Total No. of Printed Pages: **07**   No. of Questions : **50**

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PET 2024 (9016) Doctor of Philosophy (Microbiology)

(To be filled by the Candidate)

Candidate Seat Number
(As per Admit card)

OMR Sheet Number

Invigilator's signature with Date

Candidate's Seat No. in Words   :_____

Name of the Center   :_____

Paper Code & Name of Examination   : **9016- Doctor of Philosophy (Microbiology)**

Date: **03/10/2024**   **PET 2024 - EXAMINATION**

Time: **One Hours**   Total Marks: **100**

Important Instructions for the candidate	**विद्यार्थ्यांसाठी महत्त्वाच्या सूचना**
1. Write your seat number and OMR Sheet number on the question paper in the earmarked space	1. परीक्षार्थींनी आपला आसन क्रमांक या पृष्ठावरील वरच्या कोप-यात तसेच आपणास दिलेल्या उत्तर पत्रिकेचा क्रमांक त्याखाली लिहावा.
2. This question paper carries Fifty (50) Multiple-choice type questions and each question carries 2 Marks	2. या प्रश्नपत्रिकेतील सर्व प्रश्न सोडवणे अनिवार्य आहे.
3. At the commencement of examination, the question paper will be given to the student.	3. परीक्षा सुरू झाल्यावर विद्यार्थ्याला प्रश्नपत्रिका दिली जाईल.
4. Each question has four alternative responses marked (A) (B) (C) and (D). You have to darken the circle as indicated below on the correct response against each question Example: where (C) is correct answer	4. प्रत्येक प्रश्नासाठी (A) (B) (C) (D) अशी चार विकल्प उत्तरे दिली आहेत, त्यातील योग्य उत्तराचा रकाना खाली दर्शविल्याप्रमाणे ठळकपणे काळा निळा करावा. उदा: जर (C) हे उत्तर योग्य असेल तर

Example: where (C) is correct answer

(A)   (B)   ●   (D)

(A)   (B)   ●   (D)

5. Your responses to the answer are to be indicated in the OMR Sheet. If you mark at any place other than in the circle in the OMR Sheet it will not be evaluated.	5. या प्रश्नपत्रिकेतील प्रश्नांची उत्तरे ओएमआर उत्तर पत्रिकेतच दर्शवावीत इतर ठिकाणी लिहिलेली उत्तरे तपासली जाणार नाहीत.
6. Rough work is to be done at the end of this question paper.	6. प्रश्नपत्रिकाच्या शेवटी कोण्या जागेवरच कच्चे काम करावे
7. You have to return OMR answer sheet and question paper to the invigilator at the end of examination compulsorily and must not carry with you outside the examination hall.	7. परीक्षा संपल्यानंतर विद्यार्थ्यांनी मूळ ओ. एम. आर उत्तरपत्रिका पर्यवेक्षककाकडे परत करणे आवश्यक आहे तथापि प्रश्नपत्रिका व ओ. एम. आर. उत्तरपत्रिका आपल्याबरोबर नेण्यास विद्यार्थ्याला परवानगी नाही.
8. Use only Black / Blue ball point pen	8. फक्त काळ्या किंवा निळ्या बॉलपेनाच वापर करावा
9. Use of any type of calculator or log table etc. is prohibited.	9. कॅल्क्युलेटर किंवा लॉग टेबल वापरण्यास परवानगी नाही
10. There is no negative marking for incorrect answers	10. चुकीच्या उत्तरासाठी गुण कपात केली जाणार नाही

Q. No.   **Question**

1. In rate zonal density gradient particles are separated on the basis of their------------
   - **(A)** Shape
   - **(B)** Centripetal force
   - **(C)** Specific velocity
   - **(D)** Buoyant density

2. The pore size of HEPA filter is ----------
   - **(A)** $0.5\mu m$
   - **(B)** $0.3\,\mu m$
   - **(C)** $5.0\,\mu m$
   - **(D)** $10.0\,nm$

3. Which of the following is the primary purpose of a Plackett–Burman design in experimental studies?
   - **(A)** To screen and identify the most significant factors from a large number of variables.
   - **(B)** To determine the exact response surface curvature.
   - **(C)** To optimize the response variable by identifying the best factor levels.
   - **(D)** To estimate the interaction effects between factors.

4. Ogives for more than type and less than type distribution intersect at _____ .
   - **(A)** Mean
   - **(B)** Median
   - **(C)** Mode
   - **(D)** Origin

5. The coefficient of correlation_____.
   - **(A)** Cannot be negative
   - **(B)** Cannot be positive
   - **(C)** Always positive
   - **(D)** Can either be positive or negative

6. Which of the following is best describes "self-plagiarism"?
   - **(A)** Copying small portions of text from multiple sources and combining them
   - **(B)** Using another author's work without proper citation.
   - **(C)** Rewriting someone else's work and passing it off as original.
   - **(D)** Submitting the same piece of work for multiple assignments without permission.

7. _____can be used to find out average rate like kilometers per hour.
   - **(A)** Geometric mean
   - **(B)** Harmonic mean
   - **(C)** Median
   - **(D)** Mode

8. _____ is a preferred sampling method for the population with finite size.
   - **(A)** Area sampling
   - **(B)** Cluster sampling
   - **(C)** Purposive sampling
   - **(D)** Systematic sampling

9. Standard deviation is_____
   - **(A)** Measured using the unit of the variable
   - **(B)** The square root of variance
   - **(C)** Measured using the squared unit of the variable
   - **(D)** Has values generally comparable with the average value

10. What is the primary limitation of using a Scanning Electron Microscope (SEM) compared to a Transmission Electron Microscope (TEM)?
    - **(A)** SEM can only provide two-dimensional images.
    - **(B)** SEM requires sample preparation that can distort the specimen.
    - **(C)** SEM has a lower resolution than TEM.
    - **(D)** SEM cannot image biological specimens.

11. If an author has an h-index of 15, which of the following statements is correct?
    (A) The author has 15 papers with fewer than 15 citations each.
    (B) The author has at least 15 papers with at least 15 citations each.
    (C) The author has 15 papers, each with at least 15 citations, and the rest have fewer citations.
    (D) The author has exactly 15 publications in total.

12. _____of the following diagrammatic method is used to represent discrete quantitative data sector wise.
    (A) Bar diagram   **(B)** Pie Chart
    (C) Histogram   **(D)** Polygon

13. Sum of lower-class limit plus upper-class limit divided by 2 is called_____
    (A) Correction factor   **(B)** Class interval
    (C) Mid-point   **(D)** Mean

14. Which types of biosafety cabinet provide the highest level of protection for both the worker and the environment
    (A) Class I   **(B)** Class II
    (C) Class III   **(D)** Class IV

15. In an ion exchange process, what is typically used to regenerate a cation exchange resin?
    (A) An alkaline solution   **(B)** A strong acidic solution
    (C) Concentrated salt solution **(D)** A chelating agent

16. In the process of conducting research 'Formulation of Hypothesis" is followed by_____
    (A) Statement of Objectives   **(B)** Analysis of Data
    (C) Selection of Research Tools **(D)** Collection of Data

17. The full form of NCBI is _____
    (A) National Centre for Biotechnology Information
    (B) National Centre for Biological Information
    (C) National Centre for Business Information
    (D) National Centre for Baby Information

18. H^1 NMR detects signal from --------------- atoms
    (A) Carbon   **(B)** Nitrogen
    (C) Oxygen   **(D)** Hydrogen

19. The role of photomultiplier tube is to amplify the number of ------------
    (A) Neutron   **(B)** Electron
    (C) Radiation   **(D)** Proton

20. _____was the first mechanical calculating device for counting of large numbers
    (A) Pascal's Adding and Subtraction Machine **(B)** Punch Card System
    (C) ABACUS   **(D)** Slide Ruler

21. In reverse phase HPLC, there is a -------
    (A) Non polar solvent/ polar column   **(B)** Polar solvent/non polar column
    (C) Non polar solvent/non polar column **(D)** Polar solvent/polar column

22. The tracking dye used in SDS-PAGE is -------
    (A) Anionic   (B) Cationic
    (C) Non ionic   (D) Amphiphatic

23. The concentration of metal detected in Atomic Absorption Spectroscopy is in --------------
    (A) g/ml   (B) mg/lit.
    (C) mg/ml   (D) g/lit

24. What is the primary difference between a trademark and a trade secret?
    (A) Trademarks protect inventions, while trade secrets protect logos and brand names.
    (B) Trade secrets are limited in duration, whereas trademarks last indefinitely.
    (C) Trademarks require secrecy, whereas trade secrets require public disclosure.
    (D) Trademarks are publicly registered, whereas trade secrets are kept confidential.

25. Geographical classification means, classification of data according to _____.
    (A) Time   (B) Order
    (C) Ace   (D) Items

26. The primary function of Krebs cycle in the cellular respiration is --
    (A) To generate reducing equivalents (NADH and FADH2) for the electron transport chain
    (B) To convert glucose into pyruvate
    (C) To produce lactic acid
    (D) To produce ATP directly

27. The process of converting glucose to pyruvate occurs in which part of cell---
    (A) Mitochondria   (B) Golgi complex
    (C) Nucleus   (D) Cytoplasm

28. -------- plot is commonly used to analyze enzyme kinetics and determine the Km and Vmax values.
    (A) Lineweaver –Burk plot   (B) Michaelis –Menten plot
    (C) Eadie-Hofstee plot   (D) Scatchard plot

29. Which factor is not typically involved in enzyme regulation?
    (A) Temperature   (B) pH
    (C) Substrate concentration   (D) Genetic sequence of the enzyme

30. Which of the following statement about enzyme kinetics is true for a reaction following Michaelis – Menten kinetics?
    (A) The reaction rate is directly proportional to substrate concentration
    (B) The reaction rate decreases linearly with increasing substrate concentration
    (C) The Km value represents the maximum rate of the enzyme catalyzed reaction
    (D) The maximum reaction rate (Vmax) is achieved when all enzyme active sites are occupied by substrate.

31. -------- enzyme is responsible for the conversion of pyruvate to ethanol and carbon dioxide in alcoholic fermentation.
    (A) Alcohol dehydrogenase   (B) Pyruvate decarboxylase
    (C) Lactate dehydrogenase   (D) Acetaldehyde dehydrogenase

32. What role do microbes play in the fermentation of sauerkraut?
- **(A)** They produce alcohol
- **(B)** They breakdown proteins in amino acid
- **(C)** They produce carbon dioxide and lactic acid
- **(D)** They convert sugars into acetic acid

33. Which type of bioreactor is best suited for applications requiring high cell density and minimal shear stress?
- **(A)** Stirred tank bioreactor
- **(B)** Fluidized bed bioreactor
- **(C)** Packed bed bioreactor
- **(D)** Airlift bioreactor

34. What should be done if an autoclaved media shows sign of contamination?
- **(A)** Increase the temperature of the autoclave
- **(B)** Reuse it after re-autoclaving
- **(C)** Add antibiotics to the medium
- **(D)** Dispose of it and prepare new batch

35. Which of the following is the key component of Quality Control (QC)?
- **(A)** Standard operating procedures (SOPs)
- **(B)** Quality audits
- **(C)** Product inspection
- **(D)** Risk management

36. Which of the following is used as pyrimidine analog in chemotherapy?
- **(A)** 6-mercaptopurine
- **(B)** Cytarabine
- **(C)** Vinblastine
- **(D)** Dacarbazine

37. Which type of mutation does not change the amino acid sequence of the protein?
- **(A)** Missense
- **(B)** Silent
- **(C)** Nonsense
- **(D)** Framshift

38. In the lac operon, which molecule acts as an inducer.
- **(A)** Tryptophan
- **(B)** Glucose
- **(C)** lactose
- **(D)** Allolactose

39. Which viral genome type can be directly translated into protein by host ribosomes without needing to be transcribed into mRNA?
- **(A)** dsDNA
- **(B)** -ssRNA
- **(C)** dsRNA
- **(D)** +ssRNA

40. Which type of PCR is used to quantify the amount of DNA or RNA present in a sample?
- **(A)** Nested PCR
- **(B)** Digital PCR
- **(C)** RT-PCR (Reverse Transcription PCR)
- **(D)** Real-time PCR (qPCR)

41. Which type of plasmid is specifically designed for cloning and can carry large inserts of DNA?
- **(A)** Cosmid
- **(B)** Episome
- **(C)** Shuttle plasmid
- **(D)** Expression plasmid

42. Which type of antibody is typically the first produced in response to an initial infection?
- **(A)** IgG
- **(B)** IgA
- **(C)** IgM
- **(D)** IgD

43. What is the primary difference in antigen presentation between MHC class I and MHC class II molecules?
   (A) MHC Class I presents antigens derived from extracellular sources, while MHC Class II presents antigens from intracellular sources.
   (B) MHC Class I presents antigens to CD4+ T cells, while MHC Class II presents antigens to CD8+ T cells.
   (C) MHC Class I presents antigens to CD8+ T cells, while MHC Class II presents antigens to CD4+ T cells.
   (D) MHC Class I and MHC Class II present antigens in the same manner to all T cells.

44. Which microbial interaction is characterized by one organism is benefited and other is neither benefited nor harmed?
   (A) Commensalism   (B) Parasitism
   (C) Mutualism   (D) Amensalism

45. What is the difference between BOD and COD?
   (A) BOD measures total organic matter, while COD measures only biodegradable organic matter
   (B) COD is always lower than BOD in untreated wastewater.
   (C) BOD and COD are identical measurements of organic pollution.
   (D) BOD measures biodegradable organic matter, while COD measures both biodegradable and non-biodegradable organic matter.

46. Which reagent is typically used as the oxidizing agent in COD determination?
   (A) Potassium permanganate   (B) Potassium hydroxide
   (C) Potassium dichromate   (D) Hydrogen peroxide

47. The primary mode of action of *Bacillus thuringiensis* (Bt) as a biopesticide is ---
   (A) It produces a crystalline protein that damages the gut lining of insects.
   (B) It produces toxins that disrupt insect endocrine systems
   (C) It induces systemic resistance in plants against pathogens
   (D) It competes with pathogens for nutrients and space.

48. Which characteristics of xenobiotic compounds makes it recalcitrant to biodegradation?
   (A) Low water solubility
   (B) Simple molecular structure
   (C) Low molecular weight
   (D) Presence of halogen atoms like chlorine and fluorine

49. Which of the following immobilization techniques involves the physical confinement of enzymes within a semi-permeable membrane or matrix?
   (A) Encapsulation   (B) Cross-linking
   (C) Adsorption   (D) Covalent binding

50. ----- is the primary producer of penicillin in industrial fermentation?
   (A) Penicillium notatum   (B) Streptomyces griseus
   (C) Penicillium chrysogenum   (D) Aspergillus niger

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