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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
○ ○ ○ ○

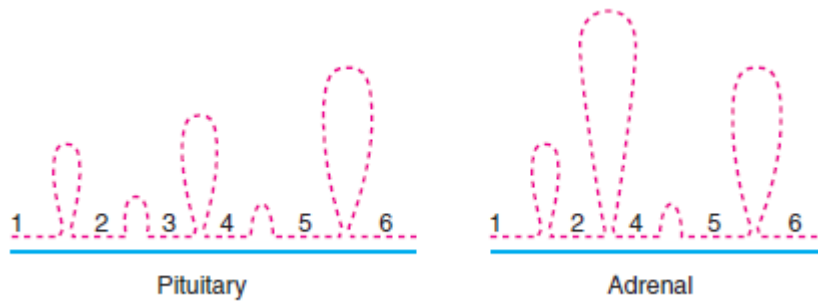
Invigilator's Signature: _____

1. A component **NOT** essential for routine Polymerase Chain Reaction is
 - A. Primer
 - B. dNTP
 - C. Reverse transcriptase
 - D. Polymerase enzyme
2. Darwin's finches are considered a good example of
 - A. Adaptive radiation
 - B. Convergent evolution
 - C. Homologous recombination
 - D. Coevolution of plants and animals
3. 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
4. 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
5. Inheritance pattern of blood group antigens can be best described as
 - A. Complete dominance
 - B. Incomplete dominance
 - C. Codominance
 - D. Partial dominance
6. 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
7. 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
8. 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

9. 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?
- $lys^+ his^+ val^+$
 - $lys^- his^+ val^+$
 - $lys^+ his^- val^+$
 - $lys^+ his^- val^-$
10. Which enzyme is not required in DNA replication in *E.coli*?
- Primase
 - Helicase
 - Ligase
 - All are required in replication
11. 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

- Molecule b is single stranded RNA
 - Molecule a is double stranded DNA
 - Molecule c has highest melting temperature
 - All are correct interpretations
12. 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
- Upper
 - Lower
 - Both
 - None
13. Where would you find Pribnow box?
- Prokaryotic transcription start site
 - Eukaryotic transcription start site
 - Prokaryotic ribosome binding site
 - Eukaryotic ribosome binding site
14. 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?

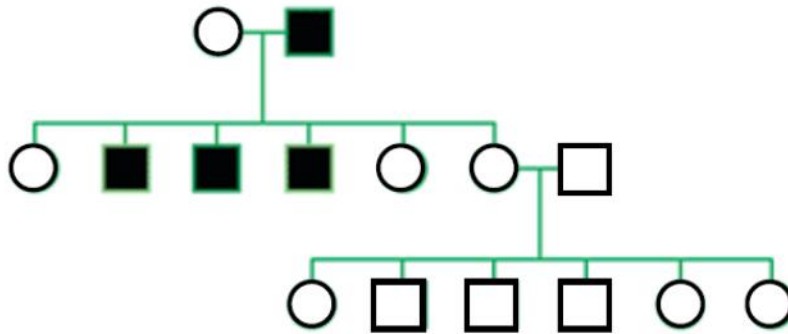


- A. Pituitary gene is longer than the adrenal gene
 - B. Adrenal gene lacks intron 3
 - C. Adrenal gene is spliced skipping the exon 3
 - D. Adrenal gene lacks exon 3
15. Binding of the ribosome to the messenger RNA in order to determine the translation start site requires
- A. SD sequences in prokaryotes
 - B. 5' cap in eukaryotes
 - C. Both are correct
 - D. None of above
16. 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
17. 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
18. 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
19. 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
20. 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
21. Microorganisms that grow under low nutrient conditions are called

- A. Autotrophs
 - B. Auxotrophs
 - C. Syntrophs
 - D. Oligotrophs
22. 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
23. 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
24. Which taxonomic group has the smallest number of organisms with a maximum of characteristics in common?
- A. Genus
 - B. Species
 - C. Kingdom
 - D. Family
25. A symbiotic combination of a fungus and a cyanobacterium is found in
- A. Nodules
 - B. Lichens
 - C. Ruminants
 - D. Thermal vents
26. BCG vaccine is derived by attenuating
- A. *Mycobacterium avium*
 - B. *Mycobacterium bovis*
 - C. *Mycobacterium vaccae*
 - D. *Mycobacterium fortuitum*
27. 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
28. Lambda phage has a genome comprised of
- A. ssDNA
 - B. dsRNA
 - C. dsDNA
 - D. ssRNA
29. Which of the following enzymes converts fibrinogen to fibrin?
- A. Streptokinase
 - B. Coagulase
 - C. Lecithinase
 - D. Hyaluronidase
30. Syphilis is caused by

- b) Trans-fat
 - c) Omega end
 - d) Saturated
- 2) Methyl end
 - 3) Presence of double bond
 - 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

40. 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.
41. 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
42. 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
43. 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
44. Microorganisms that are believed to have led to the oxygenation of primitive Earth's atmosphere are
- A. Proteobacteria
 - B. Cyanobacteria
 - C. Firmicutes
 - D. Methanogens
45. Spontaneous reactions are characterized by

- A. $\Delta G = 0$
 - B. ΔG is negative
 - C. ΔG is positive
 - D. $\Delta G = K_{eq}$
46. 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
47. Which of the following is an example of a primary metabolite?
- A. erythromycin
 - B. terpenes
 - C. aflatoxin
 - D. ethanol
48. 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
49. 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
50. *Helicobacter pylori* is usually associated with
- A. Diarrhoea
 - B. Gastric ulcers
 - C. Respiratory syndrome
 - D. Skin infections
51. 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
52. 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
53. 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
54. 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
55. For a laboratory compound microscope, what will be the resolving power when $\lambda=650\text{nm}$ and the NA =0.25?
- A. 1300nm
 - B. 1200nm
 - C. 3250 nm
 - D. 3520nm
56. 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
57. Molybdenum is part of which of the enzymes possessed by bacteria?
- A. Carbonic anhydrase
 - B. Nitrogenase
 - C. Formate dehydrogenase
 - D. Cytochrome oxidase
58. 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
59. Which of the following antibiotics is NOT a bacterial cell wall synthesis inhibitor?
- A. Penicillin
 - B. Cephalosporin
 - C. Tetracycline
 - D. Vancomycin
60. Which one of the following processes in wastewater treatment is biological operation?
- A. Sedimentation
 - B. Chlorination
 - C. Activated sludge process
 - D. Disinfection
61. 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
62. Which type of the cells listed below are <1% in human blood?
- A. Eosinophiles
 - B. Basophiles
 - C. Neutrophiles
 - D. Lymphocytes
63. 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
64. An infection that develops during a stay in the hospital is called
- A. Iatrogenic
 - B. Teratogenic
 - C. Nosocomial
 - D. Covert
65. 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
66. 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
67. Coronaviruses (CoVs) are characterised by presence of ALL except
- A. Spikes
 - B. RNA genome
 - C. Reverse transcriptase
 - D. Envelope
68. 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
69. 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
70. Electrophoresis involves separation of molecules on the basis of
- A. Charge
 - B. Migration
 - C. Electric field
 - D All of the above
71. 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
72. 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
73. 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
74. Which of the following does not predictably vary with depth of the aquatic environment?
- A. Dissolved oxygen
 - B. Temperature
 - C. Sunlight
 - D. Salinity
75. RNA interference (RNAi) is a process
- A. to stop translation
 - B. to stop transcription
 - C. to stop splicing
 - D. to transfer RNA into cells
76. _____ is the first FDA approved biotech product made using RDT
- A. Insulin
 - B. TPA
 - C. Polymerase
 - D. Interferon
77. 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
78. In Lac operon, the repressor binds to _____
- A. Promoter
 - B. Operator
 - C. UTR
 - D. SD sequence
79. In the human genome, chromosome _____ has most genes and _____ has the fewest.
- A. I, X
 - B. I, Y
 - C. I, 20
 - D. 20, I
80. In Eukaryotes, the DNA is wrapped around
- A. Histones
 - B. Actin
 - C. Myosin
 - D. Globins
81. 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
82. Which of the following cloning vectors has components of a bacteriophage?
- A. Plasmid
 - B. Cosmid
 - C. BAC
 - D. YAC
83. A double stranded DNA has 10% adenine 'The cytosine content of this DNA is -
- A. 90%
 - B. 45%
 - C. 40%
 - D. 10%
84. Which of the following toxins is used for cosmetic purposes?
- A. Diphtheria toxin
 - B. Cholera toxin
 - C. Shiga toxin
 - D. Botulinum toxin
85. 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
86. 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
87. 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
88. 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
89. 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
90. The number of electrons present in H^+ is -
- A. Zero
 - B. One
 - C. Two
 - D. Three
91. Which of the following reactions require folic acid?
- A. Redox reactions
 - B. One carbon metabolism
 - C. Transamination
 - D. Aldehyde group transfer
92. 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
93. Which of the following is an example of a saturated fatty acid?
- A. Oleic acid
 - B. Linoleic acid
 - C. Palmitic acid
 - D. Arachidonic acid

94. 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
95. Which of the following has a defined molecular weight?
- A. Starch
 - B. Glycogen
 - C. Sucrose
 - D. Chitin
96. $100 \text{ nm} =$ _____ micrometer
- A. 1
 - B. 0.1
 - C. 10
 - D. 0.01
97. 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
98. If the H^+ concentration of a solution is 0.0001 M. What is its pH?
- A. 10
 - B. 4
 - C. 2
 - D. 1
99. The 1918 Spanish flu pandemic strain of Influenza A virus was
- A. H2N2
 - B. H1N1
 - C. H3N2
 - D. H3N8
100. In west Africans, resistance to malaria caused by *P. falciparum* is associated with
- A. Sickle cell anaemia
 - B. Thalassaemia
 - C. Haemophilia
 - D. Cystic fibrosis

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