

A

Test Registration No. _____



The Maharaja Sayajirao University of Baroda
Faculty of Science
M.Sc. ENTRANCE EXAMINATION

SUBJECT: MICROBIOLOGY
DAY: TUESDAY

TIME : 12-1.30pm
DATE: 5th JULY, 2022

Important Instructions:

1. This test booklet is to be opened only when instructed by the invigilators to do so.
2. This booklet carries **100** questions in **14** printed pages. All carry equal marks.
3. For every correct answer, candidate will earn **1** mark, for every wrong answer 0.25 mark will be deducted.
4. Test Registration Number must be entered correctly in the OMR answer sheet, as advised by the invigilators. The Question Booklet code (A/B/C/ D) must also be mentioned on the OMR answer sheet (if not printed already) as instructed.
5. Answers must be marked in the OMR answer sheet using a black or dark blue ball point pen only. The circle should be filled in completely, leaving no gaps.
6. Gadgets (Mobile phones, pagers, ear phones, music players, calculators smart watches etc.) are strictly prohibited in the exam hall. If any candidate is found in possession of any of these at his/her exam seat, he/she is liable to be disqualified.
7. In case of tie in the marks the merit will be considered based on total marks in the qualifying examination.

Correct way of marking answer:

A B C D
● ○ ○ ○

Incorrect ways of marking answer:

○ A B C D ○ A B C D
✓ ○ ○ ○ ✎ ○ ○ ○ ○
✗ A B C D
○ ○ ○ ○

Invigilator's Signature: _____

1. It is thought that all cellular life has descended from LUCA. What is LUCA?
 - A. Latest Universal Common Ancestor
 - B. Last Universal Cell Ancestor
 - C. Last Universal Common Ancestor
 - D. Last Unicellular Ancestor
2. Legumes have close association of bacteria that reside in their nodules. These bacteria convert
 - A. Nitrogen to Nitrate
 - B. Nitrate to Ammonia
 - C. Nitrogen to urea
 - D. Nitrogen to ammonia
3. Does spontaneous generation of life occur? This question was clearly solved by
 - A. Cohn and Spallanzani
 - B. Pasteur and Koch
 - C. Pasteur and Hooke
 - D. Koch and Metchnikoff
4. Which of the following Scientists is correctly matched with their invention/discovery?
 - A. Carl Woese – Discovery of Prions
 - B. Stanley Pruisner-Discovery of Archaea
 - C. Kary Mullis-Invention of Polymerase Chain Reaction
 - D. David Baltimore- Discovery of DNA Polymerase
5. For a laboratory compound microscope, what will be the resolving power when $\lambda=650\text{nm}$ and the $\text{NA}=0.25$?
 - A. 1300nm
 - B. 1200nm
 - C. 3250 nm
 - D. 3520nm
6. When the radius of a coccus is 1 micrometer, then the Surface area/Volume ratio of that cell is _____ a cell of 2 micrometer radius.
 - A. Two times higher than
 - B. Half of
 - C. Ten times higher than
 - D. Ten times lower than
7. Molybdenum is part of which of the enzymes possessed by bacteria?
 - A. Carbonic anhydrase
 - B. Nitrogenase
 - C. Formate dehydrogenase
 - D. Cytochrome oxidase
8. McConkey agar helps distinguish between
 - A. Lactose utilizing and glucose utilizing organism
 - B. Lactose fermenting and lactose non-fermenting organisms

- C. Gram positive and Gram negative organisms
 - D. Hemolytic and non-hemolytic organisms
9. Which of the following antibiotics is NOT a bacterial cell wall synthesis inhibitor?
 - A. Penicillin
 - B. Cephalosporin
 - C. Tetracycline
 - D. Vancomycin
 10. Which one of the following processes in wastewater treatment is biological operation?
 - A. Sedimentation
 - B. Chlorination
 - C. Activated sludge process
 - D. Disinfection
 11. Which of the following cells of immune system are of lymphoid progenitor origin?
 - A. NK cells
 - B. B cells
 - C. T cells
 - D. All of the above
 12. Which type of the cells listed below are <1% in human blood?
 - A. Eosinophiles
 - B. Basophiles
 - C. Neutrophiles
 - D. Lymphocytes
 13. Adjuvants are substances that
 - A. enhance immunogenicity of an antigen
 - B. possess immunogenicity due to their foreignness
 - C. are antigens of highly complex nature
 - D. act as carriers for haptens
 14. An infection that develops during a stay in the hospital is called
 - A. Iatrogenic
 - B. Teratogenic
 - C. Nosocomial
 - D. Covert
 15. Relationship between total number of deaths and the total number of cases due to a disease is called
 - A. Morbidity rate
 - B. Mortality rate
 - C. Prevalence rate
 - D. Incidence rate
 16. Which of the following Part of the compound microscope helps in focusing light on the specimen?
 - A. Objective

- B. Condenser
 - C. Magnifying lens
 - D. Eyepiece
17. Coronaviruses (CoVs) are characterised by presence of ALL except
- A. Spikes
 - B. RNA genome
 - C. Reverse transcriptase
 - D. Envelope
18. The RT-PCR test for Covid-19 detects presence of
- A. Entire Virus particles
 - B. Virus antigen
 - C. Viral nucleic acid
 - D. Antibodies against the virus
19. A technique for separating solutes in a mixture on the basis of their relative distribution between a moving fluid stream and a contiguous stationary phase is called
- A. Sedimentation
 - B. Filtration
 - C. Chromatography
 - D. Size exclusion
20. Electrophoresis involves separation of molecules on the basis of
- A. Charge
 - B. Migration
 - C. Electric field
 - D All of the above
21. The Covishield vaccine
- A. Contains inactivated Virus particles
 - B. Is made up of purified spike protein
 - C. Has Viral nucleic acid which expresses spike protein
 - D. Carries Antibodies against the virus
22. DNA as genetic/ hereditary material was proved by
- A. Griffith experiment
 - B. Erwin Chargaff's experiment
 - C. Hershey-Chase Experiment
 - D. Pasteur's swan shaped flask experiment
23. Which of the following statement is true?
- A. Bacterial endospores show higher resistance to moist heat as compared to vegetative cells
 - B. Bacterial endospores cannot be destroyed by autoclaving
 - C. Moist heat is less effective than dry heat for sterilisation
 - D. Viruses cannot be destroyed by autoclaving
24. Which of the following does not predictably vary with depth of the aquatic environment?
- A. Dissolved oxygen
 - B. Temperature
 - C. Sunlight

- D. Salinity
25. RNA interference (RNAi) is a process
- A. to stop translation
 - B. to stop transcription
 - C. to stop splicing
 - D. to transfer RNA into cells
26. _____ is the first FDA approved biotech product made using RDT
- A. Insulin
 - B. TPA
 - C. Polymerase
 - D. Interferon
27. Which of the following is incorrect regarding translation?
- A. tRNA has an anticodon loop that has bases complementary to the code
 - B. Initiation is done by initiator tRNA
 - C. Changing of tRNA occurs in presence of ATP
 - D. Termination occurs with the help of tRNAs for stop codons
28. In Lac operon, the repressor binds to _____
- A. Promoter
 - B. Operator
 - C. UTR
 - D. SD sequence
29. In the human genome, chromosome _____ has most genes and _____ has the fewest.
- A. I, X
 - B. I, Y
 - C. I, 20
 - D. 20, I
30. In Eukaryotes, the DNA is wrapped around
- A. Histones
 - B. Actin
 - C. Myosin
 - D. Globins
31. Which of the following technique would allow the microscopic detection of an extra chromosome in a cell?
- A. Pedigree analysis
 - B. Karyotyping
 - C. PCR
 - D. Microarray
32. Which of the following cloning vectors has components of a bacteriophage?
- A. Plasmid
 - B. Cosmid

- C. BAC
 - D. YAC
33. A double stranded DNA has 10% adenine 'The cytosine content of this DNA is -
- A. 90%
 - B. 45%
 - C. 40%
 - D. 10%
34. Which of the following toxins is used for cosmetic purposes?
- A. Diphtheria toxin
 - B. Cholera toxin
 - C. Shiga toxin
 - D. Botulinum toxin
35. The pKa of the R group of Glutamic acid is 4.2. At pH 7.0, the R group will be
- A. Uncharged
 - B. Positively charged
 - C. Negatively charged
 - D. Protonated
36. The ΔG° for the hydrolysis of acetyl-CoA is -
- A. Small and positive
 - B. Small and negative
 - C. Large and negative
 - D. Large and positive
37. How much glucose is required to be weighed for preparing 4 liters of 50 mM glucose solution (Mol.Wt. of glucose : 180)?
- A. 36 gm
 - B. 3.6 gm
 - C. 9 gm
 - D. 90 gm
38. How much volume of 2% stock solution of penicillin is to be added to prepare 3 liters of Luria broth with 50 $\mu\text{g}/\text{ml}$ of penicillin?
- A. 7.5 ml
 - B. 75 ml
 - C. 7.5 μl
 - D. 75 μl
39. Which of the following is an example of non-ionizing rays?
- A. Gamma rays
 - B. X-rays
 - C. UV rays
 - D. All of the above
40. The number of electrons present in H^+ is -
- A. Zero
 - B. One
 - C. Two
 - D. Three
41. Which of the following reactions require folic acid?

- A. Redox reactions
 - B. One carbon metabolism
 - C. Transamination
 - D. Aldehyde group transfer
42. A tripeptide made up of amino acids of molecular weight 250, 236 and 350. The molecular weight of the tripeptide would therefore be -
- A. 836
 - B. 800
 - C. 782
 - D. None of the above
43. Which of the following is an example of a saturated fatty acid?
- A. Oleic acid
 - B. Linoleic acid
 - C. Palmitic acid
 - D. Arachidonic acid
44. When a bacterial cell suspension was diluted 10^4 times, it gave 60 colonies, when 0.1 ml was plated on nutrient agar. The total count of bacteria in the original suspension is _____ cells/ml.
- A. 6×10^5
 - B. 6×10^6
 - C. 6×10^7
 - D. 6×10^4
45. Which of the following has a defined molecular weight?
- A. Starch
 - B. Glycogen
 - C. Sucrose
 - D. Chitin
46. 100 nm = _____ micrometer
- A. 1
 - B. 0.1
 - C. 10
 - D. 0.01
47. NADH and NADPH have the following common characteristics except -
- A. Both are redox carriers
 - B. Both are coenzymes
 - C. Both are good electron donors
 - D. Both are involved in biosynthetic reaction
48. If the H^+ concentration of a solution is 0.0001 M. What is its pH?
- A. 10
 - B. 4
 - C. 2
 - D. 1
49. The 1918 Spanish flu pandemic strain of Influenza A virus was
- A. H2N2
 - B. H1N1
 - C. H3N2
 - D. H3N8

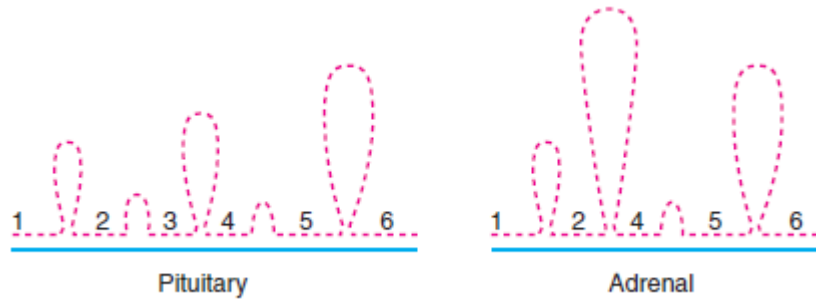
50. In west Africans, resistance to malaria caused by *P. falciparum* is associated with
- A. Sickle cell anaemia
 - B. Thalassemia
 - C. Haemophilia
 - D. Cystic fibrosis
51. A component **NOT** essential for routine Polymerase Chain Reaction is
- A. Primer
 - B. dNTP
 - C. Reverse transcriptase
 - D. Polymerase enzyme
52. Darwin's finches are considered a good example of
- A. Adaptive radiation
 - B. Convergent evolution
 - C. Homologous recombination
 - D. Coevolution of plants and animals
53. Pure water has all of the following properties EXCEPT
- A. A pH of 7.0
 - B. Has a density of $\sim 1000\text{kg/m}^3$
 - C. Has a concentration of 55.5 M
 - D. All are correct regarding pure water
54. If two black mice are crossed, nine black and three white mice result. Which of the following statements is **correct**?
- A. Black is recessive
 - B. White is dominant
 - C. Both parents were heterozygous
 - D. All are correct
55. Inheritance pattern of blood group antigens can be best described as
- A. Complete dominance
 - B. Incomplete dominance
 - C. Codominance
 - D. Partial dominance
56. A hypothetical organism has six chromosomes ($2n=6$). How many different combinations of maternal and paternal chromosomes can appear in the gametes?
- A. 9
 - B. 12
 - C. 8
 - D. None of the above
57. A mature human sperm cell has 'c' amount of DNA. How much DNA will a somatic cell have if it is in the S phase of cell cycle?
- A. C
 - B. 2c
 - C. 4c
 - D. 8c
58. Assuming a 1:1 sex ratio, what is the probability that three children produced by the same parents will consist of all daughters?
- A. 0.09
 - B. 0.125

- C. 0.008
D. None of the above
59. In a transformation experiment, a bacterial strain that is $lys^+ his^+ val^+$ is used as a donor, and $lys^- his^- val^-$ as the recipient. Initial transformants are isolated on minimal medium +histidine +valine. Which of the following genotypes of transformants will not be able to grow on the plates?
- A. $lys^+ his^+ val^+$
B. $lys^- his^+ val^+$
C. $lys^+ his^- val^+$
D. $lys^+ his^- val^-$
60. Which enzyme is not required in DNA replication in *E.coli*?
- A. Primase
B. Helicase
C. Ligase
D. All are required in replication
61. Study the following table regarding the base composition of three nucleic acid molecules a, b and c and point out the WRONG interpretation.

Nucleic Acid Molecule	%A	%T	%G	%C	%U
a.	28	28	22	22	0
b.	31	0	31	17	21
c.	15	15	35	35	0

- A. Molecule b is single stranded RNA
B. Molecule a is double stranded DNA
C. Molecule c has highest melting temperature
D. All are correct interpretations
62. The given sequence of bases represents the start of a gene on double-stranded DNA. Which strand is likely to be transcribed to synthesize mRNA?
- G C T A C G G A T T G C T G
C G A T G C C T A A C G A C
- A. Upper
B. Lower
C. Both
D. None
63. Where would you find Pribnow box?
- A. Prokaryotic transcription start site
B. Eukaryotic transcription start site
C. Prokaryotic ribosome binding site
D. Eukaryotic ribosome binding site
64. Figure below represents RNA-DNA hybrids formed by using messenger RNA for the same gene that is expressed in the pituitary and the adrenal glands. DNA is a dashed line; RNA

is a solid line. The DNA used in each case is the full-length gene. Based on the figure, which is the best explanation for the different hybrid molecules?



- A. Pituitary gene is longer than the adrenal gene
 - B. Adrenal gene lacks intron 3
 - C. Adrenal gene is spliced skipping the exon 3
 - D. Adrenal gene lacks exon 3
65. Binding of the ribosome to the messenger RNA in order to determine the translation start site requires
- A. SD sequences in prokaryotes
 - B. 5' cap in eukaryotes
 - C. Both are correct
 - D. None of above
66. An insertion of a single base in a reading frame of a protein coding gene
- A. Would result in same protein with one amino acid change
 - B. Could be restored by deletion of 2 bases
 - C. May result in shorter or abnormal protein
 - D. All are correct
67. The genetic code is degenerate. This means that
- A. One amino acid may have multiple codons
 - B. Codons can specify more than one amino acid
 - C. Multiple tRNA can recognize same codons
 - D. Same amino acid is inserted by multiple tRNAs
68. Which one of the following is a human disease that is caused by a parasite / pathogen that requires two hosts?
- A. Malaria
 - B. Typhoid
 - C. Chicken pox
 - D. Shigellosis
69. A piece of DNA has the sequence 3'-GGCGTATTC-5'. It is sequenced using the dideoxy method. How many bands will be found on the gel in the lanes for reaction mixture with ddTTP?
- A. 1
 - B. 2
 - C. 3
 - D. 4
70. Which is correct match of the blotting technique, sample analysed and probe used?
- A. Southern blot; DNA; DNA
 - B. Northern blot; RNA; DNA
 - C. Western blot; protein; antibodies

- D. All are correct
71. Microorganisms that grow under low nutrient conditions are called
- A. Autotrophs
 - B. Auxotrophs
 - C. Syntrophs
 - D. Oligotrophs
72. The group of organisms that uses light as the energy source and CO₂ as the principal carbon source is called
- A. Photoheterotrophs
 - B. Chemoheterotrophs
 - C. Photoautotrophs
 - D. Lithoautotrophs
73. K_M of an enzyme denotes
- A. Half of V_{max}
 - B. Substrate concentration when velocity is 50% of V_{max}
 - C. Maximum velocity that an enzyme can achieve
 - D. Substrate concentration when maximum velocity is achieved
74. Which taxonomic group has the smallest number of organisms with a maximum of characteristics in common?
- A. Genus
 - B. Species
 - C. Kingdom
 - D. Family
75. A symbiotic combination of a fungus and a cyanobacterium is found in
- A. Nodules
 - B. Lichens
 - C. Ruminants
 - D. Thermal vents
76. BCG vaccine is derived by attenuating
- A. *Mycobacterium avium*
 - B. *Mycobacterium bovis*
 - C. *Mycobacterium vaccae*
 - D. *Mycobacterium fortuitum*
77. The "one gene – one enzyme" hypothesis was proposed on the basis of work with
- A. *Neurospora crassa*
 - B. *Drosophila melanogaster*
 - C. *Escherichia coli*
 - D. Bacteriophage T4
78. Lambda phage has a genome comprised of
- A. ssDNA
 - B. dsRNA
 - C. dsDNA
 - D. ssRNA
79. Which of the following enzymes converts fibrinogen to fibrin?
- A. Streptokinase
 - B. Coagulase
 - C. Lecithinase

- D. Hyaluronidase
80. Syphilis is caused by
- A. Yeast
 - B. Spirochaete
 - C. Worm
 - D. Fungus
81. ELISA is a method to
- A. Quantitate antigen but not antibody
 - B. Quantitate antibody but not antigen
 - C. Quantitate either antigen or antibody
 - D. Quantitate nucleic acids
82. Polio vaccine used in India for the Pulse Polio Programme is
- A. Live attenuated vaccine
 - B. Killed vaccine
 - C. Recombinant vaccine
 - D. Subunit vaccine
83. Which among the following is caused by an acquired gene mutation rather than an inherited mutation?
- A. Thalessemia
 - B. Colour-Blindness
 - C. Haemophilia
 - D. Leukemia
84. Which of the following microorganism is used as bioinsecticide
- A. *Escherichia coli*
 - B. *Bacillus subtilis*
 - C. *Bacillus thuringiensis*
 - D. *Aspergillus niger*
85. Blight is a disease of
- A. Plants
 - B. Eyes
 - C. Cattle
 - D. Birds
86. First person to view cells under a microscope was
- A. Robert Hooke
 - B. Louis Pasteur
 - C. Antonie van Leeuwenhoek
 - D. Robert Koch
87. Immunity demonstrated by a new born baby is
- A. Passive
 - B. active
 - C. Innate
 - D. Adaptive
88. Peptidoglycan layer is absent in the cell wall of
- A. Archaea
 - B. Gram positive bacteria
 - C. Gram negative bacteria
 - D. None of these

89. Match the following and identify the correct option

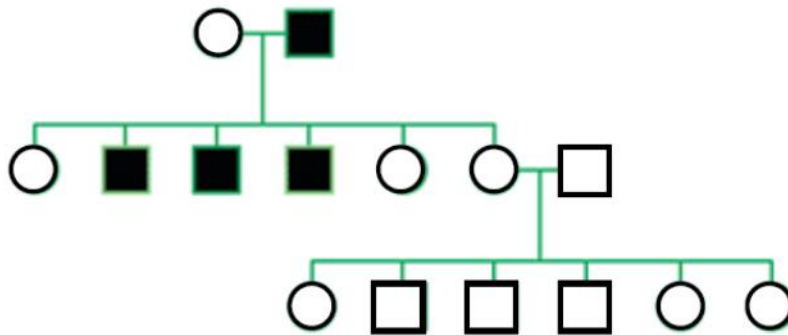
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|----------------|--|
| a) Unsaturated | 1) No double bond |
| b) Trans-fat | 2) Methyl end |
| c) Omega end | 3) Presence of double bond |
| d) Saturated | 4) Double bond in opposite orientation |

- A. a-1, b-2, c-3, d-4
- B. a-3, b-4, c-2, d-1
- C. a-1, b-2, c-4, d-3
- D. a-2, b-3, c-4, d-1

90. Erwin Chargaff proposed important clue to the structure of the DNA. Which of the following statement is **false**?

- A. Base composition of DNA varies from one species to another
- B. Base composition are different from DNA specimens isolated from different tissues of the same species
- C. Base composition of DNA in a given species does not change with an organisms age
- D. The number of adenosine residues is equal to the thymidine residues, and the number of guanosine is equal to the number of cytidine residues.

91. Look at the pedigree and decide the inheritance pattern for the disease



- A. Autosomal dominant
- B. Autosomal recessive
- C. X linked dominant
- D. Y linked

92. The CRISPR-Cas system is a type of

- A. Stem cell therapy
- B. Gene-editing system
- C. Modified PCR method
- D. Next Generation Sequencing technology

93. The term microbiome indicates

- A. Genome of a microbe
- B. Total set of proteins of a microorganism
- C. Total set of mRNA of a microorganism
- D. Collective genome of the entire set of microbes present in an environment

94. Microorganisms that are believed to have led to the oxygenation of primitive Earth's atmosphere are

- A. Proteobacteria
- B. Cyanobacteria
- C. Firmicutes

- D. Methanogens
95. Spontaneous reactions are characterized by
- A. $\Delta G = 0$
 - B. ΔG is negative
 - C. ΔG is positive
 - D. $\Delta G = K_{eq}$
96. When *E. coli* is grown on a medium containing only lactose as the C-source, which of the following molecules is bound to the Lac-operon?
- A. Lac repressor
 - B. RNA polymerase
 - C. Cyclic AMP-CRP complex
 - D. Both B & C
97. Which of the following is an example of a primary metabolite?
- A. erythromycin
 - B. terpenes
 - C. aflatoxin
 - D. ethanol
98. Transduction is unique from transformation and conjugation in that
- A. free DNA is needed
 - B. both free DNA and cell-to-cell contact are needed
 - C. virus act as vectors for DNA transfer
 - D. DNA transfer occurs from cell-to-cell contact
99. All of the following are desirable characteristics of a plasmid cloning vector **EXCEPT**
- A. multiple cleavage sites for a single restriction endonuclease
 - B. small size
 - C. antibiotic resistance markers
 - D. high transformation efficiency
100. *Helicobacter pylori* is usually associated with
- A. Diarrhea
 - B. Gastric ulcers
 - C. Respiratory syndrome
 - D. Skin infections

XXXXXXXXXX



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