

**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. Alkalods
- 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

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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  $F_2$  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  $\text{NAD}^+$  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<sub>i</sub> and NADP<sup>+</sup>?
- 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. -CH<sub>3</sub> bending - 1460, 1365 (cm<sup>-1</sup>)
  - B. -C-C- stretching - 1165 (cm<sup>-1</sup>)
  - C. -C=O stretching - 2960 (cm<sup>-1</sup>)
  - D. -C-H stretching - 2720 (cm<sup>-1</sup>)
53. An association coefficient that ignores any characters that both organisms lack is
- A. Simple matching coefficient (S<sub>SM</sub>)
  - B. Jaccard coefficient (S<sub>J</sub>)
  - C. Both SSM and S<sub>J</sub>
  - D. Similarity matrix (S<sub>M</sub>)
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.  $^{14}\text{C}$  has more neutrons
  - B.  $^{14}\text{C}$  has more electrons
  - C.  $^{14}\text{C}$  has more protons
  - D.  $^{14}\text{C}$  is an ion

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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

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