1. The stacked bar chart shows the year-wise students' participation in various games.


Which one of the following inferences is

## INCORRECT?

(a) In 2004, athletics was the most popular of these games.
(b) The year 2003 witnessed highest participation in these games.
(c) Among all the years, the popularity of Tennis was the highest in 2005.
(d) In 2003, more students played Badminton than Cricket and Tennis combined.
2. The wholesale price per unit of an item is $C_{0}$ up to first 19 units. The unit price falls by $10 \%$ if 20 to 29 units are purchased, and by another $10 \%$ if 30 ormore units are purchased. If 120 units are bought, the unit price paid is
(a) 0.89 C 0
(b) 0.97 C 0
(c) $0.91 \mathrm{C0}$
(d) 0.81 C 0
3. If the length of the smallest side of a triangle is 5 units, and the sides are in arithmetic progression with positive integer difference, the number of suchpossible triangles is
(a) 3
(b) 4
(c) 5
(d) infinite
4. A box contains four jerseys with the players' names printed. The four players pick up a jersey each at random. The total number of players wearing their ownjersey CANNOT be
(a) 1
(b) 2
(c) 3
(d) 4
5. Water is pumped into a long horizontal pipe at a fixed volumetric rate. The diameter of the pipe changes along its length as shown in the figure.


The speed of water is
(a) the same in sections $\mathrm{S}_{1}, \mathrm{~S}_{2}$ and $\mathrm{S}_{3}$.
(b) lower in section $S_{2}$ compared to the other sections.
(c) higher in section $S_{2}$ compared to the other sections.
(d) reduces gradually from $\mathrm{S}_{1}$ to $\mathrm{S}_{3}$.
6. The correct diagrammatic representation of the relations among the categories TEAM SPORTS, BALL GAMES, HOCKEY and $\mathrm{KHO}-\mathrm{KHO}$ is

Select the CORRECT option

(a) A
(b) B
(c) C
(d) D
7. In a field there are some cows and ducks. If the number of heads are33 and number of legs are 84 , then what would be the ratio of the numbers of cows toducks?
(a) $5 / 6$
(b) $3 / 8$
(c) $2 / 5$
(d) $3 / 5$
8. A fair cubic die is rolled 5 times and we get the face with number 1 all 5 times on top. The probability of getting the same face on the sixth trial is,
(a) $(1-5 / 6)(1 / 6)$
(b) $(1 / 6)$
(c) $(1 / 6)^{2}$
(d) $5 / 6$
9. Which one of the following, drawn in a linear scale, represents the triangle shown in the figure above?


Select the CORRECT option


(a) A
(b) B
(c) C
(d) D
10. The sum of all the internal angles of a hexagon in degrees is
(a) 360
(b) 540
(c) 720
(d) 600
11. The standard deviation of five numbers is zero. Which of the following must be true?
(a) All the numbers are zero
(b) The median is zero
(c) If at least one number is positive, then at least one number is negative
(d) The difference between the median and mode of these numbers is zero
12. Of the following which is the most precisely reported value of a speed measurement?
(a) $125 \mathrm{~km} / \mathrm{s}$
(b) $12.5 \times 10 \mathrm{~km} / \mathrm{s}$
(c) $125.00 \mathrm{~km} / \mathrm{s}$
(d) $1.250 \times 10^{2} \mathrm{~km} / \mathrm{s}$
13. $X$ is running around a circular track completing one round every 40 seconds. Y running in the opposite direction on the same circular track crosses $X$ every15 seconds. The time in seconds taken by Y to complete one round is
(a) 12
(b) 24
(c) 30
(d) 36
14. What is the angle between the hour and minute hand of a clock at $3 \mathrm{~h}: 15 \mathrm{~m}$ ?
(a) $0^{\circ}$
(b) $2.5^{\circ}$
(c) $5^{\circ}$
(d) 7.5
15.States in the map below are to be coloured so that no two states having a common boundary have the same colour.


The minimum numbers of colours needed is
(a) 3
(b) 4
(c) 5
(d) 6
16. In the given sequence of figures


Which of the following is the next figure


Select the correct option
(a) A
(b) B
(c) C
(d) D
17. If $2^{a} \times 5^{b}=500$, and $a$ and $b$ are integers, then $a+b$ is
(a) 5
(b) 6
(c) 7
(d) indeterminable
18. A person takes one hour more to cover a certain distance walking at a speed of 2 $\mathrm{km} /$ hour compared to walking at 3 $\mathrm{km} /$ hour. The distance is
(a) 4 km
(b) 6 km
(c) 8 km
(d) 10 km
19. It is proposed to introduce daily trains between Chennai and New Delhi in both directions simultaneously, departing at each station at 6.00 PM . If the traveltime is 36 hours, what is the minimum number of rakes (train sets) required to run the service?
(a) 2
(b) 3
(c) 4
(d) 6
20. When 100 balls were equally distributed among students in a class (having strength between 10 and 60), 7 balls remained undistributed. The number ofballs that would remain if there were 125 balls to begin with is
(a) indeterminable
(b) 1
(c) 5
(d) 9

## Section B

21. Which of the options correctly matches the proteins involved in transcription (Column A) with the DNA binding domains they carry (Column B)?

| Column A | Column B |
| :--- | :--- |
| A. TFIIIA | i. Helix-turn-helix |
| B. MyoD | ii. Zinc finger |
| C. Jun | iii. Helix-loop-helix |
| D. Cro | iv. Leucine zipper |

(a) A-iv, B-iii, C-i, D-ii
(b) A-ii, B-i, C-iv, D-iii
(c) A-iii, B-i, C-ii, D-iv
(d) A-ii, B-iii, C-iv, D-i
22. The table below lists cleavage pattern and names of species

| Cleavage pattern | Species |
| :--- | :--- |
| A. Isolecithal bilateral | i. Amphibians |
| B. Mesolecithal radial | ii. Birds |
| C. Centrolecithal <br> superficial | iii. Tunicates |
| D. Telolecithal <br> discoidal | iv. insects |

Match the cleavage patterns with the species
(a) A-i; B-ii; C-iii; D-iv
(b) A-ii; B-iv; C-i; D-iii
(c) A-iv; B-i; C-iii; D-ii
(d) A-iii; B-i; C-iv; D-ii
23. Identify the ribose conformation in the nucleotide shown below.
(a) C2'-endo
(b) C2'-exo
(c) C3'-endo
(d) C5'-exo
24. Which one of the following conditions represents autopolyploidy?
(a) More than two sets of chromosomes, both of which are from the same parental species.
(b) More than two sets of chromosomes, both of which are from the different parental species.
(c) More than two sets of chromosomes only from a single parent.
(d) Duplication of a chromosomal locus leading to spontaneous increase in the copy number of a gene.
25. Which one of the following forest type occupies the largest area in India?
(a) Tropical rain forest
(b) Tropical dry deciduous forest
(c) Temperate deciduous forest
(d) Temperate evergreen forest
26. The biological species concept defines species as a group of populations that are reproductively isolated from others. However, this definition is notapplicable to groups where sexual reproduction has not been observed yet or is extremely rare. Choose the correct option of organisms where biologicalspecies concept may therefore not apply:
(a) Monocots and basal angiosperms
(b) Ascomycetes and oligochaetes
(c) Mosses and liverworts
(d) Cyanobacteria and Euglenophyta
27. While studying pathogenic bacteria, a protein with the following features was identified:
A. It was secreted during infection conditions, but not in in-vitro cultures
B. It was also observed to be present in the membranous fraction in traces, which was released upon bacterial lysis
C. It had a heat labile N -terminal enzymatic domain that binds MHC molecules, stimulating T cells non-specifically
D. It had a C-terminal non-enzymatic domain which was highly antigenic and heat-stable

How will you best classify the toxic nature of this protein?
(a) An endotoxin
(b) Superantigen
(c) Pore-forming toxin
(d) A-B toxin
28. Which of the following nitrogen containing compounds is formed during deamination of organic nitrogen in plants?
(a) NO
(b) $\mathrm{NO}_{2}^{-}$
(c) $\mathrm{NO}_{3}^{-}$
(d) $\mathrm{NH}_{4}{ }^{+}$
29. Individual chromosomes are clearly seen during which phase of the cell cycle?
(a) $G_{0}$
(b) $\mathrm{G}_{1}$
(c) S
(d) M
30. Which one of the following statements is INCORRECT?
(a) Transient rise in $\mathrm{Ca}^{2+}$ is necessary for egg activation in mammals.
(b) Sperm induces egg activation and does not involve $\mathrm{Ca}^{2+}$.
(c) In many organisms, eggs secrete diffusible molecules that attract and activate sperm.
(d) Capacitated mammalian sperm can penetrate the cumulus and bind the zona pellucida.
31. Which one of the following statements about the recognition of tRNAs by their cognate aminoacyl-tRNAsynthetases is correct?
(a) Aminoacyl-tRNAsynthetases recognize their cognate tRNAs by the exclusive recognition of their anticodons
(b) Aminoacyl-tRNAsynthetases recognize their cognate tRNAs by recognition of their anticodons in some tRNAs only.
(c) Aminoacyl-tRNAsynthetases cannot aminoacylate a tRNA that lacks the conserved modifications in the $\mathrm{T} \varphi \mathrm{C}$ loop.
(d) Aminoacyl-tRNAsynthetases cannot aminoacylate a tRNA that lacks the conserved modifications in the DHU loop.
32. The following are selected plant apomorphies:
A. Development of xylem
B. Development of cuticle
C.Development of independent sporophyte
D. Development of eustele

Which option represents the correct evolutionary sequence of the above?
(a) A-D-B-C
(b) C-A-B-D
(c) B-C-A-D
(d) C-B-D-A
33. What is the 50th percentile of the numbers $9,5,11,3$ and 2 ?
(a) Five
(b) Six
(c) Nine
(d) Fifteen
34. Consider a predator species foraging for prey in a habitat, where there are two prey species $A$ and $B$. Assume the foraging predator can choose from a high valueprey A and low-value prey B. A and B occur at different frequencies in the environment, so it may take different average times to find the next A or Bindividual.

Choose the correct option based on the optimal foraging theory.
(a) If it takes too long to search for $A$, predators may switch to eating B only.
(b) If it takes too long to search for $A$, predators may eat both $A$ and $B$, whichever is encountered.
(c) Predators will only feed on B, regardless of search time.
(d)Predators will never feed on B, irrespective of its relative frequency.
35. Which one of the following correctly describes the effect of a mutation in phosphofructokinase (PFK), that leads only to the loss of allosteric regulation byATP?
(a) Decrease in the activity of PFK
(b) Increase in the activity of PFK
(c) Decrease in the amount of ADP generated by PFK
(d) Increase in the amount of ATP generated by PFK
36. Histone variants play important roles in chromatin function in mammalian cells. Which one of the following statements is correct in the context of thehistone variants?
(a) Histone variants have been reported for

H 3 and H 4 but not for H 2 A and H 2 B
(b) Histone variants have been reported for H3, H4, H2A but not for H2B
(c) Histone variants have been reported for H3, H4, H2B but not for H2A
(d) Histone variants have been reported for H3, H4, H2A and H2B
37. There is a species that is critically endangered, found in the Russian Far East. It is solitary, but it has been reported that some males stay with females aftermating, and may even help with rearing the young. Identify this species.
(a) Amur leopard
(b) Snow leopard
(c) Arctic fox
(d) Black-footed ferret
38. Which one of the following is a small sulfated peptide that is secreted by a rice pathogenic bacterium, Xanthomonas oryzae to modulate motility, biofilmformation and virulence?
(a) Coronatine
(b) N-acylhomoserine lactones
(c) $\mathrm{A} \times 21$
(d) EPS
39. Absorbed monosaccharides in intestinal epithelial cells exit via which one of the following transporters?
(a) GLUT2
(b) GLUT3
(c) GLUT4
(d) GLUT5
40. Which one of the following floral mutants shows the pattern 'sepals-petals-petals' repeated several times?
(a) agamous (ag)
(b) apetala1 (ap1)
(c) apetala3 (ap3)
(d)pistillata (pi)
41. Which one of the following small molecule neurotransmitters is NOT synthesized from tyrosine?
(a) Epinephrine
(b) Dopamine
(c) Serotonin
(d) Norepinephrine
42. The radioactive isotope of an element has a half-life of 100 hours. How many hours will it take for $\frac{15}{16}$ of the source amount to decay?
(a) 50
(b) 400
(c) 250
(d) 1000
43. At which one of the following electron transport chain complexes does Antimycin A typically inhibit the respiratory chain?
(a) Complex I
(b) Complex II
(c) Complex III
(d) Complex IV
44. Which of the following correctly represents the relationship between the rate of population growth and population size?
(a)


(b)

(c)

45. A few organelles that are present in a eukaryotic cell are mentioned below:
A. Centrosomes
B. Peroxisomes
C. Nucleolus
D. Endosomes

Which one of the following options represents organelles that are not membrane-bound?
(a) A and B
(b) B and C
(c) A and C
(d) A and D
46. The correct hierarchy of geological times is:
(a) eon $>$ era $>$ period $>$ epoch
(b) period $>$ era $>$ epoch
(c) epoch $>$ period $>$ era $>$ eon
(d) era > eon > period
47. Any movie that features dinosaurs should also have which of the following combinations of geological age-appropriate organisms? Choose the correctcombination.
(a) Humans, angiosperms and gymnosperms, birds
(b) Early diverging angiosperms, reptiles, amphibians
(c) Apes, gymnosperms, birds
(d) Early diverging gymnosperms, amphibians, reptiles
48. Which one of the following combinations of CD molecules and their associated functions is matched INCORRECTLY?
(a) CD1: Antigen-presenting proteins that present antigenic peptides to T -cell receptors on natural killer T cells (NKT)
(b) CD8: Thymic differentiation marker for T cells
(c) CD11a: A membrane glycoprotein that provides cell-cell adhesion by interaction with ICAM 1 (intercellular adhesion molecule 1)
(d) CD14: Activates innate immune responses by transferring LPS-LBP complex to TLR4.
49. Which one is NOT a true response of pulmonary J-receptor stimulation by hyperventilation of lung?
(a) Bronchodilation
(b) Decreased heart rate
(c)Apnoea followed by rapid breathing
(d) Low blood pressure
50. Which one of the following statements made about the bacterial replisome is INCORRECT?
(a) The rate of forward movement of DnaB helicase along the template DNA increases 10 -fold when DnaB and DNA Pol III interact, thus ensuring that the helicase does not move ahead rapidly without the polymerase.
(b) The transient interaction of the primase with the helicase allows activation of primase activity by 1000 -fold, promoting RNA primer synthesis.
(c) The length of the Okazaki fragments is typically restricted to 1000-2000 nucleotides.
(d) The E. coli oriC carries repeats of two sequence motifs: repeats of a 9-mer that collectively form the site at which the origin first becomes single-stranded, and repeats
of a 13-mer to which the DnaA initiator protein binds.
51. In which one of the following developmental events, the fate of maternal somatic cell is determined first, which then determines the fate of the developing embryo?
(a) The specification of primary organizer in amphibian embryo.
(b) The specification of dorso-ventral axis in Drosophila.
(c) The formation of the vulval precursor cells during development of C. elegans.
(d) Specification of the micromeres in case of sea urchin.
52. In remote sensing, which one of the following formulae is used for the calculation of normalized difference vegetation index (NDVI)?
(a) RED / (NIR + RED)
(b) RED / (NIR - RED)
(c) (NIR + RED) /(NIR - RED)
(d) (NIR - RED) /(NIR + RED)
53. Given below is a pedigree a pattern of inheritance

(a) X-linked recessive
(b) Autosomal recessive
(c) X-linked dominant
(d) Autosomal dominant
54. If you want to selectively kill the newly dividing mammalian cells in a cell culture assay, which of the following methods will you use?
(a) Exposure to UV radiation at 250 nm .
(b) Treatment with 5-ethynyl-2'deoxyuridine (EdU), followed by doxorubicin hydrochloride treatment.
(c) Treatment with 5-bromo-2'deoxyuridine (BrdU), followed by UV-A exposure
(d)Tritiated thymidine treatment followed by vinblastine treatment
55. Which one of the following biome is known to occur in India?
(a) Tundra
(b) Boreal forest
(c) Taiga
(d) Alpine grasslands
56. Which one does NOT occur as a physiological adjustment during heat acclimatization?
(a) Lowered threshold for start of sweating
(b) Effective distribution of cardiac output
(c) Improved skin blood flow
(d) Increased salt concentration of sweat
57. Which of the following statements regarding chlorophyll is NOT correct?
(a) Chlorophyll-a has a $-\mathrm{CH}_{3}$ group in its porphyrin-like ring structure.
(b) Chlorophyll-b has -CHO group in its porphyrin-like ring structure.
(c) Only chlorophyll-a, but not chlorophyllb, has a $\mathrm{Mg}^{++}$coordinated at the centre of the porphyrin-like ring structure.
(d) The long hydrocarbon tails of chlorophyll anchors them in the photosynthetic membrane.
58. The following picture represents a gel profile of a pair of DNA markers observed in parents P1 and P2, $F_{1}$ progeny and $F_{2}$ progeny. Four different profiles were observed in case of $\mathrm{F}_{2}$. The number of $\mathrm{F}_{2}$ progeny shoeing a given profile is indicated in brackets


Based on the above observation, which one of the following statements is correct?

1. Co-dominant DNA markers were used for this study.
2. The polymorphic DNA bands represent two independent genes.
3. If the P1 parent was crossed to the $\mathrm{F}_{1}$ individual, the progeny will show all the four profiles as observed in the case of $\mathrm{F}_{2}$ progeny.
4. If an $\mathrm{F}_{2}$ progeny which does not show either of the DNA makers (last lane of the above gel) is crossed to a P1 individual, the obtained progeny will have two types of
individual, one which shows a band and the other where no band is observed.
5. The activities of baroreceptors present in the carotid sinus are carried by the afferent fibers of neurons located in
(a) nodose ganglion
(b) geniculate ganglion
(c) petrosal ganglion
(d) spiral ganglion
6. In a conjugation experiment between Hfr strain ' $X$ ' and F-cell, lac gene enters the recipient in 4 minutes, but the F-cells remain auxotrophic for Leu, Trp, Ura, Glu, Phe and Gly. The mating is then allowed to proceed for 20 minutes and lac exconjugants are selected. Of the lac ${ }^{+}$ cells,
$35 \%$ are leu ${ }^{+}$
$98 \%$ are trp ${ }^{+}$
$10 \%$ are ura $^{+}$
$65 \%$ are $\mathrm{glu}^{+}$
$0 \%$ are phe ${ }^{+}$
$81 \%$ are gly ${ }^{+}$
Select the correct order of the genes as they enter, from the choices given below:
(a) $\operatorname{trp}^{+}, \mathrm{gly}^{+}, \mathrm{glu}^{+}, \mathrm{leu}^{+}$, ura $^{+}$, phe $+\mathrm{lac}+$
(b) lac ${ }^{+}$, phe $^{+}$, ura $^{+}$, leu $^{+}$, glu $^{+}$, gly $^{+}, \operatorname{trp}^{+}$
(c) phe $^{+}$, ura $^{+}$, leu $^{+}$, glu $^{+}$, gly $^{+}$, trp $^{+}$, lac $^{+}$
(d) $\mathrm{lac}^{+}, \operatorname{trp}^{+}, \mathrm{gly}^{+}, \mathrm{glu}^{+}$, leu ${ }^{+}$, ura $^{+}, \mathrm{phe}^{+}$
7. Which one of the following traits would hypothetically NOT be considered for preferential selection during domestication of the corresponding crops listedbelow?
(a) Increased fruit size of tomato
(b) Reduced spininess in okra
(c) Shattering seeds of corn
(d) Increased oil content of mustard
8. The measurement of distance based on counting steps or number of vertical bars by insects for navigation is called:
(a) path integration.
(b)allocentric coding.
(c)odometry.
(d) alignment image-matching.
9. Species richness can be measured with the:
(a) abundance of species in an area.
(b) number and the abundance of species in an area.
(c) number of species in an area.
(d) density of species in an area.
10. Which one of the following correctly describes the spectroscopic experiment that would help distinguish between a $\alpha$ helix, a $3_{10}$ helix and a $\pi$ helix?
(a) Near UV absorption spectrum between $250-300 \mathrm{~nm}$
(b) Fluorescence emission spectra between $350-400 \mathrm{~nm}$
(c) $1 \mathrm{H} \quad \mathrm{NMR}$ spectroscopy involving Hydrogen/Deuterium exchange
(d) Near UV Circular Dichroism spectrum between $250-300 \mathrm{~nm}$
11. The additive nature of a genetic map as suggested by Alfred Sturtevant and T. H. Morgan is possible if there is:
(a) no interference in crossovers.
(b) complete interference in crossovers.
(c) partial interference in crossovers.
(d) variable interference in crossovers dependent on the genetic distances.
12. The Biodiversity Management Committees (BMCs) envisaged under the Biological Diversity Act (2002) and Rules (2004) are constituted at which one of thefollowing administrative levels?
(a) Village
(b) Tehsil / Taluka
(c) District
(d) State
13. Lr34, a broad-spectrum disease resistance gene in wheat, encodes for a putative:
(a) Serine hydroxymethyltransferase
(b) ABC transporter
(c) Host-specific toxin
(d) TIR-NB-LRR protein
14. Which of the following is typically true of invasive species?
(a) They are r-selected
(b) They are K-selected
(c) They are habitat specialists
(d) They are always introduced by humans
15. The product of nahG gene of Pseudomonas putida catalyzes the metabolism of salicylic acid to which one of the following compounds?
(a) Benzoic acid
(b) Methyl salicylate
(c) Catechol
(d) Benzoyl-CoA
16. In crystalline NaCl , how many chloride ions surround each sodium ion?
(a) Four
(b) Six
(c) Eight
(d) Ten

## Section C

71. There are many superfamilies of adhesion proteins, which play a central role in cell-
cell adhesion in animals. Ig superfamily proteins are one such adhesionproteins. Which one of the following statements about Ig superfamily proteins is INCORRECT?
(a) The white blood cell proteins recognized by endothelial cell integrins are called ICAM (intercellular cell adhesion molecule) or VCAM (vascular celladhesion molecules)
(b) These are called Ig superfamily because they contain one or more extracellular Iglike domains that are characteristic of antibody molecules.
(c) ICAM and VCAM mediate heterotrophic binding to integrin, whereas NCAM (neural cell adhesion molecule) mediates homotrophic binding.
(d) They contain large quantities of sialic acid which inhibit adhesion by chargebased repulsion contributing to fine tuning of cell-cell adhesion.
72. Following statements were made about cell cycle regulation in eukaryotes:
A. Activity of maturation promoting factor (MPF) rises and falls in synchrony with the concentration of cyclin $B$.
B. Cdc25 phosphatase mediates removal of phosphate from the inhibitory tyrosine residue (Y15) to yield highly active MPF.
C. MPF specifically phosphorylates and depolymerizes lamin A and C, but not lamin B.
D. MPF phosphorylates H1 histone.
E. In Schizosaccharomyce spombe, overproduction of Wee1 protein decreases the length of $\mathrm{G}_{2}$ phase and extends the period of M phase by functioning as a mediator of MPF activity.

Which one of the following represents the combination of correct statements?
(a) A, B and C
(b) A, B and D
(c) B, C and E
(d) C, D and E
73. The HIPPO signaling pathway is important for cell proliferation. It is regulated by the protein kinases MST1/2 and LATS1/2, and the transcriptional activators YAP and TAZ. Accordingly, the following events may be observed within a cell.
A. Activation of TEADs by phosphorylated YAP/TAZ.
B. Activation of YAP/TAZ on phosphorylation by MST/LATS
C. Activation of TEADs by dephosphorylated YAP/TAZ
D. Inactivation of MST / LATS by repressors
Which one of the following situations can support progression of cancer?
(a) A and B
(b) B and C
(c) C and D
(d) A and D
74. The following table lists major food crops and the region of domestication

| Food crop | Region of domestication |
| :--- | :--- |
| A. banana | i. Africa |
| B. Mung bean | ii. India |
| C. Sorghum | iii. Indonesia |


| D. Wheat | iv. Middle East |
| :---: | :--- |
| Which one of the following option |  | represents the correct match between the food crop and its region of domestication?

(a) A-ii, B-iii, C-i, D-iv
(b) A-iii, B-i, C-ii, D-iv
(c) A-iv, B-i, C-iii, D-ii
(d) A-ii, B-iv, C-iii, D-i
75. Interferons $\alpha, \quad \beta$ and $\gamma$ are cytokines produced and secreted by animal cells after infection by viruses. Which one of the following statements aboutinterferons is INCORRECT?
(a) When mammalian cells are incubated with different interferons, activation of STATs (Signal Transducers and Activators of Transcription) links stimulationof cell surface receptors with gene expression.
(b) Increase in the expression of genes after addition of IFNa results only after activation of the interferon-stimulated response element (ISRE).
(c) The receptors of all three interferons belong to the Ig superfamily of receptors and do not lead to downstream phosphorylation events.
(d) An important feature of interferonSTAT signaling pathway is its specificity: each type of interferon induces transcription of a unique subset of genes.
76. A human subject can voluntarily inhibit respiration for some time but the subject feels irresistible urge to resume breathing after a while at a point which iscalled the
breaking point. The characteristic features of breaking point are suggested in the following statements:
A. The breaking point is shorter in subjects after removal of carotid bodies compared to when they have intact carotid bodies.
B. The breaking point is prolonged if the subject breathes $100 \%$ oxygen before breath holding.
C. When the subject hyperventilates with room air before breath holding, the breaking point is delayed compared to when the subject breathes normallybefore breath holding.
D. The breaking point can be reduced in a subject by making respiratory movements behind a closed glottis.
E. The breaking point is shorter when the subject is told during breath holding that her/his performance is very good compared to a situation when she/he isnot told so.

Choose both the correct statements from the following options:
(a) A and B
(b) B and C
(c) C and D
(d) D and E
77. The intake of nutrients is under intricate control. A number of statements are made about factors controlling food intake:
A. Cholecystokinin produced from small intestine stimulates food intake
B. Leptin produced in adipose tissues stimulates food intake
C. Leptin receptors are located in hypothalamus
D. Ghrelin produced in the stomach inhibits food intake
E. Leptin also stimulates the metabolic rate
F. Ghrelin increases secretion of Neuropeptide Y
Choose the combination of all correct statements from the following options:
(a) A, B and C
(b) A, B and D
(c) D, E and F
(d) C, E and F
78. In eukaryotes, DNA replication must occur with extreme accuracy and only once to prevent the damaging effects of gene amplification. The followingstatements were made regarding possible mechanisms involved in achieving tight regulation of DNA replication:
A. High APC/C activity in mitosis and early G1 phase of the cell cycle that triggers the destruction of Cdt1 inhibitor geminin, thus allowing Cdt1 to be activein early G1 to load helicases.
B. Activation of S-Cdks that regulate the phosphorylation of specific initiator proteins in the S-phase.
C. MCM helicase loads at the S-phase of the cell cycle, so that replication begins only at S-phase.
D. Cdc6 and Cdt1 bind to the origin recognition complex (ORC) and help in pre-replicative complex assembly only after mitosis.

Which one of the options has all correct statements?
(a) A, B, and C only
(b) B, C, and D only
(c) A, B, and D only
(c) A, B, C, and D
79. The table below lists the characteristics of specific tumor types (Column A) and their names (Column B).
$\left.\begin{array}{|l|l|}\hline \text { Column A } & \text { Column B } \\ \hline \text { Tumor types } & \text { Nomenclature } \\ \hline \begin{array}{lrrr|}\text { A. A tumor that has } \\ \text { arisen } & \text { from }\end{array} & \text { i. Neoplasm } \\ \text { endodermal tissue }\end{array}\right]$.

Which of the following options represents the correct match between Column A and Column B?
(a) A-iii; B-iv; C-i; D-ii
(b) A-ii; B-iv; C-vi; D-iii
(c) A-iii; B-v; C-vi; D-i
(d) A-iv; B-v; C-i; D-ii
80. Fidelity of protein synthesis depends to a large extent on the accuracy of aminoacylation of tRNAs with correct amino acids. However, given that the side chains of many amino acids are not sufficiently different, aminoacyltRNAsynthetases (aaRS) are often prone to misacylate the tRNAs. One such example of misacylation is of $\mathrm{tRNA}{ }^{\text {Thr }}$ by ThrRS. In this context, following statements are being made about E. coli ThrRS.
A. It misacylatestRNAThr equally with Ser and Cys
B. It possesses a distinct editing site that preferentially deacylates the misacylatedtRNAThr
C. The editing of the misacylatedtRNA ${ }^{\text {Throccurs }}$ frequently in cis before the release of the misacylatedtRNAThr
D. It possesses a distinct editing site that does not discriminate between the misacylatedtRNA ${ }^{\text {Thr }}$ and Thr-tRNA ${ }^{\text {Thr }}$
E. The aminoacylation and the editing sites of ThrRS are the same.

Choose the option that represents all correct statements.
(a) A and B
(b) B and C
(c) C and D
(d) D and E
81. A researcher examined the features of newly hatched birds. Species A showed open eyes, down feathers and was able to move around. Species B lackeddown feathers and was incapable of walking and its eyes were closed. Given this, choose the correct option.
(a) Species A is altricial and species B is precocial.
(b) Species A is precocial and species B is altricial.
(c) Species A and B are both precocial.
(d) Species A and B are bothaltricial.
82. Following statements were made about some of the characteristics of the human genome:
A. Evidence derived by chromosome conformation capture (3C) suggests that each chromosome comprises a series of topologically associated domains.
B. Insulators typically mark the boundaries of topologically associated domains, preventing the genes within a domain from being influenced by theregulatory modules of an adjacent domain.
C. Presence of insulators does not overcome the positional effect after integration of a transgene into the genome.
D. Insulators can provide barrier against the spread of heterochromatin.
E. Insulator sequences are absent in the Drosophila genome, which suggests their essentiality in achieving highest degree of gene regulation in humans.

Which one of the following represents the correct combination of above statements?
(a) A, B and C
(b) A, B and D
(c) B, C and D
(d) C, D and E
83. The figure below depicts a hypothetical scheme for synthesizing a target product in plants. (A), (B) and (C) are the precursors of a target product (D), whereas (E) is a byproduct. The key enzymes of the pathway are indicated as E1-E6. To enhance the levels of target product (D), following strategies were tested:

A. Enhancing the activity of the enzyme E5 by over-expression and/or protein engineering.
B. Enhancing the activity of the enzyme E4 by over-expression and/or protein engineering.
C. Enhancing the levels of (C).
D. Blocking the activity of E6 by RNAinterference or CRISPR/Cas-mediated knockout.

Which of the above mentioned strategies are likely to provide the maximum enhancement of the target product compared to the by-product, if no feedbackregulation exists for any of the enzymes in the pathway?
(a) A and B
(b) B and C
(c) C and D
(d) A and D
84. Given below is a pedigree indicating a pattern of inheritance:


The following statements are drawn from the above pedigree towards understanding the pattern of inheritance:
A. An affected male does not appear to pass the trait to his sons
B. An affected male appears to pass the allele to a daughter who is unaffected
C. All affected individuals have at least one affected parent
D. The given trait appears to be a recessive one
E. The given trait appears to be an autosomal recessive one

Select the option from the following that has all correct statements:
(a) C and E only
(b) A, B and D only
(c) E only
(d) A, B, C, D and E
85. The following table shows a list of evolutionary processes and their associated characteristics:

| Evolutionary process | Characteristic |
| :---: | :---: |
| A. Parallelism | i. closely groups evolve similar characteristics |
| B. convergence | ii. individuals of different species crossbreed |
| C. Introgression | Crossbreeding between species is mediated repeated backcrossing |
| D. Hybridization | iv. two or more distantly related groups acquire similar characteristics | evolutionary process to its salient characteristic.

(a) A-iv, B-i, C-ii, D-iii
(b) A-i, B-iv, C-iii, D-ii
(c) A-iv, B-iii, C-i, D-ii
(d) A-iv, B-ii, C-iii, D-i
86. The signal transduction pathway involved in glycogen metabolism triggered in the
liver by the hormone epinephrine involves the following steps:
A. Activation of $G$ protein $\left(\mathrm{G}_{\alpha \beta \gamma}\right)$ by the activated receptor
B. Protein kinase A activation
C. Second messenger generation $\left(3^{\prime}, 5^{\prime}\right.$ cyclic AMP)
D. Adenylyl cyclase activation

Which one of the following combinations describes these processes in the right order?
(a) A-D-C-B
(b) A-C-D-B
(c) D-A-B-C
(d) A-D-B-C
87. Dixon plot is used to study the enzyme inhibition by plotting various expressions of velocity (v) and inhibitor concentration [I] on the X -axis (Column A) and Y-axis (Column B) as given below :

| Column A(X-axis) | Column B(Y-axis) |
| :--- | :--- |
| (i) v | (i) $1 / \mathrm{V}$ |
| (ii) $1 / \mathrm{v}$ | (ii) $[\mathrm{I}]$ |
| (iii) $1 /[\mathrm{I}]$ | (iii) $1 /[\mathrm{I}]$ |
| (iv) $[\mathrm{I}]$ | (iv) v |

Which one of the following options is the correct combination from columns A and B to draw the Dixon plot?
(a) Column A -iv, Column B-i
(b) Column A -i, Column B- ii
(c) Column A- ii, Column B- iii
(d) Column A- iii, Column B- iv
88. Young seedlings of Arabidopsis plants are exposed to the following light conditions:
A. Far-Red light followed by Red light
B. Far-Red light followed by Red light and then Dark phase
C. Red light followed by Far-Red light
D. Dark phase followed by Far-Red light and then Red light
E. Far-Red light followed by Dark phase and then Red light
F. Red light followed by Dark phase and then Far-Red light
Which of the above conditions will lead to photomorphogenesis?
(a) A, B and E
(b) B and F
(c) C and F
(d) A, D and E
89. Which one of the following statements in relation to insect wings is NOT true?
(a) Insect wings are extensions of cuticle and not true appendages.
(b) In beetles, the hind wings function in flight.
(c) Males of many cricket species have forewings modified to bear soundproducing structures.
(d) Flies have a structure called frenulum, which joins the forewing to the hind wing.
90. Following are a few statements about India's biodiversity:
A. India has $2.4 \%$ of the world's land area, but accounts for $12 \%$ of all recorded species.
B. India has over 45,000 species of animals and 91,000 species of plants.
C. Four of the globally identified biodiversity hotspots can be found in India.
D. India is estimated to harbour around $60 \%$ of the global tiger population.

Which one of the following options represents all correct statements?
(a) Only A
(b) Only C
(c) Both A and B
(d) Both C and D
91. The immune system of thymectomized and lethally irradiated (A X B) $\mathrm{F}_{1}$ mice ( $\mathrm{H}-2^{\mathrm{a} / \mathrm{b}}$ ) were reconstituted by grafting thymus from Strain B mice $\left(\mathrm{H}-2^{b}\right)$ and
with (A X B) $\mathrm{F}_{1}$ bone marrow cells. These mice were then infected with lymphocytic choriomeningitis virus (LCMV). The CD8+ cytotoxic T lymphocytes from
the reconstituted mice were then cocultured with the following cells:
A. Uninfected fibroblast cells from (A X B) $\mathrm{F}_{1}$ mouse
B. Uninfected fibroblast cells from strain-A mouse
C. Uninfected fibroblast cells from strain-B mouse
D. LCMV infected fibroblast cells from (A X
B) $F_{1}$ mouse
E. LCMV infected fibroblast cells from strain-A mouse
F. LCMV infected fibroblast cells from strain-B mouse

Which of the options below indicate the cells that will be lysed by the CD8+ cytotoxic T lymphocytes from the reconstituted mice?
(a) A, C, D and F only
(b) D, E and F only
(c) D and F only
(d) B and F only
92. Glycolysis and citric acid cycle contribute precursors to many biosynthetic pathways in plants. Column $X$ lists names of the precursors and column Y lists the product synthesized.

| Column X | Column Y |
| :--- | :--- |
| A. Hexose <br> phosphate | i. Aspartate |
| B. Pyruvate | ii. Alanine |
| C. Pentose <br> phosphate | iii. Cellulose |
| D. Oxaloacetate | iv. Nucleotides |

Which one of the following options represents the correct match between column $X$ and $Y$ ?
(a) A-ii, B-iii, C-i and D-iv
(b) A-iii, B-ii, C-iv and D-i
(c) A-iv, B-i, C-iii and D-ii
(d) A-i, B-ii, C-iii and D-iv
93. Given below are a few statements about plant breeding and transgenesis:
A. Recombinant inbred lines and double haploid populations have high levels of genetic homozygosity.
B. Gene pyramiding involves introducing different genes for resistance to a specific pest in different genotypes of a plant species.
C. Agrobacterium strains with a disarmed

Ti plasmid do not require vir genes for transfer of T-DNA.
D. Molecular breeding can be used for crop improvement if the trait of interest is
present in naturally occurring populations of the plant.

Which one of the following options represents a combination of INCORRECT statements?
(a) A and B
(b) A and C
(c) B and D
(d) B and C
94. The diffraction patterns of two forms of DNA (A and B) and statements related to these patterns are given below.

A. The diffraction pattern corresponding to A-DNA is shown by form 1 with 11.6 base pairs per turn.
B. The diffraction pattern of B-DNA is shown by form 2 with 11.6 base pairs per turn.
C. The diffraction pattern of A-DNA is shown by form 2 with 11.6 base pairs per turn.
D. The diffraction pattern of B-DNA is shown by form 1 with 10 base pairs per turn.

Which one of the following options have all correct statements?
(a) C and D
(b) A and B
(c) B only
(d) D only
95. In the table below column I lists terms related to development and Column II
contains their descriptions not in a sequential manner:

| Column I | Column II <br> A. Koller's sickle <br> B. Primary <br> hypoblast <br> i. The delaminate <br> cells from epiblast <br> forming islands <br> C. Primitive groove <br> amphibian <br> blastopore |
| :--- | :--- |
| iii. Local thickening <br> of the epiblast <br> formed at posterior |  |
| edge of area |  |
| pellucida |  |$|$| iv. Equivalent of |
| :--- |
| dorsal blastopore lip |
| of |
| embryo amphibian |

Select the option with all correct matches between Column I and Column II.
(a) A-i, B-iii, C-ii, D-iv
(b) A-ii, B-i, C-iv, D-iii
(c) A-iii, B-i, C-ii, D-iv
(d) A-iv, B-ii, C-i, D-iii
96. The graphs ( $\mathrm{A}-\mathrm{C}$ ) below depict the seasonal variation in plankton biomass in three oceanic regions of Northern hemisphere (i to iii):


Oceanic regions of the world:
i. Tropical oceans
ii. Polar oceans
iii. Temperate oceans

Match the graphs (A to C) to the correct oceanic region (i to iii).
(a) A-i, B-ii, C-iii
(b) A-ii, B-i, C-iii
(c) A-i, B-iii, C-ii
(d) A-iii, B-ii, C-i
97. Following are the statements made about major functions of some of the neuroglia in normal condition:
A. Oligodendrocytes help maintain $\mathrm{K}+$ level, and contribute to the blood-brain barrier.
B. Microglia are capable of movement and phagocytosis of pathogens and damaged tissue.
C. Astrocytes produce the myelin sheath to electrically insulate neurons of the CNS.
D. Ependymal cells which are ciliated are involved in circulation of cerebrospinal fluid.

Which of the following options represents the combination of all INCORRECT statements?
(a) A and B
(b) A and C
(c) A and D
(d) C and D
98. Given below are the list of proteins (Column X) and their functions (Column Y) during floral induction.

| Column X |  |
| :--- | :--- |
| A. FLOWERING <br> LOCUS C (FLC) | i. An activator of |
| FLC |  |
| B. FLOWERING | ii. A mobile signal |
| LOCUS D (FD) | that $\quad$ induces |


|  | flowering |
| :---: | :---: |
| C. FLOWERING LOCUS T (FT) | iii. Regulate target genes that mediate the reprogramming of meristem to produce flowers |
| D. FRIGIDA (FRI) | iv. A strong repressor of flowering |

(a) A - i, B - ii, C - iii, D - iv
(b) A - iii, B - iv, C - i, D - ii
(c) A - ii, B - i, C - iv, D - iii
(d) A - iv, B - iii, C - ii, D - i
99. Mouse IgM (whole molecule) was injected into rabbit to generate antiserum. Which one of the following mouse antibody components (the same mouse fromwhich IgM molecules were used for immunization) has the possibility to be recognized using the rabbit antiserum in Western blotting?
(a) IgG F (ab')2 fragment only
(b) J chain only
(c) IgG Fc fragment only
(d) Both IgG F (ab')2 fragment and J chain
100. An individual is heterozygous for a reciprocal translocation as shown below in the given diagram:


The following statements are made about segregation of such chromosomes during meiosis and gamete formation:
A. The complexly paired 4 chromosomes fail to segregate, pass into one cell at anaphase I and the cell eventually dies.
B. Chromosomes pair between regions of maximum homology keeping the translocated part unpaired and a normal meiosis occurs.
C. One of the ways the chromosomes segregate is by alternate segregation (N1, N2 moving to one pole and T1, T2 moving to the other pole).
D. Alternate segregation produces nonviable gametes.
E. Reciprocal translocations are considered as crossover suppressors as no gametes with crossover product are produced.
Select the option from the following that describes the meiotic consequences of such translocation correctly:
(a) A only
(b) C only
(c) B and D
(d) A and E
101. Which one of the following statements best describes Bateman's principle?
(a) Female gametes (eggs) are costlier than male gametes (sperms).
(b) Reproductive variance is greater in males than in females.
(c) Females are more likely to provide parental care than males.
(c) Males use costly displays to advertise their genetic quality.
102. The figure below represents the denaturation - renaturation profile of a double stranded DNA in citrate buffer.


The percent of DNA that remains denatured at $30^{\circ} \mathrm{C}$ after cooling from $100^{\circ} \mathrm{C}$ is:
(a) $<25 \%$
(b) $30-35 \%$
(c) $>75 \%$
(d) $65-70 \%$
103. Following statements were made to explain the intracellular transport that occurs through apoplastic, symplastic and transcellular routes in plants:
A. Apoplastic transport mostly occurs through cell-wall.
B. Apoplastic transport mostly involves plasmodesmata.
C. Symplastic transport predominantly occurs through plasmodesmata.
D. Transcellular transport mostly occurs through tonoplast via vacuoles.

Which one of the following combination of statements is correct?
(a) A, B and D
(b) B, C and D
(c) A, C and D
(d) A, B and C
104. A number of statements have been made regarding heme, a component of hemoglobin, as given below:
A. It is synthesized in mature erythrocytes
B. It is synthesized by the condensation of succinyl-CoA and glycine
C. It is synthesized by the condensation of acetyl-CoA and glycine
D. Its synthesis is catalyzed by $\delta$ amino levulinate synthase

Which one of the following combinations has both INCORRECT statements?
(a) A and D
(b) A and C
(c) B and C
(d) B and D
105. Two new chemical compounds $X$ and $Y$ are synthesized in a laboratory and tested for their potency as a mutagen. The nature of the mutation produced bythese compounds is tested for reversal by other known mutagens and the following results were obtained:

| Reversed by |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| New <br> compounds | 5-Bromouracil | EMS | Hydroxylamine | Acridine orange |
| $\mathbf{X}$ | Yes | Yes | No | No |
| $\mathbf{Y}$ | No | No | No | Yes |

Which statement best describes the nature of the two mutagens?

Options:-
(a) Compound X produces single base substitutions that generate CG to TA transitions and Compound Y produces insertions or deletions
(b) Compound $X$ produces insertions or deletions and Compound $Y$ produces single base substitutions that generate CG to TA transitions.
(c) Compound X produces single base substitutions that generate CG to TA transitions and Compound Y produces TA to GC transitions.
(d) Compound $X$ produces single base substitutions that generate insertions and Compound Y produces deletions
106.
C. elegans embryo uses both autonomous and conditional modes of specification. The following statements are about specification of cell lineages:
A. The signals from the P1 blastomere instructs the EMS cell for its further development.
B. In the absence of the instructive signal, the EMS cell will divide into two MS cells.
C. In the absence of the POP-1 signal, the prospective MS cell can take up the $E$ fate.
D. The MOM-2 protein from the blastomereneighbouring the EMS cell instructs the dividing EMS blastomere to take up MS fate.

Which one of the following options represent both correct statements?
(a) A and B
(b) B and C
(c) C and D
(d) A and D
107. The pathway for de novo biosynthesis of purine nucleotides involves the production of inosine monophosphate (IMP) that serves as a precursor for AMP andGMP synthesis. IMP has the base hypoxanthine whose structure is given below:


If hypoxanthine were incorporated into double stranded DNA, which of the following options correctly represents the order of its pairing preference?
(a) adenine $>$ thymine $>$ guanine $>$ cytosine
(b) cytosine $>$ adenine $>$ thymine $>$ guanine
(c) guanine $>$ adenine $>$ thymine $>$ cytosine
(d) cytosine $>$ thymine $>$ adenine $>$ guanine
108. The hemagglutinin protein in influenza virus contains a long $\alpha$-helix, with 53 residues. Which of the following correctly describes the attributes of this $\alpha$ helix?
(a) The length is $75.6 \AA, 14$ turns, total of 102 Hydrogen bonds
(b) The length is $106 \AA, 14$ turns, total of 106 Hydrogen bonds
(c) The length is $75.6 \AA$, 14 turns, total of 104 Hydrogen bonds
(d) The length is $75.6 \AA$, 10 turns, total of 102 Hydrogen bonds
109. The following statements were made about adaptive radiation:
A. Adaptive radiation is a kind of divergent evolution driven by ecological diversification.
B. Adaptive radiation is the divergence of unrelated taxa into different niches.
C. Adaptive radiation is rare on archipelagos removed from the mainland.
D. Processes unrelated to niche exploitation can be major drivers of species diversification

Choose the option that represents all correct statements.
(a) A and B
(b) C and D
(c) B and C
(d) A and D
110. In mice, the gene encoding $T b \times 5$ is transcribed in limb fields of the forelimbs, while the genes encoding Islet1, Tbx4 and Pitx1 are expressed in presumptivehindlimbs.
Following statements are made about limb development in mouse:
A. Loss of Tbx5 gene results in complete failure of forelimb formation.
B. Hindlimb bud growth and initial patterning appears normal when Tbx 4 is knocked out, although leg development is arrested prematurely.
C. Misexpression of Pitx1 in forelimb ceases development of muscles, bones and tendons.
D. When Islet1 is inactivated specifically in the lateral plate mesoderm, the hindlimbs still develop.
Which one of the following options represents a combination of correct statements?
(a) A and B
(b) A and C
(c) B and C
(d) C and D
111. Given below is a schematic representation of the T-DNA region of a binary vector used for genetic transformation of plants.


LB: Left Border, RB: Right Border, M: Marker gene, P: Passenger gene, pA: polyadenylation signal, Pr1: Promoter of M gene, Pr2: Promoter of P gene, E:
Restriction enzyme (sites) used for digestion of genomic DNA for Southern blotting, Probe 1 and Probe 2: probes used for Southern blotting.

Transgenic plants generated using the above construct were subjected to Southern hybridization following digestion of genomic DNA with restrictionenzyme ' $E$ ', to identify true single copy integration events from LB and RB flanks of the DNA.

Based on the above information, the following statements are made:
A. Single copy events from the LB flank identified using Probe 1 would show two hybridization bands on the Southern blot.
B. Single copy events from the RB flank identified using Probe 2 would show a single hybridization band on the Southern blot.
C. For true single copy events, one hybridization band would be of the same length for each of the two probes used for hybridization.
D. True single copy events would show two bands each for copy number on the left border and right border flanks.
E. There would be no similar hybridization band obtained using Probe 1 and Probe 2.
Which one of the following options represents only correct statements?
(a) A, B and D
(b) C, D and E
(c) B, C and E
(d) A, C and D
112. The initiation of transcription is a complex process inyolving promoter recognition, conversion of the initiation complex from closed to open form, abortiveinitiation events, and finally promoter escape. The following statements are made regarding these steps in transcription initiation:
A. Promoter escape in bacteria is usually accompanied by the release of the sigma factor from the RNA polymerase holoenzyme complex.
B. Abortive initiation events in prokaryotes result in the formation of short transcripts $\sim 10$ nucleotides in length while such events in eukaryotes result information of transcripts $\sim 75$ nucleotides in length.
C. Promoter escape in eukaryotes is accompanied by the phosphorylation of the RNA polymerase large subunit on its Cterminal domain (CTD).
D. Promoter recognition in bacteria is governed by the sigma factor which binds to the -10 and -35 regions of the promoter followed by recruitment of theRNA Pol II core enzyme to form the holoenzyme.

Which one of the following options represents the combination of all correct statements?
(a) A and C only.
(b) B and D only.
(c) A, C and D.
(d) A and D only.
113. Although introns are not a part of the processed transcript that gets translated, they are important for several reasons. The following statements are madewith reference to the possible ways in which introns are crucial to cell survival.
A. They permit the generation of different protein products from the same gene.
B. They may encode miRNAs which modulate the expression of genes.
C. They often encode peptides which play a role in regulating gene expression.
D. They promote export of certain mRNAs through the recruitment of transport
proteins by the Exon Junction Complex (EJC).
E. They play a role in mRNA surveillance through the modulation of nonsensemediated mRNA decay via the Exon Junction Complex (EJC).
Which one of the following options represents the combination of all correct statements?
(a) A, B and E only.
(b) A, C and D only.
(c) A, B, D and E.
(d) B, C and D only.
114. If the weights of 10,000 seeds from 100 individuals of a tree species are measured, which one of the following distributions is expected?
(a) Binomial
(b) Poisson
(c) Gaussian
(d) No predictable distribution
115. The following table shows a list of organisms and associated adaptive characteristics.

| Organism | Adaptive <br> characteristics |  |
| :--- | :--- | :--- |
| A. Coral snake | i. Bioluminescence |  |
| B. Crystal Jelly | ii. Mimicry |  |
| C. African lungfish | iii. Aposematism |  |
| D. Monarch butterflies | iv. Aestivation |  |

(a) A-ii, B-i, C-iv, D-iii
(b) A-iii, B-ii, C-i, D-iv
(c) A-ii, B-iii, C-iv, D-i
(d) A-iv, B-i, C-ii, D-iii
116. Following statements were made about chromatin remodeling in eukaryotes:
A. Chromatin remodeling completely alters and/or slides the nucleosome, but cannot displace it.
B. Chromatin remodeling is an energy driven, developmentally regulated active process.
C. Histone acetylation is a reversible process, in which each direction of the reaction is catalyzed by different enzymes.
D. In general, acetylation of core histones reduces their affinity for DNA and destabilizes the chromatin structure, causing transcriptional repression.
E. Phosphorylation of Ser1 of histone H2A has been associated with transcription repression.
Which one of the following represents the combination of correct statements?
(a) A, B and C
(b) A, C and D
(c) B, C and E
(d) C, D and E
117. Following are certain statements regarding gibberellic acid (GA) signal transduction:
A. DELLA proteins negatively regulate GA signalling.
B. Degradation of GA receptor (GID1) is mediated by DELLA proteins.
C. Ubiquitination and subsequent degradation of DELLA proteins are independent of GID1.
D. GA binding to GID1 promotes binding of GID1 to DELLA proteins.

Which one of the following combination of statements is correct?
(a) A and B
(b) B and C
(c) C and D
(d) A and D
118. Given below are names and recognition sequences of a few restriction enzymes that are used for cloning experiments. The cleavage site of each enzyme is indicated by

EcoRI - G*AATTC
Hincll - GTY*RAC
EcoRV - GAT*ATC
BamHl - G*GATCC
Bglll - A*GATCT
Given below are different vector (Column
A) and insert (Column
B) fragments generated by digestion using the above enzymes:

| Column A | Column B |
| :--- | :--- |
| Vector fragment | Insert fragment |
| A. EcoRl | i. EcoRV |
| B. EcoRV | ii. Hincll |
| C. BamHl | iii. EcoRl |
| D. Bglll | iv. BamHl |
| E. Hincll | v. Bglll |
| Which one of the following options |  | represents the correct combinations of the vector and insert, respectively, which generate compatible ends for ligation?

(a) A - ii, B - v, C - iv
(b) B - ii, D - iv, E-i
(c) $\mathrm{A}-\mathrm{v}, \mathrm{C}-\mathrm{i}, \mathrm{E}-\mathrm{iii}$
(d) C - iv, D - i, E - ii
119. The following table enlists different ways of carrying out reverse genetics(Column $X$ ) and different strategies to achieve the same (column Y ).

| Column X | Column Y |
| :---: | :---: |
| A. Random mutagenesis | i. RNAi |
| B. Targeted mutagenesis | ii. Transposable elements |
| C. Phenocopying | iii. Homologous recombination |
|  | iv. UV mutagenesis |
| / | v. CRISPR |

(a) A - i and iv; B- iii; C- ii and v
(b) A - ii and iv; B- iii and v; C-i
(c) A-i and iv; B- iii and v; C- ii
(d) A- ii and iv; B-i and iii; C - v
120. Following are a set of statements about various models of succession:
A. In inhibition model, strong competitive interaction is present as no species is completely superior.
B. In tolerance model, later successional species are neither inhibited nor aided by species of previous stages.
C. In inhibition model, competitive interaction is weak as no species is completely superior.
D. In facilitation model, later successional species are neither inhibited nor aided by species of previous stages.

Which one of the following options represent correct statements?
(a) A and D
(b) B and C
(c) A and B
(d) C and D
121. Different waves of EEG (Column A) are listed with their frequencies (Column B) below.

| Column A | Column B |
| :--- | :--- |
| EEG eaves | Frequencies |
| A. $\alpha$ | i. $4-7 \mathrm{~Hz}$ |
| B. $\beta$ | ii. Less than 4 Hz |
| C. $\theta$ | iii. $8-13 \mathrm{~Hz}$ |
| D. $\delta$ | iv. $13-30 \mathrm{~Hz}$ |

Choose the option with all correct matches of the wave with its frequency.
(a) A-i, B-ii, C-iii, D-iv
(b) A-ii, B-iii, C-iv, D-i
(c) A-iii, B-iv, C-i, D-ii
(d) A-iv, B-i, C-ii, D-iii
122. The graph below depicts trajectories (A to D) of some of the major drivers of global environmental change (i to iv) that are mentioned alongside.


Match the trajectories with the correct drivers:
(a) A-iv, B-iii, C-ii, D-i
(b) A-i, B-ii, C-iii, D-iv
(c) A-ii, B-iv, C-i, D-iii
(d) A-iii, B-i, C-iv, D-i
123. The interactions that maintain polarity during Planaria regeneration is shown in the figure below:


Following statements regarding these interactions were made:
A. When Notum expression is knocked down, the anterior facing blastema will still form a head.
B. When Notum is expressed in the posterior end, Planaria with two heads will be formed.
C. When Wnt pathway is blocked, the resulting Planaria will have heads on both the ends.
D. High levels of Erk inhibit head specification.
Which one of the following options represents the correct combination of the statements?
(a) A and C
(b) B and C
(c) C and D
(d) A and D
124. Protein 'A' was subjected to different experiments:
i) SDS-PAGE with/without $\beta$ mercaptoethanol ( $\beta$-ME) ii) Fluorescence
iii) Far-UV and iv) Near-UV CD spectra at pH 7.0 (blue) and 3.0 (red)

The results are shown below:


Which one of the following options provides the correct inference?
Options:-
(a) Protein ' A ' is an S-S bonded homotetramer and each subunit has a molecular mass of 50 kDa , folded at pH 7.0 and molten globule at pH 3.0.
(b) Protein ' A ' has a molecular mass of 200 $\mathrm{kDa}, \beta \mathrm{ME}$ degrades the protein, low pH changes the conformation from $\alpha$ helix to $\beta$ sheet.
(c) SDS denatures protein ' A ' into different oligomeric states, low pH changes the conformation from a helix to $\beta$ sheet.
(d) SDS promotes the formation of different oligomeric states of Protein ' A ', low pH changes the conformation from $\beta$ sheet to $\alpha$ helix.
125. The following represents sequences of different alleles of a gene found in a family represented by mother (allele1/
allele2), father (allele1/allele 2) and theirtwo sons: Son1 (allele1/allele 2) and Son 2 (allele1/allele2). Further, a new mutation was observed in one of the alleles of the son, which is marked with atriangle.

Mother allele 1 CAGCATAGTCATTCGTCCATGGACTAG
Mother allele 2 CAGCATTGTCATTCGTCCATGGACTAG
Father allele 1 CAGCATTGTCATTCGTCCATGGGCTAG
Father allele 2 CAGCTTAGTCATTCGTCCATGGTACTAG
Son 1 allele 1 CAGCATAGTCATTCGTCCATGGACTAG
Son 1 allele 2 CAGCTTAGTCATTCGTCCATTGTACTAG

Son 2 allele 1 CAGCATTGTCATTCGTCCATGGACTAG
Son 2 allele 2 CAGCTTAGTCATTCGTCCATTGTACTAG
The following statements were made about the mutation:
A. The mutation arose in the germline of the father.
B. The mutation arose in the son.
C. The given DNA sequences are present on the X chromosome.
D. There is a possibility to use RFLP for tracking this variation.

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

Options:-
(a) B only
(b) A and D
(c) A and C
(d) B and D
126. The diagram below depicts the generalized distributional curves (A to D) of allochthonous organic matter and autocthonous production by differentautotrophic groups, as a stream transitions to a river.


The following are sources of organic matter:
i. Allochthonous
ii. Autochthonous from phytoplankton
iii. Autochthonous from bottom attached algae
iv. Autochthonous from aquatic macrophytes
Choose the correct option that matches the distributional curves (A to D) to the sources (i to iv):
(a) A-i, B-ii, C-iv, D-iii
(b) A-ii, B-i, C-iii, D-iv
(c) A-iii, B-ii, C-i, D-iv
(d) A-i, B-iv, C-ii, D-iii
127. The following are a set of characteristics found in the animal kingdom:
A. The body is usually streamlined. Some have spindle-shaped or elongated body.
B. The body is covered with thick-seated scales, which provides protection to the internal organs.
C. They may be herbivores or carnivores, oviparous or ovoviviparous.
D. The nervous system comprises of the brain and ten pairs of the cranial nerves.
E. All of them are oviparous and exhibit sexual dimorphism.

Select the correct set of characterizing features for the Class Pisces.
(a) B, D and E only
(b) A, B and D only
(c) B, C, D and E
(d) A, B, C and D
128. Which one of the options correctly represents organisms from the subphyla Chelicerata, Myriapoda, and Hexapoda, in this specific sequence?
(a) Arachnids, horseshoe crabs, centipedes
(b) Horseshoe crabs, centipedes, springtails
(c) Lobsters, millipedes, silverfish
(d) Arachnids, insects, crabs
129. The following statements are made about mammalian development:
A. Zygote is a totipotent stem cell.
B. The cells of inner cell mass are said to be pluripotent.
C. The three regulatory transcription factors, Oct4, Nanog and Sox2 help maintain pluripotency of the inner cell mass.
D. Cdx2 upregulates Oct4 and Nanog.

Which one of the following options represents the correct combination of the statements?
(a) A and B
(b) B and C
(c) C and D
(d) A and D
130. Following statements are made regarding the properties of two- photon
microscopy over traditional confocal microscopy:
A. By using longer wavelength, two-photon microscopy induces less photobleaching of the tissue preparation.
B. By using shorter wavelength, twophoton microscopy induces less photobleaching of the tissue preparation. C. The intensity of fluorescence emitted by the sample will remain the same even if only one of the two exciting photons impinge on the sample.
D. No fluorescence is detected unless two exciting photons simultaneously impinge on the sample.

Which one of the following combination of statements is correct?

Options:-
(a) A and C
(b) A and D
(c) B and C
(d) B and D
131.A student was asked to plot a graph representing enzyme kinetic data for initial velocity, $\mathrm{v}_{0}$, and substrate concentration, [S] using any of the equations givenbelow. The student used an equation for which neither X axis nor $Y$-axis had independent variables. Which one of the following equations might the studenthave used?
(a) $1 / \mathrm{V}_{\mathrm{o}}=\left(\mathrm{K}_{\mathrm{m}} / \mathrm{V}_{\max }\right) 1 /[\mathrm{S}]+1 / \mathrm{V}_{\text {max }}$
(b) $[\mathrm{S}] / \mathrm{V}_{\mathrm{o}}=[\mathrm{S}] / \mathrm{V}_{\max }+\left(\mathrm{K}_{\mathrm{m}} / \mathrm{V}_{\max }\right)$
(c) $\mathrm{v}_{\mathrm{o}} /[\mathrm{S}]=\left(\mathrm{V}_{\max } / \mathrm{K}_{\mathrm{m}}\right)-\mathrm{v}_{\mathrm{o}} / \mathrm{K}_{\mathrm{m}}$
(d) $\mathrm{V}_{\mathrm{o}}=\mathrm{V}_{\max }[\mathrm{S}] / \mathrm{K}_{\mathrm{m}}+[\mathrm{S}]$
132. Which one of the following statements is NOT correct?
(a) Niche breadth tends to increase with interspecific competition while intraspecific competition tends to decrease it.
(b) Species in unstable environments with fluctuating resource availabilities tend to have broad niche breadths.
(c) K-strategists are likely to be better competitors than r-strategists in a climax community.
(d) Diffuse competition increases with niche dimensionality.
133. Regulation of $m R N A$ translation is a major mechanism that maintains stoichiometric availability of ribosomal proteins (r-proteins) to rRNA molecules theybind to. Translational regulation is facilitated by general occurrence of the rprotein genes in several operons containing multiple genes. Which one of thefollowing represents an established mechanism to ensure optimal production of the r-proteins in E. coli, when the r-proteins accumulate in free form (molarexcess over rRNA)?
(a) The free r-protein(s) often bind to corresponding DNA sequence and activate transcription of rRNA genes to increase rRNA availability.
(b) The free r-protein(s) bind to RNA polymerase and represses transcription of the r-protein genes to decrease the availability of their mRNAs.
(c) The free r-protein(s) bind to the mRNA(s) and downregulate their translation.
(d) The free r-protein(s) bind free NTPs which then activates their cryptic ribonuclease activity leading to the degradation of their mRNAs.
134. Column (A) lists enzymes involved in cycle and typical function in particular cell cycle phase is listed in Column (B)

| Enzyme (Column <br> A) | Cell cycle function <br> (Column B) |
| :--- | :--- |
| A. Cdk1 | (i) Cytokinesis |
| B. APC/Ccdc20 | (ii) S-phase entry |
| C. Cdk2 | (iii) Mitotic entry |
| D. Aurora B | (iv)Anaphase onset |

Which one of the following options represents the correct match between column A and column B
(a) A-(iv), B-(iii), C-(ii), D-(i)
(b) A-(iii), B-(iv), C-(ii), D-(i)
(c) A-(i), B-(ii), C-(iii), D-(iv)
(d) A-(ii), B-(i), C-(iv), D-(iii)
135. Given below are some statements about pituitary hormones:
A. Oxytocin and vasopressin are synthesized in posterior pituitary
B. Prolactin is synthesized from anterior pituitary
C. $\alpha$ and $\beta$ MSH are secreted from intermediate lobe of pituitary in adult humans
D. Growth hormone secretion from anterior pituitary is stimulated by hyperglycemia E. Prolactin secretion is markedly increased by sleep

Choose the INCORRECT combination of statements from below:
(a) A, C and D
(b) A, B and D
(c) C, D and E
(d) B, C and E
136. The following statements were made to describe a typical collagen structure.
A. Collagen has a triple-helical domain structure which consists of three distinct achains.
B. The collagen triple helix is stabilized by isoprenyl bonds.
C. Each a-chain has a left-handed polyproline II-type helix.
D. Each a-chain is composed of multiple triplet sequences of Gly-Y-Z in which $Y$ is commonly proline and Z is usually hydroxyproline.
Which one of the following options has all correct statements?
(a) A, C and D
(b) A, B and C
(c) A and B only
(d) B and D only
137. Individuals belonging to the fossil genera Calamites are considered to be upright arborescent plants. They were characterized by stems which mostly arose from subterranean rhizomes. The cross sections of young stems showed the presence of a central pith canal and collateral vascular bundles with carinalcanals. To which of the following extant genera is this plant most similar?
(a) Psilotum
(b)Selaginella
(c) Equisetum
(d)Rhynia
138. A 'nonsense' mutation in the protein coding region of an upstream gene of a group of genes in an operon often leads to depletion of the downstream geneproducts. This is a classic example of the phenomenon of "polar effect" of the mutation. Following statements are being made about this phenomenon.
A. It occurs primarily because the termination codon generated in the upstream open reading frame (ORF) leads to termination of protein synthesis depletingthe ribosomes for translation of the downstream ORFs but it does not affect the process of transcription.
B. The phenomenon of polar effects of mutation occurs only in the operons where the point mutation leading to creation of 'nonsense' mutation also leads toformation of a stem-loop structure resulting in Rhoindependent termination.
C. While the presence of termination codon in the upstream ORF may deplete the ribosomes that travel down to the downstream ORF, the depletion ofribosomes downstream of the 'nonsense' mutation allows loading of the Rho factor that then results in premature transcription termination.
D. Presence of the suppressor tRNA reading the 'nonsense' codon generated by the mutation, is essential for causing a polar effect of the mutation.
E. Presence of the suppressor tRNA reading the 'nonsense' codon generated by the mutation diminishes the consequences of the polar effects.

Choose the option that represents all correct statements.
(a) A and C
(b) B and D
(c) C and E
(d) A and D
139. Following statements are made regarding glycogen phosphorylase and glycogen synthase activities in relation to their phosphorylation status:
A. Phosphorylation of glycogen
phosphorylase increases its activity
B. Phosphorylation of glycogen phosphorylase decreases its activity
C. Phosphorylation of glycogen synthase increases its activity
D. Phosphorylation of glycogen synthase decreases its activity

Which one of the following is a combination of correct statements?
(a) A and C
(b) B and C
(c) B and D
(d) A and D
140. chromosomes are used to keep all the alleles on one chromosome together. A balancer contains multiple inversions; so that when itrecombines with the corresponding wild type chromosome, no viable cross over products are formed. Balancers also carry an allele for a dominantphenotype.

A Drosophila male with sepia eye color is crossed to $a$ female carrying $a$ third chromosome balancer (TM6B). The allele for sepia phenotype (se) is locatedon chromosome 3 and is recessive to the wild type eye color. The dominant marker for TM6B is a tubby phenotype. Further, an individual homozygous forTM6B balancer does not survive. F1 progeny with tubby phenotype is sib-mated.

The F2 progeny is expected to have:
(a) only sepia eye color
(b) sepia, tubby and wild type flies in a ratio of 1:2:1
(c) sepia and tubby flies in a ratio of 1:2
(d) sepia and wild type flies in ratio of 3:1
141. Excision repair systems replace a short stretch of DNA around the site of damage. The following statements are made about nucleotide excision repair in $E$. coli:
A. UvrB homodimer creates the nicks on one strand on both side of the lesion.
B. The 50-60 residue-long stretch of DNA between the two nicks is removed by the action of UvrD.
C. The gap generated is filled in typically by DNA polymerase I.
D. The distortion caused by the lesion is recognized and bound by UvrA-UvrB complex.

Which one of the following options represents the combination of all correct statements?
(a) A and B only.
(b) A, B and D.
(c) C and D only.
(d) B, C and D.
142. There are different kinds of reactive oxygen species (ROS) generated in plants. The following are the some of the statements related to ROS and itsscavenging:
A. $\mathrm{H}_{2} \mathrm{O}_{2}$ is relatively more stable and travels relatively long distances.
B. ROS is scavenged only through enzymatic reactions.
C. Ascorbate-glutathione cycle is associated with the scavenging of ROS.
D. Monodehydroascorbate reductase is not an antioxidant enzyme.
Which one of the following combination of statements is correct?
(a) A and C
(b) A and D
(c) B and C
(d) B and D
143. Following statements are made about some of the abnormally expressing proteins in human cancers:
A. Increased telomerase expression always contributes to increased cell death in cancer cells.
B. Overproduction of anti-apoptotic protein (Bcl2) can lead to inappropriate cell survival and is associated with chronic lymphoblastic leukemia (CLL).
C. The E5, E6 and E7 proteins encoded by human papilloma virus (HPV) are tumor suppressors.
D. Overexpression of cyclin D1 or loss of p16 and Rb can cause inappropriate,
unregulated passage through the restriction point in late G1.
Which of the following options represents the combination of all correct statements? Options:-
(a) A and B
(b) A and C
(c) B and D
(d) C and D
144. The diagrams A-D below shows the relative abundance of major groups of plants (refer to legend) in four different geological periods (Devonian,Carboniferous, Tertiary and Cretaceous).


Match the diagrams (A to D) with the correct geological period.
(a) A-Tertiary,
B- Carboniferous,
C-

Devonian, D-Cretaceous
(b) A-Cretaceous, B- Devonian, C-Tertiary, D-Carboniferous
(c) A-Tertiary, B- Cretaceous,

CCarboniferous, D-Devonian
(d) A-Devonian, B- Tertiary, C-Cretaceous, D-Carboniferous
145. The autoregulation of blood flow in the active tissues is partly achieved locally by metabolites accumulated in these tissues. The contributions of
differentmetabolites in this autoregulation are suggested in the following statements:
A. The accumulation of $\mathrm{K}^{+}$locally in active tissues has vasoconstrictor activity.
B. The increase in osmolality in active tissues causes vasoconstriction.
C. The accumulation of lactate in active tissues may contribute to vasoconstriction.
D. The hypoxia-inducible factor- $1_{\alpha}$ (HIF-1 $1_{\alpha}$ ) produced due to local fall in $\mathrm{O}_{2}$ tension in active tissues, initiates the production of different vasodilatorysubstances.
E. Histamine released from the damaged cells of active tissues increases capillary permeability.
Choose the option with both correct statements.
(a) A and B
(b) B and C
(c) C and D
(d) D and E

