

Entrance Examinations 2017

Ph.D. Plant Sciences

Time: 2 hours

(Ph.D. Admission - January '2018 session)

Maximum Marks: 80

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 **80** questions. **Part-A:** Question Nos. **1-40** and **Part-B:** Questions Nos. **41-80** 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. Calculators and mobile phones are NOT allowed.

PART – A

1. Which of the following is the name of an animal as well as the abbreviated term of a physical mapping technique which is commonly used in Genetics and Genomics studies?
 - A. FROG
 - B. ZEBRA
 - C. RHINO
 - D. FISH

2. This is the name of a cloning vector which is derived from “F” factor of *E. coli* which contains minimum sequence needed for autonomous replication, copy number control and partitioning of plasmid. The size of this vector is 7.4 Kb and contains a gene for Chloramphenicol resistance as a selectable marker. The name of this vector is
 - A. PAC Vector
 - B. BAC Vector
 - C. YAC Vector
 - D. HAC Vector

3. Which of the following restriction endonuclease are hepta-cutter and octa-cutter respectively?
 - A. *Not* I and *Mse* I
 - B. *Mse* I and *Not* I
 - C. *Sap* I and *Not* I
 - D. *Not* I and *Sap* I

4. Which of the following tools is used in predicting cellular localization of a protein
 - A. Translation
 - B. Reverse translation
 - C. TargetP
 - D. Kyte-Doolittle

5. Generally primer3 software is used for primer designing purposes from a given gene of interest. Several factors are considered while designing PCR primers. Which of the following factors describe best for primer designing standard parameters?
 - A. Product size: depending upon the reference sequence and aim of study; primer Size: 58-62 bases; annealing temperature: 18-22°C; GC%: 50-60%; CG Clamp: 2 or 1
 - B. Product size: 58-62bp; primer Size: 300-500 bases; annealing temperature: 18-22°C; GC%: 50-60%, CG Clamp: 2 or 1
 - C. Product size: depending upon the reference sequence and aim of study; primer Size: 18-22 bases; annealing temperature: 58-62°C; GC%: 50-60%; CG Clamp: 2 or 1
 - D. Product size: depending upon the reference sequence and aim of study; primer Size: 18-22 bases; annealing temperature: 18-22°C; GC%: 10-20%; CG Clamp: 2 or 1

6. BLAST is the name of program for sequence similarity search developed at NCBI. What type of sequence is compared when “BLASTp” search option is selected?
 - A. Alignment of nucleotide sequence with nucleotide database
 - B. Alignment of translated nucleotide sequence with protein database
 - C. Alignment of amino acid sequence with protein database
 - D. Alignment of amino acid sequence with nucleotide database

7. Grignard reagent (RMgX) in reaction with ketone to give addition product which on hydrolysis produces
- A. Aldehyde B. Primary alcohol C. Secondary alcohol D. Tertiary alcohol
8. Which of the following is obtained using processed mRNA molecules as a template?
- A. rDNA B. mDNA C. cDNA D. tDNA
9. Isoschizomers are
- A. Restriction enzymes isolated from different sources that cleave within the same target sequences
B. Restriction enzymes isolated from the same source but cleave in different target sequences
C. Restriction enzymes which can cleave and reseal the DNA
D. Restriction enzymes cleave far from the target sequence
10. DAPI stain used in microscopy is chemically known as
- A. 4',6 Diamidino-2-phenylindole B. 4',6 Diamino-2-Phenylinositol
C. Dextro-amidino-2-phosphinol D. Dextro-amino-2-phenylindole
11. The core principle underlying a microarray-based experiment where short oligomeric nucleic acid molecules are used as probes and the target gene sequences to be detected are spotted on plane and solid platforms as grids is:
- A. Suppression subtractive hybridization
B. Competitive complementary hybridization
C. Northern hybridization
D. Western hybridization
12. A study revealing evolutionary relationship of an individual with other members as well as its relatedness with a common ancestor is called
- A. Epigeny B. Ontogeny C. Phylogeny D. Phyllo-taxy
13. The technique used in physical mapping of a genome to resolve the DNA fragments from yeast artificial chromosome (YAC) or bacterial artificial chromosome (BAC) libraries with large DNA inserts is:
- A. mRNA differential display B. Site-directed mutagenesis
C. Pulse-field gel electrophoresis D. Polyacrylamide gel electrophoresis

14. A set of oligonucleotide primers were designed and used to amplify a DNA sequence using both genomic and reverse transcriptase (RT) based polymerase chain reaction (PCR). Though similar conditions of amplification and gel electrophoresis were followed, a variation in band size was observed between genomic and its corresponding cDNA sequence with the later showing a reduced DNA band size than expected. The reason could be:
- A. Incomplete primer extension step
 - B. Incomplete primer annealing step
 - C. Presence of one or more exon sequences
 - D. Presence of one or more intron sequences
15. The technique involve in probing of intact cells or tissue section affixed to a microscope slide to detect the target DNA sequence and its location within the tissue is known as:
- A. PCR-based amplification
 - B. Southern hybridization
 - C. *In situ* hybridization
 - D. Dot blot hybridization
16. Peptides are generated from protein digests that have been isolated from cells in two different states. The two labelled samples are then combined, fractionated by nanoLC and analysed by tandem mass spectrometry. Fragmentation of the tag attached to the peptides generates a low molecular mass reporter ion that is unique to the tag used to label each of the digests. Measurement of the intensity of these reporter ions, enables relative quantification of the peptides in each digest and hence the proteins from where they originate. This technique is called
- A. Isotope coded affinity tag
 - B. Stable isotope labelling of amino acids in cell culture
 - C. Isobaric tag for relative and absolute quantitation
 - D. Metabolic labelling
17. When is multiple displacement amplification (MDA) preferred to using the polymerase chain reaction (PCR) for amplifying a DNA sample?
- A. When DNA concentration is extremely low
 - B. When the sequence of the DNA to be amplified is unknown
 - C. When using specific sequence oligonucleotides, a thermostable DNA polymerase
 - D. None of the above
18. You have generated stress-tolerant transgenic plants by expressing a gene that codes for a protein involved in the biosynthesis of an osmo protectant. It was confirmed that the transgene is indeed present in the plants but only a marginal improvement in tolerance was observed. Which of the following experiments **will not reveal** whether the change in phenotype is due to the presence of the transgene in these plants?
- A. Northern blot/qPCR
 - B. Southern blot
 - C. Western blot
 - D. Osmoprotectant levels estimation

19. Cycloheximide and edeine are both chemical inhibitors of translation. When cells are treated with cycloheximide, translation is inhibited immediately. When cells are treated with edeine, translation continues for some minutes before stopping. Suggest at which stage of translation cycloheximide and edeine are acting respectively.
- A. Initiation, elongation
B. Elongation, termination
C. Initiation, termination
D. Termination, initiation
20. The imidazole side chain of histidine can function as either a general acid catalyst or a general base catalyst because:
- A. In the physiological pH range both H^+ and OH^- are present at high concentrations.
B. In the physiological pH range, the nitrogen in the ring can be easily protonated/deprotonated.
C. One guanidino group is protonated, and the other is deprotonated at physiological pH.
D. The imidazole group is a strong reducing agent at physiological pH
21. The number of H^+ ions present in 1 mL of a solution with $pH = 13$
- A. 3.012×10^5
B. 6.903×10^9
C. 6.023×10^7
D. 3.012×10^7
22. Enzyme linked immunosorbent assay is a serodiagnostic technique, the substrate for detection of antigen and antibody complex through alkaline phosphatase enzyme is
- A. *p*-Nitrophenyl phosphate
B. Diamino benzidine
C. NBT/BCIP
D. Luminol
23. Which of the following amino acid residues would not provide a side chain for acid-base catalysis?
- A. Leucine
B. Serine
C. Lysine
D. Aspartic acid
24. gRNA is a frequently used term associated with
- A. RNAi knockdown approach
B. Zinc finger nuclease genome-editing approach
C. MicroRNA based knockdown approach
D. None of the above
25. Does β -particle have a charge and mass, if so which statement of the following is correct
- A. -ve charge and negligible mass
B. +ve charge and some mass
C. +ve charge and negligible mass
D. -ve charge and some mass

26. Where does the photosynthetic process occurs in anoxygenic phototropic bacteria
- A. Thylakoids
B. Chloroplast
C. Plasma membrane
D. Cytoplasm
27. Which of the following component is one of the mobile electron carrier through the membrane of the thylakoid
- A. D1 protein
B. Carotenoid
C. Cyt b_6f
D. Plastoquinone
28. The biomolecule absorbs or emits in longer wavelength with lower frequency called
- A. Hypochromic shift
B. Bathochromic shift
C. Stoke's shift
D. Hypsochromic shift
29. Which method of chromatography is suitable for separation of biochemical mixtures based on a highly specific interaction between antigen and antibody, enzyme and substrate?
- A. Gel filtration
B. Anion column
C. Cation column
D. Affinity Column
30. The membrane complexes can understand specifically by
- A. X-diffraction
B. NMR
C. Cryo-Electron microscopy
D. Confocal microscopy
31. A single plant cell with water potential value of -2 MPa is placed in a vessel of pure water. What will be the value of water potential, when the cell is fully turgid.
- A. -1 MPa
B. -4 MPa
C. 0 MPa
D. +2 MPa
32. Which of the following is an efficient waste water treatment material/technique
- A. Biological activated carbon
B. Centrifugation
C. Filtration
D. Precipitation
33. The unique cyclic structure of which of the following amino acids plays a central role in the formation of α -helices and β -sheets?
- A. Lysine
B. Proline
C. Valine
D. Arginine

34. Nickel-NTA (Ni-NTA) chromatography is a popular affinity chromatography method for the purification of histidine-tagged proteins. However, SDS-PAGE of the eluted protein can show bands in addition to your target protein. Which one of the following approach is **NOT true** for improving purity of the target protein?
- A. Add a low concentration of imidazole to the binding buffer.
 - B. Gradient elution with increasing imidazole concentration on a chromatography machine.
 - C. Include protease inhibitors during purification.
 - D. Add high concentration of imidazole to the binding buffer.
35. You discover a novel eukaryotic organism that glows in the dark. You believe this trait is due to a single gene, and you wish to clone the gene. Which of the following strategies is most likely to be successful?
- A. Isolate the genomic DNA from the organism, digest with a restriction endonuclease, insert into a plasmid vector and transform into bacteria. Screen colonies for the ability to glow in the dark.
 - B. Isolate the genomic DNA from the organism, digest with a restriction endonuclease, insert into a plasmid vector and transform into eukaryotic cells such as yeast. Screen colonies for the ability to glow in the dark.
 - C. Isolate mRNA from the organism, reverse transcribe and generate cDNA, insert into a plasmid vector and transform into bacteria. Screen colonies for the ability to glow in the dark.
 - D. Isolate mRNA from the organism, reverse transcribe and generate cDNA, insert into a plasmid vector and transform into eukaryotic cells such as yeast. Screen colonies for the ability to glow in the dark.
36. In a chromatographic separation, which of the following indices is most appropriate for the qualitative identification of a substance?
- A. Relative retention factor R_{rel}
 - B. Retention factor R_f
 - C. Retention time
 - D. Resolution
37. Which statement among the following is **NOT true** for 'phycobilisomes'?
- A. Phycobilisomes are light harvesting antennae of photosystem II
 - B. Phycobilisomes are absent in eukaryotic algae
 - C. Phycobilisomes are protein complexes anchored to thylakoid membranes
 - D. Phycobilisomes are composed of both the pigmented phycobiliproteins and the nonpigmented linker polypeptides
38. What is the major excitation and emission wavelengths of green fluorescent protein?
- A. 395 and 509 nm
 - B. 375 and 516 nm
 - C. 412 and 580 nm
 - D. 315 and 509 nm

39. You have homogenized plant tissue and would like to separate chloroplasts from nuclei. Which of the following methods would be most suitable?
- A. Polyacrylamide gel electrophoresis
 - B. Differential centrifugation using sucrose gradient
 - C. Equilibrium density gradient centrifugation on CsCl gradients
 - D. Gel filtration
40. Which one of the following method is widely used for the taxonomical identification of bacteria
- A. 16S rDNA sequencing
 - B. Antisense technology
 - C. T-DNA activation
 - D. 18S rDNA sequencing

PART – B

41. Vinblastine was isolated from
- A. *Abelmoschus crinitus*
 - B. *Hibiscus angolensis*
 - C. *Catharanthus roseus*
 - D. *Mangifera indica*
42. Caffeine belongs to the following class of compounds
- A. Alkaloids
 - B. Terpenoids
 - C. Flavonoid
 - D. Stilbenes
43. Gibberellin A1 is
- A. Protein
 - B. Diterpenoid
 - C. Polyterpenoid
 - D. Alkaloid
44. The 'hing' (asafoetida) extracted from
- A. Stem exudate
 - B. Root exudate
 - C. Stem cuttings
 - D. Bark cuttings
45. The *Index Herbarium* maintained by
- A. Kew Botanical Garden
 - B. Berlin Botanical Garden
 - C. New York Botanical Garden
 - D. Botanical Survey of India
46. Nutmeg botanical name is
- A. *Syzygium aromaticum*
 - B. *Cinnamum zeylanicum*
 - C. *Myristica fragrans*
 - D. *Cinnamomum tamala*

47. The mean yield performance of a hybrid plant is better than one of the parents, which being the best yielder among the two parents used in crossing program, then the hybrid is demonstrating:
- A. Standard Heterosis
B. Relative Heterosis
C. Heterobeltiosis
D. Luxuriance
48. The areas of maximum diversity of plants which are prevented from interference from mankind and preserved *in situ* for evolution to progress with no intervention are referred as:
- A. Gene sanctuaries
B. National parks
C. Centres for germplasm
D. National conservatories
49. The number of genetically different gametes that can be produced by an individual carrying a genotype AaBbccDDEe is:
- A. 8
B. 10
C. 32
D. 12
50. A chromosomal aberration observed in a heterozygous individual during meiotic prophase in which the four chromosomes synapse into a cross-shaped configuration is referred as:
- A. Pericentric Inversion
B. Paracentric Inversion
C. Translocation
D. Transposon
51. The host-cell proteins which are induced by prior exposure to a mild viral infection and these proteins aid to enhance general resistance against other viral infections are referred as:
- A. Inferons
B. Introns
C. Interferons
D. Intrinsic factors
52. How does bisulfite treatment followed by sequencing allow the DNA methylation status to be determined at single-base resolution?
- A. bisulfite treatment converts cytosine to uracil only
B. bisulfite treatment converts methylated cytosine to uracil only
C. bisulfite treatment converts thymine to cytosine only
D. bisulfite treatment converts thymine to uracil only
53. Where are disulfide bonds formed usually in eukaryotes?
- A. Cytoplasm
B. Periplasm
C. Endoplasmic reticulum
D. Golgi apparatus

54. Where are NAD^+ and NADP^+ used during metabolism?
- A. NADP^+ is phosphorylated in metabolic reactions to provide an extra layer of regulation.
 - B. NAD^+ is used in energy generating catabolic reactions, and NADP^+ is used in anabolic reactions.
 - C. NAD^+ is a redox carrier in metabolism, while NADP^+ is a phosphate carrier.
 - D. They can be used interchangeably in most organisms providing redundancy in metabolism.
55. Which compounds would be lipids or derivatives of lipids?
- A. Glycogen and cellulose
 - B. Cholesterol and oestrogen
 - C. Keratin and protease
 - D. Chlorophyll and haemoglobin
56. Which of the following metal ions is not likely to be found in the catalytic center of a redox enzyme?
- A. Fe^{2+}
 - B. Co^{3+}
 - C. Ca^{2+}
 - D. Mn^{2+}
57. 'Probiotics' refers to
- A. Antibiotics
 - B. Microbial dietary supplement
 - C. Vitamins
 - D. Plant based dietary supplement
58. Endospores are
- A. Certain fungal spores, enables their species to survive in adverse conditions
 - B. Certain protozoan fruiting bodies enable them to survive in adverse conditions
 - C. Certain bacterial spores, enable them to survive in adverse conditions
 - D. Non-living viral capsules, capable of infecting eukaryotic cells
59. Presence of betalains, a class of red and yellow indole-derived pigments found in plants, is a characteristic feature of family
- A. Chenopodiaceae
 - B. Amaranthaceae
 - C. Portulacaceae
 - D. Caryophyllaceae
60. Principle of parsimony is often associated with
- A. Taxometrics
 - B. Cladistics
 - C. Optometric
 - D. None of the above

68. Which is not a traditional environmental contaminant
- A. Polychlorinated biphenyls B. Pesticides
C. Heavy metals D. Polyfluoroalkyl substances
69. Which of the following is an emerging contaminant?
- A. Sucralose B. Mannose
C. Xylose D. Sucrose
70. Which of the following is **NOT true** of transition-state analogues?
- A. They mimic the transition state of an enzyme-catalyzed reaction.
B. Typically yields product more rapidly with an enzyme than the normal substrate.
C. They are bound more strongly than the substrate or the product.
D. They require the presence of a stable functional group to mimic the functionality present in the transition state.
71. Electrophoretic separation at pH 6 of a sample of polypeptide-1 (Mw 100) polypeptide-2 (Mw 200) and polypeptide-3 (Mw 400) would result in which of the following? (Note: the isoelectric point of each polypeptide occurs at pH 6)
- A. Polypeptide 3 would move the farthest.
B. Polypeptide 1 would move the farthest.
C. Polypeptide 2 would move the farthest.
D. None of the polypeptides would move.
72. "Wobble base pair" is a non-Watson-Crick base pairing between two nucleotides in RNA molecules, which one of the below given is a wobble base pair
- A. C-U B. C-A
C. G-U D. G-A
73. Similar sets of regulatory genes control development in *Arabidopsis*, *Drosophila* and mice. These genes are called
- A. Homologous genes B. Homeotic genes
C. Heterologous genes D. Clustered genes
74. Chlorophyll-a differs from chlorophyll-b in possessing which one of the following group attached to the third carbon atom of the second pyrrole ring
- A. Methyl B. Aldehyde
C. Carboxylic D. Sulfhydryl

75. Carrying capacity of an area denotes its
- A. biotic potential
 - B. the maximum ability to sustain a particular population-size
 - C. the weight of the populations of all biological species which the earth can carry
 - D. factors which impose a check on population growth
76. The chemical substance found abundantly in the middle lamella of plant cells is
- A. Suberin
 - B. Lignin
 - C. Cellulose
 - D. Pectin
77. Most of the appressoria involved in penetration contain specialized substance called
- A. L-Micropine
 - B. D-Micropine
 - C. Macerozyme
 - D. Melanine
78. RNA silencing phenomenon in fungi is called as
- A. Post transcriptional gene silencing
 - B. Quelling
 - C. Tilling
 - D. Co-suppression
79. "Laughing death" disease of human's, "katte disease" of cardamom, "cadang cadang" disease of coconut and "witches broom disease" of brinjal are caused respectively by
- A. Viroid, virus, prions and phytoplasma
 - B. Phytoplasma, prions, virusoid and fungus
 - C. Prions, virus, viroid and phytoplasma
 - D. Prions, bacteria, phytoplasma, and viroid
80. This scientist is called "the father of the green revolution" and has been awarded Noble peace prize for his works
- A. Norman Ernest Borlaug
 - B. M. S. Swaminathan
 - C. David Balcombe
 - D. Traver Davis
