiocy etc.) should not be permitted to reproduce so that the unwanted genes are gradually eliminated from the gene pool of human population.

6. (a) Eugenics is the study of possibility of improving humanity by altering its genetic composition by encouraging breeding of those presumed to have desirable genes and discouraging breeding of those presumed to have undesirable genes.

7. (a) Eugenics is the branch of science which deals with improvement of human race genetically.

8. (d) Conjoined or siamese twins arise by incomplete separation of embryo at about 15 days or more after zygote formation.

9. (b) Identical or monozygotic twins arise from a single zygote formed by fertilization of a single egg with a single sperm. Such twins are members of a clone and have the identical genotype. These arise by the separation of two or more blastomeres derived by mitotic divisions of original zygote.

11. (d) Dizygotic also known as fraternal in which twins are formed by simultaneous fertilization of two different ova by two different sperms.

Critical Thinking Questions

2. (a) Anaphase divides the paired hereditary factors into two equal and similar halves.

6. (b) $XX \times Xx$ ..... Parents

↓

$XX\ Xx\ Xx\ xx$ ..... F_1 hybrid

In F_1 generation half of the total offsprings represent parental genotype *i.e.*, *Xx*. Therefore out of 1200 seedling 600 will have parental genotype.

9. (c) Incomplete dominance shows the 1 : 2 : 1 phenotypic and genotypic ratio.

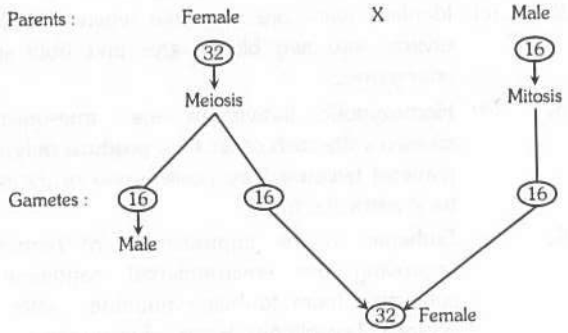
10. (d) Because mitochondrial genes also show maternal inheritance because all the mitochondria a zygote has come from the cytoplasm of the ovum.

11. (a) 20 chromosomes; because in meiosis cell division chromosome number becomes halved.

12. (c) Haploid in germinal cell, diploid in somatic cell and triploid in endosperm cells.

13. (a) Since a typical green plant is diploid, therefore it has two sets of chromosome. So the number of genome will be two because genome is a set of chromosomes.

16. (a)



Sex Determination in Honey Bee

18. (b) Cat-cry or cri-due chat syndrome is caused by the deletion of short arm of chromosome number 5 ($5p^-$). So, the genotype of affected individual in 46, *XX*, $5p^-$ in female and 46, *XX*, $5p^-$ in males.

19. (b) Frequency of crossing over is proportional to the distance of gene.

20. (d) Sir Archibald Edward Garrod was an English physician, who pioneered the field of inborn errors of metabolism. He was born on Novemeber 25, 1857, in London and died on march 28, 1936, in Cambridge.

21. (d) When a cluster of gene show linkage behaviour they do not show independent assortment because they are located very close to each other.

22. (d) During embryonic development, the primary organizer signals the development of another organ or tissue by secreting chemical factors.

24. (d) Female is larger. Many offsprings are produced from single mating.

25. (c) Translocation is a kind of chromosomal rearrangement in which a block of genes from one linkage group is transferred to another linkage group.

26. (d) Reduction division takes place during spermatogenesis. Spermatids and sperms will have haploid number of chromosomes.

27. (c) According to Radial loop model. Each chromosome has one or two interconnected scaffolds made of non histone chromosomal proteins. The scaffold bears a large member of lateral loop all over it. Each lateral loop is 30 *nm* thick fibre similar to chromatin fibre. It develops through solenoid coiling of nucleosome chain with about six nucleosomes per turn.

30. (a) The extra Y-chromosome is strongly male determining. The extra Y-chromosome leads to over production of male hormone, which causes over aggressiveness. So *XYY* men are prone to violence, criminality and antisocial behaviour.

31. (a) Recessive characters are expressed in the subsequent generation only when present on the *X* chromosome of male.

32. (b) Marriages between close relatives and cousins is not advisable because recessive lethals are carried in heterozygous conditions and express themselves only when mating takes place between two carrier individuals or close relatives.

37. (a) Identical twins are formed when one sperm fertilizes one egg to form a single zygote. They have the same genotype and phenotype and are of same sex.

38. (b) Mutation alter the configuration and position of nucleotides which is irreversible process except reverse or back mutation.

40. (b) When a man with blood group "AB" marries a woman with "O" blood group then blood group of children will be 'A' or 'B' which is differ from parental blood group.

42. (d) The mother can be true but father is not exactly true.

44. (c) In human beings, curly hairs is dominant and straight hair is recessive.

45. (d) In transition, a nitrogen base is replaced by another of its type i.e. one purine is replaced by another purine (A ⇌ G) while one pyrimidine by another pyrimidine (C ⇌ T or U).

46. (a) The term euploidy (*eu* = good + *ploid* = multiple) is applied to organisms with chromosome numbers that are multiples of some basic number. *e.g.*, *x*, 2*x*, 3*x*, 4*x*, 5*x*, 6*x*, etc.

Assertion and Reason

1. (c) The cells of the plants regenerated from cell cultures (callus) show heritable variation for both qualitative and quantitative traits, such a variation is known as somaclonal variation. These variations arise as a result of structural changes in chromosome, gene mutations, plasmagene mutations, gene amplification, altered expression of multigene families, transposable elements or mitotic crossing over. So, (A) is true but (R) is false.

2. (c) The sex of the child to be born is initially governed by the chromosomal contribution of the father. All chromosomes are paired, and the Y is dominant over the X chromosome when combined with it. A child conceived will therefore be subject during development thereafter to a predisposition towards femaleness if receiving an X chromosome from the mother and an X chromosome from the father (XX), or towards maleness if receiving an X chromosome from the mother but a Y chromosome from the father (XY). Therefore sex in human is a monogenic not polygenic.

Polygenic traits or continuous traits are those traits that are determined by the combined effect of more than one pair of genes. An example of this is human stature. The combined size of all of the body parts from head to foot determines the height of an individual. There is an additive effect. The sizes of all of these body parts are, in turn, determined by numerous genes. Human skin, hair, and eye color are also polygenic traits because they are influenced by more than one allele at different loci. The result is the perception of continuous gradation in the expression of these traits.

3. (c) Haemophilia is a blood disorder where the blood does not clot normally. Haemophilia A is the most common form, caused by a deficiency of blood clotting factor VIII. Haemophilia B is due a deficiency of blood clotting factor IX. Haemophilia is an hereditary disorder. In almost all cases, it is males that suffer the condition, although it is passed on by both females and males carrying the gene. Queen Victoria was a carrier of haemophilia A. It is also known as classical haemophilia and factor VIII deficiency haemophilia. Haemophilia B is also known as Factor IX haemophilia, and Christmas disease after the first patient diagnosed with it. Prothrombin producing platelets in such persons are not found in very low concentration.

4. (a) The first chemical mutagen discovered was mustard gas. C. Auerbach and her associates first discovered the mutagenic effects of mustard gas and related compounds during World war II. These compounds are examples of a large class of chemical mutagens that transfer alkyl (CH_3^-, $CH_3CH_2^-$ etc.) groups to the bases in DNA, thus are called alkylating agents.

5. (c)

6. (a) Carolus Linnaeus called humans as *Homo sapiens* or wise men and placed them along with apes and monkeys. There are certain similarities between human and chimpanzee. These are –
(i) RNA content of diploid cells is similar.
(ii) DNA matching shows that human similarity is 100% with chimpanzee and
(iii) Banding pattern of chromosomes shows very little difference in chromosomes 3 and 6 between humans and chimpanzee. Thus it can be concluded that among the primates, chimpanzee is the closest relative of the present day humans.

7. (a) Pollen is formed by meiosis in pollen mother cells. Hence, chromosome number will be reduced to half in pollens.

8. (d) Clones are asexually produced. These have same genotype and phenotype like parent.

9. (a) Back cross is a cross which is performed between hybrid and one of its parents. In plant breeding, back cross is performed a few times in order to increase the traits of that parent.
For example, a crop plant is crossed with a wild variety in order to obtain its disease resistance. In the process most good traits or the crop plant get diluted. The hybrid is, therefore, repeatedly crossed with parent crop plant in order to transfer the good traits back into it.

10. (a) According to Mendel's concept of inheritance, each gene had two alternative forms or allelomorphs, one being dominant and the other recessive. Practically, the wild form can mutate in several ways. The mutant form can also mutate once again to give rise to anothe mutant form. Therefore, a gene can have more than two allelomorphs. These allelomorphs make a series of multiple alleles.

11. (a) Phenylketonuria is due to deficency of liver enzyme Phenyanaline hydroxylase which converts phenylanine into tryosine. It occurs in person who are homozygous recessive. It results with a high level of phenylalanine in blood, tissue fluids and urine.

12. (a) Genotype is the hereditary properties of an organism and genetic complement of organism is called genotype.

13. (a) Holandric genes are always found on Y chromosomes of male. Hence, their inheritance is always from father to son.

14. (c) Haemophilia never occurs in women because it is a recessive gene disease if both the sex chromosome X^h X^h, it will be lethal i.e. such female die before birth. Its gene is never found on chromosome Y.

15. (a) Mutations may be either recessive or dominant. In haploid organisms like viruses and bacteria, both recessive and dominant mutations can be recognized by their effects on the phenotype of the organisms in which they originated. Therefore, in several crops desirable mutants haven been isolated among haploids derived in culture.

16. (a) The position of centromere is fixed for a chromosome. It may lie at the centre (metacentric chromosome), near the centre (submetacentric) subterminal (acrocentric chromosome) or terminal (telocentric chromosome) position. During anaphase the chromosome bends in the region of centromere. Depending upon the position of centromere, an anaphasic chromosome can have V-shape, L-shape, J-shape or I-shape.

17. (c) Genetic analyses indicate that heterochromatin is largely genetically inactive. Most of the genes of eukaryotes that have been extensively characterized are located in euchromatic regions of the chromosomes. The earlier belief that no genes are found in heterochromatic regions is not correct, because genes could be located in heterochromatic regions in several cases like *Drosophila* and tomato. The genes in heterochromatic region perhaps become active for a short period.

18. (a) The surface of centromere bears a special trilaminar plate called kinetochore. Kinetochore has points for attachment of microtubules. Microtubules produce chromosome fibres or tactile fibrils require for the movement of chromosomes during anaphase.

19. (b)

20. (b) The lampbrush chromosomes are highly elongated special kind of synapsed mid-prophase or diplotene chromosome bivalents which have already undergone crossing over. They occur in diplotene stage of most animal occystes, spermatocytes of many and even giant nucleus of unicellular alga *Acetabularia*. The number of pairs of loops gradually increase in meiosis till it reaches maximum is diplotene.

21. (a) Most sex – linked genes in male heterogametic animals are present on the X- chromosome. Some animals, however, may carry a few genes on the Y chromosome that produce visible effects on the phenotype of the organism. Y linkage is very rare in higher animal, particularly mammals. X linkage, on the other hand, is very common in all mammals that have been studied, the mammalian X chromosome contains a larger number of genes with major effects on phenotype.

22. (a) Chromosomes are stained with special fluoroscent dyes that have differential affinity for different parts of the chromosomes. It brings about specific banding pattern. Bands are segments of stained chromosomes that appear lighter, darker or stained as compared to adjacent parts. Banding technique of chromosome staining is highly useful in knowing various types of chromosomal aberrations or abnormalities like additions, deletions and inversions.

Principles of Inheritance and Variation

SET Self Evaluation Test

1. In a random mating population in equilibrium, which of the following brings about a change in gene frequency in a non-directional manner **[CBSE PMT 2003]**
   (a) Migration (b) Mutations
   (c) Random drift (d) Selection

2. Identify the correct order of organisation of genetic material from largest to smallest **[AIPMT 2015]**
   (a) Genome, chromosome, nucleotide, gene
   (b) Genome, chromosome, gene, nucleotide
   (c) Chromosome, genome, nucleotide, gene
   (d) Chromosome, gene, genome, nucleotide

3. Electroporation procedure involves **[AIIMS 2005; DUMET 2009]**
   (a) Fast passes of food through sieve pores in phloem elements with the help of electric stimulation
   (b) Opening of stomatal pores during night by artificial light
   (c) Making transient pores in the cell membrane to introduce gene constructs
   (d) Purification of saline water with the help of a membrane system

4. The total hereditary material outside the chromosome is called as **[MP PMT 2011]**
   (a) Plasmagene (b) Plasmon
   (c) Muton (d) Recon

5. Freemartin is an example of **[MP PMT 1997, 2000]**
   (a) Hormonal control of sex
   (b) Sex reversal by gene
   (c) Environmental control of sex
   (d) None of the above

6. Phenotype of an organism is the result of **[CBSE PMT 2006]**
   (a) Environmental changes and sexual dimorphism
   (b) Genotype and environment interactions
   (c) Mutations and linkages
   (d) Cytoplasmic effects and nutrition

7. Which one of the following blood group systems is determined by genes on the *X* chromosome **[MP PMT 1997]**
   (a) *Yt* (b) *ABO*
   (c) *Xg* (d) *MNSs*

8. Phenylketonuria (PKU) is an inherited disease which refers to
   (a) Decrease in phenylalanine in tissue and blood
   (b) Increase in phenyl pyruvic acid in tissue and blood
   (c) Elimination of sugar in urine
   (d) Elimination of gentisic acid in urine

9. Antigen – *A* and antibody – *B* are present in which blood group **[CPMT 1995; KCET 1999]**
   (a) *B* (b) *A*
   (c) *AB* (d) *O*

10. Which one of the following statements about the particular entity is true **[CBSE PMT (Mains) 2010]**
    (a) Centromere is found in animal cells, which produces aster during cell division
    (b) The gene for producing insulin is present in every body cell
    (c) Nucleosome is formed of nucleotides
    (d) *DNA* consists of a core of eight histones

11. In *Drosophila* female has a pair of chromosomes **[MP PMT 2011]**
    (a) Z Z (b) X X
    (c) X Y (d) Z W

AS Answers and Solutions

1	c	2	b	3	c	4	b	5	a
6	b	7	c	8	b	9	b	10	b
11	b								

1. (c) The random changes in gene frequencies occuring by chance and not under the control of natural selection are called genetic drift.

3. (c) Electroporation method are used for introduction of recombinant DNA into the host. In this procedure temporary pores are formed in the plasma membrane of the host cell. These pores permit entry of foreign DNA.

5. (a) Free martin is an examples of early influence of hormone on sex determination. Lillie and others found that when twins of opposite sex (One male and other female) are form, the male is normal but female is sterile with many male characteristics. Such sterile female is known as free martin.

8. (b) Phenylketonuria is the genetically inherited disease. It occurs due to deficiency of an enzyme phenylalanine hydroxylase which catalyses the conversion of amino acid phenylalanine into tyrosin. This results in the increased level of phenylalanine in the blood at the same time it starts depositing in various body tissue.

10. (b) 'Insulin' gene is found in every body cell but is not expressed in all cells.

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