LIFE SCIENCES
PAPER I(PART 'B')

41. During protein synthesis, L-amino acid binds to t-RNA through

    1. α-amino group.
    2. hydrophobic side chain.
    3. α–carboxyl group.
    4. carboxyl group of the side chain.

42. The peptide bond is planar

    1. due to restriction caused by rotation around c^{α}–N bond
    2. due to restriction around c^{α}–c′ bond
    3. due to delocalization of the lone pair of electrons of the nitrogen onto carbonyl oxygen
    4. because amide protons and carbonyl oxygen are involved in hydrogen bonding.

43. Hydrogen bond length will NOT be

    1. independent of the nature of donor and acceptor atoms.
    2. dependent on donor and acceptor atoms.
    3. dependent on the solvent in which the molecule is dissolved.
    4. dependent on the other atoms bonded with the donor and acceptor atom.

44. Why a DNA duplex melts at a specific temperature (T_m) on heating?

    1. Loss of base stacking energy
    2. The double helix is intrinsically unstable
    3. The single helix is more stable as compared to the double helix
    4. The DNA double helix is a co-operative structure stabilized by hydrogen bonds and base pairing

45. Lipid bilayers can be formed by phospholipids which have variable head groups and fatty acyl chains. The fluidity of the membrane will depend on

    1. only the nature of head groups.
    2. only the length of the fatty acid chains irrespective of the extent of unsaturation.
    3. only unsaturation irrespective of the length of the fatty acid chains.
    4. length and degree of unsaturation of fatty acid chains.

46. Which one of the following RNA molecules is involved in regulation of gene expression?

1. miRNA
2. rRNA
3. 5S RNA
4. tRNA

47. In which organelle is $NADP^+$ the final electron acceptor?

1. Only chloroplast
2. Only mitochondrion
3. Both chloroplast and mitochondrion
4. Lysosome

48. When the $K'_q = 1$, $\Delta G°$ is equal to

1. –1.
2. 0.
3. +1.
4. 10.

49. Which one of the following human pathogen is a flagellated protozoan?

1. *Trypanosoma*
2. *Plasmodium*
3. *Paramecium*
4. *Entamoeba*

50. Which of the following mammalian cells usually does NOT divide in adult life?

1. Epithelial cells in lung
2. Nerve cells in brain
3. Liver cells
4. Osteoblast cells

51. What happens to the Cdk-cyclin A complex at metaphase?

1. Both cyclin A and Cdk remain undegraded
2. Only Cdk is degraded
3. Only cyclin A is degraded
4. Both cyclin A and Cdk are degraded

52. The average human genome has approximately 3×10^9 base pairs coding for various proteins. If an "average" protein contains 400 amino acids, what is the maximum number of proteins that can be encoded by the human genome?

1. 2.5×10^6.
2. 2.5×10^7.
3. 3.0×10^6.
4. 3.5×10^7.

53. In eukaryotes, the interaction of enhancer and promoter elements is brought closer by

1. zinc finger.
2. DNA looping.
3. helix turn helix.
4. palindrome.

54. Which of the following cytoskeleton elements guides the movement of vesicles containing cell wall precursors from their site of formation in Golgi to the site of new wall formation in a growing pollen tube?

1. Myosin
2. Actin
3. Kinesin
4. Dynein

55. Ionophores are small hydrophobic molecules that can partition into the lipid bilayer and increase their permeability to specific inorganic ions. Which of the following is a channel forming ionophore?

1. Valinomycin.
2. Actinomycin.
3. Gramicidin A.
4. Nicin.

56. Which GTPases regulate intracellular transport in mammalian cells through vesicle fusion?

1. Rab
2. Ran
3. Ras
4. Rho

57. The region where RNA polymerase binds to promoter in prokaryotes is called

1. Pribnow box.
2. Hogness box.
3. Homeo box.
4. Shine-Dalgarno box.

58. Which of the following features highlights the difference between Z-DNA and B-DNA?

1. Double helical nature
2. Orientation of phosphate backbone
3. Pairing of G – C
4. Antiparallel nature of two polynucleotide strands of double helix

59. Ribosomal subunits are assembled in

1. cytoplasm.
2. nucleolus.
3. nucleus.
4. endoplasmic reticulum.

60. The absence of sigma factor in RNA polymerase

1. affects elongation only.
2. blocks initiation only.
3. affects both initiation and elongation.
4. does not affect transcription.

61. Which of the following features is not required in the initiation step of protein synthesis?

1. Amino acid activation
2. Binding of mRNA to the ribosomes
3. Transfer of activated amino acid to tRNA
4. Joining together of two amino acids by peptide bond formation

62. By which of the following mechanisms does cycloheximide inhibit protein synthesis?

1. Blocking the peptidyl transferase of 80S euokaryotic ribosomes
2. Blocking the peptidyl transferase of 70S prokaryotic ribosomes
3. By binding to DNA dependent RNA polymerase
4. By binding to sigma factor

63. Which of the following is a *natural* inducer of the *lac* operon in *E. coli*?

1. Lactose
2. Galactose
3. Allolactose
4. IPTG

64. Antitermination of RNA synthesis is a major mechanism of regulation in

1. lytic phase of λ phage.
2. lysogenic phase of λ phage.
3. *lac* operon.
4. *trp* operon.

65. Influenza virus binds to its host cells through which one of the following carbohydrate moiety.

1. N-acetyl glucosamine
2. N-acetyl neuraminic acid
3. Fucose
4. Mellibiose

66. In mammals, G protein coupled receptors (GPCR) play a major role in mediating effects of various hormones NOT through

1. activation of protein kinase A.
2. activation of adenylate cyclase.
3. inactivation of adenylate cyclase.
4. activation of tyrosine kinase activity.

67. Receptors for neurotransmitters are located on the

1. cell surface.
2. nucleus.
3. endosome.
4. Golgi apparatus.

68. One of the major transmembrane proteins in a "tight junction" is

1. lectin.
2. claudin.
3. adherin.
4. integrin.

69. Retroviruses are well known as cancer causing agents because it

1. causes mutations in host genes involved in growth.
2. integrates their proviral DNA next to protooncogenes.
3. generates defective viruses lacking some of the viral genes.
4. integrates their T antigens into the host genome.

70. Select the correct statement:

1. In vertebrate development, immune and nervous systems are the prevalent sites for apoptosis.
2. Apoptosis is triggered by growth stimulus.
3. The tumor suppressor factor p53 inhibits apoptosis.
4. The soluble form of tumor necrosis factor cannot induce apoptosis.

71. ELISA assay

1. uses complement mediated cell lysis.
2. uses a radiolabeled second antibody.
3. involves addition of substrate which is converted to coloured end product.
4. requires specialized red blood cells.

72. In mosaic development, the prospective potency of cells

1. equals its prospective fate.
2. is greater than prospective fate.
3. is less than prospective fate.
4. and fate are unrelated.

73. Experiments with sea urchin demonstrated species specific sperm-egg recognition through the protein

1. bindin.
2. avidin.
3. activin.
4. hyalin.

74. Exposing a regenerating limb to which of the following chemicals results in the blastema proximalization?

1. Ascorbic acid
2. Thyroxine
3. Retinoic acid
4. Glutamic acid

75. Temperature-dependent sex determination is observed in

1. *Drosophila*.
2. amphibians.
3. reptiles.
4. sea urchins.

76. Some plants require vernalization (prolonged cold treatment) for transition to flowering. For floral induction, vernalization signal is perceived primarily by

1. young leaves subtending the apical meristem.
2. mature leaves near the root-shoot junction.
3. all vegetative parts.
4. shoot apical meristem.

77. Which phase of embryogenesis in plants is characterized by the initiation of deposition of storage reserves?

1. Globular stage
2. Heart stage
3. Torpedo stage
4. Cell enlargement stage

78. Which of the following statements is NOT true in relation to growth of animals?

1. When all body parts grow at the same rate, it is called isometric growth.
2. When different body parts grow at different rates, it is called allometric growth.
3. Two-fold change in weight will cause a 1.26-fold expansion in length if growth is allometric.
4. Isometric growth cannot create dramatic changes in the structure of organisms.

79. Abnormalities during development caused by exogenous agents are called disruptions and the agents are specifically called

1. morphogen.
2. teratogen.
3. allergen.
4. mutagen.

80. At which of the following steps does application of dichlorophenyl-dimethyl urea (DCMU) inhibit electron flow during photosynthesis?

1. P680* → Pheophytin
2. $Q_A \rightarrow Q_B$
3. $Q_B \rightarrow Cytb_6f$ complex
4. $Cytb_6f$ complex → plastocyanin

81. A major functional difference between the succinyl CoA-synthetase of plant and animal cell mitochondria is that it

1. does not produce ATP in plant cell.
2. does not produce GTP in plant cell.
3. produces ATP in plants and GTP in animals.
4. produces GTP in plants and ATP in animals.

82. A common symptom of molybdenum deficiency in plants is the accumulation of nitrate in the cytosol, which results from

1. reduced nitrite reductase activity.
2. reduced nitrate reductase activity.
3. reduced transport of nitrate into the vacuoles.
4. reduced transport of nitrate into the chloroplasts.

83. The *Rht* mutations in wheat that were pivotal for 'Green Revolution' cause reduction in plant height due to impairment in

1. gibberellic acid biosynthesis pathway.
2. gibberellic acid signaling pathway.
3. auxin biosynthetic pathway.
4. auxin response pathway.

84. Which of the following phytochrome controlled responses displays red/far-red reversibility?

1. Very low-fluence responses
2. Low-fluence responses
3. High-irradiance responses
4. Very high-irradiance responses

85. At permanent wilting point, plants cannot regain turgor pressure even if transpiration stops because

1. water potential of soil (ψ_w) is less than or equal to osmotic potential (ψ_S) of the plant.
2. ψ_w is higher than ψ_S .
3. ψ_w and ψ_S are unaltered.
4. ψ_S remains unaltered.

86. Alkaloid production in plants is regulated by a change in the endogenous pool of

1. gibberellins.
2. jasmonates.
3. brassinosteroids.
4. abscisic acid.

87. Flooding and submergence of plants leads to anoxic conditions. Usually, flood-tolerant species alter their developmental programme, resulting in

1. increased activity at the apical meristem.
2. growth retardation of foliage.
3. elongation growth of their stems.
4. increased proliferation of root system.

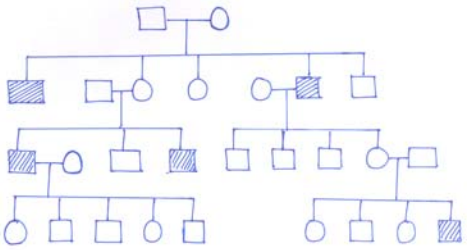
88. An organism with the genotype AABbCcDD is selfed. The four genes are independently assorting. What proportion of the progeny will show the genotype AAbbccDD?

1. 1/4
2. 1/16
3. 1/64
4. 1/256

89. Two fruitflies with mutant eye color were crossed. All progenies obtained from this cross had wild type eye colour as

1. the mutations are allelic.
2. one mutation is dominant over the other.
3. the mutations are co-dominant.
4. the mutations are in two different genes.

90. The following pedigree represents the inheritance of a rare disorder.



Based on the above pedigree, what is the most likely mode of inheritance?

1. Autosomal dominant
2. X-linked recessive
3. X-linked dominant
4. Y-linked dominant

91. Which of the following pair of relatives will have the highest genetic correlation?
    1. First double cousins
    2. Half siblings
    3. Brothers
    4. Brother-sister

92. a_1, a_2, a_3 are three alleles of a gene in *Neurospora.* Crosses between different *a* mutants gave the following results

$a_1 \times a_2$	$a_1 \times a_3$	$a_2 \times a_3$
↓	↓	↓
a_1+	a_1+	a_2+
++	a_1+	a_2+
+ a_2	++	++
+ a_2	+a_3	+ a_3

The process which best explains this result is

    1. gene conversion.
    2. forward mutation.
    3. non-homologous recombination.
    4. incomplete dominance.

93. You are provided with an *E. coli* strain auxotrophic for the amino acids Trp, Leu and Val. To select for double revertants in Trp and Leu, which amino acid(s) would you include in the growth medium?
    1. Trp
    2. Leu
    3. Val
    4. Trp, Leu, Val

94. UAG and UAA are both nonsense codons. What kind of single point mutation would cause reversion of UAG to a meaningful codon?
    1. Transition
    2. Transversion
    3. Frameshift
    4. Inversion

95. *E. coli* cells were simultaneously infected by two rII bacteriophage mutants. From the progeny obtained after lysis of the *E. coli* cells it was observed that some of the bacteriophages showed a wild type phenotype. These were obtained at extremely low frequency. This is due to
    1. complementation of the two mutations.
    2. recombination between the two mutant chromosomes.
    3. transposition of the mutation.
    4. incomplete penetrance.

96. Which of the following hormones stimulates the reabsorption of Na^+ and the secretion of K^+ in the kidney?

1. Vasopressin
2. Thyroxine
3. Prolactin
4. Aldosterone

97. The correct sequence in vertebrate embryonic development is

1. gastrocoel – blastocoel – notochord – neural crest.
2. blastocoel – gastrocoel – neural crest – notochord.
3. gastrocoel – blastocoel – neural crest – notochord.
4. blastocoel – neural crest – gastrocoel – notochord.

98. A person has a vision problem caused by the image of an object at infinity getting focused in front of retina. The error can be corrected by the use of

1. biconvex lens.
2. cylindrical lens.
3. plano convex lens.
4. biconcave lens.

99. During electrical stimulation-induced depolarization of neuron, voltage-gated

1. Na^+ channels will close.
2. K^+ channels will close.
3. Cl^- channels will open.
4. Na^+ channels will open.

100. The primary function of diaphragm is to

1. control blood pressure.
2. regulate respiration.
3. support the heart.
4. keep the rib cage dilated.

101. In nephron, the main role of deamination is to

1. reduce urine pH.
2. reduce water loss.
3. release urea.
4. release uric acid.

102. During inspiration, the air that we breathe moves through different regions of the associated organs in the sequence of

1. larynx > nasopharynx > trachea > glottis.
2. nasopharynx > glottis > larynx > trachea.
3. glottis > nasopharynx > larynx > trachea.
4. larynx > glottis > nasopharynx > trachea.

103. Knee jerk reaction is an example of what type of reflex?

1. Monosynaptic
2. Multisynaptic
3. Conditioned
4. Conscious

104. Which of the following processes is a major problem in interpreting molecular phylogeny?

1. Horizontal transfer of genes
2. Gene duplication
3. Synonymous mutations
4. Non-synonymous mutations

105. In a tissue, a cell that markedly differs in form, size and content from other cells of the same tissue is called

1. intermediary cell.
2. isotropic cell.
3. idioblast cell.
4. myrosin cell.

106. Among the extant reptiles which group is phylogenetically closely related to Aves?

1. Turtles
2. Lizards
3. Snakes
4. Crocodiles

107. The group of organisms that is now separated from the other groups of fungi based on their motile spores and cellulose-rich cell wall is

1. Myxomycetes.
2. Zygomycetes.
3. Deuteromycetes.
4. Oomycetes.

108. Some floristic elements common to both India and China are in the genus

1. *Ginkgo*.
2. *Rhododendron*.
3. *Poeciloneuron*.
4. *Erinocarpus*.

109. The difference between Indian and African wild herbivore fauna is that there are no

1. antelopes in India.
2. deer in Africa.
3. odd-toed animals in India.
4. even-toed hoofed animals in Africa.

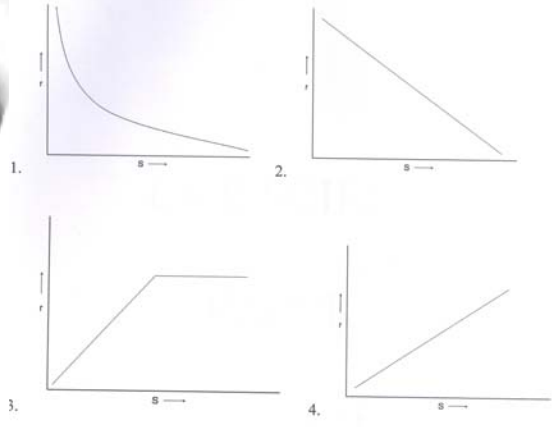
110. Which of the following bird species is endangered?

1. Hill myna
2. Great Indian bustard
3. Crow-pheasant
4. Grey hornbill

111. In spite of the prevalence of herbivory, the earth continues to be largely green because

1. the number of herbivore species is low.
2. herbivores are very inefficient feeders.
3. herbivore numbers are kept low by their predators.
4. herbivory promotes plant growth.

112. Which of the following curves represents the general relationship between body size (S) and intrinsic rate of population growth (r) ?



113. Which of the following reproductive strategies is characteristic of marine invertebrates?

1. Long generation time, small clutch size
2. Short generation time, small clutch size
3. Long generation time, large clutch size
4. Short generation time, large clutch size

114. Bergmann's Rule refers to a general tendency of mammals to be

1. larger in size in colder areas of their distribution.
2. smaller in size in areas of their distribution.
3. darker-pigmented in warmer areas of their distribution.
4. lighter-pigmented in warmer areas of their distribution.

115. When removal of a species from an ecosystem affects persistence of many other species and the impact of that species removal is disproportionate to its abundance, the species is known as

1 indicator species.
2. keystone species.
3. flagship species.
4. umbrella species.

116. Biomass turnover time is the ratio between biomass and productivity of an ecosystem. Which of the following forests should have highest biomass turnover time?

1. Tropical dry forests
2. Tropical wet forests
3. Temperate deciduous forests
4. Boreal forests

117. Conversion of nitrite to nitrate in soil is done by the bacteria of genus

1. *Azotobacter.*
2. *Nitrosomonas.*
3. *Nitrobacter.*
4. *Pseudomonas.*

118. In a population with two alleles 'a' and 'b' of a genotype in a ratio of 0.2 and 0.8 in Hardy-Weinberg equilibrium, how many individuals in a sample of 300 can be expected to be homozygous for allele 'a'?

1. 192
2. 12
3. 64
4. 96

119. Defective alleles are eliminated rapidly from a population if they are

1. recessive.
2. dominant.
3. codominant.
4. in multiple copies.

120. The correct expression of Hamilton rule for the evaluation of altruism is [C = the cost of a behavioral act to the actor, b = the benefit of that act to a beneficiary, and r = the genetic relatedness between the actor and the beneficiary]

1. $c < b \cdot r$
2. $c < b$
3. $c \cdot r < b$
4. $r < b \cdot c$

121. The evolutionary basis of sexual dimorphism is

1. differential investment in offspring.
2. difference in aggression.
3. difference in sex chromosomes.
4. difference in autosomes.

122. The evolutionary appearance of the first mammals was

1. after the extinction of dinosaurs and before the appearance of birds.
2. before the extinction of dinosaurs and after the appearance of birds.
3. before the extinction of dinosaurs and before the appearance of birds.
4. after the extinction of dinosaurs and after the appearance of birds.

123. Both the Luria-Delbruck experiment and the Lederberg and Lederberg experiment demonstrate

1. pre-selection mutations.
2. post-selection mutations.
3. directed mutations.
4. adaptive mutations.

124. Vampire bats regurgitate food in order to feed a starving member of their group. This is an example of

1. group selection.
2. reciprocal altruism.
3. selfish behavior.
4. K-selection.

125. The first appearance of amphibians on earth was during the period
1. Silurian.
2. Carboniferous.
3. Triassic.
4. Jurassic.

126. In a transgenic mouse experiment a founder male produces 100 pups and only 20 of these are transgenic. This result leads to the conclusion that the

1. founder transgenic animal is chimaeric.
2. founder animal is mosaic.
3. transgene is integrated on Y–chromosome.
4. transgene is integrated on X–chromosome.

127. An inbred mouse is cloned using another mouse strain as an egg donor. The genetic relationship between the original inbred mouse and its clone will be

1. 100%.
2. 99–100%.
3. 95–99%.
4/ 90–95%.

128. Which of the following elements can be used to immobilize a reduced protein?

1. Calcium
2. Potassium
3. Gold
4. Sodium

129. D-amino acids

1. cannot be produced by fermentation.
2. can be produced by *E. coli*.
3. can be produced by yeast.
4. can be produced by microbes provided with chiral precursors of D-amino acids.

130. Which of the following viruses is used for biocontrol of insect pests of plants?

1. Cauliflower mosaic virus
2. Cucumber mosaic virus
3. Rice tungro virus
4. Nuclear polyhedrosis virus

131. What ratio do you expect for codominant loci in F_2 populations?

1. 1:1
2. 3:1
3. 1:2:1
4. 9:3:3:1

132. The copy number of a transgene in plants can be deciphered by

1. Southern blotting.
2. northern blotting.
3. south western blotting.
4. far western blotting.

133. It is hypothesized that the mean (μ) longevity of a *Drosophila* strain is 18 days, with a variance (σ) of 3 days. What values of longevity in a sampled population will lead to rejection of the null hypothesis at 95% confidence level?

1. Only values less than 15.
2. Values less than 15 and more than 18
3. Only values more than 21
4. Values less than 12 and more than 24

134. Normalized Differential Vegetation Index (NDVI) in remote sensing refers to the following spectral band derivation:

1. Near IR – Red
2. Red / Near Red
3. (Near IR – Red) / (Near IR + Red)
4. (Near IR – Red) / Red

135. Function of a monochromator in a spectrophotometer is

1. focusing a straight beam of light.
2. dividing a light beam into its component wavelengths.
3. selecting a desired wavelength.
4. creating a light source.

136. Which of the following methods is the most appropriate for estimating the population density of burrowing animals?

1. Quadrat sampling
2. Line transect sampling
3. Tag-recapture method
4. Nearest neighbour distance method

137. A radioactive sample was counted in a scintillation counter and a value of 194930 cpm was obtained. The counting efficiency was found to be 95.7%. What is the actual amount of radioactivity present in the sample?

1. 181171 dpm
2. 190411 dpm
3. 203600 dpm
4. 211326 dpm

138. Which one of the following treatments does NOT enhance the response of a film to radioisotopes in autoradiography?

1. Staining the gel with Coomassie blue before drying
2. Use of intensifying screens
3. Exposure at low temperature
4. Preflashing the film with a light flash

139. What is the length of oligonucleotide required to give consistent specific hybridization signal in a microarray?

1. 5
2. 7
3. 9
4. 20

140. A protein is poorly expressed in a diseased tissue. To determine whether the defect is at the level of transcription or translation, which of the following blotting methods would you use?

1. Southern
2. Southern and northern
3. Northern and western
4. Western