Post Graduate School
Indian Agricultural Research Institute, New Delhi

Examination for Admission to Ph.D. Programme 2013-2014

Discipline : Biochemistry

Discipline Code : 08 Roll No. | | | | | | | |

Please Note:

(i) This question paper contains **14** pages. **Please check whether all the pages are printed in this set.** Report discrepancy, if any, **immediately** to the invigilator.

(ii) ***There shall be NEGATIVE marking for WRONG answers in the Multiple Choice type questions (No. 1 to 130) which carry one mark each. For every wrong answer 0.25 mark will be deducted.***

PART – I (General Agriculture)

Multiple choice questions (No. 1 to 30). Choose the correct answer (*a, b, c* or *d*) and enter your choice in the circle (by shading with a pencil) on the OMR - answer sheet as per the instructions given on the answer sheet.

1. Who is the present Chairman of Protection of Plant Varieties and Farmers' Right Authority (PPV&FRA)?
a) Dr. R.R. Hanchinal
b) Dr. P.L. Gautam
c) Dr. S. Nagarajan
d) Dr. Swapan K. Datta

2. Which among the following is another name for vitamin B_{12}?
a) Niacin
b) Pyridoxal phosphate
c) Cobalamin
d) Riboflavin

3. The largest share in India's farm export earning in the year 2011-12 was from
a) Basmati rice
b) Non-basmati rice
c) Sugar
d) Guar gum

4. The National Bureau of Agriculturally Important Insects was established by ICAR in _____, was earlier known as _____.
a) Bangalore; PDBC
b) New Delhi; National Pusa Collection
c) Ranchi; Indian Lac Research Institute
d) New Delhi; NCIPM

5. The most important sucking pests of cotton and rice are respectively
a) *Nilaparvata lugens* and *Aphis gossypii*
b) *Aphis gossypii* and *Thrips oryzae*
c) *Amrasca biguttula biguttula* and *Scirtothrips dorsalis*
d) *Thrips gossypii* and *Orseolia oryzae*

6. Which of the following microorganism causes fatal poisoning in canned fruits and vegetables?
a) *Aspergillus flavus*
b) *Penicillium digitatum*
c) *Clostridium botulinum*
d) *Rhizoctonia solani*

7. The cause of the great Bengal Famine was
a) Blast of rice
b) Brown spot of rice
c) Rust of wheat
d) Karnal bunt of wheat

8. Actinomycetes belong to
a) The fungi
b) Eukaryote
c) *Mycelia sterilia*
d) None of the above

9. A virus-free clone from a virus infected plant can be obtained by
a) Cotyledonary leaf culture
b) Axenic culture
c) Stem culture
d) Meristem tip culture

10. Which of the following is not an objective of the National Food Security Mission?
a) Sustainable increase in production of rice, wheat and pulses
b) Restoring soil fertility and productivity at individual farm level
c) Promoting use of bio-pesticides and organic fertilizers
d) Creation of employment opportunities

11. Agmarknet, a portal for the dissemination of agricultural marketing information, is a joint endeavour of
a) DMI and NIC
b) DMI and Ministry of Agriculture
c) NIC and Ministry of Agriculture
d) DMI and Directorate of Economics and Statistics

12. The share of agriculture and allied activities in India's GDP at constant prices in 2011-12 was
a) 14.1%
b) 14.7%
c) 15.6%
d) 17.0%

13. The average size of land holding in India according to Agricultural Census 2005-06 is
a) 0.38 ha
b) 1.23 ha
c) 1.49 ha
d) 1.70 ha

14. 'Farmers First' concept was proposed by
a) Paul Leagans
b) Neils Rolling
c) Robert Chamber
d) Indira Gandhi

15. In the year 2012, GM crops were cultivated in an area of
a) 150 million hectare in 18 countries
b) 170 million hectare in 28 countries
c) 200 million hectare in 18 countries
d) 1.70 million hectare in 28 countries

16. The broad-spectrum systematic herbicide glyphosate kills the weeds by inhibiting the biosynthesis of
a) Phenylalanine
b) Alanine
c) Glutamine
d) Cysteine

17. At harvest, the above ground straw (leaf, sheath and stem) weight and grain weight of paddy crop are 5.5 and 4.5 tonnes per hectare, respectively. What is the harvest index of paddy?
a) 45%
b) 50%
c) 55%
d) 100%

18. Crossing over between non-sister chromatids of homologous chromosomes takes place during
a) Leptotene
b) Pachytene
c) Diplotene
d) Zygotene

19. The term 'Heterosis' was coined by
a) G.H. Shull
b) W. Bateson
c) T.H. Morgan
d) E.M. East

20. When a transgenic plant is crossed with a non-transgenic, what would be the zygosity status of the F_1 plant?
a) Homozygous
b) Heterozygous
c) Hemizygous
d) Nullizygous

21. The highest per capita consumption of flowers in the world is in
a) The USA
b) India
c) Switzerland
d) The Netherlands

22. Which of the following is a very rich source of betalain pigment?
a) Radish
b) Beet root
c) Carrot
d) Red cabbage

23. Dog ridge is
a) Salt tolerant rootstocks of mango
b) Salt tolerant rootstocks of guava
c) Salt tolerant rootstocks of grape
d) Salt tolerant rootstocks of citrus

24. Which of the following micronutrients are most widely deficient in Indian soils?
a) Zinc and boron
b) Zinc and iron
c) Zinc and manganese
d) Zinc and copper

25. Which of the following fertilizers is not produced in India?
a) DAP
b) Urea
c) Muriate of potash
d) TSP

26. What is the estimated extent of salt affected soils in India?
a) 5.42 mha
b) 7.42 mha
c) 11.42 mha
d) 17.42 mha

27. Which of the following is not a feature of watershed?
a) Hydrological unit
b) Biophysical unit
c) Socio-economic unit
d) Production unit

28. Correlation coefficient 'r' lies between
a) 0 and 1
b) -1 and 1
c) -1 and 0
d) 0 and ∞

29. For the data 1, -2, 4, geometric mean is
a) 2
b) 4
c) $-\frac{7}{3}$
d) -2

30. The relationship between Arithmetic mean (A), Harmonic mean (H) and Geometric mean (G) is
a) $G^2=AH$
b) $G=\sqrt{A+H}$
c) $H^2=GA$
d) $A^2=GH$

PART – II (Subject Paper)

Multiple choice questions (No. 31 to 130). Choose the correct answer (*a, b, c* or *d*) and enter your choice in the circle (by shading with a pencil) on the OMR - answer sheet as per the instructions given on the answer sheet.

31. In terms of containment, which of the followings is an advantage of chloroplast transformation over nuclear transformation?
a) Chloroplasts are surrounded by a double membrane
b) There are no chloroplasts in pollens of most species
c) Chloroplasts are smaller than the nucleus
d) Chloroplast genome resembles more to plasmid

32. Bacteria use positive supercoiling to
a) Make genes more accessible
b) Help in replication
c) Make circular chromosomes linear
d) Make their chromosomes more compact

33. When linear form of glucose cyclises, the product is a/an
a) Anhydride
b) Glycoside
c) Hemiacetal
d) Lactone

34. A DNA vaccine is
a) A DNA molecule that is recognized by an antibody
b) A vaccine that works by stimulating the immune system to recognise pathogen's DNA sequences
c) A vaccine that is administered as DNA, the DNA is then expressed to produce a protein which stimulates an immune response
d) Gene knockout by homologous recombination

35. What cellular compartment becomes acidic during mitochondrial electron transport?
a) Mitochondrial stroma
b) Cytoplasm
c) Endoplasmic reticulum
d) Space between inner and outer mitochondrial membranes

36. The primary effect of the consumption of proteins beyond the body's immediate needs will be
a) Excretion of the excess proteins in the urine
b) An increased synthesis of muscle proteins
c) An enhancement in the amount of circulating plasma proteins
d) An increase in the amount of adipose tissue

37. The end product of uracil degradation is
a) Urea
b) NH_4^+
c) Allantoate
d) β-alanine

38. A reaction which is enthalpically opposed but entropically favoured will be
a) Spontaneous at temperature below T = $\frac{\Delta H}{\Delta S}$
b) Spontaneous at temperature above T = $\frac{\Delta H}{\Delta S}$
c) Spontaneous at all temperatures
d) Non-spontaneous at all temperatures

39. Transketolase activity is affected in
a) Biotin deficiency
b) Pyridoxine deficiency
c) PABA deficiency
d) Thiamine deficiency

40. A flavoprotein in pyruvate dehydrogenase complex is
a) Pyruvate dehydrogenase
b) Dihydrolipoyl transacetylase
c) Dihydrolipoyl dehydrogenase
d) Acetyl-dihydrolipoamide

41. A biochemical indication of vitamin B_{12} deficiency can be obtained by measuring the urinary excretion of
a) Pyruvic acid
b) Malic acid
c) Methylmalonic acid
d) Urocanic acid

42. The enzyme whose catalytic efficiency (K_{cat}/K_M) is close to the diffusion-controlled limit is
a) Nitrogenase
b) Rubisco
c) Fumarase
d) None of the above

43. The specificity constant K_{cat}/K_M is a
a) First order rate constant
b) Second order rate constant
c) Zero-order rate constant
d) Unit-less rate constant

44. The concentration of a competitive inhibitor which apparently doubles the value of Michaelis-Menten (K_M) constant is known as
a) Inhibitor constant
b) Specificity constant
c) Catalytic constant
d) Steady state constant

45. The carbon and energy source for nitrogen reduction is provided by legume plants to *Rhizobia* in the form of
a) Malate and Succinate
b) Acetate and pyruvate
c) Flavanoids and isoflavanoids
d) Chitolipooligosaccharides

46. Chemically, nod-inducers and nod-factors respectively are
a) Flavonoids and chitolipo-oligosaccharides
b) Chitolipo-oligosaccharides and flavonoids
c) Glycoproteins and proteoglycans
d) Glycoproteins and lipoproteins

47. Choline is not required for the formation of
a) Lecithin
b) Acetyl choline
c) Sphingomyelin
d) Cholic acid

48. The apparent K_M of creatine kinase for ATP immobilized on CM-cellulose is likely to be
a) Greater than that of free enzyme
b) Lesser than that of free enzyme
c) Equal to that of free enzyme
d) Equal to the equilibrium constant of free enzyme

49. 'Drosha' and 'Dicer' involved in the biosynthesis of mature micro-RNAs are
a) DNase and RNase, respectively
b) RNase and DNase, respectively
c) DNases
d) RNases

50. The isoelectric point of glutamate is
a) Considerably lower than that of glycine
b) Much higher than that of glycine
c) Equal to glycine
d) Arithmetic mean of two pKa values for α-carboxyl and α-amino groups, respectively

51. Isopentenyl pyrophosphate is a precursor of which of the following
I – Cholesterol
II – Farnesyl groups on proteins
III – Steroid hormones
a) I & II only
b) I & III only
c) II & III only
d) I, II & III

52. Which of the following best describes the hyperchromicity of DNA?
a) The shift in UV absorbance to longer wavelength upon denaturation
b) The increase in absorbance at 260 nm upon denaturation
c) The shift in UV absorbance to longer wavelength upon annealing
d) The increase in absorbance at 260 nm upon annealing

53. The unit of molar extinction coefficient is
a) $L.mole^{-1}.cm^{-1}$
b) $L.mole.cm^{-1}$
c) $mole^{-1}.cm^{-1}$
d) $M^{-1}.cm^{-1}$

54. Rubisco activase causes the activation of Rubisco by
a) Decarbamylation of an active site lysine residue of Rubisco
b) Facilitating the removal of 2-carboxy-arabinitol-1-phosphate (CA1P) from Rubisco
c) ADP-ribosylation of Rubisco
d) Binding RuBP to the E-form of Rubisco

55. RNA silencing acts at
a) Transcription level
b) Post-transcriptional level
c) Translational level
d) Post-translational level

56. The reason, the herbicide glyphosate kills plants but is not toxic to mammals is that glyphosate specifically inhibits an enzyme involved in the synthesis of aromatic acids, but in mammals
a) Liver tissue degrades glyphosate rapidly
b) An analogous enzyme doesn't exist
c) Glyphosate is rapidly conjugated and excreted in urine
d) A diet containing adequate quantities of the aromatic amino acids will compensate for the inhibition of aromatic amino acid's biosynthesis

57. According to the Nernst equation
a) A negative redox potential indicates a spontaneous reaction
b) A positive redox potential indicates a spontaneous reaction
c) The redox potential is independent of temperature
d) There is no relationship between redox potential and ΔG

58. Electrons farther out from the nucleus
a) are at a higher energy level than those that are closer to nucleus
b) Absorb energy as they move closer to the nucleus
c) are at lower energy level than those that are closer to nucleus
d) are not under the influence of nucleus

59. The Bohr Effect refers to the
a) Reduced affinity of hemoglobin for O_2 at lower pH
b) Higher pH in actively metabolising tissues
c) Increased affinity of hemoglobin for O_2 at lower pH
d) pH in actively metabolising tissues

60. The human immunodeficiency virus primarily infects
a) Plasma cells
b) Helper T-cells
c) Killer T-cells
d) Red blood cells

61. A purely ketogenic amino acid is
a) Leucine
b) Isoleucine
c) Phenyl alanine
d) Threonine

62. For DNA amplification to occur, which of these are needed?
a) Loose ribonucleotides
b) RNA primers
c) Thermostable DNA polymerase
d) All of the above

63. Trypsin cleavage sites in a polypeptide can be added by treating it with
a) Maleic anhydride
b) Citraconic anhydride
c) Cyanogen bromide
d) 2-bromo-ethylamine

64. Which chemical entity is not a part of the folic acid's chemical structure?
a) Pteridine
b) p-amino benzoic acid (PABA)
c) Glutamic acid
d) γ-amino butyric acid (GABA)

65. Which of the following proteins is absent in H_1N_1 virus?
a) Hexosaminidase
b) Haemagglutinin
c) Neuraminidase
d) Nucleocapsid protein

66. The reactions that utilize and therefore drain citric acid intermediates are called as
a) Cataplerotic reactions
b) Anaplerotic reactions
c) Amphibolic reactions
d) Degenerative reactions

67. Hemicellulose is a
a) Precursor of cellulose
b) Major matrix polysaccharide in the cell wall of plants
c) Major microfibrillar polysaccharide in the cell wall of plants
d) Group of polysaccharides that can't be extracted by 4M KOH

68. Fetal hemoglobin (HbF) has higher affinity for oxygen than does maternal hemoglobin (HbA) because of
a) More concentration of D-2,3-bisphosphoglycerate (BPG) in fetal erythrocytes than adult erythrocytes
b) Less concentration of BPG in fetal erythrocytes than adult erythrocytes
c) Higher binding of BPG to deoxy HbA than to deoxy HbF
d) Loose binding of BPG to deoxy HbA than to deoxy HbF

69. During the purification of an enzyme by the conventional biochemical techniques, generally following changes are observed after each purification step
a) Total Enzyme activity and total protein decrease while specific activity of enzyme increases
b) Total Enzyme activity and total protein increase while specific activity of enzyme decreases
c) Total Enzyme activity, total protein and specific activity of enzyme increase
d) Total Enzyme activity increases while total protein and specific activity decrease

70. A sample was counted in a scintillation counter and found to contain 58,413 cpm. 0.10 ml of standard toluene (1.85×10^6 dpm/ml) was added and sample was recounted and found to contain 173,113 cpm. What was the efficiency of counting?
a) 0.031
b) 0.062
c) 0.31
d) 0.62

71. RNA interference was first discovered in a
a) Virus
b) Bacteria
c) Fungi
d) Nematode

72. Pyrosequencing derives its name from the fact that
a) The bases are detected by pyrolysis
b) It uses the enzyme apyrase to detect the bases
c) It detects pyrophosphate released during nucleotide incorporation
d) It generates pyrogram as output

73. Protein binding regions of DNA are generally identified by one of the following techniques?
a) Finger printing
b) Foot printing
c) Western blotting
d) MALDI-TOF

74. Which of the following repetitive motifs is responsible for the formation of triple-helix in collagen?
a) Ala-X-Y
b) Gly-X-Y
c) Cys-X-Y
d) Pro-X-Y

75. Phosphinothricin is an active ingredient of the herbicide 'BASTA'. It is an analogue of which of the following amino acids?
a) L-Glutamic acid
b) L-Glutamine
c) L-Aspartic acid
d) L-Asparagine

76. The greatest buffering capacity at physiological pH would be provided by a protein rich in which of the following amino acids?
a) Lysine
b) Histidine
c) Cysteine
d) Serine

77. Before assimilation into bio-organic compounds, the sulfate must be activated
i) by adenylation
ii) with ATP sulfurylase
iii) to adenosine-5′-phosphate
iv) with APS kinase
a) Both i & iv are correct
b) Both i & ii are correct
c) Both iii & iv are correct
d) i, ii & iii are correct

78. Over-expression of Adenosine-5′-Phosphosulfate (APS) reductase and disruption of APS kinase in *Arabidopsis* is most likely to result in reduced formation of which of the following sulphur-containing compounds?
a) Glucosinolates
b) Sulfite
c) Glutathione
d) Thiosulfate

79. The highest concentration of cysteine can be found in which of the following proteins?
a) Collagen
b) Keratin
c) Myosin
d) Haemoglobin

80. How many reading frame(s) can be derived from a double stranded DNA sequence?
a) 1
b) 2
c) 3
d) 6

81. Microsatellites are mostly produced by
a) Mutation
b) Transposition
c) Recombination
d) Unequal crossing over

82. In diabetes mellitus, there is reduced oxidation of carbohydrates; what will be the effect of insulin administration on Respiratory Quotient (RQ)?
a) It will increase
b) It will decrease
c) No detectable effect
d) Initial rise and then fall

83. Emerson effect proves the
a) Concept of two photosystems in plants
b) Occurrence of photophosphorylation
c) Occurrence of photorespiration
d) Fact that there are light and dark reactions in photosynthesis

84. An attenuator would function most effectively at
a) 5′ of the transcriptional start site
b) 5′ of the last gene in the operon
c) Between the transcriptional start site and the translational initiation site
d) Between the -10 and -35 sequences

85. A complete replacement of animal protein in the diet by vegetable protein
a) Would not satisfy protein requirement of an individual
b) Might reduce the total amount of iron and vitamin B_{12} available
c) Would reduce the total amount of food consumed for the same number of calories
d) Would be expected to have no effect at all on the overall diet

86. An 'electron hole' created in photosystem-II is filled by electrons from
a) Photosystem-I
b) NADPH
c) H_2O
d) Reduced ferredoxin

87. In serine protease mechanism, His 57 functions as a
a) General acid
b) General base
c) Nucleophile
d) Both a) and b) are correct

88. In CAM plants, the accumulation of organic acid
a) Increases during the day
b) Decreases during the day
c) Increases during night
d) Decreases during night

89. Carbohydrates are commonly found as starch in plant's storage organs. Which of the following five properties of starch make it useful as a storage compound?
i) Easily translocated, ii) Chemically non-reactive, iii) Easily digested by animals, iv) Osmotically inactive, v) Synthesized during photosynthesis
a) i & v
b) ii & iii
c) ii & iv
d) i, iii & v

90. Photosynthesis cannot continue for long if during light reactions, only cyclic photophosphorylation takes place. This is because
a) Only ATP is formed; NADPH + H^+ is not formed
b) There is no evolution of O_2
c) There is unidirectional cyclic movement of electrons
d) PSI stops getting excited after a while

91. Which of the followings is a diaminodicarboxylic acid?
a) Cystine
b) Lysine
c) Aspartic acid
d) Proline

92. A 1.37×10^{-4} M solution of NADH exhibits an absorbance of 0.85 at a wavelength of 340 nm in a 1 cm cell, then its molar extinction coefficient would be
a) 6.2 cm^2 mol^{-1}
b) 6.2×10^2 cm^2 mol^{-1}
c) 6.2×10^4 cm^2 mol^{-1}
d) 6.2×10^6 cm^2 mol^{-1}

93. Keeping in view the "Fluid Mosaic Model" for the structure of cell membrane, which of the following statements is correct with respect to the movement of lipids and proteins from one lipid monolayer to the other?
a) Neither lipids, nor proteins can flip-flop
b) Both lipids and proteins can flip-flop
c) While lipids can occasionally flip-flop, proteins cannot
d) While proteins can flip-flop, lipids cannot

94. Which of the following statements about *vir* genes in T_i plasmid is incorrect?
a) They are capable of functioning in *trans* orientation
b) *Vir* A and *Vir* G are polycistronic with other *vir* genes
c) *Vir* A and *Vir* G gene products regulate the expression of other *vir* genes
d) *Vir* A product probably acts as a chemoreceptor which senses the presence of acetosyringone

95. When you chop onions, your eyes can burn because a chemical reaction produces
a) Acetic acid
b) Hydrochloric acid
c) Sulphuric acid
d) Nitric acid

96. Which of the following compounds serves as a primary link between the citric acid cycle and the urea cycle?
a) Malate
b) Succinate
c) Citrate
d) Fumarate

97. Which of the following methods is dependent on the intact peptide bond for the assay of protein content?
a) Biuret reaction
b) Kjeldahl titration
c) Ultraviolet absorption
d) Ninhydrin reaction

98. The metabolite which regulates the urea cycle by allosterically activating carbamoyl phosphate synthetase I is
a) Citrulline
b) Ornithine
c) D-Isoglutamate
d) N-acetyl glutamate

99. The atoms of pyrimidine skeleton are derived from
a) Glutamate
b) Erythrose-4-phosphate
c) PRPP
d) Aspartic acid and carbamoyl phosphate

100. Agarose, commonly used for the separation of nucleic acids on a gel, is a
a) Neutral polysaccharide
b) Anionic polysaccharide
c) Cationic polysaccharide
d) Glycoprotein

101. The products of which two *nif* genes interact stoichiometrically to function as activator/anti-activator system for the control of expression of other *nif* genes?
a) *nif* D and *nif* K
b) *nif* A and *nif* L
c) *nif* N and *nif* Q
d) *nif* H and *nif* E

102. Oxygen inhibits the polymerization of polyacrylamide gel because
a) It mops up free radicals
b) It oxidizes acrylamide
c) It forms a complex with Bis-acrylamide
d) It makes TEMED unavailable for polymerization

103. Which of the following categories of genes are not symbiotic genes?
a) *nif* genes
b) *nod* genes
c) *ntr* genes
d) *fix* genes

104. In studies of the mechanism of bacterial DNA replication, 5-bromouracil often is used as an analogue of thymidine in order to
a) Cause specific frameshift mutations for sequencing studies
b) Stop DNA synthesis at sites of thymidine incorporation
c) Synthesize a denser DNA that can be identified by centrifugation
d) Create specific sites in the DNA for mild chemical cleavage

105. Which of the following is not a DNA-binding motif?
a) Basic region-leucine zipper (bZIP)
b) cAMP responsive element (CRE)
c) Helix-turn-helix (HTH)
d) Zinc finger

106. Actinomycin D inhibits the process of transcription by
a) Deforming the DNA
b) Inactivating RNA polymerase through covalent modifications
c) Preventing the binding of transcription factors
d) Destabilizing the m-RNA

107. The enzyme which does not belong to a group of enzymes referred to as the molybdenum hydroxylases
a) Xanthine oxidase
b) Purine dehydrogenase
c) Nitrate reductase
d) Uptake hydrogenase

108. *Cot* values or DNA reassociation kinetics experiments tell us about
a) DNA complexity
b) Copy number of genes
c) Genome size
d) Ploidy level

109. In the maple syrup urine disease of human beings, the metabolic defect is related to
a) Deficiency of the vitamin niacin
b) Oxidative decarboxylation
c) Transamination of an amino acid
d) Synthesis of branched chain amino acids

110. What is the maximum R_f value for any molecule in paper chromatography?
a) 0.1
b) 1.0
c) 10.0
d) Depends on the composition of the sample loaded

111. What is the minimum resting energy expenditure of an awake, alert person called?
a) BMI
b) BMR
c) Respiratory quotient
d) NPU

112. The most rapid method to resynthesize ATP during exercise is through
a) Glycolysis
b) Phosphocreatine breakdown
c) Gluconeogenesis
d) Tricarboxylic acid cycle

113. In *lac* operon, the operator is
a) *Cis*-recessive and *trans*-recessive
b) *Cis*-dominant and *trans*-recessive
c) *Cis*-dominant and *trans*-dominant
d) *Cis*-recessive and *trans*-dominant

114. DNA with alternate purine and pyrimidines exists in which form?
a) A-form
b) B-form
c) C-form
d) Z-form

115. What prevents ribonucleotides from being incorporated into growing strand during DNA replication?
a) The active site of the enzyme cannot accommodate ribonucleotide
b) Ribonucleotides are not present in the vicinity
c) There is very less competition between deoxyribonucleotides and ribonucleotides as the concentration of the latter is very low
d) Ribonucleotides are cleared by the enzyme

116. Short-term diet plans are usually successful at achieving weight loss because they
a) Decrease appetite
b) Cause body to lose water
c) Burn large amount of stored fat
d) Increase digestion rate

117. Which one of the following is not an application of analytical ultracentrifuge?
a) Determination of relative molecular mass
b) Estimation of purity of macromolecules
c) Detection of conformational changes in macromolecules
d) Determination of isoelectric pH of a protein

118. Covalent modification of some enzymes catalyzed either by protein kinases or phosphatases is a mean of regulation of their activity. Which one of the following enzymes is converted into its active form on being phosphorylated by a kianse?
a) Acetyl CoA carboxylase
b) Glycogen synthase
c) Hormone sensitive lipase
d) Pyruvate dehydrogenase

119. Which of the following is an inhibitor of glycosylation?
a) Penicillin
b) Tunicamycin
c) Glucosamine
d) Streptomycin

120. One 'katal' is the amount of enzyme that converts
a) One mole S to P/sec
b) One mole S to P/min
c) One μmole S to P/sec
d) One μmole S to P/min

121. Consider a 'radioanalogy' for *E.coli lac* operon transcription, then
a) The promoter site and start site are the volume control
b) CAP/cAMP is the on/off switch; repressor is the volume control
c) RNA polymerase is both the on/off switch and volume control
d) The repressor is the on/off switch; CAP/cAMP is the volume control

122. The number of supercoils in a covalently closed circular DNA can only be changed if
a) At least one of the phosphodiester chains is cleaved
b) Both the phosphodiester chains are cleaved
c) Histones are bound to the DNA
d) The salt concentration is increased >1.0M

123. The half-life of ^{32}P is
a) 14.28 hours
b) 8.04 days
c) 14.28 days
d) 59.4 days

124. The light emitting group in Green Fluorescent Protein (GFP) is a derivative of following three consecutive amino acids
a) Serine, tyrosine and glycine
b) Glycine, alanine and cysteine
c) Phenylalanine, tryptophan and tyrosine
d) Histidine, glutamic acid and phenylalanine

125. Intrinsically disordered proteins are characterized by sequences
a) Lacking polar and charged amino acids
b) Lacking bulky hydrophobic groups
c) Rich in D-amino acids
d) Rich in unusual amino acids

126. Amyloids, the insoluble fibrous aggregates deposited in certain tissues, result in development of many fatal human diseases. These are basically
a) Misfolded proteins
b) Extensively branched amylopectins
c) Phytoglycogens
d) A mixture of amylose and amylopectin

127. In heterotrimeric G-proteins, GTPase activity is associated with
a) α-subunit
b) β-subunit
c) γ-subunit
d) Guanine nucleotide exchange factor (GEF)

128. The presence of c-terminal sequence, KDEL, in the mammalian proteins results in their retention in which of the following compartments of the cell?
a) Endoplasmic reticulum
b) Mitochondria
c) Peroxisome
d) Chloroplast

129. Which of the following is an ω-3 fatty acid?
a) Alpha-linolenic acid
b) Gamma-linolenic acid
c) Arachidonic acid
d) Linoleic acid

130. When two phosphatidyl glycerol moieties join with each other with the elimination of one glycerol molecule, the resulting phospholipid formed is
a) Cardiolipin
b) Cephalin
c) Ceramide
d) Ganglioside

Matching type questions (No. 131 to 140); all questions carry equal marks. Choose the correct answer (*a, b, c, d* or *e*) for each sub-question (*i, ii, iii, iv* and *v*) and enter your choice in the circle (by shading with a pencil) on the OMR - answer sheet as per the instructions given on the answer sheet.

131.

i) EF-T_u	a) Binds codon UAA and UAG
ii) RF_1	b) Binds aa-tRNA and GTP
iii) RF_2	c) Binds f_{met}-$tRNA^{fmet}$ and GTP
iv) IF_2	d) Binds codon UAA and UGA
v) IF_3	e) Binds to 30S subunit, aids binding of mRNA

132.

i) Plasmalogens	a) Glycerophospholipid with one excised fatty acyl chain
ii) Platelet activating factor	b) Glycerophospholipid containing more than two fatty acyl chains
iii) Lysophospholipid	c) Glycerophospholipid containing ether-linked alkenyl chain
iv) Cardiolipin	d) Glycerophospholipid containing ether-linked alkyl chain
v) Ceramide	e) Not a glycerophospholipid

133.

i) Inhibitor constant is equal to the concentration of inhibitor which doubles the value of K_M	a) Mixed inhibition
ii) Inhibitor constant is equal to the concentration of inhibitor which halves the value of both V_{max} and K_M	b) Uncompetitive inhibition
iii) Inhibitor constant is equal to the inhibitor concentration which halves the value of V_{max}	c) Competitive inhibition
iv) Inhibitor constant for binding of inhibitor to [E] and [ES] are different from each other	d) Irreversible inhibition
v) Inhibitor constant does not have any relationship with V_{max}	e) Non-competitive inhibition

134.

i) Glucose-6-P-dehydrogenase	a) Involved in gluconeogeneis
ii) Glucose-6-phosphatase	b) Involved in glycogen synthesis
iii) UDP-glucose-pyrophosphorylase	c) Involved in HMP pathway
iv) Phosphoglucomutase	d) Conversion of fructose for glycolysis
v) Glyceraldehyde kinase	e) Conversion of glycogen to glycolytic intermediates

135. Match the cofactors with their roles in the pyruvate dehydrogenase complex reaction

i) Coenzyme A (CoA-SH)	a) Attacks and attaches to the central carbon of pyruvate
ii) NAD^+	b) Oxidizes $FADH_2$
iii) Thiamine pyrophosphate (TPP)	c) Accepts a acetyl group from reduced lipoic acid
iv) FAD	d) Oxidizes the reduced form of lipoic acid
v) Lipoic acid in oxidized form	e) Initial electron acceptor in oxidation of pyruvate

136.

i) Phosphatidyl glycerol	a) Neutral glycosphingolipid
ii) Cardiolipin	b) Acidic glycosphingolipid
iii) Ceramide	c) Structural parent of all sphingolipids
iv) Ganglioside	d) Anionic phospholipid present in photosynthetic membranes
v) Galactocerebroside	e) Major phospholipid present in the inner mitochondrial membrane

137.

i) α-keratin	a) Transmembrane protein
ii) Collagen	b) Fibrous protein rich in Cysteine residues
iii) Concanavalin A	c) A protein with large number of intramolecular and intermolecular covalent linkages
iv) Myoglobin	d) A protein with a large proportions of β-sheets and almost devoid of α-helices
v) Glycophorin	e) A protein consisting only of α-helices spanned by short connecting links with coil conformation

138.

i) Galactinol	a) Determinant of human blood group
ii) Kestose	b) A sweetener that is used in sugarless gums and candies
iii) Xylitol	c) Fructan biosynthesis
iv) Fucose	d) Raffinose family oligosaccharides biosynthesis
v) Quinovose	e) 6-deoxy glucose

139.

i) Flavones	a) Yellow
ii) Naphthoquinone	b) Blue
iii) Phycobilins	c) Cream white
iv) Xanthophylls	d) Red
v) Pelargonidin derivatives	e) Brick-pink

140.

i) Mo	a) Arginase
ii) Ni^{2+}	b) Hexokinase
iii) Mn^{2+}	c) Nitrate reductase
iv) Mg^{2+}	d) Cytochrome oxidase
v) Cu^{2+}	e) Urease

Short questions (No. 141 to 146); each question carries FIVE marks. Write answers, including computation / mathematical calculations if any, in the space provided for each question on the question paper itself.

141. You have isolated a gene encoding an enzyme that conjugates a hormone with a sugar. You fuse the coding region of gene with 35S promoter and transfer the chimeric gene into plants. The transgenic plants only grow well in a moist environment and their seeds lack dormancy. Name the hormone involved and explain why the plants are abnormal?

142. A salt precipitated fraction of ribonuclease contained two contaminating protein bands in addition to the ribonuclease. Further studies showed that one contaminant had a MW of about 13,000, which is similar to that of ribonuclease but an isoelectric point (pI) 4 pH units more acidic than the pI of ribonuclease. The second contaminant had an isoelectric point similar to ribonuclease but had a MW of 75,000. Suggest what procedures can be adopted for separation of ribonuclease from contaminating proteins?

143. What will be the status of transcription of *lac* operon in; a) the presence of glucose and b) the absence of glucose, if there is a mutation that produces an inactive adenyl cyclase (lactose is present during both the cases)?

144. Why is the malate-aspartate shuttle system important for gluconeogenesis?

145. Carbonic anhydrase of erythrocytes (Mr. 30,000) has one of the highest turnover numbers we know of. It catalyzes the following reversible reaction

$$H_2O+CO_2 \rightleftharpoons H_2CO_3$$

If 10 μg of pure carbonic anhydrase catalyzes the hydration of 0.30 g of CO_2 in 1 minute at 37°C at V_{max}, what is the turnover number (K_{cat}) of carbonic anhydrase (in units of min^{-1})?

146. The use of fructose in the diet of Indians is increasing day-by-day. What could be the possible hazards of this changing trend?