ENTRANCE EXAMINATION FOR ADMISSION, MAY 2013.
Ph.D. (BIOCHEMISTRY AND MOLECULAR BIOLOGY)

COURSE CODE : 102

Register Number : 

Signature of the Invigilator 
(with date)

COURSE CODE : 102

Time : 2 Hours

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 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. Vitamin D deficiency in adults causes,
   (A) Rickets          (B) Osteoporosis
   (C) Osteomalacia     (D) Paget's disease of bone

2. Normal blood calcium levels range between
   (A) 8-10.5 mg/dL   (B) 6-8 mg/dL
   (C) 10.5-12 mg/ dL (D) 1-2 mg/ dL

3. Vitamins necessary for nucleic acid synthesis are
   (A) Vitamin B1 and folate          (B) Vitamin C and B1
   (C) Vitamin B3 and folate          (D) Vitamin K and Vitamin C

4. Which of these connective tissue types has proteoglycans in its matrix?
   (A) Bone             (B) Cartilage
   (C) Ligaments        (D) Tendons

5. The most abundant protein making up ~25-35% of the human body is
   (A) Albumin           (B) Hemoglobin
   (C) Proteoglycan      (D) Collagen

6. Methylation of glutamate residues is typically associated with
   (A) Chemotaxis in bacteria           (B) Nuclear translocation in eukaryotes
   (C) Inter-cellular transport in planis (D) Restriction in bacteria

7. What method did Frederick Sanger use to elucidate the structure of insulin?
   (A) High-speed centrifugation          (B) NMR spectroscopy
   (C) Analysis of amino acid sequence    (D) X-ray crystallography

8. In the double helix structure of nucleic acids, cytosine hydrogen bonds to
   (A) Deoxyribose                         (B) Guanine
   (C) Adenine                             (D) Ribose

9. The advantage of light microscopy over electron microscopy is that
   (A) Light microscopy allows one to view dynamic processes in living cells
   (B) Light microscopy provides for higher resolving power than electron microscopy
   (C) Light microscopy provides for higher magnification than electron microscopy.
   (D) (A) and (C)
10. If a young male child has cystic fibrosis, which of the following would affect his fertility?
   (A) Inability to make sperm
   (B) Failure to form genital structures appropriately
   (C) Incorrect concentrations of ions in semen
   (D) Abnormal pH in seminal fluid

11. SH2 domains on proteins are specific for which of the following sites?
   (A) Certain sequences of amino acid containing a phosphotyrosine residue
   (B) PI-3,4,5 triphosphate in the membrane
   (C) GTP-activated Ras
   (D) Ca2+-calmodulin

12. The activity of which of the following enzymes is NOT required for the release of large amounts of glucose from liver glycogen?
   (A) Glucose 6-phosphatase
   (B) Fructose 1,6-bisphosphatase
   (C) α-1,6-glucosidase
   (D) Phosphoglucomutase

13. The order of electron carriers of electron transport chain based on their increasing order of standard reduction potential is
   (A) NADH → Q → cyt b → cyt c1 → cyt c → cyt a → cyt a3 → O2
   (B) NADH → Q → cyt c → cyt c1 → cyt b → cyt a → cyt a3 → O2
   (C) O2 → cyt a3 → cyt a → cyt b → cyt c → cyt c1 → Q → NADH
   (D) O2 → cyt a3 → cyt a → cyt c → cyt c1 → cyt b → Q → NADH

14. The facilitative transporter most responsible for transporting fructose from the blood into cells is which of the following?
   (A) GLUT 1
   (B) GLUT 3
   (C) GLUT 4
   (D) GLUT 5

15. The concentration of OH- ions in a solution with an H+ concentration of 1.3 × 10^-4 M is
   (A) 6.7 × 10^-10 M
   (B) 1.3 × 10^-4 M
   (C) 7.7 × 10^-11 M
   (D) 1.3 × 10^-4 M

16. The number of stereoisomers of glucose molecule is?
   (A) 6
   (B) 10
   (C) 14
   (D) 16
17. A person with phenylketonuria cannot convert
   (A) Phenylalanine to tyrosine           (B) Phenylalanine to isoleucine
   (C) Phenol into ketones               (D) Phenylalanine to lysine

18. An example of a transamination process is
   (A) Glutamate = hexanoic acid + NH₃
   (B) Aspartate + hexanoic acid = glutamate + oxaloacetate
   (C) Aspartate + α-ketoglutarate = glutamate + oxaloacetate
   (D) Glutamate = α-ketoglutarate + NH₃

19. A ketogenic amino acid is one which degrades to
   (A) Keto-sugars
   (B) Either acetyl CoA or acetoacetyl CoA
   (C) Pyruvate or citric acid cycle intermediates
   (D) Multiple intermediates including pyruvate or citric acid cycle intermediates and acetyl CoA or acetoacetyl CoA

20. An allosteric activator
   (A) Increases the binding affinity       (B) Decreases the binding affinity
   (C) Stabilizes the R state of the protein  (D) Both (A) and (C)

21. The specificity of a ligand binding site on a protein is based on
   (A) The absence of competing ligands
   (B) The amino acid residues lining the binding site
   (C) The presence of hydrating water molecules
   (D) The opposite chirality of the binding ligand

22. The primary effect of the consumption of excess protein beyond the body’s immediate needs will be
   (A) Excretion of the excess as protein in the urine
   (B) An increase in the “storage pool” of protein
   (C) An increased synthesis of muscle protein
   (D) An enhancement in the amount of circulating plasma proteins

23. A complete replacement of animal protein in the diet by vegetable protein
   (A) Would be expected to have no effect at all on the overall diet.
   (B) Would reduce the total amount of food consumed for the same number of calories
   (C) Might reduce the total amount of iron and vitamin B12 available
   (D) Would be satisfactory regardless of the nature of the vegetable protein used
24. Ascorbic acid may be associated with all of the following EXCEPT
   (A) Iron absorption
   (B) Bone formation
   (C) Wound healing
   (D) Participation in hydroxylation reactions

25. The characteristic that all lipids have in common is
   (A) They are all made of fatty acids and glycerol
   (B) None of them is very high in energy content
   (C) They are all acidic when mixed with water
   (D) None of them dissolves in water

26. What best explains the observation of substrate specificity?
   (A) There is a precise compatibility between an enzyme's active site and the substrate
   (B) Molecules and active sites vary in size; only properly sized molecules can fit
   (C) Reaction-specific enzymes, such as hydrolases, assume a fit by folding around the most numerous substrate molecules
   (D) Polarity compatibilities; active sites contain electronegative atoms while substrates tend to carry slight positive charges

27. Diphtheria toxin
   (A) Releases incomplete polypeptide chains from the ribosome
   (B) Activates translase
   (C) Prevents release factor from recognizing termination signals
   (D) Attacks the RNA of the large subunit

28. Targeting a protein to be degraded within proteasomes usually requires ubiquitin. In the functions of ubiquitin all of the following are true EXCEPT
   (A) ATP is required for activation of ubiquitin
   (B) Linkage of a protein to ubiquitin does not always mark it for degradation
   (C) The identity of the N-terminal amino acid is one determinant of selection for degradation
   (D) ATP is required by the enzyme that transfers the ubiquitin to the protein to be degraded
29. If cyanide is added to tightly coupled mitochondria that are actively oxidizing succinate
   (A) Subsequent addition of 2,4-dinitrophenol will cause ATP hydrolysis
   (B) Subsequent addition of 2,4-dinitrophenol will restore succinate oxidation
   (C) Electron flow will cease, but ATP synthesis will continue
   (D) Subsequent addition of 2,4-dinitrophenol and the phosphorylation inhibitor, oligomycin, will cause ATP hydrolysis.

30. The chemiosmotic hypothesis involves all of the following EXCEPT
   (A) A membrane impermeable to protons.
   (B) Electron transport by the respiratory chain pumps protons out of the mitochondrion
   (C) Proton flow into the mitochondria depends on the presence of ADP and Pi'
   (D) Only proton transport is strictly regulated; other positively charged ions can diffuse freely across the mitochondrial membrane

31. 5'-phosphoribosyl-1-pyrophosphate (PAPP) is an intermediate in
   (A) The de novo synthesis of purine nucleotides
   (B) The de novo synthesis of pyrimidine nucleotides
   (C) The salvage pathway for the synthesis of purine nucleotides
   (D) All of the above

32. In Lesch-Nyhan Syndrome, lack of activity of the defective enzyme (HGPRTase) should result in higher than normal tissue concentrations of all of the following EXCEPT
   (A) Adenine
   (B) Guanine
   (C) Uric acid
   (D) Hypoxanthine

33. A complete lack of adenosine deaminase causes SCID (Severe combined immunodeficiency). Which of the following is LEAST true
   (A) Loss of the enzyme causes increased levels of dATP because there is less turnover of adenosine nucleosides in general
   (B) Increased dATP decreases the concentration of all rNTPs, blocking RNA synthesis
   (C) Increased dATP inhibits ribonucleotide reductase, such that de novo production of all rNDPs is inhibited
   (D) Adenosine deaminase loss causes SCID because T cells are particularly sensitive to DNA replication inhibition
34. Which of these complexes work by rotational catalysis?
   (A) NADH dehydrogenase (complex I)
   (B) Cytochrome c oxidase (complex IV)
   (C) Glycerol phosphate dehydrogenase (glycerol phosphate shuttle)
   (D) ATP synthase

35. In which of the following ways are peroxisomes NOT similar to mitochondria?
   (A) Engages in oxidative metabolism
   (B) Has DNA that encodes a few of its genes
   (C) Generated by splitting from pre-existing organelles
   (D) Imports preformed proteins from the cytosol

36. A hydropathy plot identifies potential membrane spanning regions of a protein by analyzing the
   (A) Primary
   (B) Secondary
   (C) Tertiary
   (D) Quaternary structure of the protein

37. Which of the following is not considered to be a second messenger?
   (A) Ca²⁺
   (B) Na⁺
   (C) Diacylglycerol
   (D) Inositol triphosphate

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

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

40. Cot 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

41. 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
42. Monosaccharides that have the same chemical formula as glucose include
   (A) Valine          (B) Lactose
   (C) Mannose        (D) Ribose

43. The Km of an enzyme – catalysed 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.

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

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

46. 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

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

48. 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

49. In adults, a severe deficiency of vitamin D causes
   (A) Night blindness          (B) Osteomalacia
   (C) Rickets                    (D) None of the above
50. 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

51. The oxygen dissociation curve for haemoglobin is shifted to the right by
(A) Decreased O₂ tension
(B) Decreased CO₂ tension
(C) Increased CO₂ tension
(D) Increased pH

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

53. Of the following body fluids, the one with the lowest pH is
(A) Plasma
(B) Pancreatic juice
(C) Liver bile
(D) Gastric juice

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

55. Which of the following intermediates of metabolism can be both a precursor and a product of glucose?
(A) Lactate
(B) Pyruvate
(C) Alanine
(D) All of the above

56. Ketone bodies may be synthesized from fatty acids by which of the following structures?
(A) Erythrocytes
(B) Brain
(C) Skeletal muscle
(D) Liver

57. Individuals resistant to malaria are deficient with one of the following enzymes
(A) Glucose-6-Phosphate dehydrogenase
(B) Lactate dehydrogenase
(C) Pyruvate Kinase
(D) ATPase
58. Which of the following enzyme facilitates dissociation of Oxyhemoglobin?
   (A) 2,3-bisphospho glycerate  (B) 3-phospho glycerate
   (C) Phospho-enol Pyruvate      (D) Pyruvate

59. H₂O₂ found in the tissue is destroyed by
   (A) Hexokinase                 (B) Oxidase
   (C) Catalase                  (D) Reductase

60. Polyphenols are present in
   (A) Apple                      (B) Coffee beans
   (C) Fish                       (D) Egg

61. Gastric ulcers are caused by
   (A) _Helicobacter pylori_      (B) _Vibrio Cholerae_
   (C) _Lactic acid bacteria_     (D) _Streptococcus_

62. Blood sugar level is reduced by
   (A) Glucagon                   (B) Insulin
   (C) Somatostatin               (D) Glucocorticoids

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

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

65. The principle and major energy source for spermatozoa is
   (A) Mannose                   (B) Glucose
   (C) Fructose                  (D) Galactose

66. Defect in ——— metabolism leads to development of cataract
   (A) Galactose                 (B) Cholesterol
   (C) Tyrosine                  (D) All the above

67. Goitre is mainly due to
   (A) Thyroxine deficiency       (B) Triidothyroxine deficiency
   (C) Iodine deficiency          (D) Excess T3 and T4 in blood
68. Diabetes insipidus is due to
   (A) Deficiency of insulin          (B) Deficiency of ADH
   (C) Excessive insulin secretion   (D) Excessive ADH secretions

69. Van den Bergh test is used to estimate serum
   (A) Bilirubin                      (B) Albumin
   (C) Ketone bodies                 (D) Creatinine

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

71. Increase in the activities of these enzymes indicate impairment in liver function
   (A) AST                            (B) ALT
   (C) ALP                           (D) All of the above

72. The serum enzyme most predominantly elevated in viral hepatitis is
   (A) Aspartate transaminase         (B) Alanine transaminase
   (C) Alkaline phosphatase          (D) $\gamma$-glutamyl transferase

73. Renal threshold for glucose is
   (A) 120mg/dl                       (B) 140mg/dl
   (C) 180mg/dl                       (D) 200mg/dl

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

75. Haemoglobin synthesis is stimulated by this peptide hormone
   (A) Erythropoeitin
   (B) Erythrocyte stimulating hormone
   (C) Colony stimulating factor
   (D) Hemopoeitin
76. Prostagladin synthesis is inhibited by
    (A) Aspirin          (B) Cyclins
    (C) Erythromycin    (D) None of the above

77. Deficiency of the following vitamin leads to Beri-beri
    (A) Thiamin          (B) Niacin
    (C) Pyridoxine      (D) None of the above

78. Which vitamin is found in rain water drops?
    (A) Vitamin A        (B) Vitamin E
    (C) Vitamin B6       (D) Vitamin C

79. Of the following trace elements, which is abundantly needed by human body?
    (A) Zinc             (B) Sodium
    (C) Potassium        (D) Manganese

80. Schilling test is used for assessing
    (A) Vitamin A absorption  (B) Vitamin C breakdown
    (C) Vitamin B12 absorption (D) Vitamin B5 absorption

81. Which of the following is an inborn error of copper metabolism?
    (A) Menkes syndrome    (B) Wilson's disease
    (C) Both of the above  (D) None of the above

82. Acrodermatitis enteropathica, an inherited disorder of _______ metabolism
    (A) Potassium          (B) Copper
    (C) Sodium             (D) Zinc

83. Antidote for cyanide is
    (A) Dicobalt edetate   (B) Propranolol
    (C) Naloxone          (D) Atropine

84. Which of the following is a growth hormone?
    (A) Somatostatin      (B) Somatotrophin
    (C) TSH               (D) None of the above
85. Acute gout is triggered by the tissue deposition of ——— ——— crystals
   (A) Potassium urate                      (B) Calcium oxalate
   (C) Sodium urate                        (D) All of the above

86. Human chorionic gonadotrophin is a
   (A) Glycoprotein                          (B) Glycolipid
   (C) Steroid                                (D) Protein

87. Which one of the following is an inborn metabolic error?
   (A) Hartnup disease                        (B) Galactosemia
   (C) Tyrosinemia                             (D) Cystinosis

88. Which of the following metabolic disease occurs only in males?
   (A) Fabry’s disease                         (B) Gaucher’s disease
   (C) Lesch-Nyhan disease                     (D) Hunter’s disease

89. Which one of the following will be different in different animals?
   (A) Fats                                    (B) Carbohydrates
   (C) Proteins                               (D) Vitamins

90. Food molecules become part of the body tissue during
   (A) Endogenous metabolism                  (B) Exogenous metabolism
   (C) Both of the above                      (D) None of the above

91. The blood bank of human body is
   (A) Liver                                  (B) Spleen
   (C) Pancreas                               (D) Heart

92. Blood clot formation is
   (A) Hormonal action                       (B) Enzymatic action
   (C) Both (A) and (B)                      (D) None of the above

93. A nerve which conveys impulses from a tissue to nerve centre is called
   (A) Efferent                                (B) Mixed
   (C) Motor                                  (D) Afferent
94. Natural lipids are readily soluble in
   (A) Oil                          (B) Water
   (C) Mercury                     (D) None of the above

95. Fats are hydrolysed to produce fatty acids and glycerol with the help of enzyme
   (A) Glycerol-3-phosphate dehydrogenase
   (B) Lipase
   (C) Triose phosphate isomerase
   (D) Triose phosphate dehydrogenase

96. Vitamin H is also known as
   (A) Tocopherol                  (B) Phylloquinone
   (C) Biotin                      (D) Nicotinic acid

97. The following are features of DNA replication EXCEPT
   (A) Semi-conservative
   (B) Semi-discontinuous
   (C) Unidirectional
   (D) Chain growth in the 5' → 3' direction

98. Which out of the following mechanisms is involved in the production of variety of
    immunoglobulins each specific for a specific antigen?
    (A) Gene replacement            (B) Gene amplification
    (C) Gene rearrangement          (D) RNA editing

99. Which out of the followings is a common enzyme for de novo as well as salvage
    pathway of purine biosynthesis?
    (A) Amidotransferase            (B) PRPP synthetase
    (C) HGPRTase                    (D) Adenylosuccinate synthetase

100. Which out of the followings is an example of post transcriptional modification?
     (A) Splicing                    (B) Class switching
     (C) Subunit aggregation         (D) Base modification