Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Biotechnology) (Second Semester) (NEP)

EXAMINATION, 2022-23

ENZYMOLOGY

Paper Code							
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Questions Booklet Series
A

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. Enzymes are ..... .

(A) Steroid in nature

(B) Protein in nature

(C) Lipid in nature

(D) Carbohydrate in nature

2. Choose the correct statement regarding lock and key model :

(A) Enzyme and substrate possess specific complementary geometric shapes.

(B) Active site of enzyme is flexible.

(C) Active site continuously changes.

(D) All of the above statements are correct.

3. The lock and key model was postulated by :

(A) Emile Fischer

(B) Daniel Koshland

(C) Carolus Linnaeus

(D) Edward O. Wilson

4. According to which model substrate is capable of inducing the proper alignment of the active site of the enzyme ?

(A) Induce fit model

(B) Lock and key model

(C) Fluid mosaic model

(D) Both (A) and (B)

5. Systematic classification of enzyme is developed by :

(A) Internal Enzyme Center

(B) International Enzyme Commission

(C) Inter Enzyme Coordinator

(D) International Enzyme Company

6. What is an enzyme with its cofactor removed called ?

(A) Apoenzyme

(B) Apkoenzyme

(C) Holoenzyme

(D) Akoenzyme

7. Which of the following enzyme usually forms the double bond in the product ?

(A) Transferase

(B) Oxidoreductase

(C) Isomerase

(D) None of the above

8. Phosphoglucomutase is the example of which category of enzyme classification ?

(A) Ligase

(B) Isomerase

(C) Lyase

(D) All of the above

9. Which of the oxidoreductases are involved in oxygen transfer from molecular oxygen ?

(A) Peroxidases

(B) Oxidases

(C) Oxygenases

(D) Dehydrogenases

10. The class of enzymes which contains extensive group of enzymes are ..... .

(A) Ligases

(B) Oxidoreductases

(C) Aldolases

(D) Esterases

11. In which of the following models, enzyme is considered as pre-shaped ?

(A) Lock and key

(B) Induced fit model

(C) Lock induced model

(D) None of the above

12. Who proposed induced fit model ?

(A) James Watson

(B) Emile Fisher

(C) Daniel E. Koshland

(D) Daniel Fisher Koshland

13. Which of the following statements is incorrect ?

(A) Changes in quaternary structure reduces the catalytic activity.

(B) Substrate binds on the allosteric site.

(C) Specificity allows the enzymes to co-exist in the same cell without any interference.

(D) Lock and key model is also known as rigid template model.

14. In which of the following model, enzyme is considered as flexible ?

(A) Lock and key

(B) Induced fit model

(C) Lock induced model

(D) None of the above

15. Which one of the following statements regarding V_{max} and K_m is false ?

(A) V_{max} is the maximum rate at which a particular enzyme-catalysed reaction can proceed.

(B) K_m is the concentration of substrate at which the rate of the reaction reaches V_{max}.

(C) A small value of K_m tells us that an enzyme binds strongly to its substrate.

(D) A large value of K_m tells us that an enzyme shows little specificity for a given substrate.

16. The catalytic efficiency of two different enzymes can be compared by the :

(A) Formation of the product

(B) K_m value

(C) Molecular size of the enzymes

(D) pH of optimum value

17. The active site of an enzyme ..... .

(A) remains rigid and does not change shape

(B) is complementary to the rest of the molecule

(C) contains amino acids without side chains

(D) None of the above

18. The active site of an enzyme differs from an antibody-antigen binding site in that the enzyme active site ..... .

(A) Contains modified amino acids

(B) Catalyzes a chemical reaction

(C) Contains amino acids without side chains

(D) None of the above are correct

19. The transition state of a catalyzed reaction is ..... .

(A) Higher in energy than that of an uncatalyzed reaction

(B) Lower in energy than that of an uncatalyzed reaction

(C) Lower in energy than the reaction substrate

(D) Bound very weakly to the catalyst

20. Which of the following assumptions was made by Michaelis and Menten while developing their equation ?

(A) Substrate bound to enzyme at any given moment is small compared to the amount of free substrate.

(B) Non-enzymatic degradation of substrate is the major step.

(C) Concentration of the substrate can be ignored.

(D) None of the above

21. Uncompetitive inhibitor :

(A) Binds to both free enzyme as well as an enzyme-substrate complex

(B) Causes no change in apparent K_m of the enzyme

(C) Lowers the V_{max} of the reaction

(D) All of the above

22. In an enzyme catalyzed reaction the K_m obtained was 10 mm and V_{max} was 100 μ-mol/min. Which one of the following options represents the initial velocity of the reaction at a substrate concentration of 10 mm ?

(A) 25 μ-mol/min.

(B) 50 μ-mol/min.

(C) 100 μ-mol/min.

(D) 75 μ-mol/min.

23. An allosteric inhibitor of an enzyme normally ..... .

(A) Denatures the enzyme

(B) Binds to the active site

(C) Participates m feedback regulation

(D) Speedup the enzyme catalysis

24. What is the effect of a competitive inhibitor on the Lineweaver-Burk plot ?

(A) It moves the entire curve to the left.

(B) It changes the *y*-intercept.

(C) It changes the *x*-intercept.

(D) It has no effect on the slope.

25. A non-competitive inhibitor ..... .

(A) It has no effect on K_m

(B) Increases V_{max}

(C) Both (A) and (B)

(D) None of the above

26. A competitive inhibitor of an enzyme is usually ..... .

(A) Highly reactive compound

(B) Metal ion such as Hg^{2+} or Pb^{2+}

(C) Structurally similar to the substrate

(D) Poison

27. Which of the statements is true regarding K_m ?

(A) It is the measure of the stability of the EP complex.

(B) It is the measure of the affinity of an enzyme for its product.

(C) A high K_m indicates weak substrate binding.

(D) All of the above

28. In which type of inhibition, inhibitor only binds to the ES complex ?

(A) Competitive

(B) Non-competitive

(C) Uncompetitive

(D) All of the above

29. In which type of inhibition, both V_{max} and K_m are decreased ?

(A) Competitive

(B) Non-competitive

(C) Uncompetative inhibition

(D) Both (A) and (C)

30. Turnover number is also known as :

(A) K_m

(B) K_{cat}

(C) K_{cam}

(D) K_{cad}

31. When the reaction reaches its plateau state, which type of kinetics is seen ?

(A) Zero order kinetics

(B) First order kinetics

(C) Second order kinetics

(D) None of the above

32. The substrate K_m in an enzyme-catalyzed reaction is ..... .

(A) usually less than K_d, the dissociation constant.

(B) neverless than K_d.

(C) cannot be equal to K_d.

(D) estimated from the Y-intercept of a Lineweaver-Burk plot.

33. Which of the following best describes the assumption made in steady state kinetic analysis ?

(A) The concentration of [S] is decreasing.

(B) The concentration of [ES] is constant.

(C) The total amount of enzyme decreases.

(D) All of the above

34. 'Ping Pong' reaction is also known as ..... .

(A) Single displacement bi-substrate reaction

(B) Single-substrate reaction

(C) Double-displacement bi-substrate reaction

(D) None of the above

35. Positive cooperative binding can be identified by ..... .

(A) A hyperbolic binding curve

(B) A Hill plot with a slope less than one

(C) A Hill plot with a slope greater than one

(D) None of the above

36. Negative cooperative binding can be identified by ..... .

(A) A hyperbolic binding curve

(B) A Hill plot with a slope less than one

(C) A Hill plot with a slope greater than one

(D) None of the above

37. The dissociation constant is ..... .

(A) A measure of how easily the alpha and beta subunits combine to form haemoglobin

(B) The inverse of the Hill coefficient

(C) The inverse of the association constant

(D) All of the above

38. Allosteric effects that occur in haemoglobin ..... .

(A) Important for maintaining Fe in the Fe^{2+} state.

(B) Minimize oxygen delivery to the tissues.

(C) Optimize oxygen delivery to the tissues.

(D) All of the above

39. The cooperativity of O_2 binding to haemoglobin results in a ..... .

(A) Extensive protein conformational change

(B) Release of H^+ with the dissociation of O_2

(C) Both (A) and (B)

(D) None of the above

40. A protein that binds two ligands in a non-cooperative manner will exhibit ..... .

(A) A sigmoidal binding curve

(B) A hyperbolic binding curve

(C) Both (A) and (B)

(D) None of the above

41. Which is not true ?

(A) Enzymes are proteins that function as catalysts.

(B) Enzymes are specific.

(C) Enzyme activity can be regulated.

(D) None of the above

42. Which of the following salts is used for fractional precipitation during protein purification ?

(A) Sodium chloride

(B) Ammonium perchlorate

(C) Ammonium sulfate

(D) Guanidinium HCl

43. If a mixture of protein and high concentration of residual salt is passed through a gel filtration column, the protein is expected to ..... .

(A) Elute from the column after the residual salt

(B) Elute before the residual salt

(C) Stick to the column

(D) Remain at the top of the column

44. The suitable method to evaluate the homogeneity is ..... .

(A) SDS-PAGE

(B) Western blotting

(C) Estimation of enzymatic activity

(D) None of the above

45. Usually ..... is/are calculated directly from X-ray diffraction data for the determination of protein structure.

(A) The number of electrons in the crystal.

(B) The electron density at different locations in the crystal.

(C) The size of the protein in the crystal.

(D) The strength of the X-ray beam used in the experiment.

46. Michaelis-Menten kinetics gives :

(A) Hyperbolic curve

(B) Parabola

(C) Sigmoidal curve

(D) Straight line with negative slope

47. The molecule, which acts directly on an enzyme and reduce rate of catalysis rate is ..... .

(A) Ac

(B) Inhibitor

(C) Modulator

(D) Regulator

48. An enzyme brings about ..... .

(A) Reduction in activation energy

(B) Increase in reaction time

(C) Increase in activation energy

(D) All of the above

49. Coenzyme is :

(A) Always a protein

(B) Often a metal

(C) Always an inorganic compound

(D) Often a vitamin

50. Apoenzyme is a :

(A) Protein

(B) Carbohydrate

(C) Vitamin

(D) Lipid

51. Enzymes are usually :

(A) Protein

(B) Colloidal

(C) Thermolabile

(D) All of the above

52. Which bond is usually not associated with enzyme-substrate interaction ?

(A) Hydrogen bonds

(B) Ionic bonds

(C) Di-sulfide bonds

(D) van der Waals' force of attraction

53. Enzyme acts with full catalytic efficiency at ..... .

(A) Catalytic temperature

(B) At normal body temperature

(C) Optimum temperature

(D) None of the above

54. Holoenzyme is composed of ..... .

(A) Prosthetic group and Co-factor

(B) Apoenzyme and Co-enzyme

(C) Co-enzyme and Prosthetic group

(D) All of the above

55. Which one is Pro-enzyme ?

(A) Pepsinogen

(B) Trypsin

(C) Chymotrypsin

(D) All of the above

56. Abzymes are :

(A) Proteins

(B) Non-catalytic antibodies

(C) Catalytic antibodies

(D) Both (B) and (C)

57. Which enzymes do not require co-enzymes for their activity ?

(A) Extracellular enzymes

(B) Intracellular enzymes

(C) Mitochondrial enzymes

(D) All of the above

58. Feedback inhibition is ..... .

(A) Initial product inhibition

(B) End product inhibition

(C) Enzymatic activation

(D) None of the above

59. Uncatalyzed reaction shows ..... .

(A) Lower activation energy

(B) Higher activation energy

(C) Moderate activation energy

(D) All of the above

60. Which bond is associated with enzyme-substrate interaction ?

(A) Hydrogen bonds

(B) Ionic bonds

(C) van der Waals' force of attraction

(D) All of the above

61. Reversible covalent modification involves ..... .

(A) Activation of proenzymes

(B) Inhibition of proenzymes

(C) Denaturation of proenzymes

(D) None of the above

62. Which enzyme utilize water as a hydroxyl group donor during the substrate breakdown ?

(A) Transferases

(B) Lyases

(C) Hydrolases

(D) All of the above

63. The rate determining step of Michaelis-Menten kinetics is ..... .

(A) The complex dissociation step to produce products

(B) The complex formation step

(C) The enzyme-substrate binding step

(D) None of the above

64. Which of the following is an example for irreversible inhibitor ?

(A) Disulfiram

(B) Oseltamivir

(C) Protease inhibitors

(D) DIPF

65. Which of the following is an example of reversible inhibitor ?

(A) Iodoacetamide

(B) Protease inhibitors

(C) Both (A) and (B)

(D) None of the above

66. Mixed inhibitor binds at ..... .

(A) The active site

(B) Allosteric site

(C) Does not bind on enzyme

(D) Binds on substrate

67. The catalytic efficiency of two different enzymes can be compared using ..... .

(A) K_m

(B) Type of product

(C) Enzymes molecular weight

(D) Optimum pH

68. Identify the disadvantage of immobilized enzymes :

(A) Repeated use of enzymes

(B) Minimal downstream processing

(C) Enzyme may become inactive

(D) Thermal stability of the enzyme increases

69. The surface of the matrix on which an enzyme is immobilized is known as ..... .

(A) Enzyme immobilization

(B) Adsorption

(C) Biosensor matrix

(D) Carrier matrix

70. Which of the following is not an adsorbent ?

(A) Sepharose

(B) Porous carbon

(C) Ion-exchange matrices

(D) None of the above

71. The enzyme is confined in a molecular cage by which immobilization method ?

(A) Adsorption

(B) Covalent binding

(C) Entrapment

(D) None of the above

72. In which of the following methods, entrapment can be achieved ?

(A) Adsorption

(B) Covalent binding

(C) Microencapsulation

(D) All of the above

73. Which of the following enzymes is used in the treatment of cancer ?

(A) Pepsin

(B) Lysozyme

(C) Asparginase

(D) Pectate lyase

74. Which of the following enzymes is used in the treatment of skin ulcers ?

(A) Collagenase

(B) Glutaminase

(C) Rhodanase

(D) None of the above

75. Which of the following enzymes is used to treat allergies caused by penicillin ?

(A) Ribonuclease

(B) Uriease

(C) β-lactamase

(D) Hyaluronidase

76. Which of the following is a widely used to treat traumatic, surgical and orthopedic injuries ?

(A) Pepsin

(B) Cellulase

(C) Amylase elastase

(D) Trypsin : chymotrypsin

77. Which of the following is not true for hyaluronidase ?

(A) It promotes rapid absorption of drug injected subcutaneously.

(B) It increases tissue permeability.

(C) It is used in the treatment of traumatic and post-operative edema.

(D) None of the above

78. Which enzyme dissolve clots in myocardial infarction ?

(A) Lysozyme

(B) Asparginase

(C) Penicillinase

(D) Urokinase

79. Which enzyme is used for treating eye infections ?

(A) Lysozyme

(B) Asparginase

(C) Penicillinase

(D) Urokinase

80. Which enzyme is not used in triacyiglycerol assays ?

(A) Lipase

(B) Glycerol kinase

(C) Urease

(D) None of the above

81. Which enzyme have antiviral activity ?

(A) Lysozyme

(B) Pectin lyase

(C) Ribonuclease

(D) None of the above

82. Which of the following enzymes is not used in the brewing industry ?

(A) Fungal α-amylase

(B) β-glucanase

(C) Papain

(D) Pectin esterase

83. Meat tenderization is done by using ..... .

(A) Lysozyme

(B) Pectin lyase

(C) Papain

(D) None of the above

84. Which enzyme is used for cheese making ?

(A) Lysozyme

(B) Urease

(C) Rennet

(D) Urokinase

85. Which enzyme is not found in pyruvate-dehydrogenase complex ?

(A) Pyruvate dehydrogenase

(B) Dihydrolipoyl transacetylase

(C) Glyceraldehyde-3 phosphate dehydrogenase

(D) Dihydrolipoyl dehydrogenase

86. Pyruvate dehydrogenase complex catalyses the conversion of :

(A) Pyruvate to acetyl-CoA

(B) Acetyl-CoA to pyruvate

(C) Phosphoenolpyruvate to pyruvate

(D) All of the above

87. In Pyruvate dehydrogenase complex 'E3 subunit' represents :

(A) Dihydrolipoyl transacetylase

(B) Pyruvate dehydrogenase

(C) Glyceraldehyde-3 phosphate dehydrogenase

(D) Dihydrolipoyl dehydrogenase

88. Which of the following will inhibit the Pyruvate dehydrogenase complex ?

(A) Increase ATP/ADP ratio

(B) Increase NADH/NAD ratio

(C) Increase acetyl-CoA / CoA ratio

(D) All of the above

89. Pyruvate dehydrogenase kinase phosphorylates ..... specific serine residues on "E1 Subunit" of pyruvate dehydrogenase complex.

(A) One

(B) Two

(C) Three

(D) Four

90. In Pyruvate dehydrogenase complex 'E1 subunit' represents :

(A) Dihydrolipoyl transacetylase

(B) Pyruvate dehydrogenase

(C) Glyceraldehyde-3 phosphate dehydrogenase

(D) Dihydrolipoyl dehydrogenase

91. In Pyruvate dehydrogenase complex 'E2 subunit' represents :

(A) Dihydrolipoyl transacetylase

(B) Pyruvate dehydrogenase

(C) Glyceraldehyde-3 phosphate dehydrogenase

(D) Dihydrolipoyl dehydrogenase

92. For enzyme purification, a method is employed to precipitate the enzyme by reducing its solubility known as ..... .

(A) Osmosis

(B) Dialysis

(C) Salting out

(D) Precipitation

93. Identify the factor that limit the rate of dialysis :

(A) Dialysis membrane relative surface area

(B) Retentate volume to diffusate volume

(C) Diffusible substance concentration outside the membrane

(D) All of the above

94. Which of the following methods is not involved in enzyme purification ?

(A) Ultrafiltration

(B) Dialysis

(C) Chromatographic techniques

(D) X-ray diffraction

95. Ethanol can be removed from protein precipitate by ..... .

(A) Lyophilisation

(B) Ultrasonication

(C) Freezing

(D) Dialysis

96. Which of the following is false for lactate dehydrogenase (LDH) ?

(A) It is a tetrameric enzyme.

(B) It catalyzes L-lactate to pyruvate.

(C) It has five isoenzymes.

(D) It is made up of five polypeptides.

97. Fatty acid synthase is a large multi-enzyme complex and the monomeric protein size is approximately ..... .

(A) 470 kDa

(B) 220 kDa

(C) 270 kDa

(D) 370 kDa

98. The pH at which the net charge on the enzyme molecule is zero is known as ..... .

(A) pKa

(B) Isoelectric point

(C) K_m

(D) None of the above

99. What does the following equation represent ?

$$\frac{1}{V_0} = \frac{k_m}{V_{max}} \frac{1}{[S]} + \frac{1}{V_{max}}$$

(A) Eadie-Hofstee plot equation

(B) Lineweaver Burk equation

(C) Miachelis-Menten equation

(D) Hanes plot equation

100. Which of the following support carriers is not used in the covalent binding method ?

(A) Agarose

(B) Cellulose

(C) Calcium alginate

(D) Glutaraldehyde

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 ny 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।