S-65

ENTRANCE EXAMINATIONS – 2018
Ph.D. Biotechnology

Time: 2 hours

Maximum Marks: 80

HALL TICKET NUMBER:

INSTRUCTIONS:

Please read the instructions carefully before answering the questions

1. Answers are to be marked on the OMR answer sheet.
2. Hand over the OMR answer sheet at the end of the examination to the invigilator.
3. The question paper contains 80 questions of multiple choices, printed in 19 pages (last three pages to be used for rough work), including this page. OMR answer sheet provided separately.
4. All questions carry one mark each.
5. In case the candidates have equal marks, preference will be given towards the candidate who has obtained higher marks in Part-A.
6. There is no negative marking for wrong answer.
7. Non-programmable scientific calculators are permitted.
8. Cell/Mobile Phones are strictly prohibited in the examination hall.

1

PART-A

1. In an examination of 3 hrs duration a total of 200 questions need to be answered. Of the 200 questions, 50 are mathematical problems. If you take twice the amount of time to answer each of the mathematical problems as compared with the time you would take to answer each of the other questions how many minutes you would be spending in total for answering all the mathematical problems?
   A. 36
   B. 60
   C. 72
   D. 100

2. Which of the programming language is best for statistical data analysis?
   A. C
   B. R
   C. JAVA
   D. FORTRAN

3. What force is in action while you are using a centrifuge machine in the lab for pelleting bacterial cultures?
   A. Acceleration due to gravity
   B. Centripetal force
   C. Centrifugal force
   D. Momentum

4. What is $\log_2 (x) = \ldots$ if $\log_4 (x) = 3$?
   A. 2
   B. 4
   C. 6
   D. 8

5. Suppose the product of two numbers x and y is 120 and the sum of their squares is 289, then x+y (i.e, the sum of these number) is____
   A. 20
   B. 23
   C. 169
   D. None of these

6. We are a group of 15 friends and of these 7 have studied Sanskrit whereas 8 have studied French and 3 have not studied any of these two languages. Please find how many of us know both Sanskrit as well as French.
   A. 0
   B. 1
   C. 2
   D. 3

7. Which of the following sequences contains the pattern [MT]-x(4)-G-H-[LG]?
   A. MAGWGHSM
   B. MVLKRGHG
   C. MTVLKGLG
   D. DSGVGKSLG

8. The peptide unit between_____and_____has the highest chance of assuming *cis* configuration.
   A. Ala, Ala
   B. Ala, Cys
   C. Gly, Met
   D. Gly, Pro

9. The resistance offered by an object to an applied force is referred to as___
   A. Inertia
   B. Potential
   C. Friction
   D. Reaction

10. How many grams of NaOH are needed to make 100 milliliters of a 0.2 molar solution of NaOH?
    A. 0.02 grams
    B. 0.8 grams
    C. 20 grams
    D. 800 grams

11. If you sell 10 items at a selling price, which is equal to the cost price of 11 items, what is the profit (in percentage) you make?
    A. 20
    B. 10
    C. 15
    D. 11

3

12. 50% of a number 'x' is equal to the three-fourth of another number y. What is the ratio of x and y?
    A. 2 : 3
    B. 3 : 2
    C. 3 : 4
    D. 4 : 3

13. From a group of 7 men and 6 women, five persons are to be selected to form a committee so that at least 3 men are there on the committee. In how many ways can it be done?
    A. 564
    B. 645
    C. 735
    D. 756

14. Advantage of NMR spectroscopy over x-ray crystallography is____
    A. It can be done on macromolecules in solution.
    B. It can give dynamics of the atoms in the molecule.
    C. You don't need to crystallize the protein.
    D. All of the above

15. What do you understand by codon bias?
    A. It is a bias for a codon of particular amino acid over other amino acids in a protein.
    B. It is a bias where a specific codon is favored over another codon for same amino acid in an organism.
    C. It is a bias where a specific t-RNA prefers to select a specific codon in a specific organism.
    D. None of the above

16. The enthalpy of combustion of the following reaction at STP is_____.
    CH_4 (g) + $2O_2$ (g) → CO_2 (g) + $2H_2O$ (l)
    Where, standard enthalpy of formation of CH_4 is -75 kJ/mol, CO_2 is -390 kJ/mol, and H_2O is -286 kJ/mol at STP
    A. -1037 kJ/mol
    B. -887 kJ/mol
    C. -812 kJ/mol
    D. -601 kJ/mol

17. In eukaryotic genome, it is observed that an individual protein domain is generally encoded by a single___.
    A. Intron
    B. Exon
    C. Gene
    D. intron exon boundary

4

18. Hydrogen Bomb is based on the principle of _____.
    A. Nuclear Fission
    B. Natural Radioactivity
    C. Nuclear Fusion
    D. Artificial Radioactivity

19. Our street cricket team had played 60 matches during 2016 and had won 30% of the matches played. In 2017 the team started winning matches in a row and raised its average to 50%. How many matches our cricket team has actually won in a row to achieve this average?
    A. 12
    B. 18
    C. 24
    D. 30

20. A train passes a station platform in 36 seconds and also it crosses a pole on the platform in 20 seconds. If the speed of the train in 54 km/hr, what is the length of the platform?
    A. 120 m
    B. 240 m
    C. 300 m
    D. 320 m

21. 1KB is equivalent to_____.
    A. 1000 B
    B. 1024 B
    C. 1000 MB
    D. 1024 MB

22. Needleman-Wunch algorithm used in sequence alignments is an implementation of_____.
    A. BLAST heuristics
    B. Dynamic programming
    C. Decision tree method
    D. Linear programming

23. The ideal *trans* peptide unit is characterized by an ω angle of _____ degrees
    A. +/-180
    B. +/- 0
    C. only + 180
    D. only -180

24. Classifying samples into two different classes based on the known training samples is known as _____.
    A. Supervised machine learning
    B. Unsupervised machine learning
    C. Clustering
    D. None

25. Compounds A and B at 1 micro molar exhibits 10% and 50% cytotoxicity to uninfected cells and 50% and 60% antiviral activities respectively. Compare antiviral activity of A and B.
    A. A<B
    B. B>>A
    C. A>B
    D. A=B

26. At what percentage the population in a city like Hyderabad should grow annually in order to double its size in 10 years?
    A. 5
    B. 10
    C. 15
    D. 100

27. In a substitution scoring matrix Alanine (A) has a score of 2 whereas Tryptophan (W) has score of 14. These scores indicate that during the evolution of protein sequences_____.
    A. A is often substituted by any other amino acid than W
    B. W is often substituted by any other amino acid than A
    C. A can be substituted by any 2 of the 20 amino acids
    D. W can be substituted by any 14 of the 20 amino acids

28. A thermodynamic system is classified as closed if it can_____.
    A. exchange energy with its surroundings , but not matter
    B. exchange both energy and matter with its surroundings
    C. exchange neither energy nor matter with its surroundings
    D. exchange only matter, but not energy, with its surroundings

29. There are 9 bananas and 6 mangoes in a fruit basket. If you are to pick a fruit in random from that basket what is the probability that the fruit you would pick is a banana?
    A. 0.40
    B. 0.60
    C. 0.25
    D. 0.33

30. The short arm of chromosome is designated as ____.
    A. p
    B. s
    C. t
    D. q

31. Square of the distance between two points (x1, y1, z1) and (x2, y2, z2) is ___.
    A. $(x2-x1)^2 + (y2-y1)^2 + (z2-z1)^2$
    B. $(x2-x1) + (y2-y1) + (z2-z1)$
    C. $(x2+x1)^2 + (y2+y1)^2 + (z2+z1)^2$
    D. $((x2-x1) + (y2-y1) + (z2-z1))^2$

32. Which of the following straight lines, given by their equations, passes through the points A(10, 6) and B(2, 2)?
    A. 2y - 2x = 6
    B. x - y = 0
    C. 4y - 2x = 4
    D. 4y - 3x = 2

33. A compound that has necessary properties to become a drug molecule is referred to as ____.
    A. Primer
    B. Lead
    C. Vaccine
    D. None of the above

34. An object of mass 9 kg is raised through a vertical distance of 40 m. If the gravitational acceleration is 9.8 m s-2, then the potential energy gained by the mass is_____
    A. 88.2 J
    B. 3528 J
    C. 360 J
    D. 392 J

35. Which one of the following enzymes hydrolyses internal phosphodiester bonds in a polynucleotide chain?
    A. PNPase
    B. DNA helicase
    C. Endonuclease
    D. Endophosphodiesterase

36. The light regulation of chloroplasts enzymes is mediated by reduced_____.
    A. Thioredoxin
    B. Ferredoxin
    C. Peroxiredoxin
    D. Glutaredoxin

37. The genetically modified microbe that acts on both C5 and C6 sugars is____.
    A. *Zymomonas mobilis*
    B. *Aspergillus*
    C. *Actinomycetes*
    D. *Clostridium*

38. In virus life cycle, the enzyme neuraminidase is useful for ____.
    A. attachment of virus to host cell.
    B. entry of virus into host cell.
    C. replication of virus in host cell.
    D. release of virus from host cell.

39. Restriction fragment length polymorphisms (RFLPs) are used to determine____.
    A. Genetic mapping
    B. RNA mapping
    C. The position of restriction endonuclease sites in a genome
    D. Organelles genome

40. Which one among the following components of a gene is likely to be least conserved in evolution?
    A. Intron
    B. Promoter
    C. Operator
    D. Exon

PART-B

41. When a cell is treated with hydrogen peroxide following damage takes place to DNA.
    A. Double strand breaks
    B. Single strand breaks
    C. Thymidine dimers
    D. Both double and single strands break

42. Panhandle structures appear during the replication of the genome of____.
    A. Retroviruses
    B. Adenoviruses
    C. Picorna viruses
    D. Fluviruses

43. Which of the following enzymes involved in ribosomal protein synthesis is a ribozyme i.e. a catalytic RNA molecule?
    A. Amino acyl t-RNA synthetase
    B. Peptidyl transferase
    C. Release factors 1 and 2
    D. Ribosome recycling factor

44. Expect value (E) in BLAST refers to _____.
    A. % sequence identity cutoff for finding homologs
    B. the number of non-hits (i.e., potential non-homologs) expected to see while searching a database of certain size
    C. the number of hits (i.e., potential homologs) expected to see while searching a database of certain size
    D. none of the above

45. Select the **wrong** statement out of the four given below about *lac* operon.
    A. Lactose analogue, lactate can also bind to repressor and inactivate it.
    B. Expression of *lac* operon occurs in the presence of lactose and absence of glucose
    C. RNA polymerase transcribes *lac* operon in the presence of IPTG
    D. Galactose does not bind to *lac* repressor

46. Which of the following statements regarding termination of transcription in prokaryotes is correct?
    A. In Rho dependent termination, the Rho factor moves along the DNA template ahead of the RNA polymerase
    B. Rho factor has topoisomerase activity of relieving supercoiling
    C. Termination often involves a stem-loop structure forming in the RNA transcript
    D. Termination often involves a stem-loop structure forming in the DNA template

47. Which of the following solvent(s) is (are) used for selective separation of supercoiled DNA from a mixture of linear dsDNA, nicked circular dsDNA, single stranded DNA and supercoiled DNA?
    A. Buffer saturated phenol
    B. Water saturated phenol
    C. Phenol, Chloroform and amyl alcohol mixture
    D. All the above

48. As per WHO, Phase-6 infection refers to_____.
    A. Predominantly animal and few human infections
    B. Possibility of recurrent infections
    C. Disease activity at seasonal levels
    D. Wide spread human infection

49. What is the name of the DNA repair system in *E. coli* in which dual incisions are made in the damaged part of the double helix, and a 12-13 base segment is removed and replaced with new DNA?
    A. Mismatch Repair
    B. Base Excision Repair
    C. Nucleotide Excision Repair
    D. AP site repair

50. The location of antigen in case of immune stimulation complexes (ISCOM) for delivery of antigen is_____.
    a. Interior
    b. Surface
    c. Interface
    d. Submerged

51. If you are using 100ng of pUC18 (2686 base pair) and you want an equal amount of molecules of pKC7 (5829), how many ng of pKC7 do you need?
    A. 214 ng
    B. 467 ng
    C. 0.0214 ng
    D. 46.7 ng

52. When a polymerase reaction conducted in the presence of alpha-S35-CTP and alpha-P32-ATP, autoradiogram of the labeled DNA show faint image, that means template is____.
    A. CC rich
    B. GC rich
    C. AT rich
    D. AA rich

53. Following peptide requires post-translational modification.
    A. Gramicidin-S
    B. T-20
    C. Insulin
    D. C-peptide

54. The enzyme that resolve topological intermediates of negatively supercoiled DNA by a turn is____.
    A. Resolvase
    B. Helicase
    C. Topoisomerase I
    D. Topoisomerase II

55. A mutation is found in a t-RNA encoding gene. The wild type allele produces a t-RNA that recognizes the codon GAA, and is charged with the amino acid Glutamic acid. The mutant t-RNA is still charged with Glu, but the anticodon is mutated such that it recognizes the codon TAA. What effect will this have on translation in these cells? How will the proteins produced be different?
    A. There will be no effect in the mutant cell and normal protein translation will occur
    B. In mutant cell, proteins will be truncated as GAA will be replaced by the stop codon TAA
    C. In mutant cell, the protein made will be longer than normal
    D. In mutant cell, the protein will be synthesized with a mutation in glutamic acid

56. If the heat capacity of one mole of an ideal gas at constant pressure is 3/2 R, the heat capacity at constant volume will be (R is gas constant)_____.
    A. –R
    B. R
    C. -½ R
    D. ½ R

57. If a protein is precipitated above 80% of ammonium sulphate saturation, what would be property of the protein?
    A. Hydrophobic
    B. Ionic
    C. Hydrophilic
    D. All the above

58. A nanoparticle formulation is injected to an animal through IV route, an injection site inflammation is observed, but no other toxicity is noticed. The reason could be_____.
   A. Particle size is more than 1 micrometer
    B. Particles are degraded
    C. Particles are aggregated
    D. Due to infection

59. Assume that genes a and b are linked and show 40% recombination. If ++/++ individual is crossed with ab/ab, then types and proportions of gametes in F_1 will be_____.
    A. ++20% : ab 20%: +b 20% : a+ 40%
    B. ++50% : ab 50%
    C. ++25% : ab 25%: +b 25% : a+ 25%
    D. ++30% : ab 30%: +b 20% : a+ 20%

60. In the given representation of Maxwell's distribution of molecular velocities, the temperatures (T) will be such that_____.
   A. $T_1 \geq T_2 \geq T_3$
    B. $T_1 > T_2 > T_3$
    C. $T_1 \leq T_2 \leq T_3$
    D. $T_1 < T_2 < T_3$
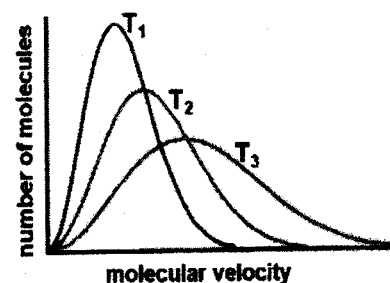
61. Hershey-Chase experiment proves that_____.
    A. RNA is the genetic material of a virus
    B. DNA is the genetic material of a virus
    C. Protein is the genetic material of a virus
    D. Non of the above

62. Which of the following methods is useful for visualization of repeats in DNA sequence?
    A. FastA
    B. Smith and Waterman algorithm
    C. Dot Matrix
    D. Needleman–Wunsch algorithm

63. When an excited chromophore releases energy through radiative transition, the emission wavelength is_____.
    A. always shorter than the excitation
    B. shorter than the excitation at lower temperature
    C. always longer than the excitation
    D. longer than the excitation at lower temperature

64. Callose, which is synthesized in response to wounding in plants, is composed of____.
    A. β-1,3-glucan
    B. β-1,4-glucan
    C. α-1,3-glucan
    D. α-1,4-glucan

65. Which centrifuge consists of a central inlet pipe and a system of conical disc, made-up of stainless steel arranged in stacks with a spacer?
    A. Basket Centrifuge
    B. Disk Bowl Centrifuge
    C. Tubular Centrifuge
    D. Solid Bowl Centrifuge

66. The given circular dichroism spectrum of a protein suggests that the protein_____.
    A. predominately contains α-helices
    B. predominately contains β-sheets
    C. contains more Trp residues among aromatic residues
    D. contains more Tyr and Phe residues among aromatic residue
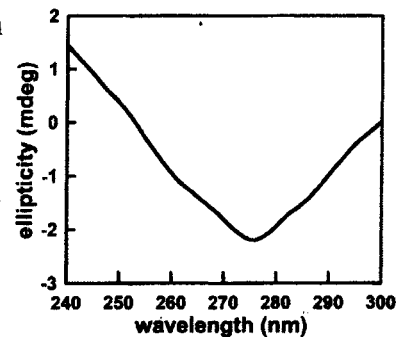
67. Which of the following NGS techniques uses "sequence by ligation" principle?
    A. Illumina dye sequencing
    B. SOLiD
    C. Ion Torrent
    D. 454 Pyrosequencing

13

68. Gel filtration chromatography separate on the basis of_____.
   A. Size using porous beads packed in the column
   B. Shape using porous beads packed in the column
   C. Size and shape using porous beads packed in the column
   D. None of the above

69. Semi-permeable membrane is selective membrane, which does not permit the passage of dissolved _____ particles.
   A. Solvent
   B. Anhydrous
   C. Solute
   D. Saturated

70. Which of the following heavy / radioisotopes is NOT suitable for DNA labeling based studies?
   A. ^3H
   B. ^{32}P
   C. ^{35}S
   D. ^{15}N

71. Which of the following statements is true about size-exclusion chromatography?
   A. During the separation of a mixture of proteins, protein with smallest molecular weight is eluted first
   B. During the separation of a mixture of proteins, protein with largest molecular weight is eluted first
   C. During the separation of a mixture of proteins, protein with largest molecular weight is eluted last
   D. During the separation of a mixture of proteins, protein with largest molecular weight flow around the beads

72. The viruses that can cause two different diseases are_____.
   A. Herpes viruses
   B. Pox viruses
   C. Adeno viruses
   D. Hepadnaviruses

73. Alternative oxidase enzyme is associated with oxidation of the following molecule in electron transport chain.
   A. Phylloquinone
   B. Ubiquinone
   C. Plastoquinone
   D. Cytochrome

74. The *In silico* method which aims to find best matching between a ligand and receptor is called____.
   A. Molecular Dynamics
   B. Homology Modeling
   C. Molecular Fitting
   D. Molecular Docking

75. Arrange the following steps involved in Gene cloning in the correct order
   i. Insertion of isolated gene to the vector
   ii. Isolation of desired gene
   iii. Introduction of recombinant vector to the host
   iv. Extraction of recombinant gene product
   v. Expression of recombinant gene in host

   A. i, ii, iii, iv, v
   B. ii, i, iii, v, iv
   C. iv, v, ii, i, iii
   D. v, iv, iii, ii, i

76. Bacterium divides every 20 minutes. If a culture containing 10^2 cells per mL is grown for 120 minutes, what will be the cell concentration per mL after 60 min?
   A. 20×10^2
   B. 60×10^2
   C. 8×10^2
   D. 6×10^2

77. Which is incorrect with reference to the transforming principle?
   A. S strain - inject into mice – Mice die
   B. R strain – inject into mice – mice live
   C. S strain (heat killed) – inject into mice – mice live
   D. S strain (heat killed) + R strain (live) – inject into mice – mice live

78. The two principal backbone torsion angles that describe conformation of a polypeptide chain are____.
   A. ψ and χ
   B. ψ and τ
   C. φ and ψ
   D. τ and φ

79. Curve width of DNA melting curve increases linearly with an inhibitor, interaction such inhibitor binding will be____.
    A. Minor groove
    B. Major groove
    C. Intercalation
    D. Covalent

80. Which of the following statement is correct with respect to gene cloning using *pBR322* vector.
    A. The *E. coli* cloning vector pBR322 has 'BamHI' restriction site in 'amp^R' gene sequence
    B. DNA can't pass through the cell membrane during transformation, because of absence of specific transport proteins
    C. Bacteria with insertional inactivation do not produce colour in the presence of chromogenic substance
    D. Purified DNA ultimately precipitated out after the addition of chilled acetone.