



**INDIAN INSTITUTE OF SCIENCE
BANGALORE - 560012**

ENTRANCE TEST FOR ADMISSIONS - 2010

**Program : Research
Entrance Paper : Biological Sciences
Paper Code : BC**

**Day & Date
SUNDAY, 25TH APRIL 2010**

**Time
9.00 A.M. TO 12.00 NOON**

GENERAL INSTRUCTIONS

- 1. This question paper consists of 100 multiple choices questions and carries a total of 100 marks, one mark for each question.**
- 2. Answers to all questions should be marked in the OMR sheet provided.**
- 3. For each question darken (fill) the appropriate bubble on the OMR sheet to indicate your answer.**
- 4. Use only HB pencils to darken the bubbles answers**
- 5. Darken only one bubble per question. If you mark more than one bubble to answer a question, it will be evaluated as incorrect**
- 6. If you wish to change your answer, please erase the existing mark completely before filling in the other bubble**
- 7. There is no negative marking for wrong answers.**
- 8. Candidates are required to fill in the required fields on the answers sheet attached.**

BIOLOGICAL SCIENCES

1. The post office is involved in processing, packaging and distribution. Because of these functions, it could be used as an analogy for which cellular organelle?
 - (A) Plasma membrane
 - (3) Nucleolus**
 - (C) Golgi apparatus
 - (D) Mitochondria
2. Which one of the following proteins is involved in promoter recognition in eukaryotes?
 - (A) TFIIF
 - (B) TFIIB
 - (C) TFIID**
 - (P) TFIIE
3. The enzyme responsible for conversion of a negatively supercoiled DNA into a relaxed circular DNA is
 - (A) DNA gyrase
 - (B) DNA Topoisomerase I
 - (C) DNA Topoisomerase II**
 - (D) DNA helicase
4. In which of the secondary structures, two residues well separated (more than 10 residues) in the amino acid sequence can be proximal in the three-dimensional structure?
 - (A) α -helix
 - (B) β -sheet
 - (C) 3_{10} -helix**
 - (D) β -turn
5. *Sma*I and *Xma*I are isoschizomers. A circular DNA has two *Sma*I and one *Xma*I sites. How many fragments will be generated by digestion with *Xma*I?
 - (A) 1
 - (B) 2
 - (C) 3**
 - (D) 4

6. The correct way to write the scientific name of garden pea is
- (A) *pisum sativum*
 - (B) *Pisum Sativum*
 - (C) *Pisum sativum*
 - (D) *PISUM sativum*
7. Replication of the full length chromosome of *E. coli*
- (A) takes exactly as long as it takes *E. coli* to divide
 - (B) takes longer than it takes *E. coli* to divide
 - (C) takes lesser time than it takes *E. coli* to divide
 - (D) depends on the use of ^{15}N or ^{14}N nitrogen source in the medium.
8. Which of the following does NOT employ nuclear receptors to mediate its signaling?
- (A) Epinephrine
 - (B) Estrogen
 - (C) Progesterone
 - (D) Testosterone
9. ^{32}P has a half life of 14 days. After 3 months what would be the residual radioactivity of 1 milli Curie of ATP labeled with ^{32}P ?
- (A) 62.5 micro Curie
 - (B) 6.25 micro Curie
 - (C) 15.5 micro Curie
 - (D) 1.55 micro Curie
10. Penicillin inhibits the synthesis of bacterial cell wall by binding to
- (A) trans-peptidase
 - (B) alanine racemase
 - (C) N-acetyl galactosamine
 - (D) N-acetyl muramic acid
11. Which compound can serve as a direct acceptor of an additional amino group derived from amino acid catabolism?
- (A) Glutamine
 - (B) Fumarate
 - (C) Alpha-ketoglutarate
 - (D) Glycerol

12. The effective resistance when two resistors of 1 and 4 ohms are connected in parallel is
- (A) 5.0 ohms
 - (B) 3.0 ohms
 - (C) 2.5 ohms
 - (D) 0.8 ohms
13. What is the smallest distance between two closely spaced points which can be resolved by light microscopy?
- (A) 20 nm
 - (B) 200 nm
 - (C) 2 micron
 - (D) 2 mm
14. The speed of an action potential through a nerve fibre can be increased by
- (A) reducing the diameter of the nerve fibre
 - (B) increasing the insulation of the nerve fibre
 - (C) increasing the concentration of the sodium and potassium ions
 - (D) decreasing the length of the nerve fibre
15. Which neuron is found in the peripheral nervous system?
- (A) Purkinje neuron
 - (B) Granule cell neuron
 - (C) Motor neuron
 - (D) Pyramidal neuron
16. Which of the following does NOT occur during the dark reaction of photosynthesis?
- (A) Utilization of NADPH
 - (B) Utilization of ATP
 - (C) Reduction of oxygen to produce water
 - (D) Synthesis of glucose
17. Akinetopsia is an acquired disorder which results in impaired ability to perceive
- (A) color
 - (B) motion
 - (C) form
 - (D) letters

18. If the absolute temperature doubles, the velocity of molecules in a gas increases by a factor of
- (A) 2
 - (B) 4
 - (C) $\sqrt{2}$
 - (D) $\sqrt{3}$
19. Antigenic determinants generated by the conformation of amino acids present in the variable regions of immunoglobins are
- (A) allotypic
 - (B) idiotypic
 - (C) anti-idiotypic
 - (D) heterotypic
20. Chorionic gonadotropin hormone, synthesized in the placenta, plays an important role in the establishment and maintenance of pregnancy in
- (A) cows
 - (B) pigs
 - (C) rodents
 - (D) humans
21. In the eye, which cells are responsible for visual detection in low light conditions?
- (A) Rods
 - (B) Cones
 - (C) ON cells
 - (D) Bipolar cells
22. What is the sequence of cell cycle progression in eukaryotic cells?
- (A) G1 to G2 to S to M
 - (B) G1 to M to G2 to S
 - (C) G1 to S to M to G2
 - (D) G1 to S to G2 to M
23. If all the 8 cysteine residues in a protein take part in making disulfide bonds, then the possible number of ways the four S-S bonds can be formed is
- (A) $8C_2$
 - (B) $8P_2$
 - (C) $7 \times 5 \times 3 \times 1$
 - (D) $4 \times 3 \times 2 \times 1$

24. Albinism is a condition that results from the lack of normal pigmentation. Individuals possessing two recessive alleles (aa) are albino. Similarly, attached earlobes result from two recessive alleles (ee). In a family, the husband is an albino with attached earlobes and the wife is pigmented with non-attached earlobes. All their 20 children are pigmented with non-attached earlobes. What is *the* genotype of the mother?
- (A) aaee
 (B) aaEE
 (C) AaEe
 (D) AAEE
25. Which of the following DNA elements will cause stable integration into plant genome?
- (A) T-DNA & Ds elements
 (B) Mu element & Ac/ Ds elements
 (C) T-DNA & Mu element
 (D) Ds elements & Ac/ Ds elements
26. Which protein has the least number of amide groups in the polypeptide backbone?
- (A) Myosin
 (B) Silk
 (C) Collagen
 (D) Keratin
27. A plasmid of 2200 bp size was isolated from *E. coli* and found to have a linking number (L_k) of 190. The negative value of the writhe (W_r) for this plasmid would
- (A) be more if the DNA adopted an A-form structure than if it did a B-form structure
 (B) be less if the DNA adopted an A-form structure than if it did a B-form structure
 (C) be independent of the A-form or the B-form structures of the DNA
 (D) vary only if the DNA in the plasmid adopted a Z-form structure
28. A recessive allele 't' is responsible for a condition called distonia. A man who has this condition marries a woman who doesn't have distonia. One of their four children suffers from this disorder. What are the possible genotypes of the man and woman?
- (A) The father is Tt; the mother is TT
 (B) The father is tt; the mother is TT
 (C) Both parents are tt
 (D) The father is tt; the mother is Tt

29. Which one of the following has least solubility in water?
- (A) Lysozyme
 - (B) Collagenase
 - (C) DNA polymerase
 - (D) Rhodopsin
30. The structure equivalent to the frogs Spemann's organizer in chicks is
- (A) Hensen's node
 - (B) Notochord
 - (C) Anterior visceral endoderm
 - (D) Ventral mesoderm
31. Which pair of amino acids represents the weakest interaction between their side chains?
- (A) Ser ... Leu
 - (B) Asn ... Thr
 - (C) Tyr ... Trp
 - (D) Lys ... Phe
32. A double reciprocal plot for an enzymatic reaction with a ping pong Bi Bi mechanism looks similar to the plot obtained for
- (A) Competitive inhibition
 - (B) Uncompetitive inhibition
 - (C) Non competitive inhibition
 - (D) Mixed non competitive inhibition
33. Aspirin, used as a common analgesic, antipyretic and anti-inflammatory agent, inhibits the synthesis of which one of the following?
- (A) Arachidonic acid
 - (B) Prostaglandins
 - (C) Glucocorticoids
 - (D) Histamine
34. Which of the following proteins are expressed on the surface of helper T cells but not on cytotoxic T cells?
- (A) CD2
 - (B) CD3
 - (C) CD4
 - (D) CD8

35. Identify the amino acid which can exist as a diastereomer

- (A) Val
- (B) Pro
- (C) Gly
- (D) Ile

36. Bacteria can be made partially diploid in a stable manner by

- (A) mating with an Hfr strain
- (B) mating with a strain that carries an F' factor containing the gene of interest
- (C) phage mediated transduction
- (D) transformation with a linear DNA fragment that carries the gene of interest

37. Heart beat is regulated by the

- (A) vagus nerve
- (B) trigeminal nerve
- (C) glossopharyngeal nerve
- (D) trochlear nerve

38. Which one of the following statements is NOT applicable to integral membrane proteins?

- (A) they have compact three-dimensional structure
- (B) they can be without α -helical region
- (C) polar side chains are exposed to the surroundings
- (D) the main chain amide and carbonyl groups are engaged in hydrogen bonding

39. At low temperature the sterol content of membrane increases in cultured cells in order to

- (A) increase membrane fluidity
- (B) increase the production of lipid intracellular signalling molecules
- (C) stabilize membrane proteins
- (D) increase permeability to water

40. If a motor nerve has a conduction velocity of 70 m/s, how long will it take an action potential to reach a muscle 0.75 m away from the spinal cord?

- (A) 10.7 ms
- (B) 1.07 ms
- (C) 14 ms
- (D) 1.4 ms

41. Point mutations in the Ras protooncogene are associated with some cancers. These point mutations lead to
- (A) loss of function
 - (B) gain of function
 - (C) no change in function
 - (D) premature termination
42. You have discovered a compound that inhibits fumarase. How many moles of ATP would you expect to be generated from one mole of acetyl CoA in the presence of inhibitor?
- (A) 5
 - (B) 6
 - (C) 6.5
 - (D) 7.5
43. In a family, both husband and wife have blood group 'A'. The first child born to them was found to have 'O' blood group. What is the probability that their next child will have blood group 'A'?
- (A) 0.5
 - (B) 0.75
 - (C) 0
 - (D) 0.25
44. Which calcium binding protein regulates the smooth muscle contraction?
- (A) Troponin-C
 - (B) Calmodulin
 - (C) Calcineurin
 - (D) Calpain
45. Which compound cannot cross the inner membrane of mitochondria?
- (A) ATP
 - (B) Pyrophosphate
 - (C) Pyruvate
 - (D) Acetyl CoA
46. Which of the following antigen-antibody interactions does NOT involve precipitation reaction?
- (A) Radial immunodiffusion
 - (B) Ouchterlony
 - (C) ELISA
 - (D) Immunoelectrophoresis

47. Cytokinesis in a plant cell is characterized by

- (A) the equal division of homologous chromosomes
- (B) pinching off of the cell membrane to divide the cell
- (C) the formation of a cell plate in the cytoplasm
- (D) the movement of the chromosomes from the metaphase plate

48. The following data refer to the hydrolysis of various tripeptides into their N-terminal amino acids and C-terminal dipeptides catalysed by intestinal aminopeptidase at pH 7.0 and 37°C.

substrate	k_{cat} (s^{-1})	K_m (mM)
L-Pro-Gly-Gly	385	1.3
L-Leu-Gly-Gly	190	0.55
L-Ala-Gly-Gly	365	1.4
L-Ala-Ala-Ala	298	0.52

Which of the following substrates would be hydrolysed most rapidly in the early stages of reaction if the enzyme was added to equimolar concentration of the substrates individually?

- (A) L-Pro-Gly-Gly
- (B) L-Leu-Gly-Gly
- (C) L-Ala-Gly-Gly
- (D) L-Ala-Ala-Ala

49. The biological activity of anterior pituitary glycoprotein hormones such as FSH and LH depends on their native structure, which is

- (A) Homodimer
- (B) Heterodimer
- (C) Monomer
- (D) Tetramer

50. An rRNA sample was degraded into its constituent nucleotides. The absorbance of this sample at 260 nm would

- (A) decrease if the degradation was effected by alkaline digestion but increase if the same was effected by a ribonuclease
- (B) increase if the degradation was effected by alkaline digestion but decrease if the same was effected by a ribonuclease
- (C) remain the same irrespective of the use of chemicals or enzymes
- (D) increase irrespective of the use of chemicals or enzymes

51. In which cells of the leaf does photosynthesis occur?

- (A) Mesophyll cells
- (B) Bundle sheath cells
- (C) Guard cells
- (D) Lower epidermal cells

52. A cell free extract of *E.coli* contains 24 mg protein/ml. 20 μ l of this extract in a standard incubation volume of 0.1 ml catalyzed the incorporation of ^{14}C -glucose from ^{14}C glucose-1-phosphate into glycogen at a rate of 1.6 nmole / min. The velocity of the reaction in terms of (i) μ moles/min and (ii) μ moles/mg protein/min are:
- (A) 1.6×10^{-2} and 3.33×10^{-2}
(B) 1.6×10^{-1} and 3.33×10^{-1}
(C) 1.6×10^{-3} and 3.33×10^{-3}
(D) 1.6×10^{-4} and 3.33×10^{-4}
53. The end-to-end distance of a 10 amino acid alpha-helix is 15.2\AA . If these ten residues were in a fully extended conformation (beta-strand) the approximate end-to-end distance would be
- (A) 15.2\AA
(B) 5\AA
(C) 32\AA
(D) 70\AA
54. Superantigens
- (A) are exceptionally large antigen molecules
(B) elicit a strong antibody response
(C) attach non-specifically to B cell receptors
(D) activate a large number of T cells
55. Which enzyme causes the release of pyrophosphate from ATP?
- (A) Glycogen phosphorylase
(B) RNA polymerase
(C) ATPase
(D) Aspartate transcarbamylase
56. In which activated form does inorganic sulphate enter metabolic pathways?
- (A) Sulpho lipid
(B) Methionine
(C) Thiourea
(D) Phosphoadenosine phosphosulphate
57. The composition of 'oral polio' vaccination given worldwide is
- (A) attenuated neurovirulent Poliovirus
(B) heat killed Poliovirus sabin type
(C) combination of types 1-3 of heat killed poliovirus strains
(D) trivalent preparation of live attenuated poliovirus types 1, 2 and 3

58. For the half reactions shown below, which one of the following statements is true?

	E° (V)
$O_2 + 2H^+ + 2e^- \leftrightarrow H_2O$	0.815
$O_2 + 2H^+ + 2e^- \leftrightarrow H_2O_2$	0.295
Cytochrome b (Fe^{3+}) + $e^- \leftrightarrow$ Cytochrome b (Fe^{2+})	0.077
$NAD^+ + H^+ + 2e^- \leftrightarrow NADH$	-0.315

- (A) Oxygen is more easily reduced than NAD^+
(B) NAD^+ has a lower tendency to get oxidized than *oxygen*
(C) cytochrome b (Fe^{2+}) is more easily oxidized than $NADH$
(D) cytochrome b (Fe^{3+}) is less easily reduced than O_2
59. Chloroform is more miscible with water than carbon tetrachloride because chloroform has a
- (A) lower dipole moment than carbon tetrachloride
(B) lower dielectric constant than carbon tetrachloride
(C) higher dipole moment than carbon tetrachloride
(D) higher order of symmetry than carbon tetrachloride
60. Which one of the following covalent modifications occurs both in DNA as well as histones and contributes to repression of transcription or gene silencing in eukaryotic cells?
- (A) Acetylation
(B) Phosphorylation
(C) Methylation
(D) Sumoylation
61. The direction of migration of the tripeptide Lys-Lys-Lys in an electric field at $pH = 3$ and at $pH = 10$ is
- (A) Cathode and Cathode respectively
(B) Cathode and Anode respectively
(C) Anode and Cathode respectively
(D) Anode and Anode respectively
62. Which phytohormones are overproduced in plant tumors caused by *Agrobacterium*?
- (A) Ethylene and auxin
(B) Auxin and cytokinin
(C) Cytokinin and Gibberellin
(D) Gibberellin and auxin

63. If the intracellular concentration of NaCl is 1%, then which solution is hypotonic to the cell?
- (A) 0.1 N
 - (B) 0.2 N
 - (C) 0.3 N
 - (D) 0.4 N
64. Which of the following statements about DNA replication is NOT common to the synthesis of both leading and lagging strands?
- (A) RNA primer is synthesized
 - (B) DNA polymerase III synthesizes DNA
 - (C) Nucleoside monophosphates are added in a 5' to 3' direction along the growing DNA chain
 - (D) DNA ligase repeatedly joins the ends of DNA along the growing strand
65. Which phytohormone induces seed dormancy?
- (A) Gibberellin
 - (B) Abscisic acid
 - (C) Auxin
 - (D) Ethylene
66. If the pre- and post-synaptic cells are incubated in Ca^{2+} -free medium, then
- (A) synaptic transmission would take place at a faster time scale
 - (B) membrane depolarization of the pre-synaptic cell would not take place
 - (C) neurotransmitters will be degraded in the synaptic cleft
 - (D) membrane depolarization of the post-synaptic cell would not take place
67. The native structure of a protein, whose formation from its denatured state is favoured at a temperature below $T = \Delta H / \Delta S$. For what values of ΔH and ΔS will this condition be satisfied?
- (A) ΔH is -ve and ΔS is +ve
 - (B) ΔH is -ve and ΔS is -ve
 - (C) ΔH is +ve and ΔS is +ve
 - (D) ΔH is +ve and ΔS is -ve
68. Upon replication of a covalently closed circular genome (such as the *E. coli* genome), the daughter chromosomes are obtained as catenated circles. These catenated circles are resolved prior to cell division by
- (A) the nicking activity of DNA polymerase
 - (B) DNA gyrase
 - (C) reverse activity of a DNA ligase followed by its forward activity
 - (D) topoisomerase I

69. Parkinson's disease is characterised by cell death in the

- (A) substantia nigra
- (B) motor cortex
- (C) frontal cortex
- (D) spinal cord.

70. Which post translational modification is used to anchor a protein on the membrane?

- (A) Phosphorylation
- (B) Prenylation
- (C) Acetylation
- (D) Methylation

71. The genome of the Avian flu virus (H5N1) that causes bird flu consists of

- (A) Single stranded DNA
- (B) Positive strand RNA
- (C) Negative strand RNA
- (D) Double stranded DNA

72. The amino acid carboxyproline has three ionizable groups with the following properties

<u>Group</u>	<u>pKa</u>
a - carboxyl	2.0
a - amino	10.5
y - carboxyl	3.8

The isoelectric point for this amino acid is

- (A) 2.9
- (B) 6.25
- (C) 7.15
- (D) 5.4

73. Which one of the following statements is CORRECT?

- (A) Phytochromes perceive red/far red light and cryptochromes perceive blue light
- (B) Phytochromes perceive blue light and cryptochromes perceive red/far red
- (C) Both phytochromes and cryptochromes can perceive the entire visible spectrum
- (D) Phytochromes and cryptochromes absorb UV light and infra red light, respectively

74. Which of *the* following is NOT a common feature of retroviruses?
- (A) They are enveloped
 - (B) Their RNA is spliced
 - (C) They contain LTRs
 - (D) They integrate into host DNA
75. In a stretch of DNA, 10 % of guanines form non-Watson and Crick base pairing with adenine. If the segment contains 29% guanine, the amount of thymine would be
- (A) 21%
 - (B) 20%
 - (C) 29%
 - (D) 18%
76. Telomerase is composed of
- (A) only protein
 - (B) only RNA
 - (C) Protein and RNA
 - (D) Protein and DNA
77. Four stainless steel rods of radius R and length L are packed **tight** in a square container. The volume of the unoccupied space at the periphery (edge) is
- (A) twice that of the unoccupied space at the center
 - (B) three times that of the unoccupied space at the center
 - (C) equal to that of the unoccupied space at the center
 - (D) four times that of the unoccupied space at the center
78. Under a given renaturing condition *E. coli* DNA reassociates with a $Cot_{1/2}$ of 4.0 and an unknown DNA sample with a $Cot_{1/2}$ of 283. The complexity of this unknown DNA will be
- (A) 4.2×10^6 bp
 - (B) 6×10^5 bp
 - (C) 3.0×10^8 bp
 - (D) 340 bp
79. Which mutation cannot occur in a tRNA encoding gene?
- (A) Deletion
 - (B) Transition
 - (C) Transversion
 - (D) Nonsense mutation

80. Bacteriophage M13 was prepared from an *E. coli* culture grown in a medium containing ^{15}N as the sole nitrogen source. It was used to infect a fresh culture of *E. coli* at an m.o.i. of about 1 and grown in a medium containing ^{14}N as the sole nitrogen source. The replicative form of DNA of M13 phage was prepared after 4 generations of *E. coli* growth and analyzed by CsCl density gradient ultracentrifugation. The separated ^{15}N and ^{14}N containing DNA will be seen as

- (A) a single band
- (B) two bands
- (C) three bands
- (D) four bands

81. Which amino acid is phosphorylated in bacterial proteins?

- (A) Arginine
- (B) Cysteine
- (C) Lysine
- (D) Histidine

82. The phrase 'horizontal gene transfer' means that

- (A) genes can diffuse within the cytoplasm
- (B) the DNA molecule can move horizontally but not vertically
- (C) genes can pass between individuals in the absence of sexual reproduction
- (D) whenever a gene passes from P to Q, another gene must pass from Q to P

83. Two children have a neurological disorder. When cells derived from these two children were fused and cultured, the resultant cells displayed normal metabolism. However, cells from either patient exhibited abnormal metabolism when cultured separately. These results indicate that

- (A) the disorder is caused by mutations in the same gene
- (B) the disorder is caused by mutations in non-allelic genes
- (C) symptoms of the disorder cannot be observed at the cellular level
- (D) the disorder cannot be due to loss of the same enzyme activity

84. DNA polymerase V in *E. coli* is crucial for the template and primer dependent polymerization of dNTPs for

- (A) the high fidelity replication of the parent chromosome
- (B) DNA synthesis during nucleotide excision repair
- (C) DNA synthesis during error prone replication
- (D) DNA synthesis during mismatch repair

85. The Shine-Dalgarno sequence facilitates binding of eubacterial mRNAs to the
- (A) 30S ribosomal subunit via the 16S rRNA
 - (B) 50S ribosomal subunit via the 23S rRNA
 - (C) 30S ribosomal subunit via the 5S rRNA
 - (D) 50S ribosomal subunit via the 5S rRNA
86. Three vertices of a parallelogram have the following coordinates: $(-4, 4)$, $(3, 6)$ and $(7, 2)$. What are the coordinates of the fourth one?
- (A) $-4, -6$
 - (B) $0, 0$
 - (C) $7, 4$
 - (D) $3, -4$
87. In human oocytes, the interval between the first and second meiotic divisions is typically a few
- (A) seconds
 - (B) hours
 - (C) days
 - (D) years
88. Gonadotropin releasing hormone and Gonadotropins are produced by
- (A) hypothalamus only
 - (B) hypothalamus and anterior pituitary respectively
 - (C) anterior pituitary and hypothalamus respectively
 - (D) anterior pituitary only
89. The storage disease associated with excess sphingomyelin is called
- (A) Niemann Pick
 - (B) Sandhoff
 - (C) Tay Sachs
 - (D) Krabbe's
90. The interaction of information coming from the two eyes for depth perception first occurs in which of the following structures devoted to vision?
- (A) Retina
 - (B) Thalamus
 - (C) Primary visual cortex
 - (D) Parietal cortex

91. An equilateral triangle is inscribed in a circle of radius r . What is the length of the side of the triangle?
- (A) r
 (B) $2r$
 (C) $\sqrt{3} r$
 (D) $(\sqrt{3}/2) r$
92. If a valine residue is buried in a protein structure, which one of the substitutions is likely to be least disruptive to the three-dimensional structure?
- (A) Val \rightarrow Ile
 (B) Val \rightarrow Gly
 (C) Val \rightarrow Thr
 (D) Val \rightarrow Phe
93. In a peptide unit $C\alpha$ refers to the central carbon atom in an amino acid and C refers to the carbon in the carbonyl group. Which covalent bond is the most difficult to rotate in the peptide unit?
- (A) $C\alpha-C$
 (B) $C-N$
 (C) $N-H$
 (D) $N-C\alpha$
94. Induced pluripotent stem cells (iPS) are usually generated from
- (A) 4-8 cell stage of an embryo
 (B) inner cell mass of blastocysts
 (C) adult somatic cells
 (D) placenta
95. Within the mitochondrion, the proton gradient develops across the
- (A) outer membrane
 (B) inner membrane
 (C) intermembrane space
 (D) matrix
96. A cellular protein has higher affinity for inositol triphosphate compared to phosphatidylinositol 4,5-bisphosphate (PIP₂). Where would you expect this protein to be localized when phospholipase C beta enzyme (which hydrolyses PIP₂) is activated?
- (A) On the plasma membrane
 (B) In the cytosol
 (C) On the ER
 (D) On the Golgi membrane

97. A mutant G_{α} protein with increased GTPase activity would
- (A) not bind to GTP
 - (B) not bind to GDP
 - (C) show increased signalling
 - (D) show decreased signalling
98. A protein segment consists of a stretch of 10 residues that adopt an α - helical secondary structure conformation. What is the maximum number of hydrogen bonds that can stabilize this α - helix?
- (A) 4
 - (B) 5
 - (C) 6
 - (D) 7
99. Salt bridges formed in proteins involve
- (A) Sulfur atoms in cysteine side chains
 - (B) Metal ions such as Na and K
 - (C) Oppositely charged side chains
 - (D) Proximal aromatic and aliphatic side chains
100. The theory of evolution by natural selection states that
- (A) selection results in generating variations
 - (B) selection and variations are independent
 - (C) evolution is independent of variation
 - (D) evolution is a rapid process