

ENTRANCE EXAMINATION – 2014
Ph.D. Plant Sciences

Time: 2 hours

Maximum Marks: 75

HALL TICKET NO.

INSTRUCTIONS

Please read carefully before answering the questions:

- Enter your Hall Ticket number both on the top of this page and on the OMR answer sheet.
- Answers are to be marked only on the **OMR answer sheet** following the instructions provided there upon.
- Hand over the OMR answer sheet to the Invigilator before leaving the examination hall.
- The question paper contains **75** questions. **Part-A:** Question Nos. **1-25** and **Part-B:** Questions Nos. **26-75** of multiple-choice printed in **15** pages, including this page. One OMR answer sheet is provided separately. **Please check.**
- The marks obtained in **Part-A** will be used for resolving the tie cases.
- Each question carries one mark.
- There is **Negative marking** for wrong answers, in **Parts A and B**. For each wrong answer, 0.33 mark will be deducted.
- Calculators and mobile phones are NOT allowed.

PART – A

1. Identify among the following the enzyme that operates only in glyoxylate cycle, but not during respiratory reactions
 - A. Citrate synthase
 - B. Malate dehydrogenase
 - C. Malate synthase
 - D. Fumarase

2. *Catharanthus roseus*, which is a source of an alkaloid, Vinblastine, belongs to the family
 - A. Annonaceae
 - B. Apocynaceae
 - C. Acanthaceae
 - D. Euphorbiaceae

3. Cytochrome b6-f complex occurs in
 - A. Mitochondria only
 - B. Chloroplasts only
 - C. Both mitochondria and chloroplasts
 - D. Neither mitochondria nor chloroplasts

4. What is reverse methanogenesis?
 - A. Oxidation of methane to carbon dioxide
 - B. Oxidation of methane to methanol
 - C. Conversion of methane to methyl halides
 - D. Conversion of methane to biomass

5. Why is an RNA primer necessary for DNA replication?
 - A. The RNA primer is necessary for the activity of Helicase
 - B. Only RNA primer can detect the template strand
 - C. DNA polymerase can only add nucleotides to RNA molecules
 - D. DNA polymerase can only add nucleotides to an existing strand

6. Which among the following does not belong to *Proteobacteria*
- A. *Neisseria*
 - B. *Vibrio*
 - C. *Helicobacter*
 - D. *Enterococcus*
7. 'Operational taxonomic unit' refers to
- A. Taxonomic units, which are valid in the nomenclature
 - B. Taxa whose phylogenetic level is not known
 - C. Taxa whose phylogenetic level is known
 - D. Taxa which are validly described
8. Diaminopimelate pathway leads to the synthesis of
- A. Glutamate
 - B. Lysine
 - C. Leucine
 - D. Isoleucine
9. What is the original source of all variations in heritable traits?
- A. Natural selection
 - B. Artificial selection
 - C. Mutation
 - D. Adaptation
10. What is an adaptive trait?
- A. Any trait that can be passed on to the next generation
 - B. Any trait that remains constant over time
 - C. Any trait that helps an organism survive and reproduce
 - D. Any trait that can not be changed by mutation
11. What is the function of the control group in an experiment?
- A. To serve as a source of backup subjects
 - B. To increase the number of participants
 - C. To serve as a standard of comparison
 - D. To prevent sampling error

12. Lignins, which are responsible for evolutionary adaptation of plants from aquatic to land possible, belong to the class _____

- A. Alkaloids
- B. Proteins
- C. Phenolics
- D. Terpenes

13. The correct order of procedure in DNA fingerprinting is

- A. DNA isolation > Restriction digestion > PCR amplification > Gel electrophoresis > Southern blotting > Autoradiography > Analysis of DNA print pattern
- B. DNA isolation > Restriction digestion > PCR amplification > Southern blotting > Gel electrophoresis > Autoradiography > Analysis of DNA print pattern
- C. DNA isolation > PCR amplification > Gel electrophoresis > Southern blotting > Restriction digestion > Autoradiography > Analysis of DNA print pattern
- D. DNA isolation > PCR amplification > Restriction digestion > Gel electrophoresis > Southern blotting > Autoradiography > Analysis of DNA print pattern

14. Number of 'High Energy P' bonds are required to translate a 400 aa protein

- A. 400
- B. 800
- C. 1200
- D. 1600

15. A reaction medium of 1000 ml containing 10 mM Tris-HCl buffer pH 7.5, 0.5 mM $MgCl_2$ and 0.05% NaN_3 has to be prepared using the stock solutions of 1 M Tris HCl pH 7.5; 100 mM $MgCl_2$ and 1% NaN_3 solution. The volumes of stocks should be mixed as

- A. 10 ml of Tris-HCl, 5 ml of $MgCl_2$ and 50 ml of NaN_3 in 935 ml of ddH_2O
- B. 50 ml of Tris-HCl, 5 ml of $MgCl_2$ and 25 ml of NaN_3 in 920 ml of ddH_2O
- C. 10 ml of Tris-HCl, 2.5 ml of $MgCl_2$ and 50 ml of NaN_3 in 937.5 ml of ddH_2O
- D. 50 ml of Tris-HCl, 2.5 ml of $MgCl_2$ and 50 ml of NaN_3 in 897.5 ml of ddH_2O

16. Identify an agent which is NOT associated with bioterrorism or biocrimes

- A. *Brucella suis*
- B. *Rickettsia prowaxekii*
- C. *Listeria monocytogenes*
- D. *Yersinia pestis*

17. In plant cells, nitrate reductase is located in

- A. Chloroplasts
- B. Mitochondria
- C. Cytoplasm
- D. Vacuole

18. The hormone ABA (abscisic acid) is NOT associated with

- A. Dormancy
- B. Stomatal aperture
- C. Abscission
- D. Biotic stress

19. Stomatal opening is regulated by light via the action of -----

- A. Phototropin
- B. Cryptochrome
- C. Cryptochrome and phytochrome
- D. cryptochrome and phototropin

20. Fredrick Griffith used smooth (S) and rough (R) strains of *Streptococcus pneumonia* in his classical experiment that showed DNA might be the genetic element. Which ONE of the following observations gave the clue for this discovery?

- A. R strain became S strain when mixed with heat killed S strain
- B. R strain remained R strain when mixed with heat killed S strain
- C. S strain became R strain when mixed with heat killed R strain
- D. R strain became S strain when mixed with live strain

21. A female cat with a mutant phenotype was bred with a wild-type male cat. All progeny (4 males and 4 females) show the mutant phenotype. On the other hand, all progeny (4 males and 4 females) from the reciprocal cross between a mutant male and wild-type female showed the wild-type phenotype. Which of the following explain the inheritance pattern of the mutation?
- A. Recessive
 - B. Sex-linked inheritance
 - C. Autosomal inheritance
 - D. Mitochondrial inheritance
22. The genetic elements, which do not get transcribed but control the transcription of other genes are
- A. Open reading frame (ORF)
 - B. Structural gene
 - C. Promoter
 - D. Coding sequence
23. An aminoacyl synthetase is responsible for
- A. Formation of peptide bond
 - B. Attaching amino group to organic acid
 - C. Movement of tRNA from A to P sites
 - D. Joining aminoacid to a tRNA
24. A typical inhibitor of photosynthesis, with no effect on mitochondrial respiration is
- A. 2,4-D
 - B. DCMU or diuron
 - C. KCN
 - D. Methyl amine
25. A typical feature of plant mitochondria, unlike the animal mitochondria is the occurrence of
- A. Cytochrome oxidase.
 - B. Alternative oxidase.
 - C. Fo-F1 complex
 - D. Chlorophyll

PART - B

26. Ferredoxin-dependent nitrate reduction occurs in
- A. Cytoplasm
 - B. Plasma membrane
 - C. Chloroplasts
 - D. Xylem cells
27. The operation of photorespiratory cycle in plants requires
- A. Peroxisomes only
 - B. Mitochondria only
 - C. Chloroplasts only
 - D. All the above three organelles
28. The major site of sulfate reduction in plant cells is
- A. Xylem vessels
 - B. Vacuoles
 - C. Mitochondria
 - D. Chloroplasts
29. Which of the following is TRUE regarding T4 terminal deoxynucleotidyl transferase?
- A. does not require existing DNA strand for adding new nucleotides
 - B. does not require template strand
 - C. can add nucleotides to 5'-end of DNA strand
 - D. can add nucleotides to 5-end of both DNA and RNA strands
30. An important intermediate involved in biosynthesis of several products of secondary metabolism in plants
- A. RuBP
 - B. Glucose
 - C. Shikimic acid
 - D. Phosphoglycerate
31. If non-disjunction occurs in meiosis II during gametogenesis, what will be the result at the completion of meiosis?
- A. all the gametes will be diploid
 - B. two gametes will be $n + 1$; and two will be $n-1$
 - C. one gamete will be $n + 1$, one will be $n-1$, and two will be n
 - D. two of the four gametes will be haploid, and two will be diploid

32. Specialized transduction can be distinguished from generalized transduction by the fact that
- A. homologous recombination is involved in the former but usually not the latter
 - B. transducing particles are involved in the former but usually not the latter
 - C. a selective medium is required to demonstrate the former but usually not the latter
 - D. lysogeny is involved in the former but usually not the latter
33. In *Drosophila melanogaster*, the two genes w and sn are X-linked and 30 map units apart. A female fly of genotype $w^+ sn^+ / w sn$ is crossed to a male from a wild-type line. What percent of male progeny will be w⁺ sn?
- A. 35
 - B. 15
 - C. 30
 - D. 45
34. In a self-fertilizing plant, what proportion of a trihybrid F₂ will breed true (*i.e.* will not segregate for any of the three loci)?
- A. $\frac{1}{2}$
 - B. $\frac{1}{4}$
 - C. $\frac{1}{8}$
 - D. $\frac{1}{64}$
35. Identify the mismatch with respect to scientists and their contributions from the following
- A. W. H. Muir – Discovery of cytokinins
 - B. C. Cocking – Enzymatic isolation and culture of protoplasts
 - C. Morel – Propagation of orchids
 - D. Melchers – Production of somatic hybrids
36. What is the frequency of heterozygotes Aa in a randomly mating population in which the frequency of all dominant phenotypes is 0.19?
- A. 0.81
 - B. 0.18
 - C. 0.09
 - D. 0.9

37. Of the two diploid species, species 1 has 36 chromosomes and species II has 28 chromosomes. How many chromosomes would be found in an allotriploid individual?
- A. 42 or 54
 - B. 46 or 50
 - C. 74 or 86
 - D. 84 or 108
38. Which of the following tool is used to predict localization of a protein with a given amino acid
- A. TargetP
 - B. BLASTP
 - C. Primer-BLAST
 - D. Sequence Translation
39. Rubber is a
- A. Monoterpene
 - B. Diterpene
 - C. Triterpene
 - D. Polyterpene
40. The follow requires NAD^+ as a cofactor
- A. T4 DNA ligase
 - B. Taq DNA ligase
 - C. T4 RNA ligase
 - D. T4 polynucleotide kinase
41. Reverse transcriptase
- A. DNA dependent RNA polymerase
 - B. RNA dependent DNA polymerase
 - C. RNA dependent protein synthase
 - D. DNA dependent protein synthase
42. Nucleotide sequence of a gene from seven plant species is given to you. Which of the following tools would you use to know the homology between the sequences?
- A. Hydropathy analysis
 - B. ChloroP
 - C. ClustalW
 - D. Primer Express

43. The appropriate method to separate the isoforms of proteins
- A. UV/visible spectroscopy
 - B. 2-dimensional electrophoresis
 - C. SDS-PAGE
 - D. Agarose gel electrophoresis
44. Secondary structure of proteins can be determined by
- A. Fluorescence spectroscopy
 - B. UV/visible spectroscopy
 - C. Circular Dichroism
 - D. Flame photometry
45. 3-Dimensional structure of proteins will be solved through:
- A. Fourier transform infrared spectroscopy
 - B. X-Ray crystallography
 - C. Electron microscopy
 - D. Auto radiography
46. Location of the protein cleavage by trypsin
- A. Lysine and Arginine
 - B. Lysine and Tyrosine
 - C. Arginine and glutamine
 - D. Phenylalanine and Lysine
47. Potato is the modification of _____
- A. Root
 - B. Stem
 - C. Bark
 - D. Leaf
48. Fructose-bisphosphate splits into Triose phosphates by the action of the enzyme
- A. fructae
 - B. phosphatase
 - C. aldolase
 - D. esterase

49. tRNA is involved in the biosynthesis of
- A. starch
 - B. nucleic acids
 - C. vitamins
 - D. proteins
50. Protein phosphorylation is a—
- A. Glycosylation
 - B. Oxidation
 - C. Posttranslational modification
 - D. Methylation
51. During what stage of photosynthesis are ATP and NADPH converted to ADP + P_i and NADP⁺?
- A. The light-independent reactions
 - B. The light-dependent reactions
 - C. A and B
 - D. Cyclic photophosphorylation
52. Find out the mismatch in the infrared spectroscopy
- A. -CH₃ bending - 1460, 1365 (cm⁻¹)
 - B. -C-C- stretching - 1165 (cm⁻¹)
 - C. -C=O stretching - 2960 (cm⁻¹)
 - D. -C-H stretching - 2720 (cm⁻¹)
53. An association coefficient that ignores any characters that both organisms lack is
- A. Simple matching coefficient (S_{SM})
 - B. Jaccard coefficient (S_J)
 - C. Both SSM and S_J
 - D. Similarity matrix (S_M)
54. An interim taxonomic status for uncultured organism is referred as
- A. "*Candidatus*"
 - B. "*Candus*"
 - C. "*Interimus*"
 - D. "*Nomus*"

55. Animals/plants which are microorganism free are called
- A. Gnotobiotic
 - B. Xenobiotic
 - C. Gentobiotic
 - D. Genobiotic
56. Which among the following is a negative interaction
- A. Proto cooperation
 - B. Commensalistic
 - C. Amensalism
 - D. Mutualism
57. An example of endomycorrhizae is
- A. *Gigaspora*
 - B. *Cenococcum*
 - C. *Pisolithus*
 - D. *Amanita*
58. Amongst the following photoreceptors, which is the most recently discovered?
- A. Aureochrome
 - B. Neochrome
 - C. Cryptochrome
 - D. UVR8
59. If the new leaves are pale green, turn yellow-green as they enlarge; plants show sparse growth; lack fruits or with few fruits, pale in color, the plants are said to be deficient in
- A. Nitrogen
 - B. Copper
 - C. Boron
 - D. Magnesium
60. Which of the following is the cellular location for ethylene receptors?
- A. Plasma membrane
 - B. Endoplasmic reticulum
 - C. Cytoplasm
 - D. Nucleus

61. Gramineous plants acquire iron with the help of
- A. Phytoalexins
 - B. Phytosiderophores
 - C. Metallothionin
 - D. Thioredoxin
62. Which of the following is the odd one?
- A. TILLING
 - B. RNAi
 - C. Virus-induced gene silencing
 - D. AFLP
63. The genetic recovery and investigation of all the products from a single meiotic event in *Neurospora*, the bread mold causing fungus is possible by
- A. Tetrad analysis
 - B. Heterokaryon analysis
 - C. Homokaryon analysis
 - D. Monad analysis
64. Given the antisense strand DNA codon 3' TAC 5', the anticodon that pairs corresponding mRNA codon could be
- A. 3' CAT 5'
 - B. 5' AUG 3'
 - C. 3' UAC 5'
 - D. 5' GUA 3'
65. A diallel mating refers to
- A. Mating between two individuals only
 - B. Mating between two different alleles only
 - C. Binary mating
 - D. Mating in all possible combinations
66. Which among the following has a transcribed structural gene product but do not get translated into protein
- A. tRNA and rRNA
 - B. mRNA and tRNA
 - C. rRNA and mRNA
 - D. mRNA alone

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67. Pseudodominance may be observed in heterozygotes for
- A. A deletion
 - B. A duplication
 - C. A reciprocal translocation
 - D. A paracentric inversion
68. The expected ratio for dominant epistasis is
- A. 9:3:4
 - B. 9:6:1
 - C. 9:3:3:1
 - D. 12:3:1
69. What do the biologists call a group of individuals of the same kind occupying a given area at the same time?
- A. The biosphere
 - B. A population
 - C. An ecosystem
 - D. A community
70. To which kingdom do all the eukaryotic, single-celled organisms belong?
- A. Archaeobacteria
 - B. Plants
 - C. Eubacteria
 - D. Protistans
71. Stevioside is _____
- A. an alkaloid
 - B. a sweet protein
 - C. a non-saccharide sweetner
 - D. a powerful anaesthetic agent
72. How does carbon-14 differ from carbon-12?
- A. ^{14}C has more neutrons
 - B. ^{14}C has more electrons
 - C. ^{14}C has more protons
 - D. ^{14}C is an ion

G-64

73. What type of bonds hold together the two strands of a DNA molecule?
- A. Hydrogen bonds
 - B. Single covalent bonds
 - C. Double covalent bonds
 - D. Ionic bonds
74. What is population variable as defined as?
- A. Population size
 - B. Populatio density
 - C. Net reproduction per individual per unit time
 - D. Net death rate per individual per unit time
75. When uniform population dispersion does occur in nature, it tends to be result of which of the following?
- A. Competition
 - B. Symbiosis
 - C. Social behavior
 - D. Interference
