Seat No.

Total No. of Pages : 13

Ph.D. Entrance Examination 2025
MICROBIOLOGY
Sub. Code: 58797

Day and Date : Tuesday, 09-Sep-2025 **Total Marks : 100**
Time : 01.00 pm to 03.00 pm

Instructions:

1) All questions are compulsory.
2) Each question carries 2 mark.
3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
4) Follow the instructions given on OMR sheet.
5) Rough work shall be done on the sheet provided at the end of question paper.

SECTION I

1. Laboratory analysis using computers and online databases is called .....

   A) In vitro B) Wet lab

   C) In silico D) Dry lab

2. Oil immersion objective lens has an NA value of .....

   A) 0.65 B) 0.85

   C) 1.33 D) 1.00

3. Trickling filter is used in ..... treatment of wastewater.

   A) Primary

   B) Secondary

   C) Tertiary

   D) Quaternary

4. Restriction Fragment Length Polymorphism (RFLP) is primarily used for .....

   A) Amplifying specific DNA sequences

   B) Creating genetically modified DNA

   C) Analyzing patterns of cleaved DNA fragments

   D) Sequencing the entire genome of a microorganism

5. LAL reagent is derived from the horseshoe crab .....

   A) Escherichia coli B) Tachypleus

   C) Salmonella typhimurium D) Staphylococcus aureus

6. ..... can be integrated with classical isolation techniques to ensure culture-purity in slow-growing environmental bacteria.

   A) Serial dilution in liquid broth

   B) Gram staining and light microscopy

   C) Use of selective antibiotics

   D) Real-time PCR screening for contaminant DNA

7. Buffered peptone water is preferred as a primary enrichment medium for Salmonella detection from processed foods because it .....

   A) Selectively inhibits competing microflora

   B) Neutralizes food preservatives and revives sub-lethally injured cells

   C) Increases the viscosity of samples for easier plating

   D) Encourages sporulation of all Gram-negatives

8. The primary stain used in the Ziehl-Neelsen and Kinyoun methods of acid-fast staining is .....

A) Methylene blue
B) Crystal violet
C) Safranin
D) Carbol fuchsin

9. The time taken by analyte molecules to pass through the free spaces between the particles of the matrix coated with the stationary phase is called .....

A) Dead time
B) Void time
C) Retention time
D) Retain time

10. Which of the following is NOT considered a reliable tool for selecting a research. topic in scientific research?

A) Peer-reviewed journals
B) Internet blogs without citations
C) Academic textbooks
D) Focus group discussions

11. Which of the following actions is considered a form of plagiarism?

A) Citing other's work properly
B) Paraphrasing another author's work with attribution
C) Using someone else's data or ideas without acknowledgment
D) Discussing general knowledge without citation

12. The assay commonly used to determine the potency of antibiotics is .....

A) Ames test
B) Kirby-Bauer disk diffusion test
C) ELISA
D) Western blot

13. PCR involves three basic steps in correct sequence as .....

A) Denaturation, elongation, annealing

B) Denaturation, annealing, elongation

C) Annealing, elongation, denaturation

D) Elongation, annealing, denaturation

14. The main purpose of a literature review is to .....

A) Collect data

B) Identify research gaps

C) Test hypothesis

D) Do statistical analysis

15. The measure of central tendency that divides data into two equal parts is .....

A) Mean

B) Median

C) Mode

D) Standard deviation

16. Any pathogen that usually causes serious human disease but is treatable by antimicrobial or anti-parasitic agents belongs to .....

A) Risk Group 4

B) Risk Group 2

C) Risk Group 1

D) Risk Group 3

17. In Reversed-phase liquid chromatography, the stationary phase is ..... and the mobile phase .....

A) More non-polar, less non-polar

B) Non-polar; relatively polar

C) More non-polar; less polar

D) Polar; relatively non-polar

18. ..... is a better strategy in ion exchange chromatography that provides the highest resolution for closely related charged species.

A) Isocratic elution at constant salt concentration

B) Stepwise increase in pH

C) Gradient elution with increasing salt concentration

D) Elution by temperature gradient

19. ..... is a detector commonly used in gas chromatography that involves burning the analyte to produce ions for detection.

A) Flame lonization Detector (FID)

B) Photodiode Array Detector (PAD)

C) Fluorescence Detector

D) Refractive Index Detector

20. ..... is a biomedical literature database which is used to retrieve full-text content.

A) Entrez

B) PubChem

C) PubMed Central

D) Medscape

21. Hidden Markov Models (HMMs) are important because they provide a powerful way to search databases for ..... related homologs.

A) Closely

B) Distantly

C) New

D) Extra

22. ..... is a command-based offline tool used for molecular structural visualization.

A) Swiss-PDB Viewer

B) RasMol

C) QMol

D) PyMol

23. The ..... tool compares translated nucleotide query sequences against translated nucleotide databases.

A) blastp B) blastn

C) tblastx D) tblastn

24. In UV-Visible spectrophotometry, ... is a factor that can cause deviation from the Beer-Lambert law at high solute concentration.

A) Wavelength calibration error

B) Solute-solute interactions

C) Use of quartz cuvettes

D) Low path length of the cuvette

25. Conventional columns used for HPLC are generally made of stainless steel and are manufactured so that they can withstand pressures of up to .....

A) 20 MPa B) 5 MPa

C) 50 MPa D) 0.5 MPa

SECTION II

26. The classical, lectin, and alternative pathways of complement activation converge at the step of .....

A) C1q binding to antibody-antigen complexes

B) Cleavage of C3 into C3a and C3b by C3 convertase

C) Formation of the Membrane Attack Complex (MAC) (C5b-9)

D) Production of the anaphylatoxin C5a

27. MHC molecules are expressed on .....

A) All nucleated cells and antigen-presenting cells

B) Red blood cells only

C) Only B cells

D) Only macrophages

28. Complement deficiencies may result in .....

A) Increased susceptibility to infections

B) Autoimmune diseases only

C) Increased antibody production

D) No clinical consequence

29. The principle of "biostimulation" in bioremediation involves

A) Adding a specific, pre-adapted consortium of microbes to a site

B) Modifying the environmental conditions to stimulate microbial growth

C) Excavating the contaminated soil and treating it in a bioreactor

D) Using plants to extract contaminants from the soil

30. A "lampbrush chromosome," observed in meiotic oocytes of some vertebrates, is characterized by

A) Extreme condensation and genetic inactivity

B) Intensely transcribed loops of chromatin

C) Being composed entirely of heterochromatin

D) A specific number of polytene bands

31. A key family of proteins that regulates the intrinsic (mitochondrial) pathway of apoptosis is .....

A) The Ras family of GTPases

B) The Bel-2 family

C) The cyclin-dependent kinases (CDKs)

D) The mismatch repair (MMR) proteins.

32. The tumour suppressor protein p53 is often called "the guardian of the genome" because it .....

A) Regulates cell division and ensures DNA repair

B) Directly promotes progression through the cell cycle

C) Is a receptor for growth factors on the cell surface

D) Functions as an activator protein for chromosome segregation

33. In Two-Dimensional Polyacrylamide Gel Electrophoresis (2D-PAGE), the proteins are separated based on two independent properties in sequence

A) Size in the first dimension and shape in the second dimension

B) Isoelectric point (pl) in the first dimension and molecular weight in the second dimension

C) Charge in the first dimension and solubility in the second dimension

D) Affinity in the first dimension and hydrophobicity in the second dimension

34. The Michaelis-Menten constant (Km) represents the .....

A) Maximum rate of the enzyme-catalyzed reaction

B) Substrate concentration at which the reaction velocity is half of Vmax

C) Turnover number of the enzyme

D) Free energy of activation for the reaction

35. The partial double-bond character of the peptide bond is a direct consequence of .....

A) The hydrogen bonding between adjacent amino acids

B) Resonance between the carbonyl carbon and the amide nitrogen.

C) The hydrophobic nature of the side chains

D) The ionic charges on the amino and carboxyl termini

36. De novo purine biosynthesis starts with .....

A) Ribose-5-phosphate

B) Pyruvate

C) Acetyl-CoA

D) Glucose

37. In probability, if two events cannot happen at the same time, they are called .....

A) Independent events

B) Mutually exclusive events

C) Dependent events

D) Complementary events

38. The "bell-shaped curve" that is symmetric around its mean describes ..... distribution.

A) Binomial

B) Poisson

C) Normal

D) Chi-square

39. In a simple linear regression equation ya bx, the value 'b' represents the .....

A) Y-intercept

B) Slope of the line

C) Predicted value of y

D) Correlation coefficient

40. A key strategy for influenza virus to initiate infection is .....

A) Penetrating intact skin

B) Binding to sialic acid receptors on respiratory epithelial cells

C) Producing siderophores

D) Resisting stomach acid

41. A key feature distinguishing systemic mycoses from superficial mycoses is .....

A) The presence of skin lesions in hosts.

B) Invasion of deep tissues in immunocompromised hosts

C) The ability to be treated with topical antifungals

D) Transmission from person to person

42. A key mechanism by which lactic acid bacteria in fermented dairy products inhibit enteric pathogens is by .....

A) Producing antibiotics

B) Lowering the pll of the gut

C) Consuming all the oxygen in the gut

D) Directly phagocytosing pathogens.

43. ..... enzyme is used in production of high fructose syrup.

A) Pectinase

B) Invertase

C) Glucose isomerase

D) Lipase

44. Adeno-Associated Virus (AAV) is a popular vector for human gene therapy because it .....

A) Has a large capacity for foreign DNA

B) Is a non-pathogenic virus that leads to long-term gene expression

C) Causes strong immune reactions which are beneficial

D) Integrates into the host genome at a specific site

45. An advantage of using Pichia pastoris (a yeast) for heterologous protein production over E. coli is that Pichia

A) Grows much faster than E. coli

B) Is cheaper and easier to genetically manipulate

C) Can perform mammalian-like post-translational modifications

D) Has a smaller genome

46. In feedback inhibition, the end product of a metabolic pathway typically .....

A) Activates the first enzyme in the pathway

B) Acts as a competitive inhibitor for the last enzyme

C) Acts as an allosteric inhibitor for the first committed-step enzyme

D) Is degraded to restart the pathway

47. BSL-4 containment is required for work with .....

A) Staphylococcus aureus

B) Hepatitis B virus

C) Escherichia coli

D) Ebola virus

48. ..... organelle is the site of beta-oxidation of fatty acids and contains the enzyme catalase.

A) Mitochondria
B) Glyoxysomes
C) Peroxisomes
D) Vacuoles

49. Which of the following is a key factor that can accelerate the biodegradation of pesticides?

A) Low moisture content in the soil
B) Anaerobic conditions for all pesticides
C) The previous exposure of the soil to the pesticide
D) High levels of salinity

50. In a Fluorescence in situ Hybridization (FISH) experiment targeting a specific uncultured bacterium, a key limitation is that it .....

A) Requires the target organism to be culturable
B) Provides no phylogenetic information
C) Cannot distinguish between live and dead cells, as rRNA can persist
D) Has a resolution that is too high, making it impractical for environmental samples

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-- ROUGH WORK --