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)

BIOENERGETICS AND INTERMEDIARY METABOLISM

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)**

1. Which one of the following acts as an activator of Phosphofructokinase-1 ?

(A) ATP

(B) AMP

(C) Citrate

(D) Acetyl-CoA

2. Which one of the following accepts hydrogen from malate ?

(A) FAD

(B) NAD^+

(C) NADP

(D) FMN

3. Acetyl-CoA is formed from pyruvate by ..... reaction.

(A) Dehydration

(B) Reduction

(C) Oxidative decarboxylation

(D) Dephosphorylation

4. The second law of thermodynamics states that :

(A) Energy can be converted from one form to another

(B) In any energy transformation, energy is conserved

(C) Every energy transfer increases the entropy of the universe.

(D) Total energy of a system remains constant.

5. Which condition favors spontaneity in a reaction ?

(A) $\Delta H > 0$ and $\Delta S < 0$

(B) $\Delta H < 0$ and $\Delta S > 0$

(C) $\Delta H > 0$ and $\Delta S > 0$

(D) $\Delta H < 0$ and $\Delta S < 0$

6. Oxidation is defined as :

(A) Gain of electrons

(B) Gain of hydrogen

(C) Loss of electrons

(D) Loss of oxygen

7. The hydrolysis of ATP to ADP releases approximately :

(A) – 7.3 kcal/mol

(B) + 7.3 kcal/mol

(C) – 3.5 kcal/mol

(D) – 15 kcal/mol

8. Which of the following is not a high-energy phosphate compound ?

(A) ATP

(B) Creatine phosphate

(C) AMP

(D) Phosphoenolpyruvate (PEP)

9. Which of the following can regenerate ATP from ADP ?

(A) Phosphoenolpyruvate

(B) AMP

(C) Glucose

(D) UTP

10. The redox potential (E°') is a measure of :

(A) Heat released

(B) Energy stored

(C) Free energy

(D) Tendency to gain or lose electrons

11. A molecule with a more positive redox potential :

(A) is a better electron donor

(B) is a better electron acceptor

(C) has more energy

(D) is unstable

12. Which of the following reactions is not directly coupled to ATP hydrolysis ?

(A) Muscle contraction

(B) Active transport

(C) Passive diffusion

(D) Biosynthesis of macromolecules

13. During oxidative phosphorylation, protons are pumped into :

(A) Cytoplasm

(B) Mitochondrial matrix

(C) Nucleus

(D) Intermembrane space

14. Oxidative phosphorylation refers to :

(A) Direct phosphorylation of ADP

(B) Phosphorylation using light

(C) ATP production via electron transport

(D) Breakdown of ATP

15. What is the primary function of biological oxidation ?

(A) Synthesis of proteins

(B) Storage of glucose

(C) Release of energy

(D) Formation of urea

16. Which anticancer drug inhibits dihydrofolate reductase ?

(A) 5-Fluorouracil

(B) Azathioprine

(C) Methotrexate

(D) Allopurinol

17. Which of the following inhibits thymidylate synthase ?

(A) Methotrexate

(B) 5-Fluorouracil

(C) Hydroxyurea

(D) Dactinomycin

18. Allopurinol decreases uric acid levels by :

(A) Inhibiting xanthine oxidase

(C) Blocking urate transporters

(B) Increasing excretion

(D) Increasing purine synthesis

19. Which of the following enzyme catalyzes the last step of glycolysis ?

(A) Hexokinase

(B) Enolase

(C) Phosphofructokinase-1

(D) Pyruvate kinase

20. In pyrimidine degradation, uracil is ultimately converted to :

(A) Xanthine

(B) Malonyl-CoA

(C) B-alanine

(D) Uric acid

21. The end product of purine catabolism in humans is :

(A) Hypoxanthine

(B) Xanthine

(C) Uric acid

(D) Allantoin

22. Severe combined immunodeficiency can result from deficiency of :

(A) Thymidylate synthase

(B) Adenosine deaminase

(C) HGPRT

(D) Xanthine oxidase

23. Lesch-Nyhan syndrome is characterized by :

(A) Severe immunodeficiency

(B) Gout, self-mutilation, and mental retardation

(C) Albinism

(D) Muscle weakness and atrophy

24. Unsaturation of fatty acids takes place in :

(A) Cytosol

(B) Smooth endoplasmic reticulum

(C) Mitochondria

(D) Lysosome

25. Sucrose (cane sugar) is a disaccharide. One molecule of sucrose on hydrolysis gives :

(A) 2 molecules of glucose

(B) 2 molecules of glucose + 1 molecule of fructose

(C) 1 molecule of glucose + 1 molecule of fructose

(D) 2 molecules of fructose

26. Identify the oxidized form of coenzymes :

(A) NADPH

(B) FAD

(C) NADH

(D) Ubiquinol

27. Derivatization of Niacin leads to the formation of :

(A) Carnitine

(B) FAD

(C) NADH

(D) ATP

28. Which one of the following vitamins is a precursor of FAD ?

(A) Vitamin B1

(B) Vitamin B2

(C) Vitamin B3

(D) Vitamin B5

29. A single molecule of Acetyl-CoA generates ..... molecules of NADH during Krebs cycle.

(A) Four

(B) Three

(C) Two

(D) One

30. Cleavage of Fructose 1, 6-biophosphate yields :

(A) Two aldoses

(B) Two ketoses

(C) An aldose and a ketose

(D) Only a ketose

31. The total number of ATP molecules synthesized in the glycolysis by substrate phosphorylation is :

(A) Two

(B) Four

(C) Six

(D) Eight

32. The product formed in the first substrate level phosphorylation step in glycolysis is :

(A) Pyruvate

(B) 3-phosphoglycerate

(C) 1, 3-bisphosphoglycerate

(D) 2-phosphoglycerate

33. Pyruvate dehydrogenase complex converts pyruvate in to :

(A) Oxaloacetate

(B) Lactate

(C) Acetyl-CoA

(D) Citrate

34. Which complex of electron transport chain is inhibited by Antimycin A ?

(A) Complex I

(B) Complex II

(C) Complex III

(D) Complex IV

35. ATP synthase is driven by :

(A) High energy phosphate transfer

(B) NADH oxidation

(C) Proton gradient

(D) Electron spin

36. Hydrolysis of lactose yields :

(A) D-galactose and D-glucose

(B) D-glucose and D-glucose

(C) D-galactose and D-fructose

(D) D-fructose and D-glucose

37. Which enzyme is involved in the pathway of ethanol fermentation ?

(A) Hexokinase

(B) Pyruvate decarboxylase

(C) Pyruvate dehydrogenase

(D) Pyruvate kinase

38. Which is the only TCA step that generates GTP ?

(A) Succinyl-CoA to succinate

(B) Citrate to isocitrate

(C) Fumarate to malate

(D) α-KG to succinyl-CoA

39. Which of the following condenses acyl and malonyl groups during fatty acid biosynthesis ?

(A) Acyl carrier protein

(B) Acetyl-CoA ACP transacetylase

(C) β-ketoacyl ACP synthase

(D) Malonyl-CoA ACP transferase

40. Which molecule condenses with acetyl-CoA to begin the TCA cycle ?

(A) Malate

(B) α-Ketoglutarate

(C) Oxaloacetate

(D) Fumarate

41. Which of the following amino acid is the precursor of cysteine ?

(A) Proline

(B) Glutamine

(C) Serine

(D) Glutamate

42. Which of the following is a non-essential amino acid ?

(A) Methionine

(B) Threonine

(C) Lysine

(D) Proline

43. Oxaloacetate is a precursor of Aspartate and :

(A) Serine

(B) Tyrosine

(C) Tryptophan

(D) Lysine

44. When a molecule of palmitic acid (16 : 0) is completely oxidized by β-oxidation, how many molecules of Acetyl-CoA are formed ?

(A) Seven

(B) Eight

(C) Nine

(D) Ten

45. When a molecule of palmitic acid (16 : 0) is completely oxidized by β-oxidation, how many molecules of NADH and $FADH_2$ are generated ?

(A) Seven

(B) Eight

(C) Nine

(D) Ten

46. Which of the following gives rise to Valine and Isoleucine ?

(A) Pyruvate

(B) Glutamate

(C) Aspartate

(D) Serine

47. Phosphoenol pyruvate and Erythrose 4-phosphate are precursors of :

(A) Histidine

(B) Aromatic amino acids

(C) Amino acids of aspartate family

(D) Amino acids of glutamate family

48. Identify the aromatic amino acid :

(A) Proline

(B) Lysine

(C) Phenylalanine

(D) Leucine

49. Which of the following is the precursor for auxin ?

(A) Phenylalanine

(B) Valine

(C) Tryptophan

(D) Arginine

50. Which of the following is an important precursor in the pyrimidine biosynthesis ?

(A) Glycine

(B) Aspartate

(C) Serine

(D) Leucine

51. Where are the enzymes for β-oxidation present ?

(A) Nucleus

(B) Cytosol

(C) Mitochondria

(D) Golgi Apparatus

52. The urea cycle primarily occurs in the :

(A) Kidney

(B) Muscle

(C) Brain

(D) Liver

53. The urea cycle converts toxic ammonia into :

(A) Urea

(B) Uric acid

(C) Creatinine

(D) Ammonium chloride

54. The final product of the urea cycle is formed by :

(A) CPS I

(B) Argininosuccinate lyase

(C) Arginase

(D) OTC

55. Dihydroxyacetone phosphate is rapidly and reversibly converted to :

(A) Glyceraldehyde 3-phosphate

(B) 1, 3-bis-phosphoglycerate

(C) Fructose 1, 6-bisphosphate

(D) Fructose 6-phosphate

56. Which one of the following is the end product of gluconeogenesis ?

(A) Glucose

(B) Citrate

(C) Pyruvate

(D) Glycine

57. Oxaloacetate is reduced to malate by :

(A) Pyruvate carboxylase

(B) Malate dehydrogenase

(C) Pyruvate kinase

(D) Phosphofructokinase-1

58. Which one out of the following enzymes acts in the pentose phosphate pathway ?

(A) Aldolase

(B) Glycogen phosphorylase

(C) Pyruvate kinase

(D) 6-phosphogluconate dehydrogenase

59. Glycerol is converted in to Glycerol 3-Phosphate by :

(A) Glycerol hydrolase

(B) Glycerol transferase

(C) Glycerol dehydrogenase

(D) Glycerol kinase

60. NADP is a cofactor used in :

(A) Catabolic reactions

(B) Anabolic reactions

(C) Elimination reaction

(D) Redox reactions

61. Which of the following is the Complex I of ETS ?

(A) NADH dehydrogenase

(B) Cytochrome c oxidase

(C) Cytochrome bc_1

(D) Succinate dehydrogenase

62. $NADP^+$ in its reduced form is :

(A) NAD

(B) NADH

(C) NADPH

(D) DPH

63. ATP synthesis via chemiosmosis mechanism is driven by :

(A) ATP Dehydrogenase

(B) ATP Synthase

(C) Kinase

(D) Phosphatase

64. Every cycle of B-oxidation produces :

(A) 1 FAD, 1 NAD^+ and 2 CO_2 molecules

(B) 1 $FADH_2$, 1 NADH and 1 acetyl co-A

(C) 1 $FADH_2$, 1 NAD^+ and 1 acetyl co-A

(D) 1 FAD, 1 NADH and 2 CO_2 molecules

65. Products of glucose oxidation essential for oxidative phosphorylation are :

(A) Pyruvate

(B) Acetyl-CoA

(C) NADPH and ATP

(D) NADH and $FADH_2$

66. NADH produced during glycolysis transfer electrons to the electron transport chain via :

(A) Malate-Aspartate shuttle

(B) Glycerol 3-phosphate shuttle

(C) Both (A) and (B)

(D) None of the above

67. Conversion of dUMP to dTMP is catalyzed by :

(A) Dihydroorotase

(B) Dihydrofolate reductase

(C) Thymidylate synthase

(D) Cytidylate synthase

68. Lesch-Nyhan Syndrom is due to deficiency of :

(A) Adenine Phosphoribosyl transferase

(B) Hypoxanthine-Guanine Phosphoribosyl transferase

(C) Xanthine Oxidase

(D) AMP Deaminase

69. Ribonucleotide reductase enzyme required for the biosynthesis of :

(A) Deoxyribonucleotides

(B) Histidine

(C) AMP

(D) CTP

70. How many double bonds are present in the linoleic acid ?

(A) One

(B) Two

(C) Three

(D) Four

71. Pentose phosphate pathway and malic enzymes provide ..... required for fatty acid synthesis.

(A) NADH

(B) FAD

(C) $FADH_2$

(D) NADPH

72. Carnitine Shuttle System has an important role in :

(A) β-oxidation of fatty acids

(B) Fatty acid synthesis

(C) Unsaturation of fatty acid

(D) All of the above

73. How many carbon atoms does citrate contain ?

(A) 4

(B) 2

(C) 6

(D) 8

74. Where are ketone bodies synthesized ?

(A) Brain

(B) Muscles

(C) Liver

(D) Adipose tissues

75. Identify the ketone bodies :

(A) Acetone

(B) Acetoacetate

(C) β-Hydroxybutyrate

(D) All of the above

76. Changes in enthalpy in an exothermic reaction is :

(A) Positive

(B) Negative

(C) Constant

(D) Neutral

77. Which of the following is a statement of the first law of thermodynamics ?

(A) Energy can be created and destroyed.

(B) Energy cannot be created or destroyed, only transformed.

(C) Entropy always decreases.

(D) The universe tends to maximum order.

78. A reaction is spontaneous when :

(A) ΔG is positive

(B) ΔG is zero

(C) ΔG is negative

(D) ΔH is positive

79. $\Delta G = \Delta H - T\Delta S$. In this equation, T refers to :

(A) Temperature in °C

(B) Temperature in °F

(C) Temperature in Kelvin

(D) Time

80. In the reduction of pyruvate to lactate, which of the following is regenerated ?

(A) H^+

(B) NADH

(C) NAD^+

(D) FAD

81. Which of the following is not a monosaccharide with 5 carbon atoms ?

(A) Arabinose

(B) Xylulose

(C) Trehalose

(D) Ribulose

82. Glycolysis begins with which of the following reactions ?

(A) Reduction

(B) Oxidation

(C) Phosphorylation

(D) Acidification

83. In which of the following forms, glucose is stored in the liver ?

(A) Glycogen

(B) Starch

(C) Dextrin

(D) Cellulose

84. Which of the following amino acids is exclusively ketogenic ?

(A) Leucine

(B) Asparagine

(C) Threonine

(D) Proline

85. Proline is the cyclized derivative of :

(A) Glutamate

(B) Arginine

(C) Glutamine

(D) Serine

86. Albinism is a disorder caused by a deficiency in which enzyme ?

(A) Phenylalanine hydroxylase

(B) Tyrosinase

(C) Tryptophan hydroxylase

(D) Histidine hydroxylase

87. Which of the following complexes of electron transport chain does not account for the pumping out of protons from the mitochondrial matrix ?

(A) Complex I

(B) Complex III

(C) Complex II

(D) Complex IV

88. Oxidation of 3 molecules of glucose by pentose phosphate pathway results in production of :

(A) 3 molecules of pentose, 6 molecules of NADPH and 3 molecules of CO_2

(B) 4 molecules of pentose, 6 molecules of NADPH and 3 molecules of CO_2

(C) 4 molecules of pentose, 3 molecules of NADPH and 3 molecules of CO_2

(D) 3 molecules of pentose, 4 molecules of NADPH and 3 molecules of CO_2

89. The use of NADPH generated from pentose phosphate pathway cannot be :

(A) Oxidized in the electron transport chain to provide 38 ATPs

(B) Used for the synthesis of fatty acids

(C) Used for steroid synthesis

(D) All of the above

90. Glucagon is released from :

(A) Muscle

(B) Pancreas

(C) Kidneys

(D) Epithelial tissues

91. Protein that contains a nucleic acid derivative of riboflavin is called :

(A) Nucleic acid

(B) Amino acid

(C) Flavoprotein

(D) None of the above

92. Phosphatidylcholine is found naturally in the body in all cells. Phosphatidylcholine is member of :

(A) Sphingophospholipids

(B) Glycolipids

(C) Glycerophospholipids

(D) Sterols

93. In the TCA cycle, one molecule of Acetyl-CoA upon complete oxidation produces :

(A) 2 GTP, 2 $FADH_2$ and 2 NADH

(B) 1 GTP, 3 $FADH_2$ and 1 NADH

(C) 1 GTP, 1 $FADH_2$ and 3 NADH

(D) 3 GTP, 1 $FADH_2$ and 2 NADH

94. Complex II of electron transport chain is also called :

(A) NADH dehydrogenase

(B) Succinate dehydrogenase

(C) Cytochrome bc1 complex

(D) Cytochrome oxidase

95. NADH and $FADH_2$ is associated with respectively :

(A) Complex II and complex III of electron transport chain

(B) Complex I and complex III of electron transport chain

(C) Complex III and complex IV of electron transport chain

(D) Complex I and complex II of electron transport chain

96. In the electron transport chain, each pair of electron donated by NADH releases sufficient energy to produce :

(A) 0.5 ATP

(B) 1.5 ATP

(C) 2.5 ATP

(D) 3.5 ATP

97. Which of the following is *not true* for cytochrome c oxidase complex ?

(A) It donates electrons to O_2.

(B) It accepts electrons from cytochrome c.

(C) It pumps two protons out of the mitochondrial matrix.

(D) It is not inhibited by cyanide.

98. Where does oxidative phosphorylation take place ?

(A) Ribosomes

(B) Nucleus

(C) Mitochondria

(D) Cell membrane

99. Which of the following produces α-ketoglutarate ?

(A) Leucine

(B) Threonine

(C) Methionine

(D) Proline

100. 3-phosphoglycerate is not the metabolic precursor for :

(A) Serine

(B) Glycine

(C) Cysteine

(D) Arginine

(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।