Code No. A-56

ENTRANCE EXAMINATION - 2021

Ph.D. Plant Sciences

Time: 2 hours Maximum Marks: 70

HALL TICKET NO.

INSTRUCTIONS

Please read 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. Answers are to be marked only on the **OMR answer sheet** following the instructions provided there upon.
3. Hand over the OMR answer sheet to the Invigilator before leaving the examination hall.
4. No additional sheets shall be provided. Rough work can be done in the question paper itself/the space provided at the end of the booklet.
5. The question paper contains **70** questions. **Part-A**: Question Nos. **1-35** and **Part-B**: Questions Nos. **36-70** of multiple-choice printed in **16** pages, including this page. One OMR answer sheet is provided separately. **Please check.**
6. The marks obtained in **Part-A** will be used for resolving the tie cases.
7. Each question carries one mark.
8. Calculators and mobile phones are NOT allowed.

PART-A

1. Which technique can be used to observe the 3D structures of sub-cellular, macro-molecular, or materials specimen?

   A) Electron Tomography
   B) Confocal Microscopy
   C) Fluorescence Microscopy
   D) X Ray Diffraction Spectroscopy

2. A potato tuber weighing 0.5 gm and water potential of 1 MPa is immersed in coconut water for 1 h. The tuber is removed and again weighed. What do you conclude about the water potential of coconut water if potato tuber weight after the treatment is reduced to 0.35 gm?

   A) Less than 1 MPa
   B) More than 1 MPa
   C) Zero MPa
   D) It is not possible to find water potential of coconut water

3. SDS-PAGE is used to determine the molecular weight of proteins, the native molecular weight of proteins is determined by the native PAGE plotting the semi-logarithmic plot of electrophoretic mobility of proteins against gel concentration. The name of the plot is ___.

   A) Laemmli plot
   B) Ferguson plot
   C) Bradford plot
   D) Lineweaver–Burk plot

4. While following a method of an enzyme purification from a leaf extract, the total activity and total protein were estimated at each step of purification. During this process, which of the following is expected?

   A) Specific activity increases and total activity increases
   B) Specific activity decreases and total activity increases
   C) Specific activity increases and total activity decreases
   D) Specific activity and total activity remain unchanged

5. In plant tissue culture techniques, root formation is promoted by _____.

   A) High auxin to cytokinin ratio
   B) High cytokinin to auxin ratio
   C) High auxin to gibberellins ratio
   D) High gibberellins to auxin ratio

6. What is the product of *lacZ* gene of pUC18 vector among the following?

   A) Encodes for antibiotic resistance
   B) Encodes for β-galactosidase enzyme
   C) Encodes for β-lactamase enzyme
   D) Encodes for X-gal (5-bromo-4-chloro-3-indolyl-β-D-galactopyranoside)

7. In a cross of two different strains a^+ b^+ x a b of yeast, the observed frequencies of ascus classes obtained were 54% Parental di-types, 40% Tetratypes and 6% Non-Parental di-types. The map distance between a and b loci uncorrected for double cross overs is _____.

   A) 26 m.u. B) 23 m.u. C) 20 m.u. D) 12 m.u.

8. Which of the following treatments to an epidermal peel causes stomata to open?

   A) Subjecting the peel to abscisic acid
   B) Immersing the peel in buffer of pH 7 and addition of KCl
   C) Subjecting the peel to jasmonic acid
   D) Subjecting the peel to cold temperature

9. The most commonly used probe for detecting glycoproteins is _____.

   A) Antibody B) Lectin C) Antigen D) RNA fragment

10. Consider the following statements on different types of molecular markers, namely RFLP (Restriction Fragment Length Polymorphism), RAPD (Random Amplified Polymorphic DNA), AFLP (Amplified Fragment Length Polymorphism), and SSR (Simple Sequence Repeats). Which combination of the following TWO statements are TRUE?

    (i) All the markers can be used in fingerprinting
    (ii) RFLP and SSR are useful for detecting allelic variations
    (iii) RAPD and SSR require radioisotopes
    (iv) All the markers involve the use of polymerase chain reaction

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

11. During real-time PCR, the taqman probe is used and the fluorescence is detected because of _____.

A) attachment of reporter dye with the quencher
B) binding of probe to the dsDNA molecule
C) separation of reporter dye from quencher
D) release of intact probe from the DNA strand

12. Which of the following statements is INCORRECT about CRISPR/Cas9?

A) CRISPR is a specialized region of DNA found in bacteria characterized by the presence of nucleotide repeats and spacers.
B) CRISR sequences play a role in the antiviral defense system of bacteria.
C) Genome editing using CRISR-Cas9 require only two components: a guide RNA and the Cas9 protein.
D) Gene edited using CRISPR-Cas9 results in the production of DNA single-strand breaks at non-targeted loci.

13. Fluorescence *In Situ* Hybridization (FISH) technique is applied to _____.

A) detect and locate histone proteins in nuclei
B) detect and locate a specific DNA sequence on a chromosome
C) detect cellular glycoprotein distribution
D) detect cholesterol deposits

14. Which among the following is NOT a mass spectrometry ionization method?

A) Electronspray ionization (ESI)
B) Fast-atom bombardment (FAB)
C) Flame ionization detector (FID)
D) Matrix-assisted laser desorption ionization (MALDI)

15. Cyanogen bromide is a pseudohalogen compound with a formula CNBr is used to cut protein molecules at the C-terminus of _____.

A) Arginine B) Lysine C) Glutamic acid D) Methionine

16. Choose the CORRECT answer:

Assertion: Designing real-time qRT-PCR (Real-Time Quantitative Reverse Transcription PCR) primers from the flanking regions of the two adjacent exons, which are interrupted by a long intron, can address the issue of non-specific amplification from the contaminated cDNA samples with gDNA under standard qPCR cycle conditions.

Reason: Long intron does not allow primers to bind to their complementary sequences in the template, thereby preventing the amplification of the product from the gDNA, contaminating the cDNA samples.

A) Assertion is true but reason is false
B) Assertion is false but reason is true
C) Both assertion and reason are true
D) Both assertion and reason are false

17. Identify the WRONG statement in relation to chromosome painting:

A) It refers to the hybridization of fluorescently labeled chromosome specific composite probe pools to cytological preparations.
B) This technique involves the use of a probe that hybridizes with a specific mRNA.
C) This technique can be used to analyze the entire genome, allowing one to screen for chromosomal aberrations.
D) This technique can be used to identify bacteria that contain specific genes, such as those that encode the enzyme nitrogenase, photosynthetic reaction center, or specific autotrophic pathways.

18. Read the following statement and reason carefully with regard to plate count anomaly and identify the CORRECT answer:

Statement: Plate counts can be highly unreliable when used to assess total cell number of natural samples. Direct microscopic counts of natural samples typically reveal far more organisms than are recoverable on plates of any given culture medium

Reason: This is likely due to a combination of factors. Importantly, microscopic methods count the dead cells, whereas viable methods do not. In addition, it is also due to different requirements for cultivation conditions.

A) Both statement and reason are correct and the reason explains the statement.
B) Only the statement is correct and the reason is incorrect.
C) Both statement and reason are incorrect
D) Statement is incorrect and reason is correct

19. Orientation of a cloned DNA fragment in a plasmid vector can be checked by _____.

A) PCR using two gene specific primers
B) Restriction digestion with an enzyme that has a single restriction site within the cloned gene and none in the vector.
C) PCR using a combination of one gene specific primer and one vector specific primer.
D) Restriction digestion with an enzyme that has two restriction sites within the vector sequence and none in the cloned gene.

20. In tomato, red fruit is dominant to yellow fruit, and purple stems are dominant to green stems. The progeny from one mating consisted of 305 red fruit, purple stem plants; 328 red fruit, green stem plants; 110 yellow fruit, purple stem plants; and 97 yellow fruit, green stem plants. The genotype of the parent plants in this cross were ____.

A) Rr Pp × Rr pp B) RR pp × rr PP C) rr PP × Rr Pp D) Rr Pp × RR Pp

21. The method for assessing the statistical significance of the positions of branches in a phylogenetic tree is called ____.

A) Bootstrapping
B) Scoring
C) Normalizing
D) Reappropriating

22. Read the following statement and reason carefully with regard to metagenomics and identify the CORRECT answer:

Statement: Metagenomics allows researchers to access the functional and metabolic diversity of microbial communities, but it cannot show which of these processes are active.
Reason: Metagenomic analysis pipelines use two approaches in the annotation of coding regions in the assembled contigs. This enables the detection of coding regions that lack homologs in the sequence databases and helps in accessing the functional and metabolic diversity of microbial communities.

A) Both statement and reason are correct and the reason explains the statement
B) Only the statement is correct and the reason is incorrect
C) Both statement and reason are incorrect
D) Statement is incorrect and reason is correct

23. Which of the following techniques involves digestion of genomic DNA with a pair of restriction enzymes, ligation with restriction site-specific adapters and PCR amplification of a subset of the fragments?

A) Restriction Fragment Length Polymorphisms
B) Amplified Fragment Length Polymorphisms
C) Random Amplified Polymorphic DNA
D) Inter Simple Sequence Repeats

24. The bulbosum technique was developed by Kasha and Kao (1970) involving the cross of *Hordeum vulgare* and *H. bulbosum*. Which of the following is INCORRECT about this technique?

A) The embryos were rescued by culturing on a nutrient medium *in vitro*.
B) Monoploids were produced from rescued embryos instead of interspecific hybrids.
C) Selective elimination of *H. bulbosum* chromosomes was observed from the cultured embryos.
D) Selective elimination of *H. vulgare* chromosomes was observed from the cultured embryos.

25. The T-DNA region of the Ti plasmid of *Agrobacterium* harbours two genes X and Y. Mutation of gene X produces a rooty tumour while mutation of gene Y produces shoots in the tumour. Based on the above information which one of the following statements is CORRECT?

A) Gene X encodes auxins and gene Y encodes cytokinins
B) Gene X encodes cytokinins and gene Y encodes auxins
C) Gene X and gene Y both encode auxins
D) Gene X encodes opines while gene Y encodes cytokinins

26. Which of the following statement is TRUE regarding plasmids having relaxed origin of replication?

A) Plasmid replication is linked with chromosomal replication
B) Plasmid replication is independent of chromosomal replication
C) Plasmids contains their own replication machinery genes on them in order to replicate
D) Relaxed plasmids do not have any restriction endonuclease recognition sites

27. Which of the following is TRUE for reverse phase chromatography?

A) Has a polar stationary phase and a non-polar mobile phase
B) HPLC - pump1 is connected to top of the column and pump-2 to bottom of the column
C) Anode and cathode are connected in a reverse way to the normal phase chromatography
D) Has a non-polar stationary phase and a polar mobile phase

28. Purification of a recombinant protein fused to glutathione S-transferase using cross-linked agarose, with glutathione covalently bound to the resin, is referred to as _____.

A) Ion-exchange chromatography
B) Thin layer chromatography
C) Gel filtration chromatography
D) Affinity chromatography

29. Neoschizomers are _____.

A) pairs of restriction enzymes specific to the same recognition sequence and cut same site but isolated from different strains of bacteria
B) pairs of restriction enzymes that recognize the same nucleotide sequence as their prototype but cleave at a different site
C) restriction enzymes changing their specificity under reaction conditions that differ from optimal conditions
D) true enzymes, discovered for first time of it's category

30. Primers used for the process of polymerase chain reaction (PCR) are _____.

A) Double-stranded RNA oligonucleotide
B) Double-stranded DNA oligonucleotide
C) Oligonucleotides which can be extended in 3' to 5' direction
D) Single-stranded DNA oligonucleotide

31. To prepare an assay buffer of 500 ml containing 50 mM Tris-HCl pH 8.0, 0.15 M NaCl and 0.1% SDS, 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 10% (w/v) SDS:

A) 50 ml of Tris-HCl, 150 ml of NaCl, 5 ml of SDS in 345 ml of ddH_2O
B) 25 ml of Tris-HCl, 75 ml of NaCl, 10 ml of SDS in 390 ml of ddH_2O
C) 50 ml of Tris-HCl, 75 ml of NaCl, 5 ml of SDS in 370 ml of ddH_2O
D) 25 ml of Tris-HCl, 75 ml of NaCl, 5 ml of SDS in 395 ml of ddH_2O

32. Diphenylamine method is employed in the quantitation of _____.

A) Starch
B) RNA
C) DNA
D) Proteins

33. In a time-of-flight mass spectrometer, the velocity v of an accelerated ion is related to its mass by which of the following?

A) Proportional to the square root of its mass
B) Not influenced by mass of the ion
C) Proportional to the cube root of its mass
D) Inversely proportional to the square root of its mass

34. While expressing a recombinant protein in *E. coli* using pET expression vector, which of the following is induced by Isopropyl ß-D-1-thiogalactopyranoside (IPTG)?

A) *E. coli* RNA polymerase
B) T7 RNA polymerase
C) *E. coli* DNA polymerase III
D) *E. coli* DNA polymerase II

35. Golden rice was created by transforming rice with two genes encoding which of the following enzymes?

A) Phytoene synthase and Zeaxanthin epoxidase
B) Phytoene synthase and Phytoene desaturase
C) Zeaxanthin epoxidase and 9-*cis*-Epoxycarotenoid dioxygenase
D) Phytoene desaturase and Carotenoid dioxygenase

PART-B

36. Glycolysis in plants differs from that of animals with respect to:

A) Fermentation in animals
B) PPi -dependent phosphofructokinase
C) Transport of glycolytic NADH to mitochondria
D) Synthesis of pyruvate from PEP in animal cells

37. When plants are exposed to abiotic stress usually the photosynthesis process gets affected. Identify the high turnover protein in such conditions from the following

A) CP43 &47 B) LHCII C) D1 D) D2

38. Integral membrane proteins are permanently attached to the membrane and such proteins can be separated from the biological membranes by using which of the following?

A) Centrifugation
B) High salt solution
C) Detergents
D) 50 mM Tris•HCl, pH 7.4

39. Which of the following statements is TRUE?

A) *nif*D and *nif*K encode for nodulins
B) Fe protein is encoded by *nif*F
C) *nif* genes are required for nitrogen fixation only by the symbiotic bacteria and not by free-living nitrogen fixers
D) *fix* genes are essential for nitrogen fixation in symbiotic nitrogen fixers but do not have counterparts in free-living forms

40. A polyploid individual possessing more than two haploid sets derived from two or more different species is called as ____.

A) Aneuploid
B) Autopolyploid
C) Allopolyploid
D) Endopolyploid

41. Serine pathway of carbon assimilation is observed among a few members of _____.

A) Chlorobi B) Methanotrophs C) Spirochaetes D) Purple sulfur bacteria

42. If an enzyme obeying Hills reaction shows negative co-operativity, then it means_____.

A) Binding of substrate to any one site of multisubunit enzyme decreases affinity for other substrate to other subunits
B) Binding of substrate to any one site of single unit enzyme decreases affinity for other substrate to other substrate
C) Binding of substrate to any one site of multisubunit enzyme increases affinity for other substrate to other subunits
D) Binding of substrate to any one site of multisubunit enzyme makes enzyme non-functional

43. sgRNA term associated with the gene-editing tools stands for _____.

A) synthetic guide RNA B) single guide RNA
C) simultaneous guide RNA D) simple guide RNA

44. Which one of the following is NOT an essential mineral nutrient in plants?

A) Nickel B) Boron
C) Molybdenum D) Silicon

45. Barbara McClintock was the first scientist to discover *Ac-Ds* system in maize. Which of the following statements is INCORRECT regarding the characteristics of *Ac-Ds* system?

A) *Ac* (Activator) is an autonomous element that can transpose on its own
B) *Ds* (Dissociation) is a non-autonomous element derived from *Ac* through deletions
C) *Ds* (Dissociation) in the presence of *Ac* (Activator) is unable to move locations and cause chromosome breaks at the site of insertion
D) The phenotypic consequence of *Ac-Ds* transposable elements includes mosaic colours in kernels of maize

46. A multi-layered waxy deposit present on the leaf on terrestrial vascular plants to prevent evaporation is made up of ____.

A) Cutin B) Suberin C) Lignin D) Mulerin

47. For the discovery of Artemisinin and its semisynthetic derivatives drugs in the treatment of malaria, Tu Youyou, shared the 2015 Nobel Prize in Physiology or Medicine. Artemisinin is extracted from the plant *Artemisia annua*, which belongs to the family _____.

A) Anacardiaceae
B) Asteraceae
C) Apocynaceae
D) Solanaceae

48. Which of the following is NOT the chemical constituent naturally obtained from Opium?

A) Morphine
B) Codeine
C) Narcotine
D) Heroin

49. Which of the following statements is CORRECT?

A) In plants acyl-CoA oxidase catalyzes transfer of electrons from O_2 during first oxidation step in β-oxidation of fatty acids.
B) Acyl-ACP is transported out of plastids to be used for further modifications in the hydrocarbon chain of fatty acids.
C) Oleosin is the membrane lipid of oleosomes.
D) Glyoxylate cycle occurs both in plants and animals.

50. Choose the INCORRECT statement regarding triploids in plants?

A) Triploids are produced by hybridization of tetraploids with diploids.
B) Triploids are seed fertile and can be propagated sexually through seeds.
C) Triploids can be produced by culture of endosperm in angiosperms.
D) Triploids generally exhibit more vigorous growth than their diploid counterparts.

51. Which of the following statements is CORRECT?

A) The electron-transport chain generates an electrical potential across the membrane because it moves electrons from the intermembrane space into the matrix.
B) The electrochemical proton gradient consists of two components: a pH difference and an electrical potential.
C) The role of chlorophyll in photosynthesis is equivalent to that of heme in mitochondrial electron transport.
D) Most of the plant dry weight of a tree comes from the minerals that are taken up by the roots.

52. Which of the following enzyme is NOT responsible for the conversion of pyruvate to phosphoenolpyruvate?

A) Malate dehydrogenase
B) Pyruvate carboxykinase
C) Glucose 6-phosphatase
D) Pyruvate carboxylase

53. Senescing leaves export much of their mineral content to the younger, healthy leaves. Element most mobilized is _____.

A) Calcium B) Sodium C) Sulphur D) Magnesium

54. *Catharanthus roseus* belongs to the family _____.

A) Leguminosae
B) Catoscopiaceae
C) Caryophyllaceae
D) Apocynaceae

55. The special term used for a gene that is related to another gene in the same organism by descent from a single ancestral gene that was duplicated and that may have a different DNA sequence and biological function is called _____.

A) Homolog B) Paralog C) Ortholog D) Syntelog

56. Most homoacetogenic bacteria that produce and excrete acetate in energy metabolism belong to the genus _____.

A) *Clostridium* B) *Bacillus* C) *Lactobacillus* D) *Pseudomonas*

57. During cell cycle, entry in the S-phase is tightly regulated. This is possible because _____. Select the CORRECT combination of statements from the following:

i. APC/C promotes ubiqitination of S-phase cyclins and mitotic cyclins, making them for proteolysis at the mitotic exit.
ii. Cyclin B1 helps in the activation of S-phase CDKs only in late G1.
iii. As mitotic CDK activity declines in late mitosis, cdc14 phosphatase activates APC/C by dephosphorylating Cdh1, thus promoting formation of APC/C
iv. Securin keeps S-phase cyclins in inactive state till late G1.

A) i and ii B) i and iii C) ii and iii D) ii and iv

58. Amphotericin B, an antifungal drug, was initially isolated from _____.

A) *Penicillium chrysogenum* B) *Cryptococcus neoformans*
C) *Ustilago maydis* D) *Streptomyces nodosus*

59. In some plants, the mechanism where timing of anther dehiscence and stigma receptivity do not coincide to avoid self-pollination is called _____.

A) Dichogamy B) Herkogamy C) Monoecy D) Dioecy

60. Which of the following is NOT a lipid-soluble photosynthetic pigment?

A) Chlorophyll B) Carotenoids C) Phycobilins D) Xanthophylls

61. Which of the following is NOT a characteristic feature of the seedlings exhibiting "triple response"?

A) Exaggerated apical/plumular hook B) Shortened hypocotyl
C) Elongated roots D) Radially swollen hypocotyl

62. Auxin transport is: _____.

A) Always basipetal both in roots and shoots
B) Always acropetal both in roots and shoots
C) Acropetal in roots and basipetal in shoots
D) Basipetal in roots and acropetal in shoots

63. Which of the following is CORRECT for the Pasteur Effect?

A) Utilization of glucose for fermentation
B) Increased glucose consumption by yeast in anaerobic condition
C) Fermentation favors aerobic condition more than anaerobic
D) Increased consumption of glucose by yeast in aerobic condition

64. Endoreduplication means ____.

A) Splitting up of endoplasmic reticulum (ER) to form rough and smooth ERs
B) Recurrent DNA replication without consequent mitosis and cytokinesis
C) Mobilization of DNA into ER and replication of DNA in the ER
D) Replication of DNA in the nuclei and endocytosis of one copy to another organelle

65. Which of the following is a Hill reagent?

A) Sucrose
B) Nicotinamide adenine dinucleotide phosphate
C) 2, 6-dichlorophenolindophenol
D) Chlorophyll

66. A cell in G_1 of interphase has 14 chromosomes. How many chromosomes and DNA molecules will be found per cell as this cell progresses through anaphase 1 of meiosis?

A) 7 chromosomes and 7 DNA molecules
B) 7 chromosomes and 14 DNA molecules
C) 14 chromosomes and 28 DNA molecules
D) 14 chromosomes and 14 DNA molecules

67. Effector-triggered immunity refers to ____.

A) Defense strategies by host plant in response to the molecular pattern at the pathogen's surface
B) Suppression of host-triggered immunity by the effector molecules produced by pathogens
C) Triggering of defense response in plant as a result of incompatible interaction of factors produced by pathogens and R gene products
D) Immunity in host plants in response to elicitors

68. Which of the following combinations represent the CORRECT statements?

i. B form of DNA has ~10 base pairs/turn
ii. Uracil is also known as 5-methylthymine
iii. The crystalline nature of cellulose is brought about by α (1 to 4) linkage between the glucose subunits.
iv. The double bonds in natural lipids are almost always *cis*, which provide fluidity to the plasma membrane.

A) i and iii
B) ii and iii
C) i and iv
D) iii and iv

69. Translocon is _____.

A) an ion channel
B) a protein channel
C) a receptor
D) a recognition particle

70. Which of the following does NOT take part in the biosynthesis of terpenes?

A) Mevalonic acid
B) Methylerythritol phosphate
C) Acetyl-CoA
D) Gallic acid

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University of Hyderabad
Entrance Examinations - 2021

School/Department/Centre : Department of Plant Sciences, School of Life Sciences
Course/Subject : Ph.D. Plant Sciences – 2021 (Code No. A-56)

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
1	A	26	B	51	B	76	
2	A	27	D	52	C	77	
3	B	28	D	53	C	78	
4	C	29	B	54	D	79	
5	A	30	D	55	B	80	
6	B	31	D	56	A	81	
7	A	32	C	57	B	82	
8	B	33	D	58	D	83	
9	B	34	B	59	A	84	
10	A	35	B	60	C	85	
11	C	36	B	61	C	86	
12	D	37	C	62	A	87	
13	B	38	C	63	B	88	
14	C	39	D	64	B	89	
15	D	40	C	65	C	90	
16	A	41	B	66	C	91	
17	B	42	A	67	C	92	
18	A	43	B	68	C	93	
19	C	44	D	69	B	94	
20	A	45	C	70	D	95	
21	A	46	A	71		96	
22	B	47	B	72		97	
23	B	48	D	73		98	
24	C	49	A	74		99	
25	B	50	B	75		100	

Note/Remarks : None

Signature of the Head
Department of Plant Sciences