

## CSIR NET Mobile Mock Test Series PAPER - II

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- Q.1) A night blooming white coloured flower with very pleasant odor and long tubular corolla is most likely to be pollinated by
- A. ☐ Butterfly
  - B. ☐ Bat
  - C. ☐ Birds
  - D. ☐ Moth
- Q.2) When the prospective neurons from an early gastrula of a frog were transplanted into the prospective epidermis region, the donor cells differentiated into epidermis. However, when a similar experiment was done with the late gastrula of frog, the prospective neurons developed into neurons only. These observations could possibly be explained by the following phenomena. The early gastrula show conditional development whereas the late gastrula shows autonomous development. The early gastrula show autonomous development whereas the late gastrula shows conditional development. The prospective neurons from the early gastrula are only specified whereas those from the late gastrula are determined. The prospective neurons from the early gastrula are determined whereas those from the late gastrula are specified. Which of the conclusions drawn above are correct?
- A. ☐ A and B
  - B. ☐ A and C
  - C. ☐ A and D
  - D. ☐ B and C

- Q.3) The cross  $E/E \cdot F/F \times e/e \cdot f/f$  is made, and the  $F_1$  is then backcrossed with the recessive parent. The progeny genotypes are inferred from the phenotypes. The progeny genotypes, written as the gametic contributions of the heterozygous parent, are in the following proportions:

$E \cdot F$  2/6

$E \cdot f$  1/6

$e \cdot F$  1/6

$e \cdot f$  2/6

How much is the distance between the genes  $e$  and  $f$ ?

- A. ☐ 10 cM
- B. ☐ 27 cM
- C. ☐ 16 cM
- D. ☐ 33 cM
- Q.4) The curved surface area of a cylindrical pillar is 264 m<sup>2</sup> and its volume is 924 m<sup>3</sup>. Find the ratio of its diameter to its height?
- A. ☐ 3:7
- B. ☐ 7:3
- C. ☐ 6:7
- D. ☐ 7:5
- Q.5) In *Drosophila*, order of genes under investigation is as shown in figure.

$b^+$    5cM    $cm^+$    10cM    $w^+$

if *Drosophila* with genotype  $b^+cm^+w^+/bcmw$  is test crossed, what would be the observed frequencies of progeny with  $b^+cmw^+/bcmw$  genotype assuming zero interference?

- A. ☐ 0.5
- B. ☐ 0.15
- C. ☐ 0.005
- D. ☐ 1.5

- Q.6) Two siblings who inherit 50% of the genome from the mother and 50% from the father show lot of phenotypic differences. Which one of the following events during gametogenesis of the parents will maximally contribute to this difference?
- A. ☐ Mutation
  - B. ☐ Recombination
  - C. ☐ Independent assortment
  - D. ☐ Environment
- Q.7) In which of the following regions of a eukaryotic gene will a point mutation most likely have a major negative impact on the function of the encoded protein?
- A. ☐ The TATA box in the promoter
  - B. ☐ The AAUAA sequence in the 3' UTR
  - C. ☐ The 5' UTR
  - D. ☐ The first nucleotide of a codon in the first exon
- Q.8) Which of the following statements about IPTG and lactose is NOT correct?
- A. ☐ IPTG is an analog of lactose
  - B. ☐ Both IPTG and lactose are inducers of the lac operon
  - C. ☐ IPTG is not metabolised while lactose is metabolised by the cells
  - D. ☐ Both IPTG and lactose need permease for entry into the cell
- Q.9) If a cell has an adequate supply of adenine nucleotides but requires more guanine nucleotides for protein synthesis, which out of these statements are false:
- A. ☐ Glutamine-PRPP amidotransferase will not be fully inhibited
  - B. ☐ AMP will be a feedback inhibitor of the condensation of IMP with aspartate
  - C. ☐ ATP will stimulate the production of GMP from IMP
  - D. ☐ ATP will inhibit nucleoside diphosphate reductase

Q.10) Which of the following are NOT transcribed by RNA polymerase II?

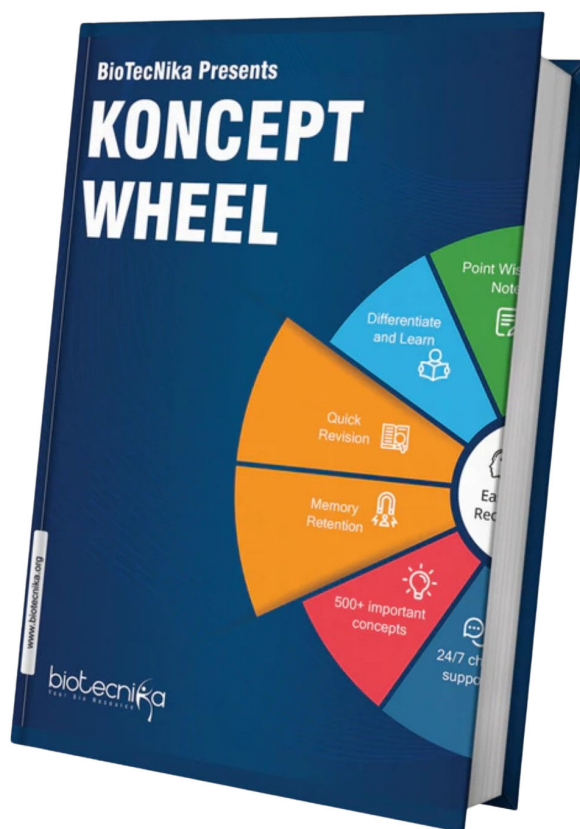
- A. ☐ tRNA and 5S rRNA
- B. ☐ mRNA and snoRNA
- C. ☐ miRNA and snoRNA
- D. ☐ miRNA and snRNA

Q.11) A practical class was going on where the students were demonstrating ATP synthesis in vitro using active mitochondria. Some students added one of the following to their tubes:-

- A. Dinitrophenol (DNP), an uncoupler
- B. Mild acidification of the medium
- C. Glutiferone, that permeabilizes both the membranes
- D. An outer membrane permeable H<sup>+</sup> quencher compound, Elila

In which one of the above, ATP synthesis will be detected?

- A. ☐ A
- B. ☐ B
- C. ☐ C
- D. ☐ D



Q.12) Three electron acceptors 'X', 'Y' and 'Z' have redox potential ( $E^0$ ) of +0.15V, +0.05 V and -0.1 V respectively. For a reaction:-



[Useful equation :  $\Delta G^0 = -nFE^0$ ]

$\Delta G^0$  = free energy change; n = number of electrons ; F = Faraday constant]

a. X and Y

b. Only X

c. Y and Z

d. Only Z

A. ☐ Option 1

B. ☐ Option 2

C. ☐ Option 3

D. ☐ Option 4

Q.13) In a 30-residue peptide, the dihedral angles  $\phi/\psi$  have been determined by one or more methods. When their values are examined in the Ramachandran plot, it is

- A. ☐ Not possible for  $\phi/\psi$  values to be distributed in the helical as well as beta sheet region
- B. ☐ Possible that the  $\phi/\psi$  values are all in the helical region although circular dichroism spectral studies indicate beta sheet conformation
- C. ☐ Possible to conclude that the peptide is composed of entirely D-amino acids
- D. ☐ Not possible to conclude if the peptide is entirely helical or entirely in beta sheet conformation

Q.14) The following are the statements about pyruvate kinase (PK).

- A. ATP is an allosteric inhibitor of PK
- B. Fructose 1, 6 bisphosphate is an activator of PK
- C. ADP is an allosteric inhibitor of PK
- D. Alanine is an allosteric modulator of PK

Which of the above statement(s) are true?

- A. ☐ A, B, C
- B. ☐ A, B, D
- C. ☐ B, C, D
- D. ☐ only A

Q.15) How many bricks, each measuring 25 cm x 11.25 cm x 6 cm, will be needed to build a wall of 8 m x 6 m x 22.5 cm

- A. ☐ 5600
- B. ☐ 6000
- C. ☐ 6400
- D. ☐ 7200

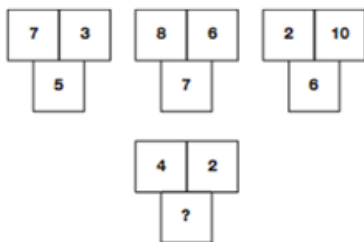
Q.16) A boat takes 90 minutes less to travel 36 miles downstream than to travel the same distance upstream. If the speed of the boat in still water is 10 mph, the speed of the stream is (in mph):

- A. ☐ 2
- B. ☐ 2.5
- C. ☐ 3
- D. ☐ 4

Q.17) A, B and C enter into a partnership in the ratio  $7/2 : 4/3 : 6/5$ . After 4 months, A increases his share 50%. If the total profit at the end of one year be Rs. 21,600, then B's share in the profit is:

- A. ☐ Rs. 2100
- B. ☐ Rs. 2400
- C. ☐ Rs. 3600
- D. ☐ Rs. 4000

Q.18) Which number replaces the question mark?



- A. ☐ 3
- B. ☐ 5
- C. ☐ 7
- D. ☐ 9

Q.19) If nIG = QehP = FgrA = R, then psA =

- A. ☐ C
- B. ☐ D
- C. ☐ E
- D. ☐ U

Q.20) A can do a work in 15 days and B in 20 days. If they work on it together for 4 days, then the fraction of the work that is left is :

- A. ☐ 1/4
- B. ☐ 1/10
- C. ☐ 7/15
- D. ☐ 8/15

Q.21) Find the odd one out among 835, 734, 642, 751, 853, 981, 532

- A. ☐ 751
- B. ☐ 853
- C. ☐ 981
- D. ☐ 532

Q.22)

In a flight of 600 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/hr and the time of flight increased by 30 minutes. The duration of the flight is (in hrs):

- A. ☐ 1
- B. ☐ 2
- C. ☐ 3
- D. ☐ 4

Q.23) Which one of the following cells in the renal corpuscle can influence glomerular filtration by its contraction?

- A. ☐ (A) Podocytes
- B. ☐ (B) Endothelial cells of glomerular capillaries
- C. ☐ (C) Parietal epithelial cells of Bowman's capsule
- D. ☐ (D) Mesangial cells

Q.24) .

Which number replaces the question mark?

7	3	6	2
2	8	5	4
1	1	2	4
4	2	1	?

- A. ☐ 7
- B. ☐ 5
- C. ☐ 4
- D. ☐ 2



Q.25) One hemoglobin molecule containing four heme groups can bind with four O<sub>2</sub>. The reactions of Hb and O<sub>2</sub> are shown below. Which one of the following reactions is fastest ?

- (A)  $\text{Hb}_4 + \text{O}_2 \rightleftharpoons \text{Hb}_4\text{O}_2$   
(B)  $\text{Hb}_4\text{O}_2 + \text{O}_2 \rightleftharpoons \text{Hb}_4\text{O}_4$   
(C)  $\text{Hb}_4\text{O}_4 + \text{O}_2 \rightleftharpoons \text{Hb}_4\text{O}_6$   
(D)  $\text{Hb}_4\text{O}_6 + \text{O}_2 \rightleftharpoons \text{Hb}_4\text{O}_8$

- A. ☐ A  
B. ☐ B  
C. ☐ C  
D. ☐ D

Q.26) Thyroxine releasing hormone (TRH) receptor belongs to

- A. ☐ (A) nuclear receptor family.  
B. ☐ (B) receptor tyrosine kinase family  
C. ☐ (C) G-protein - coupled receptor family.  
D. ☐ (D) guanylate cyclase receptor family .

Q.27) The turnover number and specific activity of an enzyme (molecular weight 40,000 D) in a reaction (V<sub>max</sub> = 4 μmol of substrate reacted/ min, enzyme amount = 2 μg) are

- A. ☐ 80,000/min, 2 × 10<sup>3</sup> μ mol substrate/min  
B. ☐ 80,000/min, 2 × 10<sup>3</sup> μ mol substrate/second  
C. ☐ 40,000/min, 1 × 10<sup>3</sup> μ mol substrate/min  
D. ☐ 40,000/min, 2 × 10<sup>3</sup> μ mol substrate/min

Q.28) Which species concept utilizes morphological and molecular characters to distinguish between species?

- A. ☐ Evolutionary
- B. ☐ Ecological
- C. ☐ Biological
- D. ☐ Phylogenetic

Q.29) The degree of genetic relatedness between the offspring and their parents is

- A. ☐ higher than that between sister and brother
- B. ☐ lower than that between sister and brother
- C. ☐ the same as that between sister and brother
- D. ☐ dependent on the number of siblings

Q.30) During which geological period was there an explosive increase in the number of many marine invertebrates phyla?

- A. ☐ Ordovician
- B. ☐ Devonian
- C. ☐ Permian
- D. ☐ Cambrian

Q.31) A farmer had 10 cows and all but 6 died. How many cows are left?

- A. ☐ 4
- B. ☐ 6
- C. ☐ 10
- D. ☐ None of the above

Q.32) Lower limits of detection by sensors is important. Which method of detection is more sensitive than glass electrode used for pH measurement?

- A. ☐ Absorption Spectroscopy
- B. ☐ Refractive Index
- C. ☐ Circular Dichroism
- D. ☐ Fluorescence spectroscopy

Q.33) Which of the following statements is incorrect for FISH technique ?

- A. ☐ A fluorescence or confocal microscope is used for detection of signal
- B. ☐ A labeled sequence of nucleotides is used
- C. ☐ Specific fluorescence tagged antibodies are used
- D. ☐ A stringent washing step is essential to remove appearance of non specific signal

Q.34) Following sets of Plasmodium falciparum sporozoites:

(i) normal sporozoites

(ii) sporozoites with mutation in the C-terminal of circumsporozoite (CS) antigen

(iii) sporozoites with mutation in the N-terminal of circumsporozoite (CS) antigen are injected into 2 groups of mice, one normal (Group A) and one (Group B) where localized knock down of heparin sulfate receptor for CS antigen in liver (cells) is achieved by injecting specific shRNA expressing lentiviral particles in the liver prior to infection. 15 days post infection, parasitemia is measured by counting infected RBC through Giemsa staining.

Which of the following groups will show maximum level of parasitemia?

- A. ☐ Group B with set (i)
- B. ☐ Group A with set (ii)
- C. ☐ Group A with set (iii)
- D. ☐ Group B with set (ii)

- Q.35) Strain A mice were crossed with strain B mice and first generation F1 mice were obtained ie (AxB)F1. A scientist then implanted thymectomized and irradiated (AxB) F1 mice with a B type thymus and then reconstituted the animals immune system with an intravenous infusion of (AxB) F1 bone marrow cells. The chimeric mice were infected with LCMV and the spleen T were then tested for their ability to kill LCMV-infected target cells from the strain A or strain B mice.

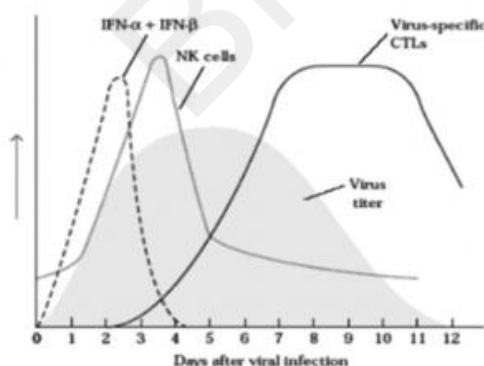
Which one of the following is the correct outcome of the experiment?

- A. ☐ LCMV-infected target cells from strain A only will be killed
- B. ☐ LCMV-infected target cells from strain B only will be killed
- C. ☐ LCMV-infected target cells from both strain A and B will be killed
- D. ☐ Neither cells from strain A nor from strain B will be killed

- Q.36) Figure below shows the time course of viral infection

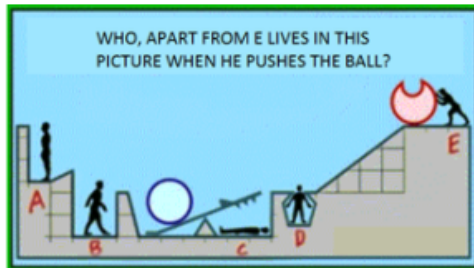
Which of the following statement is correct?

- A. IFN-alpha and IFN-beta are released from virus infected cells soon after infection
- B. IFN-alpha and IFN-beta cytokines are adaptive response which stimulate the viral specific CTL cells, quickly leading to a rise in the CTL-cell population from the basal level
- C. NK cells help contain the infection during the period required for generation of CTLs
- D. Once the CTL population reaches a peak, the virus titer rapidly decreases



- A. ☐ A, B and C
- B. ☐ B, C and D
- C. ☐ A, B and D
- D. ☐ A, B, C and D

Q.37) .



- A. ☐ A and B
- B. ☐ A, B and C
- C. ☐ A, B and D
- D. ☐ Only A

Q.38) Cellular level of tumour suppressor protein p53 is maintained by the ubiquitin ligase protein, Mdm2. Over expression of Mdm2 was found to convert a normal cell into cancer cells by destabilizing p53. Another protein p19<sup>ARF</sup> inhibits the activity of Mdm2 thus stabilizing p53. Loss of p19<sup>ARF</sup> function also converts normal cells into cancer cells. Based on the above information, which one of the following statements is correct?

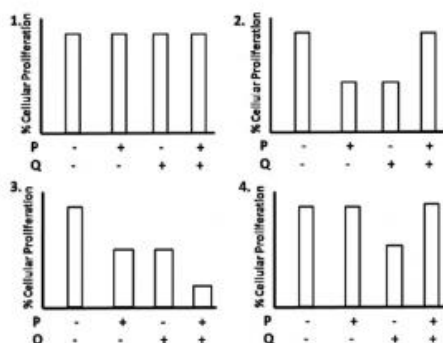
- A. ☐ Both MDM2 and p19<sup>ARF</sup> are oncogenes
- B. ☐ Both MDM2 and p19<sup>ARF</sup> are tumour suppressor genes
- C. ☐ MDM2 is an oncogene but p19<sup>ARF</sup> is a tumor suppressor gene
- D. ☐ p19<sup>ARF</sup> is an oncogene but MDM2 is a tumor suppressor gene

Q.39)

Excluding stoppages, the speed of a bus is 54 kmph and including stoppages, it is 45 kmph. For how many minutes does the bus stop per hour?

- A. ☐ 9
- B. ☐ 10
- C. ☐ 12
- D. ☐ 20

- Q.40) A virus infects a particular cell type, integrates its genome into a site that contains a proto-oncogene, transforms the cell and increases the level of a protein 'X', which increases cellular proliferation. A compound 'P' is known to increase the level of tumor suppressor proteins in that cell type whereas a compound 'Q' helps in stimulating a protein 'Z' that can bind to 'X' rendering it inactive. Which one of the following graphs correctly represents the mode of action of 'P' and 'Q'?



- A. ☐ Option 1
- B. ☐ Option 2
- C. ☐ Option 3
- D. ☐ Option 4
- Q.41) A farmer has 10 rabbits, 20 horses and 40 pigs. If we assume, that all horses are pigs, how many horses does he have?
- A. ☐ 70
- B. ☐ 60
- C. ☐ 30
- D. ☐ 20

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Q.42)

Solve this logic number sequence puzzle by observing the correct digit

$$8080 = 61357 = 02022 = 11999 = 36666 = ?$$

A. ☐ 0B. ☐ 2C. ☐ 4D. ☐ 6

BioTechnika

- Q.43) A protein X is kept in an inactive state in cytosol as complexed with protein Y. Under certain stress stimuli, Y gets phosphorylated resulting in its proteasomal degradation. X becomes free, translocates to nucleus and results in the transcription of a gene which causes cell death by apoptosis. Stress stimuli were given to following four different cases.

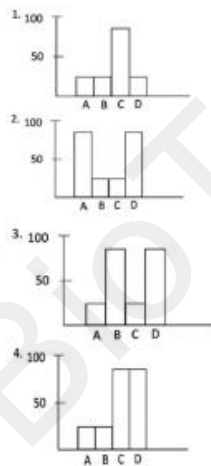
**Case A:** Protein Y has a mutation such that phosphorylation leading to proteasomal degradation does not occur.

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

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

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

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



- A. ☐ Option 1
- B. ☐ Option 2
- C. ☐ Option 3
- D. ☐ Option 4



- Q.44) In animals, four separate families of cell-cell adhesion proteins are listed in Column A and their functional characteristics are given in Column B.

Which one of the following is the correct combination?

A		B	
a.	Integrin	(i)	Lectins that mediate a variety of transient, cell-cell adhesion interactions in the blood stream
b.	Cadherin	(ii)	Contains extracellular Ig-like domains and are mainly involved in the fine tuning of cell-cell adhesive interactions during development and regeneration.
c.	Ig-super-family	(iii)	Mediates $\text{Ca}^{2+}$ -dependent strong homophilic cell-cell adhesion.
d.	Selectin	(iv)	Transmembrane cell adhesion proteins that act as extracellular matrix receptors

- 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 – (iii), c – (ii), d – (i)

- Q.45) Bag X contains 9 blue balls and 18 red balls .

Bag Y contains 7 blue balls and 14 red balls.

Liza picks a ball at random from bag X.

She puts the ball into bag Y.

Mike now picks a ball at random from bag Y.

Find the probability that Mike picks a blue ball.

- A. ☐ 15/22
- B. ☐ 7/22
- C. ☐ 1/3
- D. ☐ 8/22

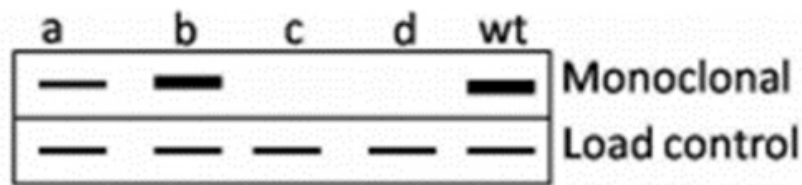
Q.46) In a typical gene cloning experiment, by mistake a researcher introduced the DNA of interest within ampicillin resistant gene instead of lac z gene. The competent cells were allowed to take up the plasmid and then plated in the media containing ampicillin, X-gal and IPTG and subjected to blue-white screening. Considering all plasmids were recombinant which one of the following statements correctly describes the outcome of the experiment?

- A. ☐ The bacteria which took up the plasmids would grow and give blue colonies.
- B. ☐ The bacteria which took up the plasmids would not grow.
- C. ☐ The bacteria which took up the plasmids would form white colonies.
- D. ☐ All the bacteria would grow and give white colonies.

Q.47) Each of the following statements concerning haptens is correct EXCEPT:

- A. ☐ A hapten can combine with (bind to) an antibody
- B. ☐ A hapten cannot induce an antibody by itself; rather, it must be bound to a carrier protein to be able to induce antibody
- C. ☐ In both penicillin-induced anaphylaxis and poison ivy, the allergens are haptens
- D. ☐ Haptens must be processed by CD8+ cells to become immunogenic

- Q.48) Four single amino acid mutants (a to d) of a protein in the epitope-region of a monoclonal antibody X were made and expressed in *E. coli*. The lysates from the four *E. coli* cultures expressing these four proteins were run on an SDS-PAGE gel and subsequently transferred to nitrocellulose membrane and Western blotted using a monoclonal antibody X raised against the wild type protein. The results are presented in the figure below: The four single mutations, upon sequencing, were found to be Valine (V) to Alanine (A); Glycine (G) to Proline (P); Alanine (A) to Aspartic acid (D) and Isoleucine (I) to Leucine (L). Which one of the following statements is correct?



- A. ☐ b is due to V → A and c is due to G → P
- B. ☐ b is due to G → P and d is due to V → A
- C. ☐ d is due to I → L and a is due to A → D
- D. ☐ c is due to V → A and a is due to I → L
- Q.49) A mineral contains a cubic and spherical cavity. The length of the side the cube is the same as the diameter of the sphere. If the cubic cavity is half filled with a liquid and the spherical cavity is completely filled with liquid, what is the approximate ratio of the volume of liquid in the cubic cavity to that in the spherical cavity?
- A. ☐ 2:1
- B. ☐ 1:1
- C. ☐ 1:2
- D. ☐ 1:4

Q.50) Intracellular pathogens like *Mycobacteria*, *Salmonella*, *Leishmania* and *Listeria* survive in macrophages by modulating host cellular machinery. In order to study the fate of these intracellular pathogens in macrophages, cells were labeled with lyso tracker Red and infected with GFP-Labeled organisms. After 2 hours at 37°C, cells were fixed, stained with anti-transferrin receptor antibody and probed with secondary antibody conjugated-blue dyes. Cells were viewed under confocal microscope. Observation: GFP-labelled *Mycobacteria*, *Salmonella* and *Listeria* were localized in the same compartment labelled with blue dyes; whereas GFP-*Leishmania* colocalize with red labelled compartment.

Which of the following statement is true based on these observations?

- A. ☐ *Mycobacteria*, *Salmonella* and *Listeria* reside in the lysosomes.
- B. ☐ *Leishmania* reside in lysosome like compartment
- C. ☐ *Leishmania* reside in a compartment which bears characteristics of early endocytic compartment
- D. ☐ *Mycobacteria*, *Salmonella* and *Listeria* lyse the phagosomal membrane and reside in cytosol.

Q.51) A problem in mathematics is given to three students A, B and C and their respective probability of solving the problem is  $\frac{1}{2}$ ,  $\frac{1}{3}$ , and  $\frac{1}{4}$ . If A, B, and C are solving problem independently, what is the probability that the problem is solved?

- A. ☐  $\frac{25}{24}$
- B. ☐  $\frac{17}{24}$
- C. ☐  $\frac{97}{120}$
- D. ☐  $\frac{3}{4}$

Q.52) In a manufacturing factory machines A, B, C produce 25%, 35%, 40% bolts respectively. Out of total 5%, 4%, 2% are defective bolts from machine A, B, and C respectively. A bolt is drawn at random from product. If bolt drawn is found to be defective, what is the probability, it is manufactured by B?

- A. ☐ 0.41
- B. ☐ 0.35
- C. ☐ 0.56
- D. ☐ 0.63

- Q.53) Given below are the intervals/duration of electrocardiogram of a human subject (Column A) and the event in heart during the process (Column B) Which one of the following options is a correct match of entries in Column A and B?

COLUMN A		COLUMN B	
a	PR interval	i	Ventricular action potential
b	QRS duration	ii	Atrioventricular conduction
c	QT interval	iii	Ventricular depolarization
d	ST interval	iv	Plateau portion of the ventricular action potential

- A. ☐ a - (i); b - (iv); c - (ii); d - (iii)
- B. ☐ a - (ii); b - (iii); c - (i); d - (iv)
- C. ☐ a - (iv); b - (ii); c - (iii); d - (i)
- D. ☐ a - (iii); b - (i); c - (iv); d - (ii)
- Q.54) A 4m 4m floor needs to be covered by tiles of size 2m 1m. Two diagonally opposite corners should be left uncovered. How many tiles are required to complete the job without breaking the tiles or overlapping them?
- A. ☐ 8
- B. ☐ 7
- C. ☐ 6
- D. ☐ Impossible to cover

Q.55) *E.coli* DNA ligase catalyses formation of a phosphodiester bond between the adjoining 3' hydroxyl, and 5' phosphoryl ends in DNA duplexes. The energetic need for this reaction is met by the hydrolysis of  $\text{NAD}^+$  to  $\text{NMN}^+$  and AMP in a three step reaction. Following statements are being made about the mechanism of this reaction.

(i) AMP is linked to the 5' phosphoryl end of the nicked DNA

(ii) Adenylyl group of  $\text{NAD}^+$  is transferred to the  $\epsilon$ -amino group of Lys in DNA ligase to form a phosphoamide adduct.

(iii) DNA ligase catalyses the formation of a phosphodiester bond by the nucleophilic attack of the 3' hydroxyl group onto the phosphate and releases AMP.

Based on the statements made above, identify the correct sequence of the reaction steps.

A. ☐ (i)-(ii)-(iii)

B. ☐ (i)-(iii)-(ii)

C. ☐ (ii)-(i)-(iii)

D. ☐ (iii)-(i)-(ii)

Q.56) Which one of the following best defines an oncogene?

A. ☐ An oncogene never codes for a cell cycle protein, which promotes cell proliferation

B. ☐ Oncogenes are always involved in inherited forms of cancer

C. ☐ An oncogene codes for a protein that prevents a cell from undergoing apoptosis

D. ☐ An oncogene is a dominantly expressed mutated gene that renders a cell advantageous towards survival

Q.57) From the following statements:

- A) Coloured images can be obtained by transmission electron microscopy by fluorescent labelling of the specimen.
- B) Scanning electron microscopy requires sectioning of the sample.
- C) Confocal microscopy uses optical methods to obtain images from a specific focal plane and excludes light from other planes.
- D) Differential-interference microscopy relies on interference between polarized light due to differences in the refractive index of the object and surrounding medium.
- E) Visualization in epifluorescence microscopy requires staining by heavy metal atoms.

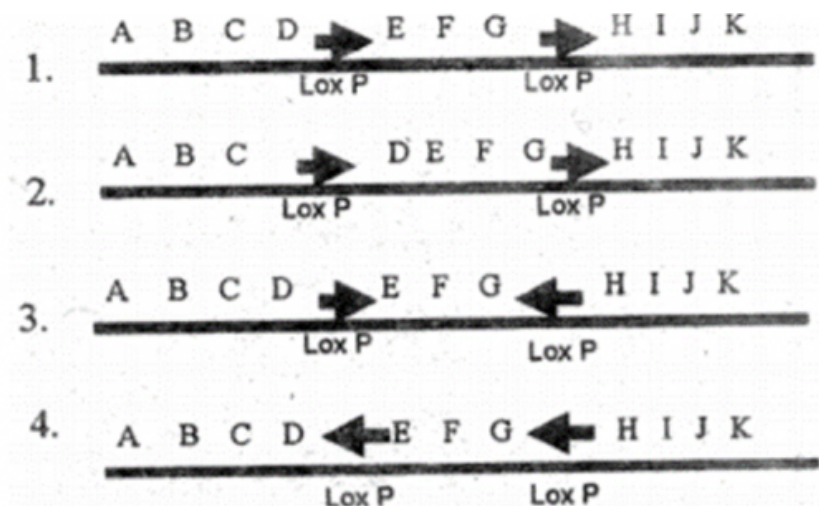
Choose the combination with two correct and one incorrect statement:

- A. ☐ B,C,E
- B. ☐ A,B,E
- C. ☐ A,C,D
- D. ☐ B,D,E

Q.58) Which one of the following is a food borne toxin?

- A. ☐ Tetanus toxin
- B. ☐ Botulinum toxin
- C. ☐ Cholera toxin
- D. ☐ Diptheria toxin



- Q.59) Cre/loxP system is used by phage P1 to remove terminally redundant sequences that arise during packaging of the phage DNA. Cre-lox system can be used to create targeted deletions, insertion and inversion in genomes of transgenic animals and plants. Consider a series of genetic markers A to K. How should the Lox P sites be positioned in order that Cre recombinase can create an inversion in the EFG segment relative to ABCD and HIJK?



- A. ☐ Option 1  
 B. ☐ Option 2  
 C. ☐ Option 3  
 D. ☐ Option 4

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- Q.60) Given below is a matrix of possible interaction [(-) harmful, (+) beneficial, (0) neutral] between species 1 & 2. the names of interactions A, B, C, D respectively are-

		Species 1		
		+	-	0
Species 2	+	C	B	
	-		A	D

- A. ☐ predation, competition, mutualism, commensalism
- B. ☐ mutualism, competition, amensalism, commensalism
- C. ☐ competition, predation, mutualism, amensalism
- D. ☐ competition, mutualism, commensalism, predation

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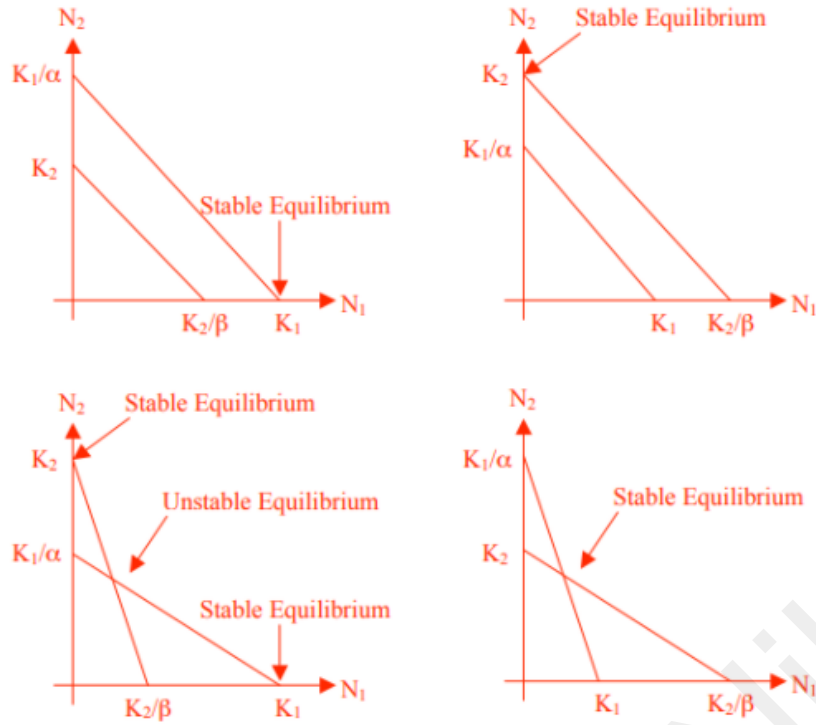
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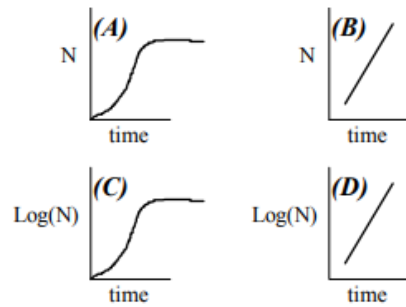
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Q.61) which of the graphs shows that the species co-exist?



- A. ☐ Option 1  
 B. ☐ Option 2  
 C. ☐ Option 3  
 D. ☐ Option 4

Q. 62) Which of these graphs demonstrates purely exponential growth?



- A. ☐ Option 1  
 B. ☐ Option 2  
 C. ☐ Option 3  
 D. ☐ Option 4

Q. 63) the Simpson Index is calculated for the data given below-

Early successional community		Late successional community	
Species	Percent cover	Species	Percent cover
A	83	F	24
B	5	G	20
C	9	H	18
D	2	I	23
E	1	J	15

the data indicate that, relative to the early successional community, late successional community has which one of the following characteristics?

- | Species Richness | Evenness |
|------------------|----------|
| 1. higher        | higher   |
| 2. higher        | lower    |
| 3. same          | lower    |
| 4. same          | higher   |

- A. ☐ Option 1  
 B. ☐ Option 2  
 C. ☐ Option 3  
 D. ☐ Option 4

- Q.64) in Sweden the Red fox (*Vulpes vulpes*) severely limits the population of its prey, including hares. however red fox population are sometime attacked by a fatal parasite, the mange mite. as mite population increases at a given site, how are hare and fox population most likely to respond at the same time? (assume that hares have no major predators at this site than fox )
- A. ☐ box fox and hare population will increase
  - B. ☐ box fox and hare population will decrease
  - C. ☐ fox population will decrease and hare population will increase
  - D. ☐ fox population will increase and hare population will decrease
- Q.65) what do Mayflies, Pacific salmon, and annual grain crops have in common? they are all-
- A. ☐ semelparous
  - B. ☐ iteoparous
  - C. ☐ oviparous
  - D. ☐ viviparous



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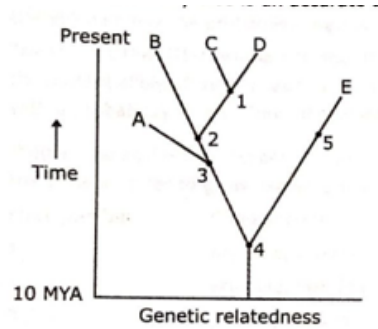
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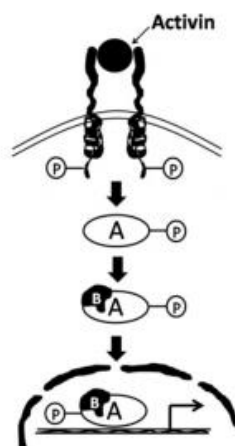
Q. 66) choose the correct statements based on this evolutionary tree



1. the entire tree is based on maximum parsimony
2. if all the species depict a taxon, this taxon is monophyletic
3. the last common ancestor of species B and C occurred more recently than the common ancestor of D and E
4. species A is the direct ancestor of both species B and C
5. the species positioned at 3 is ancestor to C,D and E

- A. ☐ 2+5
- B. ☐ 1+2+3
- C. ☐ 3+4
- D. ☐ 2+3+5

Q. 67) In the above signalling cascade, which one of the following molecules is denoted by 'B'?



- A. ☐ STAT 5
- B. ☐ SMAD 6
- C. ☐ GSK3 $\beta$
- D. ☐ SMAD 4

Q. 68) the table given below provides a list of disease and causal organisms.

	Disease		Causal Organism
A	Sleeping sickness in humans	i	<i>Trypanosoma cruzi</i>
B	Chagas disease in humans	ii	<i>Trypanosoma brucei</i>
C	Blast disease of rice	iii	<i>Magnaporthe graminis</i>
D	Powdery mildew of grasses	iv	<i>Magnaporthe oryzae</i>
		v	<i>Blumeria oryzae</i>
		vi	<i>Blumeria graminis</i>

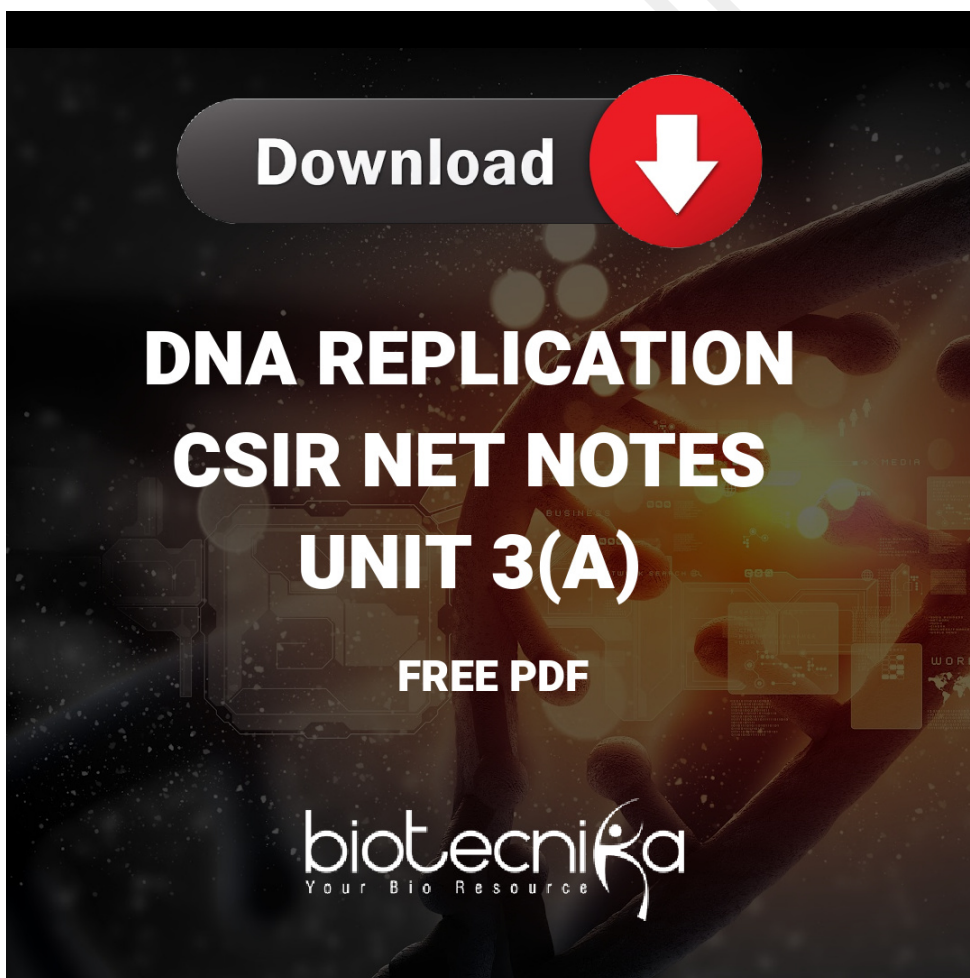
which of the following options represent the correct match between disease and the causal organism-

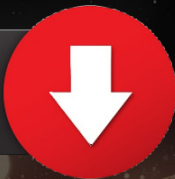
- A. ☐ A-i, B-ii, C-v, D-vi
- B. ☐ A-ii, B-i, C-iii, D-v
- C. ☐ A-i, B-ii, C-vi, D-iv
- D. ☐ A-ii, B-i, C-iv, D-vi

Q. 69) what is the probable sequence in which the following clades of animals originated, from earliest to most recent?

1. tetrapods
2. vertebrates
3. Deuterostomes
4. amniotes
5. Bilaterians

- A. ☐ 5-3-2-1-4
- B. ☐ 5-3-4-2-1
- C. ☐ 1-2-3-4-5
- D. ☐ 5-2-4-3-1



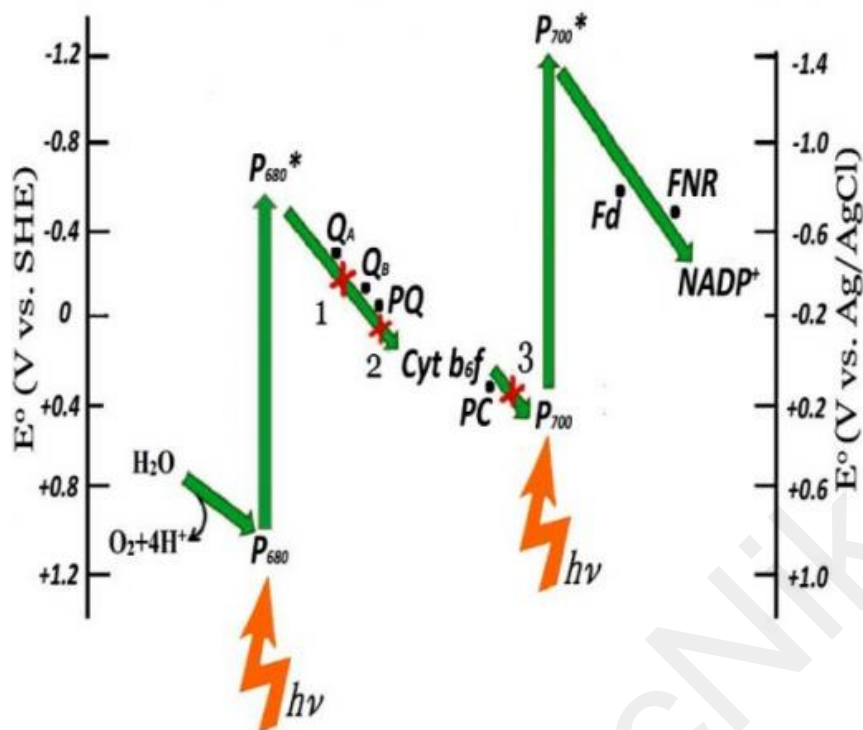
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UNIT 3(A)**

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- Q.70) P680, P680\*, P700 and P700\* are components of non-cyclic photophosphorylation pathway of the light reactions of photosynthesis as shown in the figure. Which of the 4 components is the strongest reducing agent?



- A. ☐ P680
- B. ☐ P680\*
- C. ☐ P700
- D. ☐ P700\*



Q.71) The bacterial genera carrying out nitrification, denitrification, non-symbiotic and symbiotic nitrogen fixation respectively are

A. ☐

*Nitrobacter*, *Nitrosomonas*, *Azotobacter* and *Rhizobium*

B. ☐

*Nitrosomonas*, *Pseudomonas*, *Azotobacter* and *Rhizobium*

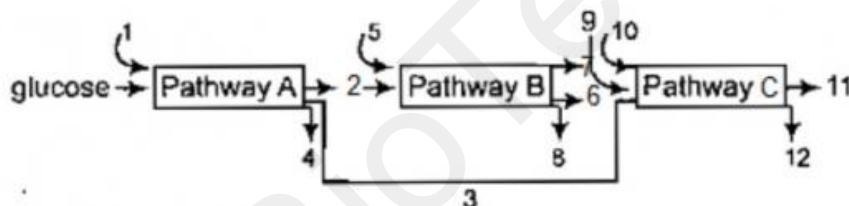
C. ☐

*Nitrobacter*, *Azotobacter*, *Nitrosomonas* and *Rhizobium*

D. ☐

*Nitrosomonas*, *Nitrobacter*, *Pseudomonas* and *Rhizobium*

Q.72) Pathway A, B and C represent the three major pathways in aerobic respiration. Arrow represents net reactants or products. Which of the following can be 4, 8 and 12 (all 3 are same)?



A. ☐

ATP

B. ☐

NADH

C. ☐

FADH<sub>2</sub>

D. ☐ CO<sub>2</sub>

Q.73) Following are certain facts about the effect of abscisic acid (ABA) on the development and physiological effect of plants:

- A. ABA promotes leaf senescence independent of ethylene
- B. ABA promotes shoot growth and inhibits root growth at low water potential
- C. ABA inhibits gibberellin induced enzyme production
- D. Seed dormancy is controlled by ratio of ABA and gibberellin

Which of the following combinations based on above statements is correct?

- A. ☐ A, B and C
- B. ☐ B, C and D
- C. ☐ A, B and D
- D. ☐ A, C and D

Q.74) Following are some statements about Krebs's cycle:

A. Pyruvate which is the end product of glycolysis, is transported from cytosol to mitochondrial matrix

B. Krebs's cycle starts with condensation of pyruvate with acetyl CoA to form citrate

C. There are 2 steps in the cycle where  $\text{FAD}^+$  is converted to  $\text{FADH}_2$

D. During conversion of succinyl CoA to succinate, a molecule of ATP is synthesized

Which of the above statements are correct?

A. ☐

A and B

B. ☐

B and C

C. ☐

C and D

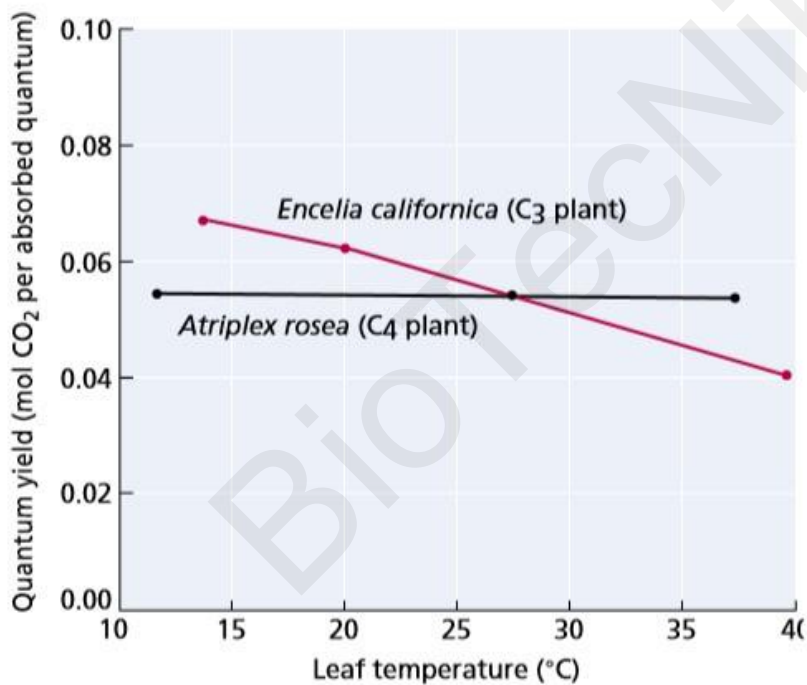
D. ☐

A and D

Q.75) Following are some statements based on the graph:

- A. Quantum yield of photosynthetic carbon fixation is affected by temperature more in C<sub>3</sub> plants as compared to C<sub>4</sub> plants
- B. For a C<sub>3</sub> plant, as the leaf temperature decreases, the quantum yield decreases
- C. Quantum yield in C<sub>4</sub> plants does not show temperature dependence due to low photorespiration
- D. At lower temperatures, photosynthesis in C<sub>4</sub> plants is more efficient than C<sub>3</sub>

Which combination of statements is INCORRECT?

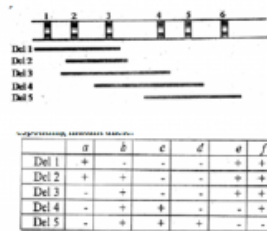


- A. ☐ A and B
- B. ☐ A and C
- C. ☐ B and C
- D. ☐ B and D

- Q.76) The following is the schematic representation region (showing 6 bands) of the polytene chromosome of *Drosophila*, along with the extent of 5 deletions (Del 1 to Del 5):

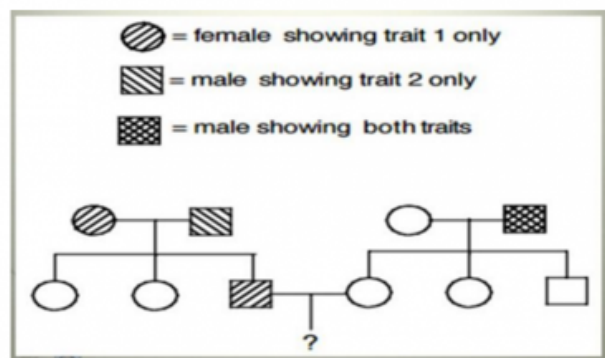
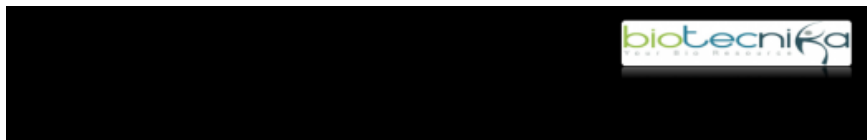
Recessive alleles *a, b, c, d, e* and *f* are known to correspond to each of the band (1 to 6), but their order is not known. When the recessive alleles are placed against each of these deletions, the following results are obtained. The plus (+) in the table indicates wild type phenotype of the corresponding allele, the minus (-) indicates the phenotype governed by the corresponding mutant allele.

Which of the following indicates the correct location of the recessive alleles on the bands of the polytene chromosomes?



- A. ☐ a-3;b-1;c-2;d-4;e-5;f-6
- B. ☐ a-2;b-1;c-3;d-4;e-5;f-6
- C. ☐ a-4;b-1;c-2;d-3;e-5;f-6
- D. ☐ a-6;b-2;c-3;d-4;e-1;f-5

- Q.77) In the following pedigree shows the segregation of two different recessive traits. Assuming that both traits are due to linked autosomal genes that are 10 cM apart, calculate the probability that the indicated child will have both recessive traits.



- A. ☐ 0.25
- B. ☐ 0.225
- C. ☐ 0.5
- D. ☐ 0.05

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## CSIR NET NOTES

### UNIT 3B RNA Synthesis & Processing



Q.78) The following is the Amino acid sequence of a part of a protein encoded by gene 'X'.

...PheLeu Val Pro Ser Tyr Cys...

A mutant for gene 'X' is isolated following treatment with a mutagen. The amino acid sequence of the same region encoded by the mutant gene is as follows:

... Phe Leu Phe Arg Arg Ile...

Which of the following mutagens is most likely to have been used?

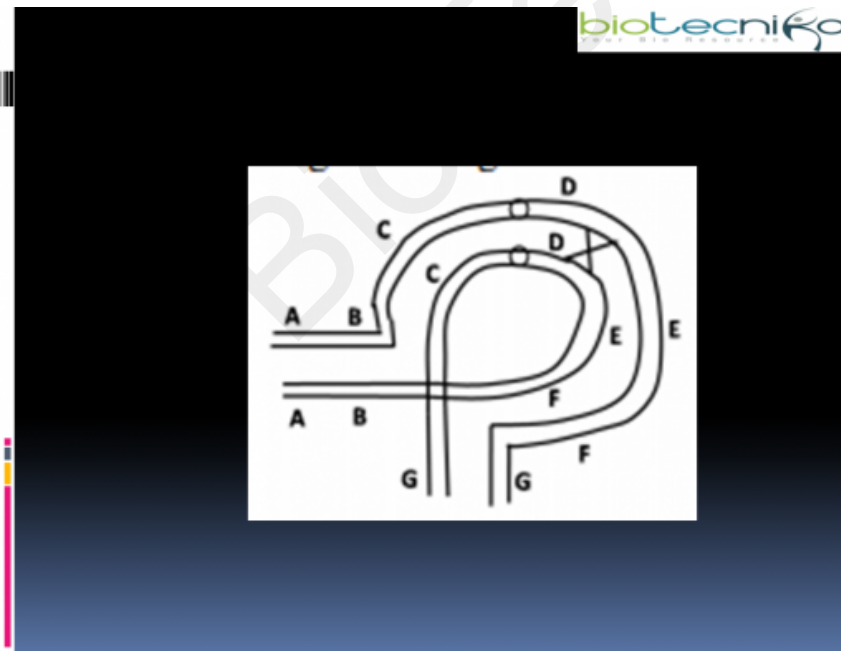
- A. ☐ 5- bromouracil
- B. ☐ 2- amino purine
- C. ☐ Ethyl methanesulfonate
- D. ☐ Acridine orange

- Q. 79) The following diagram shows meiotic pairing in an inversion heterozygote and a point where single crossing over has occurred.

The resulting gametes produced may have

- A. the chromosome having normal gene sequence
- B. the chromosome having inverted gene sequence
- C. a dicentric chromosome with duplication and deletion
- D. an acentric chromosome having duplication and deletion
- E. the chromosome having duplication and deletion

Which of the following combination will be most appropriate for the diagram shown:



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



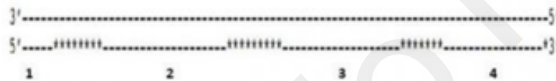
Q.80) Two human disorders, Prader-Willi syndrome and Angelman syndrome, occur when a small deletion in a specific region of chromosome 15 is contributed by either the father or mother, respectively. Why does this small deletion not behave as a recessive allele for either syndrome, that is, why is its loss not made up for by the good copy of the region on chromosome 15 contributed by the other parent?

- A. ☐ This portion of chromosome 15 is invariably mutated, so the other parent contributes recessive alleles that are thus homozygous and perturb development.
- B. ☐ The copy of chromosome 15 from the other parent has genes in the region of the deletion that are imprinted, and thus inactive; in the absence of any active copies of these genes, development cannot proceed normally.
- C. ☐ The genes in this portion of chromosome 15 are special in that they are required in two copies for normal development, and so the loss of one set does not allow normal development.
- D. ☐ Two copies of every gene in the genome are required for development, so loss of one of the copies from this region perturbs development.

Q.81) Here is a short stretch of replicating DNA from the bacterium *E. coli*.

The top strand is the template. Assume the \*\*\*\*\* are the RNA primers. This shows parts of four Okazaki fragments.

Among the four okazaki fragments which one was made first ?



- A. ☐ 1
- B. ☐ 2
- C. ☐ 3
- D. ☐ 4

- Q.82) In the fruit fly *Drosophila melanogaster*, DNA replication at a single replication fork occurs at a rate of about 2600 nucleotide pairs per minute. The DNA molecule occurring in one of the largest chromosomes of this species has been estimated to contain  $6 \times 10^7$  nucleotide pairs.

If replication of this molecule was initiated at a single origin in the middle of the chromosome, estimate the time, in days, required for complete replication of the chromosome.

- A. ☐ 8 days
- B. ☐ 26 days
- C. ☐ 16 days
- D. ☐ 10 days

- Q.83) A Scientist discovered that the x-ray pattern of wool shows a repeating structural unit spaced about 5.2 Å along the length of the wool fiber. When he steamed and stretched the wool, the x-ray pattern showed a new repeating structural unit at a spacing of 7.0 Å. Steaming and stretching the wool and then letting it shrink gave an x-ray pattern consistent with the original spacing of about 5.2 Å. Although these observations provided important clues to the molecular structure of wool. He was unable to interpret them at the time. Given our current understanding of the structure of wool, interpret Scientist's observations.

- A. ☐ Steaming and stretching disrupts the disulfide linkages in the wool fiber, opening coiled coil structure to extended conformation
- B. ☐ the coiled coil structure of keratin (present in wool) made of alpha helices is stretched to yield an extended beta-conformation with the repeat distance of 7.0 Å.
- C. ☐ Steaming breaks the peptide bond and the 3-dimensional structure of the protein changes from alpha helix to random conformation.
- D. ☐ Water molecules interfere in the structural organization of the wool fiber so when wool is dried it resumes back its original structure.

- Q.84) A DNA segment was cloned into the active site region of lacZ gene and the recombinant plasmid introduced into lacZ- strain of *E. coli* and plated on a medium containing X-gal. The colonies showed blue colour. Which one of the following statements is true ?

- A. ☐ The nature of the cloned DNA segment need not be special as cloning of any DNA in lacZ will result in disruption of its reading frame and production of blue colour on X-gal plates
- B. ☐ The cloned DNA segment could be a Group I intron whose removal from the precursor lacZ transcript in *E. coli* results in production of mature lacZ mRNA which can then produce active lacZ protein
- C. ☐ The cloned sequence is likely to be lacY sequence which is naturally a part of lac operon in *E. coli*
- D. ☐ The cloned sequence is likely to be an anti-terminator sequence that which allows full length transcription of lacZ

Q.85) What is the effect of each of the following inhibitors on electron transport and ATP formation by the respiratory chain?(a) Azide(b) Atractyloside(c) Rotenone(d) DNP(e) Carbon monoxide(f) Antimycin A

- (i)Blocks electron transport and ATP synthesis by inhibiting the exchange of ATP and ADP across the inner mitochondrial membrane.
- (ii)Blocks electron transport and proton pumping at Complex III.
- (iii)Blocks electron transport and proton pumping at Complex I.
- (iv)Blocks electron transport and proton pumping at Complex II.
- (v)Blocks ATP synthesis without inhibiting electron transport by dissipating the proton gradient.
- (vi)Blocks electron transport and proton pumping at Complex III.

- A. ☐ A-ii, B- iv, C-vi, D-iii, E-i, F-v
- B. ☐ A-vi, B - i, C-iii, D-v, E-ii, F-iv
- C. ☐ A-iii, B-vi, C-i, D-ii, E- iv, F-v
- D. ☐ A-v, B-iii, C-iv, D-i, E-vi, F-ii

Q.86) The challenges faced by aminoacyl tRNA synthetases in selecting the correct amino acid is more daunting than its recognition of the appropriate tRNA. In case of amino acids with similar structures like valine and isoleucine, this challenge is met by the enzyme possibly through its

- A. catalytic pocket.
- B. editing pocket.
- C. anticodon loop.
- D. acceptor arm.

Choose the correct set from the following:

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

Q.87) .

In a strain of *E. coli*, a fusion between the lac and trp operon took place and the new locus structure is shown below. The strain lacks the wild-type trp operon.



Given below are some of the potential scenarios :

- (A) Tryptophan will be synthesized in a medium containing lactose and tryptophan.
- (B) Tryptophan synthesis will be repressed in a medium containing glucose
- (C) Tryptophan synthesis will take place only in the absence of sufficient tryptophan in the medium

Choose the option that correctly describes the behaviours of the fusion operon.

A. ☐

A and B

B. ☐ A and CC. ☐ C onlyD. ☐ B and C

Q.88) Desert animals have a longer loop of Henle compared to that of humans. It may be due to the following reasons:

- (a) Long loop of Henle is associated with a greater amount of vasopressin secretion
- (b) In the long loop of Henle, the counter-current exchanger is more effective.
- (c) Long loop of Henle conserves more water.
- (d) Long loop of Henle stimulates the production of angiotensin II.

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

A. ☐ (A) (a) and (b)B. ☐ (B) (b) and (c)C. ☐ (C) (c) and (d)D. ☐ (D) only (d)

**Q.89) The stomach of a person was partially removed during surgery of a gastric tumour. Despite taking a balanced diet, the person developed anaemia. following possible explanations were offered:**

- (a) Lower gastric secretion inhibits folic acid absorption.**
- (b) Protein digestion was disturbed in partial gastrectomy.**
- (c) Lower HCl secretion from stomach reduced iron absorption.**
- (d) Lower secretion of intrinsic protein factor from stomach reduced Vit B12 absorption.**

**Which of the above explanations were correct?**

- A. ☐ (A) (a) and (b)**
- B. ☐ (B) (b) and (c)**
- C. ☐ (C) (c) and (d)**
- D. ☐ (D) (a) and (d)**

**Q.90) The stereocilia of auditory hair cells are arranged in rows but the heights of stereocilia are not the same in all the rows. Though the heights of stereocilia is the same within a particular row, the heights increase in subsequent rows. When the stereocilia of shorter rows are mechanically pushed towards the taller rows, the hair cells are depolarized but a push on opposite direction hyperpolarizes them. The significance of this graded height of stereocilia is:**

- 1. Each row of stereocilia may be displaced independent of other rows in physiological conditions.**
- 2. The tip of the taller stereocilia will show greater displacements as compared to shorter ones when all the rows are moving in the same axis.**
- 3. The hair cells will be depolarized or hyper polarized in different grades when the axis of displacement is changed.**
- 4. The taller stereocilia are involved with depolarization and shorter ones are responsible for hyperpolarization.**

**Which one of the following is correct?**

- A. ☐ (A) 1 only**
- B. ☐ (B) 2 only**
- C. ☐ (C) 2 and 3**
- D. ☐ (D) 2 and 4**

Q.91) GnRH is secreted during infancy (0-6 months) and puberty onwards (4 years and above) in monkeys.

However, i.v. injection of GnRH during pre-pubertal period (about 2 years of age) led to elevated LH and FSH in blood compared to untreated 2 years old monkey.

This suggests that:

1. hypothalamus is active during the pre-pubertal period.
2. GnRH action on pituitary is age-dependent.
3. pituitary matures during adulthood.
4. pituitary is active in all the stages of development in monkeys.

Which one of the following is true?

- A. ☐ (A) 1 and 2
- B. ☐ (B) 2 and 3
- C. ☐ (C) 3 only
- D. ☐ (D) 4 only

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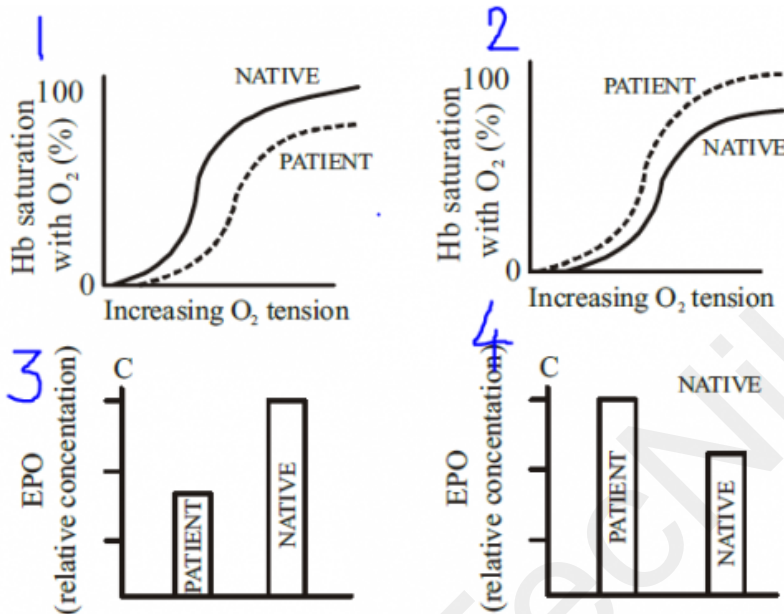
<https://btnk.org/josh>

Q.92) During the Spanish conquest of the Inca Empire at the high altitude in Peru, many soldiers fell sick. It was found that the sickness was due to the low partial pressure of  $O_2$  in the atmosphere at that altitude. To determine the reason, blood was collected from those patients. The circulating

erythropoietin (EPO) level were estimated and the  $O_2$ - dissociation curve of haemoglobin were drawn and compared with the same in native people as depicted below.

Which one of the following combinations is logically

correct ?



- A. ☐ (A) 1 and 3
- B. ☐ (B) 1 and 4
- C. ☐ (C) 2 and 3
- D. ☐ (D) 2 and 4

Q.93) A person suffering from thyrotoxicosis has an extremely high level of thyroid hormone in the blood. There is a failure of feed back regulation in the hypothalamic-pituitary thyroid

axis. The detailed blood investigation exhibited

a high level of the following:

1. Thyroid stimutaling hormone (TSH).
2. Thyroid stimulating immunoglobulin(TSI).
3. Thyrotropin releasing hormone (TRH).
4. Parathyroid hormone (PTH).

In your opinion, which one of the following is the reason  
for such thyrotoxicosis?

- A. ☐ (A) 1 only
- B. ☐ (B) 2 only
- C. ☐ (C) 2 and 3
- D. ☐ (D) 3 and 4

Q.94) What will be the approximate effective population size in a panmictic population of 240 with 200 females and 40 polygamous males?

- A. ☐ 160
- B. ☐ 133
- C. ☐ 63
- D. ☐ 67



Q.95) The following geological eras mark the advent of important events in the history of earth origin of terrestrial plants, origin of mammals, and breakup of the land mass Pangaea;

P. early Cambrian

Q. Late Devonian

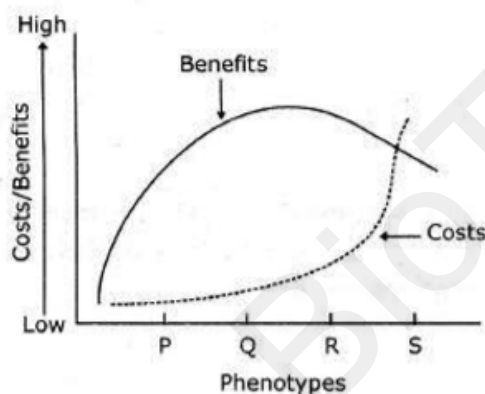
R. late Cretaceous

S. Late Jurassic

Identify the correct match of the events with the geological era.

- A. ☐ Origin of terrestrial plants - R ; Origin of mammals- S; Break up of Pangaea- P
- B. ☐ Origin of terrestrial plants - Q ; Origin of mammals- S; Break up of Pangaea- R
- C. ☐ Origin of terrestrial plants - S ; Origin of mammals- R; Break up of Pangaea- Q
- D. ☐ Origin of terrestrial plants - Q ; Origin of mammals- R; Break up of Pangaea- S

Q.96) Shown in the graph below are the fitness costs and benefits of four alternative behavioural phenotypes P, Q, R , S. Given sufficient evolutionary time, which phenotype(s) is likely to evolve as an adaptation?



- A. ☐ Q and R
- B. ☐ Q only
- C. ☐ P, Q and R
- D. ☐ S only

- Q.97) Assume a male sparrow (species X) is hatched and reared in isolation and allowed a critical imprinting period to hear the song of a male of another sparrow (species Y). Now after the isolation, what kind of behaviour will species X show?
- A. ☐ It will sing the song of species Y that it had heard in the critical period
  - B. ☐ It will sing the song of its own species X
  - C. ☐ It will not sing at all
  - D. ☐ It will sing a song not sung by either X and Y
- Q.98) The frequencies of two alleles p and q for a gene locus in a population at Hardy-Weinberg equilibrium are 0.3 and 0.7 respectively. After a few generations of inbreeding, the heterozygote frequency was found to be 0.28. The inbreeding coefficient in this case is
- A. ☐ 0.42
  - B. ☐ 0.28
  - C. ☐ 0.33
  - D. ☐ 0.67
- Q.99) Enzymes are nowadays used extensively in bioprocessing industries.
- Enzyme 1 is used for treatment of hides to provide a finer texture, in leather processing and manufacture of glue. Enzyme 2 is used for clarification of fruit juices.
- Identify Enzyme 1 and 2
- A. ☐ Amylase ; Pectinase
  - B. ☐ Protease ; Amylase
  - C. ☐ Protease ; Pectinase
  - D. ☐ Pectinase ; Amylase

**Q.100) The following are statements about molecular markers in the context of plant breeding**

- 1. Molecular markers can be used for elimination of undesirable traits**
- 2. molecular markers cannot be used for estimation of the genetic contribution of each individual parent in a segregating population .**
- 3. Molecular markers are used for mapping of QTLs, which is also possible by conventional techniques.**
- 4. Molecular markers can be used for selection of individuals from a population that are homozygous for the recurrent parent genotype at loci flanking the target locus.**

**Which of the above statements are true ?**

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

**Q.101) In order to prevent tetanus in neonates, one of the following treatments can be adopted.**

- A. Treatment of the infant with anti-toxin and the toxoid .**
- B. Immunize the mother with the toxoid .**

**In case of A, the treatment can be given**

- a. Immediately after birth**
- b. After the onset on the condition**

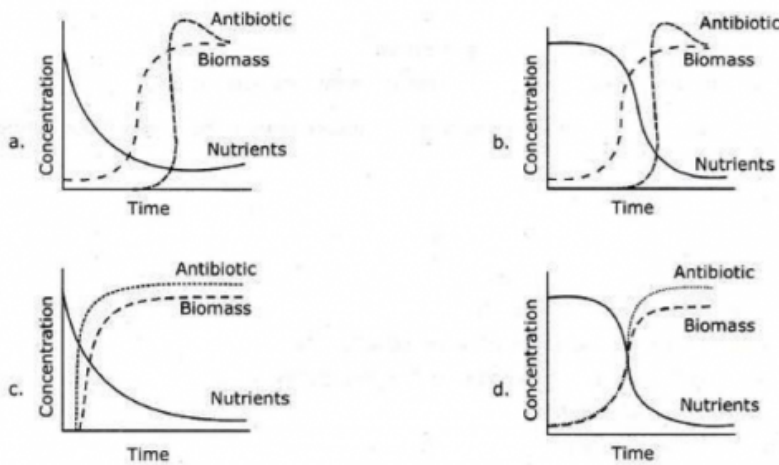
**In case of B, the immunization has to be done**

- c. before pregnancy**
- d. late in the pregnancy**

**The correct combination is**

- A. ☐ A/a
- B. ☐ A/b
- C. ☐ B/c
- D. ☐ B/d

Q.102) Which of the following curves correctly represents the process of antibiotic production by *Streptomyces* sps. ?



A. ☐ A

B. ☐ B

C. ☐ C

D. ☐ D

Q.103) For the generation of transgenic plants in crop improvement, one important regulator gene X was overexpressed in a crop plant. Out of 30 transgenic rice plants generated, 22 showed high levels of gene X expression. However, rest 8 lines displayed low levels of expression. One explanation of such observation may be :

A. ☐ Suppression effect of the transgene

B. ☐ Knock-down effect of the gene X

C. ☐ Gene silencing effect

D. ☐ Co-suppression effect of the transgene

Q.104) Match the chemical agents that interfere in oxidative phosphorylation process with their respective mode of action

Column I			Column II
(A)	Antimycin A	(i)	Inhibits $F_0$ component of ATP synthase
(B)	Oligomycin	(ii)	Disrupts inner mitochondrial membrane potential
(C)	Valinomycin	(iii)	Prevent electron transport from Fe/S cluster to ubiquinone
(D)	Rotenone	(iv)	Blocks electron transfer from cytochrome b to cytochrome $c_1$
		(v)	Inhibits adenine nucleotide translocase

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

Q.105) The following statements are made:

- A. a and b anomers of glucose are interconvertible and the ratio of their abundance is 1:2, respectively.
- B. Single chain lipids ( $\geq C_{14}$ ) form micelles and double chain lipids form bilayers in water.
- C. Proline is energetically favoured at the C termini of an  $\alpha$ -helix than at the N-termini.
- D. Major groove of DNA readily accommodates several common structural motifs in protein than the minor groove.
- E. Replacement of a canonical Watson-Crick pairing by Wobble base pairs does not change the surface properties in t-RNA.

Which one of the following combinations is INCORRECT?

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

Q.106) One goal of phylogenetic systematics is to make classification of organisms more objective and consistent with evolutionary history. Which of the following statements regarding this important area of study is not correct?

- A. ☐ The two main analytical approaches to the study of phylogenetic systematics are phenetics and cladistics
- B. ☐ Phenetic analysis compares as many characters as possible without distinguishing between homologous and analogous characters
- C. ☐ Cladistic analysis classifies organisms according to the order in time that branches arose along a dichotomous phylogenetic tree
- D. ☐ Cladistic analysis relies on analogous characters among organisms while ignoring novel homologies unique to various organisms on a branch

Q.107) 'the extremities of animals are relatively shorter in the cooler parts of a species range than in the warmer parts'- this is known as-

1. Allen's rule
2. Bergmann's rule
3. Gloger's rule
4. Rensch's rule

- A. ☐ Option 1
- B. ☐ Option 2
- C. ☐ Option 3
- D. ☐ Option 4

Q.108) Which of the following is an example of alternation of generation?

- A. ☐ A grandparent and grandchild each has dark hair but the parent has blonde hair
- B. ☐ A diploid plant produces by meiosis, a spore that give rise to multicellular haploid pollen grain
- C. ☐ A diploid animal produces gametes by meiosis and the gametes undergo fertilization to produce a diploid zygote
- D. ☐ A haploid mushroom produces gametes by mitosis and the gametes undergo fertilization which is immediately followed by meiosis.

Q.109) **Not all parasitism involves feeding on the body of the host. The exception is-**

**1. Ectoparasitism**

**2. Endoparasitism**

**3. Parasitoids**

**4. brood parasitism**

A. ☐ Option 1

B. ☐ Option 2

C. ☐ Option 3

D. ☐ Option 4

Q.110) **Which of the following can be used to distinguish a nematode worm from an annelid worm?**

**1.Type of body cavity**

**2.Number of muscle layers in the body wall**

**3.Presence of segmentation.**

**4.Number of embryonic tissue layers**

**5.Shape of worm in cross sectional view**

A. ☐ 2 only

B. ☐ 2 and 3

C. ☐ 1,2 and 3

D. ☐ 1,2,3 and 5



Q.111) Which of the following characteristics are of arthropods?

1. Protostome development
2. Bilateral symmetry
3. A pseudocoelom
4. Three embryonic germ layers
5. A closed circulatory system

- A. ☐ 1 and 2
- B. ☐ 2 and 3
- C. ☐ 1,2 and 4
- D. ☐ 2,3 and 5

Q.112) A barnacle grows on a whale, doing it no harm. This is an example of-

1. Vitalism
2. Mutualism
3. Parasitism
4. Commensalism

- A. ☐ Option 1
- B. ☐ Option 2
- C. ☐ Option 3
- D. ☐ Option 4

Q. 113) Which of the following helps a prey species advertise to predators that it is unpalatable?

1. aposematic coloration
2. cryptic coloration
3. primary compounds
4. Beltian bodies

- A. ☐ Option 1
- B. ☐ Option 2
- C. ☐ Option 3
- D. ☐ Option 4

Q. 114) A patient comes to the hospital complaining of vomiting and diarrhoea. The doctor suggested that the patient take glucose and electrolyte solution orally. Which one of the following, membrane proteins is likely to be involved in rehydrating the patient?

- A. ☐ Cystic fibrosis transmembrane regulator (CFTR)
- B. ☐ Sodium glucose transporter protein 1 (SGLT1)
- C. ☐ Insulin receptor protein (IRP)
- D. ☐ Sucrase-isomaltase protein (SIP)

Q.115) During eukaryotic cell division, metaphase to anaphase transition is regulated by degradation of

- A. ☐ Cyclin B1
- B. ☐ CDK1
- C. ☐ Aurora A kinase
- D. ☐ Polo-like kinase

Q.116) what are the correct assumption(s) of Lotka-Volterra Model?

1. Homogeneous environment;
2. no migration;
3. carrying capacity constant and direct competition for a resource
4. all of the above

- A. ☐ Option 1
- B. ☐ Option 2
- C. ☐ Option 3
- D. ☐ Option 4

Q.117) Which one of the following describes the primary function of flippases?

- A. ☐ Help in increasing lipid-protein interaction in the outer leaflet of the bilayer
- B. ☐ Move certain phospholipids from one leaflet of the membrane to another
- C. ☐ Localize more negatively charged membrane proteins in the lipid bilayer
- D. ☐ Cause uncoupling of v-SNARES and t-SNARES after fusion of incoming vesicle with target membrane

Q.118) Some statements regarding the process of autophagy are given below:

- A. Autophagy occurs when cell contains aggregated proteins
- B. Autophagosome fuses with any organelle
- C. Autophagosome is a single membrane structure
- D. Autophagosome fuse with lysosomes to form autophagolysosomes.

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

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

Q.119) Match the enzymes in column A with their respective biological function in column B.

Choose the correct combination of the answers from the options given below:

	Column A	Column B
A	Lipases	i. Catalysis of ATP- dependent translocation of the aminophospholipids, phosphatidyl ethanolamine and phosphatidylserine from the extracellular to the cytosolic leaflet of the plasma membrane
B	Flippases	ii. Catalysis of ATP-dependent translocation of plasma membrane phospholipids from the cytosolic to the extracellular leaflet.
C	Floppases	iii. Catalyze hydrolysis of triacylglycerols.
D	Scramblase	iv. Catalyze the movement of any membrane phospho-lipid across the bilayer down its concentration gradient.

- A. ☐ A-iii, B-i, C-ii, D-iv  
 B. ☐ A-i, B-iii, C-iv, D-ii  
 C. ☐ A-iv, B-ii, C-i, D-iii  
 D. ☐ A-ii, B-iv, C-iii, D-i

Q.120) Acoelomates are characterized by

- A. ☐ The absence of cavity surrounding internal organs  
 B. ☐ The presence of huge body cavity as in case of terrestrial animals  
 C. ☐ The presence of air sacs as in case of birds  
 D. ☐ The absence of brain in a group of extinct species

Q.121) Which of the following is a false statement?

- A. ☐ All sponges are hermaphrodites  
 B. ☐ Choanocytes are reproductive in function  
 C. ☐ Sponges are multicellular organisms  
 D. ☐ Porocytes allow incurrents of water

**Q. 122) Capacitation of sperms in humans**

- A. ☐ occurs during copulation
- B. ☐ occurs after the acrosome reaction
- C. ☐ takes place in the ampulla of the oviduct
- D. ☐ takes place in the epididymis of testis

**Q. 123) In case of sea urchin, which of the following is the correct sequence of events taking place during the interaction of sperm and egg?**

- A. ☐ Chemoattraction of sperm to the egg by soluble molecules secreted by the egg-- exocytosis of the sperm acrosomal vesicle to release its enzymes --binding of the sperm to the extracellular matrix of the egg --passage of sperm through this extracellular matrix --fusion of egg and sperm cell membranes.
- B. ☐ Chemoattraction of sperm to the egg by soluble molecules secreted by the egg --binding of the sperm to the extracellular matrix of the egg -- exocytosis of the sperm acrosomal vesicle to release its enzymes --passage of sperm through this extracellular matrix--fusion of egg and sperm cell membranes.
- C. ☐ Chemoattraction of sperm to the egg by soluble molecules secreted by the egg --binding of the sperm to the extracellular matrix of the egg --passage of sperm through this extracellular matrix --exocytosis of the sperm acrosomal vesicle to release its enzymes --fusion of egg and sperm cell membranes.
- D. ☐ Chemoattraction of sperm to the egg by soluble molecules secreted by the egg --passage of sperm through this extracellular matrix--binding of the sperm to the extracellular matrix of the egg-- exocytosis of the sperm acrosomal vesicle to release its enzymes --fusion of egg and sperm cell membranes.

Q. 124) **What is Induction?**

- A. ☐ refers to the initiation or cause of a change or process, such as the production of a specific morphogenetic effect in the developing embryo.
- B. ☐ a technique that is used to show how a cell or tissue moves and what it will become during normal development. Was developed by Walter Vogt as a means by which to trace the development of specific regions of the early embryo.
- C. ☐ a condition of the blastula in which there are three primary germ layers: the ectoderm, mesoderm, and endoderm. The germ layers form during gastrulation of the blastula.
- D. ☐ a 7 hr period after sperm is ejaculated into the vagina, a glycoprotein coat and seminal proteins are removed from the surface of the acrosome; this makes them more active; occurs in the uterus or uterine tubes by secreted substances by female genital track.

Q. 125) **The function of Sertoli cells are :**

- A. ☐ a technique that is used to show how a cell or tissue moves and what it will become during normal development. Was developed by Walter Vogt as a means by which to trace the development of specific regions of the early embryo.
- B. ☐ a condition of the blastula in which there are three primary germ layers: the ectoderm, mesoderm, and endoderm. The germ layers form during gastrulation of the blastula.
- C. ☐ refers to the initiation or cause of a change or process, such as the production of a specific morphogenetic effect in the developing embryo.
- D. ☐ (a kind of sustentacular cell) is a 'nurse' cell of the testes that is part of a seminiferous tubule. They nurture the developing sperm cells during spermatogenesis. It is activated by follicle-stimulating hormone and has FSH-receptor on its membranes

Q.126) You have discovered a new transposon, TnX, and would like to identify its mode of replication. A heteroduplex of the TnX sequence is made with a few mismatches and introduced into bacteria. The newly transposed genomic loci are sequenced. You find that the sequence of the transposon matched exactly with one of its parent strands. This suggests that

A. ☐

TnX transposes by conservative transposition mechanism.

B. ☐

TnX transposes using a site-specific recombination mechanism.

C. ☐

single-strands of the duplex are inserted.

D. ☐

TnX transposes by replicative mechanism.

Q.127) In order to study the intracellular trafficking of protein 'A', it was tagged with GFP (A-GFP). Fluorescence microscopy showed that A-GFP co-localizes with LAMP1. In the presence of bafilomycin A, an inhibitor of H<sup>+</sup> - ATPase, AGFP does not co-localize with LAMP1. Instead, it co-localizes with LC3 puncta. Which one of the following statements is TRUE?

A. ☐

A-GFP targets to the ER in the absence of bafilomycin A.

B. ☐

Autophagy is required for trafficking of A-GFP to lysosomes.

C. ☐

Bafilomycin A facilitates targeting of AGFP to the ER.

D. ☐

Bafilomycin A facilitates targeting of AGFP to the mitochondria.



Q.128) Fluorescence recovery after photobleaching (FRAP) is a method to estimate the diffusion of molecules in a membrane. Fluorescently labeled molecules such as:

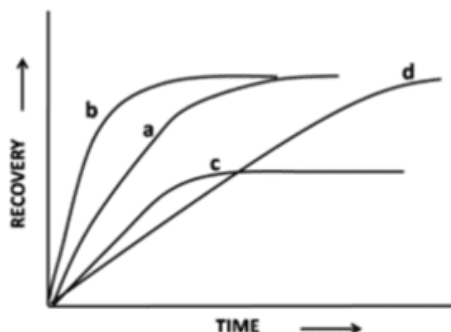
i. a receptor tagged with a green fluorescent protein (GFP)

ii. a receptor labeled with GFP which interacts with the cytoskeleton

iii. a labeled lipid

iv. a labeled protein that binds to the membrane surface is photobleached and the recovery profiles (a-d) were obtained to estimate their diffusion coefficients.

The following data were obtained: Which one of the combinations is correct?



- A. ☐ a = i; b = ii
- B. ☐ b = iii; a = iv
- C. ☐ c = iii; d = iv
- D. ☐ d = ii; b = i

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Q.129) Given below are organelles (column A) and properties associated with the organelles (column B). Choose the option that matches the organelles with the most appropriate property.

Column A		Column B	
A	Lysosomes	(i)	Anterograde transport from ER to Golgi
B	<i>cis</i> – Golgi	(ii)	Clathrin – coated vesicles
C	<i>trans</i> – Golgi	(iii)	Cop I vesicle budding
D	Cop II vesicles	(iv)	Mannose-6-phosphate receptor
E	Endocytic vesicles	(v)	Protein aggregate for secretion

A. ☐

A – (iv) ; B – (iii); C – (v); D – (i); E – (ii)

B. ☐

A – (v) ; B – (iv); C – (i); D – (v); E – (ii)

C. ☐

A – (iii) ; B – (v); C – (i); D – (iv); E – (ii)

D. ☐ A – (iv) ; B – (v); C – (ii); D – (i); E – (iii)

Q.130) To achieve a best resolution using a fluorescence microscope, what combination of wavelength of emitted light ( $\lambda$ ), refractive index and the angle ( $2\theta$ ) by which light enters into the microscope would be best choice for the user:

A. ☐  $\lambda=405$ ; refractive index=1.33;  $2\theta=90$  degree

B. ☐  $\lambda=420$ ; refractive index=1.51;  $2\theta=180$  degree

C. ☐  $\lambda=520$ ; refractive index=1.51;  $2\theta=90$  degree

D. ☐  $\lambda=405$ ; refractive index=1.51;  $2\theta=180$  degree

Q.131) A solution of a protein containing 2 mg in 1 mL was treated with an excess of N-ethylmaleimide. During the reaction in a cuvette of path length 1 cm, the absorbance at 305 nm fell from 0.26 to 0.20. Given a molar absorption coefficient for N-ethylmaleimide of  $620 \text{ L mol}^{-1} \text{ cm}^{-1}$ . Calculate the concentration of sulfhydryl groups in the solution?

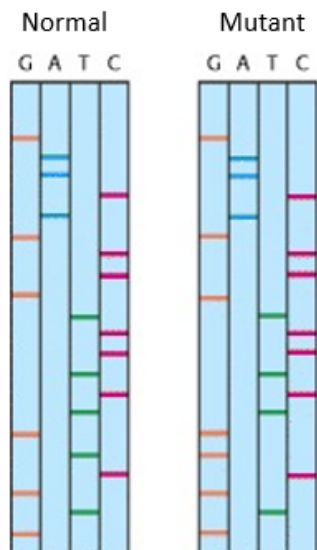
- A. ☐  $2.3 \times 10^{-5} \text{ mol L}^{-1}$
- B. ☐  $4.5 \times 10^{-5} \text{ mol L}^{-1}$
- C. ☐  $6.8 \times 10^{-5} \text{ mol L}^{-1}$
- D. ☐  $9.8 \times 10^{-5} \text{ mol L}^{-1}$

Q.132) Glycophorin of red blood cell (RBC) membrane spans the membrane only once and


the N-terminal is projected extracellularly and the C-terminal is exposed to the cytosolic side. With the help of antibodies (labelled with fluorophores) against N-terminal and C-terminal peptides, orientation of glycophorin across membrane can be verified. Which one of the following statements is correct?

- A. ☐ Intact RBC can be labelled with C-terminal antibody.
- B. ☐ Permeabilized RBC can be labelled with C-terminal antibodies as well as N-terminal antibodies.
- C. ☐ Intact RBC cannot be labelled with N-terminal antibodies.
- D. ☐ Inside out ghost of RBC can be labelled with N-terminal antibodies.


Q.133) Representations of sequencing gels obtained from Sanger's dideoxy chain termination method for variants A and B of the  $\alpha$  chain of human hemoglobin are shown here. What is the nature of the amino acid?



- A. ☐ Residue 2, L - R, CTG - CGG
- B. ☐ Residue 5, A - P, GCC - CCC
- C. ☐ Residue 6, D - G, GAC - GGC
- D. ☐ Residue 6, Q - P, CAG - CCG



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Q.134) **Numerical taxonomy involves-**

A. ☐

Overall similarity

B. ☐

Phylogenetic relationship

C. ☐

Evolutionary relationship

D. ☐

Molecular taxonomy

Biotechnika

Q.135) In the statement, Isotype is a duplicate specimen of X from the same collection of the same data and same locality, X stands for-

A. ☐

topotype

B. ☐

holotype

C. ☐

paratype

D. ☐

neotype

Q.136) The long chain alcohol which is esterified to the porphyrin head of the chlorophyll structure is

A. ☐

Dolichol

B. ☐

Farnesol

C. ☐

Phytol

D. ☐ Isoprene

Q.137) Cytokinins are derivatives of

- A. ☐ Adenine
- B. ☐ Guanine
- C. ☐ Cytosine
- D. ☐ Thymine

Q.138) Which of the following is not an early response gene for Auxin signalling?

- A. ☐ AUX/IAA
- B. ☐ SAUR
- C. ☐ GH3
- D. ☐ ARF

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Q.139) Gibberellins are chemically

A. ☐

Phenolic derivatives

B. ☐

Terpenoid derivatives

C. ☐

Adenine derivatives

D. ☐ Alkaloid derivatives

Q.140) According to Holliday model if markers are present outside the crossover point, then recombinant molecules would be generated when

A. ☐ There is no resolution

B. ☐ Always recombinant will be produced

C. ☐ Nick is on outer strand during resolution

D. ☐ Nick is on inner strand during resolution

Q.141) A group of palaeontologists digging in an area discovers a pre-historic human burial site. The same group, while exploring a nearby area, discovered fossil remains of what appeared to be more than 100 million year old dinosaur ones. Which of the following combinations of modern radiometric dating techniques should they use to calculate the age of these fossils most accurately?

A. ☐  $^{14}\text{C}$  dating for human remains and  $^{235}\text{U}$  dating for dinosaur remains.

B. ☐  $^{87}\text{Rb}$  dating for both human and dinosaur remains.

C. ☐  $^{14}\text{C}$  dating for both human and dinosaur remains.

D. ☐  $^{129}\text{I}$  dating for human remains and  $^{129}\text{Xe}$  for dinosaur remains.



**Q. 142) In a comparison of plant and animal development, it is found that:**

- A. ☐ animals evolved from plants, and animal developmental strategies are derived from those of plants.
- B. ☐ fully differentiated cells of plants are still totipotent, and will readily form a complete fertile plant, whereas the differentiated state of animal cells is difficult to reverse.
- C. ☐ gene regulation evolved later than the split between plants and animals, and is executed differently in the two kingdoms.
- D. ☐ basic metabolic pathways and intracellular structures evolved separately in plants and animals and are fundamentally different.

**Q. 143) In which out of these organisms, mid-blastula transition is not observed?**

- A. ☐ Amphibians
- B. ☐ Drosophila
- C. ☐ Zebrafish
- D. ☐ Mammals

**Q. 144) Which is true for amount of yolk and cleavage in egg of amphibian?**

- A. ☐ Mesolecithal and holoblastic cleavage
- B. ☐ Isolecithal and holoblastic cleavage
- C. ☐ Mesolecithal and meroblastic cleavage
- D. ☐ Microlecithal and meroblastic cleavage

**Q. 145) Spermatogonial stem cell undergoes extensive metamorphosis to become a spermatozoan. Meiosis leads to the formation of spermatid containing 22 autosomes and one sex chromosome. A male mouse was found in a colony which always produced only female puff upon matting. Which one Of following is a possible reason**

- A. ☐ Spermiogenesis was defective
- B. ☐ All spermgonial stem cells contained only X and no Y chromosomes
- C. ☐ Activation of Y-chromosome linked post meiotic death related gene may lead to such a situation
- D. ☐ Activation of X-chromosome linked post meiotic death related gene may lead to such a situation