

ENTRANCE EXAMINATIONS - 2023**Ph.D. Plant Sciences****Time:** 2 hours**Maximum marks:** 70**Hall Ticket No.:****INSTRUCTIONS**

Read the following instructions carefully before answering the questions:

1. Enter your Hall Ticket number both on the top of this page and on the OMR answer sheet.
2. This booklet contains seventy (35 each in Part-A and Part-B) Multiple Choice Questions (MCQs) printed on 11 pages.
3. Each question carries one mark, and there is no negative marking.
4. The marks obtained in Part-A will be used for resolving the tie cases.
5. Please ensure that this booklet contains the requisite number of pages and that no page is torn or mutilated.
6. Answers should be marked on the OMR answer sheet, which is provided separately.
7. After the test, hand over the OMR answer sheet to the invigilator.
8. No additional sheets will be provided. The last page of this booklet shall be used for rough work.
9. Use of a calculator or mobile phone is not permitted.

PART-A

1. Plant development is driven by asymmetric cell divisions. The earliest marker for asymmetry during embryogenesis is ____.

A) Abscisic acid B) Gibberellins
C) Auxin D) Nitric oxide

2. Which of the following photoreceptors in plants has an amino acid acting as a chromophore for light absorption?

A) phytochrome B) cryptochrome
C) phototropin D) UVR8

3. What is the difference between starch and cellulose?

A) Starch is a polysaccharide, whereas cellulose is a polypeptide
B) Both are polysaccharides of glucose; starch has α -1 \rightarrow 4 linkages whereas cellulose has β -1 \rightarrow 4 linkages
C) Both are polysaccharides; starch is a polymer of glucose, whereas cellulose is a polymer of fructose
D) Starch is present in plants, whereas cellulose is exclusively present in bacteria

4. To prepare a wash buffer of 1 L containing 50 mM Tris-HCl, 100 mM NaCl, pH 8.0 with 0.05% Tween 20, what volumes of the following stock solutions be mixed and made up the volume?

Stock solutions: 1 M Tris-HCl, pH 8.0, 1 M NaCl and 50% Tween 20.

A) 50 ml of Tris-HCl, 150 ml of NaCl, 5 ml of Tween 20 in 745 ml of ddH₂O
B) 100 ml of Tris-HCl, 10 ml of NaCl, 10 ml of Tween 20 in 880 ml of ddH₂O
C) 50 ml of Tris-HCl, 100 ml of NaCl, 1 ml of Tween 20 in 849 ml of ddH₂O
D) 25 ml of Tris-HCl, 100 ml of NaCl, 5 ml of Tween 20 in 870 ml of ddH₂O

5. Match the following:

(p) An accidental cell death	(i) Anastomosis
(q) Blebbing of membranes	(ii) Plasmolysis
(r) Fusion between fungal hyphae	(iii) Apoptosis
(s) Hyperosmotic stress	(iv) Necrosis

A) p (iii), q (iv), r (i) s (ii)
B) p (iv), q (iii), r (i), s (ii)
C) p (i), q (iii), r (ii), s (iv)
D) p (iv), q (iii), r (ii), s (i)

6. Which of the following statements is/are CORRECT?
- (i) Heterochromatin is associated with active genes.
 - (ii) Heterochromatin is usually found in centromeric regions.
 - (iii) Heterochromatin is located in the dark bands of polytene chromosomes.
 - (iv) Heterochromatin carries unique and single-copy genes.
- A) (i) and (ii) B) (ii) and (iii)
C) (i) and (iii) D) (i) and (iv)
7. The equilibrium model of island biogeography proposed by MacArthur and Wilson assumes that the number of species on an island represents a balance between ____.
- A) Colonization rate and extinction rate
B) Resource consumption rate and predation rate
C) Birth rate and death rate
D) Speciation rate and hybridization rate
8. Three polypeptides (A, B and C) whose masses are 55, 50, and 75 kDa with pI of 6.5, 7.0 and 8.0, respectively, were subjected to standard reducing SDS-PAGE. The order of their separation from top to bottom would be ____.
- A) A, B and C B) B, A and C
C) A, C and B D) C, A and B
9. Which mode of speciation refers to a large population of a species being separated due to the formation of a physical barrier such as a mountain or a river, leading to reproductive isolation and blockage of gene flow, eventually leading to the formation of two new species?
- A) Parapatric B) Allopatric
C) Sympatric D) Myxopatric
10. In *Neurospora crassa*, a fungus with ordered tetrads, a gene is located at a distance of 12 map units from the centromere. The expected frequency of second-division segregation of the genes is ____.
- A) 6 B) 12
C) 24 D) 30
11. Which of the following techniques cannot determine the molecular mass of the protein?
- A) SDS-PAGE B) MALDI-TOF
C) Chromatofocusing D) Gel filtration Chromatography
12. An enzyme has a K_M of 10 mM and V_{max} of 30 mM/s. Assuming Michaelis-Menten kinetics, the reaction velocity at a substrate concentration of 20 mM will be ____ mM/s.
- A) 10 B) 15
C) 20 D) 30

13. How many reading frames are tested before identifying the right ORF?
- A) 1
B) 3
C) 4
D) 6
14. In *Chlamydomonas reinhardtii*, two chloroplast markers, 'a' and 'b', were identified. What genotypes of progeny are expected from the cross $a^+ b^- mt^+ \times a^- b^+ mt^-$? (mt^+ and mt^- denote alleles for the mating type-loci)
- A) $\frac{1}{2} mt^+ a^+ b^- : \frac{1}{2} mt^- a^- b^+$
B) $\frac{1}{2} mt^+ a^+ b^- : \frac{1}{2} mt^- a^+ b^-$
C) $\frac{1}{2} mt^+ a^+ b^- : \frac{1}{2} mt^+ a^- b^+$
D) $\frac{1}{2} mt^+ a^+ b^+ : \frac{1}{2} mt^- a^- b^-$
15. A cross is made between two pure lines of sesame, one carrying a black seed coat colour and the other having white seed coat colour. If the black seed coat colour is dominant over the white seed coat colour, what would be the phenotypes of the resulting progeny in F2 generation?
- A) $\frac{1}{2}$ black : $\frac{1}{2}$ white
B) All black
C) $\frac{3}{4}$ black: $\frac{1}{4}$ white
D) All white
16. If organisms A, B, and C belong to the same class but to different orders, and if organisms D, E, and F belong to the same order but to different families, which of the following pairs of organisms would be expected to show the greatest degree of structural homology?
- A) A and B
B) A and C
C) B and D
D) D and F
17. 100 ml of 0.1 M sodium acetate solution has a pH of 8.9. To this solution, 1000 μ l of 1 M acetic acid ($pK_a = 4.76$) of pH 2.8 is added. The pH of this mixture will be ____.
- A) 8.9
B) 4.76
C) 2.8
D) 5.76
18. A researcher wants to identify the orientation of a cloned DNA fragment in a plasmid vector by using PCR. Suggest the combination of primers for this purpose.
- A) Two gene-specific primers
B) Two vector-specific primers
C) One gene-specific primer and one vector-specific primer
D) Not possible with PCR
19. The negative selection approach, which employs counter-selective agents to kill wild-type cells followed by rescue of surviving mutant cells on a specific medium, can be used to isolate the following mutants from plant cell cultures.
- A) Herbicide resistant mutants
B) Antibiotic resistant mutants
C) Disease resistant mutants
D) Auxotrophic mutants

20. A plant of the genotype AaBb is selfed. The two genes are linked and are 50 map units apart. What proportion of the progeny will have the genotype aabb?
- A) 1/2 B) 1/4
C) 1/8 D) 1/16
21. Which one of the following is TRUE for cells harboring F' plasmid?
- A) The F plasmid is non-functional
B) They exhibit increased rates of transfer of all chromosomal genes
C) They are merodiploids
D) They fail to survive as the chromosomal origin of replication is inactivated
22. A double-stranded DNA contains 20% of cytosine. What is the amount of A and T put together?
- A) 20% B) 30%
C) 50% D) 60%
23. The CO₂ compensation point for C₃ plants is greater than for C₄ plants because in C₃ plants ____.
- A) Photorespiration is present
B) Photorespiration is absent
C) Dark respiration is higher
D) Dark respiration is lower
24. Nitrogenase, a complex metal-containing enzyme, is involved in the conversion of N₂ into NH₃. Which one of the following metals are involved in activating the nitrogenase?
- A) Iron B) Molybdenum
C) Copper D) Cobalt
25. Of the dsDNA sequences given below, the sequence that is expected to have a higher melting temperature is ____.
- A) ATGACATTATTACATTAGTG
B) ATTATTATACGTATTTATAT
C) CGCGATCGGGGATTACGAGC
D) GCGCGTGCATGCCCGATGCC
26. In the specialized transduction of a gal⁻ bio⁻ strain of *Escherichia coli* using bacteriophage lambda from a gal⁺ bio⁺ lysogen, the medium that can be used to select for gal⁺ bio⁻ transductants (gal⁻ cannot utilize the galactose; bio⁻ cannot synthesize biotin) will be ____.
- A) Minimal medium containing both galactose and biotin
B) Minimal medium lacking galactose and containing biotin
C) Minimal medium containing galactose and lacking biotin
D) Minimal medium lacking both galactose and biotin

27. One centimorgan is defined as the genetic distance between two loci with a statistically corrected recombination frequency of ____.

- A) 0.1 % B) 0.5 %
 C) 1 % D) 10 %

28. Consider the following reactions that occur during glycolysis.

- (i) Conversion of glucose 6-phosphate to fructose 6-phosphate
 (ii) Conversion of glyceraldehyde 3-phosphate to 1,3-bisphosphoglycerate
 (iii) Conversion of 2-phosphoglycerate to 2-phosphoenolpyruvate
 (iv) Conversion of fructose 6-phosphate to fructose 1,6-bisphosphate

Which of the reaction(s) is/are NOT reversible?

- A) (i) and (iii) B) Only (ii)
 C) (ii) and (iv) D) Only (iv)

29. According to the ABC model of flower development, what will be the flower organization if AGAMOUS gene is mutated ____.

- A) Carpel-Stamen-Stamen-Carpel
 B) Sepal-Sepal-Carpel-Carpel
 C) Sepal-Petal-Petal-Sepal
 D) Stamen-Carpel-Carpel-Stamen

30. In a diploid organism, a particular gene responsible for a morphological feature is known to be haploinsufficient. When a loss-of-function mutation occurs in this gene, it turns out to be ____.

- A) Dominant mutation B) Recessive mutation
 C) Incomplete dominance D) Codominance

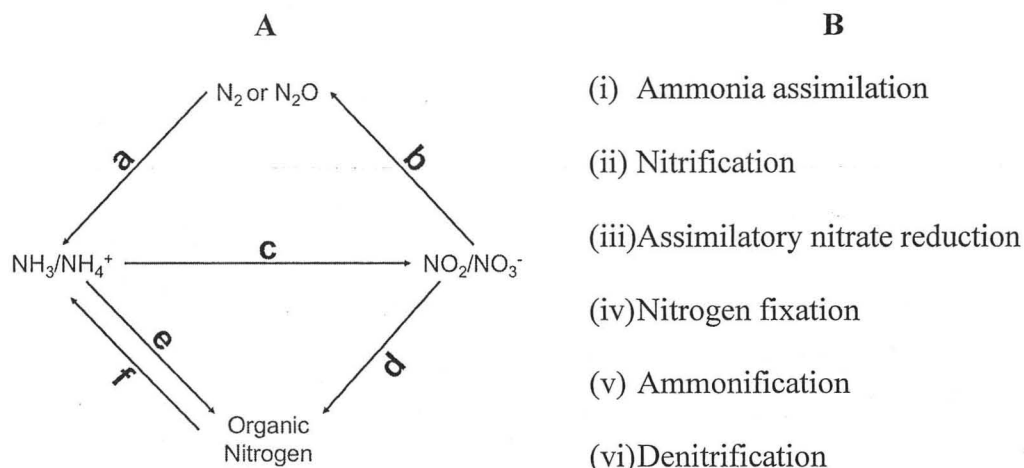
31. GC skew of a genome is calculated by the formula ____.

- A) $(G - C)/(G + C)$
 B) $(G + C)/(G - C)$
 C) $(G - C) * (G + C)$
 D) $(G + C) * (G - C)$

32. A bacterial strain can grow on a medium supplemented with Arg, Trp, and Leu. It fails to grow on media containing Arg and Trp or Leu and Trp; however, it shows growth on agar with Arg and Leu. What is the genotype of the bacterium with respect to these three amino acids?

- A) $Arg^+ leu^-$ B) $arg^- leu^-$
 C) $arg^+ leu^+$ D) $arg^- leu^+$

33. Figure (A) shows the processes underlying the biological transformation of nitrogen compounds. Match the correct names (B) with the reactions.



- A) a(iv), b(vi), c(ii), d(iii), e(i), f(v)
 B) a(v), b(i), c(iii), d(iv), e(ii), f(iv)
 C) a(iv), b(iii), c(v), d(i), e(iv), f(ii)
 D) a(ii), b(vi), c(v), d(iii), e(i), f(iv)

34. The mutant phenotype can be rescued to wild-type by genetic manipulation. This method is known as ____.

- A) Gene complementation B) Gene silencing
 C) Gene recombination D) Gene synthesis

35. A bacterial culture grown for 48 h in a medium containing radioactive sulphur would incorporate the radiolabel in the tetra-peptide:

- A) Serine-Cysteine-Tyrosine-Methionine
 B) Threonine-Lysine-Aspartic acid-Glutamic acid
 C) Alanine-Proline-Histidine-Glycine
 D) Tryptophan-Phenylalanine-Valine-Isoleucine

PART-B

36. Which of the following proteins does not act as an auxin transporter?

- A) DELLA B) AUX1
 C) ABCB D) PIN1

37. The annealing temperature of a PCR reaction is dependent on ____.

- A) Both the length and base composition of the template strand
 B) Both the length and base composition of primers
 C) Length of both template strand and PCR primers
 D) Both the length and base composition of PCR product

38. In which of the cycle/pathway is isocitrate directly converted to succinate and a two-carbon compound?
- A) Tricarboxylic acid cycle B) Calvin cycle
C) Glycolysis D) Glyoxylate cycle
39. Which of the following is a non-sacchariferous sweetener?
- A) Rebaudioside A B) Sucrose
C) Taxol D) High fructose corn syrup
40. The superiority of the hybrid over its midparental mean value is known as ____.
- A) Heterobeltiosis B) Relative heterosis
C) Commercial heterosis D) Luxuriance
41. Nuclear localization signal is rich in ____ amino acid.
- A) Valine B) Leucine
C) Lysine D) Isoleucine
42. Which genome was sequenced first?
- A) Phage Φ X174 B) *Haemophilus influenzae*
C) *Escherichia coli* D) *Saccharomyces cerevisiae*
43. According to auxin gradient-dependent patterning and gamete specification in the female gametophyte of plants, minimum (or) no auxin will present at ____.
- A) Egg cell B) Synergids
C) Antipodals D) Central cell
44. When both staminate and carpellate flowers are present in the same plant, it is called ____.
- A) Polygamous B) Dioecious
C) Monocious D) Bisexual
45. Which of the following phytohormones delays senescence?
- A) Auxin B) Ethylene
C) Gibberellin D) Cytokinin
46. Phosphates, carboxylates, and sulfonates are esters of phosphoric, carboxylic, and sulfonic acids, respectively. Which of the following statements is NOT true?
- A) The nucleophile attack occurs at acyl carbon in carbohydrates
B) The nucleophile attack occurs at alkyl carbon in sulfonates
C) The nucleophile attack occurs at the oxygen or phosphorus in phosphates
D) Sulfonates can be easily hydrolyzed

47. Eusporangiate ferns ____.
- A) Have an extensive root system
 - B) Produce a definite number of spores
 - C) Have a thick sporangial wall
 - D) Mostly lack indusium
48. Which of the following organelles can be correlated with synchronous cell division and programmed cell death in plants?
- A) Nucleus
 - B) Plasmodesmata
 - C) Chloroplast
 - D) Mitochondria
49. The prosthetic group present in an acyl carrier protein is ____.
- A) CoASH
 - B) FAD
 - C) Heme
 - D) NAD
50. Which of the following is NOT a normalized expression unit for quantifying gene expression in RNA-seq data?
- A) FPKM
 - B) TPM
 - C) RPKM
 - D) RPM
51. The secondary cell wall material is laid in plants:
- A) Outside of primary wall
 - B) Inside of primary wall
 - C) Inside of plasma membrane
 - D) Just beneath the middle lamella
52. 'Imperfect fungi' is a group represented by fungal species which have ____.
- A) Simple mycelia
 - B) No known mechanisms of sexual reproduction
 - C) Unknown phylogenetic relationship
 - D) Lost its survival mechanism against harsh environments
53. Which of the following methods can be used for generating asymmetric hybrids?
- A) Meristem culture
 - B) Anther culture
 - C) Protoplast fusion
 - D) Callus culture
54. Which of the following phytopathogens has predominantly necrotrophic mode of colonization?
- A) *Phytophthora infestans*
 - B) *Erwinia* spp.
 - C) *Erysiphe pisi*
 - D) *Puccinia graminis*

55. Which is the most appropriate spectral band for vegetation analysis using remote sensing platforms?
- A) Red, Near Infrared B) Infrared, Visible
C) Red, Microwave D) Visible, Microwave
56. Which of the following best defines an 'allele'?
- A) The position on a chromosome where a genetic variant occurs
B) A polymorphic locus
C) A DNA sequence variant that occurs at a locus
D) A monomorphic locus
57. The cleavage of 45S transcript in the nucleolus does not produce ____.
- A) 28S rRNA B) 18S rRNA
C) 5S RNA D) 5.8S rRNA
58. Which layer of microsporangium provides nutrition to the developing pollen grains?
- A) Epidermis B) Endothecium
C) Tapetum D) Microspore
59. The peptide bond, between CO and NH is ____.
- A) Chiral
B) Tetrahedral
C) Planar
D) Dihedral
60. The non-random association of alleles at different loci in the genome of an organism is known as ____.
- A) Combinatorial hybridization
B) Linkage disequilibrium
C) Genetic recombination
D) Panmictic population
61. What is the precursor for shikimate pathway?
- A) Glyceraldehyde-3-phosphate and phosphoenolpyruvate
B) Erythrose-4-phosphate and glyceraldehyde-3-phosphate
C) Erythrose-4-phosphate and Acetyl-CoA
D) Phosphoenolpyruvate and erythrose-4-phosphate
62. A bract-like structure below the spikelet of a grass inflorescence is called ____.
- A) Sheath B) Spadix
C) Glume D) Lemma

63. The term 'phenotype' denotes ____.
- A) The sum of genetic variants that contribute to a trait
 - B) Behavioural trait(s)
 - C) Physical trait(s)
 - D) A description of physical and/or behavioural characteristics
64. Which of the following viral components is commonly targeted for engineering virus resistance in plants?
- A) Coat protein
 - B) Replication protein
 - C) Satellite RNA
 - D) Movement protein
65. Negative selection is otherwise called ____.
- A) Darwinian selection
 - B) Natural selection
 - C) Purifying selection
 - D) Methodical selection
66. Which one of the following statements is NOT true for an enhancer element?
- A) It can be downstream of the gene it regulates
 - B) It can only regulate a nearby gene
 - C) It can be upstream of the gene it regulates
 - D) It can be within the intron of the gene
67. Symplast water transport is ____.
- A) Cell-to-cell path
 - B) Wall-to-cell path
 - C) Wall-to-wall path
 - D) Epidermis-to-wall path
68. Which national park has the highest number of tigers?
- A) Jim Corbett
 - B) Kaziranga
 - C) Mudumalai
 - D) Bandipur
69. Double fertilization is a characteristic of ____.
- A) Monocots
 - B) Dicots
 - C) Monocots and dicots
 - D) Monocots, dicots, and gymnosperms
70. Monophyletic group ____.
- A) Include all representatives of a clade but not most recent common ancestors
 - B) Contain unrelated organisms
 - C) Contain all representatives of the clade and most recent common ancestors
 - D) Include most recent ancestors (common) but not their descendants

University of Hyderabad
Ph.D. Entrance Examinations - 2023

School/Department/Centre : Plant Sciences (Revised)

Course : Ph.D. Subject : Plant Sciences

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
1	C	26	A	51	B
2	D	27	C	52	B
3	B	28	D	53	C
4	C	29	C	54	B
5	B	30	A	55	A
6	B	31	A	56	C
7	A	32	B	57	C
8	D	33	A	58	C
9	B	34	A	59	C
10	C	35	A	60	B
11	C	36	A	61	D
12	C	37	B	62	C
13	D	38	D	63	D
14	B	39	A	64	A
15	C	40	B	65	C
16	D	41	C	66	B
17	D	42	A	67	A
18	C	43	C	68	A
19	D	44	C	69	C
20	D	45	D	70	C
21	C	46	C		
22	D	47	C		
23	A	48	B		
24	B	49	A		
25	D	50	D		

Note/Remarks :

Signature
School/Department/Centre