P-68

ENTRANCE EXAMINATIONS – 2017

Ph.D. Biotechnology

Duration : 2 hours (Ph.D Admission - January'2018 Session) Max. Marks : 80

Hall Ticket No.

Instructions to the candidates

Please read the instructions carefully before answering the questions :

1. Write your Hall Ticket No. in the OMR Answer Sheet given to you. Also, write your Hall Ticket No. in the space provided above.
2. This Question paper consists of two parts : Part – A and Part – B contains 80 questions of multiple choices, printed in 15 pages, including this page. OMR Answer sheet provided separately.
3. Each question carries one mark and there is **no Negative marking**.
4. Answers are to be marked on the OMR Answer Sheet following the instructions provided thereon.
5. Please handover the **OMR Answer Sheet** at the end of the examination to the Invigilator.
6. In case the candidates have equal marks, preference will be given towards the candidates who has obtained higher marks in **PART - A**.
7. Non-programmable scientific calculators are permitted.
8. Cell/Mobile phones are strictly prohibited in the examination hall.

PART-A

1. A man has 9 friends, 4 boys and 5 girls. In how many ways can he invite them, if there have to be exactly 3 girls in the invitees?
   A) 320
   B) 160
   C) 80
   D) 200

2. A family of 4 brothers and 3 sisters is to be arranged in a row for a photograph. The number of ways in which they can be seated if all the sisters are to sit together is
   A) 5040
   B) 720
   C) 144
   D) 576

3. Which of the following terms $2^{1/3}$, $3^{1/4}$, $6^{1/8}$, $10^{1/12}$ is the largest?
   A) $2^{1/3}$
   B) $3^{1/4}$
   C) $6^{1/8}$
   D) $10^{1/12}$

4. Amina starts at point T, walks straight to point U which is 4 ft, away. She turns left, at 90^0 and walks to W which is 4 ft. away, turns 90^0 right and goes 3 ft, to P, turns 90^0 right and walks 1 ft, to Q, turns left at 90^0 and goes to V, which is 1 ft, away and once again turns 90^0 right and goes to O, 3 ft, away. What is the distance between T and O?
   A) 4 ft
   B) 7 ft
   C) 5 ft
   D) 8 ft

5. A, B, C, D, E and F are members of a family. Among them, there are Lawyer, Doctor, Teacher, salesman, Engineer and Accountant. There are two married couples in the family. D, who is a Salesman, is married to the lady Teacher. Doctor is married to the Lawyer. F, who is accountant is son of B. C, who is a Lawyer, is daughter-in-law of A. E is unmarried Engineer. A is grandmother of F. What is the profession of B?
   A) Accountant
   B) Doctor
   C) Lawyer
   D) Teacher

6. In a certain code language, 'Ming Young Pe' means 'Fruits are ripe'; 'Pe Lao May Mink' means 'Oranges are not ripe' and 'May Pe Nue Mink' means 'Mangoes are not ripe'. Which word in the language means 'Mangoes'?

   A) May
   B) Lao
   C) Nue
   D) Mink

7. A circle and a square have the same area. Then,
   A) Their perimeters are equal
   B) Perimeter of circle is greater
   C) Perimeter of square is greater
   D) None of the above

8. The radius of a circle is increased by 50%, then the ratio of new area to the original area will be
   A) 9:4
   B) 4:9
   C) 3:2
   D) 2:3

9. What is the molarity of a solution that contains 1.50 mol HCl in 2.50 L of solution?
   A) 1.67 M
   B) 0.600 M
   C) 1.20 M
   D) 1.40 M

10. The K_m value of an enzyme E for a substrate is 1.5 mM and the maximum rate it can attain at 1 mM of concentration is 150 μM/min. If the substrate concentration is 3.0 mM, the initial rate of reaction for will be,
    A) 20 μM/min
    B) 50 μM/min
    C) 100 μM/min
    D) 150 μM/min

11. Which one of the following plasmid DNA moves faster in gel electrophoresis
    A) Linear DNA
    B) Relaxed DNA
    C) Nicked Circular DNA
    D) Supercoiled DNA

12. In an enzyme kinetic reaction, if addition of an inhibitor decreases both K_m and V_{max}, the mechanism of inhibition is
    A) Substrate concentration dependent
    B) Enzyme concentration dependent
    C) Competitive
    D) Uncompetitive

13. Application of Southern blotting includes
    A) Preparation of RFLP maps
    B) Identification of transferred genes
    C) DNA fingerprinting
    D) All of these

14. The pH of a solution made by mixing 50 ml of 0.4 M HCL and 50 ml 0.2 M NaOH?
    A) 1
    B) 2
    C) 5
    D) 7

15. Following is not part of Lipinsky's rule of five:
    A) Log P
    B) Molecular Weight
    C) H-bond acceptor
    D) Polarizability

16. Which of the symmetry can NOT be found in water molecule?
    A) Center of symmetry
    B) Axis of symmetry
    C) Plane of symmetry
    D) None of the above

17. If half-life period of a reaction is independent of its initial concentration, then the order of reaction is
    A) Zero th order
    B) First order
    C) Second order
    D) Can't be determined

18. The number of hydrogen bonds formed by a water molecule at 300 K is nearly
    A) One
    B) Two
    C) Three
    D) Four

19. Gas constant is equal to the _____ two specific heat capacities
    A) Sum of
    B) Difference between
    C) Ratio of
    D) Product of

20. Probe is a
    A) Protein for detecting a specific DNA molecule
    B) Short piece of labeled DNA which are complementary to the nucleic acid strand to be detected
    C) Short piece of labeled DNA or RNA which are complementary to the nucleic acid strand to be detected
    D) None of these

21. What could be the maximum amount of CO_2 produced by one gram of carbon?
    A) 0.27g
    B) 0.75 g
    C) 1.33 g
    D) 3.67 g

22. Which of the following is not closely associated with the secondary structure of a protein?
    A) Protein Fluorescence
    B) Circular Dichroism
    C) Ramachandran Plot
    D) X-ray crystallography

23. Which of the following method measures changes in vibrational states of molecules?
    A) UV-Vis Spectroscopy
    B) Raman Spectroscopy
    C) Microwave spectroscopy
    D) NMR spectroscopy

24. In α-helix, the hydrogen bonds
    A) Occur mainly through the electronegative atoms of R-groups
    B) Occur only between certain amino acids in the helix
    C) Are roughly parallel to the axis of the helix
    D) Are roughly perpendicular to the axis of the helix

25. In a spontaneous process, the Helmoltz free energy of a system at constant pressure and temperature
    A) Increases
    B) Decreases
    C) Either increases or decreases
    D) Neither increases nor decreases

26. The term 'specific activity' differs from the 'activity' in that specific activity
    A) Refers to proteins other than enzymes
    B) Refers only to a purified protein
    C) Is the activity (enzyme units) in a milligram of protein
    D) Is the activity (enzyme units) of a specific protein
27. In isoelectric focusing, separation of proteins are based on
    A) Relative content of positively charged group
    B) Relative content of negatively charged group
    C) Both A and B
    D) pH

28. All of the amino acids that are found in proteins, except for proline, contain a(n)
    A) Amino group
    B) Carbonyl group
    C) Carboxyl group
    D) Ester group

29. The highest concentration of cystine can be found in
    A) Collagen
    B) Melanin
    C) Keratin
    D) Myosin

30. Which of the following reagents would be more useful in determining the N-terminal amino acid of polypeptide?
    A) Trypsin
    B) 1mol/L HCl
    C) Phenylisothiocyanate
    D) Cyanogen Bromide

31. $^{76}A_{32}$ is isotonic with
    1) $^{77}A_{32}$
    2) $^{77}B_{33}$
    3) $^{77}C_{34}$
    4) $^{78}D_{34}$

The correct alternatives are
    A) 2 and 4
    B) 1 and 3
    C) 1 and 2
    D) 2 and 3

32. During cell cycle DNA synthesis takes place in
    A) S-phase
    B) G1 and S phase
    C) G2 and S phase
    D) Entire cycle
33. From which of the following, restriction enzymes are isolated
    A) Prokaryotes
    B) Fungi
    C) Algae
    D) All of the above

34. The genetic code is said to be degenerative and universal which means that
    I) Amino acids may have more than one codon
    II) All amino acids have more than one codon
    III) Codons are common for higher and lower organisms
    IV) Codons are not found in bacteria

The correct statement is
    A) I, II and III
    B) I and II
    C) II and IV
    D) I and III

35. A boy goes to school with a speed of 3 km/h and returns with a speed of 2 km/h. If he takes 5 h to come back home from school, then the distance (in km) between the village and the school is
    A) 6
    B) 7
    C) 8
    D) 9

36. Ajay says to Bharat "I am 4 times as old as you were when I was as old as you are". The difference of their present age is 15 years. Then the age of Bharat at present is
    A) 30 yr
    B) 25 yr
    C) 35 yr
    D) 40 yr

37. If two successive PCRs are carried out, in which PCR there are chances of having a non-specific product?
    A) First PCR
    B) Second PCR
    C) Both the PCRs
    D) It depends on the annealing temperature

38. Topoisomerse I is also used for cloning of PCR product at times. Which of the following statement holds true for such type of cloning?
    A) The introduction of topoisomerase enzyme is done into the vector in the case it is very small in size
    B) The restriction site is introduced into the vector and the topisomerase enzyme is introduced into the PCR primers
    C) The topoismerase I is used for cutting both the strands
    D) The restriction site is introduced into the PCR primers and the topoisomerase enzyme is introduced into the vector

39. When PCR amplification is carried out outside the primers, it is called as:
    A) Inverse PCR
    B) Circular PCR
    C) Non-conventional PCR
    D) In-situ PCR

40. The tac promoter is an example of which type of promoter?
    A) Hybrid promoter
    B) Fusion promoter
    C) LacZ promoter
    D) AraBAD promoter

PART-B

41. Following enzyme not involved in transcription in eukaryotes:
    A) Topoisomerase II beta
    B) TF-II
    C) RNA polymerase
    D) Topoisomerase II alpha

42. Following gene expression requires tat:
    A) ITR-GFP
    B) LTR-GFP
    C) CMV-GFP
    D) ITR-GFP-ITR

43. Following size of the particle may cause injection site inflammation
    A) 1 nm
    B) 10 nm
    C) 100 nm
    D) 1000 nm

44. A cell positive for neuronal specific enolase and calbindin is
    A) Astrocyte
    B) Granule Neuron
    C) Panrkinje Neuron
    D) T Lymphocyte

45. A virus that has non-functional integration is
    A) Hepatitis B
    B) HIV-1
    C) HIV-2
    D) HTLV-III

46. Polymerase beta is important in following repair pathway,
    A) Homologous recombination
    B) Non-homologous end-joining
    C) Base excision repair
    D) Nucleotide excision repair

47. Following is indicator for establishment of AIDS
    A) CD4 cell count more than 500/cc
    B) Viral RNA less than 100 copies/cc
    C) CD8 cell count is less than 100/cc
    D) CD4 cell count is less than 200/cc

48. Circle the right answer
    I) Topoisomerase VI is a Type II topoisomerase
    II) Topoisomerase VI is a Type I topoisomerase
    III) Topoisomerase VI is present in all eukaryotes including human
    IV) Topoisomerase VI was first identified in archae

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

49. Telomere is found in
I) Bacterial chromosome
II) Both human mitochondrial DNA and nuclear chromosome
III) Human nuclear chromosome but not in human mitochondrial DNA
IV) The influenza viral genome

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

50. Which of the following statements about the *E. coli* chromosome is correct? Select all that apply
I) The *E. coli* chromosome is a single replicon.
II) Replication begins at ori C
III) Replication can start at any point in the chromosome
IV) A single replication fork moves around the molecule until the chromosome is completely replicated.
A) I and IV
B) II and IV
C) I and II
D) III and IV

51. Which of the following statements regarding chaperones is false?
A) Assisting folding is not chaperones' only function.
B) Peptidyl prolyl cis-trans-isomerase (PPI) is ATP independent.
C) Chaperones are needed to stabilize certain receptors.
D) For every chaperone in the cytosol, there is an equivalent in the endoplasmic reticulum.

52. Which property of p53 enables it to prevent the development of cancer?
A) p53 is a transcription factor that causes production of proteins that stimulate the cell cycle.
B) p53 prevents the replication of cells with damaged DNA.
C) p53 prevents cells from triggering apoptosis.
D) p53 stimulates synthesis of DNA repair enzymes that replace telomere sequence lost during cell division.

53. Tetracycline blocks the protein synthesis by
A) Inhibiting peptidyl transferase
B) Inhibiting initiation of translation
C) Inhibiting binding of aminoacyl tRNA to ribosome
D) Inhibiting translocase enzyme

54. The term 'sequela' refers to
A) Incubation
B) Clearance
C) Combination of symptoms
D) Death

55. Which one(s) is (are) the infective stage(s) of *Plasmodium falciparum*
I) Ring stage parasite
II) Merozoites
III) Sporozoites
IV) Oocysts
Select the right answer:
A) II
B) III
C) I and IV
D) II and III

56. How does the mismatch repair system distinguish between the parental (i.e. correct) DNA strand and the newly synthesized strand containing the mismatched base?
A) Thymine in the parental strand of the helix is methylated at GATC
B) Thymine in the new strand of the helix is methylated at GATC
C) Guanine in the parental strand of the helix is methylated at GATC
D) Guanine in the new strand of the helix is methylated at GATC

57. Molecular phylogenies in prokaryotes are constructed based on the nucleotide sequence analysis of the gene encoding
A) 5S rRNA
B) 16S rRNA
C) 23S rRNA
D) 18S rRNA

58. The word 'fulminant' refers to
A) Short and severe
B) Lingering
C) Hardening
D) Quick and high mortality

59. Human immunoglobulin (IgG) heavy chain genes are present on
A) Chromosome 22
B) Chromosome 2
C) Chromosome 14
D) Chromosome 12

60. Disinfectant agents to clean surgical wounds in order to control infections in humans are introduced by?
    A) Redi
    B) Semelweiss
    C) Jenner
    D) Lister

61. All of the following antibiotics bind bacterial ribosomes except
    A) Streptomycin
    B) Tetracycline
    C) Erythromycin
    D) Penicillin

62. The term refers to a disease which is present always in a population
    A) Pandemic
    B) Endemic
    C) Epidemic
    D) Hypodermic

63. You are studying DNA replication in an *E. coli* mutant, which has a partially defective DNA polymerase. In vitro experiments using the mutant DNA polymerase gives an error rate of 10^{-3}, as compared to the expected error rate of 10^{-6}. Which of the following activities is the mutant polymerase likely to be missing, as compared to the normal polymerase?

    A) 5'-3' exonuclease
    B) 3'-5' exonuclease
    C) 3'-5' recombinase
    D) 5'-3' polymerase

64. Which of the following virus infects only humans?
    A) Measles
    B) Chikungunya
    C) HIV
    D) Rabies

65. Who developed the Germ Theory of Disease?
    A) Koch
    B) Fleming
    C) van Leeuwenhoek
    D) Pasteur

66. Which one of the following antibiotics is selectively toxic to fungi?
    A) Amphotericin B
    B) Erythromycin
    C) Augmentin
    D) Ceclor

67. Which of the following organisms would not undergo meiosis?
    A) Bacteria
    B) Fungi
    C) Plant
    D) Humans

68. Mitochondrial DNA is inherited from which one of the following?
    A) Paternal only
    B) Maternal only
    C) Both paternal and maternal
    D) The offspring's own DNA

69. The host protein 'cyclophilin A' involved in the binding of
    A) HIV
    B) HCV
    C) HBV
    D) HDV

70. Which of the following is correct in case of microarray technology
    A) Hybridization of RNA: RNA
    B) Hybridization of labelled and unlabeled cDNAs
    C) Hybridization of RNA: protein
    D) All

71. FOS, JUN and MYC are:
    A) Genes coding for surface proteins expressed on cancerous cells
    B) Genes coding for protein kinases that phosphorylate transcription factors regulating cancer genes.
    C) Genes coding for transcription factors that induce growth-dependent genes.
    D) Incorrect spellings of three months of the year.

72. *Borellia burgdorferi* causes the disease
    A) Lyme's Disease
    B) Rocky Mountain Spotted Fever
    C) Hanta
    D) Rabies

73. In general, which of the following is the starting material for wine making?
A) Grape skin
B) Wheat soak
C) Orange pulp
D) Steamed Rice

74. Introducing DNA from outside into a bacterial cell mediated by chemical refers to
A) Transformation
B) Transcription
C) Transduction
D) Conjugation

75. The enveloped proteins of a virus are involved in
A) Eliciting immunological response
B) Attachment
C) Neutralization
D) All

76. Flow cytometry is useful in
A) Measurement of DNA in a cell
B) Size of a cell
C) Type of a cell
D) All

77. In terms of lac operon regulation, what happens when *E. coli* is grown in a medium containing both glucose and lactose?
A) Both CAP and Lac repressor are bound to the DNA
B) CAP is bound to the DNA but Lac repressor is not
C) Lac repressor is bound to the DNA but CAP is not
D) Neither CAP nor Lac is bound to the DNA

78. Which of the following statements about mRNA stability is correct? Please select the right answer.
I) Prokaryote mRNAs have a half-life of only a few minutes
II) Regulation of mRNA stability is way of regulating gene expression
III) It is thought that poly A tails stabilize eukaryotic mRNAs
IV) Histone mRNAs have especially long poly A tails and are especially stable
Please select the right answer.
A) I and II
B) I, II and III
C) I, II, III and IV
D) II, III and IV

79. Although the Ti plasmid has revolutionized plant genetic engineering it has one limitation of its use. Choose the correct answer
A) Cannot infect broadleaf plants.
B) Cannot be used on fruit-bearing plants
C) Cannot transmit prokaryotic genes
D) Does not infect cereal plants such as corn and rice

80. Loss of gene(s) will be there in
A) Transgenic mice
B) Knock out mice
C) Breeding mice
D) All the above