A-65

Hall Ticket No.

Entrance Examination, June 2012
Integrated M.Sc./Ph.D. Biotechnology

Time : **2 hours** **Maximum Marks : 75**

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE ANSWERING:

1. Enter your hall ticket number on this sheet and the answer (OMR) Sheet.
2. Answers have to be marked on the OMR answer sheet with BLACK/BLUE Ball point/ Sketch pen following the instructions provided there upon.
3. Hand over both the question paper booklet and OMR answer sheet at the end of the examination.
4. All questions carry one mark each.
5. 0.33 mark will be deducted for every wrong answer.
6. There are total 14 pages (excluding 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.

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Integrated MSc-PhD in Biotechnology

SCHOOL OF LIFE SCIENCES

MAXIMUM MARKS: 75

PART A

1. What is the essential requirement for the operation of a step down transformer?

   A. A laminated iron core
   B. A non-conducting core
   C. A magnetic interaction between the primary and secondary coils
   D. An electric connection among the primary and secondary coils

2. A fast moving space probe passes close to a planet. How does the gravitational environment of the planet influences the probe/or otherwise?

   A. Its speed changes but direction remains same
   B. Both the speed and direction of the probe change
   C. The direction changes while speed remains constant
   D. The gravitational environment of the planet will have no effect on the probe

3. What is the total number of sigma bonds found in the following compound?

   CH_3-CH=C=CH−C≡C−H

   A. 11
   B. 5
   C. 10
   D. 13

4. If the enthalpy change for a reaction is zero, $\Delta G°$ is equal to

   A. $\Delta H°$
   B. $ln\ K_{eq}$
   C. $T\Delta S°$
   D. $-T\Delta S°$

5. The identity of an element is determined by...

A. the number of its protons
B. the number of its neutrons
C. density of the element
D. its atomic mass

6. Osteoporosis is the disease of which organ?

A. Bones
B. Muscles
C. Eyes
D. Kidneys

7. One of the following is not a model organism used in biological studies:

A. Drosophila melanogaster
B. Neurospora crassa
C. Bos taurus
D. Escherichia coli

8. One of the following viruses is strongly associated with the development of cancer:

A. HIV
B. Visna-Maedi virus
C. H1N1
D. Rabies virus

9. The following is a system of communication and response among organisms based on their population density:

A. Quorum quenching
B. Quorum sensing
C. Quorum glow
D. Biofilm formation

10. Which genetic element is very important in rapid acquisition and transfer of drug resistance among bacteria:

A. Integron
B. IS element
C. Plasmid
D. Prophage

11. The x-component of the resultant of several vectors

A. Is equal to the sum of the x-components of the vectors
B. May be smaller than the sum of the magnitude
C. May be equal to the sum of the magnitudes of the vectors
D. All the above.

12. While walking on the ice, one should take small steps to avoid slipping. This is because smaller steps ensure

A. Larger normal force
B. Larger friction
C. Smaller friction
D. Smaller normal force

13. A neutron exerts a force on a proton which is

A. Gravitational
B. Electromagnetic
C. Weak
D. All the above

14. A coin placed on rotating turntable just slips if it is placed at a distance of 4 cm from the centre. If the angular velocity of the turntable is doubled, it will just slip at a distance of

A. 2 cm
B. 4 cm
C. 8 cm
D. 1 cm

15. The following is not a mechanism of genetic recombination:

A. Conjugation
B. Transduction
C. Gene conversion
D. Sumoylation

16. Which among the following is not a product of bacterial fermentation

A. Carbon dioxide
B. Hydrogen

C. Oxygen
D. Methane

17. Metabolic pathways like tricarboxylic acid cycle has

A. Both catabolic and anabolic functions
B. Catabolic functions only
C. Anabolic functions only
D. None of the above functions

18. An oxidation-reduction reaction involves

A. Internal rearrangment of a molecule
B. Cleavage of a large molecule into smaller molecule
C. Transfer of electrons from one molecule to another
D. Combining two small molecules to create one larger one

19. If you remove all of the functional groups from an organic molecule so that it has only carbon and hydrogen atoms, the molecule becomes a _____ molecule

A. Carbohydrate
B. Carbonyl
C. Carboxyl
D. Hydrocarbon

20. Which of the following quantities remain constant in a planetary motion (consider elliptical orbits) as seen from the sun

A. Kinetic energy
B. Angular speed
C. Angular momentum
D. Speed

21. A hydrocarbon is said to be saturated if

A. One end of the molecule is hydrophilic while the other end is hydrophobic
B. It has one or more double bonds between carbon atoms
C. It contains more than one functional group
D. Each internal carbon atom is covalently bonded to two hydrogen atoms

22. Molecular empirical formula for carbohydrates is

A. $(CHO)_2$
B. $(CH_2O)_n$
C. $2(CHO)_n$
D. $(C_2HO)_n$

23. The substance that is the general biosynthetic precursor of sex hormones and hormones of adrenal cortex is

A. Lecithin
B. Sphingomyelin
C. Phosphatidyl choline
D. Cholesterol

24. An amino acid that has a secondary amine and disrupts alpha-helix formation is

A. Threonine
B. Glycine
C. Phenyl alanine
D. Proline

25. The Maxam-Gilbert method of nucleotide sequencing is based on

A. dideoxy nucleotide triphosphates
B. chemical modifications of DNA
C. PCR
D. RT-PCR

PART B

26. Which of the following is not a mechanism whereby B cells or antibodies contribute to immunity?

A. Presentation of antigen to T cells
B. Direct cell killing
C. Opsonization
D. Complement activation

27. T cells mature in the

A. Thyroid gland
B. Spleen
C. Lymph nodes
D. None of the above

28. Which of the following is a prime example of a ribonucleoprotein enzyme, the catalytic activity of which (under nonphysiological conditions), resides solely in its RNA component?

A. Polynucleotide phosphorylase
B. Reverse transcriptase
C. RNase P
D. Bacterial RNA polymerase

29. A light receptor in certain bacteria resembles that found in the eyes of animals. What is the bacterial light receptor called?

A. Photochrome
B. Chlorophyll
C. Bacteriorhodopsin
D. Rhodopsin

30. What is the chemical basis of gene imprinting?

A. Phosphorylation of DNA
B. Methylation of DNA
C. Oxidation of DNA
D. Glycosylation of DNA

31. Which of the following types of genes are not known in any mitochondrial geneome?

A. tRNA genes
B. Respiratory chain genes
C. Glycolytic genes
D. rRNA genes

32. When proteins are hydrolyzed to amino acids and then deaminated, the carbon skeleton is fed into

A. Glycolysis pathway
B. Pentose phosphate pathway
C. Tricarboxylic acid cycle
D. Calvin pathway

33. The Ames test is used to determine if a chemical

A. increases the rate at which a bacterial cell divide
B. decreases the number of cells in a culture

C. induces mutations in a cell's DNA
D. decreases the ability of a cell to photosynthesize

34. The precursor for fatty acid biosynthesis is

A. Histidine
B. Phenylalanine
C. Malonyl CoA
D. Acetyl CoA

35. Which among the following rRNA genes are compared for bacterial phylogeny

A. 18S
B. 16S
C. 28S
D. 5.8S

36. "Sucrose density gradient" is a technique used

A. In Purifying macromolecules and nucleic acids
B. To isolate the nucleic acids
C. To determine the molecular weight of virus particles
D. To detect the virus particles in an infected plant

37. Using viral nucleic acid (specifically the RNA) as a template, the c-DNA is synthesized by using this enzyme

A. T4 DNA ligase
B. Exo III nuclease
C. Reverse transcriptase
D. RNase H

38. Which of the following inhibits transcription

A. Rifampicin
B. Ampicillin
C. Chloramphenicol
D. Kanamycin

39. Following is a technique used for RNA transfer from gel to positively charged membrane

A. Southern
B. Northern
C. Western

D. Transformation

40. The living organism whose genome was the first to be completely sequenced

A. *Φx174*
B. *H. influenzae*
C. Yeast
D. *E. coli*

41. A principal difference between prokaryotic and eukaryotic DNA replication is

A. Completely different proteins/enzymes in eukaryotes
B. Multiple origins in eukaryotes
C. No requirement for topoisomerase activity in prokaryotes
D. The absence of a nucleus in prokaryotes

42. Most of the important functional groups on biological molecules

A. Contain oxygen and/or nitrogen and are acidic
B. Contain oxygen and an amine
C. Contain nitrogen and a phosphate
D. Contain oxygen and/or nitrogen and are polar

43. Why is cellulose so difficult for most animals to digest?

A. They don't have proper enzymes to break the bonds between subunits
B. Cellulose is made up of chitin, which is indigestible
C. The bonds holding cellulose subunits together are extremely strong, stronger than any other macromolecules
D. None of the above

44. Triacylglycerol contains fatty acids and

A. Glucose
B. Glycogen
C. Glycerol
D. Guanine

45. Which of the following is not a lipid?

A. Chitin
B. Terpenes
C. Steroids
D. Prostaglandins

46. Each protein has a particular 3D structure which is decided by its

A. Secondary structure
B. Tertiary structure
C. Primary structure
D. Quaternary structure

47. The immunoglobulin that results in histamine release is

A. IgG
B. IgM
C. IgE
D. IgD

48. Which of these are involved in innate defense mechanisms?

A. Neutrophils
B. Macrophages
C. Lymphocytes
D. All of the above

49. Acquired immunity is found in

A. Invertebrates
B. Vertebrates
C. Some invertebrates
D. Both vertebrates and invertebrates

50. ELISA, used to detect antigens or antibodies, utilizes those enzymes that

A. have a high turnover rate
B. yield a stable colored product
C. are stable on conjugation to proteins
D. all of the above

51. The tuberculin skin test is an example of

A. Type IV delayed hypersensitivity
B. Allergy reaction
C. Serum sickness
D. Precipitation reaction

52. The macrophage-rich mass found at the site of injection of an adjuvant is called

A. myeloma
B. granuloma
C. adjuvant activated lymphoma
D. none of the above

53. The class of immunoglobulins that can get transported across epithelial cells is

A. IgG
B. IgE
C. IgA
D. IgM

54. MHC I genes that encode for membrane bound glycoprotein's are found in

A. All nucleated cells
B. B cells, macrophages, dendritic cells
C. Only B and T cells
D. Tumor cells

55. Joining chain (J chain) is found in

A. IgM
B. IgA
C. IgM and IgA
D. IgE

56. 'ROS' does not include

A. OH^-
B. H_2O_2
C. NO
D. H_2PO_4

57. Factor VIII produced as a therapeutic using mammalian cell cultures is used to cure

A. Anaemia
B. Thrombosis
C. Haemophilia
D. Leukemia

58. Frankia species participate in symbiotic association with

A. Parasponia
B. Casuarina
C. Azolla
D. Cycas

59. A child disturbs a wasp nest, is stung repeatedly, and goes into shock within minutes, manifesting respiratory failure and vascular collapse. This is MOST likely to be due to

A. Systemic anaphylaxis
B. Serum Sickness

C. Arthus reaction
D. Cytotoxic hypersensitivity

60. Antigen-presenting cells that activate helper T cells must express which one of the following on their surfaces?

A. IgE
B. gamma interferon
C. class I MHC antigens
D. class II MHC antigens

61. Signals required for T cell activation

A. Peptide-MHC complex
B. Co-stimulation
C. Cytokines and other effectors molecules etc.
D. All

62. Rapid but non-antigen specific immune responses are produced by the

A. Adaptive immune response
B. Innate immune system
C. Leukocytes
D. Lymphatic system

63. Which of the following are true with regard to interferons

A. Activates B cells to make virus specific antibodies
B. Are Th2 cytokines
C. Are virus proteins that interfere with activation of cytotoxic T cells
D. Inhibits virus replication by infected cells

64. Cells that release histamine and other vasoactive substances in response to allergens are

A. Neutrophils
B. Macrophages
C. NK cells
D. Mast cells

65. Which of the following disease is not an autoimmune disease

A. rheumatoid arthritis
B. lupus erythematosus
C. bovine spongiform encephalitis
D. grave's disease

66. One of the following is not a bacterial pathogen

A. *Bacillus anthracis*
B. *Leishmania tropica*
C. *Salmonella typhi*
D. *Streptococcus aureus*

67. One of the following is very strong evolutionary force that influences bacterial taxonomy

A. Horizontal gene transfer
B. Selection for virulence alleles
C. Antigenic variation
D. Patho-adaptation

68. The bacterium that uses special secretary apparatus

A. *Agrobacterium tumifaciens*
B. *Bacillus cereus*
C. *Lactobacillus delbrueckii*
D. *Lactococcus lactis*

69. The following virus is a very strong cause of cervical cancer in humans

A. Human papilloma virus
B. JC-Polyoma virus
C. H1N1 virus
D. SARS corona virus

70. The following is an important viral enzyme that is the target of popular anti-influenza drugs

A. Neuraminidase
B. HIV protease
C. RNA polymerase
D. Topoisomerase

71. The following culture medium is commonly used to culture laboratory strains of *E. coli*

A. Luria-Bertani medium
B. Mannitol salt agar
C. Blood agar
D. Brain-heart infusion medium

72. The following is not a chronic disease/infection
A. Tuberculosis
B. Typhoid
C. Bacterial meningitis
D. Crohn's disease

73. The reason for the emergence of multiple drug resistant strains of pathogens in India is

A. Under dosage due to negligence or illiteracy
B. Uncontrolled over the counter sale of drugs
C. Lack of a proper antibiotic policy
D. All of the above

74. The following parasitic infection/disease can affect the brain seriously

A. Malaria
B. Amoebic dysentery
C. Elephantiasis
D. Kala-azar

75. The following part of the chromosomes is related to ageing in humans

A. Telomeres
B. Chromatin
C. Prophages
D. Homopolymeric tracts