Cytogenetics and Plant Breeding

K1 and K2 level questions

I. Choose the correct answer:

1. The term chromosome was introduced by

   (a) Waldeyer (b) Bridges (c) Balbiani (d) Flemming

2. The bacterial chromosomes are

   (a) circular (b) linear (c) metacentric (d) submetacentric

3. In a chromosome, the chromatids are joined at a point called

   (a) centriole (b) centrosome (c) centromere (d) satellite

4. The chromosomes are visible clearly at

   (a) prophase (b) metaphase (c) anaphase (d) telophase

5. The stability to terminal part of the chromosome is offered by

   (a) satellite (b) centromere (c) histones (d) telomere

6. The five types of histones found in chromatin are

   (a) H1, H2, H3A, H3b and H4 (b) H1, H2B, H3B, H3D and H4

   (c) H1, H2A, H2B, H3 and H4 (d) H1, H2A, H2B, H3B and H4

7. Multiple copies of ribosomal genes are found in

   (a) centromere (b) nucleolar organizer (c) chromatied (d) telomere

8. L shaped chromosomes are called

   (a) telocentric (b) acrocentric (c) sub- metacentric (d) metacentric

9. Human diploid cell generally contains

   (a) 44 sex chromosomes and 2 autosomes (b) 2 sex chromosomes and 44 autosomes
   (c) 1 sex chromosome and 22 autosomes (d) 3 sex chromosomes and 44 autosomes

10. In human beings,

(a) the male has YY and the female XX chromosomes
(b) the male has XY and the female XO chromosomes
(c) the male has XO and the female XX chromosomes
(d) the male has XY and the female XX chromosomes

11. Centromere is absent in ……. chromosome.

(a) metacentric (b) sub-metacentric c) double minutes (d) acrocentric

12. Accessory chromosomes, refer to

(a) autosomes (b) B-choromosomes (c) double minutes (d) sex chromosomes

13. The chromosomes that reduces the viability of the organism is called

(a) B-choromosome (b) autosome (c) double minutes (d) sex chromosome

14. B-chromosomes are found in

(a) Man (b) pisum (c) Drosophila (d) Maize

15. Salivary glands of Drosophila contain special type of chromosomes called

(a) polytene chromosomes (b) lamp brush chromosomes

(c) double minutes (d) B-chromosomes

16. Polytene chromosomes were first observed by

(a) Bridges (b) Balbiani (c) Waldeyer (d) Flemming

17. Lamp brush chromosomes were first observed by

(a) Flemming (b) Waldeyer (c) Balbiani (d) Bridges

18. Lamp brush chromosomes are seen in

(a) Drosophila (b) Solamader (c) Nostac (d) Maize

19. Lateral loops of DNA are found in

(a) polytene chromosome (b) double minutes

(c) B-chromosome (d) lamp brush chromosome

20. Dark and interbands are seen in

(a) polytene chromosome (b) double minutes

(c) lamp brush chromosome (d) B-chromosome

21. A cell in G1 of interphase has 12 chromosomes how many chromatids will be found during metaphase two of meiosis

(a) 6 (b) 12 (c) 18 (d) 24

22. How many mitotic division must occur in a cell of the root tip to form 128 cells

(a) 7 (b) 8 (c) 64 (d) 128

23. Chromosome exhibit minimum coiling during

(a) prophase (b) metaphase (c) anaphase (d) telophase

24. Down syndrome is caused due to nondisjunction of chromosomes at

(a) Anaphase of mitosis (b) Metaphase I of meiosis

(c) Anaphase I of meiosis (d) Telophase I of meiosis

25. Amitosis is

(a) Cleavage of nucleus without recognizable chromosomes

(b) a division in which chromosomes are unequally distributed

(c) a division in which chromosome bridge are formed

(d) a division in which spindles are formed

26. Frame shift mutation is caused due to----------

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

27. The type of chromosomal aberration which does not change the number of genes is

(a) Duplication (b) translocation (c) addition (d) Deletion

28. **Non-heritable mutations are**

(a) Point mutation (b) Gene mutation (c) Lethal mutation (d) Somatic mutation

29. The most important example of point mutation is found in diseases called?

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

30. The world gene was coined by

(a) Bridges (b) Johannsen (c) Waldeyer (d) Balbiani

31. Haploid set of chromosomes in garden pea is

(a) 7 (b) 14 (c) 12 (d) 23

32. The experiments on *Lathyrus odoratus* to prove linkage were carried over by

(a) Beadle and Tatum (b) Bateson and Punnet

(c) Bateson and Balbiani (d) Johnnsen and Punnet

33. Crossing over takes place between

(a) non sister chromosomes of homologous chromosomes

(b) non sister chromosomes of heterologous chromosomes

(c) sister chromatids of heterologous chromosomes

(d) sister chromatids of homologous chromosomes

34. Crossing over takes place in …..... stage of prophase I of meiosis

a) leptotene (b) zygotene (c) pachytene (d) diplotene

35. The term mutation was first used by

(a) Hugo de Vries (b) Charles Darwin (c) Bateson (d) Jhonnsen

36. Hugo de Vries observed mutation in

(a) Hibiscus (b) Sorghum (c) Oenothera (d) Cicer

37. When a purine is replaced by another purine in the structure of DNA, this kind of gene mutation is called

(a) transversion (b) transition (c) deletion (d) addition

38. An example for chemical mutagenic agent is

(a) EMS (b) UV rays (c) X-rays (d) temperature

39. One of the best approaches for the improvement of crops is

(a) linkage (b) crossing over (c) pure line selection (d) mutant

40. The functional unit of gene is

(a) cistron (b) recon (c) muton (d) micron

41. The type of chromosomal aberration found in maize is

(a) deletion (b) duplication (c) inversion (d) translocation

42. A man has enlarged breasts, spare hair on the body and sex complement as XXY. He suffers from

(a) Down's syndrome (b) Klinefelter's syndrome

(c) Turner's syndrome (d) Edward's syndrome

43. In order of genes in a chromosome a,b.c.d,e,f,g and h becomes a,b,c,d,g,f,e and h. This type of chromosomal is called

(a) duplication (b) inversion (c) deletion (d) translocation

44. In order of genes in a chromosome a,b.c.d,e,f,g and h becomes a,b,c,d,e,f,g,h,g and h. This kind of chromosomal is called

(a) duplication (b) translocation (c) deletion (d) inversion

45. When the inverted segment at the chromosome has no centromere, this kind of inversion is called

(a) paracentric (b) pericentric (c) metacentric (d) sub-metacentric

46. At the time gametes formation, the chromosome number

(a) remains the same (b) is doubled (c) is trippled (d) is halved

47. Union of two gametes leads to formation of

(a) euploidy (b) diploidy (c) hyperploidy (d) polyploidy

48. Grapes and apples are

(a) autotetraploids (b) autotriploids (c) allotetraploids (d) allotriploids

49. Which one of the following is hypoploidy?

(a) 2n (b) 2n+1 (c) 2n+2 (d) 2n-n

50. 2n-2 refers to

(a) monosomy (b) trisomy (c) nullisomy (d) tetrasomy

51. Tetrasomy is repredented by

(a) 3n (b) 2n+1 (c) 2n+2 (d) 2n-2

52. The strongest evidence that DNA is a genetic material comes from

(a)The finding DNA is not present in the cytoplasm

(b) The fact that chromosome are made of DNA

(c) Studies of bacterial transformation

(d) The knowledge that DNA is present in the Nucleus

53. Avery and his coworkers showed the "transforming principle" as

(a) Protein (b) Polysaccharide. (c) DNA (d) RNA

54. Griffith worked with

(a) Bacteriophage (b) Drosophila (c) Frog eggs (d) Streptococcus

55. Which of the following statements about lac operon in *E.coli* is true?

a) Promoter is the binding site for the lac repressor
b) Operon is only switched on in the absence of lactose in the growth medium
c) β-galactosidase is only produced in large quantities when the lac repressor is bound to the operator
d) Lac operon mRNA is a polycistronic mRNA

56. Which of the following increases gene expression as much as 200-fold?

a) TATA box
b) Insulator
c) Enhancer
d) CAAT box

57. Where does a repressor bind an operon?

a) Operator
b) Promoter
c) Inducer
d) Catabolite activator site

58. Which of the following is not required for the expression of genes in the lactose operon?
    a) lacl gene product
    b) cAMP
    c) Allolactose
    d) Adenylate cyclase

59. If glucose is absent, but so is lactose, the lac operon will be

    a) activated
    b) repressed
    c) mutated
    d) activated but only partially

60. Post-translational control refers to:

    a) regulation of gene expression after transcription

    b) regulation of gene expression after translation

    c) control of epigenetic activation

    d) period between transcription and translation

61. Science that involves changing of the genetic content (genotype) for plant improvement

    a) **Plant Breeding**

    b) Horticulture

62. Gene locus when its cells contain two different alleles

    a) Homozygous

    b) **Heterozygous**

63. A particular gene that has identical alleles on both chromosomes

    a) **Homozygous**

    b) Heterozygous

64. Group of individuals from a species r distinct in morphology, function, yield from other group

    a) Population b) **Variety**

    c) Homozygous d) Heterozygous

65. Overall genetic content of an individual / plant

a) **Genotype**

b) Phenotype

66. Appearance / morphology / traits / characteristics of an individual that can be measured

a) Genotype

b) **Phenotype**

67. Different colors of corn is a characteristic of ____feature

a) **Qualitative**

b) Quantitative

68. Different heights of tree is a characteristic of ____feature

a) **Quantitative**

b) Qualitative

69. Mendel started the study of hybridization in

a) Psidium guajava

b) Pisum sativum

70. Three or more sets of chromosomes

a) **Polyploidy**

b) Diploid

71. _____are derived from within a single species

a) **Autopolyploidy**

b) Allopolyploidy

72. _____arise via hybridization between two species

a) **Allopolyploids**

b) Autopolyploids

73. The plant variety protected in India include

a) Extant variety

b) Essentially derived variety

c) Farmer's variety

d) All the above

74. Farmer can be considered as breeder

a) Yes

b) No

c) Yes in some cases

75. To register a plant variety, the criteria require include

a) New

b) Distinct

c) Uniform

d) All the above

76. an asexual plant propagation technique where by aerial stems are induced to form roots.

a) Air layering

b) Tip layering

77. Mature ovule from genetically different parents → hybrid seed

a) **True**

b) False

78. Having two different alleles at the same locus on homologous chromosomes → heterozygous

a) **True**

b) False

79. Capacity of a seed or spore to germinate

a) stability

b) liability

c) **viability**

d) mobility

80. The union of a segment of a plant, the scion, with a rooted portion, the stock

a) layering

b) cutting

c) crowning

d) **grafting**

81. Golden rice is the result of which type of plant breeding method?

a) Mutation breeding

b) Artificial selection

c) **Genetic modification**

d) Hybridization

82. An example of a heterozygous but homogenous population is

a) **pure line**

b) hybrid variety

c) synthetic variety

d) open pollinated variety

83. Observe and answer

Assume a plant breeder performs marker-assisted selection on the DNA in seeds in order to increase the efficiency of their breeding program. They perform these operations:
A. Set up a PCR reaction.
B. Run an electrophoresis gel or sequence selected fragments of the plant genome
C. Isolate DNA
D. Collect a tissue sample

a) B C A D

b) D C A B

c) C D B A

d) D C B A

84. Hybrids involving different species of the same genus are called

a) inter varietal

b) inter generic

c) inter specific

d) intra generic

85. Hybrids involving different genera are called

a) intervarietal

b) intergeneric

86. when the hybrid is between parents of the same species but belonging to different populations

a) Intervarietal

b) Intravarietal

87. increase in characteristics as size, growth rate, fertility, and yield of a hybrid

a) hybrid vigour

b) hybrid weakness

88. It can be done with the help of forests and Natural Reserves.

a) In situ conservation

b) Ex situ conservation

89. it is done through botanical gardens, seed banks.

a) In situ conservation

b) Ex situ conservation

90. *Saccharum Barberi* is a native of North India and S. *officinarum* belongs to South India.

a) **True**

b) False

91. A method of breeding most commonly used when the desired variation is required to be induced in a vegetatively propagated crop is:

a) **Polyploidy** b) Pedigree method of breeding

c) Mutation breeding d) Backcross method of breeding

92. A plant breeder is interested to control pollination to:

a) Prevent cross-pollination b) Control pollination

c) None of these d) **Both of these**

93. Self-pollinated species are also known as_____ species or inbreeders.

a) Allogamous b) **Cleistogamy** c) Chasmogamy d) Autogamous

94. Plant breeding is a science and art and technology which deal with _____improvement of crop plants in relation to their economic use for mankind.

a) Yield b) Production c) **Genetic** d) Good

95. Plant variety protection is required

a) To get higher yield

b) To get more paste resistant plant

c) To promote research and development

d) All the above

96. The plant variety protected in India include

a) Extant variety

b) Essentially derived variety

c) Farmer's variety

d) All the above

97. To register a plant variety, the criteria require include

a) New

b) Distinct

c) Uniform

d) All the above

98. UPOV is

a) Convention for plant variety

b) United states patent

c) Convention for patent

d) None of the above

99. Selection of homozygous plants is---------

a) Mass selection b) **Pureline selection**

c) Clonal selection d) Random selection

100. Breeding for diseases resistance requires

a) Good source resistance

b) Disease test

c) Planned hybridization

d) **All of the above**

K3 Level questions

Unit 1

1. What is chromosome labeling? Explain
2. Discuss the various phases of mitotic cell division and explain their biological significance.
3. Discuss about the application of cytogenetics
4. Define chromosome and explain its types.
5. Write short notes on qualitative chromosomal aberrations.
6. What is the significance of meiosis?
7. Name the stage of cell cycle at which one of the following events occur:
   (i) Chromosomes are moved to spindle equator.
   (ii) Centromere splits and chromatids separate.
   (iii) Pairing between homologous chromosomes takes place.
   (iv) Crossing over between homologous chromosomes takes place.

Unit 2

8. Comment on incomplete dominance with suitable examples.
9. Briefly discuss the reasons for Mendel's successes.
10. Define- Epistasis? Explain dominant epistasis.
11. Describe the duplicate gene interaction with suitable examples.
12. Describe complementary gene interaction with suitable examples.
13. Describe with suitable examples for supplementary gene interaction.
14. Why is genetic linkage important? Explain
15. State the law of segregation. Explain monohybrid cross experiment in pea plant.

Unit 3

16. Explain in detailed about physical and chemical mutagens.
17. Write about point and frame shift mutation.
18. Write short notes on gene regulatory mechanisms of eukaryotes.
19. Define- mutations and explain its Classification.
20. Write short notes on suppressor mutation.
21. What is epigenetics and how does it work?
22. What is an epigenetic disease?

Unit 4

23. What are objectives of plant breeding?
24. What are major achievements of plant breeding in India?
25. Describe the brief introduction to breeding of cultivated plants.
26. Discuss about the objectives of the plant breeding.
27. What is intergeneric hybridization? Explain with examples

28. Discuss about the clonal selection and write merits and demerits
29. Write briefly about haploids in plant breeding.
30. What is polyploidy? Explain its role in plant breeding.
31. Describe the improvement of crop plants by pedigree method and bulk method.
32. Distingue between bulk method and backcross method
33. Discuss about the merits and demerits of mass selection in plant breeding.

Unit 5

34. Discuss about the marker assisted breeding.
35. Comment the role of IBPGR and NBPGR in germplasm conservation.
36. Distinguish between intervarietal and interspecific hybridization in plant breeding.
37. Describe in brief about protection of Plant Varieties & Farmers' Rights Authority.
38. Define germplasm conservation and its role in plant breeding.

K4 Level questions

Unit 1

1. Elaborate on the various types of chromosomal aberrations with suitable sketches.
2. Define- Chromosome? Describe the various types of chromosome.
3. Distingue between mitosis and meiosis
4. Distingue between mitosis and meiosis
5. Describe the following: (a) synapsis (b) bivalent (c) chiasmata, Draw a diagram to illustrate your answer

Unit 2

6. Enumerate on theories concerned with crossing over with suitable sketches.
7. Describe the inheritance pattern in a Duplicate gene action assuming genes A and B. Write your conclusions.
8. A brode leaves (BB) and red flower (RR) with a plant having narrow leaves (bb) and white flowers (rr), the F1 hybrids (BbRr) are having intermediate leaves and pink flowers. When such individuals are inter crossed: What are the genotypes and phenotypes and their ratios Write down the proportion of individuals with
    a. broad leaves
    b. narrow leaves
    c. red flowers
    d. white flowers.
9. Enumerate on theories concerned with crossing over with suitable sketches.
10. Write an essay on sex-linked inheritance.

Unit 3

11. Briefly discuss the gene regulatory mechanisms of eukaryotes.

12. Define- mutations and explain its Classification.
13. Explain DNA is a genetic material with suitable experiment
14. Describe in detailed about the regulation of gene expression in prokaryotes.
15. Describe in detailed about the regulation of gene expression in eukaryotes.

Unit 4

15. Prepare an essay on polyploidy and haploids in plant breeding.
16. Discuss about the clonal selection and write merits and demerits.
17. Explain the applications of bulk and back cross methods in plant breeding programme.
18. Describe the applications of pure line and mass selection methods in plant breeding programme.
19. Describe the improvement of crop plants by pedigree method and bulk method.
20. Define and explain about pureline selection. Describe their merits and demerits.

Unit 5

21. Enumerate and write on national and international organizations for crop improvement.
22. Write best definition for heterosis and hybrid vigour and explain in detail
23. Prepare an essay on germplasm conservation for rice and sugarcane.
24. What are the steps involved in marker assisted breeding.
25. Explain in detail about IBPGR and NBPGR in germplasm conservation.
26. Distinguish between intervarietal and interspecific hybridization in plant breeding.
27. Describe in detailed about protection of Plant Varieties & Farmers' Rights Authority.