M-57

ENTRANCE EXAMINATION – 2016
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 **12** pages, including this page. One OMR answer sheet is provided separately.

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.

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PART-A

1. In the year 2005, the "Golden Rice-2" was developed using transgenic approaches which contain 23 fold more ..... as compared to original golden rice

   a. Vitamin A b. Zinc content c. Vitamin B d. Iron content

2. Which vitamin is called as 'beauty vitamin'

   a. Biotin b. Retinol c. Tochoferol d. Calciferol

3. Gas chromatography is used for metabolomics study for separating and analyzing compounds that can be vaporized without decomposition. Which of the following is the most suitable gas to use as a carrier gas in a gas chromatogram?

   a. Methane b. Hexane c. Ammonia d. Helium

4. In C4 plants, which enzyme performs the critical reaction of converting carbon dioxide to 3-phosphoglycerate?

   a. RuBP carboxylase b. PEP carboxylase c. RuBP activase d. PEP decarboxylase

5. Which one of the following is not a blue light photoreceptor in plants?

   a. Phototropin b. Cryptochrome c. Zeitlupe d. UVR-8

6. Which one of the following is not a peptide hormone in plants?

   a. Phytosulfokine b. Strigolactone c. Systemin d. Stomagen

7. The typical genetic ratio expected for a population segregating for a resistant trait controlled by digenic complementary recessive genes

   a. 9:3:3:1 b. 9: 7 c. 15:1 d. 9:3:6

8. "Hidden epitopes" are classified as

   a. Metatopes b. Neotopes c. Cryptotopes d. Neutralizing epitopes

9. Seed dispersal by ants is called as

   a. Elaiosomochory b. Blastochory c. Anemochory d. Meterochory

10. These are called as Amphibians of Plant Kingdom

a. Pteridophytes b. Gymnosperms c. Bryophytes d. Fungi

11. Gamma Knife and Cyber knife are two systems that are used in the treatment of

a. Cancer b. HIV and AIDS c. Arthritis d. Eye Cataracts

12. Which of the following is a target signal for proteins targeted to peroxisomes

a. R-R-L b. H-R-L c. K-K-K d. S-K-L

13. Which of the following is a site specific endonuclease in T-DNA transfer?

a. Vir D1 b. Vir B11 c. Vir E2 d. Vir D2

14. Which is the name associated with the development of 'gene gun' technique in transformation?

a. Boynton b. Pal Maliga c. J.C. Stanford d. J. Schell

15. Microcephaly is associated with

a. SARS virus b. ZIKA virus c. EBOLA virus d. HANTA virus

16. 'Gossypol' acts as an inhibitor for several dehydrogenase enzymes is derived from

a. Groundnut b. Chestnut c. Cotton d. Mexican Chillies

17. Organisms that live inside rocks or in pores between mineral grains are called as

a. Endoliths b. Extremophiles c. Psychrophiles d. Meshophiles

18. Global warming is associated with the increase in the atmospheric CO_2 concentration, what is the present global atmospheric CO_2 concentration.

a. 358 ppm b. 404 ppm c. 453 ppm d. 507 ppm

19. A disease cycle in which a pathogen that takes several years to initiate new infection is called

a. Monocyclic cycle b. Polycyclic c. Polyetic cycle d. Dicyclic

20. The herbicide phosphinothricin targets the enzyme

a. Acetolactatesynthase b. 5-enol pyruvyl shikimate-3-phosphate synthase
c. Itrilase d. Lutamine synthetase

21. Which of the following photosynthesis bacteria have both PS I & PS II?

a. Purple Sulphur bacteria
b. Cyanobacteria
c. Purple non Sulphur bacteria
d. Green Sulphur bacteria

22. Hypsochromic shift is nothing but change in spectral position to

a. Higher wavelength
b. Less energy frequency
c. Shorter wavelength
d. Shorter wavelength and lower frequency

23. Anthracyclines are a class of antibiotics, produced from

a. *Strptomyces persutus*
b. *Bacillus megaterium*
c. *Pseudomonas campestris*
d. *Podophyllum peltatum*

24. Commensalism is a biological relationship between individuals of two species in which

a. Both the species compete for space and food
b. One species obtains food or other benefits from the other without either harming or benefiting the latter
c. One species obtains food or other benefits from the other by harming the latter
d. Both the species are of the concept of "give and take"

25. LOD scores are used in genetics

a. For linkage analysis in human or animal or plant populations
b. To study epistatic interactions between two genetic loci
c. To estimate the frequency of double cross overs
d. To estimate the penetrance of allele

PART-B

26. Which of the following proteins are associated with male sterility restoration in plants

a. PPR proteins b. F-Box proteins c. VIP proteins d. TATA box proteins.

27. Paclitaxel, the most well-known natural-source cancer drug, is derived from the bark of

a. *Vinca rosea*
b. *Gloriosa superba*
c. Pacific yew tree
d. *Strychnos nuxvomica*

28. A population of a host in which all individuals have a particular character of resistance in common is called

a. Biotype b. Pathovar c. Pathodeme d. Biotroph

29. Which one of the following plant hormone is not derived from carotenoid degradation?

a. Abscisic acid b. Phaseic acid c. Brassinosteroid d. Strigolactone

30. The isotope of Hydrogen usually used in radioactive labeling of nucleic acids is

a. H_2 b. ^{1}H c. ^{2}H d. ^{3}H

31. Plant with robust root system penetrating into deeper ground water is

a. Phreatophyte b. Epiphyte c. Sporophyte d. Cryptophyte

32. Kaolinite and quartz enriched soils are

a. Ferralsol b. Vetrisol c. Podsol d. Lixisol

33. One of the amino acid is involved in phosphorylation by post translation modification

a. Valine b. Methionine c. Cysteine d. Threonine

34. Instrument used for measuring the height of a standing tree

a. Hypsometer b. Lysimeter c. Stratometer d. Manometer

35. This scientist is associated with the discovery of *Potato Spindle tuber viroid* in 1971.

a. Brakke b. T. O. Diener c. William Stanley d. Renatto Dalbecco

36. The vernalization treatment leading to flower development is sensed by

a. Leaf b. Shoot apex c. Stem d. Root

37. Which of the following protein is considered as florigen in the plants?

a. Constans b. Gigantea c. FT d. Wus

38. Norman Ernest Borlaug, who has been called "the father of the Green Revolution" has been awarded Noble Peace Prize in the year

a. 1968 b. 1970 c. 1972 d. 1974

39. Phytosiderophores are involved in transport of following mineral ion from soil to root cells in dicot plants.

a. Silicon b. Boron c. Iron d. Potassium

40. Curstose, fruticose and foliose are varieties of

a. Rusts and smuts b. Yeasts c. Lichens d. Mycorrhizae

41. Which of the following is the best host *E. coli* strain for expressing a protein that must contain disulphide bonds for it to function properly?

a. BL21(DE3) Origami b. BL21 (DE3) pLysS
c. BL21 (DE3) Rosetta d. BL21 (DE3) Star

42. A common photoreceptor between plant and animals is

a. Phytochrome b. Rhodopsin c. Phototropin d. Cryptochrome

43. DNA profiling technique to demonstrate the similarity between different plant species with a reference to some specific protein coding DNA sequences is called

a. Plant profiling b. Phyto blot c. Garden blot d. Southern blot

44. Arabidopsis and rice have diploid chromosome number of 10 and 24, respectively. Assuming no crossing over taking place, genetic variation among F2 individuals in a genetic cross is likely to be.

a. Same in both species but not zero b. More in Arabidopsis
c. More in rice d. Zero in both the species

45. In bacterial promoters, which of the following describes the 'Pribnow-Schaller box'?

a. The 5' untranslated region b. The -10 box
c. The -35 box d. The termination sequence

46. When the bark of a tree is removed in a circular fashion all around near its base, it gradually dries up and dies because

a. Water from soil cannot rise to aerial parts
b. Roots are starved of energy
c. Tree is infected by soil microbes
d. Roots do not receive oxygen for respiration

47. What is the amount of energy released at the end of glycolysis/Krebs cycle?

a. 678,000 calories b. 687,000 Calories
c. 597,000 Calories d. 569,000 Calories

48. Bacterial endospores have very specialized proteins which protect the spores from DNA damage, these are called as

a. Small acid soluble proteins (SASP)
b. DNA recovery proteins (DRP)
c. Endospore specific soluble proteins (ESSP)
d. Spore specific mega proteins (SSMP)

49. Which type of database is 'FlyBase'

a. Literature database
b. Bimolecular database
c. Model organism database
d. Biodiversity database

50. A bacterial cell with the fertility factor, F integrated into its chromosome is referred as

a. Excongujant
b. Merozygote
c. High frequency of recombination
d. Resistance transfer factor

51. The mobile phase in reverse phase chromatography is

a. Non polar organic solvent
b. Basic buffer
c. Acidic buffer
d. Polar organic solvent

52. Lipid-a stimulates the synthesis of one of the following factors

a. Transforming growth Factor (TGF)
b. Platelet-derived growth factor (PDGF)
c. Epidermal growth factor (EGF)
d. Tumor necrosis factor (TNF)

53. Which of the following is a sensor of phenolics in *Agrobacterium*?

a. VirD1 b. Vir C2 c. VirA d. Vir B

54. What are apocarotenoids?

a. These are terpenoids with C_{40} carbon
b. These are terpenoids with $>C_{40}$ carbon
c. These are terpenoids with $<C_{40}$ carbon
d. These are terpenoids with C_{40} carbon and are conjugated with glucose.

55. Algae and other submerged plants in water float during day time and sink at night, because

a. They come up to enjoy some time
b. They lose weight at night
c. They become buoyant due to accumulation of O2 as a result of photosynthesis
d. They become light due to food material accumulation

56. Proteasomes destroy proteins by unfolding them and chopping them into small fragments. What kinds of proteins are recognized by proteasomes?

a. Proteasomes recognize ubiquitinylated proteins.
b. Proteasomes recognize denatured proteins.
c. Proteasomes recognize proteins with basic or aromatic amino acids at the N-terminus.
d. Proteasomes recognize viral proteins.

57. Phenol used in DNA extraction

a. Precipitates DNA and leave proteins in aqueous solution
b. Precipitates RNA-protein complex and leave DNA in aqueous solution
c. Precipitates cell debris and leave nucleic acids-protein complex in aqueous solution
d. Precipitates proteins and leave nucleic acids in aqueous solution

58. Which of the following statements is true of RNA interference?

a. RNA interference is a normal way for organisms to regulate gene expression.
b. RNA interference is a mechanism for combating virus infection in plants.
c. Both A and B
d. RNA interference is already used therapeutically for many disorders

59. Cellulose is composed from D-glucose units, which condense through

a. α(1→4)-glycosidic *bonds*
b. β(1→4)-glycosidic *bonds*
c. β(1→6)-glycosidic *bonds*
d. α(1→6)-glycosidic *bonds*

60. The coding region of a gene is 105 nucleotides long, including both start and stop codons, which of the following would be the most likely to effect of a single nucleotide deletion at position 79 in the coding region?

a. Only the active site would be affected
b. There would be no effect on the polypeptide
c. The entire amino acid sequence of the polypeptide would change
d. There would be changes in only the last 9 amino acids

61. What is a 'proteotypic' peptide?

a. A post-translationally modified peptide
b. A stable isotope-containing peptide
c. A peptide which is unique to a specific protein
d. A peptide which is typical of all other peptides

62. Which among the following statements is <u>not correct</u> for the differences between bacterial photosynthesis *vs* plant photosynthesis?

a. Bacteria lack definite chloroplast while in plants photosynthesis happen in chloroplast
b. Photosynthesis takes place above 700 nm in bacteria, while in plants it occurs between 400 to 700 nm
c. The CO_2 reductant in bacteria is NADH + H+, while in plants the reductant is NADPH + H+
d. Non-cyclic photophosphorylation is dominant in bacteria, while cyclic photophosphorylation in plants

63. Match the following

i. Nicotine	A. Grass
ii. Cynogenic glucosinolates	B. Terpenoid
iii Silica cells	C. Cysteine-rich protein
iv. Limonene	D. Alkaloid
v. Defensin	E. Hydrogen cyanide

a. i (D), ii (E), iii (A), iv (B), v (C)
b . i (B), ii (E), iii (A), iv (D), v (C)
c. i (E), ii (D), iii (A), iv (C), v (B)
d. i (D),ii (C), iii (A), iv (E), v (B)

64. "Lantibiotics" are

a. A group of probiotics which will promote the growth of many bacteria
b. A group of prebiotics which will promote the growth of many bacteria
c. A group of antibiotics which are polycyclic peptides
d. A group of toxins which are produced by microorganisms

65. Which of the following statement is CORRECT on plant adaptation?

a. Plants adapted to cold environment have higher ratio of 'unsaturated to Saturated' fatty acids in their membrane compared to those adapted to hot Environment.
b. Plants adapted to cold environment have lower ratio of 'unsaturated to saturated' fatty acids in their membrane compared to those adapted to hot environment.
c. Plants adapted to cold environment have same ratio of 'unsaturated to saturated fatty acids in their membrane compared to those adapted to hot environment.
d. Plants do not have any unsaturated fatty acids in the membrane.

66. Which of the following statements about isoelectric focusing is correct?

a. Proteins separated by isoelectric focusing cannot be tested for biological activity.
b. Proteins separated by isoelectric focusing can be tested for biological activity.
c. The separation of proteins by isoelectric focusing is only based on charge.
d. The separation of proteins by isoelectric focusing is only based on size.

67. For an application where you require a sample of your target protein at high purity, what would be a good purification strategy? Assume that your starting point is *E. coli* cells in which the target protein fused to an affinity tag has been over-expressed.

a. Affinity chromatography (AC) followed by size exclusion chromatography (SEC)
b. AC only
c. AC followed by ion-exchange (IEX) followed by SEC
d. AC followed by IEX, followed by hydrophobic interaction (HIC) and then SEC

68. Which among the following is <u>not a correct</u> statement for terpenoids

a. Terpenoids are polymers of isoprenoids
b. Isopentanyl pyrophosphate is the processor for terpenoids
c. Biogenesis of terpenoids occurs only in plants and prokaryotes
d. Steroids, hopanoids and quinones are a class of terpenoids

69. Many plants inhibit different types of pathogens and herbivores using special chemical known as secondary metabolites. When an insect larva consumes this secondary metabolites containing plant tissue, this secondary metabolite incorporated into the insect's protein in some of the places where the mRNA codes for arginine, because the enzyme that charges the tRNA specific for arginine fails to discriminate accurately between the two amino acids. This secondary metabolites is an amino acid that is not found in protein, but is very similar to the amino acid arginine. The structure of this secondary metabolite, however, is different enough from that of arginine, that some of the resulting proteins end up with a modified tertiary structure, and hence reduced biological activity. These defects in protein structure and function lead to the developmental abnormalities that kill the insect. What is the name of this secondary metabolite?

a. Phytoalexin b. Canavanine c. Gallotannin d. Nicotine

70. Bacterial cell lysis by lysozyme is due to the

a. Hydrolysis of α-1,4-glycosidic bonds between the N-acetyl glucosamine and N-acetylmuramic acid
b. Inhibition of cell wall synthesis
c. Hydrolysis of pentapeptide bridges
d. Hydrolysis of β-1,4-glcosidic bonds between the N-acetyl glucosamine and N-acetylmuramic acid

71. The word "anammox" refers to

a. A group of microorganisms which are involved in ammonification
b. A chemical process which involves ammonification
c. A group of anaerobic microorganism which are involved in ammonia oxidation
d. A group of anoxygenic microorganisms which are involved in ammonia oxidation

72. In molecular biology and genomics different types of vectors are used for gene cloning or cloning of large eukaryotic DNA. The ideal feature of the cloning vectors should be small in size and have an antibiotic resistance gene as selectable marker. The BAC, PAC and YACs are different types of cloning vectors used for eukaryotic DNA cloning. What is the correct size and selectable markers of these 3 vectors?

a. BAC = 7.4Kb & Chloramphenicol resistance gene; PAC = 18.75Kb & Kanamycin resistance gene; YAC = 11.45Kb & Ampicillin resistance gene
b. BAC = 7.4Kb & Ampicillin resistance gene; PAC = 18.75Kb & Chloramphenicol resistance gene; YAC = 11.45Kb & Kanamycin resistance gene
c. YAC = 7.4Kb & Chloramphenicol resistance gene; BAC = 18.75Kb & Kanamycin resistance gene; PAC = 11.45Kb & Ampicillin resistance gene
d. BAC = 7.4Kb & Ampicillin resistance gene; PAC = 11.45Kb & Kanamycin resistance gene; YAC = 18.75Kb & Chloramphenicol resistance gene

73. The steps in setting up a *Pichia pastoris* expression system are listed below. Work out which of the options A-D lists the correct sequence of steps.

A. Transform competent Pichia cells
B. Add the coding sequence for an affinity purification tag to the cDNA for your 'protein of interest'
C. Determine methanol utilization phenotype
D. Screen growth and induction conditions
E. Linearize the expression vector by restriction digestion
F. Sub-clone the cDNA for your 'protein of interest' into the expression vector
G. Select transformed Pichia cells by loss of auxotrophy or antibiotic resistance
H. Screen for 'jackpot clones'

a. F, E, A, B, G, H, C, D
b. F, C, B, E, D, G, H, A
c. F, B, E, A, G, C, H, D
d. F, B, A, E, H, C, G, D

74. Several types of DNA sequencing technology are available now-a-days which are used for whole genome sequencing of an organism. One of such technology is Next Generation Sequencing (NGS). Which of the following technique best describe the NGS?

    a. GC-MS, LC-MS and NMR
    b. Sequence Tag Site (STS) and Expressed Sequence Tag (EST)
    c. Roche's 454, Illumina and ABI's SOLiD
    d. Whole genome shotgun and Clone-by-Clone approach

75. Pan-genome or "supra-genome" includes

    a. "Core genome" containing genes present in all strains, a "dispensable genome" containing genes present in two or more strains, and finally "unique genes" specific to single strains
    b. Only "core genome" containing genes present in all strains
    c. "Core genome" containing genes present in all strains and "dispensable genome" specific to single strains
    d. "Core genome" containing genes present in all strains and "unique genes" specific to single strains

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