PRINCIPLES OF INHERITANCE AND VARIATION

SECTION - A

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An Initiative by अमर उजाला

Biology By Mahesh Sir **DPP-13**

1. Mark the odd one (w.r.t. true breeding line)
   a. Shows the stable trait inheritance
   b. Shows expression for few generations only
   c. Undergone continuous self-pollination
   d. Both a and b
2. Which of the following is not a dominant trait in edible pea?
   a. Axial flower
   b. Inflated pod
   c. Green seed color
   d. Green Pod
3. The phenotype of an individual may be affected if the modified allele produces
   i. No enzyme at all
   ii. The normal/less efficient enzyme
   iii. A non-functional enzyme
   iv. Only i is correct
   a. Only i is correct
   b. i and iii are correct
   c. ii and iii are correct
   d. Only iii is correct
4. What will be possible blood group in children from the parents with B and AB blood groups?
   a. A, O
   b. A, B, AB & O
   c. A, B, AB
   d. B, O
5. In garden pea, starch is synthesized effectively in
   a. Heterozygous round seeded plants
   b. Homozygous round seeded plants
   c. Wrinkled seeded plants
   d. Pure and hybrid round seeded plants
6. F_1 progeny of Mendelian dihybrid cross produces
   a. Two types of pollen grains
   b. Four genotypes of gametes
   c. Two types of eggs
   d. Four types of pollens only
7. When Mendel self hybridized the F_1 plants (RrYy), he found that dominant and recessive traits of one character are segregated in a
   a. 9:1 ratio
   b. 3:3 ratio
   c. 10:6 ratio
   d. 3:1 ratio
8. Mendel published his work on inheritance of characters in 1865 but it remained unrecognized till 1900 because
   a. He couldn't provide any physical proof for the existence of factors
   b. His concept of factors as stable, discrete units that controlled the expression of traits did not find acceptance from the contemporaries
   c. Mendel's approach of using mathematics to explain biological phenomena was totally old
   d. Communication was not easy (as it is now)
9. Which of the following statement for chromosomal theory of inheritance is **incorrect**?
   a. Pairing and separation of a pair of chromosomes would lead to the segregation of a factor they carried
   b. Behavior of chromosomes is parallel to the behavior of genes
   c. The two alleles of a gene pair are located on homologous sites on homologous chromosomes
   d. Chromosomes as well as genes occur in pairs
10. Experimental verification of the chromosomal theory of inheritance was given by
    a. Sutton and Boveri
    b. Correns
    c. T.H. Morgan
    d. Tshermak
11. Fruit flies are one of the best materials for genetic studies because of all, except

1.(b), 2.(c), 3.(b), 4.(c), 5.(b), 6.(b), 7.(d), 8.(c), 9.(a), 10.(c), 11.(d), 12.(c)

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a. Ability to grow on simple synthetic medium in the laboratory
b. Short life span
c. Production of a large number of progeny in each mating
d. Presence of few externally visible and identifiable contrasting traits

12. Generation of non-parental gene combination is termed as
    a. Linkage
    b. Polyploidy
    c. Recombination
    d. Aneuploidy

1.(b), 2.(c), 3.(b), 4.(c), 5.(b), 6.(b), 7.(d), 8.(c), 9.(a), 10.(c), 11.(d), 12.(c)

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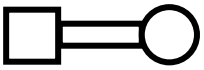
13. Initial clue about the genetic/chromosomal mechanism of sex-determination can be traced back to some of the experiments carried out in
    a. Human beings
    b. Birds
    c. Insects
    d. Plants
14. In which of the sex determination both male and female have same number of chromosomes?
    a. XY type
    b. ZO type
    c. XO type
    d. Both a and c
15. Two different types of gametes in terms of the sex chromosomes, are produced by
    a. Female fruit fly
    b. Male butterfly
    c. Male human and female *Drosphilia*
    d. Complete dominance
16. Individuals having homomorphic sex chromosomes, are produced by
    a. Only one gamete in complete life span
    b. Only type of gamete
    c. No gametes
    d. Two types of gametes
17. Which of the following phenomena leads to variation in DNA?
    a. Linkage, mutation
    b. Recombination, linkage
    c. Mutation, recombination
    d. Aneuploidy, linkage
18. Sickle cell-anaemia disorder arises due to
    a. Duplication of a segment of DNA
    b. Substitution in a single base of DNA
    c. Deletion of a segment of DNA
    d. Duplication in a base pair of RNA
19. In pedigree analysis, symbol given for sex unspecified is

    a. 
    b. 
    c. 
    d. 

20. Cystic fibrosis, Myotonic dystrophy and Thalassemia are
    a. Chromosomal disorders
    b. Autosomal recessive disorders
    c. Mendelian disorders
    d. Autosomal dominant disorders
21. Which of the following trait shows transmission from carrier female to male progeny?
    a. Autosomal dominant
    b. X-linked recessive
    c. Y-linked recessive
    d. X-linked recessive
22. Phenylketonuria is an inborn error of metabolism that is inherited as
    a. Autosomal recessive trait
    b. Sex-linked dominant trait
    c. X-linked recessive trait
    d. Autosomal dominant trait
23. Which of the following abnormalitites is due to autosomal dominant mutation?
    a. Color blindness
    b. Thalassemia
    c. Myotonic dystrophy
    d. Haemophilia
24. Absence or excess or abnormal arrangement of one or more chromosomes results in
    a. Point mutation
    b. Chromosomal disorders
    c. Mendelian disorders
    d. Gene mutation
25. Mark the **odd** one w.r.t. syndrome which occur due to failure of segregation of homologous pair of chromosomes during cell division cycle.
    a. Klinefelter's syndrome
    b. Down's syndrome
    c. Turner's syndrome
    d. Thalassemia
26. Heterozygous round and yellow seeded pea plants were selfed and total 800 seeds are collected. What is the total number of seeds with first dominant and second recessive traits?
    a. 950
    b. 300
    c. 200
    d. 150

13.(c), 14.(a), 15.(d), 16.(b), 17.(c), 18.(b), 19.(a), 20.(c), 21.(b), 22.(a), 23.(c), 24.(b), 25.(d), 26.(d)

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27. Which of the disorder is related with the Karotype given below?
    a. Turner's syndrome
    b. Down's syndrome
    c. Myotonic dystrophy
    d. Cystic fibrosis
28. Mark the **correct** match
    a. Turner's syndrome – 45 + XO
    b. Phenylketonuria – 44 + XYY
    c. Klinefelter's syndrome – 44 +XXY
    d. Thalassemia – 44 + YO
29. Physical, psychomotor and mental development is retarted in an individual affected with
    a. Down's syndrome
    b. Sickle cell-anaemia
    c. Turner's syndrome
    d. Color blindness
30. In which of the following disorder's affected individual's possess 47 chromosomes?
    a. Turner's syndrome
    b. Klinefelter's syndrome
    c. Down's syndrome
    d. Both b and c
31. The affected individuals are short statured in disorders like
    a. Turner's syndrome, phenylketonuria
    b. Down's syndrome, Turner's syndrome
    c. Klinefelter's syndrome, Down's syndrome
    d. Turner's syndrome, Klinefelter's syndrome
32. In which of the following disorder gynaecomastia
    a. Down's syndrome
    b. Turner's syndrome
    c. Klinefelter's syndrome
    d. Phenylketonuria
33. Mark the **correct** option (w.r.t. monosomy)
    a. Klinefelter's syndrome
    b. Down's syndrome
    c. Turner's syndrome
    d. Haemophilia
34. Allosomic trisomy condition is seen in
    a. Turner's syndrome
    b. Klinefelter's syndrome
    c. Down's syndrome
    d. Both b and c
35. Which of the following disorder is seen in human female only?
    a. Turner's syndrome
    b. Down's syndrome
    c. Haemophilia
    d. Klinefelter's syndrome

27.(b), 28.(c), 29.(a), 30.(d), 31.(b), 32.(c), 33.(c), 34.(b), 35.(a)

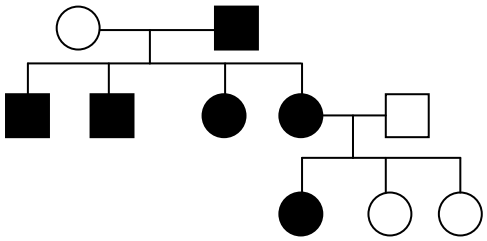
PRINCIPLES OF INHERITANCE AND VARIATION

SECTION - B

1. When a pink flowered *Antirrhinum* plant is test crossed, then phenotypic ration in resulting progenies is
   a. 1 Red: 1 White
   b. 3 Red: 1 White
   c. 2 Pink: 1 White
   d. 1 Pink: 1 White
2. Heterozygous tall and violet flowered pea plants were selfed and total 512 seeds are collected. What will be total number of seeds for both heterozygous triats?
   a. 128 b. 256 c. 384 d. 64
3. Mark the odd one (w.r.t. F_2 generation of Mendelian dihybrid cross)
   a. Frequency of TtRR genotype = 12.5%
   b. Frequency of ttrr genotype = 6.25%
   c. Frequency of TTRR genotype = 6.25%
   d. Frequency of ttRr genotype = 25%
4. Morgan hybridized yellow-bodied, white-eyed females to brown-bodied, red-eyed males and intercrossed their F_1 progeny. He observed that
   A. F_2 ratio was deviated very significantly from the 9:3:3:1 ratio
   B. Both genes did not segregate independently of each other
   C. Recombinant types are not obtained in F_2 generation
   D. Both genes segregate independently of each other
   Select the **correct** set of statements:
   a. A and B only
   b. B and C only
   c. B and D only
   d. C and D only
5. __(A)__ used the frequency of recombination between gene pairs on the __(B)__ as a measure of the distance between genes and mapped their position on the chromosome.

	(A)	(B)
a.	Morgan	Same chromosome
b.	Sturtevant	Different chromosomes
c.	Morgan	Different chromosomes
d.	Sturtevant	Same chromosome

6. While solving the problem of sex determination in large number of insects, it was observed that
   a. All eggs lack sex chromosome
   b. Some of the sperms bear the X-chromosome
   c. All eggs as well as sperms bear the X-chromosome
   d. Some of the eggs bear the X-chromosome
7. Loss or gain of a segment of DNA results in
   a. Frame-shift mutation
   b. Point mutation
   c. Polyploidy
   d. Chromosomal aberration
8. Which one of the following is a physical factor that induce mutation?
   a. Acridines
   b. HNO_2
   c. UV-rays
   d. Base analogue
9. In the given pedigree, indicate whether the shaded symbols indicate dominant or recessive allele.



   a. Recessive
   b. Codominant
   c. Dominant
   d. It can be recessive or dominant both
10. In which of the following disorder a single protein that is a part of the cascade of proteins involved in blood clotting is affected?
    a. Thalassemia
    b. Sickle-cell anaemia
    c. Haemophilia
    d. Phenylketonuria

1.(d), 2.(a), 3.(d), 4.(a), 5.(d), 6.(b), 7.(d), 8.(c), 9.(d), 10.(c)

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11. Mark the **correct** statement (w.r.t. sickle cell-anaemia)
    a. Homozygous individuals for Hb^5 are apparently unaffected
    b. Heterozygous individuals exhibit sickle-cell trait
    c. Heterozygous individuals are affected as well as carrier
    d. Homozygous individuals for Hb^A show the diseased phenotype
12. The defect sickle-cell anaemia is caused by the _____ of glutamic acid by valine at the 6^{th} position of the _____ globin chain of the haemoglobin molecule.
    a. Substitution, ß
    b. Deletion, α
    c. Duplication, ß
    d. Translocation, α
13. A Y-linked gene is responsible for hypertrichosis (long hair on ears). When an affected man marries a normal woman, what percentage of their daughters would be expected to have hairy ears?
    a. 25% b. 0% c. 50% d. 100%
14. A normal woman, whose father had color blindness, marries a normal man. What is the chance of occurrence of color blindness in the progeny?
    a. 25% b. 50% c. 100% d. 75%
15. Mr. Stevan is suffering from haemophilia and cystic fibrosis. His father is heterozygous for cystic fibrosis. The probability of Stevan's sperm having recessive X-linked as well as autosomal allele is
    a. $\frac{1}{4}$ b. $\frac{1}{16}$ c. $\frac{1}{2}$ d. $\frac{1}{8}$
16. Select incorrect one (w.r.t. reciprocal cross)
    a. To know whether the alleles are present on sex chromosomes or autosomes
    b. It is made to eliminate the effect of nuclear traits
    c. Two individuals with coast genotypes are involved
    d. Results are not changed for autosomal traits
17. The chromosome maps are not sure maps because
    a. Crossing over frequency is higher than recombination frequency
    b. One crossing over interferes and increases the frequency of nearby crossing over
    c. Crossing over frequency decreases towards the ends of chromosome
    d. Heterochromation increases crossing over
18. In *Lathyrus odoratus*, hybrid blue powered and long pollen plant is test crossed with homozygous recessive red flowers and round pollen plant then how many parental types are obtained when genes present in *cis* stage in parents?
    a. 50% b. 43.7% c. 87.4% d. 12.6%
19. Find out the frequency of AabbCcDdee if parents are AabbCCddEe and AabbccDdee
    a. 0.78% b. 12.5% c. 25% d. 50%
20. In incomplete dominance
    a. Dominant trait is completely expressed in F_1 generation
    b. Phenotypic and genotypic ratio are different
    c. Two dominant alleles are needed to express the complete dominant trait
    d. F_1 individuals have the equal traits of both parents
21. Progeny with blood group 'O' cannot be obtained in cross
    a. A × A b. A × B c. O × AB d. B × B
22. If a agouti mice (CcAa) is crossed with albino mice (ccAA), then how many albino mice are produced in resulting progeny?
    a. 4 b. 9 c. 2 d. 3
23. Match the following – (w.r.t. Pedigree analysis)

Column – I	**Column – II**
(1) Solid symbol	(i) Carrier of sex linked trait
(2) Horizontal line between symbols	(ii) Offspring
(3) Horizontal line above the symbols	(iii) Trait to be studied
(4) Dot in center	(iv) Parents

    a. (1)(iv), (2)(iii), (3)(ii), (4)(i)
    b. (1)(ii), (2)(iii), (3)(iv), (4)(i)
    c. (1)(iii), (2)(iv), (3)(ii), (4)(i)
    d. (1)(i), (2)(ii), (3)(iv), (4)(iii)

11.(b), 12.(a), 13.(b), 14.(a), 15.(c), 16.(b), 17.(a), 18.(c), 19.(b), 20.(c), 21.(c), 22.(c), 23.(c)

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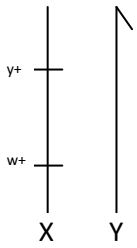
24. Which of the following parental combination has produced mutant offspring?
    a. Tt × tt = Tt
    b. tt × tt = Tt
    c. Tt × Tt = tt
    d. TT × tt = Tt
25. Epistasis and dominance are respectively
    a. Intragenic, Intergenic
    b. Non-allelic, Extra-allelic
    c. Non-allelic, Interallelic
    d. Intergenic, Non-allelic
26. Which of the following combination seems to have some linkage in character selected by Mendel?
    a. Stem height and pod color
    b. Flower color and flower position
    c. Seed shape and seed color
    d. Plant height and pod shape
27. A diploid organism is heterozygous for five loci and homozygous for 2 loci, how many types of gametes can be produced?
    a. 128 b. 32 c. 4 d. 14
28. Lesch Nyhan disease is an X-linked recessive disorder that causes neurological damage in human beings. A survey of 500 mates from a caucasian population revealed that 20 were affected with this disorder. What is the frequency of the normal allele in this population?
    a. 9.6 b. 0.8 c. 0.096 d. 96
29. How many types of zygotic combinations are possible between a cross Aa BB Cc Dd x AA bb Cc DD?
    a. 32
    b. 128
    c. 64
    d. 16
30. In a complimentary gene interaction calculate the number of phenotype and genotype produced in a cross AaBb × aaBB
    a. 1 phenotype, 2 genotypes
    b. 2 phenotypes, 4 genotypes
    c. 4 phenotypes, 4 genotypes
    d. 2 phenotypes, 2 genotypes
31. Select **incorrect** statement
    A. Linked genes cause absolute lethality
    B. Persons affected by PKU do not show mental disorder
    C. F_2 ratio in codominance and incomplete dominance are same
    D. Sex of male Drosophila is dependent on Y-chromosome
    a. (A) & (B)
    b. (B) & (C)
    c. (A), (B) & (C)
    d. All of these



32. In phenylketonuna
    a. Break down of phenylaianine is rapid
    b. Accumulation of phenylalnine in body
    c. Chromosomal constitution of patient changes
    d. TSD gene situated on chromosome 15 undergoes
33. How many types of gametes will be produced by a mutation ♂ Drosophila having following arrangement of two genes (y^+ and w^+) on X-chromosome?
    a. 2 b. 4 c. 1 d. 8
34. If interference is complete or cent percent then the frequency of observed double crossover will be
    a. Equal to expected frequency
    b. Greater than expected frequency
    c. Lesser than expected frequency
    d. Zero

24.(b), 25.(c), 26.(d), 27.(b), 28.(b), 29.(d), 30.(b), 31.(c), 32.(b), 33.(a), 34.(d), 35.(d)

35. If F_2 generation of a Mendelian dihybrid cross (TTRR × ttrr)
    a. Tall plants and violet flowered plants are obtained in 1:1 frequency
    b. Ratio of parental and non-parental plants is 1:15
    c. Recombinant plants are obtained in 1:1 frequency
    d. More than one option is correct