S-64

ENTRANCE EXAMINATION, June 2018
Ph.D. Animal Biology

Code number: S-64

Hall Ticket Number:

Maximum Time: 2 hours **Maximum Marks: 80**

INSTRUCTIONS: PLEASE READ BEFORE ANSWERING

- ***Enter your hall ticket number on this sheet and the answer (OMR) sheet.***
- ***Answers have to be marked on the OMR answer sheet following the instructions provided there upon.***
- ***Hand over OMR answer sheet to the invigilator at the end of the examination.***
- ***All questions carry one mark each. Answer all, or as many as you can.***
- ***There are a total of 12 pages in this question paper. Check this before you start answering. Answer sheet (OMR) will be provided separately.***
- ***The question paper consists of Part A and Part B. The marks obtained in Part A will be taken into consideration in case of a tie i.e., when more than one candidate gets equal marks, to prepare the merit list.***

PART "A"

1. Transmission electron microscopy analysis requires thin sections of specimen because:

A) electrons are negatively charged
B) electrons have a wave nature
C) electrons do not have mass
D) electrons have poor penetrating power

2. In SDS-PAGE, ammonium persulfate acts as a

A) solubilizing agent
B) source of free radicals
C) bridge between acrylamide and bis-acrylamide
D) pore builder in the polymerized gel

3. One of the following statements pertaining to the use of mass spectroscopy is correct:

A) separates proteins on the basis of size
B) analyzes the three dimensional shape of protein
C) separates the ionic fragments according to their mass-to-charge ratio
D) separates proteins on the basis of charge

S-64

4. In one of the following chromatographic techniques, the mobile phase moves through stationary phase by the influence of gravity or capillary action?

A) Column chromatography
B) Gas chromatography
C) High pressure liquid chromatography
D) Planar chromatography

5. According to the Beer's law, the intensity of light passing through a sample depends on

A) concentration
B) volume
C) composition
D) distance

6. The value of hydroxyl ion concentration in pure water is

A) 1×10^5 moles/litre
B) 1×10^7 moles/litre
C) 1×10^8 moles/litre
D) 1×10^9 moles/litre

7. During purification of potato 5-lipoxygenase (pI = 4.6) on gel filtration column, the major contaminant protein is patatin (pI = 7.8). As these two proteins have different pI values, which protein will appear in the flow through when the mixture is loaded on to a DEAE cellulose column?

A) Patatin
B) 5-Lipoxygenase
C) Both of them
D) None of them

8. Eastern blotting is a technique used for the detection of

A) methylation levels in DNA
B) length of poly A tail in RNA
C) post translational modifications in proteins
D) degree of unsaturation in fatty acids

9. Circular dichroism spectroscopy is used to analyze the

A) primary structure of a protein
B) secondary structure of a protein
C) extent of glycosylation of a protein
D) nature of interaction between two proteins

10. While measuring the concentration of purified molecule on UV/VIS spectrophotometer at 235 nm, an absorbance of 2.0 was observed. If the molar extinction co-efficient of the molecule is 40,000, its concentration would be

A) 0.5 μM
B) 5 μM
C) 50 μM
D) 500 μM

11. The pH of a 10^{-8} M hydrochloric acid solution is

A) equal to 8
B) equal to 7
C) more than 8
D) less than 7

12. Electron microscopy can be used to obtain the molecular weight of DNA by simply measuring the length. The conversion involves multiplying the length in microns by

A) 2×10^6
B) 2×10^5
C) 2×10^3
D) 2×10^9

13. When 0.1 ml of a 10^6-fold dilution of a bacterial culture was plated, 200 colonies appeared next day. The cell density of the original culture could be

A) 2×10^8 cells/ml
B) 2×10^6 cells/ml
C) 2×10^2 cells/ml
D) 2×10^9 cells/ml

14. CRISPR-Cas9 technology is widely used for

A) enhancing RNA interference
B) gene editing
C) analysis of DNA-protein interaction
D) detecting mRNA transcripts

15. In radial immunodiffusion (RID), concentration of the antigen loaded

A) is directly proportional to the diameter of the zone formed
B) can be measured only qualitatively
C) is directly proportional to the intensity of the zone formed
D) cannot be estimated

16. A 3 kb length of DNA has one *EcoR1* site at 275 bp and three *Pst1* sites at positions 615, 750 and 1560 bp respectively. Which of the following statement is not correct?

A) The largest product upon *EcoR1* digestion is 2725 bp
B) The largest product upon *Pst1* digestion is 1440 bp
C) The smallest product upon double digestion with the two enzymes is 275 bp
D) The smallest product upon *Pst1* digestion is 135 bp

17. Chi-square test X^2 can be applied to all of the following except to

A) measure the degree of deviation of the experimental result from the expected result
B) test the closeness observed and expected frequency
C) test population variance and sample variance
D) test the experimental variance and standard deviation

18. Inactivation of serum can be accomplished by heating at _____ for _____

A) 56°C, 30 minutes
B) 56°C, 10 minutes
C) 65°C, 30 minutes
D) 65°C, 10 minutes

19. The correct statement about the property of ionizing radiation is that it

A) can remove orbital electrons from atoms
B) can get ionized in solution
C) is a low energy radiation
D) does not carry either negative or positive charge

S-64

20. Statement: The DNA fragments generated by digesting with *BamHI* can be ligated to the vector digested with *BglII*

Reasoning: DNA fragments digested by *BamHI* and *BglII* generate compatible overhangs

A) Both, statement and reasoning are wrong
B) Statement is correct and reasoning is wrong
C) Reasoning is correct and statement is wrong
D) Both, statement and reasoning are right

21. Which one of the following method quantitatively measures the rate of transcription in a given cell-type?

A) RNA-seq
B) GRO-seq
C) DNase-seq
D) CAP-seq

22. The decrease in pH (below 4.5) due to production of acid during fermentation of glucose can be detected using

A) Citrate utilization test
B) Indole test
C) Voges-Proskauer test
D) Methyl red test

23. pKa + $\log_{10}$ (the ratio of the concentration of _____ over _____) describes the Henderson-Hasselbalch equation

A) proton acceptor; proton donor
B) conjugate acid; proton donor
C) conjugate base; proton acceptor
D) proton donor; proton acceptor

24. Which of the following is considered as a "polishing step" during protein purification?

A) Affinity chromatography
B) Ion exchange chromatography
C) Thin layer chromatography
D) Size-exclusion chromatography

25. Which of the following combination of statistical parameters is best suitable to represent results?

A) Mode and standard deviation
B) Mean and standard deviation
C) Mean and standard error
D) Mode and standard error

26. Berk-Sharp mapping is a technique to analyze

A) promoter sequence of a gene
B) terminator sequence of a gene
C) transcription start point
D) intron-exon junctions

27. The pKa values of two weak acids A and B are 4 and 6 respectively. In such a case, one of the following is correct:

A) acid A disassociates to a greater extent in water than acid B

B) when both the acids are prepared with equal molar concentrations, acid B will have lower pH

C) acid A and acid B will have the same $[H^+]$

D) acid A is likely to be more polyprotic than acid B

28. A student counted 80 cells in sixteen squares of a hemocytometer. Assuming that an undiluted cell suspension was loaded on the hemocytometer, the number of cells in the sample would be

A) 8×10^2 cells/ml

B) 8×10^3 cells/ml

C) 8×10^4 cells/ml

D) 8×10^5 cells/ml

29. Which of the following technique is used to map transcription start site of a gene?

A) Primer walking

B) *In vivo* foot printing assay

C) Primer extension

D) DNAse protection assay

30. The pH of a buffer containing 0.10 M acetic acid and 0.20 M sodium acetate is (given the pKa of acetic acid is 4.76)

A) 5.1

B) 4.1

C) 3.1

D) 2.1

31. Which of the following statements is <u>not true</u> about multiple sequence alignment?

A) Alignments can be more accurate by inclusion of secondary structure information

B) Both protein and nucleic acid secondary structure can be used

C) Alignment of three or more biological protein and /or nucleic acid sequences of identical length

D) A tool extensively used to assign functional roles to proteins

32. Culture medium that is used to enhance the growth of a specific bacterium and inhibit the growth of unwanted bacteria is known as

A) Differential medium

B) Enrichment medium

C) Selective medium

D) Enriched medium

33. Two buffers namely A and B with pH 4.0 and 6.0 respectively were prepared. Which one of the following statement is true?

A) The concentration of hydronium ion in buffer B is twice that of buffer A
B) The hydroxide concentrations in both the buffers is same since pH measures only H^+ ion concentration
C) Buffer B has greater buffering capacity
D) The concentration of hydronium ion in buffer A is 100 times that of buffer B

34. A 13-mer forward and reverse primers were used to specifically amplify target DNA sequence. The same PCR reaction is performed by reducing the length of the primers to 6 mer. What would be its impact on amplification profile?

A) Single target sequence gets amplified
B) No amplicon will be made
C) Several fragments get amplified
D) Primers fail to anneal to template DNA strand

35. The electrodes commonly used in pH meters have

A) no resistance
B) very low resistance
C) moderate resistance
D) very high resistance

36. The MCF-7 is a

A) human breast tumor line
B) human liver cell carcinoma line
C) human cervical carcinoma line
D) human colo-rectal carcinoma line

37. Which of the following stable isotope was used while gaining experimental evidence to show that DNA replicates by semi-conservative mode?

A) P^{32}
B) S^{35}
C) N^{15}
D) N^{14}

38. In absorption spectroscopy, one of the following is <u>not true</u>

A) Reflection is kept maximum
B) Involves transmission
C) Scattering is kept minimum
D) Light leaving the cuvette depends on concentration

39. A recombinant protein has ---DDDKHHHHHH--- at the junction of the His tag. Which of the following proteases is used to remove the His tag from the protein?

A) Factor X
B) Chymotrypsin
C) Enteropeptidase
D) Trypsin

40. Blue white screening was used to identify recombinants while cloning a gene into pUC vector. Which of the following is correct?

A) The blue color is due to a functional β-galactosidase indicative of a recombinant
B) The white color is indicative of a recombinant due to insertional inactivation
C) The blue color is due to a functional β-galactosidase indicative of a non-recombinant
D) The white color is indicative of a recombinant due to over expression of the recombinant protein

PART "B"

41. The hormones GnRH, Oxytocin, ADH and TRH signal via

A) cAMP
B) cGMP
C) IP3
D) GTP

42. A large geographical area characterized by its dominant form of vegetation is known as

A) ecosystem
B) community
C) niche
D) biome

43. A protein that can act as an anchor for cadherins as well as a transcription factor and is important in the specification of germ layers throughout the animal phyla is

A) Cyclin B
B) Integrin
C) Chordin
D) β-Catenin

44. Retroviruses contain

A) two copies of RNA and replicate via a DNA intermediate
B) one copy of RNA that replicates via a DNA intermediate
C) single stranded DNA that replicates via a DNA intermediate
D) double stranded DNA that integrates into host chromosome

45. Which of the following signs strongly support a diagnosis of pituitary adenoma?

A) Carpopedal spasm
B) Bitemporal Hemianopsia
C) Tremors
D) Clubbing

46. In a filial generation, the 9:3:3:1 ratio was replaced by 9:7 ratio. This could be due to

A) Epistasis
B) Hypostasis
C) Supplementation
D) Complementation

47. At the immunological synapse,

A) the initial interaction between TCR and MHC is unstable
B) the acetylcholine receptor in expressed on the T-cell
C) adhesion molecule pairs eventually move to the center of the synapse
D) production of substance P by the antigen-presenting cell is a key event

48. Insulin-

A) reduces triglyceride synthesis in liver
B) increases release of triacyl glycerol from adipose tissue
C) increases release of alanine from muscle
D) inhibits lypolysis

49. High levels of ATP inhibits glycolysis through inhibition of one of the following regulatory enzyme

A) Hexokinase
B) Phosphofrucktokinase
C) Fructose-1,6-diphosphatase
D) Glyceraldehyde-3-phosphate dehydrogenase

50. Developmental changes that occur, when different parts of an organism grow at different rates is known as

A) Allometry
B) Heterometry
C) Heterochrony
D) Heterotropy

51. Which of the following statement is true for human genome?

A) Consists of only deoxy ribonucleotides
B) Consists of only ribonucleotides
C) Consists of both ribo and deoxyribo nucleotides
D) Consists of only deoxyribo and methylated cytosine nucleotides

52. Mutations in 'split genes" are commonly observed in

A) Arthritis
B) Cystic fibrosis
C) Systemic lupus erythematosus
D) Leukemia

53. A homeotic mutation

A) is present in only one form in an individual
B) results in development of a tumor
C) substitutes one body part for another during development
D) manifests a wild type phenotype at one temperature and abnormal phenotype at another temperature

54. The respiratory quotient for a carbohydrate is

A) 0.7 B) 1.0

C) 0.8 D) 2.0

55. Development of BT cotton variety does not involve

A) germplasm breeding B) recombinant DNA technology

C) ethical and legal issues D) termination technology

56. Which of the following trisomy karyotypes in human has the mildest effect during development?

A) 47, XXX B) 47, XXY

C) 47, XX+13 D) 47, XX+21

57. In a newborn male infant, there is palpable right testis, but no left testis in the scrotal sac. The infant has no other visible abnormalities. Which of the following is the most likely abnormality involving the gonad of this infant?

A) Fusion B) Hypopituitarism

C) Incomplete descent D) Leydig cell aplasia

58. Which of the following dye is used for staining mitochondria in a cell?

A) Janus Green B) Thionine

C) Crystal Violet D) Orcein

59. Ribozymes splice introns by

A) esterification B) transesterification

C) hydrolysis D) dephosphorylation

60. Which of the following promotors depend on cAMP-CRP for transcriptional activation?

A) *ptac* promotor B) *T7* promotor

C) *plac* promotor D) *λ-plpr* promotor

61. For the Michaelis-Menten constant (Km), which of the following statements holds true?

a. High Km indicates high affinity for substrate binding

b. Km indicates the affinity between the enzyme and the substrate

c. Km defines the concentration of the substrate for effective catalysis to happen

A) a and b B) a, b and c

C) b and c D) a and c

62. Though the classical system of classification divided the living organisms into five domains (Monera, Protista, Plantae, Fungi and Animalia), the molecular taxonomical methods has only three of the following combination of domains

A) Monera, Protista, Eukarya
B) Bacteria, Protista and Eukarya
C) Bacteria, Plantae and Animalia
D) Bacteria, Archea and Eukarya

63. In animals that inhabit desert, the modification in the nephrons that allow them to survive without water for prolonged periods is

A) a long loop of Henle
B) a short collecting duct
C) a short distal tubule
D) large Bowman's capsules

64. Which one of the following statement is true for an enhancer element?

A) Present upstream of a given promoter
B) Present within the first intron of a given gene
C) Present anywhere away from the gene but within the same chromosome
D) Present anywhere in the genome on a linked or unlinked chromosome

65. The statement "in biological populations, growth is dictated not by total resources, but by the limiting factor (scarcest resource) refers to

A) Heisenberg's principle of uncertainty
B) Liebig's law of the minimum
C) Shelfor's law of tolerance
D) Botkin and Keller law of uniformitarianism

66. The clinical condition of the eye in which the light lands in front of the retina rather than normally focusing on the retina is

A) Presbyopia
B) Hyperopia
C) Emmetropia
D) Myopia

67. The chemokine RANTES belongs to one of the following types of receptors

A) CXC
B) CC
C) C
D) CX3X

68. The multiple concentric capsule layers within the pacinian corpuscle perceive and transmit _____ related signals to its central nerve fiber

A) temperature
B) pain
C) chemical gradient
D) mechanical compression

69. The predator bacterium that infects other gram negative bacteria is

A) *Haemophilus influenza*
B) *Pseudomonas putinda*
C) *Bdellovibro bacteriovorus*
D) *Proteus mirabilis*

70. Guanyl cyclases are activated by one of the following calcium binding proteins

A) Recoverin
B) Calmodulin
C) Calretinin
D) Parvalbumin

71. The functional residual capacity of the lungs equals to

A) tidal volume plus the inspiratory reserve volume
B) inspiratory reserve volume plus expiratory reserve volume
C) expiratory reserve volume plus residual volume
D) expiratory reserve volume plus tidal volume

72. CD8 is a marker of

A) B cells
B) Helper T cells
C) Activated macrophages
D) Cytotoxic T- cells

73. Conservation biologists refer to the number of individuals needed for long-term survival as

A) the bottleneck
B) the carrying capacity
C) the minimum viable population size
D) the maximum viable population size

74. Which of the following is not considered as a cell organelle?

A) Peroxisomes
B) Lysosomes
C) Glyoxysomes
D) Microsomes

75. Which of the following provides a link between the brain and the endocrine system?

A) Amygdala
B) Hypothalamus
C) Parietal lobes
D) Hippocampus

76. Select the <u>incorrect</u> combination of disease and the bacteria

A) Cellulitis - *Pasteurella multocida*
B) Tularemia - *Francisella tularensis*
C) Gastritis - *Heliobacter pylori*
D) Lyme disease - *Yersinia pestis*

77. One of the following is <u>not true</u> for an eco-system

A) Forests, wetlands and grasslands can cause uneven flow of water and cause flooding
B) Moderate temperature and maintain an even climate
C) Control soil erosions
D) Wetlands significantly stabilize sediments and prevent eutrophication

78. Which of the following not a characteristic feature of a non-genotoxic carcinogen

A) Does not cause to form DNA adducts
B) Dose response curve is linear
C) Mutagenecity tests are negative
D) Prolonged exposure with tumor promoter is needed for cellular transformation

79. Which of the following animal is featured on the logo of World Wildlife Fund (WWF)

A) Tiger
B) Giant otter
C) Elephant
D) Giant panda

80. In a normally functioning kidney, the reabsorption of one of the following substances is 87.8% of the filtered load

A) Sodium
B) Chloride
C) Bicarbonate
D) Potassium

- - - -

For rough work