Hall Ticket Number:	

Y-71

ENTRANCE EXAMINATION. 2020

PhD. Animal Biology

Time: 2 hours **Maximum Marks: 70**

INSTRUCTIONS: PLEASE READ BEFORE ANSWERING!

- ***Answer sheet (OMR) will be provided separately.***
- ***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 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 10 pages in this question paper. 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. The property of erosion displayed by biomaterials is exploited for

A) prosthesis preparation
B) dental implantation
C) drug delivery
D) stent implantation

2. Which one of the following solutions will have the lowest pH at a concentration of 100 mM

A) CH_3COONa
B) NaCl
C) Na_2CO_3
D) Na_3PO_4

3. Which of the following method is used to quantitatively define a transcriptome including very rare transcripts?

A) Southern blotting
B) Serial analysis of gene expression
C) Microarray analysis
D) Massive parallel signature sequencing

4. If the error rate in protein synthesis is about 7×10^{-4}/codon, how many polypeptides containing 600 amino acid residues would you expect to have a mutation?

A) 4.2
B) 0.3
C) 0.42
D) 0.12

5. The physical proximity between a gene promoter and distal enhancer can be determined by

A) electromobility shift assay
B) chromatin immunoprecipitation
C) chromosome conformation capture
D) fluorescence recovery after photo bleaching

6. Which one of the following promoters can be induced by increasing the temperature of the culture medium?

A) pLac
B) PTac
C) pT7
D) phage lambda pL/pR

7. Which photon processes are dominant in the context of diagnostic radiology?

A) Compton scattering and photoelectric effect
B) Compton and Rayleigh scattering
C) Photoelectric effect and pair production
D) Compton scattering and pair production

8. The percentage of agar in the solid media used for the growth of *E. coli* is

A) 0.5
B) 0.15 to 0.2
C) 1.5 to 2.0
D) 10

9. Which one of the following is referred as knock-in technology?

A) Targeted insertion of a foreign DNA element at a particular locus
B) Targeted insertion of a tissue in to particular organ in humans
C) Targeted removal of endogenous DNA element at a particular locus
D) Targeted binding of a protein at a particular DNA locus

10. The radioallergosorbent test (RAST) measures

A) antigen concentration
B) IgE antibodies
C) IgM antibodies
D) IgG antibodies

11. Which one of the following is a component of a disinfectant commonly used as an algaecide in swimming pools and municipal water bodies?

A) Mercury
B) Iodine
C) Silver
D) Copper

12. The colour taken up by mycobacteria in the acid fast stain is due to

A) Methylene blue
B) Carbol fuschin
C) Giemsa stain
D) Methyl green

13. The coefficient of variation (standard deviation / average) for a series of values whose average is 10 with a variance of 4 is

A) 10% B) 20%
C) 30% D) 40%

14. A buffer is made from equal concentrations of a weak acid and its conjugate base. By doubling the volume of the buffer solution with distilled water, the pH

A) remains almost the same B) is doubled
C) is reduced to half D) is reduced to one-fourth

15. When a mixture of four proteins given below is subjected to size exclusion (gel filtration) chromatography, the one that will elute second in the sequence is

A) cytochrome c (Mr= 13,000) B) immunoglobulin G (Mr= 145,000)
C) RNA polymerase (Mr= 450,000) D) serum albumin (Mr= 68,500)

16. The "out of focus light" in a confocal microscope is blocked by

A) galvanic mirror B) scanning mirror
C) optic deflector D) pinhole

17. Which of the following is used to determine the "fingerprint" IR spectrum?

A) Polarizing microscope B) Stereomicroscope
C) Confocal microscope D) Scanning electron microscope

18. The half-life of a radioactive material is 80 seconds. The time taken for 7/8th of the material to decay will be

A) 10 seconds B) 70 seconds
C) 240 seconds D) 640 seconds

19. Among the following gene editing technologies, the most efficient is based on

A) NHEJ B) TALEN
C) ZFN D) CRISPR-Cas9

20. The hanging drop method to study the motility of bacteria was invented by

A) Louis Pasteur B) Robert Koch
C) Edward Jenner D) Antony von Leeuwenhoek

21. Which of the following statements are true
(I) A single microRNA can target multiple transcripts of a given mRNA
(II) A single microRNA can target multiple transcripts of multiple mRNAs
(III) Multiple microRNAs can target multiple transcripts of a given mRNA
(IV) Multiple microRNAs can target multiple transcripts of multiple mRNAs
(V) All ribosomes of a different somatic cells has identical composition

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

22. High efficiency screening of libraries using DNA hybridization involves generating

A) replicates of clones
B) restriction maps
C) fragment patterns based on migration during gel electrophoresis
D) high copy number plasmids by engineering the replication control sequences

23. Zeta potential of nanoparticles is indicative of their

A) surface charge
B) Size
C) size distribution
D) Potency

24. Which of the following recombinant proteins can be purified using metal ion affinity chromatography?

A) $Protein^{C6His}$
B) $Protein^{Nmyc}$
C) $Protein^{NAviTag}$
D) $Protein^{NGST}$

25. Cells coated with a specific antibody can be purified efficiently by

A) differential centrifugation
B) fluorescence activated cell sorting
C) high speed centrifugation
D) affinity column chromatography

26. Generation of single stranded DNA probes is done by

A) inverse PCR
B) reverse transcription PCR
C) real-time PCR
D) assymetric PCR

27. Under which of the following conditions will the genes of the *lac operon* be highly expressed?

A) Low glucose, high lactose
B) High glucose, high lactose
C) High glucose, low lactose
D) Low glucose, low lactose

28. The surface topography of a biological sample is obtained by

A) scanning electron microscope
B) transmission electron microscope
C) confocal microscope
D) light microscope

29. The recombinant proteins are expressed with affinity tags to facilitate their purification. After purification the tag is removed by treating the recombinant protein with a specific protease. If the recognition sequence DDDDK exists at the fusion site, which of the following protease is used to remove affinity tag?

A) Factor-X
B) Trypsin
C) Chymotrypsin
D) Enterokinase

30. A 2 kb DNA fragment has two *PstI* sites at positions 400 and 1000 bp respectively and one *EcoRI* site at 1800 bp. Upon digestion with the two enzymes, which of the following fragments will be obtained?

A) 400, 1000 and 1800 bp
B) 400, 600, 800 and 200 bp
C) 400, 1400 and 200 bp
D) 400, 600 and 1000 bp

31. Which of the following statements is correct

(I) Gene position within the cell nucleus is determined by DNA FISH
(II) Gene position within the cell nucleus is determined by RNA FISH with exonic sequence as a probe
(III) Gene position within the live cell nucleus is determined by Fluorescence recovery after photobleaching
(IV) Gene position within the live cell nucleus is determined by CRIPR imaging

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

32. The unpleasant taste of meat that was subjected to "freezer burn" by repeated freezing is due to

A) ribosomes causing them to break into subunits
B) Golgi bodies and their vesicles
C) rough endoplasmic reticulum and release of ribosomes
D) lysosomes and resultant autodigestion

33. Why serum or serum containing medium is added to the cell culture dish after trypsinization?

A) Serum enhances the activity of trypsin
B) Trypsin doesn't detach cells unless serum is added
C) Trypsin acts as a co-enzyme for serum enzymes
D) Serum has natural protease inhibitors which prevents further cell damage

34. In an *in vitro* transcription reaction gamma-p^{32} labeled NTPs are used. Which of the following statements is correct with respect to the transcript generated?

A) Labelled, but the amount of radioactivity incorporated into the transcript increases proportionately with its size.
B) Labelled, but the amount of radioactivity incorporated into the transcript does not increases with its size

C) The transcript remains labeled and it is not possible to quantify incorporation of radioactivity

D) The transcript remains unlabelled

35. A nutritional research team followed serum levels of vitamin B12 in 120 children for three years to determine the association between cyanocobalamin deficiency and the subsequent risk of developing megaloblastic anemia. The results were as follows:
Mean: 260 pg/mL; Median: 226 pg/mL; Mode: 194 pg/mL.. From the data, it can be concluded that this distribution is

A) normal
B) negatively skewed
C) positively skewed
D) bimodal

PART "B"

36. The region that facilitates the movement of chromosomes during mitosis and meiosis is

A) kinetochore
B) subtelomere
C) centromere
D) telomere

37. The upstream activating sequence (UAS) is found upstream of an inducible promoter. Which one of the following transcription activators binds to the UAS of nif promoter?

A) Ntr-C
B) NtrB
C) NtrC-P
D) NtrA-P

38. The fatality due to novel coronavirus-19 (n-COV-19) in the recent pandemic is attributed largely due to

A) respiratory failure
B) liver dysfunction
C) renal failure
D) muscular dysfunction

39. The promoter for 5S rRNA transcribed by RNA polymerase III is located in the region between

A) -10 and -35 bp
B) -10 and + 55 bp
C) + 55 to +80 bp
D) - 55 and -80 bp

40. Which of the following is not a feature of an ideal population under the Hardy-Weinberg principle?

A) isolation from migration
B) no mutation
C) no selection
D) no random mating

41. An extracellular protozoan parasite is responsible for one of the following disease.

A) Toxoplasmosis
B) Leishmaniasis
C) Sleeping sickness
D) Malaria

42. Methotrexate impairs DNA replication by

A) inhibiting DNA polymerase I
B) inhibiting dihydrofolate reductase
C) activating nucleosidases
D) activating endonucleases

43. Which one of the following is not a phytoestrogen?

A) Genistein
B) Bispehnol A
C) Daidzein
D) Biochanin A

44. R/r and S/s are linked genes separated by 10 map units. When a cross is made between Rs/rS and rs/rs, genotypes the percentage of Rs/rs will be

A) 5
B) 10
C) 25
D) 45

45. Class switching is mediated through the activity of

A) activation-induced cytidine deaminase
B) recombination activating gene 1
C) recombination activating gene 2
D) terminal deoxynucleotidyl transferase

46. Appearance of an organism as dictated by its genotype is called

A) pedigree
B) genome
C) phenotype
D) allele

47. Succinate dehydrogenase converts succinate to fumarate. In the presence of malonate, a reversible competitive inhibitor

A) Km increases and Vmax remains the same
B) both Km and Vmax increases
C) both Km and Vmax decreases
D) Km decreases and Vmax remains the same

48. In a syngenetic graft, a tissue or organ is transplanted

A) from the same individual
B) between same species of genetically different background
C) between same species of genetically identical background
D) between members of two different genetic species

49. Which organelles have the tendency to undergo polymorphism?

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

50. In the pancreas, cells that secrete insulin are

A) beta
B) alpha
C) delta
D) epsilon

51. Goitre is caused by

A) excess secretion of thyroxin
B) deficiency of iodine
C) over eating
D) defective growth hormone

52. IgA in seromucus secretions

A) has no A chain
B) is dimeric
C) cannot bind to neutrophils
D) activates the classical complement pathway

53. *Helicobacter pylori* survives in the acidic environment of the stomach by producing

A) Protease
B) collagenase
C) Urease
D) dihydropteroate synthetase

54. Which of the following is responsible for post-transcriptional regulation of gene expression in bacteria?

A) small RNAs
B) non-coding RNAs
C) snRNA
D) sigma factor

55. Which of the following is not a mechanism by which an antibody confers protection against a pathogen?

A) Neutralization
B) Co-stimulation of T cells
C) Opsonization
D) Complement activation / deposition

56. Genes that control the final structures of appendages from each segment in *Drosophila* are

A) *Hox*
B) *Gap*
C) *Segment polarity*
D) *Pair rule*

57. Cytokine important for differentiation of myeloid cells is

A) IL-2
B) IL-3
C) IL-4
D) IL-7

58. During *Xenopus* development, BMP4 is expressed initially throughout the ectodermal and mesodermal regions of late blastula. However, during gastrulation, BMP4 will be restricted to _____ region of the embryo.

A) Anterior
B) posterior
C) Dorsolateral
D) ventrolateral

59. Malignant tumor cells differ from oncogenic transformed cells in

A) secretion of plasminogen activator
B) reduced requirement for growth factors
C) the ability to grow unattached to an extacellular matrix
D) over expression of actin microfilaments

60. RFamide-Related Peptide-3 is a mammalian orthologue of

A) Mammotropin
B) Somatotropin
C) Gonadotropin-inhibitory hormone
D) Gonadotropin-releasing hormone

61. Tumor angiogenesis is mainly due to over expression of

A) EGF
B) VEGF
C) RAS
D) p53

62. Ampulla of Lorenzini is closely related to

A) chemoreceptors
B) electroreceptors
C) mechanoreceptors
D) photoreceptors

63. All bacteria that inhabit the human body are

A) heterotrophs
B) autotrophs
C) chemolithotrops
D) phototrops

64. Which one of the following genes is not located on Y chromosome and not related to vertebrate sex determination?

A) *dmrt1b*
B) *amh*
C) *Gsdf*
D) *sox9*

65. A patient is diagnosed with Amyotrophic Lateral Sclerosis (ALS) with symptoms of muscle atrophy and muscle twitching. Which one of the following explains the condition?

A) Demyelination
B) Axon degeneration
C) Lower motor neuron dysfunction
D) Upper motor neuron dysfunction

66. Which one of the following is a highly suitable mode of degradation of excess secretory vesicles by endolysosomal degradation?

A) Autophagy
B) Crinophagy
C) Heterophagy
D) Microautophagy

67. Suprachiasmatic nucleus regulates circadian rhythms in mammals via melatonin secreted by

A) Cerebral cortex
B) Hippocampus
C) Pineal gland
D) Brodmann area

68. Relative potency of androgens is

A) 5α-dihydrotestosterone > Testosterone > Androstenedione > dehydroepiandrosterone
B) Testosterone > 5α-dihydrotestosterone > Androstenedione > dehydroepiandrosterone
C) Testosterone > 5α-dihydrotestosterone > Dehydroepiandrosterone >Androstenedione
D) 5 α-dihydrotestosterone >Testosterone > Dehydroepiandrosterone > Androstenedione

69. Which of the following is true for dorso-ventral patterning of the neural tube and somites

A) The somites pattern the neural tube after they form.
B) The neural tube plays the role of organizer in being the sole influence on patterning in the somites
C) Sonic hedgehog from the notochord and floor plate of the neural tube confers ventral fates on both the neural tube and the somite, while BMPs confer more dorsal fates.
D) Both the neural tube and the somites acquire their dorso-ventral patterning during gastrulation

70. Epiboly occurs during

A) blastulation
B) cleavage
C) gastrulation
D) Neurulation