अनुदेश

1. आपने हिंदी को माध्यम चुना है। इस परीक्षा पुस्तिका में एक सी पैटर्न (20 भाग 'A' में + 50 भाग 'B' + 75 भाग 'C' में) बहुल विकल्प प्रश्न (MCQ) दिए गए हैं। आपको भाग 'A' में से अधिकतम 15 और भाग 'B' में 35 प्रश्नों तथा भाग 'C' में से 25 प्रश्नों के उत्तर देने हैं। यदि निर्देशानुसार अधिक प्रश्नों के उत्तर दिए गए तो केवल भाग 'A' से 15, भाग 'B' से 35 तथा भाग 'C' से 25 पहले उत्तरों की जांच की जाएगी।
2. आप और आपके अवलोकन के अलग से दिया गया है। अपना शेल्फ नम्बर और केन्द्र का नाम लिखने से पहले यह जांच कीजिए कि पुस्तिका में पुष्ट पूरी तरह सही हैं तथा किसी से कैट-कैट नहीं हैं। यदि ऐसा नहीं है तो आप इनपुटलैटर से उसी कोड की पुस्तिका बदलने का निर्देशन कर सकते हैं। इसी तरह से आप उत्तर पत्र को भी जांच ले। इस पुस्तिका में एक काम करने के लिए अतिरिक्त पत्र संपत्ति है।
3. उत्तर पत्र के पुढ़े 1 में दिए गए स्थान पर अपना शेल्फ नम्बर, नाम तथा इस परीक्षा पुस्तिका का क्रमांक लिखें। साथ ही अपना नस्लाकार भी अवश्य करें।
4. आप अपनी और आपके उत्तर पत्र में शेल्फ नंबर, विद्या कोड, पुस्तिका कोड और केन्द्र कोड से संबंधित सम्मिलित वृत्ति को कारे बॉल पेन से अवश्य काला करें। यह एक भाग परीक्षार्थियों की जिम्मेदारी है कि वह और आप, उत्तर पत्र में दिए गए निर्देशों का पूरा साधन कर सकते हैं। ऐसे न करने पर कंप्यूटर विज्ञान की सही तरीकों से अनुभवित नहीं कर पाएगा, जिससे अंतर: आपको हानि, जिसमें आपकी और आपके उत्तर पत्र की अवश्यकता भी शामिल है, हो सकती है।
5. भाग 'A' तथा भाग 'B' में प्रश्न प्रकार के 2 अंक 'C' में प्रश्न प्रकार 4 अंक का है। प्रश्न गलत उत्तर का ज्ञानात्मक मुक्तियाँ 25% की दर से किया जाएगा।
6. प्रश्न के नीचे लिखा विकल्प दिए गए हैं। इनमें से केवल एक विकल्प ही "सही" अथवा "सबूतस्तम हल" हो। आपको प्रश्न के सही अथवा सबूतस्तम हल दूर करें।
7. निर्देशों का पूरा प्रश्न का प्रश्न करने के लिए एक खाता बनाए रखना जरूरी है।
8. परीक्षार्थियों को उत्तर या राख पत्रों के अतिरिक्त कहीं और कुछ भी नहीं लिखना चाहिए।
9. कंप्यूटरलैटर के उपयोग करने की अनुमति नहीं है।
10. परीक्षा के पहले पढ़ें विद्युत विकल्प स्थान से OMR उत्तर पत्र को विगतित करें। इनपुटलैटर को मूल OMR उत्तर पत्र सीडी के पत्र काटने आप इसकी कॉन्टिन्युस प्रतिशिर्प ले जा सकते है।
11. हिंदी माध्यम/संक्षेपण के प्रश्न में विलोकन होने/पाये जाने पर अधिकतम संक्षेपण प्रभावी होगा।
12. कंप्यूटर परीक्षा की पूरी अवधि तक बैठें और परीक्षार्थियों को ही परीक्षा पुस्तिका साथ ले जाने की अनुमति नहीं जारी की।
FOR ROUGH WORK
भाग 'PART 'A'

1. Two cockroaches of the same species have the same thickness but different lengths and widths. Their ability to survive in oxygen deficient environments will be compromised if
   1. their thickness increases, and the rest of the size remains the same.
   2. their thickness remains unchanged, but their length increases.
   3. their thickness remains unchanged, but their width decreases.
   4. their thickness decreases, but the rest of the size remains unchanged.

2. The bar chart shows number of seats won by four political parties in a state legislative assembly.

Which of the following pie-charts correctly depicts this information?

3. \( P \) तथा \( Q \) के मापन संबंधित यात्रिक अनुवादियों क़मशः 10% तथा 2% हैं। \( P/Q \) में प्रतिशत यात्रिक अनुवादिव कितनी है?
   1. 12.0  2. 9.8
   3. 8.0   4. 10.2

4. कितने गोचर तरीकों में शब्द CHANCE के अक्षरों को व्यवस्थित किया जा सकता है?
   1. 120  2. 720
   3. 360   4. 240
4. In how many distinguishable ways can the letters of the word CHANCE be arranged?
   1. 120   2. 720
   3. 360   4. 240

5. लापता प्रतिमान को जात कीजिये?
   
   5 7 2 3 6 9

   1. 2 14
   2. 7 2 14
   3. 7 4 2
   4. 14 2 7

6. बीजों को पानी में भिजाने पर उनके भार में 20% व आयतन में 10% की वृद्धि होती है। बीजों का घनत्व कितने गुणांक से बढ़ेगा?
   1. 1.20   2. 1.10
   3. 1.11   4. 1.09

7. Seeds when soaked in water gain about 20% by weight and 10% by volume. By what factor does the density increase?
   1. 1.20   2. 1.10
   3. 1.11   4. 1.09

8. किसी नदी का चौकाई 4.1 km है। इस नदी पर बने पुल की लंबाई का 1/7 भाग नदी के एक तट पर तथा 1/8 भाग नदी के दूसरे तट पर है। पुल की कुल लंबाई कितनी है?
   1. 5.1 km   2. 4.9 km
   3. 5.6 km   4. 5.4 km

9. A river is 4.1 km wide. A bridge built across it has 1/7 of its length on one bank and 1/8 of its length on the other bank. What is the total length of the bridge?
   1. 5.1 km   2. 4.9 km
   3. 5.6 km   4. 5.4 km

9. OA, OB, तथा OC उस वृत्त की त्रिज्यायें हैं जिसका एक चौकाई भाग दर्शाया गया है। AB का मान भी वृत्त की त्रिज्या के मान के समान है।
10. What is angle OCB?
   1. 60°  
   2. 75°  
   3. 55°  
   4. 65°

9. OA, OB, and OC are radii of the quarter circle shown in the figure. AB is also equal to the radius.

11. A hall with a high roof is supported by an array of identical columns such that, to a person lying on the floor and looking at the ceiling, the columns appear parallel to each other. Which of the following designs conforms to this?

12. Intravenous (IV) fluid has to be administered to a child of 12 kg with dehydration, at a dose of 20 mg of fluid per kg of body weight, in 1 hour. What should be the drip rate (in drops/min) of IV fluid? (1 mg = 20 drops)
   1. 7  
   2. 80  
   3. 120  
   4. 4

11. Which of the following graphs correctly shows the speed and the corresponding distance covered by an object moving along a straight line?
13. A normal TV screen has a width to height ratio of 4:3, while a high definition TV screen has a ratio of 16:9. What is the approximate ratio of their diagonals, if the heights of the two types of screens are the same?
1. 5:9
2. 5:18
3. 5:15
4. 5:6

14. Comparing numerical values, which of the following is different from the rest?
1. The ratio of the circumference of a circle to its diameter.
2. The sum of the three angles of a plane triangle expressed in radians.
3. 22/7.
4. The net volume of a hemisphere of unit radius, and a cone of unit radius and unit height.

15. A person travels $x\%$ faster than normal, he reaches $y$ minutes earlier than normal. What is his normal time of travel?
1. minutes
2. minutes
3. minutes
4. minutes
18. A man buys alcohol at Rs. 75/cL, adds water, and sells it at Rs.75/cL making a profit of 50%. What is the ratio of alcohol to water?
1. 2:1  
2. 1:2  
3. 3:2  
4. 2:3

19. The sum of digits of a two-digit number is 9. If the fraction formed by taking 9 less than the number as numerator and 9 more than the number as denominator is 3/4, what is the number?
1. 36  
2. 63  
3. 45  
4. 54

20. The distance between X and Y is 1000 km. A person flies from X at 8 AM local time and reaches Y at 10 AM local time. He flies back after a halt of 4 hours at Y and reaches X at 4 PM local time on the same day. What is his average speed for the duration he is in the air?
1. 500 km/hour  
2. 250 km/hour  
3. 750 km/hour  
4. cannot be calculated with the given information

21. RNA editing, a post-transcriptional process, is achieved with the help of guide RNA (g-RNA). Which one of the following statements about the process is NOT true?
1. g-RNA dependent RNA editing happens in the kinetoplast DNA  
2. g-RNA is involved in chemical modification of t-RNA  
3. This process involves insertion or deletion of uridines  
4. Sequences edited once may be re-edited using a second g-RNA

22. Telomerase, a RNA-protein complex which completes the replication of telomeres during DNA synthesis, is a specialised
1. RNA dependent DNA polymerase  
2. DNA dependent DNA polymerase  
3. DNA dependent RNA polymerase  
4. RNA dependent RNA polymerase
23. Consider a short double-stranded linear DNA molecule of 10 complete turns with 10.5 bp/turn. The ends of the DNA molecule are sealed together to make a relaxed circle. This relaxed circle will have a linking number of
1. 105
2. 20.5
3. 10.0
4. 10.5

In the above signalling cascade, which one of the following molecules is denoted by ‘B’?
1. STAT 5
2. SMAD 6
3. GSK3β
4. SMAD 4

25. In the above signalling cascade, which one of the following events will NOT usually lead to transformation of a normal cell into a cancer cell?
1. Gain of function of oncogenes
2. Loss of function of tumor suppressors
3. Gain of function of genes involved in nucleotide excision repair
4. Loss of function of pro-apoptosis related genes

27. Which one of the following is a food borne toxin?
1. Tetanus toxin
2. Botulinum toxin
3. Cholera toxin
4. Diptheria toxin
28. Excess oxygen consumed after a vigorous exercise is
1. to pump out lactic acid from muscle.
2. to increase the concentration of lactic acid in muscle.
3. to reduce dissolved carbon dioxide in blood.
4. to make ATP for gluconeogenesis.

29. Which one of the following describes the primary function of flippases?
1. Help in increasing lipid-protein interaction in the outer leaflet of the bilayer
2. Move certain phospholipids from one leaflet of the membrane to another
3. Localize more negatively charged membrane proteins in the lipid bilayer
4. Cause uncoupling of v-SNARES and t-SNARES after fusion of incoming vesicle with target membrane

30. Mitotic cyclin-CDK activity peaks in M phase. This is because
1. Mitotic cyclin is synthesised only in M phase.
2. Threshold level of mitotic cyclin accumulates only in late G2.
3. Cyclin subunit is activated by phosphorylation only in M phase.
4. The kinase subunit is activated by dephosphorylation only in M phase.

31. Choose the most appropriate pH at which the net charge is zero for the molecule from the data shown below:
1. 2.02
2. 2.91
3. 5.98
4. 6.87
32. Choose the correct statement about peptides in the Ramachandran plot.

1. Peptides that are unstructured will have all the backbone dihedral angles in the disallowed regions.
2. It is not possible to conclude whether a peptide adopts entirely helix or entirely beta sheet conformation.
3. The occurrence of beta turn conformation in a peptide can be deduced.
4. The sequence of a peptide can be deduced.

33. Equilibrium constant ($K_{eq}$) of a reaction is a ratio of product to substrate concentrations. The relation between ($K_{eq}$) and free energy change in a reaction ($\Delta G$) is as follows:

$$\Delta G = -RT \ln K_{eq}$$

34. The gel to liquid crystalline phase transition temperature in phosphatidyl choline (PC) lipids composed of dioleoyl (DO), dipalmitoyl (DP), distearyl (DS) and palmitoyl oleoyl (PO) fatty acids in increasing order will be

1. DOPC > DPPC > POPC > DSPC
2. DSPC > DPPC > POPC > DOPC
3. DPPC > DSPC > POPC > DOPC
4. POPC > DPPC > DOPC > DSPC

35. Which of the following is NOT an example of transmembrane transport between different subcellular compartments?

1. Transport from cytoplasm into the lumen of the endoplasmic reticulum
2. Transport from endoplasmic reticulum to the Golgi complex
3. Transport from stroma into thylakoid space
4. Transport from mitochondrial intermembrane space into the mitochondrial matrix
36. RNA polymerase II transcribes the following RNA types:
1. miRNA and some snRNA
2. miRNA and snoRNA
3. mRNA and snoRNA
4. tRNA and 5S rRNA

36. Which of the following are NOT transcribed by RNA polymerase II?
1. miRNA and some snRNA
2. miRNA and snoRNA
3. mRNA and snoRNA
4. tRNA and 5S rRNA

37. Apical ectodermal ridge induction is essential for tetrapod limb development. Which one of the following is NOT essential for the formation of a functional limb?
1. Tbx genes and Wnt
2. Androsterone
3. Apoptotic genes
4. Fibroblast growth factor

38. Which one of the following statements is WRONG?
1. The megasporocyte develops within the megasporangium of the ovule
2. Megasporocyte undergoes meiosis to produce four haploid megaspores
3. All the four megaspores undergo several mitotic divisions to form female gametophyte in most angiosperms
4. Female gametophyte is haploid

39. Which of the following proteins or mRNAs that are regionally localized within the unfertilized egg and regulate development are called:
1. gene regulators.
2. morphometric determinants.
3. cytoplasmic determinants.
4. mosaic forming factors.

40. Cell to cell communication is important in development of an organism. The ability of cells to respond to a specific inductive signal is called:
1. Regional specificity of induction
2. Competence
3. Juxtracrine signalling
4. Instructive interaction

41. Which one of the following statements is correct?
1. The megasporocyte develops within the megasporangium of the ovule
2. Megasporocyte undergoes meiosis to produce four haploid megaspores
3. All the four megaspores undergo several mitotic divisions to form female gametophyte in most angiosperms
4. Female gametophyte is haploid
41. Which one of the following compounds is NOT a part of alkaloid class of secondary metabolites?
1. Lignin
2. Indole
3. Tropane
4. Pyrrolidine

42. किसी पादप मूल के बाह्यत्वचा से अंतस्तवचा तक जल प्राप्त करने के संयुक्त पथ का निम्न में से कौन-सा श्रेणित वर्गण करता है?
1. जल किसी जिल्ली को पार करने वाले कोशिका मिश्रितियों तथा बाह्यकोशिका स्थानों में गतिशील होता है।
2. जल मूल वन्दु के आर-पार जीवत्वतंत्र से होकर गाढ़ा करता है।
3. जल अपने पथ में हर कोशिका की प्लाज्मा जिल्ली को दो बार पार करता है, एक बार अंदर आते हुये तथा एक बार बाहर जाते हुए।
4. टोनोप्लस्ट के आर-पार परिवर्तन।

43. शक्तिनाशी डाईक्लोरोफीनाइलडाईमीथियल्यूरिया है इसका संदर्भक:
1. ऐसोमेरिक एमिलों अर्थसे के जैवसंश्लेषण के लिए शिकिमेट पथ
2. P680 से P700 तक इलेक्ट्रॉन परिवर्तन
3. शाखित शूरुआत एमिलों अर्थसे पथ
4. P700 से फेरोआक्सन तक इलेक्ट्रॉन परिवर्तन

43. The herbicide, dichlorophenyldimethylurea, is an inhibitor of
1. shikimate pathway for biosynthesis of aromatic amino acids.
2. electron transport from P680 to P700.
3. branched chain amino acid pathway.
4. electron transport from P700 to ferredoxin.

44. Vasopressin secretion does NOT increase with
1. exercise
2. an increase in extracellular fluid volume
3. standing
4. vomiting

45. दबायाहियों के उद्दीपन के कारण निम्न में से कौन-सा नहीं बढ़ा होता?
1. ब्रैडिकार्डिया किरण
2. अपरकार्डिया अवरक्षण
3. विस्फोटकण
4. वाहिका-संक्रमण

45. दबायाहियों के उद्दीपन के कारण निम्न में से कौन-सा नहीं पैदा होता?
1. ब्रैडिकार्डिया किरण
2. अपरकार्डिया अवरक्षण
3. विस्फोटकण
4. वाहिका-संक्रमण

46. Serum has essentially the same composition as plasma EXCEPT that it lacks
1. Albumin
2. Stuart-Prower factor
3. Antihemophilic factor
4. Hageman factor

47. जड़रूपी में स्थित कौशिकाओं का कौन-सा प्रकार, हिस्टामिन के मुक्तन के लिए उत्तरदायी है?
1. शेल्धेम कंट कौशिकायें
2. एंटरोब्रोमायलज़ीटीसी कौशिकायें
3. मुस्कुब जलिशिायें
4. मिशिलज्ञ कौशिकायें
47. Which type of cells located in gastric glands is responsible for the release of histamine?
1. Mucous neck cells
2. Enterochromaffin-like cells
3. Chief cells
4. Parietal cells

48. Which one of the following plant derived signalling molecule induces hyphal branching of arbuscular mycorrhizal fungi, a phenomenon that is observed at the initial stages of colonization by these fungi?
1. Salicylic acid
2. Abscisic acid
3. Strigolactones
4. Systemin

49. If non-disjunction occurs in meiosis I, which of the following scenario is most likely to occur?
1. Two gametes will be n+1 and two will be n-1
2. One gamete will be n+1, two will be ‘n’ and one will be n-1
3. Two gametes will be normal and two will be n-1
4. Two gametes will be normal and two will be n+1

50. Which of the following is true for cells harbouring F’ plasmid?
1. Their F plasmid is non-functional.
2. They exhibit increased rates of transfer of all chromosomal genes.
3. They are merodiploids.
4. They fail to survive as the chromosomal origin of replication is inactivated.

51. Which mutagen is most likely to result in a single amino acid change in a gene product?
1. Ethidium bromide
2. Ethylmethane sulphonate (EMS)
3. Acridine orange
4. Ethidium bromide

52. Which of the following mutagens is most likely to result in a single amino acid change in a gene product?
1. Acridine orange
2. X-rays
3. Ethylmethane sulphonate (EMS)
4. Ethidium bromide

53. The following conditions have been observed in snail Limnaea peregra. Which one of the following scenarios is most likely to occur?
1. A female F1 progeny of dextral (D) and sinistral coiling depends on dominant allele D.
2. A female F1 progeny of sinistral (d) and dextral coiling depends upon recessive allele d.

54. Maternal inheritance of coiling of shell in snail Limnaea peregra is well established. The dextral coiling depends on dominant allele D and sinistral coiling depends upon recessive allele d. A female F1 progeny of dextral (D) type is crossed with a male sinistral snail. What will be the ratio of heterozygous: homozygous individuals in its F2 progeny?
1. 3:1
2. 1:1
3. 1:3
4. 1:2:1
1. Parental care and clutch size are positively correlated.

2. Animals maturing early tend to live longer.

3. An increase in seed size is usually associated with a decrease in seed number.

4. Allocation of higher energy for reproduction leads to higher population growth.

53. Which of the following statements supports the concept of trade-off in the evolution of life history traits?
1. Level of parental care and clutch size are positively correlated.
2. Animals maturing early tend to live longer.
3. An increase in seed size is usually associated with a decrease in seed number.
4. Allocation of higher energy for reproduction leads to higher population growth.

54. Which of the following is a correct ranking of ecosystems based on the root: shoot ratio of plants?
1. Tropical wet forest > Tropical dry forest > Temperate grassland > Tropical grassland
2. Temperate grassland > Tropical grassland > Tropical wet forest > Tropical dry forest
3. Tropical dry forest > Tropical wet forest > Tropical grassland > Temperate grassland
4. Temperate grassland > Tropical grassland > Tropical dry forest > Tropical wet forest

57. Which of the following is known as “Age of Fishes”?
1. Devonian
2. Jurassic
3. Cambrian
4. Carboniferous

58. Which of the following is NOT an assumption of the Hardy-Weinberg model?
1. Population mates at random with respect to the locus in question.
2. Selection is not acting on the locus in question.
3. One allele is dominant and the other is recessive at this locus.
4. The population is effectively infinite in size.
59. **Which of the following geological periods is characterized by the first appearance of mammals?**
1. Tertiary
2. Cretaceous
3. Permian
4. Triassic

60. **An alga having chlorophyll a, floridean starch as storage product and lacking flagellate cells belongs to the class**
1. Phaeophyceae.
2. Chlorophyceae.
3. Rhodophyceae.
4. Xanthophyceae.

61. **Which of the following is NOT true for monocots?**
1. Sieve tube members with companion cells
2. Vasculature atactostelic
3. Tricolpate pollen
4. Vascular cambium absent

62. **In which of the following mating systems there is likely to be NO conflict of interest over reproductive success between the sexes?**
1. Polyandry
2. Monogamy
3. Promiscuity
4. Polygamy

63. **Different leads are used to record ECG of humans. Which one of the following is NOT unipolar leads?**
1. Augmented limb leads
2. V1 and V2 leads
3. Standard limb leads
4. VR and VL leads

64. **The presence and distribution of specific mRNAs within a cell can be detected by**
1. Northern blot analysis
2. RNase protection assay
3. in situ hybridization
4. real-time PCR

65. **In which of the following mating systems is there likely to be NO conflict of interest over reproductive success between the sexes?**
1. Polyandry
2. Monogamy
3. Promiscuity
4. Polygamy
66. Which one of the following analytical techniques does NOT involve an optical measurement?
1. ELISA
2. Microarray
3. Flow cytometry
4. Differential Scanning Calorimetry

67. Which genes have been introduced in Bollgard II cotton to get resistance against cotton bollworm, tobacco budworm, and pink bollworm?
1. cry1Ab + cry1Ac
2. cry1Ac + cry2Ab
3. cry1Ab + cry2Ab
4. cry9C + cry2Ab

68. An optical measurement of a protein is taken before and after digestion of the protein by a protease. In which of the following spectroscopic measurements the signal change, i.e., before vs after protease treatment, could be the maximum?
1. Absorbance at 280 nm
2. Circular dichroism
3. Absorbance at 340 nm
4. Fluorescence value

69. The tetanus vaccine given to humans in the case of a deep cut is a
1. DNA vaccine
2. recombinant vector vaccine
3. subunit vaccine
4. toxoid vaccine

70. The electrospray ionization spectrum of a mixture of two peptides show peaks with m/z values 301, 401, 501, and 601. The molecular weights of the peptides are
1. 1200 and 1250
2. 1200 and 1500
3. 1350 and 1500
4. 1250 and 1350
71. From the following statements, pick the combination with ALL WRONG statements.

A. For a reaction to occur spontaneously the free energy change must be negative.
B. The interaction between two nitrogen molecules in the gaseous state is predominantly electrostatic.
C. By knowing bond energies, it is possible to deduce whether the bond is covalent bond or hydrogen bond.
D. Hydrophobic interactions are not important in a folded globular protein.

1. A and B
2. B and C
3. C and D
4. B and D

72. A researcher investigated a set of conditions for a protein with an isoelectric point of 6.5 and also binds to calcium. This protein was subjected to four independent treatments: (i) pH 6.4, (ii) 10% glycerol, (iii) 10 mM CaCl₂, (iv) 40% ammonium sulphate. This was followed by centrifugation and estimation of the protein in the supernatant. The results are depicted in the graph below.

Which of the following treatments best represents the results shown in the graph?

1. a = ammonium sulphate, b = glycerol, c = pH 6.4, d = CaCl₂
2. a = CaCl₂, b = glycerol, c = ammonium sulphate, d = pH 6.4
3. a = pH 6.4, b = CaCl₂, c = ammonium sulphate, d = glycerol
4. a = CaCl₂, b = pH 6.4, c = glycerol, d = ammonium sulphate
73. प्यूरीन के जैवसंश्लेषण में:

1. सभी N परमाणु, C4 तथा C5 एसपाटिक अम्ल से हैं।
2. N1 एसपाटिक अम्ल से है; N3 तथा N9 ग्लुटामीन पार्श्व शूकला से हैं; N7, C4 तथा C5 ग्लाइसीन से हैं।
3. N1 एसपाटिक अम्ल से है; N3 ग्लुटामीन पार्श्व शूकला से है; N9 ग्लुटामीन के C\(^{0}\) से संलग्न N से है; N7, C4 तथा C5 ग्लाइसीन से हैं।
4. N1 ग्लुटामीन से है; N3 ग्लुटामीन पार्श्व शूकला से है; N9 ग्लुटामीन के C\(^{0}\) से संलग्न N से है; N7, C4 तथा C5 ग्लाइसीन से हैं।

73. In the biosynthesis of purine:

1. All N atoms, C4 and C5 are from aspartic acid.
2. N1 is from Aspartic acid; N3 and N9 are from Glutamine side-chain; N7, C4 and C5 are from Glycine.
3. N1 is from Aspartic acid; N3 from Glutamine side-chain; N9 from N attached to C\(^{0}\) of Glutamine; N7, C4 and C5 are from Glycine.
4. N1 is from Glutamine; N3 from Glutamine side-chain; N9 from N attached to C\(^{0}\) of Glutamine; N7, C4 and C5 are from Glycine.

74. From the following statements, pick the combination with ALL correct statements.

A. Hydrogen, Deuterium and Tritium differ in the number of protons.
B. Hydrogen, Deuterium and Tritium differ in the number of neutrons.
C. Both Deuterium and Tritium are radioactive and decay to Hydrogen and Deuterium, respectively.
D. Tritium is radioactive and decays to Helium.
E. Carbon-14 decays to Nitrogen-14.
F. Carbon-14 decays to Carbon-13.

75. पेप्टाइड-प्रोटीन संरचना के बारे में निम्न चार कथन हैं:

A. \(\Omega\) तथा \(\Psi\) के समांतरण प्लाट में ग्लाइसीन के संरचना: अनुमान तथ्य का उच्चतम श्रेणी है।
B. N-सिरे पर ऐसिटिलरूप कर तथा C-सिरे पर अमाइडरूप एक A 20-अवशेष पेप्टाइड का \(\Omega = -60^\circ(\pm 5), \Psi = -30^\circ(\pm 5)\) सभी अवशेषों के लिए है। यह निर्देशन पर पहुँचा जा सकता है कि पेप्टाइड का संरचना कंडिलीन-कंडिलित-रजुक्ष है।
C. कल्पना पेप्टाइडों के लिए किसी प्रोटीन के अमिनो अम्लों के \(0, \Psi\) के अनुमान मान वैध नहीं है।
D. एक पेप्टाइड प्रस्तुत\(A_1-A_2-A_3-A_4-C\)-CONH\(_2\) (\(A_1-A_4\) एमिनो अम्ल है) एक सुपरिभाषित \(\beta\)-कुंडली अपनाता है। \(A_2\) तथा \(A_3\) के दबित कोण \(\beta\)-कुंडली के प्रकार को निर्धारित करते हैं।

सभी कथनों के संयोजन को चुने:

1. A तथा B
2. A तथा C
3. A तथा D
4. C तथा D
75. The following are four statements on peptide/protein conformation:
A. Glycine has the largest area of conformationally allowed space in the Ramachandran plot of $\phi$ and $\psi$
B. A 20-residue peptide that is acetylated at the N-terminus and amidated at the C-terminus has $\phi = -60^\circ(\pm 5), \psi = -30^\circ(\pm 5)$ for all the residues. It can be concluded that conformation of the peptide is helix-turn-strand
C. The allowed values of $\phi, \psi$ for amino acids in a protein are not valid for short peptides
D. A peptide Acetyl-A$_1$-A$_2$-A$_3$-A$_4$-CONH$_2$ (A$_1$-A$_4$ are amino acids) adopts a well-defined $\beta$-turn. The dihedral angles of A$_2$ and A$_3$ determine the type of $\beta$-turn

Choose the combination of correct statements.
1. A and B
2. B and C
3. A and D
4. C and D

76. A researcher was investigating the substrate specificity of two different enzymes, X and Y, on the same substrate. Both the enzymes were subjected to treatment with either heat or an inhibitor which inhibits the enzyme activity. Following are the results obtained where a=inhibitor treatment, b=heat treatment and c=control.

Which of the following statements is correct?
1. Only protein X is specific for the substrate, $S$
2. Only protein Y is specific for the substrate, $S$
3. Both X and Y are specific for the substrate, $S$
4. Both X and Y are non-specific for the substrate, $S$

77. हरितलवक प्रकार्य का संदर्भ ‘$A$’ है। ‘$A$’ के निम्नलिखित प्रदीपित हरितलवकों में \( O_2 \) का उत्पादन एवं ATP का संश्लेषण निम्न दर्शाये अनुसार मापा गया।

रिलेशन क-सा कथन सही है?
1. NADP$^+$ की अपचत्त को ‘$A$’ संदर्भित करता है।
2. NADP$^+$ की अपचत्त तथा प्रोटॉन प्रणाली को ‘$A$’ संदर्भित करता है।
3. प्रोटॉन प्रणाली को ‘$A$’ संदर्भित करता है NADP$^+$, अपचत्त को नहीं करता है।
4. न तो प्रोटॉन प्रणाली को, न तो NADP$^+$ अपचत्त को ‘$A$’ संदर्भित करता है।
Which statement is correct?
1. ‘A’ inhibits the reduction of NADP⁺
2. ‘A’ inhibits the proton gradient and the reduction of NADP⁺
3. ‘A’ inhibits the proton gradient but not the reduction of NADP⁺
4. ‘A’ inhibits neither the proton gradient nor the reduction of NADP⁺

78. G₁ to S phase progression is caused by D-CDK4, Rb to phosphorylate Rb and reduce its activity for E2F. E2F dissociates from Rb and activates S-phase gene expression. Overexpression of the protein ‘A’ arrests G₁ phase progression.

Which of the following statements is TRUE?
1. ‘A’ inhibits Rb-E2F interaction
2. ‘A’ inhibits CDK4 activity
3. ‘A’ phosphorylates E2F
4. ‘A’ degrades Rb

79. Cells in S-phase of the cell cycle were fused to cells in the following stages of cell cycle: (a) G₁ phase, (b) G₂ phase, (c) M phase. These cells were then grown in medium containing tritiated thymidine. Maximal amount of freshly labelled DNA is likely to be obtained in S-phase cells fused with
1. G₁ phase cells
2. G₂ phase cells
3. M phase cells
4. Both G₁ and G₂ phase cells

80. Addition of the antibiotic cephalaxin to growing E. coli cells lead to filamentation of the cells, followed by lysis. Cephalexin is an inhibitor of
1. protein synthesis
2. DNA synthesis
3. peptidoglycan synthesis
4. RNA polymerase

81. Add the fluorescently tagged protein to study protein secretion in yeast. Fluorescence was observed in:
(a) Golgi
(b) secretory vesicles
(c) the rough ER.

Which of the following describes best the sequence in which these events occur?
1. (a) → (b) → (c)
2. (b) → (c) → (a)
3. (c) → (a) → (b)
4. (c) → (b) → (a)
82. यह सुनिश्चित करने के लिए कि मात्र पूर्णत: संसाधित परिपक्व mRNAs साइटोलॉजी तक निर्यात होने अनुमति हैं, snRNPs के साथ संयोग प्रे-mRNAs केंद्र में सुरक्षित रखे जाते हैं। इसे सिद्ध करने के लिए, एक प्रयोग किया गया जिसमें एक pre-mRNA को केंद्रित करने वाले एक जीव को, जिसका मात्र एक इंट्रन है, या तो 5' या 3' समावेश बदलों पर या दोनों समावेश बदलों पर उत्पादित किया गया।

कुछ संभाव्य परिणाम निम्नलिखित हैं:
A. बंधित snRNPs की उपस्थिति के कारण दोनों समावेश बदलों पर उत्पादित Pre-mRNA केंद्र में सुरक्षित रखे जाएंगे।
B. बंधित snRNPs की अनुपस्थिति के कारण दोनों समावेश बदलों पर उत्पादित Pre-mRNA साइटोलॉजी तक नियंत्रित किये जाएंगे।
C. बंधित snRNPs की उपस्थिति के कारण 3' या 5' समावेश बदलों पर उत्पादित Pre-mRNA केंद्र में सुरक्षित रखे जाएंगे।
D. बंधित snRNPs की अनुपस्थिति के कारण 3' या 5' समावेश बदलों पर उत्पादित Pre-mRNA साइटोलॉजी तक नियंत्रित किये जाएंगे।

संभाव्य परिणामों के सही संयोजन को युक्ति:
1. B तथा C
2. A तथा D
3. B तथा D
4. A तथा C

82. In order to ensure that only fully processed mature mRNAs are allowed to be exported to cytosol, pre-mRNAs associated with snRNPs are retained in the nucleus. To demonstrate this, an experiment was performed where a gene coding a pre-mRNA with a single intron was mutated either at the 5' or 3' splice sites or both the splice sites.

Given below are a few possible outcomes:
A. Pre-mRNA having mutation at both the splice sites will be retained in the nucleus because of the presence of bound snRNPs.
B. Pre-mRNA having mutation at both the splice sites will be exported to cytosol because of the absence of bound snRNPs.
C. Pre-mRNA mutated at either 3' or 5' splice sites will be retained in the nucleus because of the presence of bound snRNPs.
D. Pre-mRNA mutated at either 3' or 5' splice sites will be exported to cytosol because of the absence of bound snRNPs.

Choose the correct combination of the possible outcomes:
1. B and C
2. A and D
3. B and D
4. A and C

83. टेलोमेरेज़, एक प्रोटीन-RNA संयुक्त, की एक विशिष्ट उल्कक टेलोमेरेज़ गतिविधि है जो DNA संस्थाशीलता के दौरान अंत:स्रोतों के प्रतिकृति क्रिया को संपूर्ण करती है। यद्यपि उसके कई गुणधर्म DNA पॉलिमरेज़ के सन्दर्भ हैं, कुछ भिन्न हैं। टेलोमेरेज़ के भिन्न गुणधर्म में से कोई-सा DNA पॉलिमरेज़ के गुणधर्म से भिन्न है?
1. न्यूक्लियोटाइडों के योजन को भारद्वाज्य करने के लिए टेलोमेरेज़ को एक दासा चाहिए।
2. टेलोमेरेज़ DNA के मात्र एक 3'-OH सिरे को विस्तारित कर सकता है।
3. टेलोमेरेज़ चक्र रजुक संस्थाशीलता नहीं करता।
4. टेलोमेरेज़ एक प्रक्रियात्मक तरीके में काम करता है।

83. Telomerase, a protein-RNA complex, has a special reverse transcriptase activity that completes replication of telomeres during DNA synthesis. Although it has many properties similar to DNA polymerase, some of them are also different. Which one of the following properties of telomerase is different from that of DNA polymerase?
1. Telomerase requires a template to direct the addition of nucleotides
2. Telomerase can only extend a 3'-OH end of DNA
3. Telomerase does not carry out lagging strand synthesis
4. Telomerase acts in a processive manner

84. सुकु द्रक्कियों में, प्रतिकृति के प्रारंभिक हेंटु भारत हेलिक्स को क्रियान्वित करने एक विशिष्ट साइटोलॉजी मिनर टेलोमेर (CDK) गतिविधि की आवश्यकता है। इसके विपरीत यह CDK गतिविधि प्रतिकृति क्रिया ने मूलस्रोत पर हेलिक्स के संक्रमण को संदर्भित करता है। इस वस्तुतत्त्व के बिखराव के लिए हेलिक्स के पास एक ही मॉक है तथा इस भारत हेलिक्स को क्रियान्वित होने के लिए मात्र एक मॉक है, जिन्म आलेखों में से कोई-सा कोशिका चक्र के G1 तथा S अवस्थाओं में इस CDK गतिविधि को स्पष्टतम संभालता है?
84. In eukaryotes, a specific cyclin dependent kinase (CDK) activity is required for the activation of loaded helicases to initiate replication. On the contrary, this CDK activity inhibits the loading of helicases onto the origin of replication. Considering the fact that during each cycle, there is only one opportunity for helicases to be loaded onto origins and only one opportunity for these loaded helicases to be activated, which one of the following graphs best depicts this CDK activity in G₁ and S phases of the cell cycle?

85. Polysome profiling of cells treated with three hypothetical translation inhibitors is shown in the plots below. These three inhibitors are
(i) CHP – leaky inhibitor of translation
(ii) LTM – arrests ribosome at the initiation codon
(iii) PTM – inhibits ribosome scanning

Match the polysome profile to the inhibitor
1. (i) – a; (ii) – b; (iii) – c
2. (i) – b; (ii) – c; (iii) – a
3. (i) – c; (ii) – b; (iii) – a
4. (i) – a; (ii) – c; (iii) – b
86. In mammals, CG rich sequences are usually methylated at C, which is a way for marking genes for silencing. Although the promoters of housekeeping genes are often associated with CpG islands yet they are expressed in mammals. Which one of the following best explains it?

1. Methylation of cytosine does not prevent the binding of RNA Pol II with the promoter, so housekeeping genes are expressed
2. During housekeeping gene expression, the enzyme methyltransferase is temporaril silenced by miRNA, thus shutting down global methylation
3. Unlike within the coding region of a gene, CG rich sequences present in the promoters of active genes are usually not methylated
4. As soon as the cytosine is methylated in the promoter region, the enzymes of DNA repair pathways remove the methyl group, thereby ensuring gene expression

87. In an experiment, red blood cells were subjected to lysis and any unbroken cells were removed by centrifugation at 600g. The supernatant was taken and centrifuged at 100,000g. The pellet was extracted with 5M NaCl and again centrifuged at 100,000g. Which of the following proteins would be present in the supernatant?

1. Band 3
2. Glycophorin
3. G protein-coupled receptor
4. Spectrin

88. A protein 'A' of the actin-based cell locomotion is a protein which

1. Is not affected by bafilomycin A.
2. Is targeted to lysosomes by GTP binding with LC3 puncta.
3. Localizes with LAMP1. Instead, it co-localizes with LAMP1.
4. Localizes with LC3 puncta. Which one of the following statements is TRUE?

1. A is targeted to the ER in the absence of GTP.
2. A-GFP localizes with LAMP1. Instead, it co-localizes with GTP.
3. A-GFP localizes with LC3 puncta.

88. In order to study the intracellular trafficking of protein 'A', it was tagged with GFP (A-GFP). Fluorescence microscopy showed that A-GFP co-localizes with LAMP1. In the presence of bafilomycin A, an inhibitor of H^+ATPase, A-GFP does not co-localize with LAMP1. Instead, it co-localizes with LC3 puncta. Which one of the following statements is TRUE?

1. A-GFP targets to the ER in the absence of bafilomycin A.
2. Autophagy is required for trafficking of A-GFP to lysosomes.
3. Bafilomycin A facilitates targeting of A-GFP to the ER.
4. Bafilomycin A facilitates targeting of A-GFP to the mitochondria.

89. In animals, four separate families of cell-cell adhesion proteins are listed in Column A and their functional characteristics are given in Column B.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Integrin (i)</td>
</tr>
<tr>
<td></td>
<td>Lectins that mediate a variety of transient, cell-cell adhesion interactions in the blood stream</td>
</tr>
<tr>
<td>b.</td>
<td>Cadherin (ii)</td>
</tr>
<tr>
<td></td>
<td>Contains extracellular Ig-like domains and are mainly involved in the</td>
</tr>
</tbody>
</table>

Which one of the following is the correct combination?
1. a – (i), b – (ii), c – (iii), d – (iv)
2. a – (ii), b – (iii), c – (iv), d – (i)
3. a – (iii), b – (iv), c – (i), d – (ii)
4. a – (iv), b – (iii), c – (ii), d – (i)

90. A student treated cancer cells with an anti-cancer drug and performed western blot analysis. Which one of the following blots is the best representation of untreated control (C) and treated (T) samples?
91. In Trypanosomes, a 35 base leader sequence is joined with several different transcripts making functional mRNAs. The leader sequence is joined with the other RNAs by:
1. a specific RNA ligase
2. the process of trans-splicing
3. a nucleophilic attack caused by a free guanine nucleotide
4. a nucleophilic attack caused by a 2'OH of an internal A present in the leader sequence

92. Following are the list of some of the pathogens (column A) and the unique mechanisms they employ for evading immune response (column B).

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. <em>Trypanosoma brucei</em> (i)</td>
<td>Capable of employing unusual genetic processes by which they generate extensive variations in their variant surface glycoproteins (VSG)</td>
</tr>
<tr>
<td>b. <em>Plasmodium falciparum</em> (ii)</td>
<td>Capable of continually undergoing maturational changes in transformation to different forms which allow the organism to change its surface molecules</td>
</tr>
<tr>
<td>c. <em>Haemophilus influenzae</em> (iii)</td>
<td>Capable of evading immune response by frequent antigenic changes in its hemagglutinin and neuraminidase glycoproteins</td>
</tr>
</tbody>
</table>

Which of the following is the correct match between the organisms and their respective mechanism to evade immune response?
1. a – (i), b – (ii), c – (iii)
2. a – (ii), b – (iii), c – (i)
3. a – (iii), b – (i), c – (ii)
4. a – (i), b – (iii), c – (ii)
93. Two steroid hormone receptors X and Y both contain a ligand binding domain and a DNA binding domain. Using recombinant DNA technology, a modified hybrid receptor H is prepared such that it contains the ligand binding domain of X and DNA binding domain of Y. Three sets of cells over-expressing receptors X, Y and H were then treated separately either with hormone X or with hormone Y. Assuming that there is no cross-reactivity, which one of the following graphs best represent the receptor-ligand binding in each case?

94. प्रोटीन Y के साथ संकुलित करके साइटोसॉल में एक प्रोटीन X को सजय अवस्था में रखा जाता है। किसी प्रतिभाल उत्तेजन के अधीन, Y फॉस्फोसेरिलित हो जाता है, तथा उसका प्रोटीनोसॉल अवकर्ष हो जाता है। X मुक्त हो जाता है, केंद्र में स्थानांतरित हो जाता है, तथा एपोप्टोसिस द्वारा कोशिका मृत्यु करनेवाले जीन केंद्र में हुई गई है। निम्न चार अलग विषयों में प्रतिभाळ उत्तेजन दिया गया:-

विषय A: प्रोटीन Y का एक उत्तरवर्ती है ताकि प्रोटीनोसॉल अवकर्ष पर से जाने वाला फॉस्फोसेरिलित हो।

विषय B: प्रोटीन Y को केंद्र तक स्थानांतरित होने को संदर्भित करते हुए एक प्रोटीन L को कोटित करने वाले एक जीन के साथ कोशिकाओं परसंक्रमण की जाती है।

विषय C: कोशिकाओं में एक रिक्ट वाहक, जो प्रोटीन L के लिए जीन को परसंक्रमण करने में काम आता है, के साथ परसंक्रमण की जाती है।

विषय D: कोशिकाओं को Z-VAD-FMK, जो एक विन्यूत स्पैक्ट्रम कैम्पस संदर्भक है, के साथ उपचारित किया जाता है।

निम्न आलेखों में से कौन-सा उपरोक्त विषयों में कोशिकाओं की एपोप्टोटिक स्थिति का श्रेणी वर्णन करता है? Y-अक्ष % एपोप्टोटिक कोशिकाओं का प्रतिनिधित्व करता है।
A protein X is kept in an inactive state in cytosol as complexed with protein Y. Under certain stress stimuli, Y gets phosphorylated resulting in its proteasomal degradation. X becomes free, translocates to nucleus and results in the transcription of a gene which causes cell death by apoptosis. Stress stimuli were given to following four different cases.

**Case A:** Protein Y has a mutation such that phosphorylation leading to proteasomal degradation does not occur.

**Case B:** Cells are transfected with a gene which encodes for a protein L that inhibits the translocation of protein Y to the nucleus.

**Case C:** Cells are transfected only with empty vector used to transfect the gene for protein L.

**Case D:** Cells are treated with Z-VAD-FMK, a broad spectrum caspase inhibitor.

Which one of the following graphs best describes the apoptotic state of the cells in the above cases? Y-axis represents % apoptotic cells.

---

95. Consider the following events which occur during fertilization of sea urchin eggs.

A. Resact/Speract are peptides released from the egg jelly and help in sperm attraction.

B. Bindin, an acrosomal protein, interacts in a species-specific manner, with eggs.

C. A “respiratory burst” occurs during cross-linking of the fertilization envelope, where a calcium-dependent increase in oxygen levels is observed.

D. IP₃, which is formed at the site of sperm entry, sequesters calcium leading to cortical granule exocytosis.

Which of the above statement(s) is NOT true?

1. Only C  
2. A and C  
3. Only D  
4. B and D
96. Following statements were given regarding the decisions taken during the development of mammalian embryos:
A. The pluripotency of the inner cell mass (ICM) is maintained by a core of three transcription factors, Oct 4, Sox 2 and Nanog.
B. Prior to blastocyst formation each blastomere expresses both Cdx 2 and the Oct 4 transcription factors and appears to be capable of becoming either ICM or trophoblast.
C. Both ICM and trophoblast cells synthesize transcription factor Cdx 2.
D. Oct 4 activates Cdx 2 expression enabling some cells to become trophoblast and other cells to become ICM.
Which of the above statements are true?
1. A and B
2. A and C
3. B and D
4. B and C

97. Apoptosis during early development is essential for proper formation of different structures. In *C. elegans*, apoptosis is accentuated by *ced-3* and *ced-4* genes, which in turn are negatively regulated by *ced-9* and eventually EGL-1. When compared to mammals, functionally similar homologues have been identified. Accordingly, which one of the following statements is NOT correct?
1. CED-4 resembles Apaf-1
2. CED-9 resembles Bcl-XL
3. CED-3 resembles caspase-3
4. CED-4 resembles caspase-9

98. B cell receptor (BCR) and T cell receptor (TCR) is membrane bound and does not appear as soluble form as does the BCR

Which one of the following statements regarding B cell receptor (BCR) and T cell receptor (TCR) is NOT true?
1. TCR is membrane bound and does not appear as soluble form as does the BCR
2. Unlike BCR, most of the TCR are not specific for antigen alone but for antigen combined with MHC
3. In order to activate signal transduction, BCR associates itself with Ig-α/Ig-β whereas TCR associates with CD3
4. The antigen binding interactions of BCR is much weaker than TCR
99. In case of amphibians, the dorsal lip cells and their derivatives are called as “Spemann-Mangold organizer”. Following statements related to the “organizer” were made:
A. It induces the host’s ventral tissues to change their fates to form a neural tube and dorsal mesodermal tissues.
B. It cannot organize the host and donor tissues into a secondary embryo.
C. It does not have the ability to self-differentiate into dorsal mesoderm.
D. It has the ability to initiate the movements of gastrulation.
E. Both β-catenin and Chordin are produced by the organizer.

Which of the above statements are correct?
1. A and D
2. D and E
3. A and E
4. B and C

100. Driesch performed the famous “pressure plate” experiment involving intricate recombination with an 8-celled sea urchin embryo. This procedure reshuffled the nuclei that normally would have been in the region destined to form endoderm into the presumptive ectoderm region. If segregation of nuclear determinants had occurred, the resulting embryo should have been disordered. However, Driesch obtained normal larvae from these embryos. The possible interpretations regarding the 8-celled sea urchin embryo are:
A. The prospective potency of an isolated blastomere is greater than its actual prospective fate.
B. The prospective potency and the prospective fate of the blastomere were identical.
C. Sea-urchin embryo is a “harmoniously equipotential system” because all of its potentially independent parts interacted together to form a single embryo.
D. Regulative development occurs where location of a cell in the embryo determines its fate.

Which of the above interpretation(s) is/are true?
1. Only A
2. Only D
3. Only A and B
4. A, C and D
101. Read the following statements related to plant-pathogen interaction
A. Systemic acquired resistance is observed following infection by compatible pathogen
B. Induced systemic resistance is activated following infection by compatible pathogen
C. A bacterial infection can induce effector triggered immunity (ETI) leading to hypersensitive response locally
D. NPR1 monomers that are released in cytosol due to salicylic acid accumulation is rapidly translocated to nucleus
Which combination of above statements is correct?
1. A, B and C
2. A, C and D
3. A, B and D
4. A, C and D

102. Given below are statements describing various features of solute transport and photoassimilate translocation in plants.
A. Apoplastic phloem loading of sucrose happens between cells with no plasmodesmatal connections
B. Growing vegetative sinks (e.g., young leaves and roots) usually undergo symplastic phloem unloading
C. Movement of water between the phloem and xylem occurs only at the source and sink regions
D. Symplastic loading of sugars into the phloem occurs in the absence of plasmodesmatal connections
Select the option that gives a combination of correct statements:
1. Only A and C
2. Only B and C
3. Only B and D
4. Only A and B

103. पादप-रोगजनक अनुस्मृत्तिवाद्य संस्थान से संबंधित निम्नलिखित कथनों को पढ़ें:
A. सुप्रभाव रोगजनक से संक्रमण के उपरांत अवश्यक तत्कालीन प्रतिरोध देखा जाता है।
B. सुप्रभाव रोगजनक से संक्रमण के उपरांत, प्रेषित तत्कालीन प्रतिरोध विश्वासित होता है।
C. जीवाणु संक्रमण, प्रभावी प्रवृत्ति प्रतिरक्षा (ETI) को प्रेषित कर सकता है, स्थानीय अधिसंचेकनीय अनुस्मृत्तिवाद्य पर से जाते हुये।
D. जीवाणु संक्रमण के उपरांत, अनुस्मृत्तिवाद्य के संस्थान प्रभावी होता है।
सही कथनों के एक संयोजन देखें-विकल्प को चुनें:
1. मात्र A तथा C
2. मात्र B तथा C
3. मात्र B तथा D
4. मात्र A तथा B

पादपहावानों के नाम स्तंभ I में तथा उनसे संगत पहलु/प्रभाव/प्रकार स्तंभ II में निम्न दिये गये हैं

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ऑक्सीन</td>
<td>(i) विलिदित वर्ण जोरपति</td>
</tr>
<tr>
<td>B</td>
<td>गिब्बरेऱ्लीनसू</td>
<td>(ii) पर्वान का अधकुंजीय नमन</td>
</tr>
<tr>
<td>C</td>
<td>साईटोकाइनसून</td>
<td>(iii) धुरीवी परिवर्तन</td>
</tr>
</tbody>
</table>
| D | एथिलीन | (iv) बीज प्रसुप्ति का अभाव द निम्न दिये गये विकल्पों से संयोजनों के सही सम्बन्धमय कौन चुनें?
1. A – (iii), B – (ii), C – (iv), D – (i)
2. A – (iv), B – (iii), C – (i), D – (ii)
3. A – (iii), B – (iv), C – (i), D – (ii)
4. A – (i), B – (iv), C – (iii), D – (ii)
103. Given below are names of phytohormones in column I and their associated features/effects/functions in column II.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Auxin</td>
</tr>
<tr>
<td>B</td>
<td>Gibberellins</td>
</tr>
<tr>
<td>C</td>
<td>Cytokinin</td>
</tr>
<tr>
<td>D</td>
<td>Ethylene</td>
</tr>
</tbody>
</table>

Select the correct set of combinations from the options given below:
1. A – (iii), B – (ii), C – (iv), D – (i)
2. A – (iv), B – (iii), C – (i), D – (ii)
3. A – (iii), B – (iv), C – (i), D – (ii)
4. A – (i), B – (iv), C – (iii), D – (ii)

104. यदि किसी रक्ताधान में A वर्ग का दाता रक्त, B वर्ग रक्त वाले ग्राही को दिया जाता है तो दाता रक्त की लाल रक्त कोशिकायं (RBCs) आस्थियष्ट होती हैं, परंतु ग्राही के RBCs न्यूनतम प्रभावित होंगी। ये प्रेक्षण निम्न कण्यां में व्याख्याय हो सकते हैं:
A. ग्राही के प्लाज्मा के अग्गलूदटतन, वर्ग A आश्लष्टणों के साथ वांधका आश्लष्टण कारणित करते हैं।
B. दाता रक्त के अग्गलूदटतन ग्राही की प्लाज्मा में तनुकिरित हुए, अथवा आश्लष्टण में परिवर्तित ।
C. ग्राही के RBCs के अपने आश्लष्टण का प्रति-A अग्गलूदटतनियों के अल्प अनुमाप कारण है।
D. दाता RBCs का उच्च आश्लष्टण प्रति-B अग्गलूदटतनियों के उच्च अनुमाप का परिणाम है।

उपरोक्त कण्यां में से कौन-से/से उपयुक्त मान्य हैं/है?
1. मात्र A
2. A तथा B
3. मात्र B
4. C तथा D

105. The arterial pressure usually rises and falls 4 to 6 mm Hg in a wave like manner causing “respiratory waves”. The probable mechanism of these waves has been proposed in the following statements:
A. The more negative intrathoracic pressure during inspiration reduces the quantity of blood returning to the left side of the heart causing decreased cardiac output.
B. The changes of intrathoracic pressure during respiration can excite vascular and atrial stretch receptors which affect heart and blood vessels.
C. The activity of medullary respiratory centres can influence the vasomotor centre.
D. The “respiratory waves” are outcome of the oscillation of the central nervous system ischemic pressure control mechanism.
Which of the above statement(s) is/are **NOT** appropriate?

1. Only A  
2. A and B  
3. B and C  
4. Only D

106. The uptake of nitrous oxide (N\textsubscript{2}O) and carbon monoxide (CO) in the blood of lung alveolar capillary relative to their partial pressure and the transit time of red blood cell in capillary is shown in the figure below:

![Diagram of N\textsubscript{2}O and CO uptake in the lung capillaries](image)

The reasons for difference in the pattern of alveolar gas exchange of N\textsubscript{2}O and CO have been proposed in the following statements:

A. N\textsubscript{2}O does not chemically combine with proteins in blood but equilibrates rapidly between alveolar gas and blood  
B. CO has high solubility in blood  
C. CO has high solubility in the alveolar capillary membrane  
D. The dispersion of N\textsubscript{2}O between alveolar gas and blood is considered as diffusion limited.

Which of the above statement(s) is/are **INCORRECT**?

1. Only A  
2. A and B  
3. Only C  
4. C and D

107. The expression of homoeotic genes in adjacent whorls of a flower determine the pattern of floral organ development. In an *Arabidopsis* mutant, floral organs are distributed as follows:

Whorl 1 (outer most) – carpel  
Whorl 2 – stamens  
Whorl 3 – stamens  
Whorl 4 (inner most) – carpel  

Loss of function mutation in which one of the following genes would have caused the above pattern of floral organ development?

1. *APETALA* 2  
2. *APETALA* 3  
3. *PISTILLATA*  
4. *AGAMOUS*

108. The expression of homoeotic genes in adjacent whorls of a flower determine the pattern of floral organ development. In an *Arabidopsis* mutant, floral organs are distributed as follows:

Whorl 1 (outer most) – carpel  
Whorl 2 – stamens  
Whorl 3 – stamens  
Whorl 4 (inner most) – carpel  

Loss of function mutation in which one of the following genes would have caused the above pattern of floral organ development?

A. P680 → PQ\textsubscript{A} → PQ\textsubscript{B} → Cytb\textsubscript{f} → Pheo → PC → P700  
B. P700 → A\textsubscript{1} → FeS\textsubscript{2} → FeS\textsubscript{A} → FeS\textsubscript{B} → Fd  
C. P680 → Pheo → PQ\textsubscript{A} → PQ\textsubscript{B} → Cytb\textsubscript{f} → PC → P700
D. P700 → A → A₀ → FeS₀ → FeSₐ → FeSₓ → Fd

निम्न संयोजनों में से कौन-सा सही है?
1. A तथा B
2. B तथा C
3. C तथा D
4. A तथा D

108. In photosynthetic electron transport, electrons travel through carriers organized in the “Z-scheme”. The following are indicated as directions of electron flow:
A. P₆₈₀ → PQₐ → PQₐ → Cytb₄ → Pheo → PC → P₇₀₀
B. P₇₀₀ → A₀ → A → FeSₓ → FeSₐ → FeS₀ → Fd
C. P₆₈₀ → PQₐ → PQₐ → Cytb₄ → PC → P₇₀₀
D. P₇₀₀ → A → A₀ → FeS₀ → FeSₐ → FeSₓ → Fd

Which one of the following combinations is correct?
1. A and B
2. B and C
3. A and D
4. A, C and D

109. A phytochrome-mediated control of photomorphogenesis is linked to many other gene functions. The following statements are made on the mechanism of phytochrome action:
A. Phytochrome function requires COP₁, an E₃ ubiquitin ligase that brings about protein degradation
B. COP₁ is slowly exported from the nucleus to the cytoplasm in the presence of light
C. HY₅ is targeted by COP₁ for degradation in the presence of light
D. HY₅ is a transcription factor involved in photomorphogenetic response

Which one of the following combinations is correct?
1. A, B and C
2. B, C and D
3. A, B and D
4. A, C and D

110. C₄ कोंबं एक CO₂ संदर्भ करता प्रक्रम है जो प्रकाशविरुद्ध कोष करने के लिए विकसित हुआ है। C₄ पादपों के कुछ महत्वपूर्ण पहलु निम्नलिखित कहते हैं:
A. C₄ पादपों के पर्यायी शारीर रखते हैं, जो पर्यायमध्ययोग तथा पूलाच्छद कोषिकाओं में भोजन करता है।
B. परिधीय पर्यायमध्ययोग कोषिकाओं में फोस्फोईडल पाईनोव्युट कोविक्सिलेस द्वारा वायुमंडलीय CO₂ स्थिरीकृत हो जाता है, एक चार कोंबं अगले दे है।
C. पर्यायमध्ययोग के आंतरिक पर्याय में चार कोंबं अगले को NAD-लेटिक अन्जाईम विज्ञानिक करने के लिए CO₂ को मुक्त करता है।
D. CO₂ फिर से पूलाच्छद कोषिकाओं में कैल्सिन चार द्वारा पुनःस्थिरीकृत होता है।

निम्न संयोजनों में से कौन-सा सही है?
1. B, C तथा D
2. A, B तथा C
3. A, B तथा D
4. A, C तथा D

110. The C₄ carbon cycle is a CO₂ concentrating mechanism evolved to reduce photorespiration. The following are stated as important features of the C₄ pathway:
A. The leaves of C₄ plants have Kranz anatomy that distinguishes mesophyll and bundle sheath cells.
B. In the peripheral mesophyll cells, atmospheric CO₂ is fixed by phosphoenol pyruvate carboxylase yielding a four-carbon acid.
C. In the inner layer of mesophyll, NAD-malic enzyme decarboxylates four-carbon acid and releases CO₂.
D. CO₂ is again re-fixed though Calvin cycle in the bundle sheath cells.

Which one of the following combinations is correct?
1. B, C and D
2. A, B and C
3. A, B and D
4. A, C and D
111. External pressure given on a mixed nerve causes loss of touch sensation while pain sensation remains relatively intact. On the other hand, application of local anaesthetics on the same nerve, induces loss of pain sensation keeping touch sensation least affected. These observations can be explained by the following statements:
A. External pressure causes loss of conduction of impulses in small diameter sensory nerve fibres
B. Local anaesthetics depress the conduction of impulses in large diameter sensory nerve fibres
C. Touch-induced impulses are carried by fibre type A
D. Fibre type C is responsible for pain sensation
Which of the above statement(s) is/are INCORRECT?

112. The probable effects of lesion of left optic tract on the vision of a human subject are given below. Identify the correct statement.
1. Blindness in the left eye but the visual field of right remains intact.
2. Blindness in the right half of the visual fields of both the eyes.
3. Blindness in the left half of the visual field of left eye and blindness in the right half of the visual field of right eye.
4. Blindness in the left half of the visual field of both the eyes.

113. Inversions are considered as cross-over suppressors because
1. Homozygous inversions are lethal and thus they do not appear in next generation
2. Inversion heterozygotes, i.e., one copy having normal chromosome and its homologue having inversion, does not allow crossing over to occur as they cannot pair at all
3. Due to inversion present, four chromosomes take part in the pairing and crossing over events and make the structure difficult for separation and gamete formation
4. The pairing and crossing overs do occur in inversion heterozygotes but the gametes having cross over products are lethal

114. The probable effects of lesion of left optic tract on the vision of a human subject are given below. Identify the correct statement.
1. Blindness in the left eye but the visual field of right remains intact.
2. Blindness in the right half of the visual fields of both the eyes.
3. Blindness in the left half of the visual field of left eye and blindness in the right half of the visual field of right eye.
4. Blindness in the left half of the visual field of both the eyes.
Three *E. coli* mutant strains were isolated. To study the nature of mutation these mutant strains were treated with mutagens EMS or proflavins and scored for revertants. The results obtained are summarized below:

<table>
<thead>
<tr>
<th>Mutant strain</th>
<th>EMS</th>
<th>Proflavin</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>B</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>C</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

(+ stands for revertants of the original mutants and – stands for no revertants obtained)

Based on the above and the typical mutagenic effects of EMS and proflavin, what was the nature of the original mutation in each strain?

1. A- Transversion  
   B- Insertion or deletion of a single base  
   C- Deletion of multiple bases
2. A- Transition  
   B- Insertion or deletion of a single base  
   C- Transversion
3. A- Insertion or deletion of a single base  
   B- Transition  
   C- Deletion of multiple bases
4. A- Transition  
   B- Insertion or deletion of multiple bases  
   C- Transversion

**115.** The following pedigree shows the inheritance pattern of a trait.

From the following select the possible mode of inheritance and the probability that the daughter in generation III will show the trait.

1. X-linked recessive, probability is 1/2
2. X-linked recessive, probability is 1/4
3. Autosomal recessive, probability is 1/2
4. Autosomal recessive, probability is 1/3

**116.** From the following select the possible mode of inheritance and the probability that the daughter in generation III will show the trait.

1. X-linked recessive, probability is 1/2
2. X-linked recessive, probability is 1/4
3. Autosomal recessive, probability is 1/2
4. Autosomal recessive, probability is 1/3
116. A pair of alleles govern seed size in a crop plant. ‘B’ allele responsible for bold seed is dominant over ‘b’ allele controlling small seed. An experiment was carried out to test if an identified dominant DNA marker (5kb band) is linked to alleles controlling seed size. A plant heterozygous for the marker and the alleles was crossed to a small seeded plant lacking the 5kb band. 100 progeny obtained from the cross were analysed for the presence and absence of the DNA marker. The results are tabulated below:

<table>
<thead>
<tr>
<th>Phenotype</th>
<th>Plant with bold seed</th>
<th>Plant with small seed</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of progeny showing presence or absence of DNA marker</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>22</td>
<td>23</td>
<td>27</td>
</tr>
</tbody>
</table>

Based on the above observations which one of the following conclusions is correct?
1. The DNA marker assorts independently of the phenotype
2. The 5kb band is linked to the allele ‘B’
3. The 5kb band is linked to the allele ‘b’
4. The DNA marker assorts independently with bold seed but is linked to the small seed trait

117. The following diagram represents steroidogenic pathway in the Zona Glomerulosa of the adrenal cortex:

What do A, B and C represent, respectively?
1. sER, Progesterone, 11(OH) cortisol
2. Mitochondria, Progesterone, Corticosterone
3. Mitochondria, 3β-Pregnenolone, 11(OH) Cortisone
4. sER, Progesterone, Corticosterone

What do A, B and C represent, respectively?
1. sER, Progesterone, 11(OH) cortisol
2. Mitochondria, Progesterone, Corticosterone
3. Mitochondria, 3β-Pregnenolone, 11(OH) Cortisone
4. sER, Progesterone, Corticosterone

118. निम्न योजना एक आम संदर्भ बिंदु से $T_4$ विभाजन के $rII$ विभाजन में लोपन (1-4) का प्रतिनिधित्व करती है:

Deletion 1
Deletion 2
Deletion 3
Deletion 4

(The bars represent the extent of deletion in each case)
वन्य प्रकार (rII") के पुनःसंयोजनियों को प्रदान करने का सामयिक (+) या असामयिक (-) के लिए चार बिंदु उपरिवर्तनों (a से d तक) का, चार लोपों के विस्तृत परीक्षण किया जाता है। परिणाम निम्न तत्वप्रकरण हैं।

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

उपररक्त के आधार पर बिंदु उपरिवर्तनों का पूर्वानुमानित क्रम है:
1. b-d-a-c
2. d-b-a-c
3. d-b-c-a
4. c-d-a-b

118. The following scheme represents deletions (1-4) in the rII locus of phage T4 from a common reference point:

Deletion 1
Deletion 2
Deletion 3
Deletion 4

(The bars represent the extent of deletion in each case)

Four point mutations (a to d) are tested against four deletions for their ability (+) or inability (-) to give wild type (rII") recombinants. The results are summarized below:

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

Based on the above the predicted order of the point mutations is
1. b-d-a-c
2. d-b-a-c
3. d-b-c-a
4. c-d-a-b

119. Following are the plots representing biological rhythms at different time points depicted as: SR = Sunrise; N = Noon; SS = Sunset; MN = Midnight

Which of the plot(s) represent the ultradian biological rhythm(s)?
1. Plot B
2. Plots A and C
3. Plots C and D
4. Plot D
1. A population of non-poisonous butterflies have the same colour pattern as some highly poisonous butterflies. Assume that the population of non-poisonous butterflies is higher than the population of poisonous butterflies. Given this, what will be the impact of this mimicry on the fitness of the population of the poisonous butterflies in the presence of the predator?
   1. It will lower the fitness, that is, fitness of the mimic is negatively frequency-dependent
   2. It will increase the fitness, that is, fitness of the mimic is positively frequency-dependent
   3. It will not affect the fitness, that is, fitness of the mimic is frequency independent
   4. It will increase the fitness, that is, fitness of the mimic is negatively frequency-dependent

121. Which of the above lineages represent the pattern of speciation by cladogenesis?
   1. Lineage 1
   2. Both the lineages 1 and 2
   3. Lineage 2
   4. Neither of the lineages 1 and 2

122. Given below is a graphical representation of changes in morphological features over a period of geological time scale, where population A accumulates heritable morphological changes and give rise to a distinct species B. Population B splits into a distinct species B₂.

Which of the above lineages represent the pattern of speciation by cladogenesis?
   1. Lineage 1
   2. Both the lineages 1 and 2
   3. Lineage 2
   4. Neither of the lineages 1 and 2

123. Red hair is a recessive trait in humans. In a randomly mating population in Hardy-Weinberg equilibrium, approximately 9% of individuals are red-haired. What is the frequency of heterozygotes?
   1. 81%
   2. 49%
   3. 42%
   4. 18%

124. Three Hfr plasmid of the Escherichia coli are used to infect a bacterial cell. Which strain of bacteria will receive the plasmid only after 2 minutes?

<table>
<thead>
<tr>
<th>Strain</th>
<th>Time of entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hfr #1</td>
<td>met (5')</td>
</tr>
<tr>
<td></td>
<td>thr (17')</td>
</tr>
<tr>
<td></td>
<td>str (25')</td>
</tr>
<tr>
<td></td>
<td>phe (30')</td>
</tr>
<tr>
<td></td>
<td>pro (45')</td>
</tr>
<tr>
<td>Hfr #2</td>
<td>str' (15')</td>
</tr>
<tr>
<td></td>
<td>pur (28')</td>
</tr>
<tr>
<td></td>
<td>pro (35')</td>
</tr>
<tr>
<td></td>
<td>his (45')</td>
</tr>
<tr>
<td></td>
<td>met (55')</td>
</tr>
<tr>
<td>Hfr #3</td>
<td>pro (2')</td>
</tr>
<tr>
<td></td>
<td>his (12')</td>
</tr>
<tr>
<td></td>
<td>met (22')</td>
</tr>
<tr>
<td></td>
<td>str' (42')</td>
</tr>
<tr>
<td></td>
<td>phe (47')</td>
</tr>
</tbody>
</table>
123. Interrupted mating experiments were performed using three different Hfr strains (1-3). The three strains have different combinations of selectable markers. The time of entry for markers for each strain is shown in the table below:

<table>
<thead>
<tr>
<th>Strain</th>
<th>Time of entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hfr #1</td>
<td>met (5’) thr (17’) str’ (25’) phe (30’) pro (45’)</td>
</tr>
<tr>
<td>Hfr #2</td>
<td>str’ (15’) pur (28’) pro (35’) his met (45’)</td>
</tr>
<tr>
<td>Hfr #3</td>
<td>pro (2’) his met (12’) str’ (22’) phe (42’)</td>
</tr>
</tbody>
</table>

Using the above data, predict the correct sequence of markers on the E. coli chromosome.
1. met-thr-str’-phe-pro-pur’-his
2. pur’-pro-his-met-thr-str’-phe
3. str’-pur’-his-met-phe-pro-str’
4. his-met-phe-thr-pro-str’t-pur’

124. Peripatus is an interesting living animal having unjointed legs, nephridia, haemocoel, trachea, dorsal tubular heart, claws, jaws, continuous muscle layers in body wall. This is considered as a connecting link between

1. Nematoda and Annelida: continuous muscle layers in body wall, unjointed legs and nephridia being nematode characters while haemocoel, trachea and dorsal tubular heart being annelid characters
2. Annelida and Arthropoda: unjointed legs and nephridia being annelid characters while claws, jaws, haemocoel, trachea and dorsal tubular heart being arthropod characters
3. Arthropoda and Mollusca: unjointed legs and nephridia being mollusca characters while claws, jaws, trachea and dorsal tubular heart being arthropod characters
4. Nematoda and Arthropoda: continuous muscle layers, unjointed legs and nephridia being nematode characters while claws, jaws, trachea and dorsal tubular heart being arthropod characters.

125. The following schematic diagram represents secondary growth in the angiosperms.

```
  A
 / \
B   C
 / \ / \ \
D   E   F
 /   /   /   \
G   H   I   J
```

125. उपरोक्त योजना के आधार पर A, B, C तथा D से संबंधित एंडोडोम और अंडरडोम के संबंधित उपरोक्त योजना के आधार पर A, B, C तथा D से संबंधित एंडोडोम और अंडरडोम के संबंधित उपरोक्त योजना के आधार पर A, B, C तथा D से संबंधित एंडोडोम और अंडरडोम के संबंधित उपरोक्त योजना के आधार पर A, B, C तथा D से संबंधित एंडोडोम और अंडरडोम के संबंधित उपरोक्त योजना के आधार पर A, B, C तथा D से संबंधित एंडोडोम और अंडरडोम के संबंधित उपरोक्त योजना के आधार पर A, B, C तथा D से संबंधित एंडोडोम और अंडरडोम के संबंधित उपरोक्त योजना के आधार पर A, B, C तथा D से संबंधित एंडोडोम और अंडरडोम के संबंधित
3. A – Cork, B – Inter-fascicular, C – Fascicular, D – Vascular
4. A – Cork, B – Fascicular, C – Inter-fascicular, D – Vascular

126. The table below lists the major fungal groups and their characteristics:

<table>
<thead>
<tr>
<th>Fungal Groups</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Ascomycota (i)</td>
</tr>
<tr>
<td>B</td>
<td>Chytrids (ii)</td>
</tr>
<tr>
<td>C</td>
<td>Glomeromycetes (iii)</td>
</tr>
<tr>
<td>D</td>
<td>Zygomycetes (iv)</td>
</tr>
</tbody>
</table>

Which one of the following options represents the appropriate match between the fungal group and their characteristics?

1. A – (ii), B – (iii), C – (i), D – (iv)
2. A – (iv), B – (ii), C – (iii), D – (i)
3. A – (i), B – (iv), C – (iii), D – (ii)
4. A – (ii), B – (iv), C – (iii), D – (i)

127. As a biologist, you want to classify three taxa, A, B and C. You have the information on three traits, p, q and r. The trait that is ancestral is counted ‘0’ and the trait that is derived is counted as ‘1’. The distribution of traits found in three taxa is given below

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>q</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>r</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Based on the above table, the following cladograms were drawn:
Based on trait distribution and the principle of parsimony, select the correct option.

1. Both ‘a’ and ‘b’ cladograms are possible
2. Only ‘b’ cladogram is possible
3. Only ‘c’ cladogram is possible
4. Only ‘a’ cladogram is possible

128. कुछ विकृति तथा मानव, प्राणी तथा पादपों के रोग निम्न दिये गये हैं।

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Bordetella pertussis</td>
<td>(i) मानव का लाइम रोग</td>
</tr>
<tr>
<td>B</td>
<td>Tilletia indica</td>
<td>(ii) ग्राम में अनाज सड़न</td>
</tr>
<tr>
<td>C</td>
<td>Borrelia burgdorferi</td>
<td>(iii) गेहूं का कर्नल बंग रोग</td>
</tr>
<tr>
<td>D</td>
<td>Anaplasma marginale</td>
<td>(iv) मानव में कूदर्कायांसी</td>
</tr>
<tr>
<td>E</td>
<td>Burkholderia glumae</td>
<td>(v) ग्राम-वैली में सोधिलतनी रक्तविद्यानता</td>
</tr>
</tbody>
</table>

128. Given below are some pathogens and diseases of humans, animals and plants.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Bordetella pertussis</td>
<td>(i) Lyme disease of humans</td>
</tr>
<tr>
<td>B</td>
<td>Tilletia indica</td>
<td>(ii) Grain rot in rice</td>
</tr>
<tr>
<td>C</td>
<td>Borrelia burgdorferi</td>
<td>(iii) Karnal bunt of wheat</td>
</tr>
<tr>
<td>D</td>
<td>Anaplasma marginale</td>
<td>(iv) Whooping cough in humans</td>
</tr>
<tr>
<td>E</td>
<td>Burkholderia glumae</td>
<td>(v) Hemolytic anemia in cattle</td>
</tr>
</tbody>
</table>

Which one of the following is the correct match between the pathogen and disease caused?

1. A – (iv), B – (iii), C – (i), D – (v), E – (ii)
2. A – (iv), B – (v), C – (i), D – (ii), E – (iii)
3. A – (iii), B – (iv), C – (v), D – (i), E – (ii)
4. A – (ii), B – (v), C – (i), D – (iii), E – (iv)

129. जीवन के तीन क्षेत्रों पर पड़नेवाले जीवों के बारे में निम्न कथन दिये गये हैं। गलत कथन को पहचानें:

1. जीवाणु तथा सुरक्षकों से अस्तरह, कुछ आधुन में दिलाप लघु शुरू में हाईड्रोकोर्निल अंतर्वितल करते हैं जो ईंधन संवीणन द्वारा निरस्तर अणुओं के साथ बोधित है।
2. पैटिडोग्लाइनस आधुनिक कोशिका भिन्नता में अनुपस्थित है।
3. प्रोटियोजीवाणु, सल्फर उपयोग करते हैं, जीवाणुक्लोरीफिल रखते प्रकोशलपोषियों की कई प्रजातियों को शामिल करते हैं।
4. माइक्रोजीवाणु, क्या ग्राम-वैली का एक समूह, ग्राम-वैली जीवाणु जिनकी कोशिका-भिन्नता नहीं है, उसी कुदू के संबंधित हैं, जैसे कि ग्राम-वैली माइक्रोजीवाणु।

129. Given below are statements pertaining to organisms belonging to three domains of life. Identify the INCORRECT statement.

1. Unlike Bacteria and Eukarya, some Archaeal membrane lipids contain long chain hydrocarbons connected to glycerol molecules by ether linkage.
2. Peptidoglycans are absent in the cell wall of Archaea.
3. Proteobacteria include many species of bacteriochlorophyll-containing, sulphur using photoautotrophs.
4. Mycoplasma, a group of low GC content, gram positive bacteria that lack cell wall, belong to the same family as the gram positive Mycobacteriaceae.

130. आप यह प्रश्न करते हैं कि नाकचिमटी की दो प्रजातियाँ, प्रजाति 1 तथा प्रजाति 2, अंतरजातियों शीलों की क्रमशः: उपरी तथा निचली परतों में निवास करती हैं। जब आपसे प्रजाति 2 निचली परत से निकाल दी जाती है, तभी प्रजाति 1 उपरी तथा निचली, दोनों परतों में निवास कर सकती है। इन
131. In a natural system, a species producing large numbers of offspring, with little or no parental care, generally exhibits which one of the following kind of survivorship curves?

![Graphs showing different survivorship curves]

1. Upper strata of the intertidal rock is the realized niche of species 1
2. Upper strata of the intertidal rock is the fundamental niche of species 1
3. Species 1 and species 2 exhibit mutualism
4. Species 1 can compete out species 2

132. Match the correct local names of temperate grasslands with their geographical range.

<table>
<thead>
<tr>
<th>Geographical range</th>
<th>Local name of the grassland</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Asia</td>
<td>A Pampas</td>
</tr>
<tr>
<td>(ii) North America</td>
<td>B Prairies</td>
</tr>
<tr>
<td>(iii) South America</td>
<td>C Steppes</td>
</tr>
<tr>
<td>(iv) South Africa</td>
<td>D Veldt</td>
</tr>
</tbody>
</table>

1. (i) – C, (ii) – B, (iii) – D, (iv) – A
2. (i) – C, (ii) – B, (iii) – A, (iv) – D
3. (i) – D, (ii) – B, (iii) – A, (iv) – C
4. (i) – B, (ii) – C, (iii) – A, (iv) – D
133. किसी प्रजाति के लिए परिकल्पित जीवन तालिका निम्नलिखित है:

<table>
<thead>
<tr>
<th>आयु वर्ग (x)</th>
<th>जीवितों की संख्या (n_x)</th>
<th>मरने वालों की संख्या (d_x)</th>
<th>आयु-विशिष्ट उत्तर-जीविता (l_x)</th>
<th>आयु-विशिष्ट जनन क्षमता (m_x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 5</td>
<td>100</td>
<td>50</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>5 – 10</td>
<td>50</td>
<td>10</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>10 – 15</td>
<td>10</td>
<td>0.2</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>15 – 20</td>
<td>10</td>
<td>0.2</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>20 – 25</td>
<td>10</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

निम्न में से कौन-सा सही शुद्ध प्रजनन गति है (R_o)?
1. 0.0
2. 0.3
3. 0.7
4. 1.5

133. निम्नलिखित में से आलेखीय प्रतितत्व बीच संभाव्य संबंधों की व्याख्या है?
(a) अतिरिक्तता, (b) कण्जीशिला, (c) कीलक, (d) विलक्षणतायी

134. किसी बिंदु-स्रोत से प्रदूषण को प्राप्त करती एक जल सरिता के विलिन औंक्सीजन (DO) तथा जैव औंक्सीजन मांग (BOD) में प्रवृत्तियों के लिए निम्न कथनों में से कौन-सा सही है?
1. किसी पूर्विक क्षेत्र में, DO तथा BOD दोनों के स्तर स्थायी रहते हैं।
2. किसी पून:प्राप्ति क्षेत्र में DO तथा BOD दोनों के स्तर तेजी से बढ़ते हैं।
3. किसी अपशांत क्षेत्र में DO स्तर तेजी से गिरता है, जबकि BOD स्तर लगभग स्थायी रहता है।
4. किसी पूर्विक क्षेत्र में DO स्तर घटता है तथा BOD स्तर वृद्धि होता है, जबकि किसी पून:प्राप्ति क्षेत्र में DO वृद्धि होता है तथा BOD घटता है।

134. निम्नलिखित में से आलेखीय प्रतितत्व बीच संभाव्य मेलान से कौन-सा है?
1. 0.0
2. 0.3
3. 0.7
4. 1.5

134. Which one of the following statements is true for the trends of Dissolved Oxygen (DO) and Biological Oxygen Demand (BOD) in a water stream receiving pollutants from a point source?
1. In septic zone, both DO and BOD levels remain stationary
2. In recovery zone, both DO and BOD levels increase rapidly
3. In decomposition zone, DO level drops rapidly, whereas BOD level remains more or less stable
4. In septic zone, DO level decreases and BOD level increases whereas in recovery zone DO increases and BOD decreases

135. निम्नलिखित में से आलेखीय प्रतितत्व बीच संभाव्य मेलान से कौन-सा है?
(a) अतिरिक्तता, (b) कण्जीशिला, (c) कीलक, (d) विलक्षणतायी

135. Following are the graphical representations of various hypotheses proposed for explaining the possible relationships between species richness (X-axis) and community services (Y-axis).
Which of the following options is the correct match between the graphical representations and the hypotheses?

1. (a) Redundancy, (b) Keystone, (c) Rivet, (d) Idiosyncratic
2. (a) Idiosyncratic, (b) Rivet, (c) Keystone, (d) Redundancy
3. (a) Rivet, (b) Redundancy, (c) Idiosyncratic, (d) Keystone
4. (a) Rivet, (b) Keystone, (c) Redundancy, (d) Idiosyncratic

136. A researcher is investigating structural changes in a protein by following tryptophan fluorescence and by circular dichroism (CD). Fluorescence and CD spectra of a pure protein were obtained in the absence of any treatment (a), in the presence of 0.5 M Urea (b), upon adding acrylamide, a quencher of tryptophan (c) and upon heating (d). The data are shown below:

Which one of the following combinations of proteins functions inside the plant cells?

137. Which of the following options is the correct match between the graphical representations and the hypotheses?
Which one of the following statements is correct?

1. CD is more sensitive to structural changes than fluorescence
2. Fluorescence is more sensitive to structural changes than CD
3. Both methods are equally responsive to structural changes
4. Acrylamide alters the secondary structure of the protein

138. Polynucleotide kinase (PNK) is frequently used for radiolabeling DNA or RNA by phosphorylating 5'-end of non-phosphorylated polynucleotide chains. Which of the following statement about PNK is NOT true?

1. PNK catalyzes the transfer of α-phosphate from ATP to 5'-end of polynucleotide chains (DNA or RNA).
2. PNK has 3'-phosphatase activity
3. PNK is inhibited by small amount of ammonium ions
4. PNK is a T4 bacteriophage-encoded enzyme

139. A gene encoding for protein X was cloned in an expression vector under the T7 RNA polymerase promoter and lac operator. Cells were induced by the addition of 1 mM IPTG at 37°C for 6 h. Cells were lysed and fractionated into insoluble bodies and cell-free supernatant by centrifugation. Protein X is present in the insoluble bodies. Which one of the following strategies would you use to express protein X in the soluble fraction (cell-free supernatant)?

1. Increase the duration of induction with 1mM IPTG
2. Grow cells at lower temperature after induction with 1 mM IPTG
3. Increase the concentration of IPTG
4. Grow cells at higher temperature after induction with 1 mM IPTG

140. Paudh prow उपप्रयोग , पाद्रीकी तनकी के उपयोग से, उपयोगक्षम साधन के सन्निकृतन तथा अतिरपत्रिभक्त दृष्टि आपातता का जा सकती है। पादों में एक जैवमार्गिक पथ का निष्क विस्तारकता करता है जहां एन्जाइमाइज़ एनजाइमाओं के एक अनुक्रम दुरारा एक पुरुषमार्ग अणु 'A' को उपाद 'T' तथा 'X' में बदला जाता है। इस पथ में एन्जाइमाइज़ 1-5 सम्हितकता है।

A gene encoding for protein X was cloned in an expression vector under the T7 RNA polymerase promoter and lac operator. Cells were induced by the addition of 1 mM IPTG at 37°C for 6 h. Cells were lysed and fractionated into insoluble bodies and cell-free supernatant by centrifugation. Protein X is present in the insoluble bodies. Which one of the following strategies would you use to express protein X in the soluble fraction (cell-free supernatant)?

1. Increase the duration of induction with 1mM IPTG
2. Grow cells at lower temperature after induction with 1 mM IPTG
3. Increase the concentration of IPTG
4. Grow cells at higher temperature after induction with 1 mM IPTG
Engineering of metabolic pathways in plants can be achieved by introduction and overexpression of appropriate candidate gene(s) using transgenic technology. The figure given below represents a biochemical pathway in plants where a precursor molecule 'A' is converted into products 'T' and 'X' through a series of enzymatic reactions. Enzymes 1-5 are involved in this pathway. Scientists attempted to increase the level of 'X' by introducing an additional copy of the gene for enzyme '5' under transcriptional control of a strong constitutive promoter. However, the developed transgenic plants did not display a proportionate increase in the level of 'X'.

The following statements were proposed for explaining the above results:
A. Enzyme '4' has greater affinity for D than enzyme '3'
B. Feedback inhibition of enzyme '5' by compound X
C. Substrate limitation for enzyme '5'

Which of the above statements could represent probable reasons for NOT obtaining a proportionate increase in the amount of X in the transgenic plants?
1. Only C
2. Only A and B
3. Only A
4. A, B and C

141. A single copy homozygous transgenic plant containing the transgene ‘A’ for fungal resistance was subsequently re-transformed with another gene ‘B’ for conferring resistance to salt-stress. The selection marker genes used for both the transformation experiments were different. Transgenic plants obtained following the re-transformation experiment were screened for salt-stress resistance and single copy events were identified by Southern hybridization. These single copy events were self-pollinated. In the event of the two T-DNAs (containing the A and B transgenes) getting integrated in unlinked locations in all the transgenic plants, the phenotypic ratios among the T₁ progeny would be:

1. 3 (Fungal resistant + Salt-stress resistant): 1 (Fungal resistant)
2. 1 (Fungal resistant): 2 (Fungal resistant + Salt-stress resistant): 1 (Salt-stress resistant)
3. 3 (Salt-stress resistant): 1 (Fungal resistant)
4. 1 (Fungal resistant): 1 (Salt-stress resistant): 1 (Fungal resistant + Salt stress resistant)
You are inserting a gene of 2kb length into a vector of 3kb to make a GST fusion protein. The gene is being inserted at the EcoRI site and the insert has a HindIII site 500bp downstream of the first codon. You are screening for the clone with the correct orientation by restriction digestion of the plasmid using HindIII plus BamHI (H+B) and HindIII plus PstI (H+P).

The map of the relevant region of the vector is shown below:

Which of the plasmids shown above represents the clone in the correct orientation?
1. A
2. B
3. C
4. D

The frequency of M-N blood types in a population of 6129 individuals is as follows:

<table>
<thead>
<tr>
<th>Blood type</th>
<th>Genotype</th>
<th>Number of individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>M^L M^N</td>
<td>1787</td>
</tr>
<tr>
<td>MN</td>
<td>M^L N^L^N</td>
<td>3039</td>
</tr>
<tr>
<td>N</td>
<td>N^L N^L^N</td>
<td>1303</td>
</tr>
</tbody>
</table>

The frequency of L^N allele in this population is
1. 0.4605
2. 0.2121
3. 0.5395
4. 0.2911
144. Mayfair genes (hypothetical) consist of a super family of transcription factors. They are found in 4 clusters in mammals; in 2 clusters in insects; and in a single cluster in an ancestor to insects. These data are consistent with all of the following explanations EXCEPT:
1. Two successive genome duplication events occurred between ancestral organism and vertebrates.
2. The first duplication may have taken place before divergence of vertebrates.
3. Exon shuffling exclusively produced such cluster.
4. Whole genome duplications could lead to such observations.

145. Fluorescence recovery after photobleaching (FRAP) is a method to estimate the diffusion of molecules in a membrane. Fluorescently labelled molecules such as
i. a receptor tagged with green fluorescent protein (GFP)
ii. a receptor labelled with GFP which interacts with cytoskeleton
iii. a labelled lipid
iv. a labelled protein that binds to the membrane surface
are photobleached and the recovery profiles (a-d) were obtained to estimate their diffusion coefficients.

The following data were obtained: