P-67

Department of Animal Biology
ENTRANCE EXAMINATION, June 2017
Ph.D. Animal Biology

Code number: P-67

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. Make sure that you have clearly marked the Booklet Code on your OMR sheet.***
- ***Hand over OMR answer sheet at the end of the examination.***
- ***All questions carry one mark each. Answer all, or as many as you can.***
- **0.33 mark will be deducted for every wrong answer.**
- ***There are a total of 12 pages in this question paper. Answer sheet (OMR) will be provided separately. Check this before you start answering.***
- ***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 student gets equal marks, to prepare the merit list.***

PART "A"

1. Chromatin immunopreciptation is used to determine the:

A) Quantitative levels of gene transcripts
B) Quantitative binding of a protein to chromatin
C) Quantitative binding of RNA to chromatin
D) Quantitative binding of protein to RNA

2. Which of the following methods can be used to establish the physical association of microRNA with messengerRNA?

A) Northern hybridization
B) HITS-CLIP
C) RNA-seq
D) ChIP-seq

3. A DNA fragment obtained through BamH1 digestion was ligated to *BglII* digested vector. Which of the following enzymes can be used to release the cloned DNA fragment?

A) *BamH1*
B) *HindIII*
C) *Sal1*
D) *Sou3A*

4. Berk-Sharp mapping is associated with mapping of:

A) Promoter
B) Interaction sites between RNA and ribosome
C) Intron-Exon regions in eukaryotic gene
D) Open promoter complex

5. The process by which human fibroblasts can be transduced to form induced pluripotent stem cells (iPS) *in vitro* using viral vectors containing regulatory genes such as *Oct4, Sox2, Nanog* and *Lin28* is known as:

A) Differentiation
B) Dedifferentiation
C) Transdifferentiation
D) Induction

6. Which of the following is an example of forward genetics?

A) Gene knock out
B) Gene knock down
C) Mutagenesis screen for dominant mutations
D) RNA interference

7. During flow cytometric analysis, cells are stained with propidium iodide to identify:

A) Viability of cells
B) Stage of the cell cycle
C) Differentiation of cells
D) Morphology of cells

8. Which of the following microscopes has the highest resolution power?

A) Transmission electron microscope
B) Scanning electron microscope
C) Confocal microscope
D) Stimulated emission depletion microscope

9. A heterodimeric protein of 70 kDa was subjected to SDS-PAGE under reducing conditions. It showed two bands of molecular mass of 44 and 26 respectively. When subjected to chromatography on a Sephadex G-100 column, what would be the expected molecular mass?

A) 70 kDa
B) 44 kDa
C) Two peaks at 44 and 26 kDa
D) 140 kDa

10. Separation techniques for proteins exploit differences in hydrodynamic properties EXCEPT:

A) Diffusion coefficient
B) Charge of the protein
C) Viscosity of the protein
D) Size

11. Adhesion of primary cells DOES NOT require pre-coating of cell culture plates with:

A) Collagen
B) Polylysine
C) Trypsin
D) Fibronectin

12. Which one of the following techniques can be used to determine the stage of cell cycle in a given cell population?

A) Super resolution microscopy
B) Electron microscopy
C) Fluorescence activated cell sorting
D) Fluorescence recovery after photo bleaching

13. Which of the following is NOT required for Polymerase Chain Reaction?

A) DNA polymerase
B) Primers
C) Template DNA
D) Dideoxy-dNTPs (ddNTPs)

14. A permanent way to establish fate map of a group of cells during embryonic development is:

A) Labelling cells with vital dye
B) Labelling cells with fluorescent dye
C) Making chimeras
D) Performing *in situ* hybridization to detect transcripts

15. A purified plasmid DNA when electrophoresed on an agarose gel separates into:

A) Linear and supercoiled forms
B) Circular and linear forms
C) Circular and supercoiled forms
D) Linear and nick-translated forms

16. "Chromosome painting", a technique used to analyze human karyotypes relies on:

A) Specific hybridization with fluorescent probe molecules
B) Inherent fluorescence due to G-C base pairs
C) Inherent fluorescence due to A-T base pairs
D) Fluorescence resonance energy transfer

17. Hexokinase catalyzes the conversion of glucose to glucose-6-phosphate with: K_{cat} of 600 S^{-1}; total enzyme concentration [E_T] 20 nM; substrate (glucose) concentration OF 40 μM; and reaction velocity of 9.6 uM S^{-1}. The Km for the substrate would be:

A) 20 μM
B) 15 μM
C) 10 μM
D) 5 μM

18. Which of the following methods can be used to determine differentially expressed genes between normal and cancerous cells?

A) Ribo-seq
B) RNA-seq
C) DNA-seq
D) DNAse-seq

19. A DNA preparation that has a 260:280 nm absorbance ratio below 1.8 is most likely contaminated with:

A) Protein
B) RNA
C) Phenol
D) Alcohol

20. Which of the following DOES NOT require knowledge of the gene you want to study during development?

A) Gene targetting
B) Forward genetic screen
C) RNAi
D) mRNA overexpression using microinjection

21. In Polymerase Chain Reaction, $MgCl_2$ acts as:

A) DNase inhibitor
B) Stabilizer for annealing
C) Co-factor
D) Stabilizer for denaturation

22. DNA fingerprinting was developed by:

A) Alec Jeffreys
B) Francis Crick
C) Oswald Avery
D) Rosalind Franklin

23. Protein-DNA interactions can be detected by:

A) Native gel electrophoresis
B) Agarose gel electrophoresis
C) SDS gel electrophoresis
D) Urea gel electrophoresis

24. Which of the macromolecules given below will be found intact at the end when solutions of all the four are mixed and incubated for 30 minutes?

A) Protein
B) Nuclease
C) Protease
D) Nucleic acid

25. The correct order of procedure that is generally followed to profile DNA is:

A) DNA isolation – PCR amplification – Electrophoresis – Southern blotting – Autoradiography – Analyses of DNA pattern
B) DNA isolation – PCR amplification – Restriction digestion – Hybridization – Electrophoresis – Southern blotting – Analyses of DNA pattern
C) DNA isolation – Restriction digestion – PCR amplification – southern blotting – Hybridization – Analyses of DNA pattern
D) DNA isolation – Restriction digestion – PCR amplification – Electrophoresis – Southern blotting – Hybridization – Autoradiography – Analyses of DNA pattern

26. Enzyme-labelled antibodies are used in all the techniques mentioned below EXCEPT:

A) Enzyme Linked Immunosorbent Assay
B) *In situ* hybridization
C) Immunohistochemistry
D) Immunofluorescence

27. How do you prepare a 10% solution from a 90% solution and then by using the same prepare serial dilutions in the range of 2, 4 and 8% solutions in a constant volume of 5 ml each?

A) Take 1 ml of 90% solution and then make it up to 10 ml and then take 1, 2 and 4 ml each and make it up to 5 ml individually
B) Take 1 ml of 90% solution and then make it up to 9 ml and then take 1, 2 and 4 ml each and make it up to 5 ml individually
C) Take 1 ml of 90% solution and then make it up to 10 ml and then take
D) Take 0.45 ml of 90% solution and then make it up to 9 ml and then take

0.5, 1 and 2 ml each and make it up to 5 ml individually

1, 2 and 4 ml each and make it up to 5 ml individually

28. Which one of the following methods CAN NOT be used effectively for estimation of hormone in clinical diagnosis?

A) RIA
B) ELISA
C) HPLC
D) FPLC

29. A filterability value of 0.75 corresponds to one of the following substances:

A) Inulin
B) Albumin
C) Sodium
D) Myoglobin

30. The principle underlying the use of the coloring dye "coomassie blue" is:

A) Dye's positive charge groups interacting with negative carboxyl groups of proteins
B) Hydrogen bonding between the dye and the protein
C) Sulfonic acid groups of the dye interacts with amine groups in protein
D) Emission of fluorescence by the dye because of multiple interactions

31. Eastern blotting is used for:

A) Detection of DNA
B) Detection of RNA
C) Detection of protein epitopes
D) Detection of carbohydrate epitopes

32. Single stranded DNA molecules, which can be used as probes, can be synthesized by:

A) Inverse PCR
B) RT-PCR
C) Asymmetric PCR
D) Nested PCR

33. The secondary antibodies that are employed during detection of primary antibodies in Western blotting are:

A) Anti-idiotypic
B) Anti-allotypic
C) Anti-isotypic
D) Anti-paratypic

34. In a diploid organism heterozygous at 2 loci, how many types of gametes can be produced?

A) 4
B) 6
C) 2
D) 8

35. What is the relation between Svedberg unit and molecular mass in Daltons in an Ultra-centrifugation experiment by sedimentation velocity method?

A) Non-linear
B) Inverse
C) Direct
D) No relation

36. An uninduced bacterial culture had 228 units of β-galactosidase per ml of culture. If 43 μg of protein was present in 1 ml of culture, what was the specific activity?

A) 45
B) 5302
C) 4381
D) 3500

37. A solution of a protein gave an absorbance of 0.34 at 280 nm. Given the $A^{1\%}$ of the protein solution is 22.9, what is the concentration of the protein in the solution?

A) 100 mg/mL
B) 14.9 mg/mL
C) 149 mg/100 mL
D) 149 mg/mL

38. How many moles of NaCl are present in 50 mL of a 0.15 M solution?

A) 0.0075
B) 0.075
C) 0.75
D) 0.00075

39. Upon complete hydrolysis, which of the following will yield only one type of monomer:

A) Triacylglycerol
B) Glycogen
C) DNA
D) Lipoprotein

40. How many genotypes of a diploid organism can be present for a locus with 5 alleles? (Hint: number of genotypes = n(n+1)/2).

A) 3.0×10^{-5} M
B) 2.85×10^{-5} M
C) 28.5×10^{-5} M
D) 3.0×10^{-3} M

PART "B"

41. Which of the following statements is true for "hydrogen bond"?

A) 9% covalent and 91% electrostatic
B) 10% covalent and 90% electrostatic
C) 1% covalent and 99% electrostatic
D) 5% covalent and 95% electrostatic

42. Solution A has pH 5.0 and solution B has pH 8.0. Hence,

A) Solution A has 30 times $[H^+]$ than solution B
B) Solution B has 300 times $[H^+]$ than solution A
C) Solution A has 1000 times $[H^+]$ than solution B
D) Solution B has 3 times $[H^+]$ than solution A

43. When Ethidium bromide is used as a fluorescent tag to visualize DNA:

A) It is intercalated by 2.5 bp of DNA increasing length by 27%
B) It is intercalated by 3.5 bp of DNA increasing length by 27%
C) It is intercalated by 2.1 bp of DNA increasing length by 23%
D) It is intercalated by 3.2 bp of DNA increasing length by 29%

44. A molecule of Hb is bound by three types of antibodies; one for BPG binding site, one for N-terminus of α-subunit and one for carboxy terminus of β-subunit. How many molecules of antibody are bound to Hb?

A) 3
B) 6
C) 5
D) 10

45. Which of the following correctly shows Eadie-Hofstee plot of enzyme kinetics?

A) V vs V/S
B) S/V vs S
C) 1/V vs 1/S
D) V vs 1/S

46. In terms of thermal stability, which of the following order is correct?

A) dsDNA>dsRNA>ssDNA>ssRNA
B) dsRNA>DNA-RNA>dsDNA>ssDNA
C) dsDNA>dsRNA>DNA-RNA>ssDNA
D) DNA-RNA>dsDNA>ssDNA>dsRNA

47. One of the following was absent in Stanley Miller's experiment for abiotic production:

A) H_2S
B) CH_4
C) NH_3
D) H_2O

48. Lactose uptake in *E. coli* is mediated by:

A) Primary active transport
B) Secondary active transport
C) Diffusion
D) Antiporter

49. If ^{14}C-malonyl CoA (labelled at carbon 2) and acetyl CoA are used in a test tube experiment with fatty acid synthase, which carbon of palmitic acid, the final product, will be labelled?

A) All the carbons of palmitic acid
B) Only the methyl carbon of palmitic acid
C) All the even numbered carbons of palmitic acid except carbon 16
D) All the odd numbered carbons of palmitic acid

50. An mRNA coding for secretory protein when translated in a rabbit reticulocyte lysate system gave a protein of 400 kDa. But when it was translated in the same system with the addition of dog pancreatic "microsomes", a protein of 360 kDa was obtained. The difference in the mass of two products is due to:

A) Loss of 40 kDa peptide from N-terminus
B) Loss of 40 kDa peptide from C-terminus
C) Loss of 20 kDa peptide from N- and C-terminus
D) Loss of 10 kDa peptide from N-terminus and 30 kDa peptide from C-terminus

51. You are advised to identify the source of two cultures of a single cell organism, A and B. One is from turbid river and another from a clean pond. Which experiment of the following will give the answer?

A) Culture samples of both in distilled water; that which bursts is from river
B) Culture samples of both in 6M sucrose; that which swells is from river
C) Culture samples of both in 6M sucrose; thtat which burs is from pond
D) Culture samples of both in distilled water; that which bursts is from pond.

52. Lysophospholipid means:

A) Phosphorylated with one fatty acid
B) Phosphorolylated with no fatty acid
C) Phosphorylated with phosphorylated fatty acid
D) Phosphorylated, but lacking one fatty acid

53. Which of the amino acids below is involved in movement of sodium and potassium in sodium-potassium ATPase pump?

A) Histidine
B) Glutamatic acid
C) Aspartic acid
D) Lysine

54. Choose the WRONG statement.

A) The ratio of lipid to protein mass is 3 in myelin
B) The ratio of lipid to protein mass in mitochondrial membrane is 0.33
C) The ratio of lipid to protein mass in membranes is never equal
D) The ratio of lipid to protein mass in most of the cell membranes is one

55. One of the following is not an integral protein:

A) Spectrin
B) Selectin
C) Caveolin
D) Integrin

56. A loss of functional mutation in γ-tubulin gen is likely to:

A) Inhibit centrosome location
B) Inhibit association of motor to microtubules
C) Inhibit bundling of γ-tubulin to β-tubulin
D) Promote disassociation of microtubes from plus-end

57. Growth hormone release is greater:

A) Shortly after waking up
B) Shortly before waking up
C) Shortly before going to sleep
D) Shortly after going to sleep

58. Which of the following tissues cannot utilize fats as source of energy?

A) Neural
B) Liver
C) Adipose
D) Muscle

59. In the sensory neurons, small stimuli are amplified by:

A) Channel proteins
B) Epinephrine
C) Biogenic amines
D) G-protein complexes

60. The most important function of loop of Henle is:

A) Secretion of substances into the urine
B) Creation of osmotic gradient in the medulla
C) Creation of glomerular filtrate
D) Reabsorption of substances from urine

61. The movement of new genes into a population as a result of migration or hybridization is called:

A) Selection
B) Adaption
C) Gene flow
D) Genetic drift

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

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

63. Metamorphosis in amphibians is triggered by environmental cues that act on the:

A) Hypothalamus
B) Pituitary
C) Eye
D) Thyroid

64. Human placenta is of the type:

A) Endotheliochorial
B) Haemochorial
C) Epitheliochorial
D) Syndesmochorial

65. Which of the following can be a molecular marker for head identity in the apical tip of Hydra?

A) BMPs
B) NODAL
C) IGF
D) WNT

66. Which feature of amphibian embryos was first identified by the experiments of Speman and Mangold?

A) The blastopore
B) The organiser
C) The blastocoel
D) The neural tube

67. Hot spots are regions of high:

A) Rarity
B) Diversity
C) Endemism
D) Critically endangered population

68. Which of the following regions has maximum biodiversity?

A) Mangrooves
B) Temperate rainforest
C) Tropical rain forest
D) Coral reefs

69. Medulla oblongata during neural development is derived from:

A) Metacephalon
B) Mylencephalon
C) Mesencephalon
D) Diencephalon

70. The size of *E. coli* genome is 4.6 Mb. How many fragments will be generated if it is digested with *EcoRI*?

A) 123
B) 6223
C) 1123
D) 1023

71. Which of the following sigma factor directs core RNA polymerase towards the -12(GC)-12(GG) consensus promotor element?

A) Sigma 32
B) Sigma 70
C) Sigma 5
D) Sigma 54

72. The headquarters of IUCN (International Union for Conservation of Nature and Natural resources) is located at

A) Paris, France
B) Vienna, Austria
C) New York, USA
D) Morges, Switzerland

73. Posttranscriptional regulation is a well-known phenomenon in bacteria. Where do you find "aptamer" sequence in RNA?

A) In attenuator region of mRNA
B) In 3' UTR of mRNA
C) In riboswitch region of mRNA
D) In the loop region of tRNA

74. Which of the following bacteriophages has single strand DNA as genetic material?

A) Bacteriophage lambda
B) Bacteriophage T4
C) Bacteriophage phiX174
D) Bacteriophage T7

75. Transcription coupled translation is observed in:

A) Prokaryotes
B) Eukaryotes
C) Viruses
D) Yeast

76. The amino acid made only in bacteria and blue green algae is:

A) Asparagine
B) Aspartic acid
C) Methionine
D) Glycine

77. Many marine birds often drink sea water, yet maintain their internal osmolarity at a constant level that is hypoosmotic to seawater. Which of the following physiological strategies best explains how the birds could maintain their tissue osmolarity?

A) Absorption of water from the environment through specialized salt-exchange glands and produce more dilute urine.
B) Absorption of salts from the environment through salt exchange glands and produce more concentrated urine
C) Excrete salts through specialized salt exchange glands and excrete less urine
D) Excrete both salts and nitrogenous wastes through specialized nasal glands

78. In Robertsonian translocation, fusion occurs at the:

A) Centromeres
B) Nucleosomes
C) Telomeres
D) Ends of long arms

79. Inhibition of transcription through methylation is due to:

A) Failure of TFs binding alone
B) Binding of proteins that facilitate methylation of histones
C) Binding of proteins that promote deacetylation of histones
D) Failure of TFs binding and also recruitment of proteins that facilitate methylation and deacetylation of histones

80. High CpG content promoters are predominantly found in:

A) House keeping genes
B) Developmentally regulated genes
C) Precociously expressed genes
D) Multipotent genes

- - - -