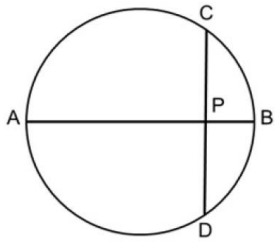
CSIR NET FEB 2022- MORING SHIFT

Section A

Q1. AB is the diameter of a circle. The chord CD is perpendicular to AB intersecting itat P. If CP = 2 and PB = 1, the radius of the circle is



(a) 1 (b) 2.5

(c) 2 (d) 5

Q2. A shopkeeper purchases a product for Rs.100and sells it making a profit of 10%. The customerresells it to the same shopkeeper incurring a loss of 10%. In these dealings the shopkeeper makes

(a) no profit, no loss (b) Rs. 11

(c) Rs. 1 (d) Rs. 20

Q3. The product of the perimeter of a triangle, the radius of its in-circle, and a number gives the area ofthe triangle. The number is

(a) 1/4 (b) 1/3

(c) ½ (d) 1

Q4. Starting from a point A you flyone mile south, then one mile east, then one mile north which bringsyou back to point A. Which of the following MUST be true?

(a) You are at the North pole

(b) You are in the Eastern hemisphere

(c) You are in the Western hemisphere

(d) You are at the South pole

Q5. Three boxes are coloured red,blue and green and so are three balls .In how many ways can one put the balls one in each box such that no ball goes into box of its own colour?

(a) 1 (b) 2 (c) 3 (d) 4

Q6. There are two buckets A and B. Initially A has 2 litres of water and B is empty. At every hour 1 litre of water is transferred from A to B followed by returning $\frac{1}{2}$ litre back to A from B half an hour later. The earliest A will get empty in:

(a) 5h (b) 4h

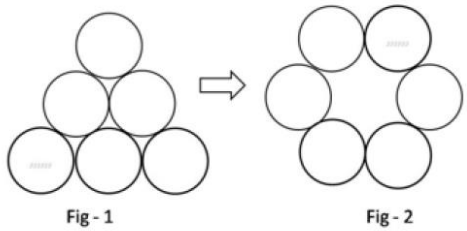
(c) 3h (d) 2h

Q7. Density of a rice grain is 1.5 g/cc and bulk density of rice heap is 0.80 g/cc. If a 1 litrecontainer is completely filled with rice, what will be the approximate volume of pore spacein the container?

(a) 350 cc (b) 465 cc

(d) 550 cc (d) 665 cc

Q8. What is the minimum number of moves required to transform figure 1 to figure 2? A move is defined as removing a coin and placing it such that it touches two other coins in its new position.



(a) 1 (b) 2

(c) 3 (d) 4

Q9. It takes 5 days for a steamboat to travel from A to B along a river. It takes 7days to return from B to A. How many days will it take for a raft to drift fromA to B (assuming all speeds are constant)?

(a) 13 (b) 35

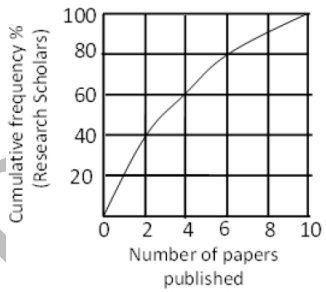
(c) 6 (d) 12

Q10. How many times starting at 1:00 pm would the minute and hour hands ofa clock make an angle of 40°with each other in the next 6 hours?

(a) 6 (b) 7

(c) 11 (d) 12

Q11.



The graph shows cumulative frequency percentage of research scholars and the number of papers published by them. Which of the following statements is true?

(a) Majority of the scholar published more than 4 papers

(b) 60% of the scholar published at least 2 papers

(c) 80% of the scholar published at least 6 papers

(d) 30% of the scholars have not published any paper

Q12. The random errors associated with the measurement of P and Q are 10%and 2%, respectively. What is the maximum percentage random error inP/Q?

(a) 12.0 (b) 9.8

(c) 8.0 (d) 10.2

Q13. If a person travels x% faster than normal, he reaches y minutes earlier than normal. What is his normal time of travel?

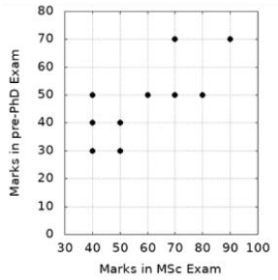
(a) $\left(\frac{100}{x}+1\right)y$ minutes

(b) $\left(\frac{x}{100}+1\right)y$ minutes

(c) $\left(\frac{y}{100}+1\right)y$ minutes

(d) $\left(\frac{100}{y}+1\right)y$ minutes

Q14.



Pre-Ph.D. exam score of 10 students are plotted against their M.Sc. marks. Which of the following is true?

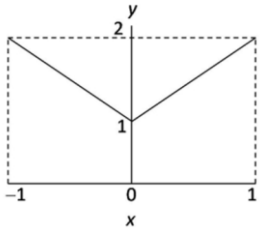
(a) Two students have scored better in Pre-Ph.D. than their M.Sc. exam

(b) All those students who scored 50 in Pre-D. scored more marks in their M.Sc. exam

(c) Two students scored the same marks in their Pre-Ph.D and M.Sc. exams

(d) The student who scored maximum in M.Sc. is the only student to get maximum in Pre-Ph.D. exam

Q15. What is the average value of y for the range of x shown in the following plot?



(a) 0 (b) 1

(c) 1.5 (d) 2

Q16. A fair die was thrown three times and the outcome was repeatedly six. If the die is thrown again what is the probability of getting six?

(a) 1/6 (b) 1/216

(c) 1/1296 (d) 1

Q17. What is the volume of soil in an open pit of size2m×2m× 10cm?

(a) 40 m^3 (b) 0.4 m^3

(c) 0 m^3 (d) 4.0 m^3

Q18. If a plant with green leaves is kept in a dark room with only green light on,which one of the following would we observe?

(a) The plant appears brighter than the surroundings

(b) The plant appears darker than the surroundings

(c) We cannot distinguish the plant from the surroundings

(d) It will have above normal photosynthetic activity

Q19. The distance from city P to city Q is 27 km. A and B start walking from Ptowards Q at speeds of 5 km/hr and 7 km/hr, respectively. B reaches Q,returns immediately, and meets A at R. What is the distance between P andR?(assume all three cities to be in one straight line)

(a) 12.5 km (b) 22.5 km

(c) 4.5 km (d) 13.5 km

Q20. A floor of size 13 × 24is to be paved using square tiles only. What is thesmallest number of tiles needed to do this?

(a) 6 (b) 15

(c) 8 (d) 9

Section B

Q21. Following statements are made about uncompetitive inhibition of an enzyme:

A. Uncompetitive inhibitor binds to both free enzyme as well as an enzyme-substrate complex.

B. Addition of uncompetitive inhibitor lowers the $V_{max}$of the reaction.

C. Apparent$K_M$of the enzyme is lowered.

D. Apparent$K_M$of the enzyme remains unchanged.

Which one of the following option represents the correct combination of thestatements?

(a) B and C (b) A and C

(c) A and B (d) A and D

Q22. Following are the pKa's of the ionizable group in lysine

pKa_1 = 2.16(α-carboxylic group)

pKa_2 = 9.06(α-amino group)

pKa_3 = 10.54(ε- amino group)

which one of the following options represents the pl of lysine?

(a) 7.25 (b) 5.61

(c) 6.35 (d) 9.8

Q23. The enzyme alkaline phosphatase was tested for its catalytic activity using the substrate para-nitrophenylphosphate. The K_M obtained was 10 m_M and V_{max} was 100µmol/min. Which one of the following options represents the initial velocity of the reaction at a substrate concentration of 10 mM?

(a) 50 µmol/min (b) 100 µmol/min

(c) 500 µmol/min (d) 20µmol/min

Q24. How many hydrogen bonds involving the backbone CO and NH can be observed in an α-helix consisting of 15 amino acid residues?

(a) 10 (b) 11

(c) 12 (d) 13

Q25. Progression across G1/S boundary followed by entry into S-phase ispromoted by the activation of which one of the following protein complexes?

(a) Cdk4/Cyclin D,

(b) Cdk2/Cyclin E,

(c) Cdk4,6/Cyclin,

(d) Cdk4,6/Cyclin D, E,

Q26. In eukaryotic cells, covalently attached lipids help to anchor some watersoluble proteins to the plasma membrane. One group of cytosolic proteinsare anchored to the cytosolic face of membrane by a fatty acyl group (e.g.myristate or palmitate). These groups are generally covalently attached towhich amino acids present at the N-terminus of the polypeptide chain?

(a) Glycine (b) Tyrosine

(c) Serine (d) Lysine

Q27. The movement of proteins bigger than 50 kDa across the nuclear envelope requires:

(a) Sec 61, (b) Tom 20,

(c) Importin β, (d) Tim 44,

Q28. Iron-sulphur clusters [Fe-S] are the key prosthetic groups that carryelectrons in all of the belowEXCEPT:

(a) NADH - CoQ reductase

(b) Succinate – CoQ reductase

(c) Cytochrome C oxidase

(d) CoQH2 –Cytochrome C reductase

Q29. In bacteria many of the tRNA genes do not contain the CCA sequence foundat the 3' end of tRNA. In this context which one of the following statementsrepresents the correct explanation?

(a) In these tRNAs amino acylation occurs at the 3′ end of the tRNAirrespective of the presence of the - CCA sequence.

(b) CCA sequence is added to these tRNA transcripts in a DNA templateindependent manner

(c) These tRNAs exploit the process of trans-splicing to include a CCAsequence at their 3′ end.

(d) The absence of CCA sequence occurred only in the last common ancestor(LCA) during the course of evolution and the current day tRNA genes always possess a sequence to encode the CCA end of the tRNA

Q30. Some cells possess peptides which contain D-form of amino acids. How do they arise?

(a) These peptides are produced by ribosomes by incorporating D- amino acids at specific positions.

(b) Ribosome makes peptides with L-amino acids only. However, some of the amino acids in the peptides are replaced by D- amino acids by a pathway that involves excision of the L-amino acids.

(c) The peptides with the D-amino acids are produced in a ribosome-independent manner.

(d) Peptides with D-amino acids exist only in archeae where they are made by the presence of racemases.

Q31. All of the following statements about bacterial transcription termination aretrueEXCEPT

(a) some terminator sequences require Rho protein for termination.

(b) inverted repeat and 'T' rich non- template strand define intrinsic terminators.

(c) Rho-dependent terminators may possess inverted repeat elements.

(d) Nus A is necessary for intrinsic transcription termination.

Q32. Which one of the following proteins is essential for both the initiation of DNAreplication as well as the continued advance of the replication fork?

(a) ORC (b) Geminin

(c) Cdc45 (d) Cdc6

Q33. Which one of the following combinations represents the major protein orprotein complex involved in chromatin condensation in yeast and human,respectively?

(a) HP1 and SIR Complex

(b) SIR complex and HP1

(c) HP1 and Su(var)

(d) SIR complex and Su(var)

Q34. Which of the following is the causative agent of filariasis?

(a) *Listeria monocytogenes*

(b)*Cryptococcusneoformans*

(c) *Francisella tularensis*

(d) *Brugiya malayi*

Q35. The cytoplasmic domain of the receptor of which of the following proteinsdoes NOT function as tyrosine kinase?

(a) Epidermal growth factor

(b) Platelet derived growth factor

(c) Insulin

(d) Asialoglycoprotein

Q36. Tumors are generally classified by

(a) the virus which caused them

(b) the person who discovered them

(c) their metastatic ability

(d) the tissue or cell of origin

Q37. A breakthrough in cancer therapy is expected where T- cells are taken froma patient are modified in the laboratory to attack cancer cells before re-infusion in the patient. These T cells are called

(a) cancer associated receptor T cells

(b) chimeric antigen-receptor T cells

(c) chimeric B and T cell

(d) cancer antigens recognition T cells

Q38. Which one of the following statements with respect to development in amphibians is correct?

(a) Gastrulation begins with the invagination of bottle cells, followed bycoordinated involution of the mesodermal precursors and the epiboly of theprospective ectoderm

(b) The organizer induces the Nieuwkoop centre

(c) The organizer is formed by the accumulation of β-catenin

(d) In the absence of BMP inhibitors ectodermal cells form neural tube

Q39. During normal development of sea urchin, β-catenin accumulatespredominantly in the micromeres, which are fated to become endoderm and mesoderm. If GSK- 3 is blocked in the developing embryo:

(a) β-catenin accumulation in the nuclei of large micromeres will be inhibitedleading to formation of ectodermal ball.

(b) β-catenin will accumulate in the nuclei of all blastula cells leading to an ectodermal ball.

(c) β-catenin will accumulate in the nuclei of all blastula cells leading to animal cells getting specified as endoderm and mesoderm.

(d) β-catenin which accumulate in the nuclei of large micromeres will beinhibited leading to animal cells getting specified as endoderm andmesoderm.

Q40. In which of the following stages of Arabidopsis embryogenesis do the visibledistinctions between the adaxial and abaxial tissues of the cotyledonsbecome initially apparent?

(a) Globular stage (b) Zygotic stage

(c) Torpedo stage (d) Mature stage

Q41. In a transplantation experiment, the area of presumptive ectoderm from anearly frog gastrula was transplanted to a region of the newt gastruladestined to become parts of the mouth. The resulting salamander larvae hadfrog like mouth parts (frog tadpole suckers) instead of balancers asobserved during development of wild type newt embryo. This is an exampleof

(a) Determination

(b) Genetic specificity of interaction

(c) Regional specificity of interaction

(d) Autonomous specification

Q42. Which of the following 'R' gene products do not contain NBS-LRR domain?

(a) RPS2 protein of Arabidopsis

(b) Xa1 protein of rice

(c) N protein of tobacco

(d) Mlo protein of barley

Q43. Photochemically generated ATP is consumed in which one of the followingphases of Calvin-Benson cycle?

(a) Only carboxylation

(b) Only regeneration

(c) Carboxylation and reduction

(d) Reduction and regeneration

Q44. Dirigent proteins predominantly play an important role in biosynthesis of:

(a) lignans (b) alkaloids

(c) terpenoids (d) amino acids

Q45. Which one of the following is used in organification of tyrosine residues in thyroglobulin protein, during thyroid hormone biosynthesis?

(a) Iodine (b) Reduced iodine

(c) Oxidized iodine (d) Hydrogen iodide

Q46. The dark current in retina is due to

(a) Closing of Na^+ channels in the outer segment of photoreceptors.

(b) Opening of K^+ channels in the inner segment of photoreceptors

(c) Opening of Na^+ channels in the outer segment of photoreceptors

(d) Closing of K^+ channels in the outer segment of photoreceptors

Q47. Which one of the following is not present in the filtration slit diaphragm?

(a) NEPH1 (b) Paxillin

(c) Nephrin (d) NEPH2

Q48. DNA was isolated from a strain of bacterium with genotype a^+ b^+ c^+ d^+ e^+ and transformed into a bacterial strain a- b-c-d- e-. The transformants were tested for the presence of the donated genes. The cotransformed genes were found as follows: a^+ and b^+ ; c^+ and e^+; d^+ and c^+ ; b^+ and d^+;

What is the order of genes on the bacterial chromosome?

(a) a b c d e (b) a c b e d

(c) a b c e d (d) a b d c e

Q49. A fly with apricot coloured eye was crossed with a sepia eyed fly of oppositesex. In F1 all flies were wild type. The genes responsible for the twophenotypes were

(a) allelic (b) non-allelic

(c) pseudo-allelic (d) paralogous genes

Q50. Human polydactyly traits having extra fingers or toes are caused by adominant allele. In a screening it was found that out of 42 individualshaving an allele for polydactyly, only 38 of them were polydactylus. Whichof the following is the correct interpretation of the observation?

(a) The penetrance of polydactyly is estimated to be 90%

(b) The expressivity of polydactyly is 90%

(c) This is an example of variable expressivity

(d) The polydactyly trait is showing complete penetrance

Q51. The basic difference between direct repair and base excision repair is

(a) Direct repair restores original structure of altered nucleotide withoutreplacement, while in base excision repair the section of DNA containing thedistortion is removed, the correct base is added and resealed.

(b) In direct repair, homologous recombination repairs the broken regionwhile base excision repair restores original structure of altered nucleotide by modification.

(c) Direct repair restores original structure by non-homologous end joining without using homologous template while in base excision repair the sectionof DNA containing the distortion is repaired by using homologousrecombination.

(d) In direct repair, an exonuclease, a DNA polymerase and a ligase are used,while in base excision repair a translesion polymerase that bypasses thebulky lesions is used by the cell.

Q52. Eukaryotes are classified into 5-6 super groups based on phylogenomicstudies. Which one of the following statements about eurkaryoticsupergroups isFALSE?

(a) Fungi and animals are more closely related to each other than either groupis to plants.

(b) Amoebozoa and opisthokonts are unikonts.

(c) Land plants and green algae belong to Archaeplastida.

(d) Alveolates and amoeba belong to same super group

Q53. What is the pattern of cleavage observed in mammals?

(a) Radial (b) Spiral

(c) Rotational (d) Bilateral

Q54. Which of the following combinations would best characterize the dominant phase of the life cycle of a pteridophyte?

(a) Diploid gametophyte

(b) Haploid gametophyte

(c) Diploid sporophyte

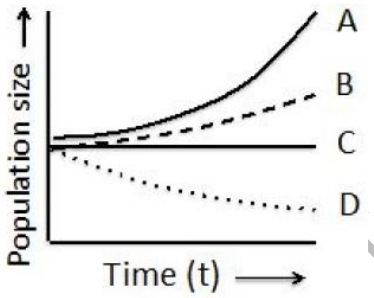
(d) Haploid sporophyte

Q55. Which one of the following gases is present in the stratosphere at a concentration higher than its concentration in troposphere?

(a) Nitrogen (b) Oxygen

(c) Ozone (d) Carbon dioxide

Q56. The graph below shows the change in the size of four populations (A-D) over time.



Which among the four populations (A, B, C and D) would have the lowest intrinsic rate of population growth(r)?

(a) A (b) B

(c) C (d) D

Q57. Consider the following ecosystems.

A. Tropical rain forests

B. Open ocean

C. Algal beds and Coral reefs

D. Marshes and Swamps

Which one of the following options represents these ecosystems in an increasing order of their contribution to annual world net primary production?

(a) B, C, D and A (b) C, D, B and A

(c) D, C, A and B (d) C, D, A and B

Q58. Historical frequencies of fires in an area can be determined by

(a) radioactive dating of the tree remains.

(b) examining the fire scars in growth rings of living trees.

(c) measuring carbon content on the soil surface after fire.

(d) examining records of evacuation history of the nearby villages.

Q59. Given below are statements on 'living fossils'. Select the correct statements.

(a) Living fossils are impressions of extant organisms in old rocks.

(b) Living fossils show high morphological divergence from fossil records.

(c) Living fossils are always an evolutionary link between two classes oforganisms

(d) Living fossils are organisms that have remained unchanged for millions ofyears

Q60. Mimicry where deceptiveness of the mimic's signal is high and fitness consequences signaled to the receiver by the mimic is also high (and negative) is

(a) Batesian mimicry

(b) Müllerian mimicry

(c) Fisherian mimicry

(d) Millerian mimicry

Q61. Consider the following four geological periods.

A. Quaternary B. Cretaceous

C. Jurassic D. Cambrian

Which one of the following options represents the correct arrangement ofthese geological periods from earliest to recent:

(a) A-B-D-C, (b) D-C-B-A,

(c) C-B-D-A, (d) B-A-C-D,

Q62. Select the correct statement related to phylogeny of primates.

(a) Lemurs are more closely related to lorises than to gibbons.

(b) Orangutans are closer to lorises than to gibbons.

(c) Tarsiers are same as old world monkeys.

(d) Humans are closer to new world monkeys than to orangutans.

Q63. Which one of the following combinations of terms is matchedINCORRECTLY?

(a) Nanopore: DNA sequencing

(b) Pyrosequencing: Protein primary structure

(c) Homologous recombination: chloroplast transformation

(d) SSRs: Co-dominant markers

Q64. Which one of the following statements is correct?

(a) If a transgenic plant heterozygous for an insertsegregates into 1:1 ratiofor the transgenic phenotype on back- crossing then it contains twounlinked copies of the insert.

(b) ANOVA allows a plant breeder to test whether measurements from threeor more treatments show statistically significant differences.

(c) Comparative genomics allows scientists to identify regions of collinearitybut not synteny between different species.

(d) For genetic mapping of a quantitative trait in plants, an RIL mappingpopulation comprising of individuals that are heterozygous at most loci ispreferred.

Q65. Which one of the following regions of the target gene is NOT used for making an RNAi construct to knock down its expression?

(a) 5′ UTR of the mature transcript

(b) 3′ UTR of the mature transcript

(c) Exonic region

(d) Intronic region

Q66. Which one of the following options represents a combination of terms thatare matchedINCORRECTLY?

(a) ddNTPs : Chain termination

(b) South Western blot: Physical interaction between DNA and proteins

(c) 5′-3′ exonuclease activity: Proof reading polymerase for PCR

(d) Yeast two hybrid system: Interaction between proteins

Q67. For a nuclear spin of spin quantum no. $\left(I=\frac{1}{2}\right)$, processing in a magnetic field at a Larmor frequency of 300 MHz, the wavelength of incident radiation required to excite the nuclear spins must be approximately

(a) 1 nm (b) 1 cm

(c) 1 m (d) 10 m

Q68. Widal test, a widely used serological test for enteric fever, is a type of

(a) precipitation reaction

(b) agglutination reaction

(c) complement fixation test

(d) immunofluorescence detection

Q69. Fluorescence microscope that requires photoactivatable probes to obtain super-resolution is

(a) Structured illumination microscope (SIM)

(b) dSTORM – stochastic optical reconstruction microscopy

(c) Stimulated emission depletion microscopy (STED)

(d) Laser scanning confocal microscope

Q70. A protein solution (0.2 ml) of unknown concentration was diluted with 0.8ml of water. To 0.5 ml of this diluted solution 4.5 ml of biuret reagent was added and the color allowed to develop. The absorbance of this mixture taken in a test tube of 1cm diameter at 540 nm was observed to be 0.20.

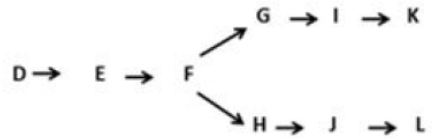
0.5 ml of BSA (4 mg/ml) solution plus 4.5 ml of biuret gave anabsorbance of 0.20 when measured as above. What is the proteinconcentration (mg/ml) in the undiluted unknown solution?

(a) 20 (b) 40

(c) 50 (d) 80

Section C

Q71. A schematic of a metabolic pathway is shown below.



Under which of the following conditions would stoichiometric amounts of end products K and L be obtained if a concerted feedback inhibition mechanism were in operation?

(a) K inhibits F→G and L inhibits F→H; D→E is inhibited at equal amounts of K and L

(b) D→E is inhibited at equal amounts of K and L; K inhibits F→H and L inhibits F→G

(d) D→E is inhibited at equal amount of G and H; K inhibits F→H and L inhibits F→G,

(d) K inhibits F→H and L inhibits F→G.

Q72. The following statements are being made to define the Michaelis constant (K_M) . It is:

A.Independent of enzyme concentration [E] and substrate concentration [S]

B.Equal to the dissociation constant when the [ES] complex dissociates more rapidly thanproduct formation

C.Equal to the dissociation constant when product formation is more rapid than [ES]complex dissociation

D.An intrinsic property of an enzyme and does not depend on pH, temperature and ionicstrength

Which one of the following combination of statements is correct?

(a) A and B only (b) A, B and D only

(c) C and D only (d) A and D only

Q73. The table below lists the biochemical characteristics of proteins andexperimental procedures used to determine them. Match the characteristicswith the experimental procedure.

List I	List II
Biochemical Characteristics	Experimental Procedure
A. 3-dimensional structure	I. Nuclear magneticresonance
B. Ionic Charge	II. Isoelectric focusing
C. Binding specificity	III. AffinityChromatography
D. Molecular Size	IV. Ultracentrifugation

Which one of the following matches is correct?

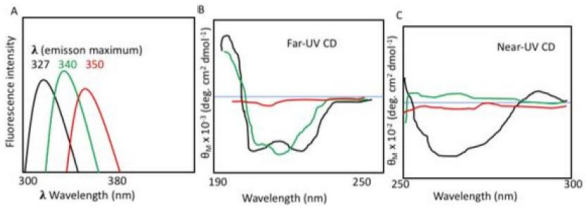
(a) A - III, B - I, C - II, D – IV

(b) A - I, B - II, C - III, D - IV

(c) A - II, B - I, C - III, D – IV

(d) A - IV, B - II, C - I, D – III

Q74.



A circular dichroism spectrum in the far-UV region informs on the kind and content of secondary structures in a protein. Near-UV and tryptophan emission spectra inform on the tertiary structure. Shown in the panels above are (A) Intrinsic fluorescence emission spectra of protein X, (B) Far-UV CD spectra of protein X, (C) Near-UV CD spectra of protein X recorded under different conditions.

Curves represent the spectra of protein 'X' at pH 7.0 (black), pH 3.0 (green), and pH 7.0 in the presence of 6.0 M guanidine hydrochloride (red).

What does the experiment report?

(a) Protein is fully folded at pH 7.0, acid-induced molten globule at pH 3.0 and unfolded in 6M guanidine hydrochloride.

(b) Protein secondary structure is reduced at pH 7.0 and the protein has formed beta fibrils at the other two conditions.

(c) The changes in fluorescence and near-UV CD indicate increase in hydrodynamic radius at pH 3.0 and in 6M guanidine hydrochloride.

(d) There is extensive denaturation of the protein both at pH 3.0 and in 6Mguanidine hydrochloride.

Q75. The pI of four proteins (A, B, C, D) are shown in the table below:

PROTEIN	Pi
A	4
B	5.5
C	7
D	9

To purify 'D' from a mixture of these four proteins in a single step, using ion-exchange chromatography, what combination of buffer pH and ion-exchangeresin would you select?

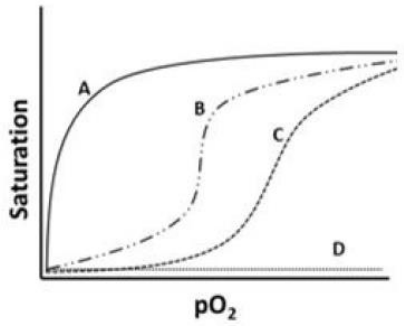
(a) pH 11, cation exchanger resin

(b) pH 2, anion exchanger resin

(c) pH 6, anion exchanger resin

(d) pH 8, cation exchanger resin

Q76. The curve B in the figure below shows the oxygen dissociation profile at physiological concentration of CO_2 and at pH7.



An increase in pH would lead to oxygen dissociation profile indicated by:

(a) curve B (no change in the dissociation profile)

(b) curve A

(c) curve C

(d) curve D

Q77. Following statements were made about chromosome cohesion during mitosisand meiosis.

A. Though cohesin is important for pairwise alignment of the chromosomeson the mitotic spindle, it is not important for the generation of tensionacross the centromere.

B. Cohesin binds to the chromosome even before the initiation of S-phase.

C. In fission yeast, centromere specific localization of Moa1 and Rec8regulates the orientation of kinetochores at meiosis-I.

D. Cohesin exhibits uniform distribution/localization pattern across thechromosomal length.

E. Polo/Cdc5 is a positive regulator of Separase, an endopeptidase thatfacilitates opening of the cohesin ring.

Which one of the following combination contains all correct statements?

(a) A, B and D only

(b) A, C and E only

(c) B, C and D only

(d) B, C and E only

Q78. Which one of the following is valid with respect to, one step growthexperiment developed by Ellis and Delbruck in 1939?

(a) The reproduction of large phage population is synchronized.

(b) A culture is directly developed by inoculation of single bacterial colonyfrom the agar plate into liquid medium.

(c) Involves only a single step of overnight culture development followed byinoculation of a fresh medium with 1% inoculum.

(d) Only a single carbon source such as glucose is used in the medium.

Q79. Given below are a few statements about nuclear transport.

A. RanGTP levels are higher in the nucleus than the cytoplasm.

B. Nuclear import receptors can shuttle between the nucleus and cytoplasm.

C. NTF2 transports RanGDP into the cytosol.

D. Export of mRNA is not directly dependent on Ran.

E. tRNA and miRNA export is mediated by exportins.

Which one of the following combination contains all correct statements?

(a) A, B, C, D only (b) B, C, D only

(c) A, B, D, E only (d) A, C, E only

Q80. During cytokinesis, a small GTPase, RhoA, localizes to the equatorialmembrane above the spindle midzone. The localization/activity of RhoA ispotentially modulated by:

A. RhoGEF Ect2 B. Aurora B kinase

C. PLK1 kinase D. MKLP1 kinesin

E. ATM and ATR

Which one of the following combination contains all correct statements?

(a) A, B and D only

(b) A, B,C and D only

(c) B, C,D and E only

(d) A, C and D only

Q81. Cellular actin levels can be as high as 100-400 µM. Of this, unpolymerized actin concentration can be as much as 50-200 µM. However, the criticalconcentration for actin polymerization in-vitro is about 0.2 µM. Some of thefollowing proteins inhibit polymerization of actin in cells.

A. Thymosin $-\beta_4$

B. Capping protein CapZ

C. Tropomodulin

D. XMAP215

Which one of the following options lists all inhibitors?

(a) A, B and C only (b) B, C and D only

(c) C, D and A only (d) D, A and B only

Q82. To delineate the steps in endoplasmic reticulum (ER) transport, a PhDstudent homogenized pancreatic acinar cells to isolate microsomes, whichretain most of the biochemical properties of the ER. For this experiment, thestudent has planned a number of controls as mentioned below.

A. Treat one set of microsomes first with detergent and then with protease.

B. Treat one set of microsomes with protease only.

C. Treat one set of microsomes with micrococcal nuclease.

D. Treat one set of microsomes with detergent only.

Select the option that represents the best combination of the controls.

(a) A, B and D only (b) B, C and D only

(c) A and C only (d) B and D only

Q83. Following statements were made about imprinting in the human genome.

A. Imprinting control centre (IC) harbors part of the SNRPN gene.

B. Imprinting of genes in an individual cannot be tissue specific.

C. Sperms and eggs exhibit identical pattern of genome methylation, exceptin the sex chromosomes.

D. At imprinted loci, expression depends on the parental origin.

Select the option with all the correct statements.

(a) A and D (b) B and D

(c) A and C (d) B and C

Q84. Mitochondrial protein synthesis is of prokaryotic origin. Following statements are being made about the ribosomes from bacteria and mitochondria:

A. The bacterial ribosome consists of small and large subunits of 30S and50S respectively, whereas in mitochondria of mammals these subunits are of28S and 39S

B. In the bacterial ribosomes the RNA: protein ratio is about 2:1 whereas inmitochondria ribosomes this ratio is usually 1:2

C. Both the bacterial and mitochondrial ribosomes consist of 30S and 50Ssubunits

D. Both the bacterial and mitochondrial ribosomes consist of RNA andprotein in the ratio of 1:1

Choose the option that represents all correct statements.

(a) A and B only (b) B and C only

(c) C and D only (d) A and D only

Q85. Given below are a few statements about the λ infection cycle

A. Competition betweencIandcIIgene products determines theestablishment of lysogeny versus lysis.

B. cI binds O_R1 first while cro binds to O_R3 first

C. Cro binding to $O_R$represses cI transcription

D. Rich medium favours lytic cycle because cII is protected from cellularproteases

Which one of the following options represents all correct statements?

(a) B and C (b) A and B

(c) C and D (d) A and C

Q86. Reproduction of ϕ×174, a single stranded DNA phage involves several steps, A few statements are given below to explain the mechanism.

A. The single stranded ϕ×174 DNA is converted into a double- stranded replicative form (RF)

B.Replication of double stranded replicative form results in the production of singlestranded phages, about 50% of which are +ve sense phages and the remaining are –vesense phages

C. Replication of the double stranded replicative form results in the production of only –vesense phages

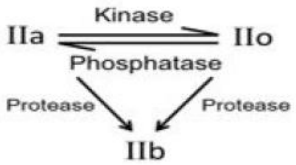
D.Replication of the double stranded replicative form results in the production of only +vesense phages

Choose the option that correctly describes the process

(a) A only (b) A and B

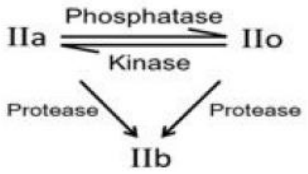
(c) A and C (d) A and D

Q87. Which one of the following schematics depicts the potential relationshipamong the subunits IIo, IIa, and IIb of RNA polymerase II?



(a) -

(b)



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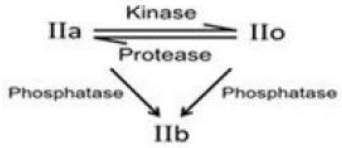

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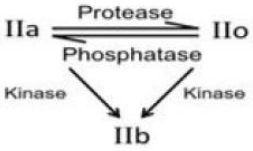


Q88. DNA replication occurs in S phase. The entry of cells into S phase is regulated by the tumor suppressor protein Rb. The statements below aremade with reference to the role of Rb.

A. Rb binds to E2F in the cytosol and prevents E2F entry into the nucleus.

B. Rb is phosphorylated by cyclin A/ cdk 4.

C. Phospho Rb activates E2F.

D. E2F activates cyclin E production which promotes the G1/S transition.

Which one of the following options represents all correct statements?

(a) A, B and C only (b) B, C and D only

(c) A, C and D only (d) C and D only

Q89. The following statements are made with reference to DNA replication:

A. Camptothecin causes intra- strand and inter- strand crosslinks in DNA,leading to stalling of replication forks.

B. Prevention of reinitiation of DNA replication during the same cell cycle is mediated by regulating the loading of the initiator complex ORC.

C. A glu → ala mutation in the nucleotide building pocket of DNA polymeraseIII could lead to the incorporation of ribonucleotides in the extending DNAchain.

D. A mutation in the gene encoding Topoisomerase II could lead toentanglement of DNA daughter strands during replication.

Which one of the following options represents all correct statements?

(a) A and B only (b) B and C only

(c) C and D only (d) B, C and D only

Q90. The population that is at highest risk against influenza infection should be immunized annually. Which one of the following is the most importantreason for this?

(a) Influenza virus can change its surface antigen very frequently.

(b) Influenza virus has a very short incubation period.

(c) Influenza virus has a reasonably longer incubation period giving memory Bcells time to respond by producing high levels of serum antibody.

(d) Repeated immunization interferes with the differentiation of plasma cellsfrom memory

cells thereby decreasing levels of neutralizing antibody.

Q91. Localized increases in the cytosolic level of free $Ca^{2+}$are critical to itsfunction as second messenger. Calmodulin, a small cytosolic protein,mediates many cellular effects of Ca^{2+}. Which of the following is NOTCORRECTfor Ca^{2+}-calmodulin interaction?

(a) Each calmodulin molecule binds six Ca^{2+}ions in a cooperative fashion.

(b) Binding of Ca^{2+}causes calmodulin to undergo a conformational change leading to active calmodulin.

(c) Since binding of $Ca^{2+}$is cooperative, a small change in the level ofcytosolic Ca^{2+}leads to a large change in the level of active calmodulin.

(d) One of the many enzymes activated by Ca^{2+}- calmodulin is cAMPphosphodiesterase, which degrades cAMP and links $Ca^{2+}$and cAMPsignaling.

Q92. Some cellular and extracellular proteins are enlisted inList Iand theirtypical characteristics are enlisted inList II

List I	List II
A. Nidogen	I. In human genome, one gene of this protein is present but many different isoforms are there due to alternative splicing
B. Fibronectin	II. An intermediate filament protein that is typically expressed in epithelial and mesenchymal cells
C. Integrin	III. One of the principal structural proteins of basal laminae.
D. Vimentin	IV. Heterodimer of α and β subunit and binds to extracellular matrix proteins.

Which one of the following is the most appropriate match ?

(a) A - I, B - II, C - III, D – IV

(b) A - II, B - III, C - IV, D - I

(c) A - III, B - I, C - IV, D – II

(d) A - II, B - IV, C - I, D - III

Q93. Following statements have been proposed for cancer cells and cancer stemcells:

A. Cancer cells mostly have mutations whereas cancer stem cells do not.

B. Cancer cells divide to form two different populations of cells whereascancer stem cells do not divide.

C. Cancer stem cells can undergo self-renewal whereas cancer cells cannot.

D. Cancer cells are predominantly resistant to chemotherapy and radiation.

E. Cancer stem cells are found only in the bone marrow and placenta.

Which one of the following combination of statements is correct?

(a) A and C (b) A and B

(c) C and E (d) C and D

Q94. Which of the following is/are associated with the presentation ofendogenous antigens by Class I MHC molecule by an Antigen Presenting Cell(APC), given the condition that there is no cross-presentation of antigens bythe APC?

(a) TAP1 and TAP2 proteins only

(b) Invariant chain (Ii)

(c) Proteosome-like subunits LMP2 and LMP7 only

(d) TAP1, TAP2 proteins and proteosome-like subunits LMP2, LMP7

Q95. Which one of the following statements isNOTcorrect regarding the tetrapodlimb development?

(a) As the limb grows outward, the stylopod forms first, then the zeugopodand the autopod is formed last. Each phase is characterized by a specificpattern of Hox gene expression.

(b) The zone of polarizing activity (ZPA) is maintained by the interaction ofthe FGFs from the AER and Shh expressed from the mesenchyme.

(c) Although cell death in the limb is necessary for the formation of digits andjoints, it is never mediated by the BMPs, which is only responsible fordifferentiating mesenchyme cells into cartilage.

(d) The dorsal-ventral axis is formed in part by the expression of Wnt7a inthe dorsal portion of the limb ectoderm, which maintains expression level ofShh in the ZPA and Fgf4 in the posterior AER.

Q96. The Dorsal protein is involved in generating the dorsal-ventral (DV) polarityinDrosophila.The following statements were made regarding the activity ofthe Dorsal protein in establishing the DV polarity.

A. In embryos that lack Gurken protein, the Dorsal protein is nottranslocated to the nucleus of the follicle cells which then causesventralization of the embryo

B. Though Dorsal protein acts as a morphogen, it is found throughout thesyncytial blastoderm of the earlyDrosophilaembryo.

C. In embryos that lack Cactus protein the Dorsal protein can be found in thenucleus of cells with a ventral fate.

D. If the Dorsal protein is blocked from entering the nucleus, the genes responsible for specifying dorsal cell types are not transcribed.

Which of the above statements are correct ?

(a) A and B (b) B and C

(c) C and D (d) A and C

Q97. Following are certain statements regarding root growth and differentiationin plants:

A. Root hair, endodermis, xylem and phloem reach maturation in elongationzone of a developing root.

B. The root epidermal cells that are incapable of forming root hairs are calledatrichoblasts.

C. Quiescent center is present just above root cap.

D. In Arabidopsis, an auxin transporter (ABCB4) plays a role in root hairemergence by maintaining intracellular auxin concentration.

(a) A, B and C (b) B, C and D

(c) A, C and D (d) A, B and D

Q98. Match the terms used in vertebrate limb development inList Iwith theirdescriptions inList II:

List I	List II
A. EMT	I. The cells found within the most posterior region of the limb bud
B. Mesenchyme	II. The thickening of ectoderm at the apex of the developing limb
C. AER	III. A loosely organized, mainly mesodermal embryonic tissue
D. Progress zone	IV. Epithelial cells making up the mesoderm of the early somatopleure undergo this transition and get included in mesenchyme cell pool
E. ZPA	V. The proliferative mesenchyme that fuels limb bud growth
F. Autopod	VI. The distal part of tetrapod limb

Which one of the following combination of the statements is correct?

(a) A - IV, B - III, C - II, D - V, E - I, F - VI,

(b) A - I, B - II, C - III, D - IV, E - V, F - VI,

(c) A - V, B - IV, C - II, D - VI, E - III, F - I,

(d) A - II, B - V, C - I, D - III, E - IV, F - VI,

Q99. Given below are some of the statements in connection with neural tubeformation in vertebrates:

A. In primary neurulation the cells surrounding the neural plate direct theneural plate cells to proliferate, invaginate and separate from the surfaceectoderm to form an underlying hollow tube.

B. In secondary neurulation the neural tube arises from the aggregation ofmesenchyme cells into a solid cord that subsequently forms cavities tocreate a hollow tube

C. In birds primary neurulation generates the neural tube from anterior up tothe hind limb developing region

D. In mammals, secondary neurulation begins at the level of sacral vertebrae

E. Anencephaly results when a failure to close the neural tube occurs,resulting in the forebrain remaining in contact with amniotic fluid.

Which one of the following options gives all correct statements?

(a) A, B, C, D and E (b) A only

(c) B and E only (d) C, D and E only

Q100. Following are certain statements regarding tracheary elements of vascularplants

A. Xylem tracheids are highly elongated tapered cells that conduct water

B. Xylem vessel elements are less elongated and narrower than tracheids

C. Angiosperms may have both tracheids and vessel elements

D. Vessel elements are the only tracheary elements in almost allgymnosperms

Which one of the following options represents the combination of correct statements?

(a) A, B and C only (b) A and C only

(c) B and C only (d) B and D only

Q101. Following are certain statements regarding phytochrome interacting factors(PIFs), a family of proteins that regulates photomorphogenic response inplants:

A. PIFs promote skotomorphogenesis by serving as transcriptional activators of dark induced genes.

B. PIFs on interaction with $P_r$get phosphorylated, followed by degradationvia the proteasome complex.

C. The degradation of PIFs takes place in the presence of light.

D. PIF-induced genes are not expressed in light.

Which one of the following options represents the combination of correct statements?

(a) A, B and C (b) A, C and D

(c) A, B and D (d) B, C and D

Q102. The phytohormones ethylene (ET), methyl jasmonate (MeJA) and salicylicacid (SA) play important roles in plant defense. The following statementswere made regarding induction of defensin PDF1.2 and pathogenesis relatedprotein PR1:

A. ET/MeJA activates PDF1.2

B. ET/MeJA activates PR-1

C. SA activates PDF1.2

D. SA activates PR-1

Which of the following options represents the combinations of correct statement

(a) A and B (b) A and D

(c) B and C (d) C and D

Q103. A researcher has obtained an Arabidopsis mutant defective in strigolactones(SLs), a novel plant hormone. The following statements were maderegarding the mutant phenotype:

A. Shoot branching gets enhanced in the mutant plant

B. Hyphal branching of arbuscular mycorrhizal fungi (AM-fungi) getsenhanced during colonization in the mutant plants

C. Shoot branching gets inhibited in the mutant plants

D. Germination of seeds of parasitic plant is prevented near the mutant plant

Which one of the following options represents the combination of correct statements?

(a) A and B (b) B and C

(c) B and D (d) A and D

Q104. During light reaction in photosynthesis, electron is transported in electrontransport chain (ETC) and produces ATP and NADPH in the process.Following are certain statements regarding ETC during light reaction:

A. Electron from P680 moves first to quinone and then to the pheophytin

B. P700 can receive electrons from plastocyanin

C. NADPH is produced at the end of light reaction

D. The hydrogen ions produced during light reaction gets concentrated in thylakoid lumen

Choose thecorrectanswer from the options given below:

(a) A, B and C (b) A, B and D

(c) A, C and D (d) B, C and D

Q105. Given below are various plant natural products and their basic structuralunit:

List I	List II
Natural products	Basic unit
A. Phenolics	I. Five-carbon isoprene unit
B. Alkaloids	II. Glucose unit attached by O-β-D-glucosyl linkage
C. Terpenoids	III. Nitrogen containing
D. Cyanogenic glycoside	IV. Aromatic arene ring with OH group

Which of the following options represents the correct match of naturalproduct and the basic unit:

(a) A- IV, B - I, C - III, D – II

(b) A - III, B - II, C - I, D - IV

(c) A - III, B - I, C - IV, D – II

(d) A - IV, B - III, C - I, D - II

Q106. The mechanisms of thermogenesis in brown adipose tissue (BAT) in cold aredescribed in the following proposed statements:

A. A thermogenic uncoupling protein, UCP1 helps in the heat production inBAT

B. Norepinephrine secretion from sympathetic nerve endings in BAT isdecreased

C. Lipolysis is increased by low level of norepinephrine in BAT

D. A high content of mitochondria in BAT helps in the oxidation of fatty acids

E. Oxidation produces much heat as ATP synthase activity is low

Which one of the following options represents the combinationof correct statements?

(a) A, B and C (b) A, D and E

(c) B, C and D (d) B, D and E

Q107. The pressure in the 'space' between lungs and chest wall is known asintrapleural pressure. The following statements are related to theintrapleural pressure at different phases of respiration:

A. At the end of quiet expiration the tendency of the lung to recoil from chestwall is balanced by the recoil of chest wall in opposite direction, andintrapleural pressure is sub atmospheric.

B. At the start of inspiration the intrapleural pressure is sub atmospheric.

C. The intrapleural pressure becomes more negative during inspiration.

D. The intrapleural pressure attains value above atmospheric pressure during expiration.

E. The intrapleural pressure becomes positive (relative to atmosphericpressure) during strong inspiratory efforts.

Which one of the following combinations is correct?

(a) A, B and C (b) B, C and D

(c) C, D and E (d) A, C and D

Q108. Hemoglobin (Hb) transports CO_2 in venous blood as carbamates. The following statements refer to the formation of these carbamates:

A.CO_2 interacts with amino terminal nitrogens of Hb polypeptide chains

B.CO_2 interacts with carboxyl terminal carbons of Hb polypeptide chains

C.Carbamates helps formation of salt bridges between α and β chains of Hb

D.Carbamates helps formation of disulfide bridges between α and β chains of Hb

Which one of the following options is a combination of correct statements?

(a) A and C (b) B and D

(c) B and C (d) A and D

Q109. Following statements are given for the ovarian hormones:

A. 17 β -estradiol, estrone and estriol are naturally occurring estrogens

B.They are 18 C steroids which do not have methyl group at 10th positions

C.They are 21 C steroids which have methyl group at 10th position

D.They are primarily synthesized by granulosa cells of the ovarian follicles

E.Their biosynthesis does not depend on the enzyme aromatase

Which one of the following options represents the combination of correct statements?

(a) A, B and C (b) A, B and D

(c) B, C and D (d) C, D and E

Q110. Below are given a set of statements for the glucocorticoid hormones:

A. They bind to cell surface receptors and influence stress adaptation

B. They bind to intracellular receptors and influence stress adaptation

C. They inhibit ACTH secretion from anterior pituitary

D. Prolonged treatment with glucocorticoids leads to atrophic and unresponsive adrenals

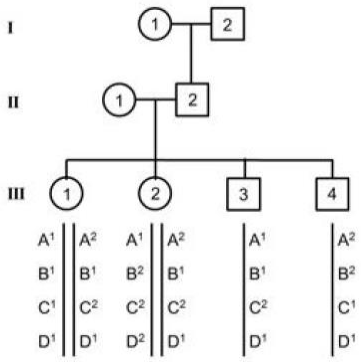
E. Their secretion does not show circadian variations

Which one of the following combination of the statements is correct?

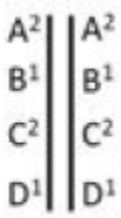
(a) A, C and E (b) B, C and D

(c) C, D and E (d) A, D and E

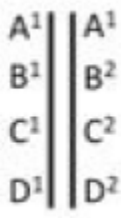
Q111. The pedigree given below represents the genotype at four different loci for the children in generation III.



Which one of the given genotypes is likely to represent the genotype of individual ll-1?



(a)



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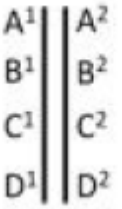

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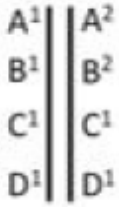


(d)

Q112. ADrosophilamutant (line A) with vestigial wings is isolated in a laboratory.The vestigial wing phenotype was observed to be recessive and mapped togene 'X'. Three other laboratories also isolated vestigial mutants, called lineB, C and D. In order to test if the mutation in lines B-D also mapped to gene'X', the following crosses were made and phenotype of F1 progeny observed.

Cross	F1 progeny (wing morphology)
A × B	Vestigial
A × C	Vestigial
A × C	Normal
B × C	Vestigial
B × D	Normal
C × D	Normal

Based on the above identify the line(s) which is most likely NOT to have a mutation in gene 'X'.

(a) Both lines B and C

(b) Line C only

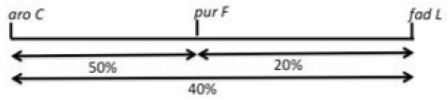
(c) Line D only

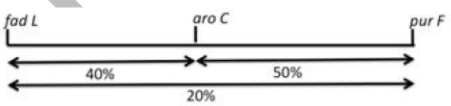
(d) Both lines B and D

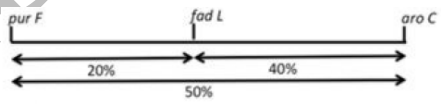
Q113. 22 transduction was used to map thefadLgene. The result of two-factorcrosses betweenfadLand two linked markers, purFandaroCare shownbelow.

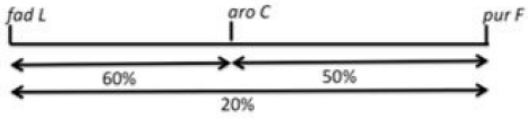
Donor	Recipient	Recombinants		Number obtained
		Selected marker	Second marker	
fadL purF+	fadL+ purF	purF+	fadL	200
			fadL +	800
fadL aroC+	fadL+ aroC	aroC+	fadL	400
			fadL +	600
aroC+ purF	aroC purF	aroC+	purF	500
			purF+	500

Which one of the following is the correct map for the three genes?

(a) 

(b) 

(c) 

(d) 

Q114. Wheat plants can have kernels of white colour or in shades of red i.e., lightred, red, dark red and very dark red (purple).

A researcher made the following cross:

P	wheat plants with white kernels	X	wheat plants with purple (very dark red) kernels
F_1	All plants with red kernels		
F_2	1/16		Plants with purple kernels
	4/16		Plants with dark red kernels
	6/16		Plants with red kernels
	4/16		Plants with light red kernels
	1/16		Plants with white kernels

The following conclusions are made from the results obtained:

A. It is a dihybrid cross where white colour is coded by gene A and the purple colour is coded by gene B

B. Two genes, both coding for the colour of kernel and each gene having two alleles, one

that produced red pigment and the other that produced no pigment.

C. Four genes, one coding for no pigment, which is epistatic over the other genes. The remaining three genes have 2 alleles each, one that produced red pigment and the other that produced no pigment.

D. The trait is influenced by the environment leading to the observed variation in kernel colour.

Which of the above conclusion(s) is/are correct?

(a) A only (b) B only

(c) C only (d) C and D only

Q115. A group of transposable elements described as 'retroelements' encompass

(a) P elements inDrosophila; LINES but not SINES in humans

(b) Copia element inDrosophila; SINES but not LINES in humans

(c) Copia element inDrosophila; LINES as well as SINES in human

(d) P elements inDrosophila; LINES as well as SINES in human

Q116. Given below are two columns listing angiosperm families and their groups

List I	List II
Group	Family
A. Basal angiosperms	I. Brassicaceae
B. Fabids	II. Cucurbitaceae
C. Malvids	III. Solanaceae
D. Lamids	IV. Nympheaceae

Which one of the following option represents the correct match of the twocolumns ?

(a) A - IV, B - II, C - I, D – III

(b) A - IV, B - I, C - III, D - II

(c) A - III, B - IV, C - II, D – I

(d) A - II, B - III, C - I, D - IV

Q117. Given below are the names of diseases caused in rice in Column X and thenames of the disease-causing organisms in Column Y.

Column X	Column Y
A. Bacterial blight	I. Entyloma oryzae
B. Grain rot	II. Rhizoctonia solani
C. Sheath blight	III. Xanthomonas oryzae pv. oryzae
D. Leaf smut	IV. Sclerophthora macrospora
E. Downy mildew	V. Burkholderia glumac

Which one of the following options represents the match of column X and Y ?

(a) A - II, B - I, C - V, D - IV, E – III

(b) A - III, B - IV, C - II, D - V, E - I

(c) A - IV, B - III, C - I, D - II, E – V

(d) A - III, B - V, C - II, D - I, E - IV

Q118. The table given below lists the conservation areas and the major group oforganisms that they are best known for.

Column X	Column Y
Conservation areas	Organisms
A. Hemis National Park	I. Orchids
B. National Chambal Sanctuary	II. Gharial
C. Nokrek National Park	III. Nepenthes
D. Sessa Sanctuary	IV. Snow leopard
E. Baghmara wildlife sanctuary	V. Endemic citrus species

Which one of the following options represents the correct match of column Xand Y

(a) A - I, B -II, C - III, D - IV, E - V

(b) A - IV, B -II, C - V, D - I, E - III

(c) A - III, B -I, C - V, D - II, E - IV

(d) A - V, B -IV, C - III, D - II, E – I

Q119. The table given below lists the morphological features and groups of plants.

List I	List II
Plant group	Morphological characters
A. Liverwort	I. Unicellular rhizoids
	II. Multicellular rhizoids
B. Moss	III. Presence of pyrenoids
	IV. Stomata on sporophyte
	V. Dominant gametophyte

Which one of the followings options represents the correct match betweenthe two columns?

(a) A - I, III and V ; B - II, III, and V

(b) A - I, III and IV ; B - II and IV

(c) A - II and V ; B - I and III

(d) A - I and V ; B - II, IV, and V

Q120. The table given below lists types of extremophiles and the environments that they are adapted to.

List I	List II
Type of extremophile	Environment
A. Psychrophile	I. High salinity
B. Hyperthermophile	II. High pressure
C. Alkaliphile	III. High alkaline environment
D. Hyperpiezophile	IV. Extreme high temperature
E. Halophile	V. Extreme cold temperatures

Which one of the following options represents the correct match of the columns?

(a) A - I, B - II, C - III, D - IV, E – V

(b) A - V, B - II, C - III, D - IV, E - I

(c) A - V, B - IV, C - III, D - II, E – I

(d) A - V, B - II, C - IV, D - III, E - I

Q121. The table given below lists fossils and the major group of plants to whichthey belong.

List I	**List II**
Fossil	Plant group
A. Naiadita lanceolata	I. Angiosperm
B. Rhynia gwyne-	II. Pteridophyte

vaughanii	
C. Antarticycas schopfii	III. Bryophyte
D. Tricolpites minutus	IV. Bryophyte

Whcih one of the following options represents the correct match betweencolumns ?

(a) A - I, B -III, C - IV, D – II

(b) A - III, B -II, C - IV, D - I

(c) A - I, B -II, C - IV, D – III

(d) A - II, B -III, C - I, D - IV

Q122. The tables below show the bird species and their abundance in three habitats P, CI and R.

Habitat P	
Species identity	Abundance
1	120
2	20
3	5
4	1
5	1

Habitat Q	
Species Identity	Abundance
1	20
2	20
3	20
4	20
5	20
6	15
7	15
8	15

Habitat R	
Species Identity	Abundance
1	80
2	25
3	15
4	10
5	5
6	3
7	3
8	3

Which one of the combinations below best represents the habitats in decreasing order of diversity?

(a) P, R, Q (b) R, Q, P

(c) R, P, Q (d) Q, R, P

Q123. The following are a few statements on shade leaves vis-à-vis sun leaves intree species

A. Higher amount of chlorophyll per dry weight

B. Lower density of stomata

C. Thicker leaves

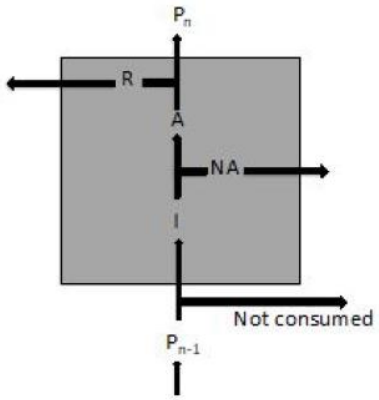
D. Lower rates of dark respiration per unit area

Which one of the following combinations of above statements is correct?

(a) A and D (b) B and C

(c) A, B and D (d) B and D

Q124. The diagram below depicts energy flow within a single trophic level, where I =amount ingested, NA= amount not assimilated, R= respiration, and Pn= biomass production at trophic level.



Which one of the following options represents correct values for Pn, NA, R and I in kcal respectively, if Pn-1 =1000 kcal, I/ Pn-1 = 20%, A/I = 35% and Pn/A= 20%?

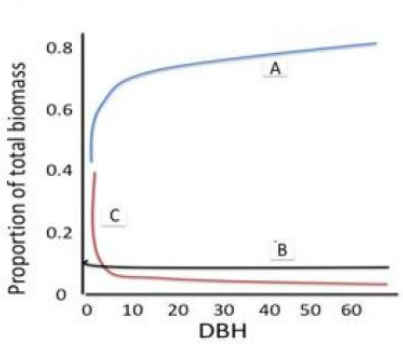
(a) 56 14 130 200

(b) 14 130 56 200

(c) 200 130 56 14

(d) 56 130 200 14

Q125. The following graph shows the change in proportion of biomass in foliage (leaves), branch and stem wood(bole) for a tree species as a function of DBH (diameter at 1.5 m above ground)

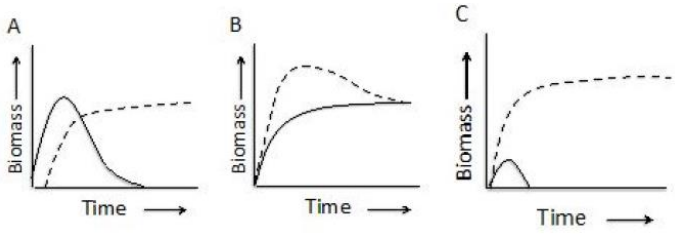


Which one of the following options correctly matches the curves (A, B, and C) with stem wood, foliage and branch, respectively?

(a) A, B and C (b) A, C and B

(c) B, C and A (d) B, A and C

Q126. The graphs given below show the possible behavior of two species over the course of succession.



Possible effects observed during succession are:

i. Total suppression

ii. Convergence

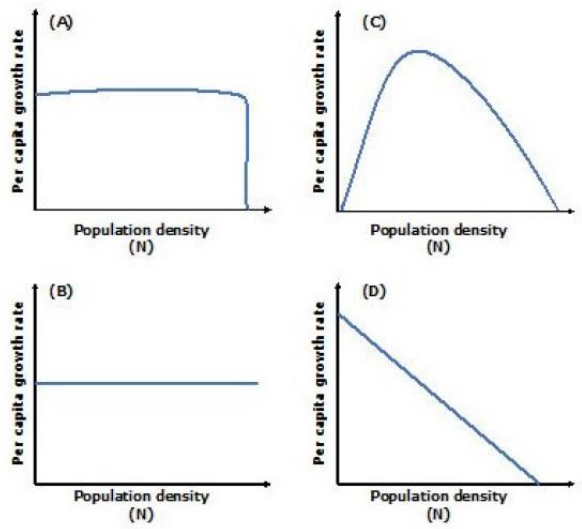
iii. Sequential succession

Choose the correct option matching the graphs with the possible effect:

(a) A-(i), B-(ii), C-(iii) (b) A-(ii), B-(iii), C-(i)

(c) A-(iii), B-(ii), C-(i) (d) A-(iii), B-(i), C-(ii)

Q127. Consider the following graphs for per capita growth rate $\left(\frac{1}{N}\right)\left(\frac{dN}{dt}\right)$ as a function of population density (N).



Which one of the plots correctly depicts strong Allee effect in a population?

(a) a (b) b

(c) c (d) d

Q128. In the Table below,Column Idescribes movements of organisms andColumn IIdescribes the type of movement.

Column I	Column II
A. A silk moth flies at an angle perpendicular to the direction of the wind to pick up a scent trail	I. Mnemotaxis
B. Bacteria burrow down into mud in the northern hemisphere in response to the earth's magnetic field	II. Klinotaxis
C. A girl reaches her school using a pharmacy and a bookshop as landmarks	III. Magnetotaxis
D. Planaria move towards the direction of higher concentration of food by comparing the gradient of stimuli around it	IV. Menotaxis

Which one of the following options represents the correct match of column Iwith Column II

(a) A - IV, B - III, C - I, D – II

(b) A - IV, B - III, C - II, D - I

(c) A - I, B - III, C - IV, D – II

(d) A - I, B - II, C - III, D - IV

Q129. The following represents an equation for Bayesian statistics:

$$P(H|E) = \frac{P(H)\ P(E|H)}{P(E)}$$

(A) = P(H|E), (B) = P(H), (C) = P(E|H), (D) = P(E)

Which one of the following options correctly represents A, B, C and D in the above equation?

(a) A-Evidence, B-Posterior probability, C-Likelihood, D-Prior probability

(b) A- Likelihood, B-Prior probability, C-Posterior probability, D-Evidence

(c) A-Posterior probability, B-Prior probability, C-Likelihood, D-Evidence

(d) A-Prior probability, B-Evidence, C-Posterior probability, D-Likelihood

Q130. In a population that is in Hardy-Weinberg equilibrium, the frequency of the recessive homozygote genotype of trait q is 0.04. The percentage of individuals homozygous for the dominant allele is

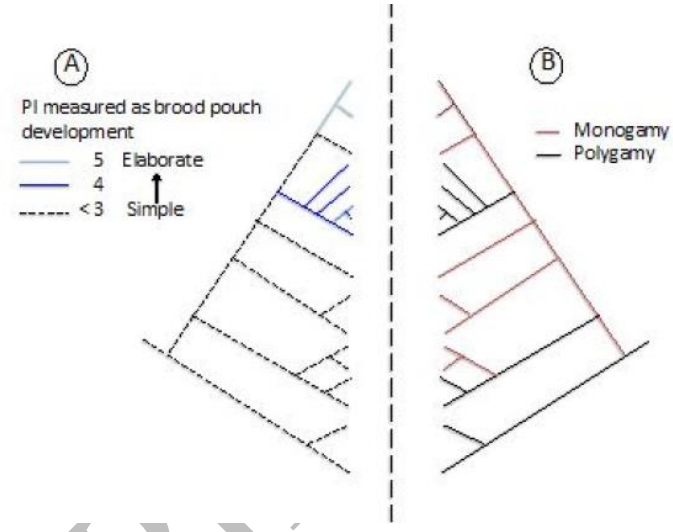
(A) 64 (B) 40

(C) 32 (D) 16

(a) A and C (b) B and D

(c) B and C (d) A and D

Q131. A researcher is interested in investigating if parental investment (PI, panel A) by male seahorses and pipefishes is correlated with their mating patterns (MP-monogamy and polygamy, panel B). For this, the researcher builds a phylogenetic tree of seahorses and pipefishes and maps PI and MP scores on to the tree as shown in figure below.



Based on the trees generated, which one of the following conclusions can the researcher correctly arrive at?

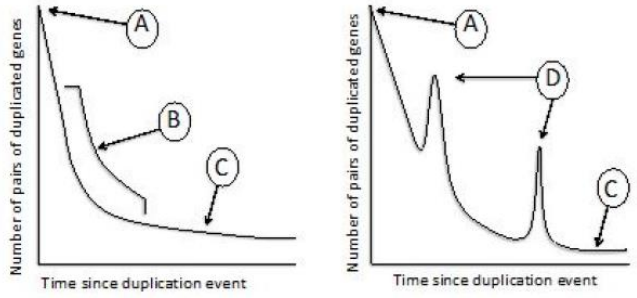
(a) Polygamy is correlated with simpler brood pouches.

(b) Monogamy is not correlated with elaborate brood pouches.

(c) Monogamy is correlated with elaborate brood pouches.

(d) Polygamy is correlated with elaborate brood pouches.

Q132. Given below are graphs depicting two possible dynamics of gene duplication events over a period of time during genome evolution.



Based on the above figures, which one of the following options correctly represents the identity of A, B, C and D?

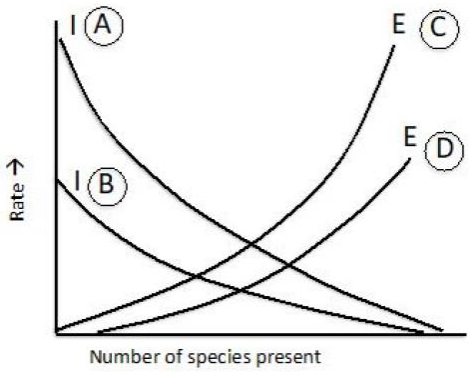
(a) A-Gene duplication event, B-random loss of duplicated genes, C-remainingpairs of duplicated genes, D-additional gene duplication events

(b) A-remaining pairs of duplicated genes, B-gene duplication event, C-random loss of duplicated genes, D-additional gene duplication events

(c) A-additional gene duplication events, B-random loss of duplicated genes,C-remaining pairs of duplicated genes, D- Gene duplication event

(d) A-Random loss of duplicated genes, B-additional gene duplication events,C-gene duplication event, D-remaining pairs of duplicated genes

Q133. A researcher working on island biogeography mapped how isolation-controlled immigration (I), and area-controlled extinction (E), will act on number of species present on the islands. He forgot to label the size of the islands [small or large) and the location of the islands (near or far) on the graph,



Using information from MacArthur and Wilson's equilibrium theory, select the option that correctly identifies A B, C and D in the figure above,

(a) A-large, B- small, C-near, D-far

(b) A-small, B-large, C-far, D-near

(c) A-near, B-far, C-small, D-large

(d) A-far, B-near, C-large, D-small

Q134. Given below are some terms and concepts related to phytoremediation inColumn AandB

Column A	Column B
A. Excluders	I. Can absorb and transfer heavy metals to aerial parts without phytotoxicity symptoms
B. Heavy metal proteintransporter	II.Salix sp. AndPopulus sp.
C. Hyperaccumulators	III. Transgenesis
D. High biomass, non-accumulators	IV. Can restrict heavy metal ions

	to the roots anddetoxify them

Which one of the following options represents the most appropriate match ofall terms/concepts in column A and B?

(a) A - II, B - IV, C - I, D – III

(b) A - III, B - IV, C - II, D - I

(c) A - II, B - III, C - IV, D – I

(d) A - IV, B - III, C - I, D - II

Q135. Given below are the various protein cleaving reagents (List I) and theirrecognition sites (List II) in the target protein.

List I	List II
A. CNBr	I. –Asp-Ala-
B. Trypsin	II. –Phe-Ala-
C. Caspase	III. –Met-Ala-
D. Chymotrysin	IV. –Arg-Gly.

Which one of the following options represents the correct combination ofitems

(a) A - III, B - II, C - I, D - IV,

(b) A - IV, B - II, C - I, D - III,

(c) A - IV, B - I, C - II, D - III,

(d) A - III, B - IV, C - I, D - II,

Q136. Given below are a few terms related to map-based sequencing of genomes:

A. Partial digestion with restriction enzymes.

B. Assembly of contigs

C. Pulsed field gel electrophoresis

D. Cloning in cosmids/YACs/BACs

E. Sub-cloning and sequencing

Which one of the following options represents the correct order of steps(based on the above terms) in map-based sequencing?

(a) C-B-D-E-A (b) C-A-D-B-E

(c) E-A-B-D-C (d) A-C-B-D-E

Q137. Given below are a few statements on technologies/concepts related to development of transgenic plants:

A. Frequency of genetic transformation is influenced only by the genes ofAgrobacteriumand not by those of the host plants.

B. Transgenic plants containing a single copy of the transgene arepreferred over those that contain multiple transgene copies for subsequent genetic analysis.

C. Supervirulent strains ofAgrobacteriumcan be generated by increasing the copy number of virulence genes.

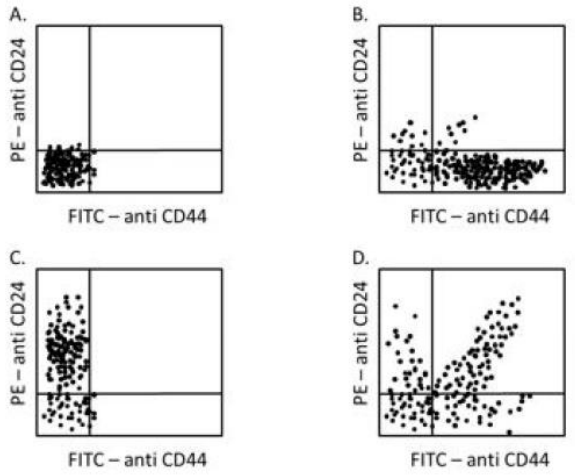
D. A nonconditional negative selection marker has to be necessarily usedwith a strong constitutive promoter for the development of transgenicplants.

Which one of the following options represents a combination of allINCORRECTstatements?

(a) A and D only (b) C only

(c) B and C only (d) D only

Q138. Consider the four results that were obtained from immunophenotyping of human breast cancer cells.



Which one of the following options correctly depicts the above results?

(a) 'B' represents a plot that denotes a high percentage of cancer stem cells inthe breast cancer cells.

(b) 'D' denotes a plot where dual positive cells predominate, representing thedead cells.

(c) 'A' denotes a plot where only cells stained with CD44 and CD24 areobserved.

(d) 'C' represents a plot where only fibroblast cells are present.

Q139. A culture was started by inoculating the medium with 100 cells having ageneration time of 2 hours. Assuming the culture grows in ideal synchronyfor at least 24 hours, what will be the number of cells in the culture at 2hours and 9 hours?

(a) 2.0×10^2cells, 1.6×10^3cells, respectively.

(b) 2.0×10^2cells, 2.4×10^3cells, respectively.

(c) 2.0×10^4cells, 3.2×10^3cells, respectively.

(d) 2.0×10^4cells, 1.6×10^8cells, respectively.

Q140. From the steps listed below, some are used to evaluate the goodness of fit using the chi-square test.

A.The mean, variance and standard deviation are calculated

B. Variance calculated using $\frac{\sum(x_1 - \bar{x})^2}{n-1}$

C. Test statistic calculated using $\frac{\sum(\text{observed} - \text{expected})^2}{\text{expected}}$

D.The degree of freedom is calculated as n-1, where n is the number of ways in which theexpected classes are free to vary

E.The probability value is obtained

Which one of the following options provides the correct sequence of steps in this statistical analysis?

(a) A, C, D (b) C, D, E

(c) B, A, D (d) A, D, E

Q141. Inverse PCR is performed for site-directed mutagenesis with complementaryprimers (having the desired mutation) using a plasmid having the clonedgene as template. The following statements were made regarding the aboveexperiment.

A. PCR is followed by transformation of bacterial cells directly with the reaction mixture. A large number of the transformants will have the wildtype gene.

B. The PCR mixture is treated with Dpn I and then used to transformbacterial cells. Most of the transformants will have the mutant gene.

C. PCR is followed by transformation of bacterial cells directly with the reaction mixture. None of the transformants will have the mutant gene.

D. The PCR mixture is treated with Dpn I and then used to transformbacterial cells. Half of the transformants will have the mutant gene.

Which one of the following options represents a combination of all correctstatements?

(a) A and B (b) A and D

(c) B and C (d) B only

Q142. The molecular ion peak $[M]^{\cdot+}$ of an analyte as measured by Electron Ionization Mass Spectrometry has an m/z of 149 and a relative abundance of 100%. The $[M]^{\cdot+}$ has a relative abundance of 6.7% and the $[M + 2]^{\cdot+}$ peak has a relative abundance of 5%. The abundance of the major isotope of H, C, N, O and S are ^{1}H-100%, ^{12}C-98,9%,^{12}C-1.1%, ^{14}N-99.6%, ^{15}N-0.4%, ^{16}O-99,8%, ^{18}O-0.2%, ^{32}S-95.0%, ^{33}S-0.75 % and ^{34}S-4.2%. The most probable molecular formula of the compound is:

(a) $C_7H_{21}N_2O$ (b) $C_5H_{11}NO_2S$

(c) $C_6H_{13}O_2S$ (d) $C_6H_{15}NOS$

Q143. Which one of the statements given below regarding generation ofmonoclonal antibodies isINCORRECT?

(a) Monoclonal antibodies are the product of a single stimulated B-lymphocyte.

(b) To generate large quantity of monoclonal antibodies, a normal stimulatedantibody producing B cell is fused with a long lived B cell tumor.

(c) The hybridoma generated for antibody production is selected on HATmedium.

(d) For HAT selection of hybridoma, the antibody producing B-cells are pre-treated with 8-azaguanine to block salvage pathway of DNA synthesis.

Q144. Optical remote sensing has been increasingly used to monitor vegetationglobally. The table below lists different regions of the electromagneticradiation (EMR) spectrum as well as different vegetation characteristics:

List I	List II
Part of the EMR spectrum	Vegetation characteristics
A. Ultraviolet	I. Plant water content
B. Visible	II. Foliage density
C. Near Infrared	III. Plant photosynthetic pigments
D. Shortwave Infrared	

Which one of the following combinations correctly matches the EMR regionwith the vegetation character analysed:

(a) A - I, B - II, C – III (b) A - I, B - III, C - II

(c) B - II, C - III, D – I (d) B - III, C - II, D - I

Q145. *Pichia pastorisis* a good host for producing human proteins for therapeuticuse. Given below are some statements on the reasons for its utility.

A. It produces large amount of recombinant protein.

B. It has the property of secreting proteins into the medium.

C. It allows the formation of disulphide bonds similar to those in humans.

D. It carries out protein glycosylations identical to those found in humans.

Which one of the following options represents a combination of correct statements?

(a) A and B only

(b) A, B and C only

(c) A, B and D only

d) B, C and D only