



**INDIAN INSTITUTE OF SCIENCE
BANGALORE - 560012**

ENTRANCE TEST FOR ADMISSIONS - 2009

**Program : Integrated Ph.D
Entrance Paper : Biological Sciences
Paper Code : BS**

**Day & Date
SUNDAY, 26TH APRIL 2009**

**Time
2.00 P.M. TO 5.00 P.M.**

GENERAL INSTRUCTIONS

1. This question paper consists of only multiple choice questions.
2. Answers are to be marked in OMR sheet provided.
3. For each question darken the appropriate bubble to indicate your answer.
4. Use only HB pencils for bubbling answers.
5. Mark only one bubble per question. If you mark more than one bubble, the question will be evaluated as incorrect.
6. If you wish to change your answer, please erase the existing mark completely before marking the other bubble.
7. There are 100 multiple choice questions, and each question carries 1 mark.
(100 questions X 1 mark per question = 100 marks)
8. There is negative marking. Each incorrect answer will result in subtraction of 0.25 marks from the total.

BIOLOGICAL SCIENCES

(There are 100 multiple choice questions. All the questions are compulsory. 1 mark for each correct answer and -0.25 marks for each incorrect answer).

1. Elevation in boiling point is best suited for molecular weight measurement of which of the following substances?
 - (A) Sucrose
 - (B) Ribonuclease A
 - (C) Plasmid pBR322
 - (D) Sodium chloride.
2. Urea can form hydrogen-bonded dimers in solution. The equilibrium constant (K) for dimerization is measured in pure water and in 2 M solution of methanol in water. The value of K is
 - (A) Greater in water than in the methanol solution
 - (B) Less in water than in the methanol solution
 - (C) Equal in both
 - (D) Not determinable, since the temperature is not specified.
3. The half life of a reaction is independent of the initial concentration of the reactant(s) for
 - (A) Zero order reaction
 - (B) First order reaction
 - (C) Second order reaction
 - (D) Any reaction composed of a single elementary step
4. In a five residue-long peptide, each amino acid can adopt three conformations. The total number of conformations that the peptide can adopt is
 - (A) 15
 - (B) 243
 - (C) 8
 - (D) 125
5. C4 plants are more productive than C3 plants because they
 - (A) Are efficient in photosynthesis
 - (B) Have less photorespiration
 - (C) Can utilize more nutrients from the soil
 - (D) Have fewer stomata

6. The oxygen-carrying protein of invertebrates is

- (A) Hemoglobin
- (B) Hemocyanin
- (C) Myoglobin
- (D) Ceruloplasmin

7. Which of the following is correct about enzymes?

- (A) They do not decrease the activation energy of the reaction
- (B) They do not bind molecules other than substrate molecules
- (C) They do not increase the rate of reaction
- (D) They do not alter the equilibrium of the chemical reaction

8. For an enzyme reaction inhibited at a fixed concentration of a competitive inhibitor, increasing the concentration of the substrate would result in

- (A) No change in the inhibition
- (B) An increase in the maximal rate (V_{max}) of the reaction
- (C) A decrease in the inhibition
- (D) An increase in K_m

9. *E. coli* can synthesize a correct full length human β -globin chain when the cDNA corresponding to its mRNA is cloned into an expression vector. However, it cannot do so when the β -globin gene is cloned from the chromosomal DNA. This is because

- (A) tRNAs do not recognize the codons in the intervening sequences
- (B) Bacteria lack the enzymes necessary for splicing eukaryotic mRNA precursors
- (C) Intervening sequences contain hairpin loops that block ribosomal function
- (D) The bacterium cannot process the precursor protein to its mature form.

10. Under conditions of decreased photorespiration and efficient photosynthesis, C4 plants

- (A) Reduce leaf temperature by decreasing stomatal openings
- (B) Reduce water loss by decreasing stomatal openings
- (C) Increase leaf temperature by increasing stomatal openings
- (D) Increase transpiration rates by increasing stomatal openings

11. Compared to other algae, red and brown algae are able to live at greater depths in the ocean because

- (A) Their accessory pigments absorb blue and green light
- (B) Their accessory pigments absorb red light
- (C) They can withstand cold temperatures
- (D) They are heterotrophic

12. The metabolic rate of mammals varies with body mass according to the following relationship

$$(\text{body mass})^{0.75}$$

Which of the following can be correctly inferred from the above relationship?

- (A) The metabolic rate will increase with decreasing environmental temperatures
- (B) Mass specific metabolic rate decreases as body mass increases
- (C) Metabolic rate increases more rapidly than body mass
- (D) Food intake is unrelated to body size

13. What is the maximum number of hydrogen bonds possible between a water molecule and a protein?

- (A) 0
- (B) 1
- (C) 2
- (D) 3

14. What is the number of hydrogen bonds in a B-DNA of 1000 base pairs with the proportion of bases C, A, and T in one of the strands corresponding to 60%, 30% and 10% respectively?

- (A) 2600
- (B) 2400
- (C) 2200
- (D) 2000

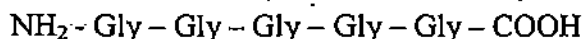
15. Which of the following has the highest affinity for hemoglobin?

- (A) Carbon dioxide
- (B) Carbon monoxide
- (C) Oxygen
- (D) Hydrogen

16. Identify the tetrahedral carbon from the following

- (A) The α -carbon of an amino acid
- (B) Carbon at the carboxyl group of an amino acid
- (C) Carbons in the phenylalanine ring
- (D) Carbon in an adenine ring

17. A peptide containing 5 amino acids is synthesized by randomly choosing amino acids from a pool of 20 standard amino acids. What is the probability of synthesizing a peptide that has the following sequence?



- (A) 0
(B) $1/(20)^5$
(C) $1/20$
(D) $1/(20 \times 5)$
18. With respect to the plane of its orbit, if the axis of the earth were not tilted, the earth would exhibit
- (A) Longer winter and shorter summer seasons
(B) Longer spring and shorter fall seasons
(C) An absence of latitudinal gradients
(D) An absence of seasons
19. Two cities on the same latitude (10° N) are located at 55° longitude and 115° longitude East of Greenwich respectively. The time difference between these two cities is
- (A) 4 hours
(B) 2 hours
(C) 8 hours
(D) zero hours
20. A 22 m long python is just able to curl itself around the trunk of a cylindrical tree. The radius of the tree trunk is
- (A) 7.00 m
(B) 1.87 m
(C) 3.50 m
(D) 3.14 m
21. An experiment to study seed germination started with 1000 seeds. Germination begins on the 11th day, and the probability of germination is known to be constant at 0.10 per day between the 11th and 15th day. How many seeds are likely to germinate on the 13th day?
- (A) 81
(B) 90
(C) 100
(D) 80.11

22. Four pieces of equal weight have to be formed from 1kg of iron. These then need to be painted. Which of the following options will need the maximum amount of paint?
- (A) Four spheres
 - (B) Two spheres and two cubes
 - (C) Four cubes
 - (D) One cube, one dodecahedron, one icosahedron and one sphere
23. One third of a class of 360 students failed in mathematics, one fourth failed in physics, one fifth in chemistry and one sixth in biology. If none of the students failed in more than one subject, how many students passed in all the four subjects?
- (A) 36
 - (B) 3
 - (C) 18
 - (D) 0
24. When data from a million families with two children each was compiled, there were exactly one million boys and one million girls. The fraction of parents with one son and one daughter is likely to be
- (A) 0.50
 - (B) 0.25
 - (C) Slightly less than 0.50
 - (D) Slightly more than 0.50
25. Each of the five departments from the division of biological sciences of a University deposes two members to serve on the interview committee. If the committee can have only five members, and if each of the departments has to be represented in the committee, in how many different ways can the committee be constituted?
- (A) 5^2
 - (B) 32
 - (C) $5!$
 - (D) ${}^{10}C_2$
26. Species A, B, C and D flower every alternate year, every five years, every three years and every four years respectively. If all of them flowered in 2001, how many times will all of them flower in the same year before 2180?
- (A) 2
 - (B) 3
 - (C) 60
 - (D) 1

27. A scientist added a chemical (cyanide) to an animal cell to stop aerobic respiration. Which of the following is most likely to have been affected by this treatment?
- (A) Active transport of substances across the plasma membrane
 - (B) Passive transport of substances across the plasma membrane
 - (C) Diffusion of substances across the plasma membrane
 - (D) The size of the ribosomes in the cytoplasm
28. Unrelated rodent species from various deserts from around the world look strikingly similar in their morphological characters. This is a case of
- (A) Convergent evolution
 - (B) Parallel evolution
 - (C) Disruptive selection
 - (D) Stabilizing selection
29. In a population at Hardy-Weinberg equilibrium in which the frequency of A alleles (p) is 0.3, the expected frequency of Aa individuals is
- (A) 0.21
 - (B) 0.42
 - (C) 0.63
 - (D) 0.70
30. Which of the following markers are used in paternity analysis?
- (A) Allozymes
 - (B) Mitochondrial DNA
 - (C) Microsatellites
 - (D) Isozymes
31. Which of the following is not a measure of genetic diversity?
- (A) Heterozygosity
 - (B) Number of polymorphic loci
 - (C) Number of genotypes
 - (D) Number of mitochondria in a cell
32. Considering the thickness of cellular membrane, roughly how many aminoacids would you expect in a transmembraneous α -helix?
- (A) 5
 - (B) 10
 - (C) 20
 - (D) 40

33. A nerve cell with a myelinated axon is likely to have a
- (A) Relatively low rate of conduction of action potentials
 - (B) Relatively low rate of conduction of synaptic potentials
 - (C) Relatively high rate of conduction of action potentials
 - (D) Relatively high rate of conduction of synaptic potentials
34. Sound pressure is measured in units called decibels (dB). Sound pressure level in $\text{dB} = 20 \log(p/p_{\text{ref}})$ where p_{ref} is a reference sound pressure level. If the sound pressure level of a source is increased hundred-fold, by how many decibels will the sound increase in magnitude?
- (A) 10 dB
 - (B) 20 dB
 - (C) 40 dB
 - (D) 100 dB
35. Which of the following sounds is likely to be detected by the human ear in air at the furthest distance from source?
- (A) The song of a humpback whale
 - (B) The song of a cricket
 - (C) The alarm call of a mouse
 - (D) The alarm call of a langur
36. A fighting fish is confined in a transparent glass aquarium. It is presented with two artificial, identical and stationary fish models one at a time, each suspended just outside the aquarium wall and the fish is scored in each trial for the occurrence of an aggressive response during presentation of the model. The models are of two different colors, red and blue. The fish responds aggressively to the blue model but not to the red one. Which one of the following interpretations is correct?
- (A) The fighting fish is unable to perceive the color red.
 - (B) The fighting fish can perceive the color red but chooses to ignore the red model.
 - (C) Aggression in the fighting fish is released more effectively by the color blue than red
 - (D) Red models will never be able to elicit aggressive responses in the fighting fish.
37. Identify the side chain from the following list of amino acids that could be phosphorylated.
- (A) Gln
 - (B) His
 - (C) Trp
 - (D) Arg

38. Adult fruit flies are positively phototactic and will approach sources of light. In a two-choice, Y-maze experiment, individual flies prefer ultraviolet to visible light. A single-gene mutation renders all flies in the population blind. Each individual of the mutant population is tested in four trials in the Y-maze, where it has to choose between ultraviolet and visible light. What is the probability that an individual mutant fly will approach the ultraviolet source in all four trials?
- (A) 0.5
 - (B) 0.25
 - (C) 0
 - (D) 0.0625
39. If 16% of newborns in a population have sickle cell anemia, what percentage of the population will be more resistant to malaria?
- (A) 84%
 - (B) 36%
 - (C) 24%
 - (D) 48%
40. In an experiment, honeybees were trained to visit a feeder with a blue label kept 100 m away from their nest. The label on the feeder was then changed to yellow, and another feeder labeled with a blue tag was kept on the opposite side of the nest, 100 m away. What would you expect to see?
- (A) Most honeybees will keep visiting the original feeder, but there will also be a few bees at the new feeder.
 - (B) All honeybees will now go to the new feeder.
 - (C) The honeybees will split equally between the two feeders.
 - (D) All honeybees will go only to the first feeder.
41. Phenylketonuria is inherited in an autosomal recessive manner. A man who is affected with phenylketonuria marries a woman who is heterozygous at that locus. What is the probability that their first child will have phenylketonuria?
- (A) $1/8$
 - (B) $1/2$
 - (C) $1/4$
 - (D) $3/4$
42. Familial polydactyly is a rare autosomal dominant trait. If an individual receives the allele for polydactyly, it will be expressed 80% of the time and it will not be expressed 20% of the time. What is the probability that a woman with familial polydactyly will have a normal child?
- (A) $2/5$
 - (B) $1/2$
 - (C) $9/10$
 - (D) $3/5$

43. A cross between two true breeding lines one with dark blue flowers and the other with bright white flowers produces F1 offspring that are light blue. When the F1 progeny are selfed a 1:2:1 ratio of dark blue to light blue to white flowers is observed. What genetic phenomenon is consistent with these results?
- (A) Epistasis
 - (B) Incomplete dominance
 - (C) Codominance
 - (D) Inbreeding depression
44. The likelihood of an individual in a population carrying two specific alleles of a human DNA marker, each of which has a frequency of 0.2, will be:
- (A) 0.4
 - (B) 0.32
 - (C) 0.16
 - (D) 0.08
45. The following genotypes are found in a population
 $AA : Aa : aa :: 60 : 20 : 20$. What are the allele frequencies of A and a?
- (A) $A = 0.7$ and $a = 0.3$
 - (B) $A = 0.6$ and $a = 0.2$
 - (C) $A = 0.8$ and $a = 0.2$
 - (D) $A = 0.3$ and $a = 0.7$
46. The recurrent risk of a genetic disorder is the probability that the next child born in a family will be affected, given that one or more previous children is affected. What is the recurrent risk for a dominant trait in which one parent is affected?
- (A) $1/2$
 - (B) $1/4$
 - (C) $1/8$
 - (D) 0
47. The number of nucleoli increases in yolky eggs during their formation as they participate in the synthesis of
- (A) rRNA
 - (B) tRNA
 - (C) mRNA
 - (D) hnRNA
48. Genetic drift is higher in
- (A) Non-migrating populations
 - (B) Large populations
 - (C) Small populations
 - (D) Migrating populations

49. If all the sons of a couple are color blind then the

- (A) Mother is color blind
- (B) Mother is normal and father is color blind
- (C) Mother is a carrier and father is color blind
- (D) Mother is a carrier and father is normal.

50. The presence of differences in height among humans is due to

- (A) Incomplete dominance
- (B) Co-dominance
- (C) Semi-dominance
- (D) Multiple genes

51. Populations undergoing selection can remain in equilibrium because

- (A) Of balance between mutation and selection
- (B) Selection does not affect equilibrium
- (C) Equilibrium is a property of all populations
- (D) Selection is necessary for maintaining equilibrium

52. An individual performs a certain task correctly 90% of the time (i.e., 10% is the failure rate on each performance). What is the probability that if there are two such individuals who function independently, at least one of them will perform the task correctly?

- (A) 99.99%
- (B) 99.9%
- (C) 99%
- (D) 90%

53. Often the identical mutation is found in many children born to the same parents. Neither parent carries the mutation. A likely explanation is that the mutation occurred in

- (A) The germ line of both parents after meiosis
- (B) The soma of both parents
- (C) The germ line of one parent before meiosis
- (D) All the affected zygotes

54. A rare X-linked allele is present in the human population at a frequency of 1 in 10^5 . Among those who carry the allele, the proportion of males is about

- (A) 1 in 2
- (B) 1 in 3
- (C) 1 in 4
- (D) 1 in 5

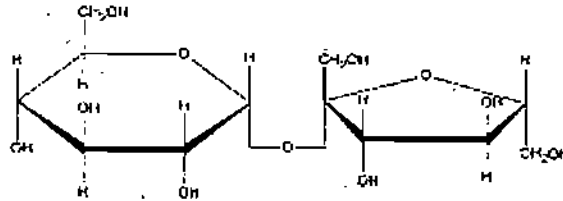
55. Metabolism of a mole of acetoacetate results in net production of the following number of moles of ATP
- (A) 2
 - (B) 12
 - (C) 23
 - (D) 4
56. When a solution containing 2×10^{-3} M of a weak acid with pKa of 3.5 is mixed with 2×10^{-3} M of its conjugate base, the pH of the resulting solution is
- (A) 3
 - (B) 7
 - (C) 3.5
 - (D) 6
57. Ascorbic acid plays the following role in collagen synthesis
- (A) Binds to the transcription factor to activate transcription
 - (B) Serves as a cofactor for glycosylation of prolines
 - (C) Serves as a reducing agent in the process of establishing correct cross links
 - (D) Serves as a cofactor for hydroxylation of prolines
58. If a patient is deficient in pyruvate kinase, how many net moles of ATP would be generated upon conversion of 1 mole of glucose to pyruvate?
- (A) 0
 - (B) 1
 - (C) 2
 - (D) 4
59. Pyruvate dehydrogenase
- (A) Produces glyceraldehyde-3-phosphate from pyruvate
 - (B) Is induced by the presence of NADH
 - (C) Requires pyridoxal phosphate as cofactor
 - (D) Requires thiamine pyrophosphate as cofactor
60. Photoautotrophs require which of the following to sustain their growth?
- (A) Light and simple carbohydrates
 - (B) Light and oxygen
 - (C) Simple carbohydrates and oxygen
 - (D) Light and carbon dioxide

61. If a chemical compound binds to the allosteric site of an enzyme it will
- (A) Competitively inhibit enzyme activity
 - (B) Lower the energy of activation
 - (C) Not affect enzyme activity
 - (D) Reduce the enzyme reaction rate
62. What do the pentose phosphate pathway, the Entner-Doudoroff pathway, and the glycolytic pathway have in common?
- (A) They are all anabolic pathways
 - (B) They all occur in all species of bacteria
 - (C) They are all fermentation pathways
 - (D) They all oxidize glucose to pyruvate
63. A competitive inhibitor of an enzyme will lead to
- (A) Change in V_{max} and K_m value
 - (B) An increase in K_m but no change in V_{max}
 - (C) A decrease in V_{max} but no change in K_m
 - (D) An increase in K_m and a decrease in V_{max}
64. Which of the following is incorrect about mammalian mitochondria?
- (A) Mitochondria possess DNA and functional transcriptional as well as translational machinery.
 - (B) Some of the mitochondrial proteins are coded by nuclear genes
 - (C) Except for the aminoacyl-tRNA synthetases most other proteins are coded by nuclear genes
 - (D) Mitochondria of maternal origin are the only mitochondria that are passed down to the progeny
65. Amino acids exhibit optical isomerism. This is due to the presence of
- (A) An α -amino group
 - (B) An asymmetric carbon atom
 - (C) An α -carboxyl group
 - (D) An α -carbon atom
66. If all the four bases occur randomly in a eukaryotic genome, which amino acids will occur least frequently?
- (A) Glycine and Proline
 - (B) Methionine and Tryptophan
 - (C) Arginine and Leucine
 - (D) Aspartic acid and Glutamic acid

67. Which of the following statement on the "chikungunya" virus is not correct?
- (A) Chikungunya means "that which bends up"
 - (B) It is an insect-borne DNA virus of the genus Alphavirus
 - (C) It is transmitted to humans by virus-carrying *Aedes* mosquitoes.
 - (D) Chikungunya causes joint pain.
68. Which of the following is not a common property of retroviruses?
- (A) They are enveloped
 - (B) They undergo RNA splicing
 - (C) They possess two copies of RNA
 - (D) They integrate into host DNA
69. Which of the following viruses are known for 'cap-snatching' from host cell mRNA?
- (A) Poliovirus
 - (B) Influenza virus
 - (C) HIV
 - (D) Hepatitis B virus
70. What will be the pH of 0.1 M solution of sodium acetate?
- (A) Above 7
 - (B) 5.2
 - (C) Below 7
 - (D) 7.0
71. If a secretory IgA is subjected to SDS-PAGE under reducing conditions, the following number of bands can be visualized after staining
- (A) 1
 - (B) 2
 - (C) 3
 - (D) 4
72. A class II MHC molecule consists of the following number of polypeptide chains
- (A) One
 - (B) Two
 - (C) Three
 - (D) Four
73. Which one of the following cell types produces antibodies?
- (A) Macrophages
 - (B) T-lymphocytes
 - (C) Plasma cells
 - (D) Astrocytes

74. During bacterial cell wall synthesis, D-alanine is
- (A) Directly incorporated into the cell wall from the cellular pool of amino acids
 - (B) Initially incorporated in the L-form and then converted to D-form by racemase
 - (C) Incorporated by the ribosome
 - (D) Generated from D-glutamate
75. When a eukaryotic cell culture is grown in the presence of tritiated thymidine, the label would be incorporated into
- (A) DNA in the nucleus
 - (B) DNA in the nucleus and into mitochondria
 - (C) DNA and RNA in the nucleus
 - (D) RNA in the nucleus
76. Dead cells in adult plants occur in
- (A) Xylem
 - (B) Cambium
 - (C) Leaf mesophyll
 - (D) Parenchyma
77. The following plant hormone is synthesized from an amino acid precursor
- (A) Ethylene
 - (B) Auxin
 - (C) Cytokinin
 - (D) Abscisic acid
78. When a mix of a 50-mer oligonucleotide and free nucleotides is added to a gel-filtration column with exclusion volume of 10,000 Da, the following result can be expected
- (A) The oligonucleotide and the nucleotides would be retained in the column and they both can bind the resin
 - (B) The oligonucleotide would elute and the nucleotides would be retained in the column
 - (C) Both of them would elute in the void volume
 - (D) The column matrix would collapse on addition of DNA
79. A patient with type I diabetes mellitus would have
- (A) Increased production of fatty acids from glucose in liver
 - (B) Decreased conversion of fatty acids to ketone-bodies
 - (C) Increased stores of triacylglycerol in adipose tissue
 - (D) Increased production of acetone

80. The sugar whose structure is shown below



- (A) Is a substrate for β -galactosidase
 - (B) Contains a beta 1, 2 linkage
 - (C) Contains two hexose sugars
 - (D) Contains one hexose and one pentose sugar
81. A system is at equilibrium when ΔG is
- (A) Negative
 - (B) Positive
 - (C) Zero
 - (D) Equal to ΔH
82. Interaction between side chains of phenylalanine and valine is dominated by
- (A) Electrostatic interaction
 - (B) van der Waal's interaction
 - (C) Hydrogen bond interaction
 - (D) Cation- π interaction
83. Fatty acids are not degraded immediately after their synthesis, because
- (A) Newly synthesized fatty acids cannot be converted into their coenzyme A (CoA) derivatives
 - (B) High NAD^+ levels present after the fatty acid synthesis inhibit their degradation
 - (C) Transport of fatty acids to mitochondria, the power house of the cell, is inhibited under the conditions of fatty acid synthesis
 - (D) Fatty acids need to mature into LDL before they can be utilized
84. Proteins serve as buffers because
- (A) They possess a large number of highly stable peptide bonds
 - (B) The N-terminal amino group can establish intramolecular or intermolecular interactions with the C-terminal carboxyl group
 - (C) They possess polar side chains
 - (D) They possess cysteines which can be either oxidized or reduced

85. Maximum level of DNA replication in mammalian cell occurs during

- (A) G1 phase
- (B) M phase
- (C) S phase
- (D) G2 phase

86. As the blood sugar rises, the liver metabolizes it by glucokinase and hexokinase. If the K_m of glucokinase is 10 mM and that of hexokinase is 1 mM for glucose, which of the following statements is correct?

- (A) Hexokinase will metabolize 100 times more glucose than glucokinase
- (B) Hexokinase will have a higher V_{max} than the glucokinase
- (C) Glucose will be utilized by glucokinase only after hexokinase is inactivated
- (D) Affinity of glucose for hexokinase is better than its affinity for glucokinase

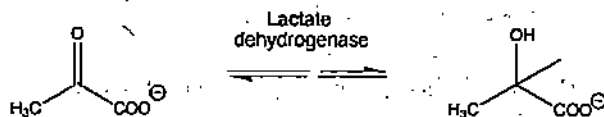
87. If the K_{eq} of a reaction in the forward direction is 10, then the K_{eq} for the reverse reaction is

- (A) 10
- (B) 1
- (C) 0.1
- (D) 0.01

88. Chargaff's rule is applicable

- (A) To all DNA and RNA molecules
- (B) To DNA and RNA hybrids
- (C) Only to segments of DNA that constitute genes
- (D) Only to bacterial DNAs

89. The enzyme lactate dehydrogenase converts pyruvate to lactic acid (see reaction below).



Of the methods listed below which method will be most specific to follow the course of the reaction?

- (A) Raman spectroscopy
- (B) Fluorescence spectroscopy
- (C) Isothermal calorimetry
- (D) Circular dichroism

90. Three polypeptides (A, B and C) whose masses were 55 kDa, 50 kDa and 75 kDa with pI of 6.5, 7.0, and 8.0 respectively were subjected to standard reducing sodium dodecyl sulfate (SDS)-polyacrylamide gel electrophoresis. The order of their separation from top to bottom would be

- (A) A, B, and C
- (B) B, A, and C
- (C) A, C, and B
- (D) C, A, and B

91. Match the related terms in the following two columns

- | | |
|--------------|--------------|
| a) carotene | i) betel nut |
| b) lycopene | ii) chilli |
| c) capsaicin | iii) carrot |
| d) ricin | iv) castor |
| e) arecain | v) tomato |

and identify the correct combination of matches from the following options

- (A) a & i ; b & ii; c & iii; d & iv; e & v
- (B) a & iii; b & v ; c & ii , d & iv; e & i
- (C) a & iii; b & v ; c & ii; d & i ; e & iv
- (D) a & iii; b & i ; c & ii ; d & iv; e & v

92. The possible genotypes of endosperms borne on a heterozygous (Rr) plant will be

- (A) RRR, RRr, rRr, rr
- (B) RRr, rRr
- (C) RR, Rr, rr
- (D) Rr

93. Match the related terms in the following two columns

- | | |
|----------------|-----------------------|
| a) radish | i) underground fruit |
| b) potato | ii) modified root |
| c) peanut | iii) modified stem |
| d) cauliflower | iv) modified meristem |

and identify the correct combination of matches from the following options

- (A) a & iii; b & ii; c & i; d & iv
- (B) a & ii; b & i ; c & iii; d & iv
- (C) a & iii; b & ii; c & iv; d & i
- (D) a & ii; b & iii; c & i; d & iv

94. The side chains of the amino acids serine, asparagine, and glutamine are all
- (A) Normally negatively charged at pH 7.0
 - (B) Normally positively charged at pH 7.0
 - (C) Able to interact with water
 - (D) Indifferent to their environment
95. Inositol triphosphate-gated calcium channels are located in the
- (A) Plasma membrane
 - (B) Smooth ER
 - (C) Inner mitochondrial membrane
 - (D) Exocytotic vesicles
96. In Gram negative bacteria, the periplasmic space is where
- (A) Plasmid DNA is located
 - (B) All proteins fold
 - (C) Secretory proteins acquire their disulfides
 - (D) Membrane proteins acquire their transmembrane domains
97. Methylation of glutamate residues is typically associated with
- (A) Chemotaxis in bacteria
 - (B) Nuclear translocation in eukaryotes
 - (C) Restriction in bacteria
 - (D) Inter-cellular transport in plants
98. DEAE cellulose is an example of an anion exchanger which preferentially binds to
- (A) Proteins with basic isoelectric points
 - (B) Proteins with acidic isoelectric points
 - (C) Proteins with neutral charge
 - (D) Proteins with abundance of apolar residues
99. Gluconeogenesis is not capable of making glucose from
- (A) Alanine
 - (B) Lactate
 - (C) Glycerol
 - (D) Palmitate
100. Which of the following is true about gluconeogenesis?
- (A) It is stimulated by glucagon
 - (B) It occurs in adipose tissue
 - (C) It is inhibited by glucagon
 - (D) It is stimulated by insulin

END OF THE QUESTION PAPER