ENTRANCE EXAMINATION FOR ADMISSION, MAY 2012.

Ph.D. (BIOCHEMISTRY & MOLECULAR BIOLOGY)

COURSE CODE : 102

Register Number :

Signature of the Invigilator
(with date)

COURSE CODE : 102

Time : 2 Hours Max : 400 Marks

Instructions to Candidates :

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each of the question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the ANSWER SHEET using HB pencil.
4. Avoid blind guessing. A wrong answer will fetch you –1 mark and the correct answer will fetch 4 marks.
5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.
6. Do not open the question paper until the start signal is given.
7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.
8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.
9. Use of Calculators, Tables, etc. are prohibited.

1. One important mechanism for maintaining sequence identity among the many copies of a gene within a tandem array is
   (A) unequal crossing-over
   (B) gene conversion
   (C) retrotransposition
   (D) deletion

2. Apical dominance in plant is governed by
   (A) Ethylene
   (B) Auxin
   (C) Gibberellin
   (D) Abscisic acid

3. Number of substrate level phosphorylations occurring in citric acid cycle....
   (A) One (B) Two (C) Three (D) Four

4. C_0t analysis provides an estimate of the
   (A) G + C content of the DNA
   (B) Tm of the DNA
   (C) Complexity of the genome
   (D) Hyperchromic shift of the genome

5. Which of the following substances is secreted at a synaptic junction between a nerve and a muscle membrane?
   (A) Adrenaline
   (B) Acetylcholine
   (C) Dopamine
   (D) Serotonin

6. Monosaccharides that have the same chemical formula as glucose include.
   (A) Valine (B) Lactose (C) Mannose (D) Ribose

7. The Km of an enzyme – catalyst reaction
   (A) is equal to the catalytic rate when all substrate sites are full
   (B) describes the affinity of an enzyme for its substrate
   (C) is dependant on the enzyme concentration
   (D) is equal to the substrate concentration when the rate of the reaction is maximal

8. Which of the following antibody is involved in hypersensitive reactions?
   (A) IgG (B) IgE (C) IgM (D) IgD

9. Ceramide is a precursor to which of the following compounds?
   (A) Phosphatidyl serine
   (B) Sphingomyelin
   (C) Phosphatidyl glycerol
   (D) Phosphatidyl choline

10. Which of the following would rule out hyperuricemia in a patient?
   (A) Lesch-Nyhan syndrome
   (B) Gout
   (C) Xanthine oxidase hyperactivity
   (D) Carbamoyl phosphate synthase deficiency

11. Analysis of DNA structure by X-ray diffraction is governed by...
(A) Watson-crick law
(B) Bragg's law
(C) Wilkin's law
(D) Franklin's law

12. Kinetin is a....
(A) Shoot inducing agent
(B) Root inducing agent
(C) Bud forming agent
(D) None of the above

13. Which of the following statements accurately describes sex hormones?
(A) They bind specific membrane receptors
(B) They interact with DNA directly
(C) They cause release of a proteinaceous second messenger from the cell membrane
(D) They enhance transcription when bound to receptors

14. Which of the following tissues is capable of contributing to blood glucose?
(A) Skeletal muscle
(B) Adipose tissues
(C) Cardiac muscle
(D) Duodenal epithelium

15. Initiators of Porphyrin ring formation are
(A) Succinyl-CoA and valine
(B) Acetyl CoA and lysine
(C) Succinyl-CoA and glycine
(D) Acetyl CoA and glycine

16. Hemicellulose is made up of
(A) Fructose
(B) Galactose
(C) Xylose
(D) Glucosamine

17. Which enzyme deficiency cause Niemann Pick disease?
(A) Sphingomyleinase
(B) Aryl sulphatase A
(C) Hexoaminidase A
(D) Alpha-Galactosidase

18. Which of the following results is provided by northern blot analysis?
(A) Detects specific base pairs
(B) Detects DNA molecules
(C) Detects RNA molecules
(D) Detects proteins

19. Which of the following can be used for quantitative determination for aminoacids in general?
(A) Pauly's reagent
(B) Fluorescamine
(C) Sakaguchi reaction
(D) Ninhydrin

20. Proteins may be separated according to size
(A) Isoelectric focussing
(B) SDS-PAGE
(C) Ion exchange chromatography
(D) Molecular exclusion chromatography

21. The greatest buffering capacity at physiologic pH would be provided by a protein rich in which of the following amino acids?
(A) Lysine
(B) Histidine
(C) Aspartic acid
(D) Valine

22. In Glycolysis ATP synthesis is catalyzed by
(A) Hexokinase
(B) Phosphofructokinase
(C) Glyceraldehyde-3-phosphate dehydrogenase
(D) Phosphoglycerate kinase

23. Which of the hemoglobin designations below best describes the relationship of subunits in the quaternary structure of adult hemoglobin?
(A) $(\alpha_1 - \alpha_2)\ (\beta_1 - \beta_2)$
(B) $\alpha_1 - \alpha_2 - \alpha_3 - \alpha_4$
(C) $(\beta_1 - \beta_2 - \beta_3 - \alpha_1)$
(D) $(\alpha_1 - \beta_1) - (\alpha_2 - \beta_2)$

24. Opsonins include...
(A) Perforin
(B) C9
(C) IFN γ
(D) C3b

25. Which one of the following proteins is found in the thick filaments of skeletal muscle?
(A) α-actinin
(B) Myosin
(C) Troponin
(D) Tropomyosin

26. Which of the following biomolecules is likely to have buffering action?
(A) DNA
(B) Polysaccharide
(C) Lipids
(D) Proteins

27. Isoelectric focusing method separates protein molecules according to their...
(A) net content of glutamic acid
(B) molecular weight
(C) net charge
(D) charge/mass ration

28. What is biome?
(A) That part of the earth and its atmosphere, which inhabits living organisms
(B) A complex of communities interacting with one another
(C) The flora on land
(D) The flora in an ocean

29. The denitrification means
(A) reduction of NO_2 to ammonia by bacteria in the soil
(B) conversion of ammonia to amino acids
(C) conversion of ammonia to nitrates and gaseous nitrogen
(D) oxidation of ammonia to nitrate

30. Most of the atmospheric air is present in
(A) troposphere (B) stratosphere
(C) thermosphere (D) ionosphere

31. The cholesterol molecule is a
(A) Benzene derivative (B) Quinoline derivative
(C) Steroid (D) Tocopherol

32. Which of the following proteins is, in fact, a multifunctional enzyme complex in higher organisms?
(A) Acetyl transacylase (B) Malonyl transacylase
(C) 3-Hydroxyacyl-ACP-dehydrase (D) Fatty acid synthetase

33. The correct order of passage of electrons through the cytochromes of the respiratory chain is
(A) a – a3 – b – c – c1 (B) a3 – a – b – c1 – c
(C) b – c1 – c – a – a3 (D) a3 – a – c – c1 – b

34. How many moles of high energy phosphate bond equivalents are utilized in the synthesis of 1 mole of triacylglycerol from free fatty acids and glycerol?
(A) 3 (B) 4 (C) 7 (D) 9

35. The ratio that most closely approximates the number of net molecules of ATP formed per mole of glucose utilized under aerobic conditions to the net number formed under anaerobic conditions is
(A) 25:1 (B) 18:1 (C) 13:1 (D) 9:1

36. The activity of pyruvate carboxylase is dependent upon the positive allosteric effector
(A) Acetyl CoA (B) AMP
(C) Citrate (D) Isocitrate

37. Rats fed a fat-free diet from birth would be deficient in
(A) Prostaglandins (B) Phospholipids
(C) Triacylglycerols (D) Cholesterol

38. The Citric acid cycle is inhibited by
(A) Arsenite (B) Malonate
(C) Fluoroacetate (D) All of the above

39. Which of the following statements is correct?
(A) All coenzymes are vitamins
(B) All water-soluble vitamins act as coenzymes/coenzyme precursors
(C) Prostglandins may be derived from fat-soluble vitamins
(D) Vitamin A intoxication from the ingestion of polar bear livers is a myth

40. All the following are involved in calcium metabolism and function EXCEPT
(A) Thyroxine
(B) Parathyroid hormone
(C) Calcitonin
(D) Vitamin D

41. The important reactive group of glutathione in its role as an antioxidant is
(A) Serine
(B) Sulfhydryl
(C) Tyrosine
(D) CoA

42. Molecular iron, Fe, is
(A) stored primarily in the spleen
(B) excreted in the urine as Fe2+
(C) stored in the body in combination with ferritin
(D) absorbed in the intestine by transferrin

43. In adults, a severe deficiency of vitamin D causes
(A) Night blindness
(B) Osteomalacia
(C) Rickets
(D) None of the above

44. Which of the following enzymes is localized in the inner membrane of the mitochondrion?
(A) Acyl CoA synthetases
(B) Isocitrate dehydrogenase
(C) Fatty acyl CoA oxidation enzymes
(D) Succinate dehydrogenase

45. The oxygen dissociation curve for haemoglobin is shifted to the right by
(A) decreased O_2 tension
(B) decreased CO_2 tension
(C) increased CO_2 tension
(D) increased pH

46. Phenylketonuria is caused by a lack of
(A) Phenylalanine hydroxylase
(B) Phenylalanine α-ketoglutaric transaminase
(C) Homogentisate oxidase
(D) DOPA decarboxylase

47. Of the following body fluids, the one with the lowest pH is
(A) plasma
(B) pancreatic juice
(C) liver bile
(D) gastric juice

48. Glucose can be oxidized by the
(A) Liver
(B) Brain
(C) Heart
(D) All of the above

49. Which of the following intermediates of metabolism can be both a precursor of and a product of glucose?

(A) Lactate
(B) Pyruvate
(C) Alanine
(D) All of the above

50. Ketone bodies may be synthesized from fatty acids by which of the following structures?

(A) Erythrocytes
(B) Brain
(C) Skeletal muscle
(D) Liver

51. Analysis of pH 8.6 electrophoretic patterns of haemoglobin isolated from the blood of patients heterozygous for the sickle cell gene would reveal

(A) One band
(B) Two bands
(C) Three bands
(D) Four bands

52. Proteolytic action of the enzyme trypsin is specific to which one of the following amino acids?

(A) Tryptophan
(B) Tyrosine
(C) Lysine
(D) Carboxyl terminal amino acid

53. Which of the following amino acids is ketogenic but not glucogenic?

(A) Isoleucine
(B) Tyrosine
(C) Leucine
(D) Phenylalanine

54. Since the pK values for aspartic acid are 2.0, 3.9, and 10.0, it follows that the isoelectric point (pI) is

(A) 3.0
(B) 3.9
(C) 6.0
(D) 7.0

55. Inactive zymogens (proenzymes) are precursors of all the following gastrointestinal enzymes EXCEPT

(A) Ribonulcease
(B) Trypsin
(C) Chymotrypsin
(D) Carboxypeptidase

56. K_m and V_{max} can be determined from the LB plot of the Michaelis-Menten equation. When V is the reaction velocity at substrate concentration S, the x-axis experimental data are expressed as

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

57. Which of the following compounds serve as a primary link between the citric acid cycle and the urea cycle?

(A) Malate (B) Fumarate (C) Succinate (D) Citrate

58. Which of the following techniques for purification of proteins can be made specific for a given protein?

(A) Affinity chromatography
(B) Gel-filtration chromatography
(C) Ion-exchange chromatography
(D) Electrophoresis

59. The reactions of the urea cycle occur

(A) in the cytosol
(B) in the mitochondrial matrix
(C) in the mitochondrial matrix and the cytosol
(D) in peroxisomes

60. Which of the following is a metabolic pathway common to bacteria and humans?

(A) Purine synthesis
(B) Nitrogen fixation
(C) Cell-wall mucopeptide synthesis
(D) Fermentation to ethyl alcohol

61. The mushroom poison amanitin is an inhibitor of

(A) Protein synthesis
(B) mRNA synthesis
(C) DNA synthesis
(D) Glycoprotein synthesis

62. The hydrolytic step leading to the release of a polypeptide chain from a ribosome is catalysed by

(A) Stop codons
(B) Peptidyl transferase
(C) Release factors
(D) Dissociation of ribosomes

63. Thymine is present in which of the following?

(A) Ribosomal RNA
(B) Prokaryotic mRNA
(C) tRNA
(D) None of the above

64. A potent inhibitor of protein synthesis that acts as an analogue of aminoacyl-tRNA is

(A) Puromycin
(B) Mitomycin C
(C) Rifampicin
(D) Streptomycin

65. Which of the following is transcribed during repression?

(A) Structural gene
(B) Promoter gene
(C) Regulator gene
(D) Operator gene

66. Ornithine cycle performs

(A) ATP synthesis
(B) Urea formation in spleen
(C) Urea formation in liver
(D) Urine formation in liver

67. Treatment with alloxan destroys the

(A) Sertoli cells
(B) Leydig cells
(C) β-cells of pancreatic islets
(D) STH cells

68. After sperm cells are produced, they are mainly stored in the

(A) Urethra
(B) Seminal vesicles
(C) Epididymis
(D) Prostate

69. Pollination is a characteristic of

(A) Angiosperms
(B) Pteridophytes
(C) Bryophytes
(D) All of the above

70. The DNA is the genetic material was proved conclusively by

(A) J.D. Watson
(B) Hershey and Chase
(C) Alfred Griffith
(D) Boveri and Sutton

71. The specific activity of an enzyme would be reported in which of the following units of measure?

(A) Millimoles per liter
(B) Units of activity per milligram of protein
(C) Micromoles per minute
(D) Units of activity per minute

72. A noncompetitive inhibitor of an enzyme

(A) Increases *Km* with no or little change in *V*max
(B) Decreases *Km* and decreases *V*max
(C) Decreases *V*max
(D) Increases *V*max

73. Which one of the following enzymes catalyzes high-energy phosphorylation of substrates during glycolysis?

(A) Pyruvate kinase
(B) Phosphoglycerate kinase
(C) Triose phosphate isomerase
(D) Glyceraldehyde-3-phosphate dehydrogenase

74. Ammonium sulphate is capable of precipitating protein because....

(A) protein is denatured
(B) proteins aggregate
(C) proteins are dehydrated
(D) proteins complex with salts

75. The reactions of the urea cycle occur
(A) in the cytosol
(B) in the mitochondrial matrix
(C) in the mitochondrial matrix and the cytosol
(D) only in lysosomes

76. Which of the following antibody is involved in hypersensitive reactions?
(A) IgG (B) IgE (C) IgM (D) IgD

77. Analysis of DNA structure by X-ray diffraction is governed by...
(A) Watson-Crick law (B) Bragg's law
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78. Which of the following tissues is capable of contributing to blood glucose?
(A) Skeletal muscle (B) Adipose tissues
(C) Cardiac muscle (D) Duodenal epithelium

79. Hemicellulose is made up of
(A) Fructose (B) Galactose
(C) Xylose (D) Glucosamine

80. Number of substrate level phosphorylations occurring in citric acid cycle....
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(C) Three (D) Four

81. C_0t analysis provides an estimate of the
(A) G + C content of the DNA
(B) Tm of the DNA
(C) Complexity of the genome
(D) Hyperchromic shift of the genome

82. The Km of an enzyme – catalyst reaction
(A) is equal to the catalytic rate when all substrate sites are full
(B) describes the affinity of an enzyme for its substrate
(C) is dependent on the enzyme concentration
(D) is equal to the substrate concentration when the rate of the reaction is maximal

83. Hormone whose receptors are located in the nucleus of the cell include
(A) Thyroxine (B) NGF
(C) Insulin (D) FSH

84. Which of the following is not considered to be a second messenger?
(A) Ca^{2+} (B) Na^{+}
(C) Diacylglycerol (D) Inositol triphosphate

85. All the following amino acids are essential in mammals EXCEPT
(A) Phenylalanine (B) Lysine
(C) Tyrosine (D) Leucine

86. The allosteric activator of glycogen synthase D is
(A) UTP (B) ADP
(C) Glucose-6-phosphate (D) Glucose-1-phosphate

87. Aspirin inhibits which of the following enzymes?
(A) Lipoprotein lipase (B) Lipoxygenase
(C) Cyclooxygenase (D) Phospholipase A_2

88. An alcoholic amine residue is present in which of the following lipids?
(A) Sphingomyelin (B) Ganglioside
(C) Glucocerebroside (D) Phosphatidic acid

89. The number of net molecules of ATP yielded in the conversion of one glucosyl residue in glycogen to two molecules of lactate is
(A) One (B) Two
(C) Three (D) Four

90. Which of the following enzymes is particularly sensitive to inhibition by fluoride ions?
(A) Hexokinase (B) Enolase
(C) Pyruvate Kinase (D) Phosphohexose isomerase

91. Glisson's capsules are found in
(A) Kidney of frog (B) Heart of frog
(C) Liver of mammals (D) Pancreas of rabbit

92. Cod liver oil is a rich source of
(A) Vitamin A (B) Vitamin C
(C) Vitamin B (D) Vitamin K

93. Carbonic anhydrase is present in high concentration in
(A) Plasma (B) Erythrocytes
(C) Leucocytes (D) Thrombocytes

94. In normal expiration the diaphragm is
(A) Arched
(B) Flattened
(C) Not involved
(D) Perforated

95. Chloride shift is essential for transport of
(A) CO_2 and O_2
(B) CO_2
(C) O_2
(D) N_2

96. Hemoglobin is found in
(A) All invertebrates
(B) Only in vertebrates
(C) Earthworm and rabbit
(D) Earthworm and cockroach

97. Serum differs from plasma in having
(A) Excess of fibrinogen and other clotting factors
(B) Absence of fibrinogen and other clotting factors
(C) Excess of haemoglobin
(D) None of the above

98. The blind spot is
(A) The part of retina on which light is not focused
(B) A defective region in the eyes of the colour blind persons
(C) The point from where the optic nerve emerges
(D) The junction between retina and ciliary muscles

99. The Eustachian tibe connects the middle ear chamber with the pharynx in
(A) Amphibians only
(B) Mammals only
(C) All land vertebrates
(D) All vertebrates

100. Static sensory spots for maintaining equilibrium of body in man are located in
(A) Cochlea
(B) Utriculus and sacculus
(C) Utriculus, succulus and semicircular canals
(D) Cochlea and lagena