

Code Number: J-59

**ENTRANCE EXAMINATION – 2015**

**Ph.D. Plant Sciences**

Time: 2 hours

Maximum Marks: 75

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. The question paper contains **75** questions. **Part-A:** Question Nos. **1-25** and **Part-B:** Questions Nos. **26-75** of multiple-choice printed in **13** pages, including this page. **One OMR answer sheet** is provided separately. **Please check.**
5. The marks obtained in **Part-A** will be used for resolving the tie cases.
6. Each question carries **one mark**.
7. There is **Negative marking** for wrong answers, in **Parts A and B**. For each wrong answer, **0.33 mark** will be deducted.
8. Calculators and mobile phones are **NOT** allowed.

**PART-A**

1. Accumulation of microorganisms, plants, algae or animals on wetted surfaces is known as  
as  
A) Biosphere  
B) Fragmentation  
C) Bioventing  
D) Biofouling
2. Imitation of the models, systems, and elements of nature for the purpose of solving complex human problems is known as  
A) Bioscrubbers  
B) Biosensors  
C) Biomimetics  
D) Biofilms
3. Biomedicine products whose active drug substance are made by a living organism or derived from a living organism by means of recombinant DNA or controlled gene expression methods are known as  
A) Biomimetics  
B) Biosensors  
C) Biofoulers  
D) Biosimilars
4. Compounds that lower the surface tension (or interfacial tension) between two liquids or between a liquid and a solid are known as  
A) Siderophores  
B) Bioplastics  
C) Biosurfactants  
D) Biofilters
5. Pollution control technique using living material to capture and biologically degrade pollutants is known as  
A) Biofiltration  
B) Bioenhancement  
C) Biobricking  
D) Biosubstitution
6. Simultaneous degradation of two compounds, in which the degradation of the second compound (the secondary substrate) depends on the presence of the first compound (the primary substrate) is known as  
A) Protocooperation  
B) Synergism  
C) Cometabolism  
D) Mutualism

7. Chemical substance or microorganism which can deter, render harmless, or exert a controlling effect on any harmful organism by chemical or biological means is known as
- A) Biostimulant                                  B) Biocide  
C) Biodiesel                                        D) Biopolymer
8. In which route the photosynthesis occurs during anaerobic conditions in cyanobacteria
- A) Only PS I-cyclic photophosphorylation  
B) Only non-cyclic electron transport  
C) Only cyclic photophosphorylation  
D) Only Cyb<sub>6</sub>f- cyclic photophosphorylation
9. To reduce five molecules of carbon dioxide to glucose through photosynthesis, how many molecules of NADPH and ATP are required?
- A) 6 NADPH and 6 ATP                        B) 10 NADPH and 15 ATP  
C) 15 NADPH and 10 ATP                    D) 6 NADPH and 10 ATP
10. Identify the precursor of Niacin (Vitamin) from the following list of amino acids.
- A) Threonine                                        B) Tyrosine  
C) Phenylalanine                                D) Tryptophan
11. How many isomers can Glucose have if it has 4 asymmetric carbon atoms?
- A) 4    B) 8  
C) 12     D) 16
12. In lactose, the glycosidic linkage is
- A)  $\beta$ -1-4 linkage                                B)  $\beta$ -1-2 linkage  
C)  $\alpha$ -1-4 linkage                                D)  $\alpha$ -1-2 linkage
13. In protein secondary structure, the  $\alpha$ -helix has
- A) 3.4 amino acid residue/turn            B) 3.6 amino acid residue/turn  
C) 3.0 amino acid residue/turn            D) 3.8 amino acid residue/turn

14. The enzymes are biological catalysts; in order to speed up the enzyme reaction which statement could obey from the given answers

- A) Lowering the energy of activation      B) Control the pH  
C) Prevent the denaturation of substrate      D) Optimum temperature

15. When  $[S] = K_M$ , the velocity of an enzyme catalyzed reaction is about

- A) 0.1  $V_{max}$       B) 0.25  $V_{max}$   
C) 0.5  $V_{max}$       D) 0.75  $V_{max}$

16. Identify the equation of Lineweaver-Burk Inversion

- A)  $1/V_o = (K_M/V_{max}) 1/S + 1/V_{max}$       B)  $1/V_o = (V_{max}/K_M) 1/S + 1/V_{max}$   
C)  $1/V_o = (K_M/V_{max}) 1/S + 1/K_M$       D)  $1/V_o = (1/K_M/V_{max}) 1/S + 1/V_{max}$

17. When glucose is converted to lactate by anaerobic glycolysis, the equivalent of \_\_\_\_ ATPs are derived. When glucose is completely oxidized to  $CO_2$  by glycolysis, Pyruvate dehydrogenase, and the TCA cycle, the equivalent of \_\_\_\_ ATPs are derived.

- A) 7; 20      B) 2; 36  
C) 7; 32      D) 2; 12

18. Which of the following statements best describes the  $\beta$ - oxidation of fatty acids?

- A) One Acetyl CoA is produced in each turn of the  $\beta$ - oxidation spiral  
B)  $\beta$ - oxidation of fatty acids is an extra mitochondrial process  
C) The enzymes present in the form of multienzyme complex  
D) 129 ATPs are required for the formation of one mol of palmitic acid

19. Fats and oils containing ester groups can be hydrolyzed with

- A) Aqueous acid, aqueous base or enzymes      B) Only Enzymes  
C) Only Polar and nonpolar bases      D) Only acid groups

20. The energy of electron transfer from NADH and  $FADH_2$  is efficiently conserved in what form?

- A) Triacylglycerols      B) Glycogen  
C) Carbon dioxide ( $CO_2$ )      D) A proton gradient

21. Which molecule is the initial step for condensation with phosphoenolpyruvate during synthesis of aromatic amino acids?
- A) Erythrose 6-phosphate  
B) Erythrose 4-phosphate  
C) Shikimate 3-phosphate  
D) Shikimate 6-phosphate
22. The theory of scattering shows that the phenomenon results in the type of quantized vibrational changes that are associated with infrared absorption observed in
- A) Circular dichroism spectroscopy  
B) Atomic absorption spectroscopy  
C) Raman Spectroscopy  
D) Nuclear magnetic resonance
23. The shift of absorption to a longer wavelength is called
- A) Stoke's shift  
B) Hypsochromic shift  
C) Bathochromic shift  
D) Hyperchormic shift
24. High-energy electromagnetic radiation released by a radioactive nucleus is called
- A) Alpha particle  
B) Beta particle  
C) Electrical charge  
D) Gamma rays
25. In isoelectric focusing, separation of proteins is based on
- A) pH  
B) Relative content of charged groups  
C) Based on the molecular weight  
D) Based on reducing agent

## PART-B

26. In mass spectrometry, molecules are identified based on their
- A) Mass to charge ratio  
B) Charge to mass ratio  
C) Only charge  
D) Only mass
27. Which of the following is indispensable for fermentation?
- A) Carbon dioxide  
B) Formaldehyde  
C) Zymase  
D) Acetic acid

28. Zygotic embryo culture following interspecific hybridization has resulted in haploid induction in

- A) *Hordeum vulgare*
- B) *Nicotiana tabacum*
- C) *Mirabilis jalapa*
- D) *Pisum sativum*

29. Nitrogen content is kept constant in the biosphere because of

- A) N<sub>2</sub> fixation
- B) Nitrogen cycle
- C) N<sub>2</sub> evolution
- D) Industrial release

30. BLASTX is

- A) Search translated nucleotide database using a protein query
- B) Search protein database using a translated nucleotide query
- C) Search a nucleotide database using a nucleotide query
- D) Search nucleotide database using a translated nucleotide query

31. Axial filament is found in

- A) *Treponema*
- B) *Bacillus*
- C) *Rhizobium*
- D) *Pseudomonas*

32. Find out the **mismatch** of electron acceptor and its reduced product

- A) NO<sub>3</sub><sup>-</sup> – NO<sub>2</sub><sup>-</sup>
- B) SO<sub>4</sub><sup>2-</sup> – H<sub>2</sub>S
- C) SeO<sub>4</sub><sup>2-</sup> – Se
- D) CO<sub>2</sub> – CH<sub>4</sub>

33. One of the following is a member of the class *Alphaproteobacteria*

- A) *Bacillus*
- B) *Spirochaeta*
- C) *Rickettsia*
- D) *Leucothrix*

34. Which one among the following is a diaminoacid present in peptidoglycan?

- A) L-Alanine
- B) N-Acetylglucosamine
- C) D-Glutamic acid
- D) L-Lysine

35. An association coefficient, a function that measures the agreement between characters possessed by two organisms, ignoring characters that both organisms lack is
- A) Jaccard coefficient ( $S_J$ )                      B) Simple matching coefficient ( $S_{SM}$ )  
C)  $S_J$  and  $S_{SM}$                               D) Non-matching coefficient ( $S_{NM}$ )
36. Ammonia oxidation to nitrate depends on the following two bacteria
- A) *Nitrosomonas-Nitrospira*              B) *Azospirillum-Pseudomonas*  
C) *Nitrobacter-Nitrococcus*              D) *Nitrosospira-Nitrococcus*
37. Identify the mismatch
- A) Selective medium – Bismuth sulfite agar  
B) Differential medium – MacConkey agar  
C) Enrichment medium – Lysine iron agar  
D) Characteristic medium – Sulfide, indole, motility (SIM) medium
38. Archaeal lipids differ from bacterial lipids in having
- A) Isopranyl glycerol ethers rather than glycerol fatty acid esters  
B) Glycerol fatty acid esters rather than isopranyl glycerol ethers  
C) Glycerol esters rather than fatty acid ethers  
D) Phosphoglycerol fatty acid rather than phosphoglycerol esters
39. Which of the following genes is a marker for shoot apical meristem?
- A) *Clavata3*                                      B) *Leafy*  
C) *Apetala2*                                      D) *Aux1*
40. Gramineous plants acquire iron with the help of
- A) Phytoalexins                                  B) Phytosiderophores  
C) Metallothionin                                D) Thioredoxin
41. Amongst the different photoreceptors present in plants, -----has two cofactors for absorption of light
- A) Cryptochrome                                B) Phytochrome  
C) Phototropin                                    D) UV-B photoreceptor

42. Which of the following proteins is the **odd** one based on its function?

- A) PIN1                                      B) AUX1  
C) ABP1                                      D) DELLA

43. When a bacterium such as *E. coli* is shifted from a warm growth temperature to a cooler growth temperature, it compensates by

- A) Putting longer-chain fatty acids into its membranes  
B) Putting more unsaturated fatty acids into its membranes  
C) Increasing its metabolic rate to generate more heat  
D) Synthesizing thicker membranes to insulate the cell

44. GFP is a fluorescent protein isolated from jellyfish, *Aequoria victoria*. It transduces the blue chemiluminescence of the protein aequorin into green fluorescent light by energy transfer. The gene for GFP has become a useful tool for making chimeric proteins of GFP linked to other proteins where it functions as a fluorescent protein tag. The fluorophore of GFP is comprised of

- A) Ser 65 Tyr 66 and Gly 67              B) Ser 57 Tyr 58 and Gly 59  
C) Tyr 65 Ser 66 and Gly 67              D) Gly 65 Tyr 66 and Ser 67

45. Rapid Amplification of cDNA ends (RACE) is a technique used in molecular biology to obtain the full length sequence of an RNA transcript found within a cell. RACE results in the production of a cDNA copy of the RNA sequence of interest, produced through reverse transcription followed by PCR amplification of the cDNA copies. 5' end can be confirmed by performing by 5' RACE. Can you identify the end enzyme used for this purpose?

- A) Poly A Polymerase                      B) RNA dependent DNA polymerase  
C) DNA dependent RNA polymerase      D) Terminal nucleotidyl transferase

46. Kunkel's method of site-directed mutagenesis is a molecular biology method that is used to make specific and intentional changes to the DNA sequence of a gene and any gene products. Also called site-specific mutagenesis or oligonucleotide-directed mutagenesis, it is used for investigating the structure and biological activity of DNA, RNA, and protein molecules, and for protein engineering. The most commonly used two enzymes in this process is:

- A) Vent polymerase and *KpnI*              B) Vent polymerase and *DpnI*  
C) Vent polymerase and *XmaI*              D) Vent polymerase and *SmaI*



47. Bacterial expression vectors all have the sequences related to Thrombin, Entero kinase and Factor XA at the junctions of fusion tags and will be used to remove fusion tag from the expressed proteins. Thrombin cleaves the peptide bond between

- A) Glutamic acid and Aspartate
- B) Arginine and Glycine
- C) Aspartic acid and Tyrosine
- D) Lysine and Glutamic acid

48. Recently, there were news articles about the pandemic of Ebolavirus in the West African nations. This virus belongs to

- A) Positive sense RNA virus
- B) Reverse transcribing virus
- C) Negative sense RNA virus
- D) Single stranded DNA virus.

49. A class of bacterial expression vectors are designed to express the desired proteins as GST fusions on the principle that the GST rapidly folds into a stable and highly soluble protein upon translation, however, these proteins are purified by passing through this columns

- A) Glutathione columns
- B) GLAG tags
- C) Histidine tags
- D) Talon columns

50. Rabbit reticulocyte lysate system is used to perform the function given below

- A) To generate run off transcripts
- B) To generate *in vivo* transcripts
- C) To translate mRNA
- D) The study silencing of the transcripts

51. If you would like to remove step wise mononucleotides from the 3' hydroxyl end of duplex DNA, which enzyme you need to use to perform the same

- A) Endo nuclease III
- B) Exo nuclease III
- C) Klenow large fragment
- D) DNA polymerase III

52. Which of the following molecules binds strongly to avidin?

- A) Biotin
- B) Folic acid
- C) Niacin
- D) Lipoic acid

53. Plastids

- A) Present in all plant cells
- B) Present only in leaf cells
- C) Present in aerial parts only
- D) Absent in all fresh water algal cells

54. The first plant to have its genome sequenced belongs to

- A) Compositae
- B) Solanaceae
- C) Brassicaceae
- D) Fabaceae

55. The precursor for fatty acid biosynthesis is

- A) Histidine
- B) Phenylalanine
- C) Malonyl CoA
- D) Acetyl CoA

56. To fix 1 mole of CO<sub>2</sub>

- A) C<sub>4</sub> plants require more ATP than C<sub>3</sub> plants
- B) C<sub>3</sub> plants require more ATP than C<sub>4</sub> plants
- C) C<sub>3</sub> and C<sub>4</sub> plants require the same amount of ATP
- D) C<sub>3</sub> plants require more ATP and more NADPH than C<sub>4</sub> plants

57. Tryptophan is the precursor for the biosynthesis of

- A) Auxin
- B) Gibberellin
- C) Cytokinin
- D) Absciscic acid

58. Which of the following compounds serves as a coenzyme for transaminase reactions?

- A) Thiamine pyrophosphate
- B) Coenzyme A
- C) Pyridoxal phosphate
- D) FAD

59. A bottle containing an enzyme solution is labeled as 10,000 units/mg protein with a concentration of 10 mg/ml protein in 100 mM Tris-HCl. From this bottle, if 1.0 ml of enzyme solution is taken in a new bottle and 9.0 ml of double distilled water is added, total how many units of enzyme is present in the new bottle?

- A) 8,000 units
- B) 1,000 units
- C) 100,000 units
- D) 10,000 units

60. Two *Drosophila* recessive mutations of bristles are nuked and singed. When the two mutants are mated, each offspring had bristles with mutant characteristics, not wild-type. We can say that these two mutations
- A) Complement and are therefore allelic
  - B) Do not complement and are therefore allelic
  - C) Do not complement and are therefore not allelic
  - D) Do not complement and are therefore on different pieces of DNA
61. Which of the following statements about histones is **incorrect**?
- A) They bind tightly to the DNA
  - B) They are highly alkaline proteins
  - C) They are negatively charged
  - D) They can be modified to regulate expression from DNA
62. A cross is made involving two genes of interest in yeast and the following tetrads were obtained: 8 non-parental ditypes; 37 tetratypes; 80 parental ditypes. The map distance between these two genes is
- A) 18
  - B) 21.2
  - C) 29.6
  - D) 36
63. The restoration of function by a second mutation at a different site in the same gene is called
- A) Reverse mutation
  - B) Tautomeric shift
  - C) Intergenic suppression
  - D) Intragenic suppression
64. Map units on a linkage map cannot be relied upon to calculate physical distances on a chromosome because
- A) The frequency of crossing over varies along the length of the chromosome
  - B) The gene order on the chromosomes is slightly different in every individual
  - C) Physical distances between genes change during the course of the cell cycle
  - D) The relative distances that are measured varies in each individual

65. Identify the statement that is **true** regarding genome imprinting

- A) It involves an irreversible alteration in the DNA sequence of imprinted genes
- B) It is greatest in females because of the larger maternal contribution of cytoplasm
- C) It explains cases in which the gender of the parent from which an allele is inherited affects the expression of that allele
- D) It is an irreversible process as the imprinted genes do not erase and reestablish during the course of development

66. Which of the following is **not** a component of Ti plasmid based vectors?

- A) An origin of replication for replication in *Escherichia coli*
- B) The right and left border sequence of the T-DNA
- C) A polylinker site
- D) Cytokinin genes

67. Expression of **bar** gene in transgenic plants can confer resistance to the following herbicide

- A) Phosphinothricin
- B) Glyphosate
- C) 2,4-dichlorophenoxyacetic acid
- D) Atrazine

68. The thylakoids of chloroplasts are removed and kept in a culture medium containing CO<sub>2</sub> and water. If the set-up is exposed to light, hexose sugars are not formed as end products. The most appropriate reason for this phenomenon is

- A) CO<sub>2</sub> assimilation cannot take place in the presence of light
- B) The pigment systems are not working
- C) The light trapping device is non-functional
- D) Enzymes are not available

69. Why is cambium considered a lateral meristem?

- A) Because it gives rise to lateral branches
- B) Because it increases the girth of the plant
- C) Because it increases the length of the plant
- D) Because it increases the height and diameter of the plant

70. The function of crista in mitochondrion is?

- A) Intake of oxygen
- B) Carbon assimilation
- C) Elimination of carbon dioxide
- D) Electron transport and ATP synthesis

71. The mechanism ensuring the genetic continuity in mitosis is

- A) Segregation of maternal and paternal characters
- B) Crossing over
- C) Halving chromosome number between the two daughter cells
- D) Formation of two daughter cells with identical DNA

72. Gibberellins stimulate flowering in

- A) Day neutral plants
- B) Short day plants
- C) Long day plants
- D) All of the above

73. A lot of starch is deposited in a banana fruit as it matures. Which of the following explains how the starch gets there?

- A) Starch solution passes through cells such as companion cell to fruit
- B) Starch grains pass through cells from xylem to fruit
- C) A sugar solution passes through cells such as companion cells to the fruit where it is changed to starch
- D) Starch solution passes through cells from phloem to fruit

74. Closed vascular bundles are those in which

- A) A bundle sheath surrounds a vascular bundle
- B) Cambium is not present
- C) Cambium is present
- D) Vascular bundles lie close

75. Which of the following fruits is a case of parthenogenesis?

- A) A fruit without seeds after fertilization
- B) A fruit with seeds after fertilization
- C) A fruit with viable seeds without fertilization
- D) A fruit with viable seeds after fertilization