

C-11

ENTRANCE EXAMINATIONS – 2023
(Ph.D. Admissions - January 2024 Session)
Ph.D. Biochemistry

Hall Ticket No.

Time : 2 hours

Max. Marks : 70

Instructions

Please read the following instructions carefully before answering:

1. Enter Hall Ticket number in the space provided above and also on OMR sheet
 2. Paper contains two sections: Part A and Part B, with 60 questions for 70 marks.
Part A contains 25 questions. Questions 1 to 15 carry one mark each. Questions 16 to 25 carry 2 marks each. Part B contains 35 questions, each question carries one mark. There is no negative marking in any section.
 3. Answers must be marked on the OMR sheet per the instructions provided.
 4. **Please return the OMR answer sheet at the end of the examination**
 5. Apart from the OMR sheet, the question paper contains 12 (twelve) pages including the instructions.
 6. No additional sheet will be provided. Rough work can be carried out in the question paper in the space provided at the end of the booklet.
 7. Non programmable calculators are allowed.
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Part A

1. Triploids are not fertile because:
 - A) Gametes are diploid for all chromosomes are formed that cannot fertilize
 - B) Gametes are haploid for all chromosomes are formed that cannot fertilize
 - C) Gametes are diploid for some chromosomes and haploid for others that cannot fertilize.
 - D) No gametes are formed due to non-disjunction.
2. Annealing temperature in a PCR needs to be:
 - A) Slightly lower than the melting temperature of the primers.
 - B) Slightly higher than the melting temperature of the primers.
 - C) Exactly at the melting temperature
 - D) The temperature at which the DNA polymerase has the best activity for polymerization.
3. The slowest migrating band on the gel for plasmid preparation represents:
 - A) Supercoiled form of the plasmid
 - B) Linear form of the plasmid
 - C) Nicked form of the plasmid
 - D) Single-stranded plasmid DNA

4. PAM (Protospacer adjacent Motif) concerning CRISPR is present on the
- A) crRNA
 - B) tracrRNA
 - C) Target genome
 - D) sgRNA
5. In RT-PCR, what is the relation between Ct values obtained and amount of RNA present in the sample?
- A) Directly proportional
 - B) Ct value equals the concentration of RNA
 - C) Inversely proportional
 - D) Ct value does not indicate about RNA abundance.
6. A bag contains 3 white, 3 black, and 2 red balls. One by one three balls are drawn without replacing them, then find the probability that the third ball is red.
- A) $1/4$
 - B) $3/4$
 - C) $1/9$
 - D) $8/9$
7. From 6 different novels and 3 different dictionaries, 4 novels and 1 dictionary are to be selected and arranged on a row on the shelf so that the dictionary is always in the middle. Then the number of such arrangements is
- A) Less than 500
 - B) At least 500 but less than 750
 - C) At least 750 but less than 1000
 - D) At least 1000
8. You plan to clone your favorite gene (YFG) in a bacterial expression vector pE at the *Bam* HI site. The size of YFG and pE are 0.5 kb and 3 kb respectively. Your advisor suggested you to keep 1:3 vector: insert ratio in the ligation mixture. Which of the following will give you the desired stoichiometry?
- A) Vector 100 ng and insert 50 ng
 - B) Vector 100 ng and insert 100 ng
 - C) Vector 100 ng and insert 150 ng.
 - D) Vector 100 ng and insert 300 ng
9. A sequence of amino acids in a certain protein is found to be -Ser-Gly-Pro-Gly-. The sequence is most probably part of a
- A) Sheet
 - B) Turn
 - C) Helix
 - D) Loops

10. What is the fraction of deprotonated histidine at pH =7, the pKa of histidine is 7.4
- A) 0.28
 - B) 0.21
 - C) 0.50
 - D) 0.38
11. The outer membrane of mitochondria is permeable to ions and solutes with molecular weight less than 10 kDa is due to the presence of
- A) TOM complex
 - B) Porins
 - C) Pores
 - D) Carriers
12. In urea cycle the enzymes are compartmentalized in mitochondria and cytosol because
- A) No specific reason
 - B) To prevent reductive amination of alpha-ketoglutarate in mitochondria
 - C) Metabolites cannot pass through the mitochondrial membrane
 - D) Urea is formed in the mitochondria only
13. One reason why vaccines fail to work in very young infants is the presence of
- A) Maternal antibodies
 - B) Glucoproteins
 - C) Endotoxins
 - D) Adjuvant
14. Which one of the following hydrogen bonds (shown as dotted bonds) best represents the type of hydrogen bond that keep the α -helix and the β -sheet in a protein from falling apart?
- A) $\text{O}-\text{H}\cdots\cdots\text{O}=\text{C}$
 - B) $\text{O}-\text{H}\cdots\cdots\text{NH}=\text{C}$
 - C) $\text{N}-\text{H}\cdots\cdots\text{NH}=\text{C}$
 - D) $\text{N}-\text{H}\cdots\cdots\text{O}=\text{C}$
15. In a class of 100 students there are 70 girls whose average marks in a subject are 75. If the average marks of the complete class is 72, then what is the average mark of the boys?
- A) 73
 - B) 65
 - C) 68
 - D) 74

16. Match the columns correctly

- | | |
|--------------------------------------|---------------------------|
| <u>Set I</u> | <u>Set II</u> |
| a. Glucose 6-phosphate Dehydrogenase | i) Phenylketoneuria |
| b. Phenylalanine Hydroxylase | ii) Irreversible reaction |
| c. Pyruvate Kinase | iii) HMP shunt pathway |
| d. Hemolytic anemia | iv) NADPH |

Correct answer is

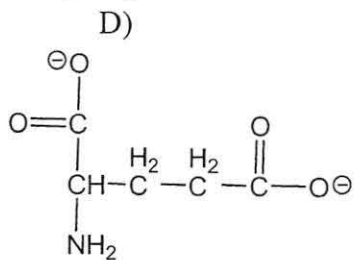
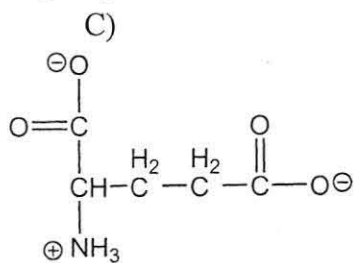
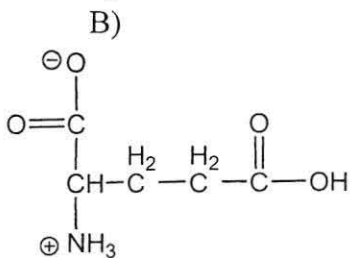
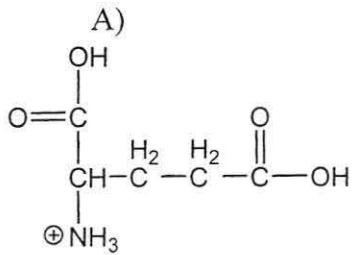
- A) i-b, ii-c,iii-d; iv-a
 B) i-a, ii-d, iii-c, iv-b
 C) i-b, ii-d, iii-c, iv-a
 D) i-a, ii-c, iii-d, iv-b
17. A protein was purified from anaerobic bacteria and analyzed by polyacrylamide gel electrophoresis containing SDS. Following protein staining, a single band was observed. The same protein was analyzed on a second electrophoresis under native conditions (i.e. non-denaturing, or without SDS). This gel shows two bands after staining. Assuming no errors was committed during these experiments. What is best possible explanation about the protein?
- A) Two proteins with identical molecular mass having same pI
 B) Two proteins of identical molecular mass having different pI
 C) Two identical polypeptides attached with disulfide bond
 D) Two different polypeptides attached with disulfide bond
18. A cross is made between an Hfr that is $met^+ thr^+ str^r$ and an F⁻ that is $met^- thr^- str^s$. Interrupted-mating studies show that met^+ enters the recipient last, so met^+ recombinants are selected on a medium containing threonine and streptomycin. These recombinants are tested for the presence of the thr^+ and str^r alleles. Based on the recombinants obtained as shown below, what would be the order of genes in this strain and the distance between the markers?

$met^+ thr^+ str^r$	280
$met^+ thr^+ str^s$	1
$met^+ thr^- str^r$	7
$met^+ thr^- str^s$	60

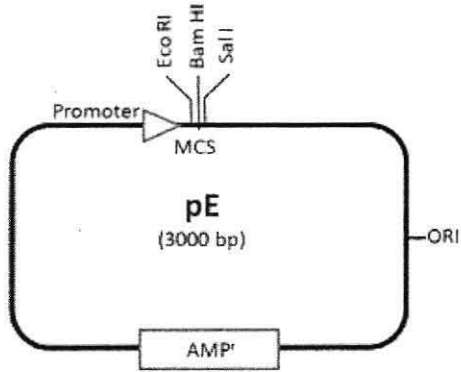
- A) Order is $met str thr$; and distances are respectively 17.2 mu and 2 mu
 B) Order is $met str thr$; and distances are respectively 21 mu and 2.5 mu
 C) Order is $met thr str$; and distances are respectively 17.2 mu and 2 mu
 D) Order is $met thr str$; and distances are respectively 21 mu and 2.5 mu
19. Which group of peptides are produced after cleavage of the following peptide with trypsin?
 Met-Ala-Tyr-Met-Phe-Arg-Gly-Asp-Lys-Glu-Trp
- A) Met-Ala-Tyr-Met-Phe-Arg; Gly-Asp-Lys; Glu-Trp
 B) Met-Ala-Tyr; Met-Phe; Arg-Gly-Asp-Lys-Glu-Trp

- C) Met-Ala-Tyr-Met-Phe-Arg-Gly-Asp; Lys-Glu-Trp
 D) Met; Ala-Tyr-Met; Phe-Arg-Gly-Asp-Lys-Glu-Trp

20. Which one of the following ionic species of glutamate would be prevalent at pH 9.0?



21. Since you have performed non-direction cloning of your favorite gene (YFG), which is 0.5 kb at the *Bam* HI site of the expression vector pE (3 kb) you wanted to check for the orientation of the insert. To that end you wanted to use restriction enzymes whose sites are present once in the insert and once in the vector at the multiple cloning sequences (MCS) as shown in the figure. The *Eco* RI site is present at 100 bp downstream of the start codon, while the *Sal* I site is present 250 bp downstream of the start codon of the gene.



Which of the following statements is correct?

- A) If the insert is in the correct orientation digestion with *Eco* RI will give three fragments: 100 bp; 400 bp and 3000 bp
- B) If the insert is in the correct orientation digestion with *Eco* RI will give two fragments: 400 bp and 3100 bp
- C) If the insert is in the wrong orientation digestion with *Eco* RI will give two fragments: 400 bp and 3100 bp
- D) If the insert is in the wrong orientation digestion with *Sal* I will give two fragments: 250 bp and 3000 bp

22. The binding affinity (K_a) of a protein for its ligand at pH 7.0 and room temperature is $2 \times 10^5 \text{ M}^{-1}$. At what ligand concentration will be 80% of the protein-bound?

- A) 20 μM
- B) 40 μM
- C) 4 μM
- D) 2 μM

23. Kinetic parameters of a lipase were found to be: k_{cat} of 25.0 s^{-1} and K_m of 0.0048 M . At what substrate concentration it would show one-fifth of its maximum rate?

- A) $9.6 \times 10^{-4} \text{ M}$
- B) $1.2 \times 10^{-3} \text{ M}$
- C) $2.4 \times 10^{-2} \text{ M}$
- D) $1.2 \times 10^{-1} \text{ M}$

24. During lagging strand synthesis, to join together two precursor fragments, several enzymatic activities happen sequentially. From the following, pick the relevant activities and arrange them in the correct order. Note that the two Okazaki fragments are already synthesized.

- i) 5'-3' polymerase activity of DNA Pol III.
- ii) 5'-3' helicase activity of DnaB.
- iii) 5'-3' polymerase activity of DNA Pol I
- iv) 3'-5' exonuclease activity of DNA Pol III.
- v) Ligase activity.

vi) 5'-3' exonuclease activity of DNA pol I.

- A) ii; i; iii, vi; v
- B) vi; iii; v
- C) ii; iii; iv; v
- D) ii; I; iv; v

25. The frequency of two alleles in a gene pool of a population that is in Hardy-Weinberg equilibrium is 0.19 (A) and 0.81(a). The percentage heterozygous and homozygous recessive individuals in this population is

- A) 66 and 31 respectively
- B) 31 and 66 respectively
- C) 38 and 62 respectively
- D) 62 and 38 respectively

Part B

26. The P:O ratio is a measure of how many moles of ATP are formed from ADP per gram

- A) Atom of oxygen for a given substrate
- B) Mole of oxygen for a given substrate
- C) Mole of a given substrate
- D) Mole of oxygen per unit time for a given substrate

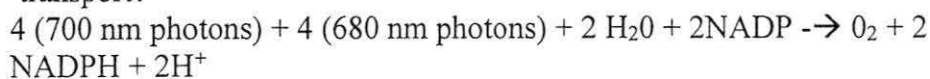
27. Which of the following is not an electron carrier of the electron transport chain?

- A) NAD
- B) Coenzyme Q
- C) NADP
- D) FAD

28. The addition of valinomycin to the active respiring mitochondria in the presence of potassium dissipates

- A) Proton gradient
- B) Electric potential
- C) Chemical and Electric potential
- D) Electric potential followed by Proton gradient

29. The overall free energy change for photosynthetic NADP⁺ reduction. What is the overall free energy change (delta G) for noncyclic photosynthetic electron transport?



- A) - 1388 kJ/mole
- B) - 950 kJ/mole

- C) - 438 kJ/mole
D) -694 kJ/mole
30. Inappropriate Antidiuretic hormone (ADH) secretion can be associated with which of the following events?
- i) Diabetes mellitus
 - ii) Diabetes insipidus
 - iii) Hyponatremia
 - iv) Water intoxication
- A) i, ii, iii, iv
B) ii, iii
C) ii, iii, iv
D) i, iii
31. Non-enzymatic reaction between the carbonyl group of glucose with amino group of the Lysine-R chain is known as?
- A) Aldol condensation
 - B) Schiff's base
 - C) Maillard reaction
 - D) Glycosylation
32. Which of the following derivative of the bile contributes to the color of the feces?
- A) Stecobilirubin
 - B) Stercobilinogen
 - C) Stecobilin
 - D) Stercobilin
33. Hormone that antagonizes the insulin action and is also considered diabetogenic.
- A) Glucagon
 - B) Progesterone
 - C) Corticotropin
 - D) Growth hormone
34. During nerve conduction action potential and Na/K-ATPase pump work in coordination. Identify the correct statement about both events.
- A) Both events pump Na⁺ in and K⁺ out of the cell.
 - B) During an action potential Na⁺ ions move in and K⁺ ions move out and the Na/K pump exports Na⁺ ions out and K⁺ in.
 - C) During action potential Na⁺ ions move out and K⁺ ions move in and the Na/K pump imports Na⁺ out and export K⁺.
 - D) Both events pump Na⁺ ions out and K⁺ ions into the cell.

35. Gestational diabetes could be due to
- A) High hCG secretion
 - B) High glucagon secretion
 - C) High placental lactogen (hPL) secretion
 - D) Low insulin secretion
36. Palmitoleic acid as an
- A) Saturated Fatty acid
 - B) Monounsaturated Fatty acid
 - C) Polyunsaturated Fatty acid
 - D) None of the above
37. Cholesterol is a
- A) Plant sterol
 - B) Animal sterol
 - C) Microbial sterol
 - D) All of the above
38. A futile cycle or substrate cycle
- A) may have a role in regulating metabolic processes
 - B) dissipates energy in the form of heat
 - C) maintains energy homeostasis
 - D) All of the above
39. Complete hydrolysis of a glycerophospholipid yields glycerol, palmitic acid, oleic acid, and phosphoric acid in the molar ratio 1:1:1:1. The lipid that was hydrolyzed was
- A) Phosphatidic acid
 - B) Phosphatidylglycerol
 - C) Phosphatidylcholine
 - D) Phosphatidylinositol 4,5-bisphosphate
40. The direct products of β oxidation of a fully saturated, straight-chain fatty acid of 17 carbons are
- A) 7 Acetyl-CoA and 1 propionyl-CoA
 - B) 6 Acetyl-CoA and 2 propionyl-CoA
 - C) 6 Acetyl-CoA and 1 propionyl-CoA
 - D) 7 Acetyl-CoA and 2 propionyl-CoA

41. When a protein is denatured by heating the absorption as measured in UV light will
- A) Always increase
 - B) Always decrease
 - C) Increase or decrease depends upon wavelength
 - D) Remain unaffected
42. Major interaction for protein structure stabilization is
- A) Hydrophobic interaction
 - B) Ionic interaction
 - C) Hydrogen bond interaction
 - D) Van der-Waal interaction
43. If you were given to purify a protein "A" from a tissue by employing different techniques, how will you check the purity of protein "A"?
- A) By Assay of protein
 - B) By SDS-PAGE
 - C) By Affinity chromatography
 - D) By spectrophotometer
44. Polyuria can occur in
- A) Diabetes mellitus
 - B) Diarrhoea
 - C) Acute glomerulonephritis
 - D) High fever
45. Serum cholesterol is decreased in
- A) Endemic goitre
 - B) Thyrotoxicosis
 - C) Myxoedema
 - D) Cretinism
46. Phenomena that some cells evoke a specific developmental response in other cells is.
- A) Embryonic influence
 - B) Embryonic induction
 - C) Embryonic stimulation
 - D) Embryonic dominance

47. Blastoderm splits occur in
- A) blastulation
 - B) pompulation
 - C) neurulation
 - D) gastrulation
48. BLASTn is a:
- A) Multiple sequence alignment tool
 - B) Multiple genomes database
 - C) Pairwise sequence alignment tool
 - D) Protein sequence database
49. KEGG is primarily a:
- A) Gene expression database
 - B) Pathways database
 - C) Sequence database
 - D) Structure database
50. What is the expected ratio of genotype in an F₂ progeny of a monohybrid cross when one of the alleles is dominant?
- A) 1: 3 B) 1:2:1 C) 4:0 D) 1:1:1:1
51. Which one of the following statements is INCORRECT?
- A) Alleles are alternate forms of the same gene
 - B) During meiosis, gametes inherit one allele of a gene
 - C) In a population, when individuals with same combination of alleles show different degrees of phenotype, it is a case of incomplete penetrance
 - D) In a population, there can be multiple alleles for the same gene
52. Ribosome assembly takes place
- A) In the nucleus
 - B) In the cytosol
 - C) in the endoplasmic reticulum lumen
 - D) on nuclear membrane
53. Glycosylation of proteins happens in the
- A) Endoplasmic reticulum only
 - B) Endoplasmic reticulum and Golgi
 - C) Endoplasmic reticulum and lysosomes
 - D) Golgi and plasma membrane

54. Which of the following statements is correct?
- A) Phosphofructokinase 2 is a tandem enzyme
 - B) Citrate synthase is a tandem enzyme
 - C) Phosphofructokinase 1 is a tandem enzyme
 - D) Hexokinase is a tandem enzyme
55. Which of the following two enzymes are glyoxylate cycle-specific enzymes?
- A) Glyoxylic acid synthase and Malate dehydrogenase
 - B) Isocitrate lyase and Malate synthase
 - C) Protein kinase and protein phosphatase
 - D) Aldolase and Pyruvate Kinase
56. The core oligosaccharide added to asparagine residues in N-glycan synthesis contains
- A) 2 N-Acetylglucosamine, 8 Mannose and 3 Glucose
 - B) 1 N-Acetylglucosamine, 9 Mannose and 3 Glucose
 - C) 2 N-Acetylglucosamine, 9 Mannose and 3 Glucose
 - D) 2 N-Acetylglucosamine, 7 Mannose and 3 Glucose
57. In the Urea cycle which of the following is correct for the formation of one urea molecule
- A) 2ATP B) 3 ATP C) 1 ATP D) No ATP
58. Glutamine synthetase is regulated reversibly by
- A) Adenylation and Deadenylation
 - B) Phosphorylation and Dephosphorylation
 - C) By Allosteric regulation
 - D) None of the above
59. Which of the following is a glycosylated form of hemoglobin used for assessing long-term blood glucose control?
- A) Hemoglobin F
 - B) Hemoglobin A1c
 - C) Hemoglobin S
 - D) Hemoglobin C
60. Which cardiac marker is considered specific for myocardial infarction?
- A) Creatine kinase (CK)
 - B) Myoglobin
 - C) Troponin
 - D) Lactate dehydrogenase (LDH)

University of Hyderabad
Entrance Examinations - 2023
Ph.D. Admissions – January 2024 session

School/Department/Centre : LIFE SCIENCES/BIOCHEMISTRY
Course : Ph.D. Subject : BIOCHEMISTRY

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

Note/Remarks : NONE

Signature *S.V. Naresh Babu V. Sepuri*

School/Department/Centre : *जीवविज्ञान संकाय / School of Life Sciences*

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