

Roll No.

Question Booklet Number

O. M. R. Serial No.

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M. Sc. (Microbiology) (Second Semester)

EXAMINATION, July, 2022

BACTERIAL METABOLISM & PHYSIOLOGY

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. The membrane potential produces a force :
 - (A) opposing ion movements that increase V_m
 - (B) driving ion movements that reduce V_m
 - (C) Both (A) and (B)
 - (D) None of the above
2. In Calvin cycle, 1 molecule of glucose is formed from :
 - (A) $6\text{CO}_2 + 30\text{ATP} + 12\text{NADPH}$
 - (B) $6\text{CO}_2 + 12\text{ATP}$
 - (C) $6\text{CO}_2 + 18\text{ATP} + 12\text{NADPH}$
 - (D) $6\text{CO}_2 + 18\text{ATP} + 30\text{NADPH}$
3. Gene expression in Nif operons is dependent on :
 - (A) RNA polymerase σ_{54} factor
 - (B) Nif A and Nif L
 - (C) Only (B)
 - (D) Both (A) and (B)
4. Where are bacteriochlorophyll present in the cell ?
 - (A) Chloroplast
 - (B) Cytoplasm
 - (C) Mitochondria
 - (D) Membrane
5. Mention the part that is not involved in Krebs's cycle :
 - (A) Acetylation
 - (B) Dehydrogenation
 - (C) Oxidative Phosphorylation
 - (D) Decarboxylation
6. The free-energy change for transport, G_t is :

$$\Delta G_t = RT \ln \frac{C_2}{C_1}$$

If there is a tenfold difference in concentration between two compartments, the cost of moving 1 mol of an uncharged solute at 25°C across a membrane separating the compartments is therefore :

 - (A) 5.7 kJ/mol
 - (B) 6.9 kJ/mol
 - (C) 10 kJ/mol
 - (D) 15 kJ/mol

7. Instead of $-\text{CH}_3$ group at the third C of the side group of Chla, Chlb has :
 - (A) $-\text{COOH}$ group
 - (B) $-\text{CO}$ group
 - (C) $-\text{CHO}$ group
 - (D) $-\text{OH}$ group
8. Iron-transport molecules are :
 - (A) Hydroxamates
 - (B) Catecholates
 - (C) Both (A) and (B)
 - (D) None of the above
9. Na^+ glucose transporter is an example of :
 - (A) Symport
 - (B) Antiport
 - (C) Facilitated diffusion
 - (D) ATP driven active transport
10. Which of the following is a chlorophyll molecule lacking central Mg^{2+} ion ?
 - (A) Chla
 - (B) Bacteriochlorophyll
 - (C) Chlc
 - (D) Pheophytin
11. The statement correct about rTCA cycle :
 - (A) Key enzymes are ATP citrate lyase, α -ketoglutarate synthase, fumarate reductase
 - (B) It is a reductive pathway
 - (C) Pathway present in Archaea
 - (D) All of the above
12. Hydrogen-oxidizing microorganism :
 - (A) Can oxidize hydrogen gas to produce energy
 - (B) Donate electrons either to an electron transport chain or to NAD, depending on the hydrogenase
 - (C) Only (A)
 - (D) Both (A) and (B)
13. The region in which bacteriochlorophyll can absorb light is :
 - (A) Ultraviolet region
 - (B) Infrared region
 - (C) Visible region
 - (D) Microwave region
14. Phycobilins (phycoerythrin and phycocyanin) are accessory pigments found in :
 - (A) Green plants
 - (B) Cyanobacteria and red algae
 - (C) Blue green algae and diatoms
 - (D) Red algae and brown algae
15. Name the physiochemical process in which chemical energy is produced by light energy :
 - (A) Photosynthesis
 - (B) Respiration
 - (C) Oxidative decarboxylation
 - (D) Oxidative phosphorylation

16. Which statement is not correct about the effect of presence of reduced nitrogen sources on nitrogenase enzyme complex :
- (A) Nitrogenase enzyme synthesis is regulated at transcriptional level
 - (B) Reversibly inactivated by ADP-ribosylation of Fe protein
 - (C) Reversibly inactivated by ADP-ribosylation of Mo-Fe protein
 - (D) Interfering with the supply of reductant to nitrogenase
17. Which of the following statements are true regarding Photosystems ?
- (A) Photosystems are arrangements of chlorophyll and other pigments packed into membrane.
 - (B) Many prokaryotes have only one photosystem.
 - (C) Both (A) and (B) are correct
 - (D) Only (A) is correct.
18. Which of the following is an anoxygenic photosynthetic organism ?
- (A) Plants
 - (B) Photosynthetic protists
 - (C) Cyanobacteria
 - (D) Green and Purple photosynthetic organism
19. Anoxygenic photosynthetic bacteria are :
- (A) Photoautotrophs
 - (B) Photoheterotrophs
 - (C) Detritivores
 - (D) Omnivores
20. Which statement is not true about nitrifying bacteria ?
- (A) Biological ammonia oxidation to nitrate
 - (B) Reduction of nitrate to ammonia
 - (C) Use proton motive force to reverse the flow of electrons and reduce NAD
 - (D) Make ATP by oxidative phosphorylation
21. Solutes that are compatible with metabolism and growth at high intracellular concentrations :
- (A) choline, betaine, proline
 - (B) arabitol, glycerol and mannitol
 - (C) potassium ions
 - (D) All of the above
22. Some anoxygenic phototrophs use hydrogen sulfide instead of water to do photosynthesis. Finish the following equation : $\text{CO}_2 + 2\text{H}_2\text{S} + \text{photons} \rightarrow$
- (A) $\text{H}_2\text{O} + 2\text{S} + \text{neutrons}$
 - (B) $\text{CH}_2\text{O} + \text{H}_2\text{O} + 2\text{S}$
 - (C) $\text{CH}_2\text{S} + \text{O}_2 + \text{energy}$
 - (D) $\text{CH}_2\text{S} + \text{SO} + \text{light}$

23. Cyclic photophosphorylation results in the formation of :
- (A) ATP
 - (B) NADPH
 - (C) ATP + NADPH
 - (D) ATP + NADPH and O₂
24. The cell yield of type I organisms from a given amount of methane or methanol is higher than the cell yield of type II organisms because :
- (A) Lower energy requirement of RuMP pathway
 - (B) Less production of ATP during Serine pathway
 - (C) Both (A) and (B)
 - (D) None of the above
25. Quorum sensing is used by bacterial cells to determine which of the following ?
- (A) the size of the population
 - (B) the availability of nutrients
 - (C) the speed of water flow
 - (D) the density of the population
26. Manganese is required in :
- (A) Chlorophyll synthesis
 - (B) Nucleic acid synthesis
 - (C) Plant cell wall formation
 - (D) Photolysis of water during photosynthesis
27. The final product of Calvin cycle is :
- (A) RuBP
 - (B) Glucose
 - (C) Dihydroxy acetone phosphate
 - (D) Glyceraldehyde-3-phosphate
28. Reduction of NADP occurs in :
- (A) Oxidative photophosphorylation
 - (B) Cyclic photophosphorylation
 - (C) Non-cyclic photophosphorylation
 - (D) None of the above
29. Sulfur oxidizing chemolithotrophs can not oxidize :
- (A) SO₃⁻
 - (B) SO₄²⁻
 - (C) H₂S
 - (D) S⁰
30. Electrons from the excited chlorophyll molecules of PS-II are first accepted by :
- (A) Pheophytin
 - (B) Ferredoxin
 - (C) Cytochrome f
 - (D) Cytochrome b

31. Gases such as carbon dioxide and oxygen cross the cell membrane by :
- (A) Primary active transport
 - (B) Secondary active transport
 - (C) Passive diffusion through lipid bilayer
 - (D) Gas transport protein
32. Aquaporins and glucose transporter are examples of :
- (A) Simple diffusion
 - (B) Osmosis
 - (C) Facilitated diffusion
 - (D) Active transport
33. In what case, the transporters are known as antiporters ?
- (A) when 2 substances move in same direction
 - (B) when 2 substances move in same direction and 1 in opposite
 - (C) when 3 substances move in same direction
 - (D) when 2 substances move in opposite direction
34. The biological reduction of di-nitrogen to ammonia is catalysed by how many types of nitrogenase enzyme complex ?
- (A) Three types
 - (B) Four types
 - (C) Five types
 - (D) Six types
35. Which statement is correct about ABC transporters ?
- (A) use the energy of ATP hydrolysis
 - (B) can transport include ions, amino acids, peptides, sugars
 - (C) None of the above
 - (D) Both of the above
36. What is the first reaction of the pentose-phosphate pathway ?
- (A) Oxidation of glucose 6-phosphate to 6-phosphoglucono- δ -lactone
 - (B) Oxidation of 6-phosphogluconate to ketopentose ribulose 5-phosphate
 - (C) Reduction of 6-phosphoglucono- δ -lactone to glucose 6-phosphate
 - (D) Reduction of ketopentose ribulose 5-phosphate to 6-phosphogluconate

37. Electrochemical gradient exists whenever there is :
- (A) A net difference in charges
 - (B) Excess liquids
 - (C) No difference in charges
 - (D) None of the above
38. Which statement is not true for PEP-PTS ?
- (A) Phosphorylation of molecule while transportation
 - (B) Oxidation of molecule while transportation
 - (C) Involves two enzymes
 - (D) Heat-stable protein is a part of PEP-PTS
39. In EMP pathway, the process by which ATP is formed from ADP is :
- (A) Reduction
 - (B) Oxidative phosphorylation
 - (C) Substrate-level phosphorylation
 - (D) Photophosphorylation
40. Which statement is not true about passive diffusion ?
- (A) The rate of passive diffusion is dependent on the size of the concentration gradient
 - (B) The rate of uptake decreases as more nutrient is acquired
 - (C) ATP required
 - (D) Larger molecules, ions, and polar substances do not cross membranes by passive diffusion
41. What is the similarity between active transport and facilitated diffusion ?
- (A) Both face saturation effect
 - (B) Requires transporters
 - (C) Depend upon H^+ gradient across membrane
 - (D) Both (A) and (B)
42. Which of the following statements is correct about oxidative pentose phosphate pathway ?
- (A) It generates NADH
 - (B) It oxidizes NADPH to $NADP^+$
 - (C) The pathway supplies ribose 5-phosphate and NADPH in the quantities the cell requires
 - (D) Glucose 6-phosphatase catalyzes the rate limiting reaction of the pathway

43. Drastic variations in cytoplasmic pH can harm microorganisms by :
- (A) disrupting the plasma membrane
 - (B) inhibiting the activity of enzymes
 - (C) inhibiting the activity of transport proteins
 - (D) All of the above
44. Nitrogenase can reduce a variety of molecules other than N_2 :
- (A) Acetylene
 - (B) Cyanide
 - (C) None of the above
 - (D) Both (A) and (B)
45. Group translocation system is a method of :
- (A) transport of nutrients in prokaryotes
 - (B) transport of nutrients in eukaryotes
 - (C) transport ions
 - (D) energy-independent transport
46. Besides their role in transport, which protein can act as chemoreceptors for chemotaxis ?
- (A) PTS proteins
 - (B) Solute binding protein
 - (C) Heat resistant protein
 - (D) Both (A) and (B)
47. Cleavage of Fructose 1, 6-bisphosphate yields :
- (A) Two aldoses
 - (B) Two ketoses
 - (C) An aldose and a ketose
 - (D) Only a ketose
48. Bioluminescence is created by enzyme luciferase on chemical reaction of fatty aldehyde and FMNH₂ with :
- (A) CO₂
 - (B) Methane
 - (C) O₂
 - (D) Hydrogen

49. Which of the following is the uphill process ?
- (A) Passive transport
 - (B) Diffusion
 - (C) Osmosis
 - (D) Active transport
50. Secondary active transport depends upon :
- (A) ATP
 - (B) H^+ and Na^+ gradient
 - (C) NADH
 - (D) $FMNH_2$
51. ED pathway first reported in :
- (A) *Pseudomonas saccharophila*
 - (B) *Bacillus subtilis*
 - (C) *Salmonella typhimurium*
 - (D) *Xanthomonas campestris*
52. Nitrifying bacteria belongs to the nutritional class of _____.
- (A) Chemoorganoautotrophy
 - (B) Photolithoautotrophy
 - (C) Chemolithoautotrophy
 - (D) Photoorganoheterotrophy
53. In primary active transport, solute accumulation is coupled directly to an exergonic chemical reaction :
- (A) ATP to ADP and P_i
 - (B) NADH to NAD^+
 - (C) Glucose oxidation
 - (D) None of the above
54. Which of the following are characteristics of active transport ?
- (A) Uphill process
 - (B) Require energy
 - (C) Against electrochemical gradient
 - (D) All of the above
55. The activity of this enzyme increases when the ATP supply of a cell depletes :
- (A) Glucokinase
 - (B) Phosphofructokinase-I
 - (C) Hexokinase
 - (D) Pyruvate kinase

56. Phenomenon of plasmolysis cannot be seen in :
- (A) Bacteria
 - (B) Animal cells
 - (C) Plant cells
 - (D) Fungal cells
57. A number of pressures may have selected for multicellularity, including :
- (A) physicochemical stress
 - (B) nutrient scarcity
 - (C) predation
 - (D) All of the above
58. ABC transporters employ special substrate binding proteins :
- (A) Present in the periplasmic space of Gram-negative bacteria
 - (B) Present in the cytoplasm
 - (C) None of the above
 - (D) Both (A) and (B)
59. Which is a wrong statement for bacterial transport system ?
- (A) Often a microorganism has more than one transport system for each nutrient
 - (B) A proton gradient can power active transport either directly or indirectly
 - (C) linked transport of two substances in one direction is called antiport
 - (D) Active transport is thermodynamically unfavorable (endergonic) process
60. The enzyme responsible for production of pyruvate and glyceraldehyde 3-phosphate :
- (A) 6-phosphogluconate dehydratase
 - (B) KDPG aldolase
 - (C) glucose-6-phosphate dehydrogenase
 - (D) PEP kinase

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।