

ENTRANCE EXAMINATIONS – 2023

Ph.D. Biochemistry

C-11

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 together 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 have to be marked on the OMR sheet as per the instructions provided.
 4. **Please return the OMR answer sheet at the end of examination**
 5. Apart from OMR sheet, the question paper contains 11 (eleven) pages including the instructions.
 6. No additional sheet will be provided. Rough work can be carried out in the question paper itself in the space provided at the end of the booklet.
 7. Non programmable calculators are allowed.
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Part A

1. Which of the following mechanisms prevail in the evolution of prokaryotes?
 - A) Gene duplication
 - B) Transposons
 - C) Horizontal gene transfer
 - D) Mutations

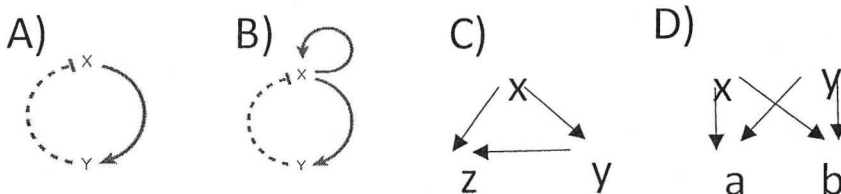
2. Gestational diabetes could be due to
 - A) High hCG secretion
 - B) High glucagon secretion
 - C) High placental lactogen (hPL) secretion
 - D) Low insulin secretion

3. In the probe preparation using random primers oligonucleotides of six base pairs are used. Calculate the number of possible random combinations if only A, G and C nucleotide are included.
 - A) 729
 - B) 216
 - C) 4096
 - D) 324

4. The pH of a solution of 0.01 N for NaOH at 25°C is
 - A) 9
 - B) 2
 - C) 12
 - D) 14

5. All statements given below exemplify phenotypic plasticity EXCEPT
- A) Adaptive mechanism displayed by cancer cells in response to hypoxic stress.
 - B) Some of the changes in an organism's behavior, morphology and physiology in response to a unique environment.
 - C) Genotype of organism remain same but phenotype is altered.
 - D) Altered gene expression due to mutations in an organism.

6. Which of the following is the most suitable representation of feed-forward regulation of hormone action?



7. Which of the following peptides will display the slowest migration through a column filled with a strong cation exchange resin?

- A) Lysinyl-arginyl-glycine
- B) Alanyl-glutamic acid
- C) Aspartyl-aspartyl-glutamic acid
- D) Alanyl-glycinyl-lysine

8. Which of the electron transport chain complex is involved in the moving of electrons from a lipid soluble electron carrier to a water soluble mobile electron carrier?

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

9. Which is the most negative standard redox potential component found in Nature?

- A) Cytochrome bf
- B) Photosystem I
- C) Photosystem II
- D) Plastoquinone

10. The population of rabbits in a forest is 1,25,000. If the annual birth rate is 3.3% and the annual death rate is 1.3%, calculate the population after 3 years

- A) 1,32,651
- B) 1,63,615
- C) 1,44,601
- D) 1,52,888

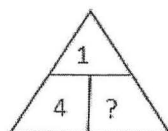
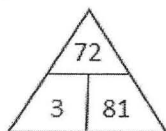
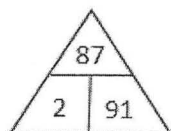
11. If south-east becomes north, north-east becomes west, and so on. What will west become

- A) North-East
- B) North-West
- C) South-West
- D) South-East

12. A buffer tank can be filled by two taps A and B in 12 minutes and 16 minutes respectively. The full tank can be emptied by a third tap in 8 minutes. If all the taps be turned on at the same time, in how much time will the empty buffer tank be filled up completely?

A) 48 minutes B) 36 minutes C) 20 minutes D) 24 minutes

13. The missing number



A) 16 B) 17 C) 61 D) 71

14. Which of the following can be the correct correspondence between PAM and BLOSUM matrices:

A) PAM250 AND BLOSUM45
 B) PAM1 and BLOSUM62
 C) PAM120 and BLOSUM80
 D) PAM1 and BLOSUM80

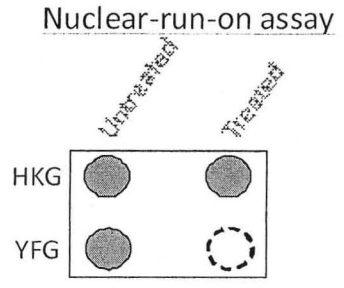
15. Complete hydrolysis of a glycerophospholipid yields glycerol, palmitic acid, oleic acid and phosphoric acid in the molar ratio 2:1:1:1. The lipid that was hydrolysed was

A) Phosphatidic acid
 B) Phosphatidylglycerol
 C) Phosphatidylcholine
 D) Phosphatidylinositol 4,5-bisphosphate

16. The following synthetic templates in 1 and 2 are translated in a cell free translational systems. How many polypeptides are synthesized from these two templates? 1. 5' ACACACACACACAC 3' ; 2. 5' AACUAACUAACU AACUAACUAACU 3'

A) One polypeptide from template 1 and one from template 2
 B) One dipeptide from template 1 and one tripeptides from template 2
 C) Two polypeptides from template 1 and two short peptides from template2
 D) Three polypeptides from template 1 and three polypeptides from template 2

17. You want to investigate the expression of your favourite gene (YFG), when you treat cells with a chemical C. You have also studied the expression of a house keeping gene (HKG) under the same condition as a normalizing control. You have performed two types of experiment to study the transcripts: quantitative-RT-PCR and nuclear-run-on assay. The results of these experiments are given below:



Quantitative RT-PCR data		
Gene name	Untreated control (C_T value)	Treated with chemical C (C_T value)
YFG	26	26
HKG	24	25

- Select the option that gives the most appropriate inference of the result.
- A) The transcription of YFG is up-regulated two folds in response to the treatment.
 - B) The transcription of YFG is down-regulated two folds in response to the treatment.
 - C) The transcription of YFG remained unchanged, but the transcription of HKG is up-regulated two-folds.
 - D) YFG is not transcribed under the treated condition, and the stability of YFG transcripts are increased under the treated condition.
18. Statistically, how many times a random 5 base pair DNA sequence would appear in a bacterial genome having a total of 1.024×10^6 base pairs. Assume random distribution of the DNA bases across the genome.
- A) Once B) 10 times C) 100 times D) 1000 times
19. The k_{cat} and K_M of a wild type enzyme towards a reaction are found to be 0.37 s^{-1} and 3.4 mM . A mutant of this enzyme towards the same reaction has shown k_{cat} and K_M of 1.1 s^{-1} and 0.7 mM respectively. Calculate the approximate fold increase in the catalytic efficiency by the mutant than the wild type enzyme.
- A) 14 B) 3 C) 0.2 D) 0.02
20. You infected C1 mouse was with LCM-virus. You then isolated cytotoxic T cells (Tc-cells) from the spleen of the infected mouse. From the cells given below, select the option that has all the cell types that will be lysed by these Tc-cells.
- A) un-infected and LCM-infected fibroblast cells from C1 mouse
 - B) un-infected endothelial cells from C1 and LCM-infected fibroblast cells from H-2K mouse

- C) LCM-infected endothelial cells from H-2k and C1 mouse
 D) LCM-infected endothelial and fibroblast cells from C1 mouse

21. Given below are statements on sarcomere contraction.

- I. Sarcomere shortens during contraction as myosin filaments come together.
 II. Sarcomere shortens during contraction as actin filaments come together.
 III. 'A' band remain unchanged while only 'I' band get shorten.
 IV. 'A' band remain constant while both 'H' zone and 'I' band shorten

Identify the option that has all correct statements.

- A) I and III are correct
 B) II and III are correct
 C) I and IV are correct
 D) II and IV are correct
22. Which of the following statements are true about bilirubin?
 I) Bilirubin is a waste product that originates from the breakdown of hemoglobin
 II) Bilirubin is conjugated with glucuronic acid to form bilirubin glucuronide which is insoluble in water.
 III) Unconjugated bilirubin is also known as indirect bilirubin
 IV) Bilirubin is majorly excreted through stool and only some fraction of bilirubin is excreted through urine.
- A) Only I and II
 B) Only II and III
 C) Only I, III and IV
 D) Only III and IV
23. Proteins are targeted to specific organelles due to the presence of sorting signals and follow different mechanisms to enter the organelles. Researchers isolated proteins from different organelles and added them to in vitro transport assay systems that are fully competent to carry out import. Which one of the following options has the correct combinations of organelles that would be competent to import these isolated proteins?
- A) Endoplasmic reticulum, lysosomes and Golgi
 B) Lysosomes only
 C) Peroxisomes and nucleus
 D) Endoplasmic reticulum only
24. When a male and female with genotype $AaBbCcDd$ are crossed, what proportion of the progeny are likely to be $AaBbccDd$?
- A) 1/16 B) 1/32 C) 1/128 D) 1/256
25. Given below are a few components that can affect the mitochondrial electron transport chain function

I. Valinomycin II. Nigericin III. Rotenone IV. Oligomycin

Choose the option that has the correct combination of components that will completely destroy the electrochemical potential across inner membrane of mitochondria.

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

Part B

26. If there is a mutation in the p_L promoter in the λ -genome, which of the following proteins will still be synthesized in a bacterial cell infected with λ phage?
- A) Only Cro B) Cro and CII
C) Cro, CI and CII D) Cro, CII and Q
27. The following four statements were made about SOS response in *E. coli*.
Statement I: It is mutagenic.
Statement II: It is inducible.
Statement III: The strand-invasion activity of RecA protein is crucial for SOS response.
Statement IV: The proteolytic activity of RecA protein is crucial for SOS response.
- Which one of the following options has all the correct statements?
- A) Only statement I and II are correct.
B) Only statement I, II, and III are correct.
C) Only statement I, II, and IV are correct.
D) Statements I, II, III, and IV are correct.
28. Which of the eukaryotic initiation factors in eIF4F complex bound with 5' mRNA interacts with 43S complex (Comprising MFC, eIF1A, eIF2.GTP.Met-tRNA_i) on one side and to PolyA binding protein (PABP) bound to 3' mRNA?
- A) eIF4E B) eIF4G C) eIF4A D) eIF4B
29. Signal Recognition Particle
- A) Promotes synthesis of proteins made in the cytosol by increasing initiation rates
B) Promotes synthesis of Proteins made on the surface of Endoplasmic reticulum by increasing elongation rates of secretory proteins
C) Inhibits synthesis of proteins made in the cytosol by inhibiting the initiation
D) Inhibits synthesis of proteins made on the surface of Endoplasmic reticulum by blocking elongation step

30. How many GTPs are hydrolyzed during the initiation of eukaryotic protein synthesis?
- A) 1 B) 2 C) 3 D) 4
31. In a di- or trihybrid cross the most frequently observed offspring are from gametes that underwent:
- A) Single crossing over
B) Double crossing over
C) No crossing over
D) Multiple Crossing overs
32. Alkaline lysis method of plasmid isolation is based on
- A) Easier renaturation of small sized plasmids compared to irreversible denaturation of large sized genomic DNA
B) Easier renaturation of large sized genomic DNA compared to irreversible denaturation of small sized plasmid DNA
C) Difference in the pH of plasmids and genomic DNA
D) Difference in the sequence of plasmid and genomic DNA
33. The Bradford reagent used for protein estimation primarily binds to
- A) Cysteine and cystine amino acids in the protein.
B) Glycine, Alanine and Valine residues of the proteins
C) Phenylalanine, Tyrosine and Tryptophan residues of the proteins
D) Lysine, Arginine and Histidine residues of the proteins.
34. Select the option that represents the correct matches between Group I and Group II given below.
- | Group I | Group II |
|------------|--------------------|
| P. RNase P | 1. Polyadenylation |
| Q. RNase H | 2. Splicing |
| R. snRNAs | 3. Ribozymes |
| S. CstF | 4. DNA-RNA hybrids |
- A) P-3, Q-4, R-2, S-1
B) P-4, Q-3, R-2, S-1
C) P-3, Q-2, R-1, S-4
D) P-2, Q-4, R-1, S-3
35. Which one of the following DNA sequences carries an invert repeat?
- A) 5'ATGAGCCCCGAGTA3'
3'TACTCGGGGCTCAT 5'
- B) 5'ATGAGCCGGCTCTA3'
3'TACTCGGCCGAGAT5'
- C) 5'ATGAGCCGAGCCTA3'
- D) 5'ATGAGCCTATGGTA3'

3'TACTCGGCTCGGAT5'

3'TACTCGGATACCAT 5'

36. Which one of the following enzyme mechanisms does not involve covalent catalysis?
A) Chymotrypsin
B) Lysozyme
C) Trypsin
D) HIV protease
37. Which kind of enzyme inhibition can have K_M unaltered?
A) Competitive
B) Uncompetitive
C) Non-competitive
D) Mixed
38. Which of the following statements about skin grafts between different strains of mouse is correct?
A) A skin graft from strain A mouse to strain B if gets rejected in 15 days, a second graft on the same mouse from strain C will show hyperacute rejection within 2 days.
B) A skin graft from strain A mouse to strain B if gets rejected in 15 days, a second graft on the same mouse from strain A will show hyperacute rejection within 2 days.
C) A skin graft from strain A mouse to strain B if gets rejected in 15 days, a second graft on the same mouse from strain A will get accepted.
D) A skin graft from strain A mouse to strain B if gets rejected in 15 days, a second graft on the same mouse from strain A will show highly delayed rejection, if any.
39. Select the statement that is INCORRECT for complementarity determining regions (CDRs) of antibodies.
A) CDRs determine antibodies specificity
B) CDRs, in part, denote junctional diversity of V(D)J segments
C) Immunoglobulin class switching can change CDRs of an antibody
D) CDRs, in part, represent regions undergone somatic hypermutation
40. For an enzyme following Michaelis-Menten kinetics, if $K_M = 5$ mM, and $v_o = 12.5 \mu\text{mol}/(\text{mL}\cdot\text{s})$ what is the V_{max} in $\mu\text{mol}/(\text{mL}\cdot\text{s})$ when $[S] = 5$ mM?
A) 25 B) 50 C) 62.5 D) 125
41. Backbone of a protein is constituted by
A) Torsion angles ϕ and ω
B) Three torsion angles, ϕ , ψ and ω
C) Two torsion angles, ϕ and ψ
D) $C\alpha$ and only two torsion angles
42. The two most popular techniques, X-ray crystallography and NMR are used to determine the macromolecular structure at the atomic level. The analysis of X-ray diffraction data and 2D NMR data yield respectively

- A) electron density map and count of hydrogen atoms in the molecule
B) table of interatomic distances and electron density map
C) electron density map and table of interatomic distances
D) 3-d protein structure and 2-d protein structure
43. A substance of molecular weight 423 Da is dissolved in water and made a final concentration of $32\mu\text{g/ml}$. The solution of the substance shows an absorption of 0.27 at 540nm when measured in a cuvette with a 1cm light path. The molar absorption coefficient of the substance at 540nm is
- A) $355.2\text{ M}^{-1}\text{cm}^{-1}$
B) $3552\text{ M}^{-1}\text{cm}^{-1}$
C) $3.55\text{ M}^{-1}\text{cm}^{-1}$
D) $3.55 \times 10^{-3}\text{ M}^{-1}\text{cm}^{-1}$
44. Oleic acid as an
- A) Omega-3 fatty acid
B) Omega-6 fatty acid
C) Omega-9 fatty acid
D) Omega-12 fatty acid
45. The essential fatty acids are
- A) Oleic acid, and Linolenic acid
B) Linoleic acid and Arachidonic acid
C) Linoleic acid and Linolenic acid
D) Oleic acid and Arachidonic acid
46. The direct products of oxidation of a fully saturated, straight chain fatty acid of 13 carbons are
- A) 7 molecules of Acetyl-CoA and 1 molecule of propionyl-CoA
B) 6 molecules of Acetyl-CoA and 1 molecule of propionyl-CoA
C) 4 molecules of Acetyl-CoA and 2 molecule of propionyl-CoA
D) 5 molecules of Acetyl-CoA and 1 molecule of propionyl-CoA
47. Typhoid is confirmed by which one of the following tests?
- A) Pap smear Test
B) Tourniquet Test
C) Widal Test
D) Schick Test
48. The $\text{Na}^+ \text{K}^+$ -ATPase pump maintains the membrane potential in cells by pumping
- A) Na^+ and K^+ in same direction against the concentration gradient.
B) Na^+ and K^+ in opposite directions, each against the concentration gradient.
C) Na^+ and K^+ in oppose directions along the concentration gradient.

D) Na^+ against the concentration gradient and K^+ along the concentration gradient

49. Which of the following mechanism helps to maintain ATP levels in a rigorously contracting muscle?
- A) Creatine phosphate donates phosphate to ADP to replenish ATP levels
 - B) By increasing the rate of aerobic glycolysis
 - C) By accelerating the conversion of lactic acid to glucose via Cori cycle.
 - D) By stimulating glucose release from liver glycogen.
50. The human pancreas comprises of small cluster of specialized cells that make up the endocrine part of gland called
- A) Alpha cells
 - B) Beta cells
 - C) Islets of Langerhans
 - D) Ghrelin secreting cells
51. In mammalian cells that have just crossed the restriction point, you are likely to find
- A) Highly phosphorylated retinoblastoma protein
 - B) Activated Anaphase promoting complex (APC/C)
 - C) Rapidly depolymerizing microtubules
 - D) Activated spindle assembly checkpoint
52. A male who has N disease, which is a homozygous recessive trait, is married to a female who is heterozygous for the same trait. What are the chances for this couple to have a child without the disease?
- A) 100% B) 75% C) 50% D) 25%
53. Protein p53 is a tetramer. Due to missense mutations in one of the alleles, approximately 94% of p53 protein becomes inactive. Considered p53 is a trimer, approximately what percentage of the protein becomes inactive under similar circumstances?
- A) 94 B) 75 C) 99 D) 88
54. Which of the following is not a phylogenetic tree building tool?
- A) Phylogeny B) PHYLIP C) MEGA D) Archaeopteryx
55. A yeast cell has been chemically treated to create a cell devoid of all mitochondrial DNA. Which one of the following will be the likely outcome?
- A) Cell will not have any means of making ATP but may survive on external ATP

- B) Oxygen consumption of cell will be severely reduced or zero
 C) Oxygen consumption will be unchanged
 D) Cell cannot use glucose for energy but respiration will be higher to compensate for loss of mitochondrial DNA
56. A process is endothermic in nature and is energetically favorable. Which one of the following options are correct?

- A) Delta H is negative, delta S would be positive, Delta G is negative
 B) Delta H is negative, delta S would be negative, Delta G is negative
 C) Delta H is positive, delta S would be positive, Delta G is negative
 D) Delta H is negative, delta S would be zero, Delta G is negative

57. Which of the following is likely to be correct for a fluorescent dye used to stain cell nucleus for fluorescence microscopy?

- A) Dye has high fluorescence in water and in all cellular environments, and when bound to RNA and DNA
 B) Dye is non-fluorescent but gives great contrast in electron microscopy
 C) Dye is non-fluorescent in water but has high fluorescence when bound to lipids and proteins
 D) Dye is non-fluorescent in water but has high fluorescence when bound to DNA

58. Statement (S): Often cancer cells decouple glycolysis from TCA cycle.
 Reason (R): Warburg effect is beneficial to cancer cells.

Which one of the following options is correct?

- A) Both S and R are correct, R is the right explanation for S
 B) Both S and R are correct, R is not the right explanation for S
 C) S is wrong but R is correct
 D) S is correct and R is wrong

59. Select the option that represents the correct match between Set I and Set II given below

Set I	Set II
a) Secondary messenger	i) Protein kinase C
b) Primary effector	ii) Gq protein
c) Transducer	iii) Phospholipase C
d) Secondary effector	iv) Acetyl choline
	v) IP3
A) a-v ; b-i ; c- ii ; d-iv	
B) a-v; b-iii; c- ii ; d-i	
C) a-v ; b-iii; c- i; d-iv	
D) a-iv; b-ii ; c- iii; d-i	

60. Haemoglobin has maximum affinity for

- A) oxygen
 B) carbon dioxide

- C) carbon monoxide
- D) 2,3-biphosphoglycerate

University of Hyderabad
Ph.D. Entrance Examinations - 2023

School/Department/Centre
Course : Ph.D.

: Life Sciences/Biochemistry
Subject : Biochemistry

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

Note/Remarks :

Signature Naresh Sepuri
School/Department/Centre

Department of Biochemistry,