10

QUESTION PAPER SERIES CODE
A

Centre of Examination : _____

Roll No. : _____

Name of Candidate : _____

S A U

Entrance Test for Ph.D. (Biotechnology)

[2013]

Time : 3 hours *Maximum Marks* : 70

INSTRUCTIONS FOR CANDIDATES

Candidates must read carefully the following instructions before attempting the Question Paper :

(i) Write your Name and Roll Number in the space provided for the purpose on the top of this Question Paper and in the OMR/Answer Sheet.

(ii) This Question Paper has Two Parts : Part—A and Part—B.

(iii) Part—A (Objective-type) has 20 questions of **1** mark each. All questions are compulsory.

(iv) Part—B (Objective-type) has 100 questions (Q. Nos. **21–120**), out of which only **fifty** should be answered. Each question carries **1** mark.

(v) *PLEASE DO NOT ATTEMPT MORE THAN 50 QUESTIONS IN PART—B. IF YOU ATTEMPT MORE THAN 50 QUESTIONS, ONLY THE FIRST 50 WILL BE EVALUATED.*

(vi) **Please darken the appropriate Circle of 'Question Paper Series Code' on the OMR Sheet in the space provided.**

(vii) Part—A and Part—B (Multiple-choice) Questions should be answered on OMR Sheet.

(viii) Answer written by the candidates inside the Question Paper will NOT be evaluated.

(ix) Calculators and Log Tables may be used.

(x) Pages at the end have been provided for Rough Work.

(xi) **Return the Question Paper and the OMR/Answer Sheet** to the Invigilator at the end of the Entrance Test.

(xii) **DO NOT FOLD THE OMR/ANSWER SHEET.**

INSTRUCTIONS FOR MARKING ANSWERS IN THE 'OMR SHEET'

1. **Please ensure that you have darkened the appropriate Circle of 'Question Paper Series Code' on the OMR Sheet in the space provided.**
2. Use only Blue/Black Ballpoint Pen to darken the Circle. Do not use Pencil to darken the Circle for Final Answer.
3. Please darken the whole Circle.
4. Darken ONLY ONE CIRCLE for each question as shown below in the example :

Wrong	Wrong	Wrong	Wrong	Correct
● ⓑ ⓒ ●	Ⓐ ⓑ ⓒ ⓓ	Ⓐ ⓑ ⓒ Ⓓ	◉ ⓑ ⓒ ●	ⓐ ⓑ ⓒ ●

5. Once marked, no change in the answer is allowed.
6. Please do not make any stray marks on the OMR Sheet.
7. Please do not do any rough work on the OMR Sheet.
8. Mark your answer only in the appropriate Circle against the number corresponding to the question.
9. There will be no negative marking in evaluation.

PART—A

1. What would be the pOH of a solution if $[H^+] = 10^{-3}$ *M*?

   (a) 0

   (b) 3

   (c) 7

   (d) 11

2. If 1 mL of 10 *N* NaOH is added to a litre of pure water at pH 7·0, what is the final pH?

   (a) 7·0

   (b) 7·8

   (c) 10

   (d) 12

3. The dissociation constants for insulin and its receptor is 1×10^{-10}, of calcium to calmodulin is 2×10^{-5}, of gp 41 to anti-HIV immunoglobulin is 4×10^{-10}, and of an enzyme *X* to its substrate is 5×10^{-5}. Which of the following pairs has the highest affinity to each other?

   (a) Insulin and its receptor

   (b) Calcium and calmodulin

   (c) Anti-HIV IgG and gp41

   (d) Enzyme *X* and its substrate

4. Electrophoresis of histones (pI = 8·5) and myoglobin (pI = 5·5) under nondenaturing conditions (pH = 7·0) results in

   (a) histones migrating to cathode and myoglobin to anode

   (b) histones migrating to anode and myoglobin to cathode

   (c) both migrating to cathode

   (d) smearing of the gel due to running it at pH 7·0

5. Who among the following experimented with the dissected leg of a frog?

   (a) Volta

   (b) Jenner

   (c) Salk

   (d) Galvani

6. The universal blood donors for ABO system type are

(a) A

(b) B

(c) O

(d) AB

7. The theory that life originated elsewhere and seeded life on the earth is called

(a) meteorite evolution

(b) panspermia

(c) extraterrestrial ecology

(d) exobiology

8. Dental formula of rabbit is

(a) 2, 0, 3, 3/1, 0, 2, 3

(b) 1, 0, 2, 3/2, 2, 0, 3

(c) 1, 0, 3, 3/2, 2, 0, 3

(d) 2, 1, 3, 2/2, 1, 2, 3

9. Some radioactive isotopes emit

(a) infrared rays

(b) ultraviolet rays

(c) gamma rays

(d) radio waves

10. Which of the following did early methanogens use from the early atmosphere to generate energy?

(a) CO_2 and H_2

(b) H_2O and O_2

(c) CH_4 and CO_2

(d) N_2 and O_3

11. Which one of the following is a live vaccine?

(a) Recombinant rabies vaccine

(b) Diphtheria

(c) Tetanus

(d) BCG

12. Which one of the following is a reference electrode?

(a) Oxygen electrode

(b) Hydrogen electrode

(c) Glass electrode

(d) Helium electrode

13. Which of the following does not contain DNA or RNA?

(a) Prokaryote

(b) Eukaryote

(c) Prion

(d) Viroid

14. An ultracentrifuge is run at 50000 r.p.m. The $r_{average}$ is 4 cm. The RCF of the centrifugation is

(a) 22400 g

(b) 44800 g

(c) 11200 g

(d) 10000 g

15. Which of the following isotopes is used to determine the function of thyroid?

(a) Na^{24}

(b) K^{42}

(c) Ca^{45}

(d) I^{131}

16. Plague is spread by

(a) dogs

(b) pigs

(c) rats

(d) mosquitoes

17. Which of the following is a flightless bird?

(a) Peacock

(b) Duck

(c) Emu

(d) Swan

18. The strongest muscle in the body is present in

(a) arm

(b) jaw

(c) thigh

(d) neck

19. In healthy human blood, the ratio of erythrocytes/leukocytes is close to

(a) 10–20

(b) 100–200

(c) 500–1000

(d) 5000–10000

20. Visible range of spectrum ranges from

(a) 200 nm to 700 nm

(b) 400 nm to 700 nm

(c) 100 nm to 400 nm

(d) 500 nm to 1000 nm

PART—B

21. Central components of cell-cycle control system are

(a) microtubules

(b) spindle poles

(c) cyclin-dependent protein kinases

(d) anaphase-promoting complexes

22. Anaphase-promoting complex catalyzes the ubiquitylation and destruction of

(a) Securin

(b) S-cyclin

(c) M-cyclin

(d) All of the above

23. During ATP synthesis by ATP synthase in mitochondrial membrane, O-state conformation of the nucleotide-binding site of β subunit binds

(a) ADP and Pi more strongly

(b) ATP very poorly and ADP and Pi weakly

(c) ATP and Pi very tightly

(d) Can't bind ATP

24. Cyclic electron flow through photosystem 1 (PSI) generates

(a) proton motive force

(b) NADPH

(c) O_2

(d) All of the above

25. Absorption of each photon by PSII results in the transfer of

(a) one electron

(b) two electrons

(c) four electrons

(d) eight electrons

26. Which of the following is primary lipid component of biomembranes?

(a) Phospholipid

(b) Sphingolipid

(c) Sterol

(d) Chylomicron

27. What is the main advantage of the C4 photosynthesis strategy over the C3 strategy?

(a) They allow the plant to avoid photorespiration by producing a four-carbon sugar in place of glucose

(b) They make it possible for the plant to use the Calvin cycle at night and during the day

(c) They allow the plant to fix carbon more efficiently under conditions of low atmospheric CO_2

(d) They help the plant conserve water and synthesize glucose efficiently under hot and dry conditions

28. The postal address for proteins earmarked for lysosomes is

(a) mannose 6-phosphate

(b) KDEL

(c) signal peptide

(d) chitobiose

29. The maximum diversity in receptors is found in the case of

(a) nuclear receptors

(b) voltage gated ion channels

(c) GPCR

(d) tyrosine kinases

30. Photosystem II

(a) does not have a reaction centre

(b) is reduced by NADPH

(c) passes electrons to photosystem I

(d) has P_{700} at its reaction centre

31. Which of the following electron carriers in the respiratory chain is a protein-bound prosthetic group?

(a) Coenzyme Q

(b) Ubiquinone

(c) Cytochrome C

(d) Both (a) and (b)

32. Which of the following does not take place in the 5′ to 3′ direction?

(a) DNA replication

(b) Transcription

(c) Nick translation

(d) RNA editing

33. In the Meselson-Stahl DNA replication experiment, what percent of the DNA was composed of one light strand and one heavy strand after one generation of growth in ^{14}N containing growth media?

(a) 0

(b) 25

(c) 50

(d) 100

34. In the classical model of transcriptional control by Jacob and Monad, a repressor protein binds to a/an

(a) enhancer

(b) AUG sequence

(c) TATA box

(d) operator

35. DNA polymerase III is thought to add nucleotides

(a) to the 5′ end of the RNA primer

(b) to the 3′ end of the RNA primer

(c) in the place of the primer RNA after it is removed

(d) on the single-stranded templates without need for an RNA primer

36. Frederick Griffith accidentally discovered transformation when attempting to develop a vaccine for pneumonia. He injected mice with samples from S-strain (virulent) and/or R-strain (nonvirulent) pneumococci bacteria (*Streptococcus pneumoniae*). Which of the following results is not consistent with Griffith's experiments?

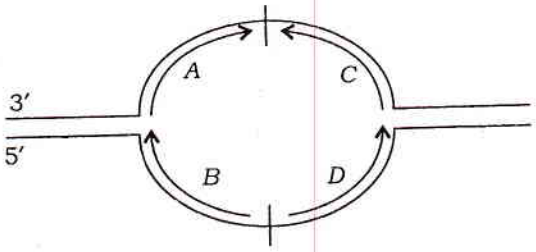
(a) Injected S-strain; mouse dies

(b) Injected R-strain; mouse lives

(c) Injected heat-killed S-strain; mouse lives

(d) Injected mixture of heat-killed S-strain and live R-strain; mouse lives

37. Which of the arrows in the diagram below best represents the direction of lagging strand DNA synthesis?



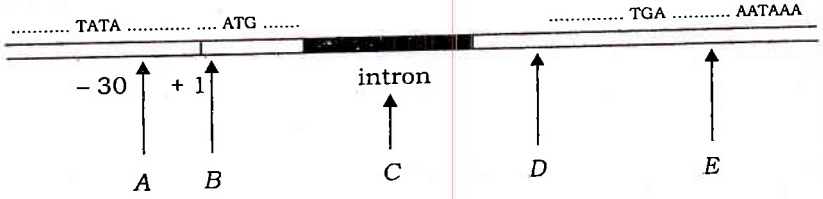
(a) A

(b) B

(c) C

(d) D

38. The diagram below depicts a eukaryotic gene. In which region would the insertion of a single base pair of DNA be most likely to cause a frameshift mutation?



(a) A

(b) B

(c) C

(d) D

39. What provides the energy that drives the addition of nucleotides to a growing DNA chain during replication?

(a) The release of a pyrophosphate

(b) The hydrolysis of ATP

(c) The hydrolysis of a pyrophosphate

(d) The hydrolysis of GTP

40. Termination of transcription by eukaryotic RNA polymerase II

(a) is triggered by a stop codon

(b) is catalyzed by poly A polymerase

(c) takes place precisely at the polyadenylation signal

(d) is triggered by a stem-loop structure in the RNA

41. Regarding transcription of eukaryotic genes by RNA polymerase II, enhancers are best characterized as

(a) DNA sequences to which transcriptional activators bind

(b) proteins that stimulate transcriptional initiation

(c) DNA sequences to which basal transcription factors bind

(d) proteins that inhibit transcriptional initiation

42. Transition state idea in chemical reactions led Linus Pauling to predict

(a) catalytic antibody

(b) ribozymes

(c) autoantibodies

(d) induced antibodies

43. Hapten-specific antibodies can be generated by

(a) using alum instead of FCA

(b) immunizing with hapten protein conjugate

(c) injecting horse instead of rabbit

(d) administering glucocorticoids along with the hapten

44. Which one of the following types of cells is known to be involved in the initial presentation of antigen to T-lymphocytes?

(a) Dendritic cells

(b) Plasma cells

(c) Neutrophil polymorphonuclear leucocytes

(d) Erythrocytes

45. Which one of the following types of cells produces IgE?

(a) Mast cells

(b) Eosinophils

(c) T-lymphocytes

(d) Plasma cells

46. The human immunodeficiency virus interacts with which one of the following cell-surface molecules to gain entry into cells of the immune system?

(a) CD4

(b) CD19

(c) CD40 ligand

(d) CD8

47. Pattern recognition receptors (PRR) include

(a) LPS

(b) PAMPs

(c) Lipoteichoic acid

(d) Lectin-like molecules

48. Complement component C3 is cleaved by

(a) C3b

(b) C3bBb

(c) factor B

(d) factor D

49. Which of the following cells are similar to macrophages?

(a) Langerhans cells

(b) Kupffer cells

(c) Epithelial cells

(d) Megakaryocytes

50. Propidium iodide would stain

(a) dead cells

(b) live cells

(c) erythrocytes

(d) platelets

51. Trypsin cleaves a protein predominantly at

(a) C-terminal to arginine residue

(b) N-terminal to arginine residue

(c) C-terminal to tyrosine residue

(d) N-terminal to tyrosine residue

52. Which of the following molecules have a triple helix structure?

(a) Immunoglobulin molecule

(b) MHC molecule

(c) Insulin molecule

(d) Collagen molecule

53. The weakest force is

(a) van der Waals

(b) covalent bond

(c) ionic bond

(d) hydrogen bond

54. UV causes sunburn but not IR, because of

(a) high energy

(b) low wave number

(c) low frequency

(d) high wavelength

55. A homo-pentameric protein of 125 kD is run on an SDS-PAGE, the size of the band obtained was

(a) 125 kD single band

(b) 50 kD single band

(c) 25 kD single band

(d) 75 kD band and 50 kD band

56. In isopycnic centrifugation, the particle separation is based on

(a) weight

(b) charge

(c) density

(d) size

57. In an alpha decay, the mass number of a radioactive atom

(a) increases by 4

(b) decreases by 2

(c) decreases by 4

(d) increases by 2

58. A student ordered for ^{14}C-labeled glucose and used it as a substrate for alcohol fermentation. However, there was absolutely no radioactivity found in the final ethanol product. Which carbon could possibly be labeled in the original substrate that was bought if the radioactivity was lost as CO_2?

(a) Labeled at C1 position

(b) Labeled at C2 position

(c) Labeled at C3 position

(d) Labeled at C6 position

59. In 2010, Felisa Wolfe-Simon identified Halomonadaceae bacterium thriving in the arsenic-rich saline Mono Lake in California ('a bacterium that can grow by using arsenic instead of phosphorus', Wolfe-Simon et. al., *Science*, 332 : 1163–1166. Note that later studies refuted claims that the bacteria thrived only on arsenic for growth—Reaves et. al., *Science*, 2012; Erb et. al., *Science*, 2012). What would be the net ATP synthesized by this bacterium through glycolysis (considering that the carbon source is glucose)?

(a) 0

(b) 2

(c) 4

(d) 30–32

60. Which of the following substrates would not be a source for substrate level phosphorylation?

(a) Phospho*enol*pyruvate

(b) 1,3-bisphosphoglycerate

(c) Phosphocreatine

(d) Fructose-1, 6-bisphosphate

61. Cassava roots also contain significant amounts of cyanogenic glucosides, which upon hydrolysis release hydrocyanic acid (HCN). It must therefore be properly prepared before consumption. Improper preparation can leave enough residual cyanide to cause acute poisoning. This poisoning is a result of

(a) lack of cyanide-resistant NADH oxidation pathway in African tribes

(b) Inhibition of electron transfer to the terminal electron acceptor

(c) Uncoupling of phosphorylation from electron transfer

(d) Inhibition of the F_0 subunit of the F_0F_1-ATPase

62. 2,4-dinitrophenol (DNP) and carbonylcyanide-*p*-trifluoromethoxyphenyl hydrazone (FCCP) are two chemicals that are very hydrophobic and act as proton ionosphores. In the mid-1930s, DNP was approved as a diet pill in the treatment of obesity and is still used by some athletes to lose body fat. (By 1938, however, it has been medically discontinued due to dangerous side effects including fatality). DNP acts as a weight-reducing agent by

(a) inhibiting the F_0-F_1 ATPase

(b) preventing electron transfer from Fe-S centre to ubiquinone

(c) uncoupling phosphorylation from electron transfer

(d) inhibition of ATP-ADP exchange

63. Lack of vitamin B1 (thiamine) in the human diet leads to a condition known as beriberi, characterized by edema, pain, paralysis and characteristic neurological symptoms such as loss of reflexes, anxiety and confusion. In the advanced stages there is also paralysis and ultimately death due to lactic acidosis. What makes the brain the most susceptible organ under B1-deficiency?

(a) B1 is needed in myelin biosynthesis

(b) B1 is used for synthesis of nucleotides in growing neurons

(c) B1 is an important precursor for acetylcholine synthesis

(d) B1 is an important cofactor for pyruvate dehydrogenase complex

64. A researcher treats a solution containing animal cells with ouabain, a substance that interferes with the Na^+ /K^+ pump embedded in the cell membrane, and causes cells to lyse. Treatment with ouabain results in

(a) high levels of extracellular Ca^{2+}

(b) high levels of extracellular K^+ and Na^+

(c) increased intracellular concentration of Na^+

(d) decreased intracellular concentration of Na^+

65. When $[S] = K_M$, the velocity of an enzyme-catalyzed reaction is about

(a) $0 \cdot 1 * V_{max}$

(b) $0 \cdot 2 * V_{max}$

(c) $0 \cdot 5 * V_{max}$

(d) $0 \cdot 9 * V_{max}$

66. Which of the following processes is likely to happen due to a low [ATP]/[AMP] ratio in the cell?

(a) Secretion of insulin by the pancreas

(b) Increased glucose uptake in skeletal muscle

(c) Fatty acid synthesis in the liver

(d) Reduced activity of AMP-activated protein kinase

67. During hypoglycemia, which of the following events is likely to happen in a liver hepatocyte?

(a) Activation of protein kinase A

(b) Dephosphorylation of pyruvate kinase

(c) Increased expression of GLUT2 transporters

(d) Cytosolic translocation of hexokinase IV

68. Adenoid is the disease in which

(a) spleen enlarges

(b) thymus enlarges

(c) nasal tonsil enlarges

(d) thyroid enlarges

69. The grey crescent of frog's embryo represents the future

(a) anterior side of the developing embryo

(b) posterior side of the developing embryo

(c) dorsal side of the developing embryo

(d) ventral side of the developing embryo

70. The fertilized egg in human female gets implanted in the uterus after

(a) two months of fertilization

(b) about one week of fertilization

(c) one month of fertilization

(d) three weeks of fertilization

71. The correct sequence in the formation of sprematozoa is

(a) spermatogonia → spermatids → spermatocytes → spermatozoa

(b) spermatids → spermatogonia → spermatocytes → spermatozoa

(c) spermatids → spermatogonia → primary spermatocytes → secondary spermatocytes → spermatozoa

(d) spermatogonia → primary spermatocytes → secondary spermatocytes → spermatids → spermatozoa

72. Life span of RBC in human blood circulation is

(a) 50 days

(b) 75 days

(c) 120 days

(d) 200 days

73. In determining the phenotype of ABO blood system

(a) O is dominant over A

(b) B is dominant over A

(c) O is recessive

(d) All of the above

74. The biological clock in higher vertebrates is regulated by the

(a) pituitary gland

(b) cerebral cortex

(c) suprachiasmatic nucleus in hypothalamus

(d) thymus

75. Which one of the following ecological pyramids can never be inverted?

(a) Pyramid of number

(b) Pyramid of size

(c) Pyramid of biomass

(d) Pyramid of energy

76. Wood consists of accumulated

(a) primary xylem

(b) phloem

(c) sclerenchyma

(d) secondary xylem

77. What is the chemical nature of *Bacillus thuringiensis* (Bt) toxin, gene for which is used for developing insect resistance GM crops?

(a) Oligopeptides

(b) Polypeptides

(c) Nucleic acids

(d) Lipopolysaccharides

78. In flowering plants, apomixis refers to

(a) sexual reproduction without the development of seeds

(b) asexual reproduction through seeds

(c) double fertilization

(d) dedifferentiation

79. Cell division in callus is promoted mainly by

(a) auxins

(b) gibberellins

(c) abscisic acids

(d) cytokinins

80. Maximum rate of photosynthesis will occur in the presence of

(a) white light

(b) red light

(c) blue light

(d) green light

81. What is the correct order for the following events in the interaction of a cell with a signal?

(1) Alteration of cell function
(2) signal binds to receptor
(3) signal released from source
(4) signal transduction

(a) 1–2–3–4

(b) 2–3–1–4

(c) 3–2–1–4

(d) 3–2–4–1

82. Why do some signals ('first messengers') trigger 'second messengers' to activate target cells?

(a) The first messenger requires activation by ATP

(b) The first messenger is not water soluble

(c) The first messenger binds to many types of cell

(d) The first messenger cannot cross the plasma membrane

83. Which of the following is not a consequence of a signal binding to a receptor?

(a) Activation of receptor enzyme activity

(b) Diffusion of the receptor in the plasma membrane

(c) Change in conformation of the receptor protein

(d) Breakdown of the receptor to amino acids

84. Which of the following is not a common type of receptor?

(a) Ion channel

(b) Protein kinase

(c) G protein-linked receptor

(d) Adenylyl cyclase

85. Which of the following is not a second messenger?

(a) Inositol trisphosphate

(b) ATP

(c) Cyclic AMP

(d) Diacylglycerol

86. All of the following are true about penicillin, except

(a) it was discovered by Alexander Fleming

(b) it was an accidental discovery

(c) it is produced by a bacterium

(d) it was the first antibiotic used by humans

87. Who among the following scientists first discovered the process of transformation?

(a) Frederick Griffith

(b) Robert Koch

(c) Edward Jenner

(d) Louis Pasteur

88. All of the proteins encoded by the genome, which are capable of expression in the cell, are known as

(a) Proteomes

(b) Chromosomes

(c) Proteases

(d) Genes

89. For SDS electrophoresis, proteins are coated with a reagent to give them a uniform —— charge so that their distance of migration depends on ——.

(a) positive; molecular weight

(b) negative; shape

(c) positive; shape

(d) negative; molecular size/mass

90. Which of the following forms of transport occurs only in eukaryotes?

(a) Facilitated diffusion

(b) ABC transport

(c) Endocytosis

(d) Group translocation

91. The pressure (psi-pounds per square inch) at the earth's surface is

(a) 0 psi

(b) 3 psi

(c) 15 psi

(d) 18 psi

92. The type of antimicrobial drug that would be least toxic to humans is a drug that

(a) inhibits cell wall synthesis

(b) disrupts the cytoplasmic membrane

(c) inhibits nucleic acid synthesis

(d) inhibits metabolic pathways

93. Which of the following define genes of common ancestry in two genomes that share the same function?

(a) Homologs

(b) Open reading frames

(c) Proteomes

(d) Orthologs

94. Most tRNA molecules begin with a 5′ —— and all end with a 3′ ——, to which the amino acids attach.

(a) phosphate; hydroxyl

(b) C; GGA

(c) G; CCA

(d) A; TTA

95. What occurs when an inducer is added to a medium containing an organism with a metabolic pathway controlled by a repressor?

(a) The inducer combines with the repressor and activates the repressor

(b) The inducer combines with the repressor and inactivates the repressor

(c) The inducer combines with the substrate and blocks induction

(d) The inducer combines with the substrate and activates induction

96. Screening food products for more than one pathogen at a time can be achieved by using

(a) real-time PCR with a forward and reverse primer pairs

(b) multiplex PCR with primer pairs targeting species-specific genes

(c) multiplex PCR with random hexamers as primers

(d) quantitative PCR with a universal forward/reverse primer pair

97. Which of the following kinds of ion gradient do extreme halophilic archaea exclusively utilize?

(a) Proton

(b) Sodium ion

(c) Potassium ion

(d) Calcium ion

98. Chemical indicators of life left in the geological fossil record are known as

(a) biosignatures

(b) Rubisco

(c) abiotic artifacts

(d) enzyme markers

99. Biofilms play a major role in enhancing bacterial virulence, because

(a) biofilm strains are mutants

(b) the exopolymer matrix is highly toxic and mutagenic

(c) biofilm bacteria are intracellular pathogens

(d) bacteria in biofilms are more resistant to antimicrobials and phagocytosis

100. If the frequency of males affected with a genetic disorder linked to X-chromosome in a population is 0·10, what will be the expected frequency of affected females?

(a) 0·001

(b) 0·1

(c) 0·01

(d) 0·02

101. Simple tandem repeat polymorphisms in humans are most useful for

(a) DNA fingerprinting

(b) reconstructing the relationships of humans and chimps

(c) transferring disease-resistance factors into bone marrow cells

(d) Not useful at all

102. A homeotic mutation is one which

(a) is present in only one form in an individual

(b) substitutes one body part for another in development

(c) results in development of a tumor

(d) is wild type at one temperature and abnormal at another

103. Positional cloning refers to

(a) cloning cDNA

(b) cloning a portion of a gene using PCR

(c) inserting a gene at a particular position in the plasmid

(d) mapping a gene to a chromosomal region and then cloning it from that region

104. Generation of antibody diversity in vertebrate animals takes place through

(a) the presence of as many genes in the germ line as there are types of antibodies possible

(b) infection with bacteria in B-cells

(c) polyploidy in antibody-forming cells

(d) rearrangement of DNA

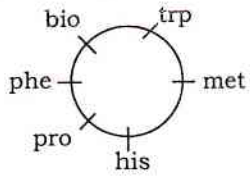
105. A gene mapping experiment was conducted in *E. coli* to map pro, his, bio, met, phe and trp genes using 3 different Hfr strains.

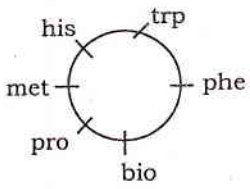
Strain 1 order of transfer (early to late): trp met his pro

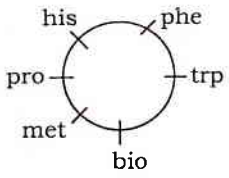
Strain 2 order of transfer (early to late): his met trp bio

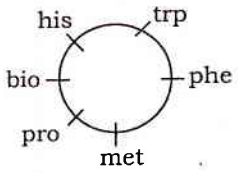
Strain 3 order of transfer (early to late): pro phe bio trp

Based on the results, what is the most likely map?

(a) 

(b) 

(c) 

(d) 

106. X-chromosome inactivation

(a) normally takes place in males but never in females

(b) takes place in humans so that the same X-chromosome is inactive in all of the cells of a female

(c) occurs in fruit flies but not in mammals

(d) results in random turning off one of the two X-chromosomes in female mammals

107. If a chiasma forms between the loci of genes A and B in 20% of the tetrads of an individual of genotype AB/ab, the percentage of gametes expected to be Ab is

(a) 40

(b) 20

(c) 10

(d) 5

108. Which of the following enzymes is required for the movement of most mobile DNA elements?

(a) Telomerase

(b) Reverse transcriptase

(c) Integrase

(d) Transposase

109. Which of the following histone proteins is involved in higher order folding of chromatin?

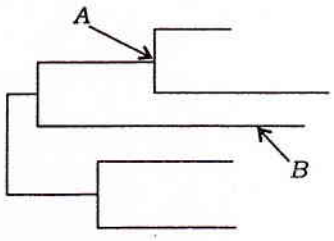
(a) H2A

(b) H1

(c) H2B

(d) H3

110. In the following dendrogram, what do *A* and *B* represent?



(a) *A* = branch; *B* = branch

(b) *A* = node; *B* = branch

(c) *A* = root; *B* = branch

(d) *A* = node; *B* = root

111. Which one of the following methods can be used for predicting protein secondary structure?

(a) Knowledge-based analyses

(b) Probabilistic analyses

(c) Machine-learning methods

(d) All of the above

112. In a mass spectrometer, the ions move according to their

(a) size

(b) charge

(c) molecular weight to length ratio

(d) mass to charge ratio

113. Anti-Stokes shift is defined as

(a) the scattered light has higher energy than the incident light

(b) the scattered light has lower energy than the incident light

(c) the scattered light has higher wavelength than the incident light

(d) the scattered light has the same wavelength as the incident light

114. Atomic emission spectroscopy is used to identify

(a) metals

(b) inert metals

(c) elements

(d) nonmetals

115. Paramagnetism is due to

(a) paired electrons

(b) unpaired electrons

(c) temperature

(d) metals having magnetic susceptibility of $-10^{-6}\ g^{-1}$

116. A 1 mCi source of ^{125}I gives a dose of $10\ mSvh^{-1}$ at 1 cm. What will be the dose rate at 5 cm?

(a) $2{\cdot}4\ mSvh^{-1}$

(b) $0{\cdot}2\ mSvh^{-1}$

(c) $0{\cdot}4\ mSvh^{-1}$

(d) $2\ mSvh^{-1}$

117. The energy of a photon of wavelength 350 nm is

(a) $5{\cdot}68 \times 10^{-19}$ J

(b) 568×10^{-19} J

(c) $32{\cdot}8 \times 10^{-19}$ J

(d) $4{\cdot}5 \times 10^{-19}$ J

118. Gibbs free energy of a spontaneous process

(a) is negative

(b) is positive

(c) is zero

(d) can be either negative or positive

119. The oxygen atom in a water molecule contains

(a) one lone pair of electrons

(b) two lone pairs of electrons

(c) no lone pair of electrons

(d) four lone pairs of electrons

120. Which of the following contains highest entropy?

(a) Liquid water

(b) Water vapour

(c) Snow

(d) Ice

★★★