Code No. Y-69

ENTRANCE EXAMINATIONS – 2020

(Ph.D. Admissions - January 2021 Session)

Ph.D. Plant Sciences

Time: 2 hours Maximum Marks: 70

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 **70** questions. **Part-A**: Question Nos. **1-35** and **Part-B**: Questions Nos. **36-70** of multiple-choice printed in **12** 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. The main bonds that occur in the secondary structure of proteins are

   A) Hydrophobic interactions
   B) Peptide bonds
   C) Disulfide bonds
   D) Hydrogen bonds

2. Cellulose is composed of 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

3. Which one of the following amino acids are involved in phosphorylation by post-translation modification?

   A) Serine
   B) Methionine
   C) Cysteine
   D) Valine

4. The C-N distance in a peptide bond is typically

   A) 1.1 Å
   B) 1.32 Å
   C) 1.35 Å
   D) 1.4 Å

5. The photosynthesis process is a

   A) Reductive, endergonic, catabolic
   B) Reductive, exergonic, anabolic
   C) Oxidative, exergonic, catabolic
   D) Reductive, endergonic, anabolic

6. Hypsochromic shift causes the change in spectral position to-

   A) Higher wavelength
   B) Less energy frequency
   C) Shorter wavelength
   D) Shorter wavelength and lower frequency

7. Which of the following is **not** correct about plant viruses?

   A) Used in precise gene-editing
   B) Used in virus-induced gene silencing
   C) Used in virus-mediated overexpression
   D) Replicate by binary fission

8. In the process of protein transport to the chloroplast, which of the following class of proteins is more likely to lack a transit peptide?

   A) Outer envelope specific proteins
   B) Inner envelope specific proteins
   C) Stroma specific proteins
   D) Thylakoid specific proteins

9. Consider the following statements and choose the **correct** answer.

Assertion: In plants, chloroplast *matK* is considered a better DNA barcode than mitochondrial *CO1*.
Reason: *matK* is one of the most rapidly evolving coding sections of the plastid genome, which gives it good discriminatory power, whereas the sequence of the plant *CO1* gene is highly conserved, thus limiting its discriminatory ability.

A) The assertion is true, but the reason is false
B) Both assertion and reason are true, and the reason is the correct explanation of the assertion
C) Both assertion and reason are false
D) Both assertion and reason are true, but the reason is not the correct explanation of the assertion

10. Which of the following enzymes is used to remove 3' overhangs or fill-in of 5' overhangs to form blunt ends?

A) Taq DNA polymerase
B) T4 DNA polymerase
C) T4 DNA Ligase
D) Cel1 endonuclease

11. Which of the following enzymes is involved in the biogenesis of small interfering RNA in plants?

A) RNA polymerase I
B) RNA polymerase II
C) RNA polymerase III
D) RNA polymerase IV

12. Perls blue staining is a test used to demonstrate

A) Fe
B) Mn
C) P
D) Mg

13. Consider the following statements and choose the **correct** answer.

Statement 1: Sucrose is the major transport sugar in the higher plants.
Statement 2: Sucrose is a nonreducing sugar.

A) Both statements are true
B) Both statements are false
C) Statement 1 is true, and statement 2 is false
D) Statement 1 is false, and statement 2 is true

14. In an ideal condition, when single-stranded DNA is allowed to reanneal, how many class(s) of fragments can usually be distinguished by their frequency of repetition within a plant genome:

A) One
B) Three
C) Five
D) Seven

15. If 20% of nucleotides from a DNA molecule contain the base T, what percent will contain the base G?

A) 10%
B) 20%
C) 30%
D) 40%

16. Consider the following statements and choose the right answer.

Statement 1: The enzymes responsible for transcription in prokaryotic and eukaryotic cells are called DNA-dependent RNA polymerases.
Statement 2: RNA polymerase moves along the template DNA strand toward its 3' end during transcription.

A) Both statements are false
B) Both statements are true
C) Statement 1 is false, and statement 2 true
D) Statement 1 is true, and statement 2 false

17. The Mendel's dwarf pea plant was defective in the synthesis of the plant hormone.

A) Jasmonic acid
B) Gibberellic acid
C) Indole acetic acid
D) Abscisic acid

18. Which one of the following molecules is the common precursor for the biosynthesis of carotenoids, gibberellic acid, and abscisic acid?

A) Copalyl diphosphate
B) Geranylgeranyl pyrophosphate
C) Ent-kaurene
D) Linolenic acid

19. In the ABC model of flower development, which combination specifies the petals?

A) AA
B) AB
C) AC
D) BC

20. Which one of the following plants has both strategy I and strategy II for iron uptake in roots?

A) Wheat
B) Maize
C) Barley
D) Rice

21. Which one of the following hormones has its receptor localized on the endoplasmic reticulum?

A) Auxin
B) Gibberellin
C) Ethylene
D) Brassinosteroids

22. Transposable elements like *bobo* mediate intrachromosomal recombination in Drosophila such that two *bobo* elements on the same chromosome pair and recombine with each other. What would be the result of such recombination if the *bobo* elements were oriented in the same direction on the chromosome?

A) Insertion
B) Deletion
C) Duplication
D) Inversion

23. Mutation in a single nucleotide resulting in a codon that codes for a different amino acid is called

A) Transversion
B) Missense mutation
C) Frameshift mutation
D) Nonsense mutation

24. Suppose the average molecular mass of an amino acid is assumed to be 100 Daltons. How many nucleotides will be present in an mRNA coding sequence specifying a single polypeptide with a molecular mass of 27000 Daltons?

A) 810
B) 910
C) 710
D) 1010

25. If Down's syndrome occurs in about 1 in 700 and Turner syndrome occurs in about 1 in 5000 in the general population, and each is separately and randomly distributed in the general population, what is the chance that a baby will be born with both these abnormalities?

A) 1/5,000,000
B) 1/4,000,000
C) 1/3,500,000
D) 1/3,000,000

26. Which one of the following is **not** an essential mineral nutrient in plants?

A) Nickel
B) Molybdenum
C) Silicon
D) Boron

27. If an organism produces 16 types of gametes, the organism is heterozygous for

A) 2 genes
B) 3 genes
C) 4 genes
D) 5 genes

28. A set of virulence genes (*vir* genes), located in the *Agrobacterium* Ti-plasmid, is activated by

A) Octopine
B) Nopaline
C) Acetosyringone
D) Auxin

29. Which mineral element is required for the synthesis of Cytochrome C

A) Copper
B) Iron
C) Magnesium
D) Cobalt

30. The conventional approach of determining the genetic basis responsible for a known phenotype is called as

A) Forward genetics
B) Reverse genetics
C) Phylogenetics
D) Cytogenetics

31. The mutant phenotype can be rescued to wild-type by genetic manipulation. This method is known as:

A) Gene complementation
B) Gene silencing
C) Gene recombination
D) Gene synthesis

32. The set of all the genes present in a given species is called ____.

A) Multigenome
B) Pangenome
C) Intragenome
D) Macrogenome

33. Match the following inhibitors with the corresponding electron transport chain complex and choose the **correct** answer from the options given below

1. Complex I	i. Azide
2. Complex II	ii. Oligomycin
3. Complex III	iii. Malonate
4. Complex IV	iv. Rotenone
5. Complex V	v. Antimycin A

A) l-iv; 2-v; 3-i; 4-ii; 5-iii
B) l- v; 2-ii; 3-iv; 4-i; 5-iii
C) l-iv; 2-v; 3-ii; 4-iii; 5-i
D) l-iv; 2-iii; 3-v; 4-i; 5-ii

34. Which of the following is **not** related to enzyme kinetics?

A) Eadie-Hofstee diagram
B) Hanes-Woolf plot
C) Michaelis-Menten equation
D) Gattermann-Koch reaction

35. Identify the **correct** order of basic modules in a mass spectrometer

A) Ion source-focusing lens-analyzer-detector
B) Ion source-analyzer-focusing lens-detector
C) Focusing lens-ion source-analyzer-detector
D) Analyzer-ion source-focusing lens-detector

Part B

36. Red-flowered plants of *Mirabilis jalapa* (four o'clock plant), when crossed with white-flowered plants, the flowers produced by F_1 plants were pink in colour. When F_1 individuals are self-crossed, the phenotypic ratio of F_2 plants will be ____.

A) 1 Red : 2 White: 1 Pink
B) 3 Red: 1 White
C) 1 Red: 2 Pink : 1 White
D) 1 Red: 3 Pink

37. Consider the following reactions that occur during glycolysis.

(i) Conversion of glucose-6-phosphate to fructose-6-phosphate
(ii) Conversion of glyceraldehyde-3-phosphate to 1,3-bisphosphoglycerate
(iii) Conversion of 2-phosphoglycerate to 2-phosphoenolpyruvate
(iv) Conversion of fructose-6-phosphate to fructose-1,6-bisphosphate

Which of the reaction(s) is/are **not** reversible?
A) (i) and (iii)
B) Only (ii)
C) (ii) and (iv)
D) Only (iv)

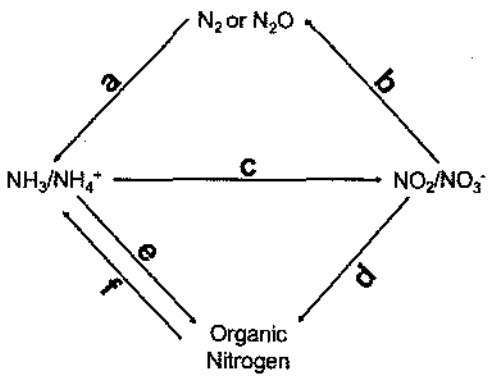
38. Consider the following statements about H^+-ATPase in higher plants.

(i) H^+-ATPase uses the energy of hydrolysis of ATP
(ii) H^+-ATPase maintains a high H^+ concentration inside the cell
(iii) H^+-ATPase maintains the cytosolic pH in the range of 7.3-7.5
(iv) H^+-ATPase generates proton motive force (pmf)

Which of the statements are **true**?
A) (i) and (ii)
B) (i) and (iv)
C) (i), (ii) and (iii)
D) (i), (iii) and (iv)

39. Figure (A) shows the processes underlying the biological transformation of nitrogen compounds. Match the **correct** names (B) with the reactions.

A



B

(i) Ammonia assimilation
(ii) Nitrification
(iii) Assimilatory nitrate reduction
(iv) Nitrogen fixation
(v) Ammonification
(vi) Denitrification

A) a(iv), b(vi), c(ii), d(iii), e(i), f(v)
B) a(v), b(i), c(iii), d(vi), e(ii), f(iv)
C) a(iv), b(iii), c(v), d(i), e(vi), f(ii)
D) a(ii), b(vi), c(v), d(iii), e(i), f(iv)

40. Transport of xenobiotics into plant cell vacuoles for their detoxification is facilitated by _____.

A) Vacuolar H^+- ATPases
B) Signal recognition particle receptors
C) ATP-binding cassette transporters
D) Ion channels

41. Ammonium persulphate used in polymerization of acrylamide and bisacrylamide to prepare polyacrylamide gels for electrophoresis is _____.

A) An oxidizing agent
B) A reducing agent
C) Determines the pore size of the polymerized gel
D) A crosslinker

42. For preparing one litre of 500 mM disodium ethylenediaminetetraacetate.$2H_2O$ (EDTA disodium salt dehydrate, molecular weight: 372.24 g/mol) solution in water, _____ and make up the volume to 1L.

A) Add 186.12 g in 800 ml of water, adjust the pH to 8.0 using NaOH
B) Add 186.12 g in 800 ml of water, adjust the pH to 6.0 using HCl
C) Add 372.44 g in 800 ml of water, adjust the pH to 6.0 using HCl
D) Add 93.06 g in 800 ml of water, adjust the pH to 8.0 using NaOH

43. Phage T7 promoter containing plasmids are used for overexpression of cloned genes because of

A) Their convenient size
B) Their single-stranded nature
C) The exquisite specificity of T7 RNA polymerase to phage promoters
D) T7 infects *E.coli* and lysogenizes the cell

44. The macromolecule chitin is

A) Phosphorous-containing polysaccharide
B) Nitrogen-containing polysaccharide
C) Sulphur-containing polysaccharide
D) Simple and branched polysaccharide

45. The first step in two-dimensional gel electrophoresis generates a series of protein bands by isoelectric focusing. In the second step, a strip of this gel is turned 90 degrees, placed on another gel containing SDS, and an electric current is again applied. In this second step_____

A) The individual bands become stained so that the isoelectric focus pattern can be visualized
B) The proteins with similar isoelectric points become further separated according to their molecular weight
C) The individual bands become visualized by interacting with protein-specific antibodies in the second gel
D) The proteins in the bands separate more completely because the second electric current is in the opposite polarity to the first current

46. Location of the protein cleavage by trypsin

A) Lysine and Arginine
B) Lysine and Tyrosine
C) Arginine and glutamine
D) Phenylalanine and Lysine

47. If 10 gm of sodium chloride (NaCl; FW 58.44) are dissolved into 100 ml of water, what is the molar concentration of sodium chloride in the solution?

A) 0.17
B) 0.58
C) 1.71
D) 5.84

48. In competitive inhibition

A) V_{max} unchanged and K_m increases
B) V_{max} decreases and K_m unchanged
C) Both V_{max} and K_m decrease
D) Both V_{max} and K_m increase

49. In glycoproteins, the carbohydrate moiety is always attached through the amino acid residues_____

A) Tryptophan, aspartate, or cysteine
B) Asparagine, serine, or threonine
C) Glycine, alanine, or aspartate
D) Aspartate or glutamate

50. The relation of D-Glucose with D-Galactose and D-Mannose, respectively, is

A) C-4 anomer and C-2 anomer
B) C-4 epimer and C-2 epimer
C) C-2 epimer and C-4 epimer
D) C-2 anomer and C-4 anomer

51. Which of the following statements about histone 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

52. Choose the **correct** answer regarding the function of the non-sense codon.

A) It translocates mRNA to the cytoplasm from DNA
B) It releases the synthesized polypeptide chain from ribosomes
C) It carries specific amino acid molecule on mRNA
D) It releases polypeptide chain from methionine

53. In summer squash, white color fruit (W) is dominant over yellow color (w), and disc-shaped fruit (D) is dominant over sphere-shaped fruit (d). Determine the genotypes of the parents if the white color, disc-shaped fruit crossed with white color, sphere-shaped fruit gives ¾ white color, disc-shaped fruit and ¼ yellow color, disc-shaped fruits.

A) WW Dd x WW dd
B) Ww Dd x Ww dd
C) Ww Dd x WW dd
D) Ww DD x Ww dd

54. Recessive genes a, b, c, d, e, and f are closely linked in a chromosome, but their order is unknown. Three deletions in the region are examined. One deletion uncovers a, d and e; another uncovers c, d, and f, and the third uncovers b and c. What is the possible order of the genes?

A) a d e f b c
B) a c b f e d
C) a e d f c b
D) a e d c f b

55. The vector used in recombinant DNA technology should have many desirable properties. Choose the **correct** statements from the following.

i. It should be autonomously replicating
ii. It should have a unique restriction enzyme site for various restriction enzymes to insert foreign DNA
iii. It should be easily isolated and purified
iv. It should contain at least one selectable marker genes
v. It should have a large size with stringent control of replication

A) i, ii, iii & v
B) i, ii, iv & v
C) i, ii, iii & iv
D) ii, iii, iv & v

56. If two genes 'a' and 'b' are 12.0 map units apart, one expects to find

A) 12.0% recombinant gametes from a doubly heterozygous parent
B) 6.0% recombinant gametes from a doubly heterozygous parent
C) A chiasmata between the 'a' and 'b' loci in 12% of the meiosis
D) A chiasmata between the 'a' and 'b' loci in 88% of the meiosis

57. Garden pea is a diploid organism with 7 pairs of chromosomes (2n = 14). How many chromosomes and chromatids are present in Metaphase II of meiosis?

A) 7 chromosomes and 7 chromatids
B) 7 chromosomes and 14 chromatids
C) 14 chromosomes and 14 chromatids
D) 14 chromosomes and 28 chromatids

58. A cross is made between two different strains of *Neurospora crassa* differing with respect to a specific gene for mapping its position to the centromere. The tetrads issued from the cross, **A** × **a** were isolated and classified as first-division and second-division segregation patterns. Which of the following tetrads represents a first-division segregation pattern?

A) A A a a A A a a
B) A A a a a a A A
C) a a A A A A a a
D) A A A A a a a a

59. Skoog and Miller (1957), through classical experiments conducted with tobacco pith tissue cultures, have put forth the concept of hormonal control of organ formation. Which of the following growth regulators were used by them in these experiments?

A) BAP & NAA
B) BAP & IBA
C) IPA & NAA
D) KN & IAA

60. The characteristic feature of the F_1 plant population is:

A) All are heterozygotes
B) All are homozygotes
C) A mixture of homozygotes and heterozygotes
D) A mixture of pure lines and inbred lines

61. The percentage increase in homozygosity achieved per each generation of backcrossing is:

A) 100% B) 75%
C) 50% D) 25%

62. The minimum size of the progeny population resulting from the random union of all possible gametes from the parents with the genotype, AaBbCc is:

A) 27 B) 9
C) 64 D) 100

63. The proportion of genetic variance to the total phenotypic variance is known as:

A) Selection advance B) Additive variance
C) Heritability D) Selection intensity

64. The gradual loss of variability from cultivated plants and their related species is known as:

A) Loss of vigour B) Introgression
C) Genetic mutation D) Genetic erosion

65. In one of the following DNA markers, the application of both polymerase chain reaction (PCR) and restriction digestion of the DNA is carried to generate polymorphism in plants:

A) Random amplified polymorphic DNA
B) Restriction fragment length polymorphism
C) Amplified fragment length polymorphism
D) Single nucleotide polymorphism

66. One student was working on a single nucleotide polymorphism of a plant species. The student was performing SNP typing using a technique called "ARMS Test". What is the full form of ARMS?

A) Amplification Refractory Mutation System
B) Allele Repetition and Methylation Setting
C) Amplification of Repeat Mismatch Sequence
D) Alternate Regulatory Molecular Scanning

67. What is the most important characteristic of a shuttle vector?

A) A vector that can move between the nucleus and cytoplasm
B) A vector that can move between mitochondria, nucleus, and cytoplasm
C) A vector that can replicate in the cells of more than one organisms
D) A vector that can replicate inside the cells as well as outside the cells

68. Generally, during the PCR reaction cycle, what is the top lid temperature of a PCR machine?

A) Almost 10 °C lesser than denaturation temperature
B) Almost 10 °C greater than denaturation temperature
C) Equal to extension temperature
D) Lid temperature should always be maintained at 0 °C during the PCR cycle

69. Which of the following is a C3-C4 intermediate plant?

A) *Panicum*
B) Sugarcane
C) Maize
D) Pineapple

70. The ovules that are completely inverted so that the micropyle is facing downward and situated near the base of the funiculus are called

A) Anatropus ovule
B) Orthotropus ovule
C) Campylotropous
D) Amphitropous

Ph. D. Plant Sciences

Final Submitted
12-01-2021

PartA		Part B	
Question	Answer	Question	Answer
1	D	36	C
2	B	37	D
3	A	38	D
4	B	39	A
5	D	40	C
6	C	41	A
7	D	42	A
8	A	43	C
9	B	44	B
10	B	45	B
11	D	46	A
12	A	47	C
13	A	48	A
14	B	49	B
15	C	50	B
16	D	51	C
17	B	52	B
18	B	53	D
19	B	54	C
20	D	55	C
21	C	56	A
22	B	57	B
23	B	58	D
24	A	59	D
25	C	60	A
26	C	61	C
27	C	62	C
28	C	63	C
29	B	64	D
30	A	65	C
31	A	66	A
32	B	67	C
33	D	68	B
34	D	69	A
35	A	70	A

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