

ENTRANCE EXAMINATION – 2018
Ph.D. Plant Sciences

Time: 2 hours

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. If a bacterium can divide every 30 min, starting with single individual bacterium, how many bacteria will be there in medium if there is exponential growth for 6 hrs?

A. 4096	B. 2048	C. 1024	D. 13
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2. Gottlieb Haberlandt was the first to culture isolated somatic cells of higher plants *in vitro*. Which of the following statements is **NOT True** with regard to his experiments?
 - A. He cultured cells to study the properties and potentialities of an individual somatic cells
 - B. He cultured highly differentiated mature cells
 - C. He cultured the cells on nutrient media that lacked growth hormones
 - D. He observed that few of the cultured cells divided while others failed to divide

3. The A and B loci are 20 m.u. apart. If a plant AB/ab is selfed, the proportion of progeny that are AAbb?

A. 0.01	B. 0.1	C. 0.02	D. 0.2
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4. Cellular habituation that occurs *in vitro* cultures can result from all of the following **EXCEPT**
 - A. Prolonged periods of *in vitro* subcultures
 - B. Sensitivity of the cultured cells to endogenous hormones
 - C. Epigenetic modification leading to changes in DNA expression
 - D. Accumulation of specific mutations in DNA which cannot be reversed

5. Phage M13 vectors are widely used for obtaining
 - A. Single stranded copies of cloned DNA suitable for DNA sequencing
 - B. Double stranded copies of cloned DNA suitable for DNA sequencing
 - C. Fragments of cloned DNA suitable for DNA sequencing
 - D. Double stranded copies of cloned DNA suitable for electrophoresis

6. Which of the following dyes can be **exclusively used** to stain plant cell walls

A. DAPI	B. Di-hydro Ethidium
C. Propidium iodide	D. Safranin

7. The most efficient substrate of an enzyme is usually considered to be the one with the _____

A. largest Km	B. largest kcat/Km
C. smallest kcat/Km	D. smallest Km

8. Which of the following is **NOT** the possible cause of hyperhydricity in plant tissue cultures?
- A. High ammonium concentration
 - B. High cytokinin concentration
 - C. Culture of plants in liquid media
 - D. High concentration of a gelling agent
9. Which of these effects results from slow injection of a large sample volume on a chromatographic column?
- A. Increased resolution
 - B. Decreased resolution
 - C. Non-linear detector response
 - D. No effect is observed
10. Which of the following acts as a chromophore for UV-B photoreceptor, UVR8?
- A. Flavin
 - B. Pterin
 - C. Tryptophan
 - D. Tetrapyrrole
11. An oxidation-reduction reaction involves:
- A. Internal re-arrangement of a molecule
 - B. Cleavage of a large molecule into smaller molecule
 - C. Transfer of electrons from one molecule to another
 - D. Combining two small molecules to create one larger one
12. For obtaining taxonomic evidence, which of the following methods will **NOT** be considered as a part of molecular systematics
- A. Total DNA/DNA hybridization
 - B. Serology
 - C. Chromosome painting
 - D. DNA barcoding
13. The study involving mapping polygenes using markers that control traits like yield and height of a plant is called as
- A. Qualitative trait loci
 - B. Quantitative trait loci
 - C. Epistatic trait loci
 - D. Complementary trait loci
14. You hypothesize that the wild-type allele of a gene has a negative effect on rice grain yield. You are given funding for about two years to generate knock-out lines for this gene and test the phenotype of the resulting mutants. Assume that rice can be easily transformed and plants regenerated from tissue culture to obtain first generation seeds within nine months. Which is the quickest method to get knock-out lines?
- A. RNAi
 - B. Antisense technology
 - C. T-DNA activation
 - D. CRISPR/cas9

15. The mapping population generated through a series of backcrosses and selection between two genetically diverse genotypes which are identical in almost all traits except for the trait under study is called as:
- A. Near-Isogenic lines
B. Recombinant Inbred lines
C. Hybrid lines
D. Double haploid lines
16. To synthesize a complementary DNA (cDNA) strand from a purified messenger RNA (mRNA), one of the following enzyme is used to catalyze the reaction:
- A. DNA dependent RNA polymerase
B. RNA dependent DNA polymerase
C. DNA dependent DNA polymerase
D. RNA dependent RNA polymerase
17. A cross is made between two maize genotypes exhibiting variation for a digenic trait wherein one of the genotypes carries gene loci, "Ab/aB" while the other with "ab/ab". If these loci are tightly linked ruling out the probability of crossing over between them, the resulting progeny would be:
- A. All progeny will be phenotypically "Ab"
B. All progeny will be phenotypically "ab"
C. 50% of the progeny will be phenotypically "AB" and 50% phenotypically "ab"
D. 50% of the progeny will be phenotypically "Ab" and 50% phenotypically "aB"
18. To prepare 1 L of buffer of 25 mM Tris base (121.14 g/mol), 200 mM glycine (75.07 g/mol) and 1% SDS, the following amounts are nearest to the correct weighed amounts to be taken:
- A. 3.03 g of Tris Base; 1.5 g of glycine 10 g of SDS
B. 3.03 g of Tris Base; 15 g of glycine 10 g of SDS
C. 3.03 g of Tris Base; 15 g of glycine 1 g of SDS
D. 30.3 g of Tris Base; 15 g of glycine 1 g of SDS
19. A unique protein, which is enriched with glutamate and aspartate residues all along is available in the lab. This protein needs to be digested, taking advantage of the above said amino acids. Suggest a right protease to cleave this protein.
- A. Trypsin and chymotrypsin
B. V8 protease
C. Clostripaine
D. Cyanogen bromide
20. The following repairs single stranded nicks in duplex DNA
- A. T4 DNA ligase
B. Calf intestinal phosphatase
C. T4 polynucleotide kinase
D. DNA Polymerase I

21. A plain paper can prevent, spread/passage of this type of a radioisotope which emits
- A. X-rays B. α -rays C. β -rays D. Neutron rays
22. "Star activity" of a restriction enzyme refers to
- A. very high specific activity
B. cleaving at non-canonical sites under non-standard reaction conditions
C. common site with restriction enzyme of different origin
D. the shape of DNA looks like star in 3-dimensional form with the action of enzyme
23. What is bathochromic shift?
- A. The shift of absorption to a longer wavelength
B. The shift of absorption to a shorter wavelength
C. An increase in absorption intensity
D. When primary metabolites shift towards aromatic & colored secondary metabolites
24. In infra-red spectroscopy, the absorbed radiation matches to
- A. Resonance of molecule B. The vibrational frequency
C. Magnetic spin energy D. Electron split energy
25. Which technique is appropriate if a molecule contains one/more chiral chromophores?
- A. UV spectroscopy B. Nuclear magnetic resonance
C. Circular dichroism D. Electron split resonance
26. Native gel electrophoresis separation process of proteins follows with
- A. Denaturing B. Mild SDS C. Non-denaturing D. Added DTT
27. The decay rate of a radioactive isotope could be increased by increasing the---
- A. Size of the sample B. Temperature C. Pressure D. pH
28. Where the Edman reagent cleaves in polypeptides
- A. at C-terminus B. at Lys and Arg
C. at Phe and Tyr residues D. at N-terminus
29. Which method would be used for finding out the photochemical efficiency of photosystem II activity ?
- A. Chl a Fluorescence B. O_2 liberation
C. CO_2 liberation D. UV-Visible spectroscopy

30. One research scholar has amplified a genomic region from 4 different rice genomic DNA using common primers. All 4 rice varieties gave amplified product of 3.2 to 3.3 Kb in size. After sequencing of amplified product, he found that at specific position in all 4 varieties "GAT" was repeated 4 times, 7 times, 8 times and 11 times respectively. Such types of repeat sequence in the genome is known as
- A. Minisatellites B. Microsatellites C. Sequence contig D. DNA shuffling
31. Few protein antibodies are found to exhibit enzymatic properties and they are called as:
- A. Ribozymes B. Isozymes C. Abzymes D. Allozymes
32. Which of the following is **NOT** an example of Gel Electrophoresis ?
- A. PAGE B. SAGE C. PFGE D. OFAGE
33. During whole genome sequencing of an organism, which of the following approach will minimize the number of physical gaps onto the comprehensive physical map of the organism during minimum tiling path?
- A. Identify markers from related species and use to prepare probes to identify clones
B. Prepare more than one probe from single marker to identify more clones
C. Prepare more genomic library using the combination of different restriction enzymes and vectors and screen all libraries using marker based probe
D. There is no need to minimize the number of physical gaps from the physical map as genome itself contain gaps in the genomic region
34. If a DNA fragment from one species is used to probe a Southern transfer of DNAs from related species, and one or more hybridization signals are obtained, then it is likely that the probe contains one or more genes. This process is called
- A. Zoo blotting B. Northern blotting
C. Species profile model D. Probenecid
35. A scientist has prepared a DNA-probe complementary to his known DNA sequence. He labelled his probe with a fluorescent marker. He took the chromosome of the organism of interest on the microscopic slide and denatured it. Further he denatured the probe also and added to the same slide and allowed the probe to hybridize to its complementary site. Later he washed the excess of probe and observed under fluorescent microscope. Which of the following technique he was using?
- A. Fluorescent *in situ* hybridization
B. Fluorescence resonance energy transfer microscopy
C. Fluorescence recovery after photobleaching
D. Immunofluorescent staining

36. What are Cy3 and Cy5?
- Both are fluorescent dye commonly used to label nucleic acid
 - These are the class of organic compounds which contain different form of Cyano group and commonly used in HPLC
 - Both are plant based secondary metabolites containing different level of anthocyanin content in leaf and flower respectively
 - These are the check points of real-time PCR product at Cycle 3 and Cycle 5 respectively
37. What do you understand by IC_{50} value?
- It is a measure of the potency of a substance/compound in inhibiting a specific biological or biochemical function by half
 - When any Journals successfully pass the parametric evaluation are awarded the ICV (Index Copernicus Value) index – valid for 50 weeks only
 - It is an Integrated Circuit (IC) which is used in Microarray machine at 50 places for RNA expression analysis
 - It is the name of gene prediction software which gives 50 types of different possible match either at DNA or RNA or at protein level
38. In biotechnology laboratories, we generally use abbreviated term of some of the techniques/experiments or chemicals/buffer. Which of the following is **NOT** the name of technique/tool or chemical/buffer?
- CLADE
 - FISH
 - BLAST
 - TEMED
39. Any suspected organism is finally accepted as the cause of a specific disease when it fulfills certain criteria formulated by Koch. Koch's postulates are:
- The organism must be consistently associated with the disease in question
 - The organism must be isolated from diseased plant in pure culture
 - The organism of pure culture must be capable of mutation
 - The organism of pure culture when inoculated back into healthy plant, must be capable of reproducing the symptoms of the disease
- I and II are correct
 - I, II and III are correct
 - I, II and IV are correct
 - All are correct
40. When a test cross is made between two genotypes; A-Bb and A-bb, the progeny resulting from such a cross would be:
- $\frac{1}{4}$ A-Bb: $\frac{3}{4}$ A-bb
 - $\frac{1}{2}$ A-Bb: $\frac{1}{2}$ A-bb
 - $\frac{3}{4}$ A-Bb: $\frac{1}{4}$ A-bb
 - 15 A-Bb: 1A-bb

48. The three features which characterize the Angiosperms are:
- Naked seeds, flowers, double fertilization.
 - Double fertilization, covered seeds, flowers.
 - Dominant gametophyte, covered seeds, flowers.
 - Dominant sporophyte, naked seeds, double fertilization.
49. Pathogen-infected plants produces several pathogenesis-related proteins (PR proteins) to avoid further spread of infection. Infected plant parts also produces a type of compound which is known as "Oil of Wintergreen". What is this compound?
- Methyl isocyanate
 - Ethyl hexanoate
 - Butyl acetate
 - Methyl salicylate
50. Microtubules are a component of the cytoskeleton, found throughout the cytoplasm. These tubular polymers of tubulin are highly dynamic in nature. Two compounds are used to disassemble and assemble the microtubules respectively are
- Vinca alkaloids and Taxanes
 - Topoisomerase I and Topoisomerase II enzymes
 - Actinomycin and Bleomycin
 - Alkylating agents and Anthracyclines
51. Match the following combinations and tick mark the correct option from codes given below
- Endemic – Incidence periodical and in wide areas
 - Epidemic-constantly occurring disease year to year in moderate to severe form
 - Epiphytotic – incidence periodical and environmental condition dependent
 - Sporadic – Incidence irregular and in lesser areas
- I and II are correct
 - I, II and III are correct
 - III and IV are correct
 - All are correct
52. Photoblastism is defined as:
- The effect of light on seed germination
 - The effect of light on flowering
 - The bending of a plant towards light
 - The growth of a plant in the dark
53. The major site of sulphate reduction in plant cells is
- Xylem
 - Vacuoles
 - Mitochondria
 - Chloroplast

63. Which one of the following is a plant peptide hormone?
- A. Ubiquitin
B. Phytosulfokine
C. Kinetin
D. Castasterone
64. Which of the following is a DNA polymerase enzyme
- A. T4 polynucleotide kinase
B. Topoisomerase I
C. T4 Terminal deoxynucleotidyl transferase
D. Taq DNA ligase
65. Antimicrobial lytic proteins that make pores in and cause the lysis of the bacterial cell membranes are called as
- A. Auxotroph
B. Hyperplasia
C. Secretome
D. Cecropins
66. Antibiotic Cycloserine inhibits bacterial growth by interfering specifically the following
- A. Transglycosylation stage of bacterial cell wall synthesis
B. Transpeptidation step of bacterial cell wall synthesis
C. Synthesis of peptidoglycan
D. Nucleic acid biosynthesis
67. 'Variolation' is a process similar to that of modern day vaccination was followed back in 1000 BC against smallpox, name of the scientist is
- A. Edward Jenner
B. Robert Koch & Louis Pasteur
C. Frederick Twort
D. Felix d'Herelle
68. Complex II of mitochondria contains:
- A. 4Fe3S, 3Fe3S, 2Fe4S
B. 4Fe3S, 3Fe3S, 2Fe3S
C. 3Fe4S, 4Fe4S, 2Fe2S
D. 4Fe3S, 4Fe4S, 2Fe2S
69. 'Ribozymes' are small RNA molecules believed to be the first molecules to exhibit catalytic properties and cleave the RNA molecule *cis*-preferentially are found in
- A. Prion
B. Bacteriophage
C. Spiroplasmas
D. Avsunviroids
70. Identify the mismatch
- A. Microcosms – Stimulate a natural habitat
B. Winogradsky column – Anaerobic cultivation of microorganisms
C. Lead, Cadmium, Mercury – Not plant nutrients
D. 5-Aminolevulinic synthase – Present only in plant and microorganisms

71. An overgrowth of the protoplast of a parenchyma cell into an adjacent xylem vessel or tracheid is called as

- A. Tyloses B. Vesicles C. Teliospores D. Telium

72. Phytol, the hydrophobic side chain of chlorophyll is a

- A. Triterpene B. Polyterpene
C. Monoterpene D. Diterpene

73. Ubiquitin does the following

- A. Post-translational modification B. Deamidation
C. Mediates protein degradation D. Isomerization

74. Lignin belongs to the following class of compounds in plants

- A. Alkaloids B. Carbohydrates
C. Phenolics D. Terpenoids

75. Forest fires produce the following plant hormone

- A. karrikin B. stomagen C. strigolactone D. clavata3

76. Which kind of special pigment complexes can harvest light energy in cyanobacteria?

- A. Phycocyanin B. Bacterial Chlorophyll
C. Phycobilisomes D. Phycoerythrin

77. From which metabolic pathway the carbohydrate can be synthesised

- A. Calvin cycle B. Glycolysis
C. Krebs cycle D. Pentose phosphate pathway

78. Match the best combination between plant RNA polymerases from column M and their main role from column N

Column M

- a) RNA polymerase I
b) RNA polymerase II
c) RNA polymerase III
d) RNA polymerase IV

Column N

1. Promotion of methylation associated higher order heterochromatin formation
2. Transcription of ribosomal gene
3. Transcription of protein encoding genes
4. Transcription of t-RNA

- A. a-1, b-3, c-4, d-2
C. a-2, b-1, c-3, d-4

- B. a-2, b-3, c-4, d-1
D. a-1, b-4, c-3, d-2

79. An important intermediate involved in the biosynthesis of several product of secondary metabolism in plants

- A. RuBP B. Glucose C. Shikimic acid D. Nicotine

80. Phytostabilization, rhizofiltration, phytovolatilization, and phytotransformation: these all terms represent

- A. Phytosanitary B. Phytoremediation
C. Phytoanticipation D. Rhizophydiales
