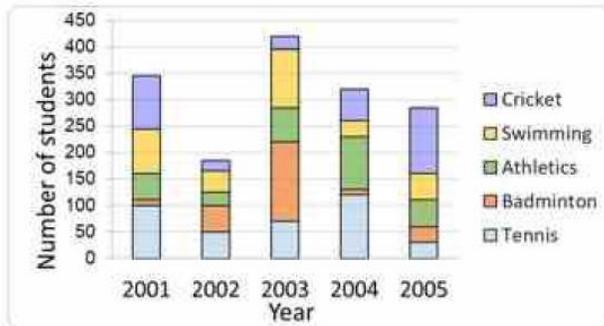


# CSIR NET June Exam 2022

## Question Paper for Life Science (Shift 1)



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

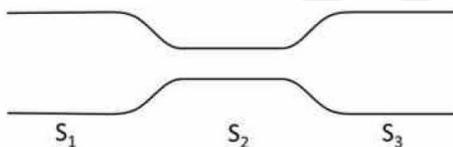


Which one of the following inferences is INCORRECT?

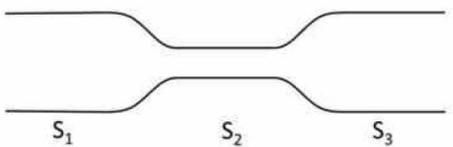
- A. In 2004, athletics was the most popular of these games
- B. The year 2003 witnessed highest participation in these games
- C. Among all the years, the popularity of Tennis was the highest in 2005
- D. In 2003, more students played Badminton than Cricket and Tennis combined.

**Ans. C**

2. Water is pumped into a long horizontal pipe at a fixed volumetric rate. The diameter of the pipe changes shown in the figure.



The speed of water is



- A. the same in sections  $S_1$ ,  $S_2$  and  $S_3$ .
- 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  $S_1$  to  $S_3$ .

**Ans. C**

3. A fair cubic die is rolled 5 times and we get the face with number 1 all 5 times on top. The probability of face on the sixth trial is,

- A.  $(1-5/6)$   $(1/6)$
- B.  $(1/6)$

C.  $(1/6)^6$

D.  $5/6$

4. A box contains four jerseys with the players' names printed. The four players pick up a jersey each at random. The number of players wearing their own jersey CANNOT be

A. 1

B. 2

C. 3

D. 4

**Ans. D**

5. 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

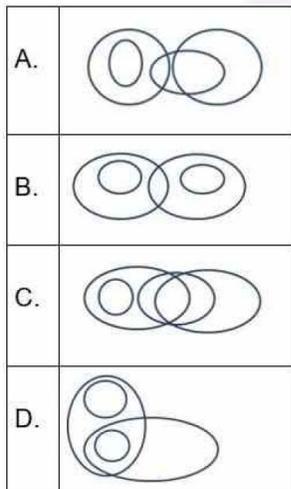
C. If at least one number is positive, then at least one number is negative

D. The difference between the median and mode of these numbers is zero

**Ans. B**

6. The correct diagrammatic representation of the relations among the categories TEAM SPORTS, BALL GAMES, and KHO-KHO is

Select the CORRECT option



A. A

B. B

C. C

D. D

**Ans. C**

7. It is proposed to introduce daily trains between Chennai and New Delhi in both directions simultaneous station at 6.00PM. If the travel time is 36 hours, what is the minimum number of rakes (train sets) requ service?

- A. 2
- B. 3
- C. 4
- D. 6

8. When 100 balls were equally distributed among students in a class (having strength between 10 and 60 undistributed. The number of balls that would remain if there were 125 balls to begin with is

- A. indeterminable
- B. 1
- C. 5
- D. 9

9. The sum of all the internal angles of a hexagon in degrees is

- A. 360
- B. 540
- C. 720
- D. 600

10. What is the angle between the hour and minute hand of a clock at 3h:15m?

- A.  $0^\circ$
- B.  $2.5^\circ$
- C.  $5^\circ$
- D.  $7.5^\circ$

**Ans. A**

11. of the following which is the most precisely reported value of a speed measurement?

- A. 125 km/s
- B.  $12.5 \times 10$  km/s
- C. 125.00 km/s
- D.  $1.250 \times 10^2$ km/s

12. 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

13. X is running around a circular track completing one round every 40 seconds. Y running in the opposite direction crosses X every 15 seconds. The time in seconds taken by Y to complete one round is

- A. 12
- B. 24
- C. 30
- D. 36

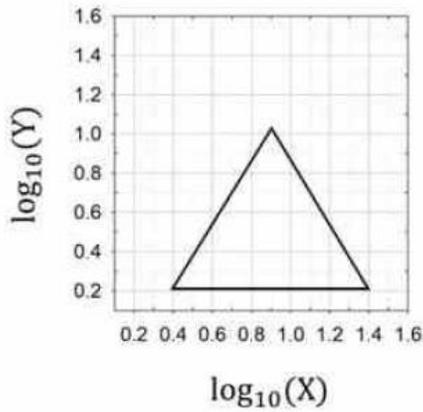
14. The wholesale price per unit of an item is  $C_0$  up to first 19 units. The unit price falls by 10% if 20 to 29 units are purchased and by another 10% if 30 or more units are purchased. If 120 units are bought, the unit price paid is

- A.  $0.89 C_0$
- B.  $0.97 C_0$
- C.  $0.91 C_0$
- D.  $0.81 C_0$

15. 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

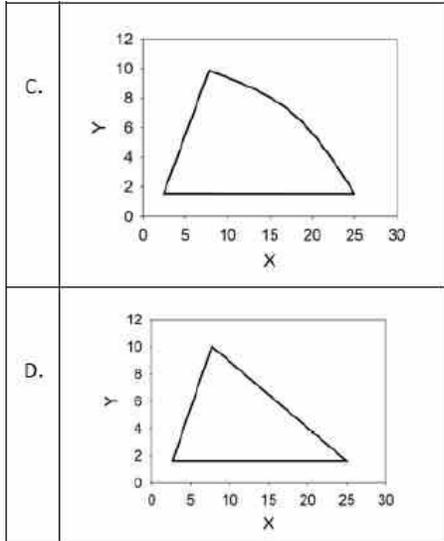
16.



Which one of the following, drawn in a linear scale, represents the triangle shown in the figure above?

Select the CORRECT option

A.	
B.	

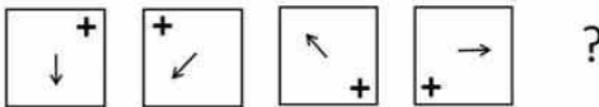


- A. A
- B. B
- C. C
- D. D

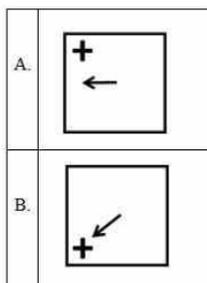
17. If the length of the smallest side of a triangle is 5 units, and the sides are in arithmetic progression with difference, the number of such possible triangles is

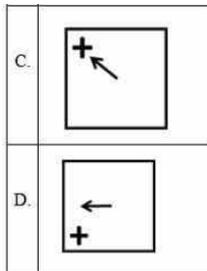
- A. 3
- B. 4
- C. 5
- D. Infinite

18. 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

19. In a field there are some cows and ducks. If the number of heads are 33 and number of legs are 84, the ratio of the numbers of cows to ducks?

- A. 5/6
- B. 3/8
- C. 2/5
- D. 3/5

20. A person takes one hour more to cover a certain distance walking at a speed of 2 km/hour compared to 4 km/hour. The distance is

- A. 4
- B. 6
- C. 8
- D. 10

21. Which of the options correctly matches the proteins involved in transcription (Column A) with the DNA elements 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

Option :

- 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 activities of baroreceptors present in the carotid sinus are carried by the afferent fibers of neurons

A. nodose ganglion

B. geniculate ganglion

C. petrosal ganglion

D. spiral ganglion

23. In remote sensing, which one of the following formulae is used for the calculation of normalized differen(NDVI)?

A.  $RED / (NIR + RED)$

B.  $RED / (NIR - RED)$

C.  $(NIR + RED) / (NIR - RED)$

D.  $(NIR - RED) / (NIR + RED)$

24. The Biodiversity Management Committees (BMCs) envisaged under the Biological Diversity Act (2002) aconstituted at which one of the following administrative levels?

A. Village

B. Tehsil / Taluka

C. District

D. State

**Ans. C**

25. Which one of the following correctly describes the spectroscopic experiment that would help distinguish a  $3_{10}$  helix and a  $\pi$  helix?

A. Near UV absorption spectrum between 250-300nm

B. Fluorescence emission spectra between 350-400nm

C.  $^1H$  NMR spectroscopy involving Hydrogen/Deuterium exchange

D. Near UV Circular Dichroism spectrum between 250-300nm

26. Which one of the following correctly describes the effect of a mutation in phosphofructokinase (PFK), thloss of allosteric regulation by ATP?

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

27. The table below lists cleavage pattern and names of species.

Column I Cleavage pattern		Column II Species	
A.	Isolecithal bilateral	(i)	Amphibians
B.	Mesolecithal radial	(ii)	Birds
C.	Centrolecithal superficial	(iii)	Tunicates
D.	Telolecithal 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)

28. 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

29. The radioactive isotope of an element has a half-life of 100 hours. How many hours will it take for 15/16 of to decay?

A. 50

B. 400

C. 250

D. 1000

30. In which one of the following developmental events, the fate of maternal somatic cell is determined first 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.

**Ans. C**

31. In a conjugation experiment between bacterial Hfr strain 'X' and F<sup>-</sup> cell, lac gene enters the recipient in F<sup>-</sup> cells remain auxotrophic for Leu, Trp, Ura, Glu, Phe and Gly. The mating is then allowed to proceed f lac<sup>+</sup> exconjugants are selected. Of the lac<sup>+</sup> cells,

35% are leu<sup>+</sup>

98% are trp<sup>+</sup>

10% are ura<sup>+</sup>

65% are glu<sup>+</sup>

0% are phe<sup>+</sup>

81% are gly<sup>+</sup>

Select the correct order of the genes as they enter, from the choices given below:

A. Trp<sup>+</sup>, gly<sup>+</sup>, glu<sup>+</sup>, leu<sup>+</sup>, ura<sup>+</sup>, phe<sup>+</sup> lac<sup>+</sup>,

B. Lac<sup>+</sup>, phe<sup>+</sup>, ura<sup>+</sup>, leu<sup>+</sup>, glu<sup>+</sup>, gly<sup>+</sup>, trp<sup>+</sup>

C. Phe<sup>+</sup>, ura<sup>+</sup>, leu<sup>+</sup>, glu<sup>+</sup>, gly<sup>+</sup>, trp<sup>+</sup>, lac<sup>+</sup>

D. Lac<sup>+</sup>, trp<sup>+</sup>, gly<sup>+</sup>, glu<sup>+</sup>, leu<sup>+</sup>, ura<sup>+</sup>, phe<sup>+</sup>

**Ans. C**

32. The additive nature of a genetic map as suggested by Alfred Sturtevant and T. H. Morgan is possible if **tl**

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.

**Ans. D**

33. There is a species that is critically endangered, found in the Russian Far East. It is solitary, but it has some males stay with females after mating, and may even help with rearing the young. Identify this spe

A. Amur leopard

B. Snow leopard

C. Arctic fox

D. Black-footed ferret

**Ans. D**

34. Any movie that features dinosaurs should also have which of the following combinations of geological a organisms? Choose the correct combination.

A. Humans, angiosperms and gymnosperms, birds

B. Early diverging angiosperms, reptiles, amphibians

C. Apes, gymnosperms, birds

D. Early diverging gymnosperms, amphibians, reptiles

**Ans. B**

35. Consider a predator species foraging for prey in a habitat, where there are two prey species A and B. As predator can choose from a high-value prey A and low-value prey B. A and B occur at different frequenc environment, so it may take different average times to find the next A or B individual.

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.

**Ans. B**

36. 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

37. Which one of the following floral mutants shows the pattern 'sepals-petals-petals' repeated several time

- A. agamous (ag)
- B. apetala1 (ap1)
- C. apetala3 (ap3)
- D. pistillata (pi)

**Ans. A**

38. Absorbed monosaccharides in intestinal epithelial cells exit via which one of the following transporters?

- A. GLUT2
- B. GLUT3
- C. GLUT4
- D. GLUT5

**Ans. C**

39. Which one of the following traits would hypothetically NOT be considered for preferential selection durii the corresponding crops listed below?

- A. Increased fruit size of tomato
- B. Reduced spininess in okra
- C. Shattering seeds of corn
- D. Increased oil content of mustard

**Ans. B**

40. If you want to selectively kill the newly dividing mammalian cells in a cell culture assay, which of the fo 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

41. Which one of the following statements about the recognition of tRNAs by their cognate aminoacyl-tRNA correct?

- A. Aminoacyl-tRNA synthetases recognize their cognate tRNAs by the exclusive recognition of their antico
- B. Aminoacyl-tRNA synthetases recognize their cognate tRNAs by recognition of their anticodons in some
- C. Aminoacyl-tRNA synthetases cannot aminoacylate a tRNA that lacks the conserved modifications in th
- D. Aminoacyl-tRNA synthetases cannot aminoacylate a tRNA that lacks the conserved modifications in thi

**Ans. A**

42. Which one of the following small molecule neurotransmitters is NOT synthesized from tyrosine?

- A. Epinephrine
- B. Dopamine
- C. Serotonin
- D. Norepinephrine

43. 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 ba
- C. It had a heat labile N-terminal enzymatic domain that binds MHC molecules, stimulating T cells non-s

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

**Ans. C**

44. In crystalline NaCl, how many chloride ions surround each sodium ion?

- A. Four
- B. Six
- C. Eight
- D. Ten

**Ans. C**

45. Which one of the following is a small sulfated peptide that is secreted by a rice pathogenic bacterium, X to modulate motility, biofilm formation and virulence?

- A. Coronatine
- B. N-acylhomoserine lactones
- C. Ax21
- D. EPS

46. 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

47. Which of the following nitrogen containing compounds is formed during deamination of organic nitrogen

- A.  $NO$
- B.  $NO_2^-$
- C.  $NO_3^-$
- D.  $NO_4^-$

48. The product of nahG gene of Pseudomonas putida catalyzes the metabolism of salicylic acid to which on compounds?

- A. Benzoic acid

B. Methyl salicylate

C. Catechol afcia

D. Benzoyl-CoA

49. Which of the following statements regarding chlorophyll is NOT correct?

A. Chlorophyll-a has a -CH<sub>3</sub> 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 chlorophyll-b, has a Mg<sup>++</sup> coordinated at the centre of the porphyrin-like ri

D. The long hydrocarbon tails of chlorophyll anchors them in the photosynthetic membrane.

**Ans. C**

50. At which one of the following electron transport chain complexes does Antimycin A typically inhibit the

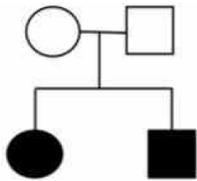
A. Complex I

B. Complex II

C. Complex III

D. Complex IV

51. Given below is a pedigree indicating a pattern of inheritance:



Which one of the following options correctly describes the pattern of inheritance shown in the above p

A. X-linked recessive

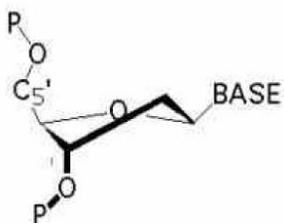
B. Autosomal recessive

C. X-linked dominant

D. Autosomal dominant

**Ans. B**

52. Identify the ribose conformation in the nucleotide shown below.



- A. C2'-endo
- B. C2'-exo
- C. C3'-endo
- D. C5'-exo

53. 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

**Ans. D**

54. Which one of the following statements is INCORRECT?

- A. Transient rise in  $\text{Ca}^{2+}$  is necessary for egg activation in mammals.
- B. Sperm induces egg activation and does not involve  $\text{Ca}^{2+}$ .
- 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.

**Ans. B**

55. 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

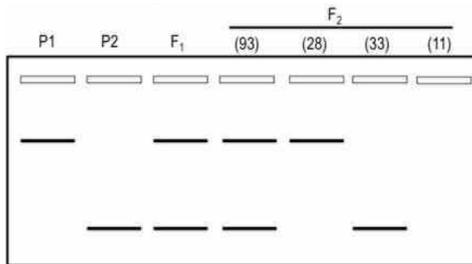
**Ans. C**

56. Lr34, a broad-spectrum disease resistance gene in wheat, encodes for a putative:

- A. Serine hydroxymethyl transferase
- B. ABC transporter
- C. Host-specific toxin
- D. TIR-NB-LRR protein

**Ans. D**

57. The following picture represents a gel profile of a pair of DNA markers observed in parents P1 and P2, their  $F_1$  progeny. Four different profiles were observed in case of  $F_2$ . The number of  $F_2$  progeny showing a given profile is indicated



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 represents two independent genes.
3. If the P1 parent was crossed to the  $F_1$  individual, the progeny will show all the four profiles as observed in the c
4. If an  $F_2$  progeny which does not show either of the DNA markers (last lane of the above gel) is crossed to a P1 in progeny will have two types of individual, one which shows a band and the other where no band is observed.

- A. Co-dominant DNA markers were used for this study.
- B. The polymorphic DNA bands represents two independent genes.
- C. If the P1 parent was crossed to the  $F_1$  individual, the progeny will show all the four profiles as observe progeny.
- D. If an  $F_2$  progeny which does not show either of the DNA markers (last lane of the above gel) is crosse the obtained progeny will have two types of individual, one which shows a band and the other where no

58. Which one of the following biome is known to occur in India?

- A. Tundra
- B. Boreal forest
- C. Taiga
- D. Alpine grasslands

**Ans. B**

59. Histone variants play important roles in chromatin function in mammalian cells. Which one of the follow correct in the context of the histone variants?

- A. Histone variants have been reported for H3 and H4 but not for H2A and H2B
- 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

60. 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

**Ans. D**

61. 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.

**Ans. D**

62. 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
- B. 10-fold when DnaB and DNA Pol III interact, thus ensuring that the helicase does not move ahead rapidly of DNA polymerase.
- C. The transient interaction of the primase with the helicase allows activation of primase activity by
- D. 1000-fold, promoting RNA primer synthesis.
- E. The length of the Okazaki fragments is typically restricted to 1000-2000 nucleotides.
- F. The *E. coli* *oriC* carries repeats of two sequence motifs: repeats of a 9-mer that collectively form the *si* origin first becomes single-stranded, and repeats of a 13-mer to which the DnaA initiator protein binds.

63. Individual chromosomes are clearly seen during which phase of the cell cycle?

- A. G<sub>0</sub>
- B. G<sub>1</sub>
- C. S
- D. M

**Ans. D**

64. The biological species concept defines species as a group of populations that are reproductively isolated. However, this definition is not applicable to groups where sexual reproduction has not been observed or rare. Choose the correct option of organisms where biological species concept may therefore not apply:

- A. Monocots and basal angiosperms
- B. Ascomycetes and oligochaetes
- C. Mosses and liverworts
- D. Cyanobacteria and Euglenophyta

**Ans. D**

65. The measurement of distance based on counting steps or number of vertical bars by insects for navigati

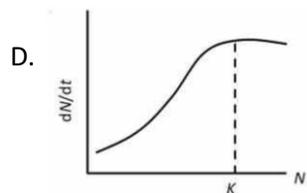
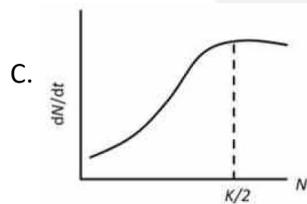
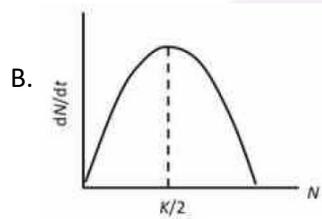
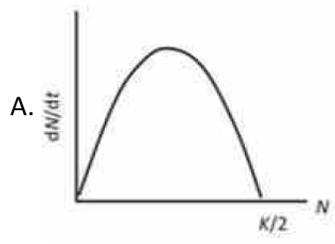
- A. path integration.
- B. allocentric coding.
- C. odometry.
- D. alignment image-matching.

66. 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

**Ans. A**

67. Which of the following correctly represents the relationship between the rate of population growth and



68. What is the 50th percentile of the numbers 9, 5, 11, 3 and 2?

- A. Five
- B. Six
- C. Nine
- D. Fifteen

69. Which one of the following combinations of CD molecules and their associated functions is matched INC

CD1: Antigen-presenting proteins that present antigenic peptides to T-cell receptors on natural killer T

CD8: Thymic differentiation marker for T cells

CD11a: A membrane glycoprotein that provides cell-cell adhesion by interaction with ICAM 1 (intercell molecule 1) CD11a: a first sisaltd til ICAM 1 (intercellular adhesion molecule 1)

CD14: Activates innate immune responses by transferring LPS-LBP complex to TLR4.

70. 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.

**Ans. B**

71. Different waves of EEG (Column A) are listed with their frequencies (Column B) below

Column A		Column B	
EEG waves		Frequencies	
A	$\alpha$	i	4-7 Hz
B	$\beta$	ii	Less than 4 Hz
C	$\theta$	iii	8-13 Hz
D	$\delta$	iv	13-30 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

72. Given below are names and recognition sequences of a few restriction enzymes that are used for cloning experiments. The cleavage site of ea

EcoRI - G\*AATTC

HinclI -GTY\*RAC

EcoRV – GAT\*ATC

BamHI - G\*GATCC

BglII -A\*GATCT

73. 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.	EcoRI	i.	EcoRV
B.	EcoRV	ii.	HinclI
C.	BamHI	iii.	EcoRI
D.	BglII	iv.	BamHI
E.	HinclI	v.	BglII

Which one of the following options represents the correct combinations of the vector and insert, respectively, which generate compatible ends f

- A. A - ii, B-v, C - iv
- B. B - ii, D - iv, E – i
- C. A -v, C - i, E - iii
- D. C - iv, D - i, E - ii

73. Glycolysis and citric acid cycle contribute precursors to many biosynthetic pathways in plants. Column X lists na and column Y lists the product synthesized.

Column X	Column Y
A. Hexose phosphate	i. Aspartate
B. Pyruvate	ii. Alanine
C. Pentose 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

**Ans. B**

74. A student was asked to plot a graph representing enzyme kinetic data for initial velocity,  $V_o$ , and **substra** [S] using any of the equations given below. The student used an equation for which neither X-axis **nor** Y independent variables. Which one of the following equations might the student have used?

- A.  $1/v_o = (K_m / V_{max}) 1 / [S] + 1 / V_{max}$   
B.  $[S]/v_o = [S] / V_{max} + (K_m / V_{max})$   
C.  $v_o / [S] = (V_{max} / K_m) - v_o / K_m$   
D.  $v_o = V_{max} [S] / K_m + [S]$

75. In Drosophila, balancer chromosomes are used to keep all the alleles on one chromosome together. **A ba** multiple inversions; so that when it recombines with the corresponding wild type chromosome, no **viabl** products are formed. Balancers also carry an allele for a dominant phenotype.

A Drosophila male with sepia eye color is crossed to a female carrying a third chromosome balancer (TM sepia phenotype (se) is located on chromosome 3 and is recessive to the wild type eye color. The **domin** is a tubby phenotype. Further, an individual homozygous for TM6B balancer does not survive. F<sub>1</sub> progen phenotype is sib-mated.

The F<sub>2</sub> 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

76. 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 domestica

- 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

77. Individuals belonging to the fossil genera Calamites are considered to be upright arborescent plants. The characterized by stems which mostly arose from subterranean rhizomes. The cross sections of young st presence of a central pith canal and collateral vascular bundles with carinal canals. To which of the follo is this plant most similar?

- A. Psilotum
- B. Selaginella
- C. Equisetum
- D. Rhynia

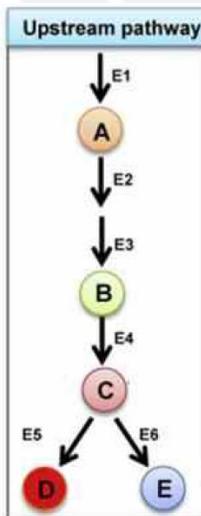
78. Following are certain statements regarding gibberellic acid (GA) signal transduction:

- 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

79. The figure below depicts a hypothetical scheme for synthesizing a target product in plants. (A), (B) and (C) of a target product (D), whereas (E) is a by-product. The key enzymes of the pathway are indicated as E1levels 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 ©.

D. Blocking the activity of E6 by RNA-interference or CRISPR/Cas-mediated knockout. Which of the above mentioned strategies are likely to provide the maximum enhancement of the target the by-product, if no feedback regulation 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

**Ans. D**

80. Following are the statements made about major functions of some of the neuroglia in normal condition:

A. Oligodendrocytes help maintain K<sup>+</sup> 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

81. There are many superfamilies of adhesion proteins, which play a central role in cell-cell adhesion in anin proteins are one such adhesion proteins. Which one of the following statements about Ig superfamily pi INCORRECT?

A. The white blood cell proteins recognized by endothelial cell integrins are called ICAM (intercellular cell or VCAM (vascular cell adhesion molecules)

B. These are called Ig superfamily because they contain one or more extracellular Ig-like domains that a antibody molecules.

C. ICAM and VCAM mediate heterotrophic binding to integrin, whereas NCAM (neural cell adhesion molec homotrophic binding.

D. They contain large quantities of sialic acid which inhibit adhesion by charge-based repulsion contribut cell-cell adhesion.

82. In the table below Column I lists terms related to development and Column II contains their descriptions not in a

	Column I		Column II
A.	Koller's Sickle	(i)	The delaminated cells from epiblast forming islands
B.	Primary hypoblast	(ii)	Homologous to amphibian blastopore
C.	Primitive groove	(iii)	Local thickening of the epiblast formed at posterior edge of area pellucida
D.	Hensen's node	(iv)	Equivalent of dorsal blastopore lip of amphibian embryo

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)

83. The following table shows a list of organisms and associated adaptive characteristics.

	Column I (Organism)		Column II (Adaptive Characteristics)
A.	Coral snake	(i)	Bioluminescence
B.	Crystal Jelly	(ii)	Mimicry
C.	African lungfish	(iii)	Aposematism
D.	Monarch butterflies	(iv)	Aestivation

Select the correct option that matches the name of the organism with their correct adaptation.

- 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)

84. C. elegans embryo uses both autonomous and conditional modes of specification. The following statement 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 blastomere neighbouring the EMS cell instructs the dividing EMS blastoma 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

85. Following are a set of statements about various models of succession:

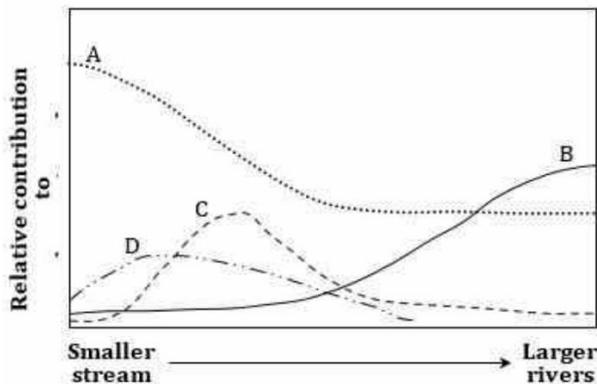
- A. In inhibition model, strong competitive interaction is present as no species is completely superior.
- B. In tolerance model, later successional species are neither inhibited nor aided by species of previous s
- C. In inhibition model, competitive interaction is weak as no species is completely superior.
- D. In facilitation model, later successional species are neither inhibited nor aided by species of previous

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

**Ans. C**

86. The diagram below depicts the generalized distribution curves (A to D) of allochthonous organic matter production by different autotrophic groups, as a stream transitions to a river.



The following are sources of organic matter:

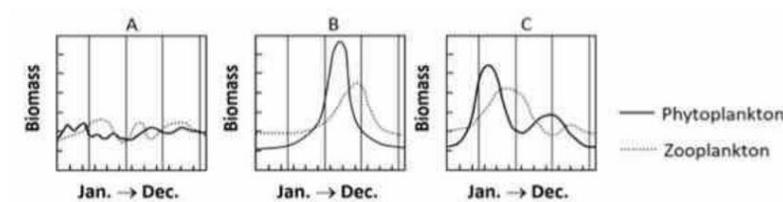
- (i) Allochthonous
- (ii) Autochthonous from phytoplankton
- (iii) Autochthonous from bottom attached algae

(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)

87. The graphs (A-C) below depict the seasonal variation in plankton biomass in three oceanic regions of No. (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)

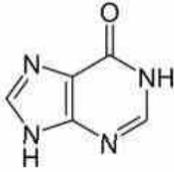
**Ans. B**

88. Which one of the following statements is NOT correct?

- A. Niche breadth tends to increase with interspecific competition while intraspecific competition tends to
- B. Species in unstable environments with fluctuating resource availabilities tend to have broad niche brea
- C. K-strategists are likely to be better competitors than r-strategists in a climax community.
- D. Diffuse competition increases with niche dimensionality.

**Ans. D**

89. The patyway for de novo biosynthesis of purine nucleotides involves the production of inosine monopho serves as a precursor for AMP and GMP synbthesis. IMP has the base hypoxanthine whose structure is give



If hypoxanthine were incorporated into double stranded DNA, which of the following options correctly of its pairing preference?

Options :

- A. adenine > thymine > guanine > cytosine
- B. cytosine > adenine > thymine > guanine
- C. guanine > adenine > thymine > cytosine
- D. cytosine > thymine > adenine > guanine

**Ans. A**

90. The intake of nutrients is under intricate control. A number of statements are made about factors control

- 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

91. A 'nonsense' mutation in the protein coding region of an upstream gene of a group of genes in an opero depletion of the downstream gene products. This is a classic example of the phenomenon of "polar effect.

Following statements are being made about this phenomenon.

- A. It occurs primarily because the termination codon generated in the upstream open reading frame (OR) termination of protein synthesis depleting the ribosomes for translation of the downstream ORFs but it d process of transcription.

B. The phenomenon of polar effects of mutation occurs only in the operons where the point mutation leads to formation of a stem-loop structure resulting in Rho-independent termination.

C. While the presence of termination codon in the upstream ORF may deplete the ribosomes that travel downstream ORF, the depletion of ribosomes downstream of the 'nonsense' mutation allows loading of tRNA then results in premature transcription termination.

D. Presence of the suppressor tRNA reading the 'nonsense' codon generated by the mutation, is an essential effect of the mutation.

E. Presence of the suppressor tRNA reading the 'nonsense' codon generated by the mutation diminishes the polar effects.

Choose the option that represents all correct statements.

Options :

- A. A and C
- B. B and D
- C. C and E
- D. A and D

**Ans. D**

92. Column I lists enzymes involved in cell cycle and typical function in a particular cell cycle phase is listed in Column II

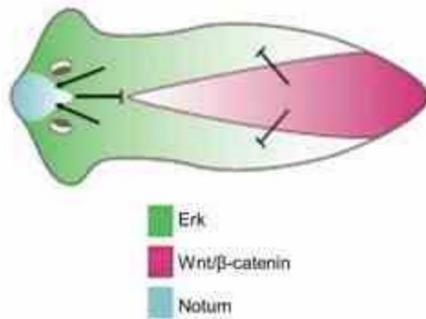
	<b>Column I (Enzyme)</b>		<b>Column II (Cell cycle function)</b>
A.	Cdk1	(i)	Cytokinesis
B.	APC/C <sup>cdc20</sup>	(ii)	S-phase entry
C.	Cdk2	(iii)	Mitotic entry
D.	Aurora B	(iv)	Anaphase onset

Options:

- 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)

**Ans. D**

93. 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

94. The initiation of transcription is a complex process involving promoter recognition, conversion of the initial closed to open form, abortive initiation events, and finally promoter escape. The following statements are these steps in transcription initiation:

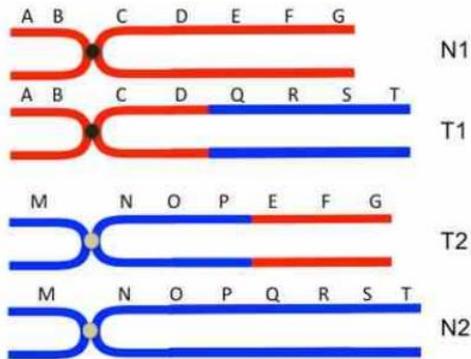
- A. Promoter escape in bacteria is usually accompanied by the release of the sigma factor from the RNA polymerase holoenzyme complex.
- B. Abortive initiation events in prokaryotes result in the formation of short transcripts ~10 nucleotides in length. In eukaryotes, abortive initiation events result in formation of transcripts ~75 nucleotides in length.
- C. Promoter escape in eukaryotes is accompanied by the phosphorylation of the RNA polymerase large subunit terminal domain (CTD).
- D. Promoter recognition in bacteria is governed by the sigma factor which binds to the -10 and -35 region followed by recruitment of the RNA 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.

**Ans. C**

95. An individual is heterozygous for a reciprocal translocation as shown below in the given diagram :



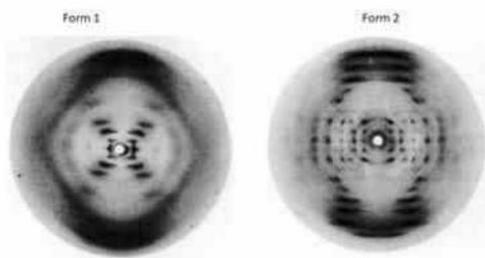
The following statements are made about segregation of such chromosomes during meiosis and gameter

- A. The complexly paired 4 chromosomes fail to segregate, pass into one cell at anaphase I and the cell e
- B. Chromosomes pair between regions of maximum homology keeping the translocated part unpaired an occurs.
- C. One of the ways the chromosomes segregate is by alternate segregation (N1, N2 moving to one pole to the other pole).
- D. Alternate segregation produces non-viable gametes.
- E. Reciprocal translocations are considered as crossover suppressors as no gametes with crossover prod

Select the option from the following that describes the meiotic consequences of such translocation correct

- A. A only
- B. C only
- C. B and D
- D. A and E

96. The diffraction patterns of two forms of DNA (A and B) and statements related to these patterns are given



- 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

97. The immune system of thymectomized and lethally irradiated (A X B) F<sub>1</sub> mice (H-2a/b) were reconstituted thymus from Strain B mice (H-2b) and with (A X B) F<sub>1</sub> bone marrow cells. These mice were then infected choriomeningitis virus (LCMV). The CD8<sup>+</sup> cytotoxic T lymphocytes from the reconstituted mice were the the following cells:

- A. Uninfected fibroblast cells from (A X B) F<sub>1</sub> 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<sub>1</sub> 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<sup>+</sup> cytotoxic T lymphocytes from mice?

- A. A, C, D and F only
- B. D, E and F only
- C. D and F only
- D. B and F only

98. Following statements are made regarding the properties of two- photon microscopy over traditional con

- A. By using longer wavelength, two-photon microscopy induces less photobleaching of the tissue prepare
- B. By using shorter wavelength, two-photon microscopy induces less photobleaching of the tissue prepare
- C. The intensity of fluorescence emitted by the sample will remain the same even if only one of the two 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?

- A. A and C
- B. A and D
- C. B and C
- D. B and D

**Ans. B**

99. 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

100. 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

101. Following statements were made to explain the intracellular transport that occurs through apoplastic, system 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

**Ans. C**

102. In eukaryotes, DNA replication must occur with extreme accuracy and only once to prevent the damaging amplification. The following statements were made regarding possible mechanisms involved in achieving DNA replication:

- A. High APC/C activity in mitosis and early  $G_1$  phase of the cell cycle that triggers the destruction of Cdt thus allowing Cdt1 to be active in early  $G_1$  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 assem 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
- D. A, B, C, and D

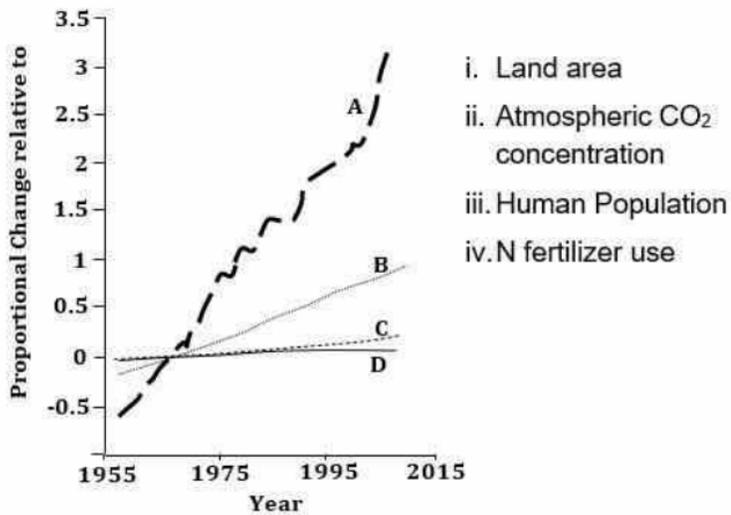
103. The following statements are made about mammalian development:

- 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 in
- 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

104. The graph below depicts trajectories (A to D) of some of the major drivers of global environmental change 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)

**Ans. D**

105. 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

106. The following table shows a list of evolutionary processes and their associated characteristics:

	<b>Column I (Evolutionary process)</b>		<b>Column II (Characteristic)</b>
A.	Parallelism	(i)	closely related groups evolve similar characteristics
B.	Convergence	(ii)	individuals of different species crossbreed
C.	Introgression	(iii)	crossbreeding between species is mediated by repeated backcrossing
D.	Hybridization	(iv)	two or more distantly related groups acquire similar characteristics

Select the correct option that matches the 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)

**Ans. B**

107. There are different kinds of reactive oxygen species (ROS) generated in plants. The following are the so statements related to ROS and its scavenging:

- A.  $H_2O_2$  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

**Ans. A**

108. The autoregulation of blood flow in the active tissues is partly achieved locally by metabolites accumulator

The contributions of different metabolites in this autoregulation are suggested in the following statement

- A. The accumulation of  $K^+$  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 $\alpha$ ) produced due to local fall in  $O_2$  tension in active tissues, initial of different vasodilatory substances.
- 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

109. Two new chemical compounds X and Y are synthesized in a laboratory and tested for their potency as a nature of the mutation produced by these compounds is tested for reversal by other known mutagens an results were obtained:

Reversed By				
New Compounds	5-Bromouracil	EMS	Hydroxylamine	Acridine orange
X	Yes	Yes	No	No
Y	No	No	No	Yes

Which statement best describes the nature of the two mutagens?

- A. Compound X produces single base substitutions that generate CG to TA transitions and Compound Y pr deletions
- B. Compound X produces insertions or deletions and Compound Y produces single base substitutions that transitions.
- C. Compound X produces single base substitutions that generate CG to TA transitions and Compound Y pr transitions.
- D. Compound X produces single base substitutions that generate insertions and Compound Y produces de

Options :

- 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)

110. The table below lists the characteristics of specific tumor types (Column I) and their names (Column II).

	<b>Column I (Tumor types)</b>		<b>Column II (Nomenclature)</b>
A.	A tumor that has arisen from endodermal tissue	(i)	Neoplasm
B.	Cancer cells arisen from hematopoietic stem cells that do not grow as solid tumor	(ii)	Carcinoma
C.	A permanent change in the genome of a cell that results in abnormal growth	(iii)	Sarcoma
D.	A tumor that has arisen from mesodermal connective tissue	(iv)	Leukemia
			Lymphoma
			Transformation

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)

111. Fidelity of protein synthesis depends to a large extent on the accuracy of aminoacylation of tRNAs with However, given that the side chains of many amino acids are not sufficiently different, aminoacyl-tRNAs are often prone to misacylate the tRNAs. One such example of misacylation is of tRNAThr by ThrRS. In the statements are being made about E. coli ThrRS.

- A. It misacylates tRNAThr equally with Ser and Cys
- B. It possesses a distinct editing site that preferentially deacylates the misacylated tRNAThr
- C. The editing of the misacylated tRNAThr occurs frequently in cis before the release of the misacylated t
- D. It possesses a distinct editing site that does not discriminate between the misacylated tRNAThr and T
- 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

112. Mouse IgM (whole molecule) was injected into rabbit to generate antiserum. Which one of the following components (the same mouse from which IgM molecules were used for immunization) has the possibility using the rabbit antiserum in Western blotting?

- A. IgG F(ab')<sub>2</sub> fragment only
- B. J chain only
- C. IgG Fc fragment only
- D. Both IgG F(ab')<sub>2</sub> fragment and J chain

113. A human subject can voluntarily inhibit respiration for some time but the subject feels irresistible urgent t after a while at a point which is called the breaking point. The characteristic features of breaking point a following statements:

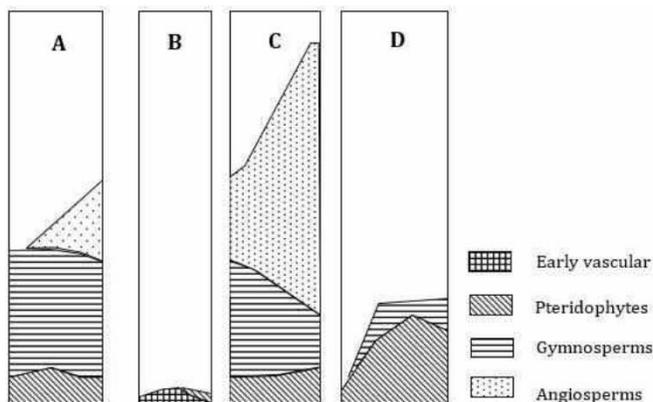
- A. The breaking point is shorter in subjects after removal of carotid bodies compared to when they have bodies.
- B. The breaking point is prolonged if the subject breathes 100% oxygen before breath holding.
- C. When the subject hyperventilates with room air before breath holding, the breaking point is delayed c the subject breathes normally before breath holding.
- D. The breaking point can be reduced in a subject by making respiratory movements behind a closed glo
- E. The breaking point is shorter when the subject is told during breath holding that her/his performance compared to a situation when she/he is not 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

114. The diagrams A-D below shows the relative abundance of major groups of plants (refer to legend) in fou geological periods (Devonian, Carboniferous, Tertiary and Cretaceous).

Match the diagrams (A to D) with the correct geological period.



Options :

- A. A-Tertiary, B- Carboniferous, C-Devonian, D-Cretaceous
- B. A-Cretaceous, B- Devonian, C-Tertiary, D-Carboniferous
- C. A-Tertiary, B- Cretaceous, C-Carboniferous, D-Devonian
- D. A-Devonian, B- Tertiary, C-Cretaceous, D-Carboniferous

115. 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 associate 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 point in late G1.

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

- A. A and B
- B. A and C
- C. B and D
- D. C and D

116. Dixon plot is used to study the enzyme inhibition by plotting various expressions of velocity and inhibitor concentration [I] on the X-axis (column I) and Y-axis (column II) as given below :

	<b>Column I (X-axis)</b>		<b>Column II (Y-axis)</b>
A.	v	(i)	1/v
B.	1/v	(ii)	[I]
C.	1/[I]	(iii)	1/[I]
D.	[I]	(iv)	V

Which one of the following options is the correct combination from column I and II to draw :

**Column I Column II**

- A. (i) (ii)
- B. (ii) (iii)
- C. (ii) (iii)
- D. (iii) (iv)

117. The hemagglutinin protein in influenza virus contains a long  $\alpha$ -helix, with 53 residues. Which of the following describes the attributes of this  $\alpha$  helix?

- A. The length is 75.6 Å, 14 turns, total of 102 Hydrogen bonds
- B. The length is 106 Å, 14 turns, total of 106 Hydrogen bonds
- C. The length is 75.6 Å, 14 turns, total of 104 Hydrogen bonds
- D. The length is 75.6 Å, 10 turns, total of 102 Hydrogen bonds

118. The signal transduction pathway involved in glycogen metabolism triggered in the liver by the hormone involves the following steps:

- A. Activation of G protein ( $G_{\alpha\beta\gamma}$ ) by the activated receptor
- B. Protein kinase A activation
- C. Second messenger generation (3',5' 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

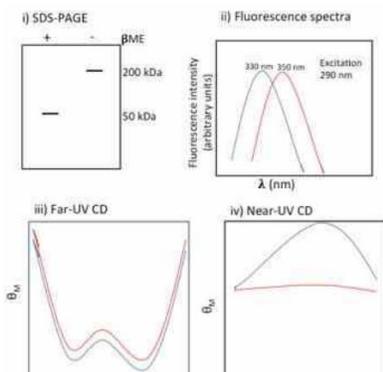
119. Which one of the options correctly represents organisms from the subphyla Chelicerata, Myriapoda, and specific sequence?

- A. Arachnids, horseshoe crabs, centipedes
- B. Horseshoe crabs, centipedes, springtails
- C. Lobsters, millipedes, silverfish
- D. Arachnids, insects, crabs

120. 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 sp (blue) and 3.0 (red)

The results are shown below:



Which one of the following options provides the correct inference?

- A. Protein 'A' is an S-S bonded homotetramer and each subunit has a molecular mass of 50 kDa, folded at globule at pH 3.0.
- B. Protein 'A' has a molecular mass of 200 kDa,  $\beta$ ME degrades the protein, low pH changes the conformation  $\beta$  sheet.
- C. SDS denatures protein 'A' into different oligomeric states, low pH changes the conformation from  $\alpha$  he SDS
- D. SDS promotes the formation of different oligomeric states of Protein 'A', low pH changes the conformation  $\alpha$  helix.

121. 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

**Ans. D**

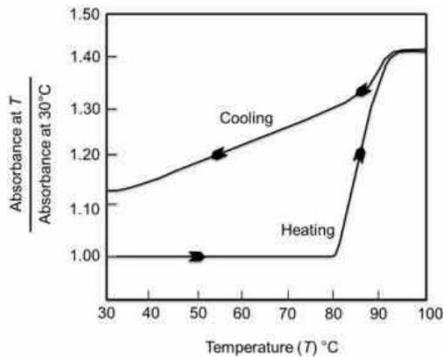
122. Following statements were made about cell cycle regulation in eukaryotes:

- A. Activity of maturation promoting factor (MPF) rises and falls in synchrony with the concentration of c
- B. Cdc25 phosphatase mediates removal of phosphate from the inhibitory tyrosine residue (Y15) to yield
- C. MPF specifically phosphorylates and depolymerizes lamin A and C, but not lamin B.
- D. MPF phosphorylates H1 histone.
- E. In Schizosaccharomyces pombe, overproduction of Wee1 protein decreases the length of G2 phase and 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

123. 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°C after cooling from 100°C is:

- A. < 25%
- B. 30 – 35%
- C. > 75%
- D. 65-70%

124. 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

125. In mice, the gene encoding Tbx5 is transcribed in limb fields of the forelimbs, while the genes encoding Pitx1 are expressed in presumptive hindlimbs.

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 Tbx4 is knocked out, although leg d 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

126. 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.
- D. Males use costly displays to advertise their genetic quality.

**Ans. C**

127. Regulation of mRNA translation is a major mechanism that maintains stoichiometric availability of ribosomes (to rRNA molecules they bind to). Translational regulation is facilitated by general occurrence of in several operons containing multiple genes. Which one of the following represents an established mechanism for optimal production of the r-proteins in E. coli, when the r-proteins accumulate in free form (molar excess)?

- A. The free r-protein(s) often bind to corresponding DNA sequence and activate transcription of rRNA genes to increase their availability.
- B. The free r-protein(s) bind to RNA polymerase and represses transcription of the r-protein genes to decrease 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 degradation of their mRNAs.

128. Given below are the list of proteins (Column I) and their functions (Column II) during floral induction.

	Column I		Column II
A.	FLOWERING LOCUS C (FLC)	(i)	An activator of FLC
B.	FLOWERING LOCUS D (FD)	(ii)	A mobile signal that 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

Which one of the following options represents the correct match between column I and column II?

- 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)

**Ans. B**

129. Excision repair systems replace a short stretch of DNA around the site of damage. The following statement 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.

130. The following represents sequences of different alleles of a gene found in a family represented by mother father (allele1/allele 2) and their two sons: Son1 (allele1/allele 2) and Son 2 (allele1/allele2). Further, observed in one of the alleles of the son, which is marked with a triangle.

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 CAGCTTAGTCATTCGTCCAT△GTACTAG  
Son 2 allele 1 CAGCATTGTCATTCGTCCATGGACTAG  
Son 2 allele 2 CAGCTTAGTCATTCGTCCAT△GTACTAG

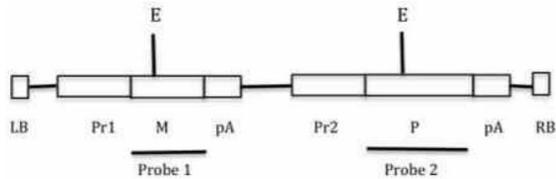
The following statements were made about the mutation:

- 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?

- A. B only
- B. A and D
- C. A and C
- D. B and D

131. Given below is a schematic representation of the T-DNA region of a binary vector used for genetic transfer



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

Transgenic plants generated using the above construct were subjected to Southern hybridization following genomic DNA with restriction enzyme 'E', to identify true single copy integration events from LB and RB

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
- B. Single copy events from the RB flank identified using Probe 2 would show a single hybridization band and blot.
- C. For true single copy events, one hybridization band would be of the same length for each of the two hybridization.
- D. True single copy events would show two bands each for copy number on the left border and right border.
- 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

132. A researcher examined the features of newly hatched birds. Species A showed open eyes, down feathers move around. Species B lacked down feathers and was incapable of walking and its eyes were closed. G 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 both altricial

133. Interferons  $\alpha$ ,  $\beta$  and  $\gamma$  are cytokines produced and secreted by animal cells after infection by viruses. Why following statements about interferons is INCORRECT?

- A. When mammalian cells are incubated with different interferons, activation of STATs (Signal Transducer Transcription) links stimulation of cell surface receptors with gene expression.
- B. Increase in the expression of genes after addition of IFN $\alpha$  results only after activation of the interferon response element (ISRE).
- C. The receptors of all three interferons belong to the Ig superfamily of receptors and do not lead to down phosphorylation events.
- D. An important feature of interferon-STAT signaling pathway is its specificity: each type of interferon ind of a unique subset of genes.

134. The following table enlists different ways of carrying out reverse genetics (Column I) and different strategies (Column II).

	Column I		Column II
A.	Random mutagenesis	(i)	RNAi
B.	Targeted mutagenesis	(ii)	Transposable elements
C.	Phenocopying	(iii)	Homologous recombination
D.		(iv)	UV mutagenesis
			CRISPR

Which one of the following options is a correct match between column I and column II?

- 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)

**Ans. D**

135. If the weights of 10,000 seeds from 100 individuals of a tree species are measured, which one of the following is expected?

- A. Binomial
- B. Poisson

C. Gaussian

D. No predictable distribution

136. Which one of the following statements in relation to insect wings is NOT true?

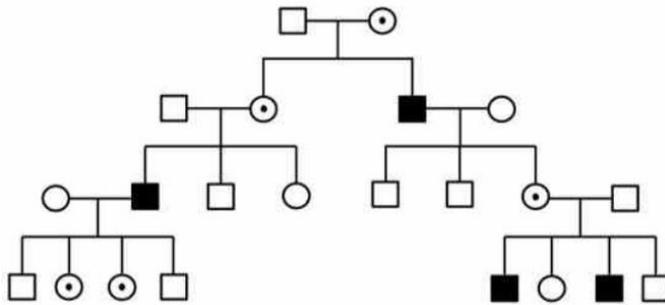
A. Insect wings are extensions of cuticle and not true appendages.

B. In beetles, the hind wings function in flight.

C. Males of many cricket species have forewings modified to bear sound-producing structures.

D. Flies have a structure called frenulum, which joins the forewing to the hind wing.

137. 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

**Ans. B**

138. The following statements were made to describe a typical collagen structure.

A. Collagen has a triple-helical domain structure which consists of three distinct  $\alpha$ -chains.

B. The collagen triple helix is stabilized by isoprenyl bonds.

C. Each  $\alpha$ -chain has a left-handed polyproline II-type helix.

D. Each  $\alpha$ -chain is composed of multiple triplet sequences of Gly-Y-Z in which Y is commonly proline and 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

139. 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 topologically associated domains.
- B. Insulators typically mark the boundaries of topologically associated domains, preventing the genes within being influenced by the regulatory modules of an adjacent domain.
- C. Presence of insulators does not overcome the positional effect after integration of a transgene into the
- D. Insulators can provide barrier against the spread of heterochromatin.
- E. Insulator sequences are absent in the *Drosophila* genome, which suggests their essentiality in achieve 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

**Ans. B**

140. 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
- D. In general, acetylation of core histones reduces their affinity for DNA and destabilizes the chromatin 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

**Ans. A**

141. 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

**Ans. D**

142. 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 gen 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 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

143. Although introns are not a part of the processed transcript that gets translated, they are important for the following statements are made with 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 nonsense-mediated mRNA decay via 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.

144. The HIPPO signaling pathway is important for cell proliferation. It is regulated by the protein kinases MST and the transcriptional activators YAP and TAZ. Accordingly, the following events may be observed with

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

145. Following statements are made regarding glycogen phosphorylase and glycogen synthase activities in re 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

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