

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

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 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 \rightarrow Q \rightarrow cyt b \rightarrow cyt c₁ \rightarrow cyt c \rightarrow cyt a \rightarrow cyt a₃ \rightarrow O₂
 - (B) NADH \rightarrow Q \rightarrow cyt c \rightarrow cyt c₁ \rightarrow cyt b \rightarrow cyt a \rightarrow cyt a₃ \rightarrow O₂
 - (C) O₂ \rightarrow cyt a₃ \rightarrow cyt a \rightarrow cyt b \rightarrow cyt c \rightarrow cyt c₁ \rightarrow Q \rightarrow NADH
 - (D) O₂ \rightarrow cyt a₃ \rightarrow cyt a \rightarrow cyt c \rightarrow cyt c₁ \rightarrow cyt b \rightarrow Q \rightarrow 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 + NH_3
 (B) Aspartate + hexanoic acid = glutamate + oxaloacetate
 (C) Aspartate + α ketoglutarate = glutamate + oxaloacetate
 (D) Glutamate = α -ketoglutarate + NH_3
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 translocase
 - (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 P_i
 - (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) Ca^{2+}
 - (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) T_m 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 K_m 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) Sulfhydryl
 (C) Tyrosine (D) CoA
48. Molecular iron, Fe, is
 (A) Stored primarily in the spleen
 (B) Excreted in the urine as Fe^{2+}
 (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. H_2O_2 found in the tissue is destroyed by
 (A) Hexokinase (B) Oxidase
 (C) Catalase (D) Reductase
60. Polyphenols are present in
 (A) Apple (B) Coffee beads
 (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) Triiodothyroxine 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) γ -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. Prostaglandin 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
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