

Roll No.

Question Booklet Number

O. M. R. Serial No.

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M. Sc. (Biochemistry) (Second Semester)

EXAMINATION, July, 2022

BIOENERGETICS AND INTERMEDIARY METABOLISM

Paper Code

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Questions Booklet
Series

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Time : 1:30 Hours]

[Maximum Marks : 100

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 60 questions. Examinee is required to answer any 50 questions in the OMR Answer-Sheet provided and not in the question booklet. If more than 50 questions are attempted by student, then the first attempted 50 questions will be considered for evaluation. 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 60 प्रश्न हैं। परीक्षार्थी को किन्हीं 50 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। यदि छात्र द्वारा 50 से अधिक प्रश्नों को हल किया जाता है तो प्रारम्भिक हल किये हुए 50 उत्तरों को ही मूल्यांकन हेतु सम्मिलित किया जाएगा। 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. Production of NADPH in a chloroplast takes place during ?
 - (A) cyclic photophosphorylation
 - (B) non cyclic photophosphorylation
 - (C) series photophosphorylation
 - (D) substrate-level photophosphorylation
2. The primary electron acceptor in cyclic photophosphorylation is :
 - (A) a protein that contains iron and sulphur
 - (B) carbon dioxide
 - (C) FAD
 - (D) NADP
3. The pigment molecules of a chloroplast are located :
 - (A) within its thylakoid membranes
 - (B) within its intrathylakoid spaces
 - (C) within its inner membrane
 - (D) within the space between its inner and outer membrane
4. In plant cell, the light reactions of photosynthesis take place in the :
 - (A) cytosol
 - (B) endoplasmic reticulum
 - (C) chloroplasts
 - (D) leucoplasts
5. The molecule in the Calvin-Benson cycle that combines with carbon dioxide is :
 - (A) glyceraldehyde phosphate
 - (B) ribulose biphosphate
 - (C) phosphoenol pyruvic acid
 - (D) citric acid
6. Some important hormones involved in carbohydrate metabolism are :
 - (A) insulin, glucagon, epinephrine and parathormone
 - (B) insulin, glucagon, epinephrine and glucocorticoids
 - (C) insulin, glucagon, calcitonin and glucocorticoids
 - (D) epinephrine, neotin, glucagon and insulin
7. The mechanism of ATP formation both in chloroplast and mitochondria is explained by :
 - (A) Relay pump theory of Godlewski
 - (B) Cholodny-Wont's Model
 - (C) Chemiosmotic theory
 - (D) Munch's pressure/Mass flow model
8. β -oxidative enzymes bring about oxidation of :
 - (A) sugars
 - (B) fatty acids
 - (C) amino acids
 - (D) polypeptides

9. The pathway of Kreb's cycle is used for the synthesis of the amino acids :
- (A) glutamic acid and aspartic acid
 - (B) alanine and glycine
 - (C) glutamic acid and valine
 - (D) arginine and tryptophan
10. In Kreb's cycle FAD is the electron acceptor during the conversion of :
- (A) succinyl CoA to succinic acid
 - (B) α -keto glutaric acid to succinyl CoA
 - (C) fumaric acid to malic acid
 - (D) succinic acid to fumaric acid
11. The chief constituents of Hill reaction are :
- (A) ATP and NADPH₂ in chloroplast
 - (B) ATP and NADPH₂, in mitochondria
 - (C) Only oxygen
 - (D) A reduced substance and O₂ in chloroplast
12. What is the correct sequence of electron transport in a respiratory chain ?
- (A) Ubiquinone \rightarrow Flavoprotein \rightarrow NADH-Cytochrome \rightarrow Cytochrome b \rightarrow Cytochrome c \rightarrow Cytochrome c₁
 - (B) NADH \rightarrow Flavoprotein \rightarrow Ubiquinone \rightarrow Cytochrome b \rightarrow Cytochrome c \rightarrow Cytochrome a
 - (C) Flavoprotein \rightarrow NADH \rightarrow Ubiquinone \rightarrow Cytochrome c \rightarrow Cytochrome c₁ \rightarrow Cytochrome b
 - (D) NADH \rightarrow Ubiquinone \rightarrow Flavoprotein \rightarrow Cytochrome c \rightarrow Cytochrome c₁ \rightarrow Cytochrome b \rightarrow Cytochrome a
13. Which one of the following is not the function of the citric acid cycle ?
- (A) generation of guanosine triphosphate (GTP)
 - (B) generation of reduced nicotinamide adenine dinucleotide (NADH) and reduced flavin-adenine dinucleotide (FADH₂)
 - (C) complete catalysis of oxidation to carbon dioxide and water
 - (D) net synthesis of oxaloacetate from acetyl coenzyme A (acetyl CoA)

14. Glycolysis is regulated by all the enzymes except :
- (A) hexokinase
 - (B) phosphohexose isomerase
 - (C) phosphofructokinase
 - (D) pyruvate kinase
15. Consider the following statements in citric acid cycle :
- (1) Three hydride ions (hence, six electrons) are transferred to 3 NAD⁺ molecules.
 - (2) One pair of hydrogen atoms (hence, two electrons) are transferred to one NADP⁺ molecule.
 - (3) One pair of hydrogen atoms (hence, two electrons are transferred to a FAD molecule).
 - (4) One NADH molecule is utilized in the process.
- Which of these statements are correct ?
- (A) 1 and 2
 - (B) 1 and 3
 - (C) 2 and 4
 - (D) 1, 3 and 4
16. Fat formation from glucose takes place in order to :
- (A) relieve liver from excess of glycogen
 - (B) remove excess of fatty acids from circulation
 - (C) keep blood sugar level constant
 - (D) all of the above
17. All the following amino acids contain only methyl or methylene groups as constituents of their side chains except :
- (A) valine
 - (B) alanine
 - (C) glycine
 - (D) leucine
18. Glucose is converted to glycogen in the :
- (A) mouth cavity
 - (B) intestine
 - (C) liver
 - (D) kidney
19. The long chain of fatty acid is gradually broken down until it is reduced to 2C-atom by the process called :
- (A) degradation of fats
 - (B) oxidation
 - (C) β -oxidation
 - (D) none of the above

20. End product of protein catabolism is :
- urea
 - uric acid
 - glutamine
 - ammonia
21. The hydrolysis of fats is accelerated by the presence of which of the following cations/ions ?
- Na^+
 - Mg^{++}
 - Ca
 - Fe^{++}
22. The monosaccharides like glucose and fructose exist :
- only in rings form
 - only in open straight chain
 - both in ring and open straight chain form
 - none of the above
23. The first step of β -oxidation involves the activation of fatty acid in the presence of :
- ATP and aldehyde dehydrogenase
 - ATP and thiokinase enzyme
 - ATP and 3-ketoacyl thiolase
 - Ca^{++} and thiokinase enzyme
24. In glycolysis, ultimately :
- fructose is converted into glucose
 - protein is converted into glucose
 - glucose is converted into pyruvic acid
 - starch is converted to glucose
25. In hexose monophosphate shunt, number of molecules of carbon dioxide evolved is :
- same as glycolysis
 - more than glycolysis
 - less than glycolysis
 - much less than glycolysis
26. During glycolysis, ATP and the coenzyme Mg^{++} help the enzyme activity of :
- enolase
 - pyruvic acid kinase
 - phosphohexose isomerase
 - glucokinase
27. Net gain of ATP molecules in anaerobic respiration, i.e. breakdown of one molecule of glucose into two molecules of pyruvic acid is :
- two
 - thirty six
 - four
 - thirty eight

28. Which of the following processes releases a carbon dioxide molecule ?
- (A) glycolysis
 - (B) lactic acid fermentation
 - (C) hydrolysis of glucose
 - (D) alcoholic fermentation
29. Most of the energy in the cells is liberated by oxidation of carbohydrates when :
- (A) pyruvic acid is converted into acetyl-CoA
 - (B) pyruvic acid is converted into CO and H₂O
 - (C) sugar is converted into pyruvic acid
 - (D) glucose is converted into alcohol and CO₂
30. In human final product of purine degradation is :
- (A) urate
 - (B) urea
 - (C) thymidine
 - (D) xanthine
31. Free energy liberated during oxidation per mole palmitic acid is AG [cal/mole] :
- (A) – 4600
 - (B) 326,000
 - (C) – 686,000
 - (D) – 2,338,000
32. Which one of the following is an isoenzyme ?
- (A) Lactic dehydrogenase
 - (B) Hexokinase
 - (C) Citrate synthetase
 - (D) Aldolase
33. β -oxidation pathway of fatty acid oxidation resembles :
- (A) Krebs's cycle
 - (B) ETS
 - (C) glycolysis
 - (D) Calvin cycle
34. Combination of apoenzyme and co-enzyme is known as :
- (A) prosthetic group
 - (B) holoenzyme
 - (C) enzyme product complex
 - (D) enzyme substrate complex

35. The link between glycolysis and Kreb's cycle is :
- (A) pyruvic acid
 - (B) malic acid
 - (C) acetyl CoA
 - (D) oxaloacetic acid
36. The phenomenon of inhibitory effect on photosynthesis due to extremely intense light is called as :
- (A) ionization
 - (B) solarization
 - (C) polarization
 - (D) evaporation
37. Chemi-osmotic hypothesis of oxidative phosphorylation was proposed by :
- (A) Slater
 - (B) Boyer
 - (C) Mitchell
 - (D) Green and Ji
38. In *Panicum maximum* and *Chloris gayana* the C_4 -pathway is type :
- (A) NADP-ME
 - (B) PCK
 - (C) NAD-ME
 - (D) All of the above
39. Which of the following fatty acids has the lowest melting point ?
- (A) Fatty acids with sites of unsaturation with cis double bonds
 - (B) Fatty acids with sites of unsaturation with trans double bonds
 - (C) Fatty acids with no sites of unsaturation
 - (D) Fatty acids with longer hydrophobic tails
40. A structural characteristics common to lipids which allow them to function as good energy stores is :
- (A) They are all hydrophobic
 - (B) They are all hydrophilic
 - (C) They have large numbers of carbon-phosphorus bonds
 - (D) They have large numbers of carbon-hydrogen bonds

41. Keratin is a protein having large amount of :
 (A) calcium
 (B) magnesium
 (C) sulphur
 (D) phosphorus
42. Ribozyme is :
 (A) RNA with extra phosphate
 (B) RNA without phosphate
 (C) RNA without sugar
 (D) RNA with enzyme activity
43. Which of the following statements regarding C₄ plants is/are true ?
 (1) The C₄ plants are considered to possess greater photosynthetic efficiency as compared to Calvin cycle plants
 (2) They can utilise greater light intensities
 (3) Their temperature optima for photosynthesis exceeds those of C₄ plants
 (4) Extensive peripheral reticulum is present in the chloroplasts of these plants
 (A) 1 and 2
 (B) 1, and 3
 (C) 2 and 4
 (D) All of the above
44. Which of the following statements is/are true regarding pentose-phosphate pathway ?
 (A) It provides ribose sugar for the synthesis of nucleic acids
 (B) It provides alternative route for lipid metabolism
 (C) It plays important role in fixation of nucleic acids
 (D) Both (A) and (C) are correct
45. Wavelength of light shorter than 680 m affects both pigments system I and II, while wavelength longer than 680 μm affects only :
 (A) Pigment system II
 (B) Pigment system I
 (C) Both (A) and (B)
 (D) None of the above

46. How many molecules of oxygen (O_2) are used during the glycolysis of one glucose molecule ?
- zero
 - one
 - sixteen
 - thirty eight
47. Which of the following intermediates can be isolated from yeast that is fermenting wine but not from healthy muscle ?
- citrate
 - acetaldehyde
 - lactate
 - acetyl CoA
48. Glyceraldehyde phosphate is oxidized during glycolysis. What happens to the hydrogen atom and the electron that are removed during oxidation ?
- They oxidize NAD^+
 - They reduce NAD^+
 - They are transferred to pyruvic acid
 - They are eliminated in the form of methane
49. The production of ATP by oxidative phosphorylation is driven by the energy from :
- coenzyme A
 - isomerization of the cytochromes
 - the formation of NADH
 - the diffusion of protons from the intermembrane space to the matrix of the mitochondrion
50. The function of coenzyme A is to :
- isomerize pyruvic acid
 - isomerize NAD
 - activate the acetyl group
 - facilitate oxidative phosphorylation
51. The free energy change ΔG from the conversion of one molecule of glucose to six molecules of carbon dioxide is – 686 kcal/mol, yet only about 266 kcal/mol of this is captured within ATP molecule. The rest is :
- converted to heat
 - lost within carbon dioxide
 - transferred to water
 - used to form lactic acid
52. Oxygen, which forms part of the electron transport system, enters the mitochondrion as an atom in :
- glucose ($C_6H_{12}O_6$)
 - pyruvic acid ($C_3H_4O_3$)
 - oxygen gas (O_2)
 - carbon dioxide (CO_2)
53. In a eukaryotic cell; glycolysis takes place :
- within the nucleus
 - on the rough endoplasmic reticulum
 - in the cytoplasm but outside the organelles
 - within the mitochondria

54. Which of the following statements regarding fatty acid as respiratory substrate is/are true ?
- (1) A fatty acid enters cellular respiration as acetyl CoA.
 - (2) The rate of ATP production is slower than when glucose is used.
 - (3) An oxygen atom has to be added to each of the two carbon fragment of a fatty acid before it can be used in cellular respiration.
 - (4) Catabolism of fatty acids requires more oxygen.
- (A) 1 and 2
 - (B) 2 and 3
 - (C) 1 and 3
 - (D) all of the above
55. The point in cellular respiration at which a particular amino acid enters depends on the :
- (A) temperature of the cell
 - (B) pH of the cell
 - (C) particular R group of the amino acid
 - (D) phase of cellular respiration that needs fuel
56. Fatty acids enter cellular respiration as :
- (A) one-carbon fragments
 - (B) two-carbon fragments
 - (C) three-carbon fragments
 - (D) long chains of 20 carbon atoms
57. The electron transport chain is a group of molecules located in the :
- (A) inner membrane of the mitochondria
 - (B) intermembrane space of the mitochondria
 - (C) matrix of the mitochondria
 - (D) outer membrane of the mitochondria
58. The inner membrane of the mitochondria is very selective about what it normally allows to enter to organelle. One molecule it regularly allows in is :
- (A) citric acid
 - (B) ATP
 - (C) glucose
 - (D) pyruvic acid
59. The Krebs's citric acid cycle and terminal electron transport take place :
- (A) within the nucleus
 - (B) in the cytoplasm but outside the organelles
 - (C) on the rough endoplasmic reticulum
 - (D) mitochondrial matrix
60. Photophosphorylation in a chloroplast is most similar to which of the following mitochondrial reactions ?
- (A) oxidative phosphorylation
 - (B) hydrolysis
 - (C) oxidative decarboxylation
 - (D) substrate-level phosphorylation

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

Example :

Question :

Q. 1 (A) ☒ (B) (C) (D)

Q. 2 (A) (B) ☒ (C) (D)

Q. 3 (A) ☒ (B) (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 एक सबसे सही अथवा सबसे उपयुक्त उत्तर छोटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ☒ (B) (C) (D)

प्रश्न 2 (A) (B) ☒ (C) (D)

प्रश्न 3 (A) ☒ (B) (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।