Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Biochemistry) (Second Semester)

EXAMINATION, 2025-26

(Old Syllabus Effective from 2022)
(Only Back Paper Students)

ENZYMOLOGY

Paper Code							
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Questions Booklet Series
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Time : 1:30 Hours] [*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page) **(शेष निर्देश अन्तिम पृष्ठ पर)**

(Only for Rough Work)

1. Multienzyme complexes are difficult to isolate because :

(A) They are small.

(B) Weak interactions dissociate easily.

(C) No cofactors are present.

(D) They are unstable proteins.

2. LDH5 (M4) is predominant in :

(A) Heart

(B) Brain

(C) Skeletal muscle

(D) RBC

3. LDH1 (H4) is predominant in :

(A) Liver

(B) Muscle

(C) Heart

(D) Kidney

4. LDH has how many isoenzyme forms ?

(A) 2

(B) 3

(C) 4

(D) 5

5. Lactate dehydrogenase (LDH) isoenzymes are composed of :

(A) 2 subunits

(B) 3 subunits

(C) 4 subunits

(D) 5 subunits

6. Isoenzymes differ in :

(A) Catalytic function

(B) Amino acid sequence

(C) Substrate type

(D) Reaction type

7. Enzyme-enzyme interaction in multienzyme complexes leads to :

(A) Increased efficiency

(B) Increased K_m

(C) Reduced specificity

(D) Enzyme degradation

8. The final product of FAS is usually :

(A) Stearic acid

(B) Palmitic acid

(C) Oleic acid

(D) Linoleic acid

9. Fatty acid synthesis requires :

(A) NADPH

(B) NADH

(C) $FADH_2$

(D) ATP only

10. The growing fatty acid chain is transferred between active sites via :

(A) ACP arm

(B) Diffusion

(C) ATP

(D) NADH

11. ACP (Acyl Carrier Protein) carries intermediates via :

(A) Lysine

(B) Serine-phosphopantetheine

(C) Histidine

(D) Arginine

12. Fatty acid synthase (FAS) complex in eukaryotes is :

(A) Multienzyme complex in one polypeptide

(B) Separate enzymes

(C) Located in mitochondria

(D) Ribosomal enzyme

13. PDH phosphatase is activated by :

(A) ATP

(B) NADH

(C) Ca^{2+}

(D) Acetyl-CoA

14. PDH complex is inhibited by :

(A) ADP

(B) NAD^{+}

(C) Acetyl-CoA

(D) CoA

15. The El component of PDH requires :

(A) FAD

(B) TPP

(C) NAD^{+}

(D) CoA

16. Which cofactor is NOT a part of PDH complex ?

(A) TPP

(B) FAD

(C) NAD^{+}

(D) Biotin

17. PDH complex converts :

(A) Pyruvate → Acetyl-CoA

(B) Pyruvate → Lactate

(C) Glucose → Pyruvate

(D) Acetyl-CoA → Pyruvate

18. Pyruvate dehydrogenase (PDH) complex is located in :

(A) Cytosol

(B) Nucleus

(C) Ribosome

(D) Mitochondrial matrix

19. Substrate channeling refers to :

(A) Diffusion of intermediates into cytosol

(B) Enzyme degradation

(C) Product inhibition

(D) Direct transfer of intermediates between active sites

20. Multienzyme complexes are advantageous because they :

(A) Allow substrate channeling

(B) Increase diffusion distance

(C) Reduce enzyme specificity

(D) Prevent catalysis

21. PFK is activated by :

(A) ATP

(B) Citrate

(C) AMP

(D) NADH

22. Phosphofructokinase (PFK) is inhibited by :

(A) AMP

(B) ADP

(C) Pi

(D) ATP

23. In ATCase regulation :

(A) ATP inhibits enzyme

(B) CTP activates enzyme

(C) ATP activates, CTP inhibits

(D) Both inhibit

24. Aspartate transcarbamoylase (ATCase) is regulated by :

(A) ATP and CTP

(B) NADH only

(C) Oxygen

(D) Glucose

25. Flip-flop mechanism refers to :

(A) Simultaneous catalysis

(B) Alternating activity between subunits

(C) No enzyme activity

(D) Substrate degradation

26. Half-site reactivity implies :

(A) All active sites active simultaneously

(B) Only half of sites active at a time

(C) No active sites

(D) Enzyme inactive

27. Zymogens are activated by :

(A) Phosphorylation

(B) Proteolysis

(C) Allosteric regulation

(D) Substrate binding

28. Irreversible covalent modification involves :

(A) Temporary phosphorylation

(B) Allosteric binding

(C) Substrate binding

(D) Proteolytic cleavage

29. Reversible covalent modification is commonly mediated by :

(A) Kinases and phosphatases

(B) Proteases

(C) Lipases

(D) Polymerases

30. Covalent modification of enzymes includes :

(A) Phosphorylation

(B) Denaturation

(C) Hydrolysis

(D) Translation

31. In Scatchard plot, slope equals :

(A) V_{max}

(B) K_m

(C) $-1/K_d$

(D) k_{cat}

32. Scatchard plot is used to determine :

(A) Enzyme velocity

(B) Binding affinity and number of binding sites

(C) Reaction rate

(D) Enzyme structure

33. Hill coefficient equal to 1 indicates :

(A) Positive cooperativity

(B) Negative cooperativity

(C) No cooperativity

(D) Infinite binding

34. Hill coefficient (n_H) for positive cooperativity is :

(A) = 1

(B) < 1

(C) > 1

(D) = 0

35. Negative cooperativity results in :

(A) Decreased affinity after binding

(B) Increased affinity after binding

(C) No effect

(D) Constant affinity

36. Positive cooperativity is indicated by :

(A) Hyperbolic curve

(B) Linear curve

(C) No change

(D) Sigmoidal curve

37. In the sequential model (KNF model) :

(A) All subunits change at once.

(B) Ligand binding induces stepwise conformational change.

(C) No cooperativity exists.

(D) Enzyme is inactive.

38. The "concerted model" (MWC model) assumes :

(A) All subunits switch states simultaneously

(B) Subunits act independently

(C) Sequential binding only

(D) No conformational change

39. Allosteric enzymes generally :

(A) Follow the Michaelis-Menten kinetics

(B) Are monomeric

(C) Lack regulatory sites

(D) Show sigmoidal kinetics

40. Feedback inhibition typically involves :

(A) Activation of first enzyme by product

(B) Irreversible inhibition of all enzymes

(C) Degradation of substrate

(D) Inhibition of first committed step by end product

41. Zn^{2+} in carboxypeptidase functions to :

(A) Denature substrate

(B) Activate water molecule

(C) Break peptide bond directly

(D) Stabilize enzyme structure

42. Carboxypeptidase is an example of :

(A) Metalloprotease

(B) Serine protease

(C) Lyase

(D) Isomerase

43. Lysozyme mechanism involves :

(A) Covalent intermediate with Asp residue

(B) Metal ion catalysis

(C) Radical mechanism

(D) No intermediate

44. Lysozyme catalyzes hydrolysis of :

(A) Peptide bonds

(B) Phosphodiester bonds

(C) Ester bonds

(D) Glycosidic bonds

45. In chymotrypsin, Asp102 functions to :

(A) Act as nucleophile

(B) Stabilize histidine

(C) Bind substrate

(D) Release product

46. The catalytic triad of chymotrypsin includes :

(A) Ser-His-Asp

(B) Ser-Gly-Ala

(C) Lys-Asp-Glu

(D) His-Leu-Val

47. Chymotrypsin catalysis involves the formation of :

(A) Schiff base

(B) Free radical

(C) Disulfide bond

(D) Acyl-enzyme intermediate

48. In RNase A, which residues act as acid and base ?

(A) Asp and Glu

(B) Lys and Arg

(C) His 12 and His 119

(D) Ser and Gly

49. Ribonuclease A catalysis involves :

(A) Metal ion catalysis

(B) Covalent catalysis only

(C) No catalysis

(D) Acid-base catalysis

50. Which residue is mutated in chymotrypsin to test catalytic function ?

(A) Serine

(B) Glycine

(C) Alanine

(D) Proline

51. Site-directed mutagenesis is used to :

(A) Randomly mutate DNA

(B) Specifically alter amino acids in enzyme

(C) Denature enzyme

(D) Increase substrate concentration

52. Diisopropyl fluorophosphate (DFP) modifies :

(A) Histidine residues

(B) Lysine residues

(C) Arginine residues

(D) Serine residues

53. Chemical modification of active site residues helps in :

(A) Determining enzyme sequence

(B) Identifying functional groups in catalysis

(C) Increasing enzyme activity

(D) Protein folding

54. Transition state stabilization lowers :

(A) ΔG of reaction

(B) Substrate concentration

(C) Enzyme concentration

(D) Activation energy

55. Strain theory suggests enzymes :

(A) Destabilize substrate toward transition state

(B) Stabilize substrate ground state

(C) Prevent reaction

(D) Remove substrate

56. Orientation effect in catalysis ensures :

(A) Substrate binds randomly

(B) Enzyme denaturation

(C) Product inhibition

(D) Reactive groups align properly

57. The proximity effect enhances reaction rate by :

(A) Increasing entropy

(B) Increasing enthalpy

(C) Decreasing entropy

(D) Breaking covalent bonds

58. Covalent catalysis involves :

(A) Temporary covalent bond between enzyme and substrate

(B) Permanent enzyme modification

(C) No intermediate formation

(D) Only electrostatic interactions

59. Which amino acid commonly participates in acid-base catalysis near physiological pH ?

(A) Glycine

(B) Histidine

(C) Valine

(D) Leucine

60. In general acid-base catalysis, the catalyst :

(A) Donates or accepts protons during reaction

(B) Forms covalent bond permanently

(C) Changes enzyme conformation

(D) Only stabilizes substrate

61. The Briggs-Haldane approach differs from Michaelis-Menten by :

(A) No steady-state assumption

(B) Uses steady-state assumption

(C) Ignores ES complex

(D) Assumes irreversible binding

62. Active site specificity is mainly due to :

(A) Protein primary structure

(B) 3D conformation of enzyme

(C) Temperature

(D) Substrate concentration

63. Random Bi-Bi mechanism means :

(A) Substrates bind in any order

(B) Fixed order of binding

(C) Only one substrate binds

(D) Products bind first

64. In ordered Bi-Bi mechanism :

(A) Substrates bind randomly

(B) Products are released simultaneously

(C) No ES complex forms

(D) One substrate must bind first

65. Ping-Pong mechanism involves :

(A) Ternary complex formation

(B) Covalent intermediate enzyme

(C) Only one substrate binding

(D) No product release

66. In irreversible inhibition :

(A) Enzyme is permanently inactivated

(B) Inhibitor binds reversibly

(C) K_m increases only

(D) Only V_{max} increases

67. Uncompetitive inhibition results in :

(A) Increase in K_m

(B) Increase in V_{max}

(C) No change

(D) Decrease in both K_m and V_{max}

68. Non-competitive inhibition results in :

(A) Increase in K_m

(B) Increase in V_{max}

(C) No change in V_{max}

(D) Decrease in V_{max}

69. A competitive inhibitor affects Lineweaver-Burk plot by :

(A) Changing slope only

(B) Changing intercept at Y axis only

(C) Parallel lines

(D) No change

70. In competitive inhibition :

(A) V_{max} decreases

(B) K_m decreases

(C) K_m increases

(D) Both K_m and V_{max} decrease

71. At very high substrate concentration, enzyme kinetics becomes :

(A) First order

(B) Second order

(C) Zero order

(D) Third order

72. An enzyme operating at [S] << K_m shows :

(A) First-order kinetics

(B) Zero-order kinetics

(C) Mixed-order kinetics

(D) No reaction

73. Catalytic efficiency is best represented by :

(A) K_m

(B) V_{max}

(C) k_{cat}/K_m

(D) $k_{cat} \times K_m$

74. Turnover number (k_{cat}) is defined as :

(A) K_m/V_{max}

(B) $[E]t/V_{max}$

(C) $K_m \times V_{max}$

(D) $V_{max}/[E]t$

75. In Eadie-Hofstee plot, the slope equals :

(A) K_m

(B) $-K_m$

(C) V_{max}

(D) $-V_{max}$

76. The y-intercept of Lineweaver-Burk plot represents :

(A) K_m

(B) V_{max}

(C) $1/V_{max}$

(D) $-1/K_m$

77. The Lineweaver-Burk plot is a graph of :

(A) V *vs.* [S]

(B) V *vs.* 1/[S]

(C) 1/V *vs.* [S]

(D) 1/V *vs.* 1/[S]

78. For an enzyme with high substrate affinity :

(A) K_m is high

(B) K_m is low

(C) V_{max} is low

(D) k_{cat} is zero

79. The Michaelis constant (K_m) is best defined as :

(A) Substrate concentration at half V_{max}

(B) Enzyme concentration at half V_{max}

(C) Maximum velocity

(D) Rate constant for ES formation

80. In the Michaelis-Menten model, the steady-state assumption implies :

(A) [ES] = 0

(B) Substrate concentration is constant

(C) Product formation is negligible

(D) Rate of ES formation = rate of ES breakdown

81. Which enzyme class forms bonds using ATP ?

(A) Lyases

(B) Ligases

(C) Hydrolases

(D) Isomerases

82. Which factor alters enzyme conformation reversibly ?

(A) Heat denaturation

(B) Extreme pH

(C) Allosteric effector

(D) Proteolysis

83. The inactive enzyme precursor is called :

(A) Apoenzyme

(B) Isoenzyme

(C) Zymogen

(D) Holoenzyme

84. Which method is best for determining enzyme purity ?

(A) UV spectroscopy

(B) Dialysis

(C) Centrifugation

(D) SDS-PAGE

85. Michaelis-Menten kinetics assumes :

(A) Enzyme is saturated at all times

(B) Steady-state of ES complex

(C) Product formation is irreversible only

(D) Substrate concentration is zero

86. Which condition leads to enzyme denaturation ?

(A) Optimal pH

(B) Low substrate concentration

(C) Presence of cofactor

(D) High temperature

87. An enzyme assay measures :

(A) Enzyme concentration

(B) Protein purity

(C) Catalytic activity

(D) Molecular weight

88. Which enzyme class transfers functional groups ?

(A) Transferases

(B) Ligases

(C) Isomerases

(D) Lyases

89. Holoenzyme consists of :

(A) Only protein

(B) Only cofactor

(C) Apoenzyme + cofactor

(D) Denatured protein

90. Apoenzyme refers to :

(A) Active enzyme

(B) Enzyme-substrate complex

(C) Denatured enzyme

(D) Protein part without cofactor

91. In affinity chromatography, separation is based on :

(A) Size

(B) Charge

(C) Specific binding interaction

(D) Solubility

92. Which enzyme class catalyzes oxidation-reduction reactions ?

(A) Transferases

(B) Hydrolases

(C) Oxidoreductases

(D) Lyases

93. Turnover number (k_{cat}) refers to :

(A) Substrate binding rate

(B) Product release rate

(C) Number of substrate molecules converted per enzyme per unit time

(D) Enzyme stability

94. Which factor does NOT directly affect enzyme activity ?

(A) Temperature

(B) pH

(C) Substrate concentration

(D) Molecular weight

95. Enzyme activity is usually expressed in :

(A) Moles per hour

(B) IU and Katal

(C) mg/ml

(D) Molarity

96. Which state of enzyme retains its primary structure but loses activity ?

(A) Native state

(B) Denatured state

(C) Inactive state

(D) Apoenzyme state

97. Which purification technique separates proteins based on charge ?

(A) Gel filtration

(B) Affinity chromatography

(C) Ion-exchange chromatography

(D) Dialysis

98. A constant specific activity during purification indicates :

(A) Loss of enzyme

(B) Denaturation

(C) Enzyme homogeneity

(D) Inhibition

99. Specific activity of an enzyme is defined as :

(A) Activity per mg of total protein

(B) Activity per mole of enzyme

(C) Activity per ml of solution

(D) Total activity divided by time

100. During enzyme purification, which parameter increases with each purification step ?

(A) Total protein

(B) Total activity

(C) Specific activity

(D) Yield

(Only for Rough Work)

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.
6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.
7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.
8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.
9. There will be no negative marking.
10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.
11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.
12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर—A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।
7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।
8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।
9. निगेटिव मार्किंग नहीं है।
10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।
12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।