

ENTRANCE EXAMINATIONS – 2018
(Ph.D. Admissions - January 2019 Session)

Ph.D. Plant Sciences

Duration : 2 hours

Max. Marks : 80

Hall Ticket No.

Instructions to the candidates

Please read the instructions carefully before answering the questions :

1. Write your Hall Ticket No. in the OMR Answer Sheet given to you. Also, write your Hall Ticket No. in the space provided above.
2. This Question paper consists of two parts : Part – A and Part – B contains with 40 Questions in each Part, printed in **14** pages including this page. OMR Answer sheet will be provided separately.
3. Each question carries one mark.
4. Answers are to be marked on the OMR Answer Sheet following the instructions provided thereon.
5. Please handover the **OMR Answer Sheet** at the end of the examination to the Invigilator.
6. The marks obtained in **PART-A** will be used for resolving the tie cases.
7. Calculators and Mobile Phones are **NOT** allowed.

PART-A

1. In alkaline lysis (mini-prep) method, plasmid DNA is isolated without contamination of chromosomal DNA from *E. coli*, because
 - A. Chromosomal DNA is fully digested by alkali, but plasmid is not digested
 - B. Chromosomal DNA is trapped in cell debris, but plasmid DNA remains in solution
 - C. Alkali allows only escape of plasmid DNA from cell but not of chromosomal DNA
 - D. Alkaline phosphatase can digest chromosomal DNA but not plasmid DNA
2. A unicellular algae having water potential of -2 MPa is placed in a solution with -4 MPa water potential. Which one of the following statement is true?
 - A. Water will move from external solution to algae
 - B. Water will move from algae to external solution
 - C. There will be no net movement of water
 - D. None of above is true
3. Which of the following methods is **not** used for separation of nucleic acids?
 - A. Polyacrylamide gel electrophoresis
 - B. Agarose gel electrophoresis
 - C. Starch gel electrophoresis
 - D. Denaturing gel electrophoresis
4. Which one of the following defines the concept of Genomic Library?
 - A. A database where the sequence of an organism's genome is stored
 - B. A collection of many clones possessing different DNA fragments from the same organisms ligated to vectors
 - C. A collection of genomics book that describes Genomes, Genes, Marker and ESTs of different organisms
 - D. A database that describes Genomes, Genes, Marker and ESTs of same organism
5. Which breeding method utilizes natural selection to increase the frequency of adaptable and superior genotypes during initial years of population advancement following hybridization of two purelines in a combination breeding program?
 - A. Back cross method
 - B. Pedigree method
 - C. Bulk method
 - D. Recurrent selection method

6. Phosphoric acid is tribasic, with pKa values of 2.14, 6.86, and 12.4. The ionic form that predominates at pH 3.2 is:

- | | |
|----------------------------|------------------------------|
| A. H_3PO_4 | B. H_2PO_4^- |
| C. HPO_4^{2-} | D. PO_4^{3-} |

7. To physically separate different chlorophylls from a leaf, a suitable method is

- | | |
|-------------------------|-------------------------|
| A. Ultra-Centrifugation | B. Paper Chromatography |
| C. Crystallization | D. Pressure filtration |

8. The UV absorbance is not used for estimation of one of these macromolecules

- | | |
|------------|-----------|
| A. DNA | B. RNA |
| C. Protein | D. Starch |

9. If the genomic DNA of haploid yeast cells is fractionated using pulsed field electrophoresis, how many distinct DNA bands would be visible?

- | | |
|-------|-------|
| A. 7 | B. 8 |
| C. 14 | D. 16 |

10. The A locus and the B locus are very tightly linked that no recombination is ever observed between them. If Ab/Ab is crossed with aB/aB and the F_1 is intercrossed, the proportion of AaBb phenotypes that will be seen in the F_2 will be

- | | |
|--------|----------------------------------|
| A. 25% | B. 50% |
| C. 75% | D. AaBb is not possible |

11. Which of the following compounds is an inhibitor of ethylene activity?

- | | |
|-------------------|-----------------------|
| A. Silver nitrate | B. Ferrous sulphate |
| C. Sodium nitrate | D. Magnesium sulphate |

12. Why RNA is hydrolyzed by alkali, whereas DNA is not?

- A. RNA has uracil, unlike DNA
- B. The 2' deoxy sugar of RNA is more susceptible than 2' oxy ribose of DNA
- C. The 2' deoxy sugar of DNA is less susceptible than 2' oxy ribose of RNA
- D. The 2' deoxy ribose of DNA is not affected by alkali as DNA is present inside the nucleus and wrapped by nucleosomes so that no DNA is free for alkali action

13. Which of the following agents mediate oxidative cleavage of disulphide bonds?

- | | |
|-----------------------------|---------------------|
| A. β -mercaptoethanol | B. Dithiothreitol |
| C. Performic acid | D. Dithioerythritol |

14. A researcher performed ELISA using secondary antibody conjugated to alkaline phosphatase enzyme and measured the readings at the following wavelength
- A. 405 nm B. 450 nm C. 505 nm D. 520
15. In a family, both husband and wife have blood group 'A'. The first child born to them was found to have 'O' blood group. What is the probability that their next child will have blood group 'A'?
- A. 0.5 B. 0.75
C. 0 D. 0.25
16. The ratio of SDS to protein in SDS-PAGE is
- A. 1.4:1 B. 1: 1.4 C. 1:2 D. 4:1
17. Which one of the following elements need *not* be present in an expression vector?
- A. Selection marker to select host cells containing the vector
B. Two different origins of replication
C. Promoter sequence upstream of the cloned gene
D. Unique restriction enzyme sites for insertional cloning
18. If 2 loci are 20 cM apart, what proportion of the cells in prophase of the first meiotic division will contain a single crossover in the region between them?
- A. 10% B. 20%
C. 30% D. 40%
19. Arsenic exerts its toxic action by attacking
- A. -CH group of enzyme B. -CO group of enzyme
C. -SH group of enzyme D. PO_4^{3-} group of enzyme
20. In which of the following techniques restriction endonuclease is NOT used?
- A. RFLP B. AFLP C. RAPD D. CAPS
21. What is the function of dideoxy NTPs in Sanger's method of DNA sequencing?
- A. Inhibit chain elongation by DNA polymerase
B. Disrupt the formation of hydrogen bonds
C. Generate breaks in the newly synthesized chain
D. None of the above

22. The ability of *Vibrio fischeri* to produce bioluminescence chemicals only when a certain population density has been reached is an example of

- A. Liebig's law of the minimum
- B. Quorum sensing
- C. Shelford's law of tolerance
- D. The 2nd law of thermodynamics

23. Which one of the following is *true* about "Two-Hybrid System?"

- A. Used to identify proteins that interact *in vivo*. Employs two different plasmids, one encodes a hybrid protein consisting of a DBD fused to a so-called bait or probe protein and the other encodes a hybrid protein consisting of AD fused to a so-called fish or target protein.
- B. Used to identify proteins that interact *in vitro*. Employs two different plasmids, one encodes a hybrid protein consisting of a DBD fused to a so-called bait or probe protein and the other encodes a hybrid protein consisting of AD fused to a so-called fish or target protein.
- C. Used to identify proteins that interact *in vivo*. Employs two different plasmids, one encodes a hybrid protein consisting of AD fused to a so-called bait or probe protein and the other encodes a hybrid protein consisting of DBD fused to a so-called fish or target protein.
- D. Used to identify proteins that interact *in vitro*. Employs two different plasmids, one encodes a hybrid protein consisting of AD fused to a so-called bait or probe protein and the other encodes a hybrid protein consisting of DBD fused to a so-called fish or target protein.

24. After completion of genome sequencing of an organism using clone based approach, which of the following software/programs is generally used for sequence quality and sequence assembly into proper contig?

- | | |
|----------------------------|-------------------------|
| A. FGENESH; GENSCAN; GENEI | B. PHRED; PHRAP, CONSED |
| C. Pfam; SMART; BLOCKS | D. SALAD; PLAZA; NCBI |

25. In *Escherichia coli*, the inability of the *lac* repressor to bind an inducer would result in

- A. Constitutive synthesis of β -galactosidase
- B. No substantial synthesis of β -galactosidase
- C. Synthesis of inactive β -galactosidase
- D. Inducible synthesis of β -galactosidase

26. In which of the following techniques the enzyme CEL I is used?

- | | | | |
|---------------|------------|---------|--------|
| A. Microarray | B. TILLING | C. AFLP | D. NGS |
|---------------|------------|---------|--------|

27. A polypeptide chain made of 100 amino acids if contains only ' α -helices' in its entire structure, the distance occupied will be

- | | |
|----------|----------|
| A. 150 Å | B. 105 Å |
| C. 155 Å | D. 165 Å |

28. Theoretical plates are used to

- A. Estimate the efficiency of a column
- B. Measure the distribution of the analyte between mobile and stationary phases
- C. Determine the thickness of the stationary phase
- D. Indicate the uniform flow of the stationary phase

29. The glycine molecular formula is $C_2H_5O_2N$. What would be the molecular formula for a linear oligomer made by linking ten glycine molecules together by condensation synthesis?

- | | |
|-------------------------------|-------------------------------|
| A. $C_{20}H_{60}O_{29}N_{10}$ | B. $C_{20}H_{50}O_{20}N_{10}$ |
| C. $C_{20}H_{32}O_{11}N_{10}$ | D. $C_{20}H_{45}O_{10}N_{10}$ |

30. Which among the following mapping populations is best suited to obtain plant progeny with homozygous recessive alleles?

- | | |
|---------------------------|----------------------|
| A. Doubled haploid plants | B. Hemizygous plants |
| C. Monosomic plants | D. Trisomic plants |

31. In gas chromatography the basis for separation of the components of the volatile material is the difference in

- | | |
|---------------------------|---------------------|
| A. Partition coefficients | B. Conductivity |
| C. Molarity | D. Molecular weight |

32. When placed in a magnetic field, all the random spins of the nuclei

- A. Rotate 90° away from the induced field
- B. Reverse their direction
- C. Spin between planes
- D. Align with the magnetic field

33. In which of the following vectors, the transcription termination sequence is present?

- | | |
|-------------------------|------------|
| A. pUC19 | B. pET-28a |
| C. pBluescript II SK(+) | D. pBR322 |

34. The restriction sites (REs) of *Bam*HI and *Eco*RI are and GGATCC and GAATTC, respectively. These were selected to be used in a cloning strategy and *Bam*HI site was decided to be inserted in the Forward Primer (FP) while *Eco*RI was decided to be used in the Reverse primer (RP) in the complementary strand. The gene of interest will be first PCR amplified by using these primers. In what orientation (from 5' to 3') the REs can be used to successfully clone a gene in the 'sticky end' cloning approach?
- A. GGATCC-FP and GAATTC-RP
 - B. CCTAGG-FP and GAATTC-RP
 - C. GGATTC-FP and CTTAAG-RP
 - D. CCTAGG-RP and CTTAAG-RP
35. Which of the following methods is better suited to study phylogeny among the members with highly divergent protein sequences to create a phylogenetic tree?
- A. Maximum Likelihood method
 - B. Maximum Parsimony method
 - C. Distance method
 - D. None of the above
36. The Southern blotting technique depends on
- A. Similarities between the sequences of probe DNA and experimental DNA
 - B. Similarities between the sequences of probe RNA and experimental RNA
 - C. Similarities between the sequences of probe protein and experimental protein
 - D. Similarities between the sequences of probe antigen and experimental antibody
37. Which of the following assays **cannot** be used to examine Transcription Factor-Promoter binding?
- A. Co-filtration and quantitative PCR
 - B. Electrophoretic mobility shift assay
 - C. Yeast one-hybrid analysis
 - D. Yeast two-hybrid analysis
38. Which of the following is **not** used in a molecular cloning experiment?
- A. Gene gun
 - B. Golden Gate Assembly
 - C. Gateway system
 - D. Restriction Endonucleases

39. Which of the following restriction endonucleases is used to create nicks in the target sequence in the CRISPR/Cas9 genome editing approach?

- | | |
|----------------|----------------------|
| A. <i>FokI</i> | B. <i>BsaI</i> |
| C. <i>BbsI</i> | D. None of the above |

40. Green fluorescent protein (GFP), a bioluminescent polypeptide isolated from *Aequorea victoria* jellyfish is used in cell biology experiments of all walks of life. The fluorophore of GFP is comprised of these amino acids

- | | |
|-------------------------|-------------------------|
| A. Ser 76 Gly 67 Tyr 56 | B. Ser 65 Tyr 66 Gly 67 |
| C. Tyr 67 Ser 66 Gly 73 | D. Tyr 76 Ser 56 Gly 67 |

PART-B

41. Which of the following is *not* a precursor of any plant hormone?

- | | |
|------------------------|---------------|
| A. Methionine | B. Tryptophan |
| C. <i>ent</i> -Kaurene | D. Glycine |

42. The phenomenon by which a hybrid exhibits vigour and performs better than its parents is called heterosis. When the heterosis is estimated over the mid parental mean value of the two parents involved in hybridization, it is known as

- | | |
|-------------------------|-----------------------|
| A. Standard heterosis | B. Heterobeltiosis |
| C. Economical heterosis | D. Relative heterosis |

43. In aerobic respiration process, how many ATP molecules can be produced from complete respiration of one molecule of glucose?

- | | | | |
|-------|-------|-------|-------|
| A. 32 | B. 34 | C. 36 | D. 38 |
|-------|-------|-------|-------|

44. Which of the following components is important in carbohydrate and fat metabolism?

- | | |
|-------------------|-----------------|
| A. Citric Acid | B. Pyruvic Acid |
| C. Glyceraldehyde | D. Acetyl-CoA |

45. Mating of plant genotypes in all possible combinations is called

- | | |
|------------------------|-------------------------|
| A. Half-diallel mating | B. Diallel mating |
| C. Half-sib mating | D. Line X Tester mating |

46. Most plants obtain the nitrogen from the soil in the form of

- | | | | |
|------------|-----------------|-----------------|------------|
| A. Nitrate | B. Nitrogen Gas | C. Nitric oxide | D. Ammonia |
|------------|-----------------|-----------------|------------|

47. The incompatibility reaction of pollen determined by its own genotype and not by the genotype of the plant on which it is produced is observed in which of the following modes of self-incompatibility?

- | | |
|-------------------------|----------------------------|
| A. Heteromorphic system | B. Gametophytic system |
| C. Sporophytic system | D. Pseudo-fertility system |

48. In the context of approximate whole genome size, which one of the following is correct?

- A. Rice: 390 Mb, Maize: 2500 Mb; Wheat: 1700 Mb; Barley: 5100 Mb
 B. Rice: 390 Mb, Maize: 17000 Mb; Wheat: 2500 Mb; Barley: 5100 Mb
 C. Rice: 17000 Mb, Maize: 5100 Mb; Wheat: 390 Mb; Barley: 17000 Mb
 D. Rice: 390 Mb, Maize: 2500 Mb; Wheat: 17000 Mb; Barley: 5100 Mb

49. CO₂ fixing enzymes are present in

- | | |
|--------------|-------------------|
| A. Stroma | B. Grana lamella |
| C. Cytoplasm | D. Stroma lamella |

50. Which characteristic domain is found in eukaryotic proteins that facilitates their entry into endoplasmic reticulum?

- | | |
|-------------------------------|----------------------------|
| A. Stop transfer domain | B. Signal sequence |
| C. Signal recognition protein | D. Signal protein receptor |

51. The term used for entire gene set of all strains of a species is called

- | | |
|-------------------|---------------------------|
| A. Genome Browser | B. Pan Core Genome |
| C. Metagenome | D. Translational genomics |

52. Anoxygenic bacterial photosynthesis comprises

- | | |
|----------------------|------------|
| A. PSI | B. PSII |
| C. Both PSI and PSII | D. Cyt b6f |

53. Rice productivity hampers due to infection caused by different microbes. One of the microbial infections leads to blast disease in rice. This disease is caused by

- | | |
|------------------------------|------------------------------|
| A. <i>Xanthomonas oryzae</i> | B. <i>Rhizoctonia solani</i> |
| C. <i>Rhizoctonia oryzae</i> | D. <i>Magnaporthe grisea</i> |

54. Sickle cell anemia occurs due to mutation in β -Globin gene which is found on which of the following human chromosome?

- | | |
|------------------|------------------|
| A. Chromosome 1 | B. Chromosome 11 |
| C. Chromosome 21 | D. Chromosome 23 |

55. Leghemoglobin in nitrogen-fixing nodules helps as

- A. Cofactor for dinitrogenase enzyme
- B. Cofactor for dinitrogenase reductase enzyme
- C. Oxygen presenter for nitrogen-fixing enzyme complex
- D. Oxygen scavenger for nitrogen-fixing enzyme complex

56. The circular chromosomes after replication will still be interlocked and have to be separated before cell division. This task is done by

- A. DNA topoisomerase
- B. DNA gyrase
- C. Nuclease
- D. Restriction endonuclease

57. Which of the following enzymes is involved in epigenetic inheritance?

- A. MAP Kinase
- B. Acetyl CoA carboxylase
- C. Telomerase
- D. Histone methyl transferase

58. A protein has 30% alanine. If all the alanines in the protein are replaced by glycines,

- A. helical content will decrease
- B. β -sheet content will increase
- C. there will be no change in conformation
- D. the alanine-substituted protein will be less structured than the parent protein

59. An excess supply of which of the following nutrients is the most common cause of eutrophication in freshwater lakes?

- A. Phosphorous
- B. Calcium
- C. Sulphur
- D. Potassium

60. Match the following using the codes given below:

- | | |
|------------------|-----------------------|
| 1. Lauric acid | a. Hexadecanoic acid |
| 2. Myristic acid | b. Dodecanoic acid |
| 3. Palmitic acid | c. Octadecanoic acid |
| 4. Stearic acid | d. Tetradecanoic acid |

- A. 1-(b), 2-(a), 3-(c), 4-(d)
- B. 1-(c), 2-(a), 3-(b), 4-(d)
- C. 1-(a), 2-(d), 3-(b), 4-(c)
- D. 1-(b), 2-(d), 3-(a), 4-(c)

61. An enzyme catalyzed reaction was measured in the presence and absence of an inhibitor. For an uncompetitive inhibition,
- Only K_m is increased
 - Both K_m and V_{max} are decreased
 - Only V_{max} is decreased
 - Both K_m and V_{max} are not affected
62. Shikonin, a compound with various pharmacological activities, is the first commercially produced secondary metabolite from cell cultures of *Lithospermum erythrorhizon*. This compound was originally found to be present in large amounts in which of the following parts of the above plant species?
- Leaves
 - Flowers
 - Stem
 - Roots
63. The advances in molecular biology have unveiled the identity of genes studied by Gregor Mendel. The first of Mendel's gene to be cloned was the one controlling
- pod color
 - pod form
 - flower position
 - seed shape
64. In a cross of a lysogenic Hfr with a non-lysogenic F^- (minus) recipient, the entry of the lambda prophage into the nonimmune cell immediately triggers the prophage into a lytic cycle, this event is called as
- Zygotic genome activation
 - Zygotic induction
 - Generalized transduction
 - Specialized transduction
65. All of the following statements are true about epigenetics except:
- It causes changes in gene expression without a change in the underlying DNA sequence
 - DNA methylation is the most broadly studied epigenetic change
 - Epigenetic changes are not influenced by the environment
 - Noncoding RNAs can cause epigenetic modification
66. What is the sex of the *Drosophila melanogaster* with the chromosome composition 3X 4A?
- Male
 - Female
 - Intersex
 - Metafemale
67. Which of the following compounds is nonpurine type of cytokinins and is relatively less susceptible to plant degrading enzymes than the other listed ones?
- 2-Isopentyl adenine purine
 - Kinetin
 - Zeatin
 - Thidiazuron

68. Which of the following statement is correct for male gametophyte of higher plants?

- A. Has one sperm cell and two vegetative cells
- B. Has two sperm cells and two vegetative cells
- C. Has one sperm cell and one vegetative cell.
- D. Has two sperm cells and one vegetative cell

69. The spiral phyllotaxis in angiosperm follows the following mathematical series for placement of leaves.

- A. Fibonacci Series
- B. Bernoulli Series
- C. Euler Series
- D. Poisson Series

70. This plant is native to tropical and sub-tropical parts of the Indian Subcontinent and commonly called as 'flame-of-the-forest' and 'bastard teak'. The scientific name of this plant is

- A. *Butea frondosa*
- B. *Piper betel*
- C. *Betula arborea*
- D. *Taraxacum officinale*

71. Match the following using the codes given below:

- | | |
|-------------------------------|-------------------------------|
| 1. Pantothenic acid | a. 5'-Deoxyadenosyl cobalamin |
| 2. Vitamin-B ₁₂ | b. Pyridoxal phosphate |
| 3. Vitamin-B ₆ | c. Coenzyme-A |
| 4. Vitamin-B ₂ | d. FAD |
| A. 1-(b), 2-(a), 3-(c), 4-(d) | |
| B. 1-(c), 2-(a), 3-(b), 4-(d) | |
| C. 1-(a), 2-(d), 3-(b), 4-(c) | |
| D. 1-(b), 2-(d), 3-(a), 4-(c) | |

72. The flowering in a short day plant can be inhibited by a 5-minute exposure in middle of night by following light

- A. UV light
- B. Blue light
- C. Green light
- D. Red light

73. Which of the following variant of RNA is present only in plants?

- A. siRNA
- B. tasiRNA
- C. miRNA
- D. lncRNA

74. Which of the following cells undergo programmed cell death to become functional?

- | | |
|------------------------|------------------|
| A. Phloem sieve tube | B. Xylem vessel |
| C. Stomatal guard cell | D. Root cap cell |

75. For their discovery of 'cancer therapy by inhibition of negative immune regulation' these two scientists were awarded Nobel prize in 2018 in Physiology and Medicine

- A. George P. Smith and Sir Gregory P. Winter
- B. James P. Allison and Tasuku Honjo
- C. Gérard Mourou and Donna Strickland
- D. Denis Mukwege and Nadia Murad

76. Cyanobacteria differ from green unicellular algae in one of the following

- A. Cyanobacteria reduce sulphur compounds
- B. Cyanobacteria have no nuclei
- C. Cyanobacteria lack cell walls
- D. Green algae have cell membranes

77. The carnivorous habit of plants has evolved mainly to compensate for deficiency in the soil for the following element

- | | |
|--------------|--------------|
| A. Potassium | B. Nitrogen |
| C. Calcium | D. Manganese |

78. A living fossil is an extant taxon that closely resembles organisms otherwise known only from the fossil record, find out the name of a 'living fossil' from the below given list

- | | |
|-------------------------|--------------------------------|
| A. <i>Ginkgo biloba</i> | B. <i>Gloriosa superba</i> |
| C. <i>Glycine max</i> | D. <i>Zingiber officinalis</i> |

79. In what order do the following five steps occur in the photochemical reaction centers?

1. Excitation of the chlorophyll a molecule at the reaction center
2. Replacement of the electron in the reaction center chlorophyll
3. Light excitation of antenna chlorophyll molecule
4. Passage of excited electron to electron-transfer chain
5. Exciton transfer to neighboring chlorophyll

- | | |
|--------------|--------------|
| A. 1-2-3-4-5 | B. 3-2-5-4-1 |
| C. 3-5-1-4-2 | D. 4-2-3-5-1 |

80. 'Wild fire disease of tobacco' is caused by the production of non-host specific toxin called Tabotoxin and is produced by this microorganism

- A. *Alternaria tenuis* pv. *tabaci*
- B. *Pseudomonas syringae* pv. *tabaci*
- C. *Fusicoccum amygdali* pv. *tabaci*
- D. *Cochliobolus victoriae* pv. *tabaci*
