

B-10

ENTRANCE EXAMINATIONS 2022

Ph.D. Biotechnology

Time: 2 hours

Maximum Marks: 70

Hall Ticket No.

Instructions:

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. Answers are to be marked on the **OMR answer sheet**.
3. Hand over the OMR answer sheet at the end of the examination to the invigilator.
4. The question paper contains 70 questions of multiple choices. OMR answer sheet provided separately.
5. All questions carry one mark each.
6. There is **no negative marking** for wrong answer.
7. If there is a tie, the marks obtained in **Part A** will be used to resolve the tie.
8. Non-programmable scientific calculators are permitted.
9. Cell/Mobile Phones are strictly prohibited in the examination hall.
10. There are total **15** pages including the instructions page.

Part-A

1. Following structure exhibits dipole moment
 - A) Alpha helix
 - B) Beta sheet
 - C) B-DNA
 - D) Sucrose

2. If a protein shows four conformations C1, C2, C3, C4 with the potential energy of -40, -50, -70, -30 KJ which is the stable conformation
 - A) C1
 - B) C2
 - C) C3
 - D) C4

3. When proteins in a given sample are precipitated with ammonium sulfate at different saturation concentrations, which percent saturation a hydrophobic protein could be detected:
 - A) 20%
 - B) 40%
 - C) 60%
 - D) 80%

4. Which of the following microscopes are used to visualize the protein fused to an appropriate reporter in a living cell.
 - A) Scanning Electron Microscope
 - B) Fluorescence microscope
 - C) Phase contrast microscope
 - D) None of the above

5. For glycoproteins most commonly used probe is
 - A) Antibody
 - B) Antigens
 - C) Lectins
 - D) Interferons

6. The separation technique of charged molecules under the influence of electric current is called
 - A) Colony hybridization
 - B) Dot blot techniques
 - C) Western blotting
 - D) Electrophoresis

7. The identity of an element is determined by the
 - A) Number of its protons
 - B) Number of its neutrons
 - C) Density of the element
 - D) Its atomic mass

8. During separation of proteins using SDS-PAGE, the following two dyes are used
- I. 2,6-Dichlorophenolindophenol
 - II. Bromophenol blue
 - III. Coomassie Brilliant Blue
 - IV. 2,4-Dichlorophenol

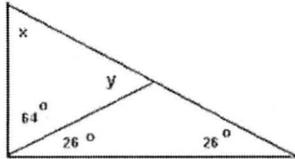
The correct answer is

- A) I and III
 - B) I and IV
 - C) II and III
 - D) II and IV
9. To construct a recombinant plasmid, the plasmid and the DNA to be inserted are digested with the same restriction enzyme and added to the ligation reaction mix. Which of the following enzymes can be used to prevent self- ligation?
- A) Polynucleotide kinase
 - B) Ligase
 - C) Terminal transferase
 - D) Alkaline phosphatase
10. What is the final pH of a solution made by mixing 40 ml of 0.3 M HCl and 20ml of 0.2M NaOH.
- A) 1
 - B) 2
 - C) 5
 - D) 7
11. Which of the following thermodynamic relation for an equilibrium reaction is true at the condition that $K_{eq} = 1$?
- A) $\Delta C_p = 0$
 - B) $\Delta S = \Delta H/ T$
 - C) $\Delta C_p = \Delta C_v$
 - D) $\Delta G = 1$
12. Which of the following compound is used as an internal reference in NMR spectroscopy?
- A) Tetramethylammonium hydroxide
 - B) 1,1-diphenyl-2-picrylhydrazyl
 - C) 1,1-diphenyl-2-butene
 - D) Tetramethylsilane
13. Parvathi started from her home to the temple between 8am and 9am when the hands of the clocks are together. She arrived the temple between 2pm to 3pm, when the hands of the clock were exactly 180° apart. She travelled for
- A) 5 hours 30 minutes
 - B) 6 hours 45 minutes
 - C) 6 hours
 - D) 5 hours 10 minutes

14. The ionic strength of 0.2 M K_2SO_4 is _____ mol/L.

- A) 0.3
- B) 0.4
- C) 0.6
- D) 0.8

15. Find the value of x and y angles in the triangle



- A) $X = 52^\circ$, $Y = 64^\circ$
- B) $X = 64^\circ$, $Y = 52^\circ$
- C) $X = 45^\circ$, $Y = 71^\circ$
- D) $X = 58^\circ$, $Y = 58^\circ$

16. Which of the following parasites belong to the phylum Apicomplexa

- A) *Trypanosoma rhodesiense*
- B) *Plasmodium falciparum*
- C) *Leishmania donovani*
- D) *Entamoeba histolytica*

17. Choose the right answer

- A) B DNA is a left-handed DNA helix with a pitch of $34^\circ A$
- B) B DNA is a left-handed DNA helix when the relative humidity is 75%
- C) B DNA is formed when the relative humidity is 92%
- D) A DNA is a right-handed DNA helix which has 10 base pair per turn of helix

18. Exercise is to gym as eating is to _____

- A) Food
- B) Dieting
- C) Fitness
- D) Restaurant

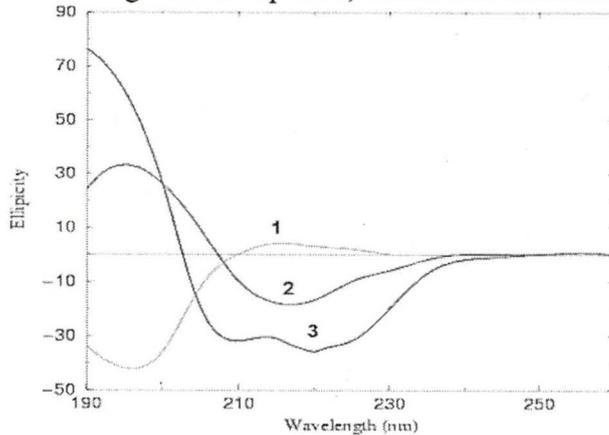
19. In a group of fifteen, seven can speak Hindi, eight can speak Telugu, and three cannot speak either. How many of these can speak both Hindi and Telugu.

- A) 0
- B) 3
- C) 4
- D) 6

20. If a person walks at 14 km/hr instead of 10 km/hr, he would have walked 20 km more. The actual distance travelled by him is:

- A) 50 KM
- B) 70 KM
- C) 20 KM
- D) 28 KM

21. In the given CD spectra, which line indicates the beta sheet?



- A) 1
 B) 2
 C) 3
 D) None of the above
22. Battery X lasts longer than Battery Y.
 Battery Y doesn't last as long as Battery Z.
 If these two statements are true, then which of the following statement is correct
- A) Battery Z lasts longer than Battery X.
 B) Battery Z doesn't last longer than Battery X.
 C) Battery Z lasts equally as Battery X.
 D) It is Uncertain which battery among X and Z last longer.
23. Here are some words translated from an artificial language.
myncabel means saddle horse
conowir means trail ride
cabelalma means horse blanket
- Which word could mean "horse ride"?
- A) almamyn
 B) conocabel
 C) cabelwir
 D) conoalma
24. If two organisms show the regions of conserved synteny, it means that the orthologous genes examined in the two species are
- A) Present in the same localization order on a chromosome
 B) Present on different chromosomes
 C) Dissimilar in sequences to each other
 D) Dissimilar in sequences to each other and present on different chromosome
25. Dot matrix can be efficiently utilized
- A) To visualize multiple sequence alignment
 B) To graphically visualize regions of similarity between two sequences
 C) To use the output of the Needleman and Wunsch algorithm
 D) To use the output of the Smith-Waterman algorithm

26. Which of the following sequencing technique is used to detect methylation levels in DNA?
- A) ATAC-sequencing
 - B) RNA-sequencing
 - C) Bisulfite sequencing
 - D) None of the above
27. In an experiment the \log_2 fold change for a gene is estimated as 1, when compared to treated versus control. If the expression level of this gene in the control sample is 150 then what is the expression level in the treated sample?
- A) 150
 - B) 100
 - C) 300
 - D) Cannot be determined
28. Cellular organelle(s) involved in the Ca^{2+} level in the cell
- A) Mitochondria
 - B) Endoplasmic Reticulum
 - C) Mitochondria and vesicles
 - D) Mitochondria and Endoplasmic Reticulum
29. The expression of transgene in the target tissue is identified by
- A) Transgene
 - B) Reporter
 - C) Promotor
 - D) Enhancer
30. SWISS-PROT is a database which deals with
- A) Genomes
 - B) RNA sequences
 - C) Phenotypic markers
 - D) Proteins
31. Reiske Iron-sulfur protein is located in one of the following complexes of mitochondrial electron transport chain
- A) Complex I
 - B) Complex II
 - C) Complex III
 - D) Complex IV
32. Data retrieval tool of NCBI
- A) BankIt
 - B) Entrez
 - C) Seqin
 - D) Webin

33. Which of the following amino acid has pI value more than 10.

- A) Tryptophan
- B) Cysteine
- C) Proline
- D) Arginine

34. The melting temperature of DNA in distilled water is

- A) Room temperature
- B) 60°C
- C) 70°C
- D) 80°C

35. Which of the following amino acids are non-essential.

- I. Alanine
- II. Histidine
- III. Aspartate
- IV. Glutamate
- V. Lysine
- VI. Tryptophan

- A) I, II, IV, VI
- B) I, III, IV
- C) III, V, VI
- D) II, III, IV, V

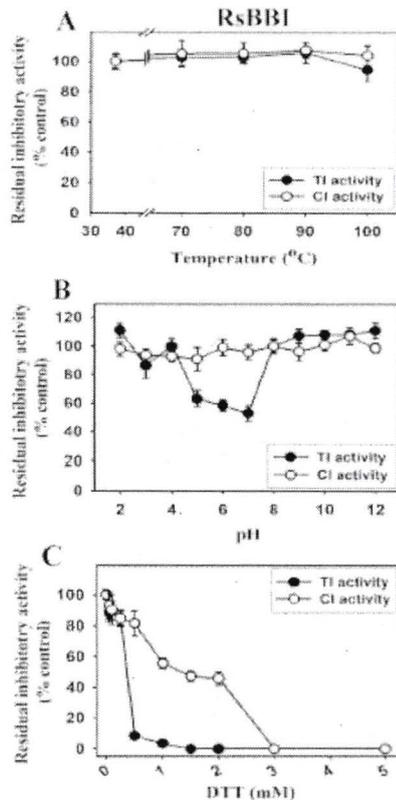
Part B

36. The virus that integrates into the host genome, but does not require for its replication,
- A) Hepatitis B
 - B) HIV-1
 - C) Influenza
 - D) TMV
37. Non-covalently linked DNA intermediates formed during homologous pairing are known as
- A) Joint molecules
 - B) Holliday junction
 - C) Quadruplex DNA
 - D) D-loop
38. In an enzymatic reaction, when the activity of the inhibitor, I, was monitored at different concentrations and $1/v$ and $1/[S]$ was plotted at different concentrations, the graph shows an increase in both slope and intercept on Y-axis with increasing concentrations, what would be the affinity of I to:
- A) Enzyme only
 - B) Enzyme and Substrate complex only
 - C) Both (a) and (b)
 - D) None of the above
39. Ligand-based drug design involves regression of biological activity with
- A) Structure
 - B) Solubility
 - C) Stability
 - D) Molecular descriptors
40. Energy minimization method for optimization a molecule using both search direction and decrease in energy is
- A) Conjugated descent
 - B) Steep descent
 - C) Newton-Ramphon method
 - D) Monte Carlo
41. Which of the following cellular event is **NOT** directly associated with mitochondria
- A) Apoptosis
 - B) ATP synthesis
 - C) Cell cycle regulation
 - D) Protein degradation
42. which of these compounds generate a feeling of well- being and inhibits sense of pain
- A) Melatonin
 - B) Cortisol
 - C) Adrenalin
 - D) Endorphin

43. The vaccines prepared through recombinant technology is
- First generation vaccine
 - Second generation vaccine
 - Third generation vaccine
 - Fourth generation vaccine
44. Which one of the following statements is true?
- Alleles cannot admix so hybrid alleles do not usually occur in a population
 - A particular gene can have only two alleles
 - Pseudogenes occur frequently in viral genomes
 - A single trait or phenotype can be affected by many different genes
45. Find out the correct order of the steps involved in the development of a bacterial phylogeny/ancestry
- Isolation in pure culture
 - Deduction of a distance matrix
 - Construction of a network or tree
 - DNA extraction
 - Analysis of DNA polymorphisms through fragment analysis or sequencing
 - Validation of tree topology and inference of phylogeny
- II, I, IV, VI, V, III
 - I, II, IV, VI, III, V
 - II, VI, I, III, V, IV
 - I, IV, V, II, III, VI
46. Consider the following statements
- Four carbon acids are required for fixation of CO₂ in bundle sheath cells
 - Light plays a role in activating the C4 cycle enzymes: NAD-MDH, PEPCase and PPDK
 - Light activation of NAD-MDH involves the ferredoxin-thioredoxin system
 - Light activation of PEPCase and PPDK is regulated by allosteric effectors and protein phosphorylation
- Which of the following are correct
- I, II, III, IV
 - I and II
 - I and IV
 - II and III
47. Fluorescence is emitted by one of the following compounds during ROS analysis in a living cell.
- H₂DCF-DA
 - DCF
 - H₂DCF
 - DCF-DA

48. Alternative Oxidase (AOX) participates in mitochondrial electron transport chain. Identify the correct statements with respect to AOX
- AOX is found in plants, algae, fungi and protozoan
 - AOX transfers electrons from Ubiquinol to O_2 bypassing cytochrome *c* oxidase
 - AOX transfers electrons from Ubiquinone to O_2
 - AOX is encoded by mitochondrial genome
- A) I and II
B) I and III
C) II and IV
D) III and IV
49. Identify the correct statements from the following
- Sucrose and Pi are inhibitors of sucrose-phosphate synthase
 - Fructose-6-phosphate and Pi are activators of Fructose-2,6-bisphosphatase
 - Fructose-6-phosphate and Pi are activators of Fructose-6-phosphate 2-kinase
 - Fructose-2,6-bisphosphate and Pi are inhibitors of Fructose-1,6-bisphosphatase
- A) I and II
B) I and III
C) II and IV
D) III and IV
50. Which among the following is **NOT** an approach for LOCAL ALIGNMENT?
- A) Smith Waterman
B) k-tuple
C) Word method
D) Needleman Wunsch
51. The metabolic database is
- A) KEGG
B) SWISS-PROT
C) PDB
D) OMIM
52. Which is the correct group of sentences for Neglected Tropical Diseases (NTDs)?
- NTDs mainly affect the poorest countries of the developing world.
 - Dengue fever, leishmaniasis and filariasis are the few examples of NTDs.
 - All NTDs are transmitted through vectors like mosquitoes, black flies etc.
 - NTDs are common in those areas where people do not have clean water and proper hygiene.
- A) I, II and III
B) II, III and IV
C) I, II and IV
D) I, III and IV

53. Bowman-Birk Inhibitor (BBI) is a protein molecule with defensive role and inhibit the activity of proteases such as trypsin and chymotrypsin. A novel BBI is purified from seeds of *Rhynchosia sublobata*, a wild species of cultivated pigeon pea and it is named as RsBBI. The RsBBI in its pure form is tested for its stability against temperature, pH and Dithiothreitol (DTT). The stability of RsBBI is expressed in terms of percent control of its residual trypsin inhibitory (TI) activity and chymotrypsin inhibitory (CI) activity as shown in the following figure.



The following conclusions are drawn from the figure shown above

- I. The CI activity of RsBBI is stable from 37 °C (control) to 100 °C while TI activity of RsBBI is stable from 37 °C (control) to 90 °C and lost less than 10% of its activity at 100 °C when compared with control.
- II. The CI activity of RsBBI is stable from 37 °C (control) to 100 °C while TI activity of RsBBI is stable from 37 °C (control) to 90 °C and lost 90% of its activity at 100 °C when compared with control.
- III. Exposure of RsBBI to 1.0 mM DTT resulted in more than 90% loss in its TI activity and approximately 50% loss in its CI activity when compared with their respective controls.
- IV. The TI activity of RsBBI is stable between pH 5.0 and pH 7.0 while CI activity of RsBBI is lost by approximately 50% between pH 5.0 and pH 7.0

Identify the correct statements

- A) I and III
- B) II and III
- C) III and IV
- D) I and IV

54. Identify the incorrect matching.
- | | |
|-----------------|--|
| A) Pox virus | Egression |
| B) Herpes virus | Two different diseases by a same virus |
| C) Adeno virus | Intracellular enveloped virions |
| D) Dengue virus | Antibody dependent enhancement |
55. Which of the following statements are **False**.
- T&B cells are produced in bone marrow
 - T&B cells are matured in thymus
 - T&B cells play key role in cell mediated immunity
 - T&B cells have the memory
56. Which of the following statement is **True**.
- Immunoglobulin A (IgA) has the sub classes
 - Immunoglobulin M (IgM) exists in monomeric form
 - Immunoglobulin D (IgD) crosses the placenta
 - Immunoglobulin G (IgG) acts as receptor on developing B cells
57. The correct order of formation of membrane attack complex (MAC) formation in the classical pathway of complement system is
- Binding of complement component C1 to antigen-antibody complex
 - Splitting of C3
 - Splitting of C4 and C2 components to form C4b2a
 - Formation of C5 convertase
 - Binding of complement component C1 to antigen-antibody complex
 - Splitting of C4 and C2 components to form C4b2a
 - Splitting of C3
 - Formation of C5 convertase
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 - Formation of C5 convertase
 - Binding of complement component C1 to antigen-antibody complex
 - Splitting of C4 and C2 components to form C4b2a
 - Formation of C5 convertase
 - Splitting of C3
58. Which of the following is part of Gene Ontology description?
- Molecular Function
 - Protein Interaction
 - ORF prediction
 - Structure determination

59. Which of the following are primary databases?

- i. GenBank
- ii. DDBJ
- iii. PFAM
- iv. PRODOM

- A) i and ii
- B) ii and iv
- C) i and iii
- D) ii and iii

60. Match the following

- I. Clustal Omega
- II. BLAST
- III. BLOSUM
- IV. GenBank

- 1. Comprehensive database of nucleotide sequences
- 2. A substitution matrix
- 3. Sequence search tool
- 4. Multiple sequence alignment tool

- | | I | II | III | IV |
|----|---|----|-----|----|
| A) | 1 | 2 | 3 | 4 |
| B) | 4 | 3 | 2 | 1 |
| C) | 2 | 4 | 1 | 3 |
| D) | 2 | 4 | 3 | 1 |

61. To visualize a protein molecule structure which of the following tool can be used?

- A) IMBOSS
- B) RASMOL
- C) FASTA
- D) BLAST

62. Which of the following method is **NOT** associated to the prediction of Protein-Protein Interactions?

- A) Gene Neighborhood
- B) Phylogenetic profiles
- C) Newick method
- D) Domain fusion

63. GOR method is known to predict

- A) Sequence of a protein
- B) Gene from a DNA sequence
- C) Secondary structure of a protein
- D) Tertiary structure of a protein

64. Which of the following is **NOT** a forcefield.

- A) GROMACS
- B) GROMOS
- C) OPLS-AA
- D) AMBER

65. Arrange the following steps involved to perform homology modelling in the correct order.

- 1) Selection of Template
- 2) Model Evaluation
- 3) Backbone Model Building
- 4) Model Refinement
- 5) Alignment of template and target sequence

- A) 5, 1, 2, 4, 3
- B) 4, 3, 2, 5, 1
- C) 1, 2, 3, 4, 5
- D) 1, 5, 3, 4, 2

66. Protein engineering is the process of developing useful or valuable proteins. Find the correct order for the basic process of protein engineering?

- I. Design of protein structure
- II. DNA synthesis
- III. Prediction of protein function
- IV. Nucleotide sequence derived from amino acid sequence

- A) I, II, III, IV
- B) II, IV, I, III
- C) IV, III, II, I
- D) III, I, IV, II

67. Identify the correct pairs of chromosomal disorders.

- | | |
|-------------------------|----------------------------------|
| A) Down syndrome | 1. FMR1 gene on the X chromosome |
| B) Klinefelter syndrome | 2. Trisomy 21 |
| C) Fragile X syndrome | 3. Missing X chromosome |
| D) Turner syndrome | 4. Extra X chromosome |

Which of the pairs are correctly matched?

- | | I | II | III | IV |
|----|---|----|-----|----|
| A) | 3 | 1 | 4 | 2 |
| B) | 2 | 4 | 1 | 3 |
| C) | 1 | 4 | 3 | 2 |
| D) | 1 | 2 | 4 | 3 |

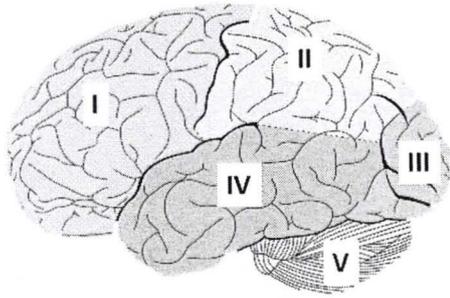
68. The expression of the gene can't be determined by

- A) Southern blot hybridization
- B) Reporter gene analysis
- C) Western blot analysis
- D) Immunofluorescence assay

69. Bacterial genomes are protected from its own endonucleases by

- A) Immune mechanism
- B) Methylation at restriction sites
- C) Nuclease resistant genome
- D) CRISPR- Cas mechanism

70. Match the correct labels for brain parts?



1. Parietal lobe
2. Cerebellum
3. Frontal lobe
4. Occipital lobe
5. Temporal lobe

Which of the pairs are correctly matched?

	I	II	III	IV	V
A)	3	1	4	5	2
B)	2	3	1	4	5
C)	1	5	4	3	2
D)	5	2	4	1	3

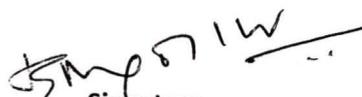
University of Hyderabad
Ph.D. Entrance Examinations - 2022

School/Department/Centre
Course : Ph.D.

: Department of Biotechnology and Bioinformatics
Subject : Biotechnology

Q. No.	Answer	Q.No.	Answer
1.	A	36.	A
2.	C	37.	A
3.	D	38.	C
4.	B	39.	D
5.	C	40.	A
6.	D	41.	D
7.	A	42.	D
8.	C	43.	C
9.	D	44.	D
10.	A	45.	D
11.	B	46.	C
12.	D	47.	B
13.	C	48.	A
14.	C	49.	B
15.	B	50.	D
16.	B	51.	A
17.	C	52.	C
18.	D	53.	A
19.	B	54.	C
20.	A	55.	B
21.	B	56.	A
22.	D	57.	B
23.	C	58.	A
24.	A	59.	A
25.	B	60.	B
26.	C	61.	B
27.	C	62.	C
28.	D	63.	C
29.	B	64.	A
30.	D	65.	D
31.	C	66.	D
32.	B	67.	B
33.	D	68.	A
34.	A	69.	B
35.	B	70.	A

Note/Remarks :


Signature

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