

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

Ph.D. Biotechnology

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 **18** pages (last three pages to be used for rough work) including this page. OMR Answer sheet will be provided separately.
3. Each question carries one mark and there is no **Negative marking**.
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. You may take the Question Paper after the examinations is over.
6. In case the candidates have equal marks, preference will be given towards the candidates who has obtained higher marks in **PART - A**.
7. Non-programmable scientific calculators are permitted.
8. Cell/Mobile phones are strictly prohibited in the examination hall.

PART A

1. Ethane has _____ ionic bonds
 - A. 1
 - B. 2
 - C. 3
 - D. 0
2. Methane has _____ Carbon atom(s) and is (are) in _____ geometry
 - A. 1, tetrahedral
 - B. 2, tetrahedral
 - C. 1, trigonal
 - D. 2, trigonal
3. Hydrogen bonds are _____ and, essentially _____ interactions
 - A. weak, electrostatic
 - B. strong, electrostatic
 - C. weak, covalent
 - D. strong, covalent
4. The Phi angle of a L-Prolyl residue in a polypeptide chain is, ideally, restricted to _____ degrees
 - A. +120
 - B. -120
 - C. +60
 - D. -60
5. A bacterial genome is 50% GC rich. The probability of finding the subsequence GTTTGC any where in the genome is _____
(Note: ^ means "to the power of")
 - A. 6×0.25
 - B. 6×0.5
 - C. $(0.25)^6$
 - D. $(0.5)^6$
6. Of the following lists _____ corresponds to the list with only hydrophobic amino acids
 - A. G, P, R, K, L
 - B. P, R, K, L, I
 - C. I, P, L, W, A
 - D. K, R, S, T, E

7. A newly formulated BP lowering medicine was tested on 100 volunteers. The BP values were measured before and after medication and their mean values were found to be 130 and 120. A statistical significance test was performed and the corresponding p-value was found to be >0.05 . What should be your interpretation on the efficacy of the drug?
- The drug is effective given the sample size
 - The drug is not effective given the sample size
 - The patients were probably not taking the drug as prescribed
 - Can not say anything. Retrial has to be carried out by altering the drug dose.
8. In a typical Normal distribution, the highest probability value corresponds to the _____ of the random variables
- Mean value
 - The lowest extreme value
 - The upper quartile value
 - The highest extreme value
9. The area of a rectangle is "A" square centimeters (sq. cm). If both length and breadth of the rectangle are doubled then the total area of the resultant rectangle is _____
- 2 X "A" sq. cm
 - 4 X "A" sq. cm
 - "A" sq. cm
 - "A/2" sq. cm
10. Limit of $(\sin x/x)$ as $x \rightarrow 0$ is _____
- 1
 - 0
 - 2
 - 1
11. Which of the following best defines the 'quaternary structure' of a protein?
- The interaction of amino acid side chains.
 - The sequence of amino acids in a polypeptide chain.
 - The folding of the polypeptide backbone in three-dimensional space.
 - The arrangement of two or more polypeptide subunits into a single functional complex.
12. Which one of the following amino acid is least mutable during the course of evolution?
- Lysine
 - Glycine
 - Tryptophan
 - Isoleucine

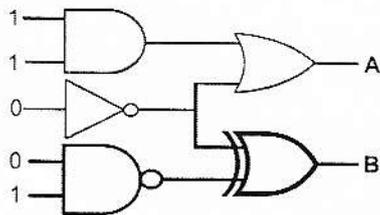
13. 'Phenylketonuria' is caused due to
- Amino acid starvation
 - Urea deficiency
 - Acidity
 - DNA polymorphism
14. The stage of the drug discovery that involves the use of animals is
- Compound discovery
 - Preclinical
 - Clinical
 - Launching
15. Diamond symbol in Flow chart represents
- Input/output
 - Process
 - Decision
 - Termination
16. Some boys are sitting in three rows all facing North such that B is in the middle row. C is just to the right of B but in the same row. D is just behind of C while A is in the North of B. In which direction of A is D?
- South-East
 - South-West
 - North-East
 - North-West
17. If you want to double the period of the simple pendulum, the length of the string should be
- Remained same, as the length of the string is independent of the period of the pendulum
 - Halved
 - Doubled
 - Quadrupled
18. Circle which one of the following represents increasing order of basic strength of the following compounds
Aniline (I), p-nitroaniline (II), p-toluidine (III)
- $II < III < I$
 - $III < I < II$
 - $III < II < I$
 - $II < I < III$

19. The probability of selecting a prime number at random from the numbers (1, 2, 3, ..., 35) is
- 11/35
 - 12/35
 - 13/35
 - None of the above
20. If the radius of the circle is increased by 30%, then its area is increased by
- 40%
 - 69%
 - 70%
 - 50%
21. BF_3 is an acid according to
- Lewis theory
 - Brønsted & Lowry
 - Arrhenius
 - None of the above
22. The vapour pressure of the molecules follows
- Water > ethanol > glycol
 - Ethanol > glycol > water
 - Ethanol > water > glycol
 - Glycol > water > ethanol
23. The heat capacity of a system at constant pressure is defined as
- Change in enthalpy upon the change in temperature
 - Change in internal energy upon the change in temperature
 - Change in entropy upon the change in temperature
 - Change in free energy upon the change in temperature
24. Diastereomers are
- Non-superimposable, mirror images with at least one stereocentre
 - Non-superimposable, not mirror images with at least one stereocentre
 - Non-superimposable, mirror images with at least two stereocentres
 - Non-superimposable, not mirror images with at least two stereocentres
25. If the Phi and Psi angle of a peptide is 60° and 45° , respectively, then the structure will be
- Right-handed alpha-helix
 - Left-handed alpha-helix
 - π -helix
 - β -sheet

26. The decimal equivalent of the binary number 110011100 is

- A. 414
- B. 412
- C. 428
- D. 398

27. Given below is circuit of logic gates. Provided the input as shown in figure what would be the value of A and B?



- A. A = 0 and B = 0
- B. A = 0 and B = 1
- C. A = 1 and B = 0
- D. A = 1 and B = 1

28. The coordinates for two points a & b in 2 dimensional space are (3,5) and (6,9) respectively. What would be the distance between the points?

- A. 5
- B. 12
- C. 9
- D. 7

29. Which of the following method is used to predict the nominal dependent variable from continuous variable?

- A. Linear Regression
- B. Correlation
- C. Logistic Regression
- D. None

30. If addition of an inhibitor decreases both the K_m and V_{max} values of an enzyme-substrate reaction following Michaelis-Menten mechanism, the inhibitor is

- A. Competitive inhibitor
- B. Uncompetitive inhibitor
- C. Non-competitive inhibitor
- D. Mixed inhibitor

31. Which of the following value of correlation coefficient represents the strongest relationship
- A. 0.3
 - B. -0.7
 - C. 0.09
 - D. 0.65
32. Select the protein sequence which match the pattern given below
[RTH]-X-[AG]-{FY}-X(3)-[LK]
- A. T-Y-G-H-M-L-P-K
 - B. R-P-G-F-K-K-P-L
 - C. M-G-A-Y-N-W-R-L
 - D. H-A-G-F-Y-S-L-K
33. Which of the following clustering approach requires distance matrix
- A. K-means clustering
 - B. Hierarchical clustering
 - C. Both
 - D. None
34. What is the range of coefficient of correlation?
- A. ± 2
 - B. ± 0.5
 - C. ± 1
 - D. ± 0.75
35. What type of data is required for chi-square test?
- A. Interval
 - B. Ratio
 - C. Continuous
 - D. Categorical
36. A bucket has 6 white, 5 black, 1 yellow and 3 green balls. Find the probability of drawing 2 white balls if they are picked randomly?
- A. $1/7$
 - B. $4/25$
 - C. $4/5$
 - D. $2/15$

37. How many grams of NaCl are required to prepare 200 mL of a solution of 1 M NaCl?
- A. 5.844
 - B. 11.688
 - C. 1.168
 - D. 58.44
38. $\log_{10} 0.001 = ?$
- A. -3
 - B. -2
 - C. 10
 - D. -1
39. If the speed of a moving body increases by 1.6 times, then the kinetic energy of the body _____ times
- A. increases 1.6
 - B. increases 2.56
 - C. decreases 2.56
 - D. increases 3.2
40. If a person walks at 15 km / h instead of 10 km / h, he would have walked 20 km more. The actual distance travelled by him is
- A. 70
 - B. 50
 - C. 60
 - D. 40

PART B

41. If 10 bacterial cells growing for 2 hours produced 10^4 cells, the generation time of the bacterial species:
- A. 9
 - B. 12
 - C. 13
 - D. 20
42. How does the mismatch repair system distinguish between the parental (i.e. correct) DNA strand and the newly synthesized strand containing the mismatched base?
- A. Thymine in the parental strand of the helix is methylated at GATC
 - B. Thymine in the new strand of the helix is methylated at GATC
 - C. Guanine in the parental strand of the helix is methylated at GATC
 - D. Guanine in the new strand of the helix is methylated at GATC
43. A dihybrid for qualitative trait is crossed with homozygous recessive individual of its type, the phenotypic ratio is
- A. 3:1
 - B. 1:2:1
 - C. 9:3:3:1
 - D. 1:1:1:1
44. Which of the following processes make direct use of oxygen?
- A. Fermentation
 - B. Electron transport
 - C. Citric acid cycle
 - D. Glycolysis
45. The example for the latent infections is
- A. Herpes viruses
 - B. Pox viruses
 - C. Flaviviruses
 - D. Togaviruses
46. The tuberculin skin test is an example of
- A. Type IV delayed hypersensitivity
 - B. Allergy reaction
 - C. Serum sickness
 - D. Precipitation reaction

47. Examination of a X-ray structure of a protein reveals that it is composed of just one domain and 40% of the amino acid residues are in helices and about similar % of residues in beta-strands. What structural class do you assign this protein domain to?
- A. Alfa-Class
 - B. Beta-Class
 - C. Alfa-Beta Class
 - D. Can't assign to any class
48. If a plasmid is having two antibiotic resistant genes, say ampicillin resistant and chloramphenicol resistant. If the plasmid grows in ampicillin containing medium but not in chloramphenicol, what can be concluded?
- A. The insert is not present in any of the gene
 - B. The insert is present between both of the genes
 - C. The insert is present in ampicillin gene but not in chloramphenicol gene
 - D. The insert is present in chloramphenicol gene but not in ampicillin gene
49. Expect (E-) value in BLAST depends on _____
- A. Only on the length of the input sequence
 - B. The lengths of both input sequence and the total size of the database that is being searched
 - C. The % identity of the local alignment between the query and the subject
 - D. Only the size of the database that is being searched
50. Gaps in an alignment indicate _____ that have happened during evolution of the aligned sequences
- A. Only Substitutions
 - B. Only conservations
 - C. Insertions or deletions
 - D. Sequence shuffling events
51. Statement (S): Small non-coding RNA molecules can post-transcriptionally regulate gene expression in bacteria
Reason (R): This is because sRNA is complementary to the mRNA of the gene it regulates and its binding either activate translation or silence by destabilization of mRNA.
- A. (S) and (R) are true, (R) is the correct explanation of (S)
 - B. (S) and (R) are true, but (R) is not the correct explanation of (S)
 - C. (S) is true, but (R) is not true
 - D. Both (S) and (R) are not true

52. The frequency of somatic mutation in Ig genes is greatest during
- A. differentiation of pre-B cells into mature B cells
 - B. differentiation of pre-T cells into mature T cells
 - C. generation of memory B cells
 - D. antibody secretion by plasma cells
53. Suppose the “- G-P-G-R-S-T-G-” is found in a protein sequence. What secondary structure this sequence might adopt? Your most apt answer is a ———
- A. Loop
 - B. Helix
 - C. Beta-strand
 - D. Part of it helix and the remaining beta-strand
54. B cell becomes immunocompetent
- A. following productive rearrangement of variable region heavy-chain gene segments in germ-line DNA
 - B. following productive rearrangement of variable region heavy-chain and light-chain gene segments in germ-line DNA
 - C. following class switching
 - D. during affinity maturation
55. The three-dimensional structure of protein can be determined by
- A. Protein microarray
 - B. Cryo-electron microscopy
 - C. Yeas two-hybrid system
 - D. Surface plasmon resonances
56. 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) Star
 - B. BL21 (DE3) pLysS
 - C. BL21 (DE3) Rosetta
 - D. BL21 (DE3) Origami
57. Patients with a single nucleotide polymorphism (SNP) at the HLA-B*5701 locus are hypersensitive to the medicine
- A. Storcin
 - B. Sustiva
 - C. Abakavir
 - D. Penecillin

58. The _____ RNA polymerase has a single subunit
- A. T7
 - B. *E. coli*
 - C. *Bacillus subtilis*
 - D. Lambda phage
59. The example for the 'slow infection' is
- A. Leprosy
 - B. Cholera
 - C. Small pox
 - D. Diabetes
60. In the detection of β S globin mutation of sickle cell anemia, the mutant probe interacts with
- A. Heterozygous carrier gene
 - B. Homozygous mutant gene
 - C. Both
 - D. None
61. The promoters of RNA polymerase III are located at
- A. -35 to -10 downstream
 - B. Internal to the transcribed sequence
 - C. More than 100 base pair upstream
 - D. +1 to +10 upstream
62. Subacute sclerosing panencephalitis is caused by
- A. Chikungyna virus
 - B. Measles virus
 - C. Zika virus
 - D. Ebola virus
63. Which of the following is not part of Gene Ontology description
- A. Molecular Function
 - B. Cell Interaction
 - C. Biological process
 - D. Cellular component
64. The mechanism that permits immunoglobulins to be synthesized in either a membrane-bound or secreted form is
- A. allelic exclusion
 - B. codominant expression
 - C. the one-turn/two-turn joining rule
 - D. differential RNA processing

65. Match the following and choose the option with correct combination of elements

List I

1. photorespiration
2. Cu containing enzyme
3. Carboxylation
4. Oxygen evolution

List II

- a. Photolysis of water
- b. Rubisco
- c. Plastocyanin
- d. Phosphoglycolate
- e. Nitrogenase

The correct answer is

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

66. Which of the following virus involves the 'RNA' as intermediate in its genome replication

- A. Human immunodeficiency Virus (HIV)
- B. Adeno virus
- C. Hepatitis B Virus (HBV)
- D. Hepatitis C Virus (HCV)

67. Circle the correct statement regarding the lac operon of *E. coli*

- A. A null mutation in LacI prevents expression of beta-galactosidase
- B. Mutation in LacO results in constitutive expression of beta-galactosidase
- C. LacO encodes a trans factor
- D. The LacI gene is induced by allolactose

68. During evolution gene duplication is the most likely a reason to generate

- A. Orthologs
- B. Paralogs
- C. Analogs
- D. Duplogs

69. The following genetic elements are important for the lambda growth. Circle the element that acts in *cis*

- A. N
- B. Q
- C. Nut
- D. Bacterial *recA*

70. Which of the following statements are true?
- I. All mRNA is capped at its 5' position
 - II. mRNA in the mitochondria and chloroplast are not capped
 - III. mRNA processing is similar in bacteria and archaebacteria
- A. I and II
 - B. II and III
 - C. II
 - D. I
71. If two related organisms have regions of conserved synteny, it means that the orthologous genes examined
- A. in the two species are present in the same order localization on the chromosome
 - B. in the two species are identical in sequences only
 - C. in the two species are on different chromosomes
 - D. are not present in one species
72. If the effect of quenching decreases with increasing temperature, then the mechanism of quenching on a fluorophore will be?
- A. Static quenching
 - B. Dynamic quenching
 - C. Collisional quenching
 - D. Not predictable
73. PROSITE is used to find
- A. protein secondary structure
 - B. interacting proteins
 - C. biologically meaningful patterns or profiles of protein
 - D. protein homology
74. Restriction enzymes present in several micro-organisms cut foreign DNA at specific sites. The enzymes do not cut the cellular DNA because
- A. The susceptible specific sites are masked by proteins
 - B. The cellular DNA does not have the specific sites
 - C. The restriction enzymes and DNA occupy different compartments
 - D. The susceptible sites are modified by cellular enzymes
75. The function of leghaemoglobin in the root nodules of legumes is
- A. Nodule differentiation
 - B. Inhibition of nitrogenase activity
 - C. Oxygen removal
 - D. Expression of nif gene

76. Virus 'poly protein' means
- A. Virus makes more proteins at a time
 - B. Virus assembles more proteins at a time
 - C. Virus genome acts as single open reading frame to synthesize a protein
 - D. Virus cleaves a protein to yield many proteins
77. A cross in which the F1 generation resembles both the parents
- A. Incomplete dominance
 - B. Complete dominance
 - C. Codominance
 - D. Inheritance of one gene
78. The light dependent and O_2 independent production of ATP is called
- A. photorespiration
 - B. photophosphorylation
 - C. photo-oxidation
 - D. oxidative phosphorylation
79. Which of the following is NOT a soft-ionization method in Mass spectroscopy?
- A. Matrix-assisted laser desorption ionization
 - B. Electrospray ionization
 - C. Electron impact ionization
 - D. Fast atom bombardment
80. Identify the techniques used for genome wide global gene expression profiling
1. DNA microarray 2. qRT-PCR gene expression 3. NGS whole transcriptome sequencing 4. Northern blotting technique.
- The correct combination is
- A. 1 and 2
 - B. 1 and 3
 - C. 2 and 3
 - D. 3 and 4