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ENTRANCE EXAMINATION, 2015

Ph.D. Biotechnology

Time: 2 hours

Maximum Marks: 75

HALL TICKET NO.

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INSTRUCTIONS

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE ANSWERING:

1. Enter your hall ticket number on this sheet and the answer (OMR) sheet.
2. Answers are to be marked only on the OMR answer sheet with BLACK/BLUE ball point/Sketch pen following the instructions provided there upon.
3. Hand over OMR answer sheet at the end of examination.
4. All questions carry one mark each.
5. 0.33 mark will be deducted for every wrong answer.
6. There are total **13** pages (including this page) in this question paper. Check this before you start answering.
7. 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, when more than one student gets equal marks, to prepare the merit list.
8. Non-programmable scientific calculators are permitted.
9. Cell/Mobile phones are strictly prohibited in the examination hall.

Part A

1. Tesla is the unit of:
 - A) Magnetic flux density
 - B) Resonance
 - C) Photon flux
 - D) Mass charge

2. If two linear single stranded DNA molecules are heated to 368 K followed by cooling to 278 K, the product formed is
 - A) Double stranded DNA with blunt ends
 - B) Double stranded DNA with overhangs
 - C) Single stranded circular DNA
 - D) Linear single stranded DNA

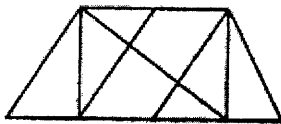
3. A fires 7 shots to B's 5, but A kills only once in 4 shots while B kills once in 2 shots. When B has missed 20 times, A has killed:
 - A) 90 birds
 - B) 14 birds
 - C) 25 birds
 - D) 20 birds

4. The calculated bond order in O_2^- ion is
 - A) 1.0
 - B) 1.5
 - C) 2
 - D) 2.5

5. Protein A and B have similar migration on native page; while Protein A shows two times higher molecular weight than protein B on SDS PAGE, which of the following is true:
 - A) A and B are monomeric
 - B) A and B are dimeric
 - C) A is monomeric and B is dimeric
 - D) A is dimeric and B is monomeric

6. LED - television works on the following principle
 - A) Luminescence
 - B) Phosphorescence
 - C) Electro Luminescence
 - D) Fluorescence

7. The reaction of 2-chloropyridine with sodium ethoxide is
- A) Elimination followed by addition
 - B) Electrophilic aromatic substitution
 - C) Addition followed by substitution
 - D) Nucleophilic aromatic substitution
8. When it is 8.30 A.M. on Wednesday of Greenwich, then:
- A) It is 10.30 P.M. on Wednesday at New Delhi
 - B) It is 6.15 A.M. on Tuesday at New York
 - C) It is 3.30 P.M. on Wednesday at Sydney
 - D) It is 5.30 P.M. on Wednesday at Tokyo
9. Example of fermions are
- A) Electron and proton
 - B) photon and proton
 - C) Electron and proton
 - D) Photon
10. What is the number of triangles in the given figure?



- A) 12
 - B) 20
 - C) 8
 - D) 14
11. Which of the following is the least dense metals?
- A) Mercury
 - B) Lithium
 - C) Germanium
 - D) Platinum
12. Which of the following are the ingredients of gun metal?
- A) Iron, zinc and sodium
 - B) Iron, copper and brass
 - C) Copper and Tin
 - D) Aluminum and Uranium
13. The minimum calculated distance of Mars from Earth is:
- A) 54.6 Million Km
 - B) 401 Million Km
 - C) 225 Million Km

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- D) 95.5 Million Km
14. Which statement is incorrect about the Z-DNA form:
- A) It entails a left handed double helix winding to the left in a zig-zag pattern
 - B) The major and minor grooves show little difference in width
 - C) Certain conditions such as high salt and negative supercoiling induce it
 - D) Once induced, it usually persists longer and remains stable
15. The difference between the molecular weight of sucrose and that of the sum of the molecular weights of its components (glucose and fructose) is:
- A) 0
 - B) 2
 - C) 18
 - D) 16
16. Different isotopes of an element are physically separated by the process of:
- A) Ultracentrifugation
 - B) Filtration
 - C) Evaporation
 - D) Distillation
17. Proteogenomics is an approach of identification of proteins and peptides wherein:
- A) Mass spectrometry based data are used for identification of novel peptides
 - B) Novel peptides are mined from customized genomic and transcriptomic databases
 - C) Mass spectrometry data are searched and compared against genomic and transcriptomics databases for the identification of novel peptides
 - D) Novel peptides are identified at the interface of proteomics and genomics approaches**
18. The following is a potent alkylating mutagen that is used as a tool in genetic screens:
- A) Nitosoamine
 - B) N-methyl formamide
 - C) Acridine orange
 - D) Nitroso-ethyl urea
19. Internal ribosome entry site (IRES) elements are present in the genome of
- A) Rabies virus
 - B) Smallpox virus
 - C) Vaccinia virus
 - D) Poliovirus
20. The following are the reservoirs/vectors for Ebola and Marburg viruses:
- A) Fruit Bats
 - B) Mosquitoes
 - C) Rodents
 - D) Migratory Birds

21. Mate pair information is not retained in this sequencing technique:
A) Solexa sequencing
B) Sanger sequencing
C) 454 sequencing
D) SoLiD sequencing
22. There are 3 non-graduated gallons A B C:
Gallon A having max capacity of 7 litres is currently filled with 4 litres of water
Gallon B having max capacity of 5 litres is currently filled with 3 litres of water
Gallon C having max capacity of 3 litres is currently filled with 2 litres of water
- How can you measure 1 liter of water in minimum number of steps?
- A) Pour 1 litre of water from gallon A to gallon C
B) Pour water from gallon C to completely fill gallon B and leftover is one litre water
C) Step A followed by step B
D) Pour exactly 1 litre water from gallon C to gallon A
23. $() + () + () + () + () = 30$. This is what you have for an equation. The following are the numbers that you can use to fill in the brackets, if required with the use of a (-) sign: 1, 3, 5, 7, 9, 11, 13 & 15. Your correctly filled brackets should be:
A) $(15 - 9) + (13 - 7) + (7 - 1) + (9 - 1) + (13 - 9)$
B) $(11 - 5) + (15 - 11) + (5 - 1) + (15 - 1) + (3 - 1)$
C) $(7 - 5) + (13 - 1) + (9 - 1) + (1) + (3 - 1)$
D) A or B
24. What function the transformer performs at a power station?
A) regulates heating of electric lines by stepping up the voltage
B) decreases heating of electric lines by stepping up the current
C) increases heating of electric lines by stepping up the voltage
D) decreases heating of electric lines by stepping down the voltage
25. The following type of chart is used to display the work break down structure of a project:
A) Dough nut chart
B) Gantt chart
C) Bubble chart
D) Radar chart

Part B

26. Which of the following programs does not take PDB file as an input:
A) RasMol

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- B) Chime
 - C) BLAST
 - D) PyMol
27. Beta-amyloid Plaques are associated with
- A) Huntington disease
 - B) Alzheimer's disease
 - C) ALS
 - D) Parkinson's disease
28. The development of pollen in tapetum cells is prevented by the expression of an enzyme from *Bacillus amyloliquefaciens*
- A) Hexokinase
 - B) ATPase
 - C) Cytochrome oxidase
 - D) Ribonuclease
29. 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
30. Biodegradable nanoparticles have following features
- A) Kill cells
 - B) Escape from immune system
 - C) Accumulate in the Gut
 - D) Unstable
31. Which of the following genetic elements insert at tRNA genes in their host chromosome
- A) Genomic islands
 - B) IS elements
 - C) Plasmids
 - D) Prophages
32. Which of the following is the most common and stable confirmation for a polypeptide chain
- A) Alpha helix
 - B) Beta pleated sheets
 - C) Anti-parallel beta pleated sheets
 - D) Tertiary structure

33. Which of the following statements is/are true regarding the distribution of ions during the resting membrane potential of a neuron
- a) K^+ is more concentrated inside the cell
 - b) Na^+ is more concentrated inside the cell
 - c) Ca^{+2} is concentrated more outside the cell
 - d) Na^+ is concentrated more outside the cell
- A) Only (a) and (b) are true
B) Only (a), (c), and (d) are true
C) Only (c) and (d) are true
D) Only (b) and (c) are true
34. Inactivation of a gene that codes for a repressor protein which is involved in regulation of genes X, Y and Z leads to
- A) Inhibition of X, Y and Z transcription
 - B) Constitutive expression of X, Y and Z genes
 - C) Rapid degradation of X, Y and Z mRNA
 - D) Disappearance of X, Y and Z proteins
35. Structures that have the same evolutionary origin although they may have different structures or functions are said to be
- A) alogous
 - B) analogous
 - C) homologous
 - D) Non-homologous
36. In a mixture of proteins listed below, which should elute second in size-exclusion chromatography
- A) cytochrome c $M_r = 13,000$
 - B) immunoglobulin G $M_r = 145,000$
 - C) ribonuclease A $M_r = 13,700$
 - D) RNA polymerase $M_r = 450,000$
37. Programmed cell death or apoptosis is
- A) a genetically coded and regulated process
 - B) not associated with ischemia
 - C) inflammatory response
 - D) a result of multiple random events
38. The bacterial effector protein that induces hummingbird phenotype in cultured epithelial cells
- A) Botulinum toxin
 - B) CagA
 - C) Staphylococcal protein A
 - D) LPS

39. Sickle cell anemia is a disease resulting from missense mutation. What amino acid is substituted at the original glutamic acid? This mutation affects which protein chain in the hemoglobin
- A) Valine; beta hemoglobin
 - B) Valine; alpha hemoglobin
 - C) Methionine; alpha hemoglobin
 - D) Cysteine; beta hemoglobin
40. Which of the following is NOT a feature of a typical bacterial operon?
- A) The genes are translated into a single polypeptide
 - B) The genes in the operon are transcribed into a single mRNA molecule
 - C) The genes frequently encode proteins that are involved in a single biochemical pathway
 - D) The genes are under the control of a single promoter
41. Which of the following amino acids will be the site of enzyme modification by phosphorylation?
- A) Arginine
 - B) Cysteine
 - C) Phenylalanine
 - D) Serine
42. Ebola virus genome is
- A) +ve ssRNA
 - B) -ve ss RNA
 - C) ds RNA
 - D) ss DNA
43. Which of the following drug inhibits DNA replication
- A) Rifampicin
 - B) Puromycin
 - C) Oligomycin
 - D) 5-Fluorouracil
44. Which of the following is a mobile electron carrier protein in the photosynthetic electron transport
- A) Plastoquinone
 - B) Plastocyanin
 - C) Phycocyanin
 - D) D1 protein
45. The following gene/locus when deleted from the X or Y-chromosome can lead to misidentification of gender in forensic or prenatal analysis
- A) a Holandric gene
 - B) Amelogenin
 - C) SRY gene

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52. A famous biological sample repository based in the US is
- A) ATCC
 - B) NCBI
 - C) NTTC
 - D) NIST
53. Thin layer chromatography can be used to distinguish between different amino acids. If a particular amino acid has low solubility in the mobile phase used, then the amino acid
- A) will have a low Rf value
 - B) will spend more time dissolved in the mobile phase than attached to the stationary phase
 - C) must have a high molecular mass
 - D) will move at a speed close to that of the solvent
54. Calcium channels in Endoplasmic reticulum of plants and animals are controlled by
- A) cAMP
 - B) Inositol 1,4,5-triphosphate
 - C) cGMP
 - D) G-proteins
55. In isoelectric-focusing the following substances are used to give a pH gradient
- A) Veronal
 - B) Tris
 - C) Polyaminopolycarboxylic acids
 - D) Phosphate buffer
56. Graft and tumor rejection are mediated primarily by
- A) non-complement-fixing antibodies
 - B) phagocytic cells
 - C) helper T cells
 - D) cytotoxic T cells
57. Eukaryotic cells with DNA damage often cease progression through the cell cycle until the damage is repaired. This type of control over the cell cycle is referred to as
- A) Proteosome control
 - B) Damage control
 - C) Anticyclin control
 - D) Checkpoint control
58. Area of the brain associated with speech is called:
- A) Broca's area
 - B) Wernicke's area
 - C) Angular gyrus
 - D) Ventricles

59. Pharmacophore is a
- A) Receptor
 - B) Molecular structure feature
 - C) Drug effect
 - D) Substrate effect
60. United Nations Educational, Scientific and Cultural Organization (UNESCO) celebrated the year 2014 as:
- A) International Year of Bioinformatics
 - B) International Year of Crystallography
 - C) International Year of Molecular Biology
 - D) International Year of Structural Biology
61. Peroxiredoxins do not reduce
- A) H_2O_2
 - B) Paraquat
 - C) Alkylperoxides
 - D) Peroxinitrites
62. Two-dimensional electrophoresis is a combination of which two techniques?
- A) Isoelectric focusing and affinity chromatography
 - B) Ion-exchange chromatography and SDS-PAGE
 - C) Isoelectric focusing and SDS-PAGE
 - D) Isoelectric focusing and ion-exchange chromatography
63. Following labelled ATP can be used to label DNA or protein using a kinase
- A) α -P-32 ATP
 - B) P-32-inorganic phosphate
 - C) γ -P32 ATP
 - D) B-P32 ATP
64. The mechanism that permits immunoglobulins to be synthesized in either a membrane-bound or secreted form is
- A) allelic exclusion
 - B) codominant expression
 - C) the one-turn/two-turn joining rule
 - D) differential RNA processing
65. Polynucleotide ligase joins two DNA molecules together by forming a covalent bond between
- A) Two OH groups of adjacent strands
 - B) A 3' OH group and a 5' PO_4 group
 - C) A 3' PO_4 group and a 5' OH group
 - D) Two carbon atoms of adjacent nucleotides on the same strand

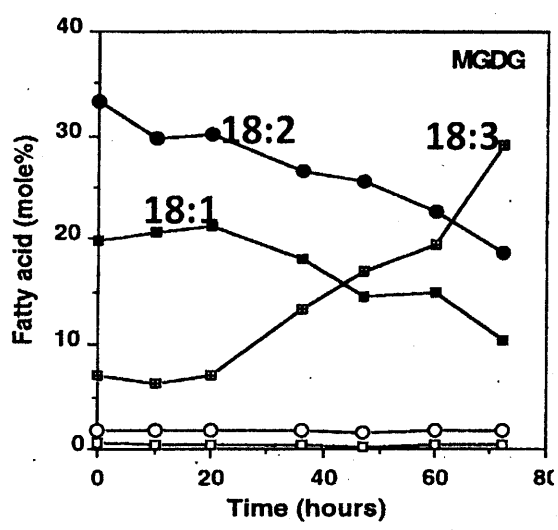
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66. Which of the following separates molecule according to their size
- A) Gel-Filtration chromatography
 - B) Affinity chromatography
 - C) Isoelectric focusing
 - D) Ion exchange chromatography
67. Which of the following describes RNA interference
- A) Antisense RNA molecules block the translation of mRNA molecules
 - B) Double-stranded RNA molecules are bound by proteins that block their translation
 - C) Double-stranded RNA molecules are cleaved by a nuclease into short interfering RNA molecules
 - D) Short interfering RNA molecules bind to the ribosome to prevent the translation of viral mRNAs
68. Which statement is scientifically correct about raw honey?
- A) It retains footprints of all the components of the eco-social system of the beehive
 - B) It holistically entails benefits of pure honey, pollen, wax and other unknown biotic components and enzymes/peptides added by the bees and by their farmed microbiota
 - C) It contains probiotic bacteria from the honey crop of bees
 - D) All of the above
69. One of the following is a regulatory protein
- A) Gp120
 - B) integrase
 - C) Reverse transcriptase
 - D) Tat
70. The frequency of somatic mutation in Ig genes is greatest during
- A) differentiation of pre-B cells into mature B cells
 - B) differentiation of pre-T cells into mature T cells
 - C) generation of memory B cells
 - D) antibody secretion by plasma cells
71. The methods used for locating transcription start site are
- A) Gel retardation and footprinting
 - B) Northern analysis and RT-PCR
 - C) Primer extension and S1 nuclease mapping
 - D) Cloning of 5' UTRs and DNA Sequencing
72. A person with lactose intolerance is most likely deficient in breaking the following chemical bond:
- A) An ester linkage
 - B) A phosphodiester bond
 - C) An amide bond
 - D) A glycosidic bond

73. Severe Acute Respiratory Syndrome (SARS) virus belongs to the family
- A) Picornaviridae
 - B) Coronaviridae
 - C) Adenoviridae
 - D) Abolaviridae

74. Which of the following processes is thought to underlie concerted evolution
- A) Gene conversion
 - B) Lateral gene transfer
 - C) Programmed cell death
 - D) Transposition

75. Based on the time dependent changes in the fatty acid composition of a bacterial membrane as shown in the following figure, identify the abiotic stress treatment given to the bacterial culture



- A) Heat stress
- B) Salt stress
- C) Cold stress
- D) Oxidative stress

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