Code No. A-57

ENTRANCE EXAMINATION – 2021

Ph.D. Microbiology

Time: 2 hours Maximum Marks: 70

HALL TICKET NO.

INSTRUCTIONS

Please read carefully before answering the questions:

1. Enter your Hall Ticket number both on the top of this page and on the OMR answer sheet.
2. Answers are to be marked only on the **OMR answer sheet** following the instructions provided there upon.
3. Hand over the OMR answer sheet to the Invigilator before leaving the examination hall.
4. No additional sheets shall be provided. Rough work can be done in the question paper itself/ the space provided at the end of the booklet.
5. The question paper contains **70** questions (**Part-A**: Question Nos. **1-35** and **Part-B**: Questions Nos. **36-70)** of multiple-choice printed in **14** pages, including this page. One OMR answer sheet is provided separately. **Please check.**
6. The marks obtained in **Part-A** will be used for resolving the tie cases.
7. Each question carries one mark.
8. Calculators and mobile phones are NOT allowed.

PART – A

1. The word "Psittacosis" in infection biology represents one of the following:

   A) It is a type of psychological disorder happens in the patient of Covid-19 after recovery
   B) It is another name of "mucormycosis" which is fungal infection caused by mucormycetes
   C) It is another name of "Parrot fever" a zoonotic infectious disease of human beings
   D) Generic name for infection caused by black fungus which infects brain and lungs

2. Which of the following is *not true* about telomeres?

   A) The telomere is a repeating DNA sequence present at the end of the eukaryotic chromosomes
   B) The telomere protects chromosomal ends from degradation and loss of genetic information
   C) The telomeres prevent the chromosomes from fusing to each other
   D) The telomere length is maintained in the absence of telomerase enzyme

3. Identify the *wrong* statement regarding 'Gene conversion':
   A) It arises due to mutations after exposure to ionizing radiation
   B) It is one of the consequences of the recombination process
   C) It results from a normal DNA repair process in the cell known as mismatch repair
   D) It results in the aberrant ratios of 3A : 1a instead of 2A : 2a in four-spored asci such as yeast

4. Match the following microorganisms with their detection criteria:

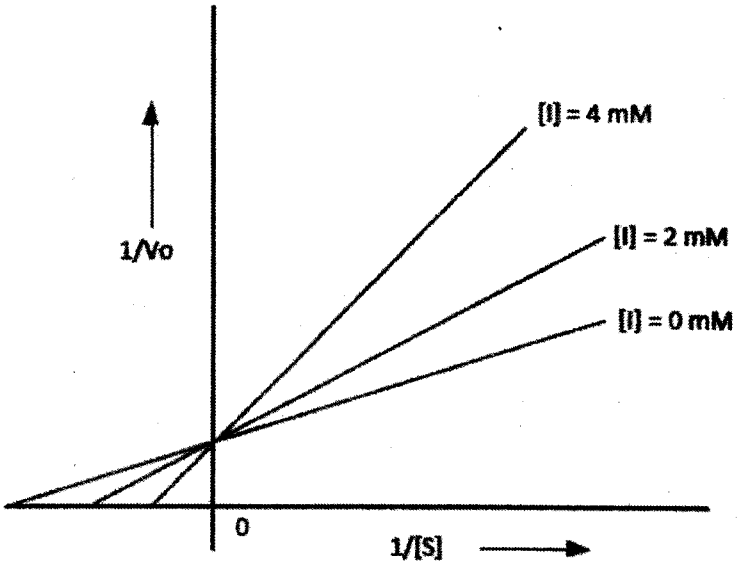
P. Gram- positive bacteria	1. Cotton-blue staining
Q. Gram-negative bacteria	2. Thick cell-walled with highly cross-linked peptidoglycans
R. Phytoplasma visualization	3. Diene's staining
S. Fungal mycelia	4. Thin cell-walled covered by an outer membrane

   A) P-4, Q-2, R-1, S-3 B) P-2, Q-4, R-3, S-1
   C) P-4, Q-3, R-2, S-1 D) P-2, Q-4, R-1, S-3

5. A stock of 1milligram (mg) per millilitre (ml) of a mycotoxin, Nivalenol needs to be diluted to prepare a working solution of concentration, 0.5 microgram (µg) per microlitre (µL). How much quantity of the stock solution should be diluted to make the solution of volume, 500 µL?

   A) 50 µL B) 100 µL C) 200 µL D) 250 µL

6. The activity of an enzyme was measured by varying the concentration of the substrate (S) in the presence of three different concentrations of inhibitor (I) 0, 2 and 4 mM. The double reciprocal plot given below suggests that the inhibitor (I) exhibits:



A) Substrate inhibition
B) Uncompetitive inhibition
C) Mixed inhibition
D) Competitive inhibition

7. The following are some of the vitamins used by the microorganism for their growth. Identify the *correct* functions of the vitamins from the following statements:

I. Folic acid functions in the one-carbon metabolism
II. Lipoic acid helps in the transfer of acyl groups
III. Thiamine helps as a precursor of NAD and NADH biosynthesis
IV. Biotin helps in the transfer of aldehyde group

A) III and IV
B) I and II
C) II and III
D) I and IV

8. The following are some of the common habitats of microorganisms. Identify the *wrong* matches from the following:

I. Methanogens – Rumen – Endosymbionts of various anaerobic protozoa
II. Spirochetes – Animal hosts – Obligate pathogens
III. Halophilic Archaea – Hyper saline environments – Solar salt evaporation ponds
IV. Chloroflexi – Anoxic habitats – Obligate phototrophs

A) I and III
B) II and IV
C) I and II
D) IV alone

9. Read the following statements with regard to chemo (anaerobic NO_3^- respiration) organoheterotrophic bacteria and identify the *correct* statement:

A) These are a class of bacteria which obtain energy through anaerobic respiration with nitrate as electron acceptor, derive electrons from reduced inorganic compounds and grow using CO_2 as the sole source of carbon.
B) These are a class of bacteria which obtain energy through anaerobic respiration with nitrate as electron acceptor, derive electrons from organic compounds and grow using CO_2 as the sole source of carbon.
C) These are a class of anaerobic organisms that conserve their energy, electrons, and carbon from organic chemical sources and use nitrate as an electron acceptor.
D) These are a class of bacteria that conserve their energy and electrons from organic sources and carbon from inorganic sources.

10. Identify the mismatches:

I. Winogradsky column – Enrichment vehicle
II. Most Probable Number – Estimate the number of viable and non-viable cells
III. Laser tweezer – Helps in the isolation of bacterial colonies from natural samples
IV. 4',6-Diamido 2-phenylindole – Stains nucleic acid

A) I and II B) III and IV C) II and III D) I and IV

11. Quantum yield in photosynthesis is defined as:

A) Number of quanta required for release of one O_2
B) Number of O_2 molecules produced per quanta absorbed
C) Number of chlorophyll molecules required to absorb one quantum
D) Number of chlorophyll molecules responsible for release of one O_2

12. High-energy bond (~) of ATP indicates:

A) Formation of this bond requires energy
B) Hydrolysis of this bond releases energy
C) Products of hydrolysis have lesser energy than the molecule itself
D) Products of hydrolysis have more energy than the molecule itself

13. The Phenomenon of loss of energy of excited pigment molecule as light wave length of longer wave length than the wavelength of absorbed light is known as:

A) Homogenous energy transfer B) Resonance
C) Fluorescence D) Phosphorescence

14. Which of the below statements on disulfide bonds in antibodies is/are false?
    I. Joining the two heavy chains
    II. Joining one heavy with one light chain
    III. Stabilizing the domain structure
    IV Joining the two light chains

    A) I and II
    B) II alone
    C) III and IV
    D) IV alone

15. Oxygen supply is limited during alcohol production by fermentation using budding yeast. This is because _____.
    A) Budding yeasts are obligate anaerobes
    B) Budding yeasts lose mitochondria in the absence of oxygen
    C) Budding yeasts are facultative anaerobes
    D) Oxygen will react with the alcohol that is toxic to budding yeast

16. Transamination reaction follows which one of the statements given below?
    A) Only non-essential amino acids undergo transamination
    B) Transaminases require a coenzyme derived from vitamin B12
    C) Transaminases require a coenzyme derived from vitamin B6
    D) Transamination is an irreversible reaction in amino acid catabolism

17. Quenching of metabolites refers to:
    A) a rapid and sudden stopping of the metabolism on a timescale
    B) a slow process of stopping of the metabolism on a timescale
    C) a process of extraction of metabolites using organic solvents
    D) a process in which cells are lysed and extracted for metabolites

18. What is isotopic fractionation?
    A) It is the relative partitioning of the heavier and lighter isotopes between two coexisting phases in a natural system
    B) It is the breakdown of radioactive decay
    C) It is the carbon dating fractionation of natural system
    D) It is the isotopic analysis of metabolites used in the laboratory studies

19. Arbuscular mycorrhizal fungi secrete large quantities of a glycoprotein known as ____, which plays a critical role in aggregate stability is:

    A) Glomalin
    B) Mycolin
    C) Glucomyin
    D) Arbusculin

20. What is the binding energy?

A) It is the activation energy .
B) The energy required to form a bond
C) The energy required to bind substrate
D) Free energy released in the formation of enzyme-substrate interaction

21. The 'Stokes's shift' is an important phenomenon in spectroscopy, and it means:

A) Wavelength difference from absorption and emission
B) Emission wavelength difference
C) Bandwidth in fluorescence
D) Steady state absorption and emission

22. A male affected with an X-linked dominant trait will have what proportion of offspring affected with the trait?

A) 1/2 sons and 1/2 daughters
B) All sons and no daughters
C) All daughters and no sons
D) 3/4 daughters and 1/4 sons

23. Changes in patterns of methylation of DNA are often associated with cancer. Hypermethylation can contribute to cancer by ____.

A) Inhibiting DNA replication mechanism
B) Inhibiting the expression of tumor-suppressor genes
C) Stimulating the transcription and translation of oncogenes
D) Stimulating telomerase activity

24. Cardiolipin is found to be enriched in one of the following:

A) Vacuolar membrane B) Mitochondrial membrane
C) Plasma membrane D) Endoplasmic reticulum

25. Consider the following statements and select the answer with *correct* statements:

I. Lysogens are cells that contain prophages.
II. Bacterial lawns infected by lytic viruses can be detected by the presences of plaques.
III. Virulent phages can assume a prophage state.

A) I and II B) II and III C) I and III D) I, II and III

26. Which statement best describes the pKa of amino groups in proteins?

A) pKa of α-amino group is higher than the pKa of ε-amino group
B) pKa of α-amino group is lower than the pKa of ε-amino group
C) pKa of α-amino group is same as the pKa of ε-amino group
D) pKa of α-amino group is higher than the pKa of guanidine side chain of arginine

27. A purified protein appears as a single band of 90 kDa when subjected to reducing denatured SDS-PAGE. In a size exclusion chromatography experiment, this protein elutes between alcohol dehydrogenase (160 kDa) and β-amylase (190 kDa). How many identical subunits is this protein composed of?

A) One B) Two C) Three D) Five

28. Which techniques can be used for determination of molecular mass of macromolecules?

A) Circular dichroism
B) Mass spectrometry
C) UV-Visible spectroscopy
D) IR spectroscopy

29. Which of the following elements is a constituent of biotin and coenzyme A?

A) Sulphur B) Molybdenum C) Copper D) Iron

30. Under anaerobic conditions in the cell, fermentation is necessary because:

A) Lactate is produced
B) Ethanol produced leaches out of the cell
C) NADH is oxidized to NAD^+
D) ATP is produced

31. Choose the *correct* answer:

Statement 1: Splitting of dinitrogen molecule into free nitrogen atom in biological N_2 fixation is carried out by nitrogenase enzyme.
Statement 2: Leghemoglobin in root nodules creates aerobic condition for optimum activity of nitrogenase enzyme.

A) Both statements are correct
B) Both statements are incorrect
C) Statement 1 is correct and statement 2 is incorrect
D) Statement 1 is incorrect and statement 2 is correct

32. Match the entries listed in the Group I with the Group II.

Group I	Group II
P. Proximity Ligation assay	1. Protein-DNA interaction,
Q. Bisulfite Sequencing	2. Ampholytes
R. Chromatin Immunoprecipitation	3. Protein modifications analysis
S. Chromatofocusing	4. DNA Methylation analysis

A) P-4, Q-1, R-2, S-3 B) P-4, Q-3, R-1, S-2
C) P-3, Q-4, R-1, S-2 D) P-3, Q-4, R-2, S-1

33. A mixture of a 100 mer oligonucleotide and free nucleotides was loaded on to a gel-filtration column with exclusion limit of 10 kDa. The following result is expected:

A) The oligonucleotide and the free nucleotides would be retained in the column as they bind to the resin
B) The oligonucleotide would elute first followed by the free nucleotides
C) Both of them would elute in the void volume
D) The free nucleotides would elute first followed by the oligonucleotide

34. The secondary infection caused by the black fungus in Covid-19 patients were treated with the drug Amphotericin B. The mode of action of this drug in the patient would be:

A) It binds to sterols fungal membrane, disrupting membrane permeability and causing leakage of cell constituents in fungus
B) It binds to fungus RNA and disrupt RNA function and further protein synthesis
C) It disrupts the mitotic spindle and inhibit cell division in fungus cells
D) It does NOT act on fungus cells but provides acid and base layer to the patient's brain and lungs to protect from further fungal infection

35. Symbiotic nitrogen fixation in legume nodules involves a complex interaction between *Rhizobium* and legume roots. The following statements are made while studying what governs this complex interaction?

I. Integration of Sym plasmid of *Rhizobium* in the root nuclear genome
II. Sensing of plant flavonoids by rhizobia
III. Activation of *nod* genes in rhizobia
IV. Activation of *NODULIN* genes in legume roots.

Which of the above statements are <u>*correct*</u>?

A) I, II and III B) I, III and IV C) II, III and IV D) I, II and IV

PART – B

36. The Hardy-Weinberg principle relates the allelic frequencies to the genotypic frequencies in a randomly mating population. Consider a single locus with two alleles which are at Hardy-Weinberg equilibrium. If the frequency of the recessive homozygous genotypes is 0.49, what would be the frequency of heterozygotes in the population.

A) 0.42 B) 0.14 C) 0.21 D) 0.36

37. The mass and extinction coefficient of a protein are 11237 Da and 15 mM^{-1} cm^{-1} respectively. A solution of this protein upon a 1:100 dilution shows an absorbance of 0.35. What is the concentration of this protein in moles/L and in mg/ml?

A) 0.23×10^{-3} M and 25.8 mg/ml
B) 2.3×10^{-3} M and 25.84 mg/ml
C) 23×10^{-3} M and 25.8 mg/ml
D) 0.23×10^{-3} M and 2.58 mg/ml

38. As per the succession of the stages of prophase condition of a cell undergoing meiotic-I division, which order among the following is *correct*?

I. Leptotene
II. Zygotene
III. Pachytene
IV. Diplotene
V. Diakinesis

A) I, 1V, III, II, V
B) I, II, IV, III, V
C) I, II, III, IV, V
D) II, IV, III, V, I

39. Where are bacteriochlorophylls present in a cell?

A) Cytoplasm
B) Plasma membrane
C) Mitochondria
D) Chloroplast

40. The noncovalent association of protein between electrically neutral molecules, collectively known as?

A) Hydrophobic B) Ionic C) Covalent D) van der Waals forces

41. Which of the following is the most preferred buffer condition for separation of double-stranded DNA samples using agarose gel electrophoresis?

A) Buffer of pH 4
B) Buffer of pH 5.5
C) Buffer of pH 7.5
D) Buffer of pH 10.0

42. The plant hormone present in root exudates and known to promote host plant-arbuscular mycorrhiza association and also stimulate germination of weedy parasites is

A) Ethylene B) Auxin C) Strigolactone D) Abscisic acid

43. The blood poisoning caused by the presence of large quantities of bacteria in the blood stream is generically known as:

A) Leukemia B) Septicaemia C) Erythema D) Hormoligosis

44. The basis of proteins separation in an SDS-PAGE experiment is due to their:

A) Molecular weight
B) Positively charged side chains
C) Negatively charged side chains
D) Isoelectric points

45. Which of the following tissues in plants often remain free from viral invasion?

A) Fruit pericarp
B) Leaf epidermis
C) Root cortex
D) Shoot apical meristem

46. The metal ion present as the cofactor assisting nitrate reductase activity is

A) Magnesium
B) Manganese
C) Molybdenum
D) Copper

47. TCA cycle has got amphibolic role in cell metabolism because:

A) Both ATP and NADH are produced in the cycle
B) It is the main pathway for generation of metabolic form of energy
C) It is responsible for oxidative as well as reductive reactions
D) Precursors of various pathways are also produced during the cycle besides their oxidation

48. Match the following groups of microorganisms with their natural habitats:

P. Methanogen	1. Hot sulphur springs
Q. Halophiles	2. Oxygen-free environment
R. Thermocidophiles	3. Severe cold climate
S. Psychrophiles	4. Extreme salt concentration

A) P-4, Q-3, R-1, S-2
B) P-2, Q-4, R-1, S-3
C) P-4, Q-3, R-2, S-1
D) P-2, Q-4, R-3, S-1

49. A major structural polymer with repeats of N -acetylglucosamine and N -acetylmuramic acid residues cross-linked by peptide side chains is observed in:

A) Chitin B) Cutin C) Peptidoglycan D) Pectin

50. The catabolic pathway in which no net oxidation-reduction occurs but the electrons of a substrate are distributed among the products is:

A) Respiration B) Fermentation C) Photosynthesis D) Glycolysis

51. Match the following terminology to describe the growth status of a bacterial population:

P. Bacterial culture accumulates toxic waste
Q. Bacterial culture in exponential growth
R. Bacterial growth ceases but cells are active
S. Bacteria adapt to growth conditions

1. Log phase
2. Lag phase
3. Death Phase
4. Stationary Phase

A) P-4, Q-1, R-3, S-2
B) P-3, Q-1, R-4, S-2
C) P-2, Q-1, R-4, S-3
D) P-3-Q-2, R-4, S-1

52. In *Neurospora*, a fungus with ordered tetrads, a gene is located at a distance of 15 map units from the centromere. The expected frequency of second-division segregation of the gene will be:

A) 7.5 B) 15 C) 20 D) 30

53. The highly virulent pathogen of maize, *Cochliobolus heterostrophus* race T, produces host selective polyketide toxin known as ____.

A) C-toxin B) Ch-toxin C) T-toxin D) Zn-toxin

54. Monokaryotic fruiting is a developmental transition observed in ____.

A) *Buchnera hispida*
B) *Cryptococcus neoformans*
C) *Deinococcus radiodurans*
D) *Legionella pneumophila*

55. The sugar chain structure and their linkages in a glycan can be determined by analyzing partially hydrolyzed fragments known as ____.

A) Fractional analysis
B) Glyco analysis
C) Linkage analysis
D) Dialysis

56. In bioremediation, sufficient microbial biomes will be grown in the path of contaminant migration to stop or slow contaminant movement. This concept is called ____.

A) Biocontain
B) Biocurtain
C) Bioaction
D) Bioinhibition

57. The photosynthetic and mitochondrial electron transports are affected by which of the following three elements?

A) Cu, Mn, and Fe
B) Co, Mn, and Fe
C) Cu, Mg, and Cl
D) Zn, Cu, and Fe

58. One of the following antibiotics reversibly binds to the receptors on the 30S ribosomal subunit of an infectious bacterium, preventing attachment of aminoacyl-tRNA to the RNA-ribosome complex and inhibiting bacterial protein synthesis:

A) Tetracycline
B) Penicillin
C) Amoxicillin
D) Griseofulvin

59. The cytokinins are an important class of hormones promoting growth of cells. Which of the following statements are *correct*?

I. Cytokinin as cell division promoting factor was discovered by F. Skoog and C. Miller.
II. A high relative ratio of cytokinin: auxin in cell cultures led to the root formation
III. Coconut milk contains a cell division-inducing factor known as kinetin.

A) I and II
B) I and III
C) II and III
D) I, II and III

60. A double heterozygote has the coupling configuration A B/a b of two genes that have a frequency of recombination of 0.05. If one gamete is chosen at random, what is the probability that it is a nonrecombinant gamete?

A) 0.025
B) 0.05
C) 0.95
D) 0.475

61. Match the given enzymes with their putative functions in molecular biology

P. Primase	1. Unwinding double stranded DNA into single stranded DNA
Q. Ligase	2. Regulating supercoiling of bacterial DNA
R. Topoisomerase	3. Catalyzing synthesis of short RNA sequences to start DNA replication
S. Helicase	4. Joining breaks in the phosphodiester backbone of a DNA molecule

A) P-3, Q-4, R-2, S-1 B) P-1, Q-4, R-3, S-2
C) P-4, Q-3, R-1, S-2 D) P-3, Q-4, R-1, S-2

62. In a host-pathogen interaction, the protein molecules secreted by the pathogen into the host to suppress defense responses are known as:

A) Effectors B) Adapters C) Concatemers D) Receptors

63. Match the common terminology used to describe the mode of nutrition of microorganisms:

P. Auxotrophs	1. Organisms that obtain energy by the oxidation of electron donors
Q. Prototrophs	2. Organisms could carry out photon capture to synthesis compounds
R. Phototrophs	3. Organisms that exhibit one or few nutritional requirements
S. Chemotrophs	4. Organisms that can grow on a minimal medium

A) P-3, Q-4, R-1, S-2 B) P-2, Q-4, R-3, S-1
C) P-4, Q-2, R-1, S-3 D) P-3, Q-4, R-2, S-1

64. One of the following is *not* a feature of a fungal organism:

A) Secreting extracellular enzymes to degrade biopolymers
B) Produce large number of small organic molecules of unusual structure
C) Carry out photosynthesis and nitrogen fixation like other microorganisms
D) Unable to use inorganic compounds other than oxygen as terminal acceptors in respiration

65. A receptor that binds immunoglobulin (antibody) to a cell surface is called a:

A) Fc receptor B) Complement receptor
C) I- receptor D) CD molecule

66. How many copies of the H2B histone would be found in a chromatin containing 50 nucleosomes?

A) 5 B) 10 C) 50 D) 100

67. Match the following types of plasmids with their characteristic biological function:

P. COL plasmid	1. Codes for virulence to promote infection
Q. TOL plasmid	2. Carries transfer (*tra*) genes
R. F plasmid	3. Codes for a multistep metabolic reaction
S. Ti Plasmid	4. Carries genes coding for bacteriocins

A) P-3, Q-4, R-1, S-2
B) P-4, Q-3, R-2 S-1
C) P-2, Q-4, R-1, S-3
D) P-3, Q-4, R-2, S-1

68. Which among the following viral causal agents was used in the first decisive experiments showing that nucleic acids carry hereditary information, and that nucleic acid alone is sufficient for viral infectivity:

A) Cauliflower Mosaic Virus
B) Tomato Spotted Wilt Virus
C) Cucumber Mosaic Virus
D) Tobacco Mosaic Virus

69. Chemical nature of the nodulation (Nod) factors is:

A) Lipoproteins
B) Oligosaccharides
C) Lipochitooligosaccharides
D) Oligopeptides

70. The arrangement of cDNA clones in an overlapping and contiguous manner is known as:

A) Coding sequence
B) Open reading frame
C) Contig
D) Cistron

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University of Hyderabad
Entrance Examinations - 2021

School/Department/Centre : Department of Plant Sciences, School of Life Sciences
Course/Subject : Ph.D. Microbiology – 2021 (Code No. A-57)

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
1	C	26	B	51	B	76	
2	D	27	B	52	D	77	
3	A	28	B	53	C	78	
4	B	29	A	54	B	79	
5	D	30	C	55	A	80	
6	D	31	C	56	B	81	
7	B	32	C	57	A	82	
8	B	33	B	58	A	83	
9	C	34	A	59	B	84	
10	C	35	C	60	C	85	
11	B	36	A	61	A	86	
12	C	37	B	62	A	87	
13	C	38	C	63	D	88	
14	D	39	B	64	C	89	
15	C	40	D	65	A	90	
16	C	41	C	66	D	91	
17	A	42	C	67	B	92	
18	A	43	B	68	D	93	
19	A	44	A	69	C	94	
20	D	45	D	70	C	95	
21	A	46	C	71		96	
22	C	47	D	72		97	
23	B	48	B	73		98	
24	B	49	C	74		99	
25	A	50	B	75		100	

Note/Remarks : Final Answer Key is same as Provisional Answer Key. No Corrections have been made.

11/09/2021

Signature of the Head
Department of Plant Sciences

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