Pathfinder Academy

# CSIR NET

# Life Sciences

## Question Paper

## December 2024 Shift 1

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|---|---|---|---|
| Roll No | **LIFE SCIENCES -** | Registered Photo | Exam Day Photo |
| Registration No | **703 01-Mar-2025** | | |
| Candidate Name | **09:00-12:00** | | |
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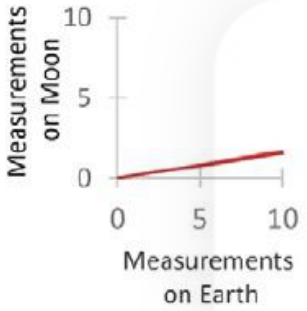
## 1) PART A

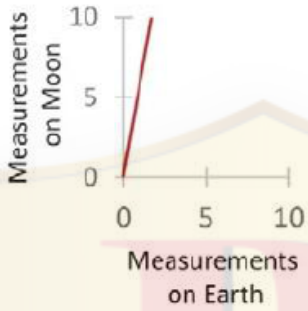
### Question No. 1 / Question ID 703104 — Marks: 2.00

Masses of several objects were measured on the Earth as well as on the Moon using the same two-pan balance. The graph of the measurements obtained on the two sites would appear as

1.




2.

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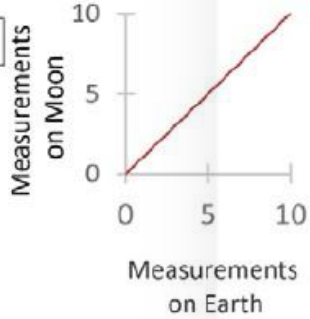
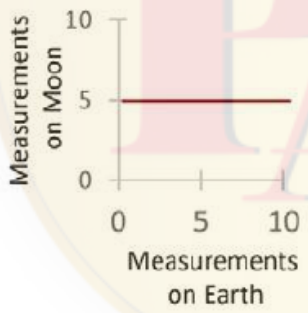



4.




### Question No. 2 / Question ID 703106 — Marks: 2.00

In the fictional country of Petreversia, which of the following provinces is the odd one out?

1. TANGODIN
2. PATACAHON
3. BACCANEH
4. HORVITHA

**Question No. 3 / Question ID 703111** Marks: 2.00

A boy in a family says "I have twice as many sisters as I have brothers" but one of his sisters claims that she has the same number of brothers and sisters. The numbers of girls and boys in that family are, respectively

1. 4 and 2
2. 3 and 2
3. 3 and 4
4. 4 and 3

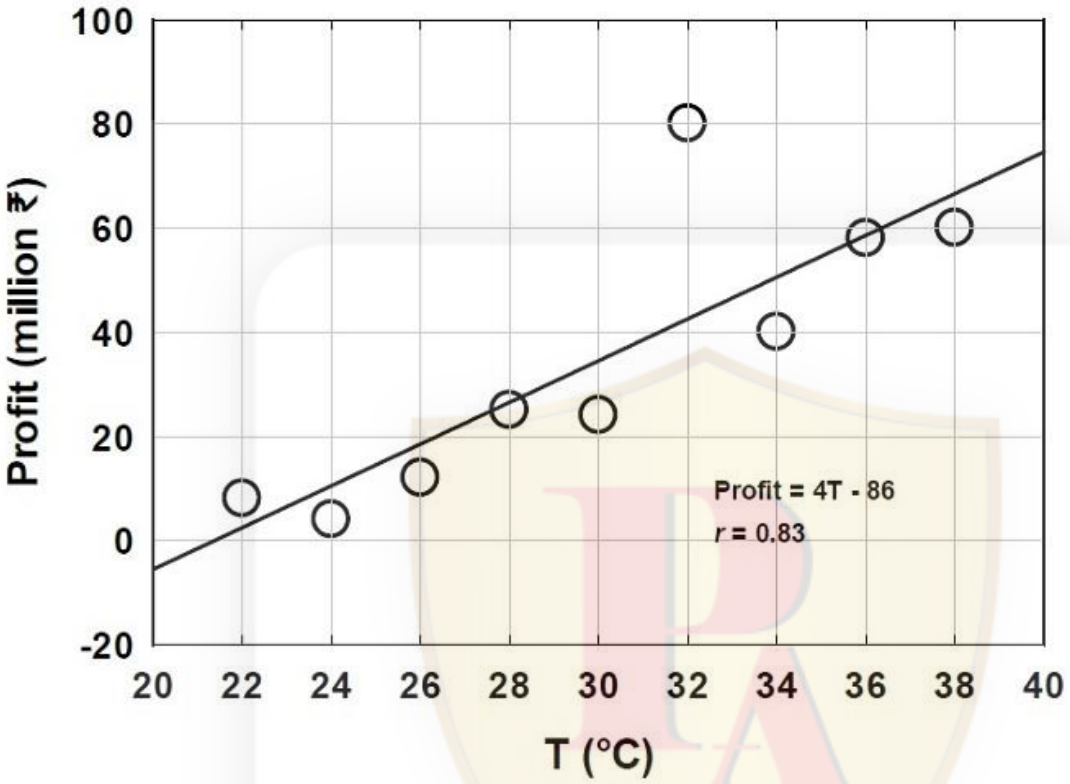
**Question No. 4 / Question ID 703119** Marks: 2.00

The geometric mean of squares of two positive integers is 10. The smallest possible sum of these two integers is

1. 7
2. 8
3. 11
4. 10

**Question No. 5 / Question ID 703102** Marks: 2.00

The given figure shows a line fit using least squares method between profit in chocolate business and mean temperature (T) data for a city. The correlation coefficient obtained from this data is *r*. Which one of the following statements is INCORRECT?




1. The sum of the squared differences between the observed and estimated values of profit is minimum.
2. About 69% of the variation in profit is explained by the variation in temperature.
3. At 30°C, estimated profit is 34 million ₹.
4. Data point (32, 80) is anomalous and therefore must be discarded.

**Question No. 6 / Question ID 703108** Marks: 2.00

A cube is coloured on each face by one of yellow, orange, red, blue, green and pink colours. Orange is opposite to yellow. Pink is between orange and yellow. Red is alongside of Pink. Green is between red and blue. Orange is at top. What is opposite to blue?

1. Red
2. Green
3. Pink
4. Yellow

**Question No. 7 / Question ID 703107** Marks: 2.00

How many 4-digit numbers can be generated from the digits 1, 2, 3, 4, 5 and 6 such that 123 always appear as a string? No digit appears more than once.

1. 8
2. 4
3. 6
4. 12

**Question No. 8 / Question ID 703120** Marks: 2.00

An item in a shop is priced at ₹ 375 excluding tax. The shopkeeper offers a discount of 15%, however there is a tax of 12% before discount on the item. The selling price of the item is:

1. ₹ 318.75
2. ₹ 420
3. ₹ 357
4. ₹ 382.5

**Question No. 9 / Question ID 703113** Marks: 2.00

Five girls are standing in a line. Out of them, Henna is to the left of Agatha, between Agatha and Dipti there are 3 places, and Shabnam has both Lata and Dipti as neighbours. Then,

1. Lata is to the right of Agatha
2. Henna is at the extreme Left
3. there are exactly two places between Henna & Dipti
4. there is exactly one place between Shabnam & Agatha

**Question No. 10 / Question ID 703115** Marks: 2.00

A 6-digit security code is made using digits from 0 to 9. The first and the last digits are known. If the remaining four digits are known to be primes, at the most how many trials are required to determine the code?

1. 100
2. 2560
3. 256
4. 10000

**Question No. 11 / Question ID 703117** Marks: 2.00

A fair coin is tossed two times independently and X denotes the number of heads. Then a fair 6-faced die is thrown at random (independently of the tosses) and Y denotes the number on the top of the die. What is the probability that the value of X+Y is 4?

1. $\frac{1}{2}$
2. $\frac{1}{3}$
3. $\frac{1}{4}$
4. $\frac{1}{6}$

**Question No. 12 / Question ID 703110** Marks: 2.00

If the words FAST, SLOW and TONE are written as 3475, 2913 and 1648 but not necessarily in the same order, then using the same code how the word NEAT would be written?

1. 7513
2. 7953
3. 7593
4. 1537

**Question No. 13 / Question ID 703105** Marks: 2.00

Let A: export, B: rainfall, C: harvest, D: godown storage
Which one of the following sequences is correct?

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

**Question No. 14 / Question ID 703112** Marks: 2.00

Fifteen distinct points are randomly placed on the circumference of a circle. At most how many triangles can be formed using these points?

1. 105
2. 455
3. 2730
4. 30

**Question No. 15 / Question ID 703101** Marks: 2.00

$\sqrt{0.99 \times 0.99 \times 0.99}$ is closest to

1. 0.99×0.33
2. 0.33×0.33×0.33
3. 0.99×0.99×0.99
4. 0.33

**Question No. 16 / Question ID 703116** Marks: 2.00

The sum of the digits of a four-digit number 'abcd' is subtracted from the number. Then the result of this will be always divisible by

1. 9
2. 11
3. 13
4. 14

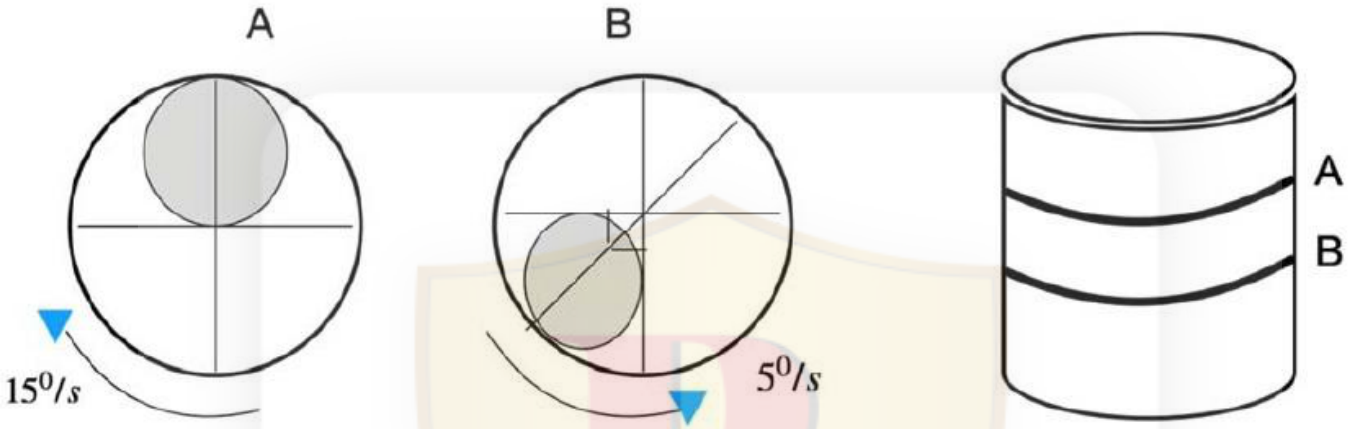
**Question No. 17 / Question ID 703114** Marks: 2.00

If you add liquid soap in the centre of a bowl of water, which has black pepper flakes floating in it, the pepper flakes will

1. start dissolving
2. move away from the centre
3. settle down
4. not move

**Question No. 18 / Question ID 703118** Marks: 2.00

A cylinder has two concentric identical metal plates placed on each other that have identical circular holes as shown in the figure (shaded area). The plate A rotates in clockwise direction at 15° per second. The plate B rotates in anti-clockwise direction at 5° per second. If the starting positions of the plates as seen from the top of the cylinder are as shown below, the first instance when both the shaded regions completely coincide happens at:




1. 11.25 seconds
2. 3.25 seconds
3. 6.75 seconds
4. 8.35 seconds

**Question No. 19 / Question ID 703109** Marks: 2.00

A rectangular sheet of 31.4 cm x 10 cm size is rolled across its length to make a cylinder without overlap. What will be the approximate volume of the cylinder?

1. 785 $cm^3$
2. 1570 $cm^3$
3. 3140 $cm^3$
4. 6280 $cm^3$

**Question No. 20 / Question ID 703103** Marks: 2.00

Choose the option to fill in the blank that will make the following statement logically correct:

COUNTING WITH PRECISION THE NUMBER OF OCCURRENCES OF THE LETTER "I" IN THIS SENTENCE YIELDS _____.

1. SEVEN
2. EIGHT
3. NINE
4. TEN

**2) PART B**

**Question No. 1 / Question ID 703160** Marks: 2.00

Which one of the following is the most significant factor that explains the evolution of iteroparity in animals?

1. Slower developmental rates over their lifespan
2. Predictable environmental conditions
3. Low adult survival rates
4. Cost per reproductive event is high

**Question No. 2 / Question ID 703149** Marks: 2.00

In a population with the ABO blood group system, if the frequency of the allele $I^A$ is 0.3, the frequency of the allele $I^B$ is 0.2, and the frequency of the allele *i* is 0.5, what would be the expected percentage of population with blood group A, considering that the population is under Hardy-Weinberg equilibrium?

1. 9%
2. 24%
3. 39%
4. 42%

**Question No. 3 / Question ID 703168** Marks: 2.00

Hormone pregnancy tests work by detecting the presence of the hormone, human chorionic gonadotropin (hCG) using immunoassay. Which types of cells will develop to produce hCG in pregnant females?

1. Pluripotent stem cells
2. Trophoblast cells
3. Endometrial cells
4. Granulosa cells

**Question No. 4 / Question ID 703130** Marks: 2.00

Match the columns:

| Column X | | Column Y | |
|---|---|---|---|
| *E. coli* genes involved in replication | | Functional eukaryotic orthologues | |
| A. | DnaB | i. | Polα/ primase |
| B | DnaC | ii. | cdc6 |
| C. | β clamp | iii. | PCNA |
| D. | DnaG | iv. | MCM complex |

Which one of the following options represents all correct matches between Column X and Column Y?

| | | | | |
|---|---|---|---|---|
| 1. | A (i) | B (ii) | C (iii) | D (iv) |
| 2. | A (iv) | B (i) | C (ii) | D (iii) |
| 3. | A (iv) | B (ii) | C (iii) | D (i) |
| 4. | A (ii) | B (iv) | C (iii) | D (i) |

**Question No. 5 / Question ID 703139** Marks: 2.00

The regeneration of a severed Axolotl limb is mediated by which one of the following cellular responses to injury?

1. Blastema formation
2. Transdifferentiation
3. Induced pluripotency
4. Stem cell dedifferentiation

**Question No. 6 / Question ID 703170** Marks: 2.00

A transmembrane receptor protein (X) and a transmembrane protein bound to the actin cytoskeleton (Y) with fluorescent tags were expressed in a cell. A fluorescence recovery after photobleaching (FRAP) experiment was performed on these proteins. Which one of the following options represents the most likely outcome of this experiment?

1. Fluorescence of both proteins will be recovered at the same rate.
2. Fluorescence of X will be recovered later than Y.
3. Fluorescence of Y will be recovered later than X.
4. Being membrane proteins, no recovery of fluorescence is expected.

**Question No. 7 / Question ID 703128** Marks: 2.00

Dynein is a microtubule-dependent motor protein essential for cellular processes. Which one of the following statements related to dynein function is INCORRECT?

1. It helps in cilia and flagella beating.
2. It transports organelles in anterograde direction.
3. It participates in spindle assembly and positioning.
4. It interacts with dynactin for efficient transport.

**Question No. 8 / Question ID 703166** Marks: 2.00

Which of the following molecular marker techniques uses a single primer in a PCR reaction for identifying polymorphisms between genotypes?

1. SSR (Simple sequence repeats)
2. AFLP (Amplified fragment length polymorphism)
3. RAPD (Randomly amplified polymorphic DNA)
4. SCAR (Sequence characterized amplified regions)

**Question No. 9 / Question ID 703142** Marks: 2.00

Which one of the following statements with regard to glyoxylate cycle is INCORRECT?

1. It is absent in humans.
2. It occurs in specialized microsomes called glyoxysomes.
3. This cycle allows for the synthesis of sugars from fatty acids.
4. It involves enzymes of both the glyoxysome and the mitochondrion.

**Question No. 10 / Question ID 703134** Marks: 2.00

Which one of the following statements regarding cytoskeleton proteins is INCORRECT?

1. Actin and tubulin proteins appear to have arisen from single-copy genes, present before multicellular eukaryotes diverged.
2. Tubulin specifically binds ATP, while actin binds preferentially to GTP.
3. FtsZ, a tubulin relative, forms a filamentous ring needed to affect cell division in certain prokaryotic species.
4. MreB, an actin relative, forms filaments required for the cell shape in certain prokaryotic species.

**Question No. 11 / Question ID 703121** Marks: 2.00

A novel organism synthesizes proteins using ribosomes from the C-terminal end to the N-terminal end rather than the usual direction (N- to C-terminus). Which main chain atom will be the nucleophile for the reaction to form peptide bonds?

1. Nitrogen of the amine group
2. Carbon of the carboxyl group
3. Oxygen of the carboxyl group
4. Alpha-carbon (Cα)

**Question No. 12 / Question ID 703164** Marks: 2.00

Many marine mammals communicate over several kilometres in the ocean. This is due to

1. their ability to communicate using ultrasound.
2. the higher density of water compared to air.
3. lower oxygen levels in the open ocean.
4. water filtering out high-frequency sounds.

**Question No. 13 / Question ID 703152** Marks: 2.00

A mutation in a Drosophila gene causes a reduction in eye size, if animals are grown at 29°C but not at 18°C. This happens even if the animals bear a single copy of this mutation. Based on this information, this mutation can be described as:

1. Temperature insensitive, dominant
2. Temperature sensitive, recessive
3. Temperature insensitive, recessive
4. Temperature sensitive, dominant

**Question No. 14 / Question ID 703126** Marks: 2.00

The majority of modifications on histone molecules happen at their _____

1. N-terminal tail.
2. C-terminal tail.
3. Globular core.
4. Spread equally throughout the polypeptide.

**Question No. 15 / Question ID 703157** Marks: 2.00

Within a broadly distributed taxonomic clade, populations and species of larger size are generally found in colder environments, while populations and species of smaller size are typically found in warmer regions. This observation is commonly referred to as:

1. Allen's rule
2. Bergman's rule
3. Gause's rule
4. Gloger's rule

**Question No. 16 / Question ID 703133** Marks: 2.00

The CaM Kinase II acts as a molecular memory device as well as a frequency decoder of $Ca^{2+}$ oscillation. Which one of the following statements regarding CaM Kinase II is INCORRECT?

1. CaM Kinase II activity increases as a function of $Ca^{2+}$ pulse frequency.
2. CaM Kinase II requires $Ca^{2+}$ and Calmodulin to remain in an active state.
3. A brain-specific CaM Kinase II knockout mouse will have difficulty in remembering where things are.
4. The molecular memory function is lost in an autophosphorylation defective CaM Kinase II.

**Question No. 17 / Question ID 703148** Marks: 2.00

Which one of the following acetylcholine receptors is located in the nodal tissue of heart?

1. $M_5$
2. $N_M$
3. $M_2$
4. $M_4$

**Question No. 18 / Question ID 703163** Marks: 2.00

Cleaner fish remove parasites from larger fish. Which evolutionary mechanism most likely maintains this interaction?

1. Kin selection
2. Mutualism
3. Direct competition
4. Character displacement

**Question No. 19 / Question ID 703144** Marks: 2.00

Which one of the following microbes is an obligate biotroph?

1. *Botrytis cinerea*
2. *Phytophthora infestans*
3. *Puccinia graminis*
4. *Trichoderma harzianum*

**Question No. 20 / Question ID 703155** Marks: 2.00

*Saara hardwickii,* a spiny-tailed lizard, is a diurnal, ground-dwelling species currently known from the Indian subcontinent. It is endemic to which one of the following habitats?

1. Rainforests of Eastern Himalayas
2. Dry deciduous forests of central India
3. Moist deciduous forests of Western Ghats
4. Thar desert of India

**Question No. 21 / Question ID 703145** Marks: 2.00

Which one of the following is generated in skeletal muscle cells by the single quanta of acetylcholine released from the motor nerve terminals?

1. Inhibitory post-synaptic potential
2. Inhibitory junction potential
3. Endplate potential
4. Miniature endplate potential

**Question No. 22 / Question ID 703147** Marks: 2.00

Which one of the following statements about human chorionic gonadotropin is INCORRECT?

1. It contains galactose and hexosamine.
2. Its α-subunit is identical in TSH.
3. Its β-subunit is smaller than α-subunit in size.
4. It is primarily luteinizing in nature.

**Question No. 23 / Question ID 703127** Marks: 2.00

Which one of the following is NOT a major phospholipid in mammalian plasma membrane?

1. Phosphatidylinositol
2. Phosphatidylserine
3. Sphingomyelin
4. Cholesterol

**Question No. 24 / Question ID 703167** Marks: 2.00

Which experiment would best validate the bioremediation potential of a microbial strain degrading oil spills in seawater?

1. Using seawater without oil contamination to monitor microbial growth.
2. Testing microbial growth in seawater with added nutrients but no oil.
3. Monitoring oil concentration in a system inoculated with microbes versus an uninoculated system.
4. Comparing microbial growth in aerated versus non-aerated seawater samples.

**Question No. 25 / Question ID 703150** Marks: 2.00

UV mutagenesis was performed to isolate mutants of the *lacZ* gene. The mutation rate of this gene is 1 X $10^{-4}$ per cell division. Assuming that an *E. coli* culture was initiated from a culture density of 1 X $10^{2}$ cells and grown to a density of 1 X $10^{6}$ cells, how many *lacZ* mutants are expected in this population?

1. ~ 1
2. ~ 10
3. ~ 100
4. ~ 1000

**Question No. 26 / Question ID 703135** Marks: 2.00

Fill in the blanks:

Glioblastomas, oligodendrogliomas, and astrocytomas harbour mutations in isocitrate dehydrogenase (IDH). The IDH mutations found in these cancers cause the enzyme to convert isocitrate into the oncometabolite, _____, which accumulates in cancer cells. This oncometabolite works by inhibiting several enzymes that require _____ for their function.

1. 2-hydroxyglutarate, succinate
2. 2-hydroxybutyrate, α-ketoglutarate
3. 2-hydroxyglutarate, 2-hydroxybutyrate
4. 2-hydroxyglutarate, α-ketoglutarate

**Question No. 27 / Question ID 703154** Marks: 2.00

The order Psilotales can be identified by which one of the following characteristics?

1. Leafless and rootless body with a dichotomously branching stem
2. Very large fronds, some reaching 4.5 m or more in length
3. Scale leaves that are borne in whorls at the node
4. A plant body that consists of microphylls and roots only

**Question No. 28 / Question ID 703169** Marks: 2.00

Which one of the following techniques can identify acetylation on a lysine residue of a protein?

1. Mass spectrometry
2. SDS-PAGE
3. Light scattering
4. CD spectroscopy

**Question No. 29 / Question ID 703146** Marks: 2.00

Which one of the following blood cell types is formed from megakaryocyte during development of blood cells from bone marrow?

1. Monocytes
2. Neutrophils
3. Eosinophils
4. Platelets

**Question No. 30 / Question ID 703132** Marks: 2.00

Which one of the following modifications in their native system does NOT lead to translation inhibition?

1. Nucleotide addition resulting in incorporation of a stem-loop structure in the mRNA upstream of the Shine-Dalgarno sequence.
2. Nucleotide addition resulting in the Shine-Dalgarno sequence being a part of a stem-loop structure in the mRNA.
3. Expression of an eIF2 mutant that mimics its phosphorylated state.
4. Mutation that leads to decrease in the processivity of capping enzyme that leaves numerous mRNAs devoid of CAP structure.

**Question No. 31 / Question ID 703136** Marks: 2.00

Which one of the following statements about peripheral lymph nodes is INCORRECT?

1. They contain fibroblast reticular cells that form a conduit system to guide cell movement within the node.
2. They are responsible for immune responses to blood-borne pathogens.
3. T cells encounter antigen presented on dendritic cells in the paracortex of lymph nodes.
4. They contain B cells in special areas called follicles.

**Question No. 32 / Question ID 703153** Marks: 2.00

As per the India State of Forest Report 2021, the percentage cover of 'very dense forests' as a component of the country's total geographical area is:

1. 3.04
2. 9.33
3. 9.44
4. 21.71

**Question No. 33 / Question ID 703156** Marks: 2.00

Which one of the following morphological characters can help you differentiate Leptosporangiate ferns from the Eusporangiate ferns?

1. Presence and absence of sporangium
2. Ploidy of the spores
3. The number of cells from which the sporangium is formed
4. The total number of alternations of generations recorded in a single life cycle

**Question No. 34 / Question ID 703131** Marks: 2.00

Which one of the following statements about RNA polymerase in eukaryotes is INCORRECT?

1. RNA polymerase I synthesizes 18S, 5.8S and 28S rRNAs.
2. RNA polymerase II synthesizes messenger RNA (mRNA).
3. RNA polymerase II requires a sigma factor (σ) to initiate transcription.
4. RNA polymerase III synthesizes 5S rRNA and tRNA.

**Question No. 35 / Question ID 703125** Marks: 2.00

Which one of the following is likely to enter a pure phospholipid bilayer?

1. $CO_2$ and Diethyl urea
2. Water and Glucose
3. Lysine and Ethanol
4. Urea and Chloride ions

**Question No. 36 / Question ID 703122** Marks: 2.00

The citric acid cycle (TCA) operates only in the presence of molecular oxygen ($O_2$). This is because

1. $O_2$ activates enzymatic dehydrogenation reactions in the cycle.
2. $O_2$ accepts electrons from electron transport chain, allowing reoxidation of NADH to $NAD^+$.
3. $O_2$ removes toxic by-products of the TCA cycle.
4. $O_2$ activates ATP synthase.

**Question No. 37 / Question ID 703129** Marks: 2.00

Two types of mutant *E. coli* were identified: in the hypermethylation mutant (type A), DNA is methylated at the GATC sequences as soon as daughter DNA is synthesized; and in the second type, GATC sequences are never methylated (type B).

Which mutant will have a greater effect on the MMR system, leading to the accumulation of spontaneous mutations?

1. Type A > Type B
2. Type B > Type A
3. Type A = Type B
4. Type B mutants will not accumulate spontaneous mutations

**Question No. 38 / Question ID 703137** Marks: 2.00

Which one of the following statements regarding mutations in the mitochondria during aging is INCORRECT?

1. Mutations in mitochondrial genome lead to defects in energy production.
2. The mutation rate in mitochondria is much higher than that in the nucleus.
3. Mutations reduce ROS production since electron transport is faulty.
4. There is an enhanced rate of apoptosis in cells with mutant mitochondria.

**Question No. 39 / Question ID 703165** Marks: 2.00

Live vaccines are generally used to protect against which one of the following viruses?

1. Hepatitis A
2. Hepatitis B
3. Rabies
4. Smallpox

**Question No. 40 / Question ID 703158** Marks: 2.00

Which one of the following is an example of character displacement?

1. Two sympatric lizards with similar morphologies consume the same insects.
2. Two sympatric birds evolve distinct beak shapes to consume seeds of different plants.
3. A predator evolves higher visual acuity to catch camouflaged prey.
4. Two plant species have similar flower shapes to attract the same pollinators.

**Question No. 41 / Question ID 703151** Marks: 2.00

The disease phenylketonuria is caused by the null allele of the gene phenylalanine hydroxylase (PAH). This is an example of a recessive mutation. Which one of the following terms is the best description of the wild type allele of PAH?

1. Gain-of-function
2. Haplosufficient
3. Epistatic
4. Allele with additive effect

**Question No. 42 / Question ID 703140** Marks: 2.00

Which is the correct hierarchy of gene activity in early *Drosophila* segmentation?

1. Gap, pair-rule, segment polarity, maternal
2. Maternal, gap, pair-rule, segment polarity
3. Maternal, pair-rule, gap, segment polarity
4. Segment polarity, pair-rule, gap, maternal

**Question No. 43 / Question ID 703138** Marks: 2.00

The epigenetic regulators DEMETER (DME) and MEDEA (MEA) act synergistically to repress endosperm development in the absence of double fertilization during seed development in Arabidopsis. Which one of the following options is the correct enzymatic function of DME and MEA?

1. DME is a DNA glycosylase; MEA is a DNA methyl transferase.
2. DME is a DNA methyl transferase; MEA is a histone methyl transferase.
3. DME is a histone methyl transferase; MEA is a DNA methyl transferase.
4. DME is a DNA glycosylase; MEA is a histone methyl transferase.

**Question No. 44 / Question ID 703161** Marks: 2.00

The dominant and recessive alleles of a gene are 'A' and 'a', respectively. In 1000 offspring, if 500 are 'aa' and 500 are of the other genotypes, which one of the following is the most likely combination of parental genotypes?

1. Aa and Aa
2. AA and Aa
3. Aa and aa
4. AA and aa

**Question No. 45 / Question ID 703162** Marks: 2.00

What type of invertebrate fossils, commonly found in the Spiti Valley of India, are characteristic of the Cambrian era?

1. Ammonites
2. Trilobites
3. Mosquitoes
4. Glossopteris

**Question No. 46 / Question ID 703124** Marks: 2.00

Which one of the following types of interactions will be predominantly contributing to the stability of a nucleosome?

1. Hydrogen bonds between DNA base pairs and serine / threonine residues of histones.
2. van der Waal's interactions between DNA base pairs and hydrophobic residues of histones.
3. Hydrogen bonds between DNA phosphate backbone and the main chain atoms of histones.
4. Electrostatic interactions involving DNA phosphate backbone and lysine residues of histones.

**Question No. 47 / Question ID 703123** Marks: 2.00

Which one of the following statements is true regarding β-oxidation of fatty acids?

1. It occurs in the intermembrane space (IMS) region of mitochondria.
2. All the reactions are same for the saturated and unsaturated fatty acids.
3. Fatty acids are oxidized at C-3 position to remove a two-carbon unit.
4. Lipoprotein lipase catalyzes the first step.

**Question No. 48 / Question ID 703141** Marks: 2.00

Which one of the following events occurs during the light reaction of photosynthesis and directly contributes to the formation of ATP?

1. Splitting of water molecules into oxygen, protons, and electrons
2. Transfer of electrons from Photosystem I to $NADP^+$ to form NADPH
3. Carbon fixation by the enzyme RuBisCO in the stroma
4. Establishment of a proton gradient across the thylakoid membrane

**Question No. 49 / Question ID 703143** Marks: 2.00

Which of the following Vitamin B complex derivatives constitute the chromophore of the blue light photoreceptor cryptochrome in plants?

1. B3 and B12
2. B2 and B9
3. B2 and B12
4. B3 and B9

**Question No. 50 / Question ID 703159** Marks: 2.00

Tectonic uplift can alter the drainage patterns of rivers, thereby isolating populations of many species. Population isolation of this kind results from which one of the following processes?

1. Dispersal
2. Vicariance
3. Range expansion
4. Competitive exclusion

**3) PART C**

**Question No. 1 / Question ID 703214** Marks: 4.00

The table below shows types of chemical mutagens and names of mutagens.

| Column X | | Column Y | |
|---|---|---|---|
| Types of chemical mutagens | | Names of mutagens | |
| A | Base analogs | i | Nitrous acid |
| B | Intercalating agents | ii | Ethyl Methane Sulphonate |
| C | Deaminating agents | iii | Ethidium Bromide |
| D | Alkylating agents | iv | 5-Bromouracil |

Which one of the following options shows the correct match between Column X and Column Y?

1. A : iv B : iii C : i D : ii
2. A : i B : iv C : iii D : ii
3. A : ii B : iii C : iv D : i
4. A : iii B : ii C : i D : iv

**Question No. 2 / Question ID 703173** Marks: 4.00

At what range of substrate concentration will an enzyme with a $k_{cat}$ of 30 $s^{-1}$ and a $K_m$ of 0.005 M show one-quarter of its maximum rate?

1. $3.0 \times 10^{-3}$ M to $3.1 \times 10^{-3}$ M
2. $0.65 \times 10^{-3}$ M to $0.75 \times 10^{-3}$ M
3. $1.65 \times 10^{-3}$ M to $1.75 \times 10^{-3}$ M
4. $2.7 \times 10^{-3}$ M to $2.8 \times 10^{-3}$ M

**Question No. 3 / Question ID 703174** Marks: 4.00

A cytoplasmic monomeric protein containing a single non-surface exposed cysteine residue precipitates upon mutation of the Cys to 'Ile'. However, the mutation of Cys to 'Ala' leads to a soluble and functional protein equivalent to the native form. Which one of the following statements explains the above observations?

1. Cys mutated to ‘Ile’ alters the net charge of the protein, while mutation to ‘Ala’ does not.
2. Cys mutated to 'Ala' alters the net charge of the protein, while mutation to ‘Ile’ does not.
3. Cys mutated to 'Ala' causes steric hindrance in the core of the protein, while mutation to ‘Ile’ does not.
4. Cys mutated to 'Ile' causes steric hindrance in the core of the protein, while mutation to ‘Ala’ does not.

**Question No. 4 / Question ID 703182** Marks: 4.00

Given below are a few statements about intracellular protein transport.

A. Proteins that are destined for the lysosome are tagged with a mannose-6-phosphate (M6P) group in the Golgi apparatus, which is recognized by the M6P receptor in the trans-Golgi network.
B. Signal recognition particle directly mediates the insertion of proteins into the mitochondrial membrane.
C. The KDEL receptor in the ER and Golgi apparatus works by retrieving soluble ER resident proteins that have accidentally moved to the Golgi.
D. Cargo proteins that need to be exported from the ER are packaged into COPII vesicles based on the presence of an ER export signal in their cytosolic tail.
E. Clathrin-coated vesicles are primarily involved in vesicle trafficking between the Golgi apparatus and the ER.

Choose the option that has all correct statements.

1. A, C and D
2. A, B and E
3. A and D only
4. C and E

**Question No. 5 / Question ID 703191** Marks: 4.00

The following statements are made regarding the role of cadherins in cell junctions.

A. Cadherins are calcium-dependent adhesion molecules that mediate cell to cell adhesion by forming homophilic interactions.
B. Cadherins function in tight junctions, sealing the space between adjacent cells.
C. N-cadherins are primarily found in epithelial cells and mediate adhesion to the basal lamina.
D. Cadherins are involved in the formation of focal adhesions, linking the cell cytoskeleton to the ECM.
E. Cadherins interact with the actin cytoskeleton through associated proteins like catenins.

Which one of the following options represents all correct statements?

1. B, C and E
2. A, B and D
3. A and D only
4. A and E only

**Question No. 6 / Question ID 703181** Marks: 4.00

Given below are components that facilitate transfer of molecules across phospholipid bilayers (Column X) and the properties of these components (Column Y).

| Column X | | Column Y | |
|---|---|---|---|
| Membrane component | | | Activity |
| A | ATP powered pumps | I | Movement of molecules against concentration gradient coupled to another molecule moving down the concentration gradient |
| B | Uniporter | II | Free diffusion of hydrophilic molecules |
| C | Channels | III | Movement of molecules against a concentration gradient and/or electric potential |
| D | Symporter | IV | Transport of hydrophilic molecules down their concentration gradients |

Choose the option that correctly matches the components with their properties.

1. A (IV) B (II) C (I) D (III)
2. A (II) B (III) C (IV) D (I)
3. A (III) B (IV) C (I) D (II)
4. A (III) B (IV) C (II) D (I)

**Question No. 7 / Question ID 703229** Marks: 4.00

The following table shows forest floor litter pool and aboveground litterfall data for three forest types.

| Forest Type | Forest floor litter pool ($gC/m^2$) | Aboveground litterfall ($gC/m^2/yr$) |
|---|---|---|
| A. | 5000 | 50 |
| B. | 1500 | 300 |
| C. | 600 | 600 |

Based on the provided information, which one of the following options accurately identifies the various forest types?

1. A- Tropical forest, B- Temperate deciduous forest, C- Temperate coniferous forest
2. A- Temperate coniferous forest, B- Temperate deciduous forest, C- Tropical forest
3. A- Temperate coniferous forest, B- Tropical forest, C- Temperate deciduous forest
4. A- Tropical forest, B- Temperate coniferous forest, C- Temperate deciduous forest

**Question No. 8 / Question ID 703217** Marks: 4.00

Quantitative Trait Loci (QTLs) can be identified using two main approaches: bi-parental matings (BPM) and Genome-Wide Association Studies (GWAS). Below are some descriptors related to these strategies:

A. Large sample size
B. Small sample size
C. Population derived from controlled crosses
D. Random mating populations
E. Limited to two alleles per locus
F. Multiple alleles per locus
G. Linkage-based mapping
H. Linkage disequilibrium-based mapping

The table below presents four incomplete statements regarding BPM and GWAS. Each statement can be completed using the above descriptors.

| Option | The analysis is typically conducted on _____ | | The number of alleles that can possibly be analysed_____ | | The analysis relies on ____ | | Sample size needed to identify loci with small effect _____ | |
|---|---|---|---|---|---|---|---|---|
| | BPM | GWAS | BPM | GWAS | BPM | GWAS | BPM | GWAS |
| i. | C | D | E | F | G | H | A | A |
| ii. | D | C | E | F | H | G | A | B |
| iii. | C | D | F | E | H | G | B | A |
| iv. | D | C | F | E | G | H | B | B |

Which one of the following options correctly completes all statements?

1. i
2. ii
3. iii
4. iv

**Question No. 9 / Question ID 703196** Marks: 4.00

The table below shows different developmental processes and associated signaling molecules/pathways.

| | Developmental Process | Signaling molecules/pathways |
|---|---|---|
| A | Dorsal/ventral axis specification in amphibian embryo | Wnt/β-catenin; BMP4; Activin/Nodal |
| B | Dorsal/ventral axis specification in mammalian limb | Engrailed; Wnt/β-catenin; BMP |
| C | Dorsal/ventral axis specification in Drosophila oocyte | FGF; Hh; Dpp |
| D | Anterior/posterior axis specification in mammalian limb | Shh; FGF; Notch |

Which one of the following options represents the correct association of developmental processes and signaling molecules?

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

**Question No. 10 / Question ID 703187** Marks: 4.00

The mRNA of the *E. coli lac* operon contains the open reading frames for *lacZ*, *lacY*, and *lacA* genes from a single cistron. It is observed that *lacZ* is translated more frequently than *lacY* or *lacA*. Which one of the following statements best describes the reason for this observation?

1. The Shine-Dalgarno sequence is present upstream of *lacZ*, but not *lacY* or *lacA*, affecting translation initiation rates.
2. Inhibitory RNA structures are present upstream of the AUG codon of *lacY* and *lacA*, but not *lacZ*, affecting translation initiation rates.
3. Variations in the Shine-Dalgarno sequence upstream of *lacZ*, *lacY*, and *lacA* have different affinities for the ribosome, affecting translation initiation rates.
4. Inhibitory RNA structures are present in the *lacY* and *lacA* coding sequence but not *lacZ*, affecting translation elongation rates.

**Question No. 11 / Question ID 703220** Marks: 4.00

Match the animal in Column X with its characteristic in Column Y.

| Column X | | Column Y | |
|---|---|---|---|
| A. | Snakes | I. | Lateral Line |
| B. | Spiders | II. | Heat sensing pits |
| C. | Fishes | III. | Echolocation |
| D. | Dolphins | IV. | Spinnerets |

Which one of the following options represents all correct matches between Column X and Column Y?

1. A-II B-IV C-I D-III
2. A-I B-II C-III D-IV
3. A-III B-I C-II D-IV
4. A-II B-III C-IV D-I

**Question No. 12 / Question ID 703232** Marks: 4.00

Which one of the following statements is NOT part of the neutral paradigm in ecology?

1. All individuals in the community have equal fitness and competitive ability.
2. Loss of competing species to extinction is through a slow, random process.
3. Diversity is maintained by speciation rates counteracting extinction rates.
4. Ecological drift results in stable coexistence of a given set of species.

**Question No. 13 / Question ID 703171** Marks: 4.00

An enzyme has been found to efficiently catalyse the following reaction:

$$A \underset{k_r}{\overset{k_f}{\rightleftharpoons}} B$$

$$K_{eq} = \frac{k_f}{k_r}$$

Where,

$k_f$ : Forward rate of the reaction

$k_r$ : Reverse rate of the reaction

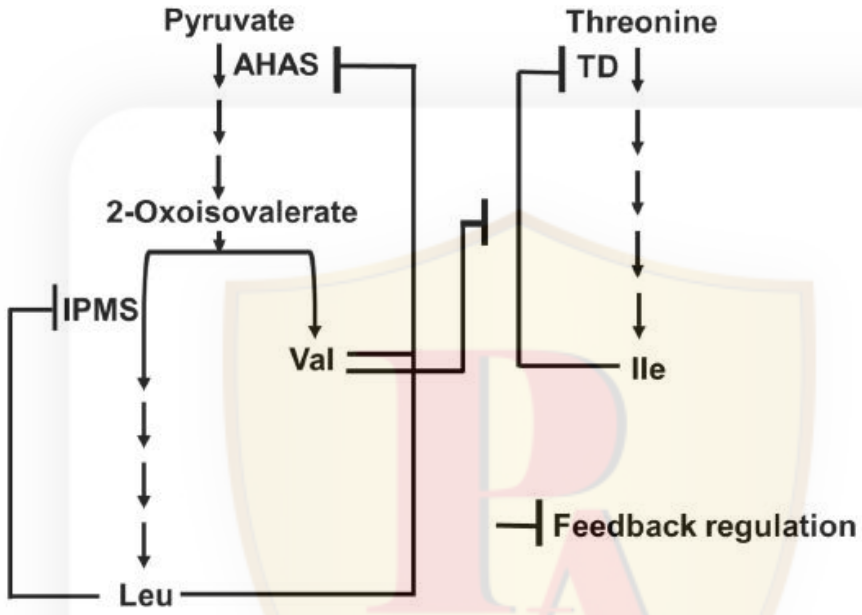
$K_{eq}$ : Equilibrium Constant

Which one of the following parameters will be increased over the uncatalyzed reaction by the enzyme?

1. $k_r$
2. $K_{eq}$
3. $1/k_r$
4. $1/K_{eq}$

**Question No. 14 / Question ID 703202** Marks: 4.00

The figure below depicts the feedback regulation in the biosynthesis pathway of three branched-chain amino acids (BCAA) - Leu, Val, and Ile, acting at three major steps catalyzed by enzymes AHAS, IPMS, and TD. The activity of AHAS is feedback regulated by the synergistic combination of Leu and Val. IPMS activity is regulated exclusively by Leu. Ile regulates TD activity while Val can relax this feedback regulation on TD by Ile.




Which one of the following possibilities of BCAA pools is likely to occur in the RNAi knockdown of IPMS?

1. Both Leu and Val will decrease.
2. Leu will decrease, and Val remains unchanged.
3. Leu will decrease and both Val and Ile will increase.
4. Only Leu will decrease.

**Question No. 15 / Question ID 703193** Marks: 4.00

The following statements are made regarding apoptosis in the nematode, *C. elegans*:

A. The human ortholog of *C. elegans*, CED-9 is overexpressed in a B-cell lymphoma.
B. A *ced-9(gain-of-function);ced-3(loss-of-function)* double mutant will have more than 947 non-gonadal cells.
C. If purified EGL-1 is added to a CED-9/CED-4 complex *in vitro*, the autocleavage of CED-3 does not occur.
D. CED-8 is a multi-spanning plasma membrane protein that is required for externalization of phosphatidylserine.

Which one of the following options represents all correct statements?

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

**Question No. 16 / Question ID 703231** Marks: 4.00

The following statements describe change in allele frequencies over time.

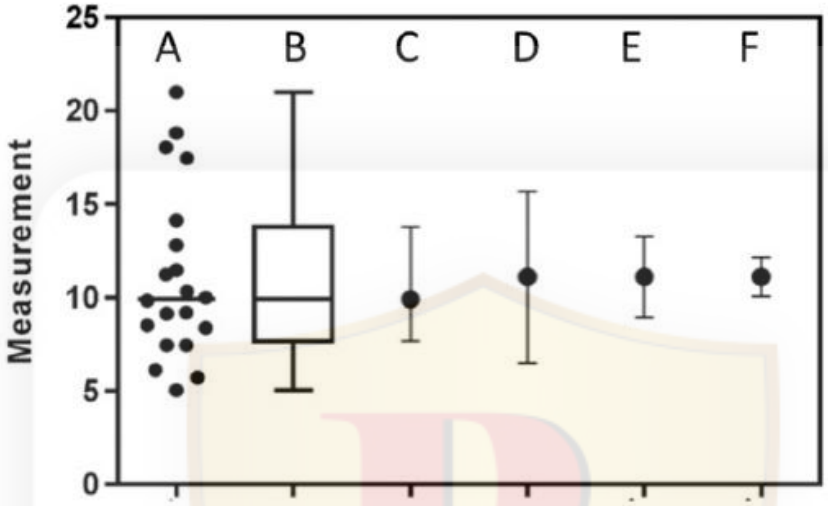
A. Fixation of an allele is purely by chance, while other alleles are lost.
B. Genetic drift can lead to the loss of certain alleles over time, reducing genetic diversity within the population.
C. Changes in allele frequencies are due to positive selection.
D. There is a pronounced effect in small populations, where random events can drastically alter allele frequencies.

Which one of the following options represents the combination of all correct statements if allele frequencies change purely due to genetic drift?

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

**Question No. 17 / Question ID 703240** Marks: 4.00

The figure given below represents the same data in six different ways. "A" represents the scatter plot of all data points and "B" is its corresponding box and whisker plot. "C" to "F" represent the same dataset with different measures of central tendency alongside various measures of variation (SEM - Standard Error of Mean, SD - Standard Deviation, CI - 95% confidence interval).




Which one of the following options is a correct representation of the data?

| | | | |
|---|---|---|---|
| 1. | C = Mean ± quartiles; | D= Median ± SEM; | E = Median ± CI |
| 2. | D = Mean ± SD; | E= Mean ± CI; | F = Mean ± SEM |
| 3. | C = Median with quartiles; | D= Mean ± SEM; | E = Mean with CI |
| 4. | D = Mean ± SEM; | E = Mean ± CI; | F = Mean ± SD |

**Question No. 18 / Question ID 703195** Marks: 4.00

The following statements were made regarding regulation of aging in *C. elegans*:

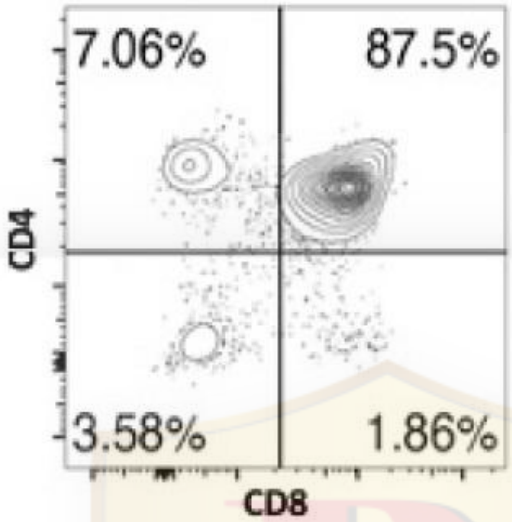
A. In most cells, p53 remains bound to a repressor protein to keep it inactive, which is activated under oxidative stress when DNA damage separates p53 from its repressor.
B. DAF-2 functions as an insulin-like growth factor receptor to block Forkhead transcription factor and increases the life span.
C. When DAF-2 is not active, cells reduce the production of DNA repair enzymes.
D. Dietary restriction increases mTORC1 activity, enhancing functional stem cells and longevity.

Which one of the following options has the combination of all correct statements?

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

**Question No. 19 / Question ID 703237** Marks: 4.00

In an experiment, FITC-CD4 and PE-CD8 were used to stain thymocytes. The cells were then run through a flow cytometer and the data were plotted as CD4 vs CD8. The results are shown in the figure below and following statements are made:




A. Rearrangement of TCR-β locus is initiated in cells included in the quadrant containing 3.58% of the population.
B. TCR-α locus rearrangement occurs in cells included in the quadrant containing 87.5% population.
C. FITC-CD4 and PE-CD8 cannot stain the same cells.
D. Rearranged TCR-γδ receptor is expressed on 7.06% population of cells.

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

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

**Question No. 20 / Question ID 703212** Marks: 4.00

Men suffering from enlarged prostate disease were prescribed drugs that would specifically target the androgen receptor (AR). While developing the drug, the following considerations were deliberated on:

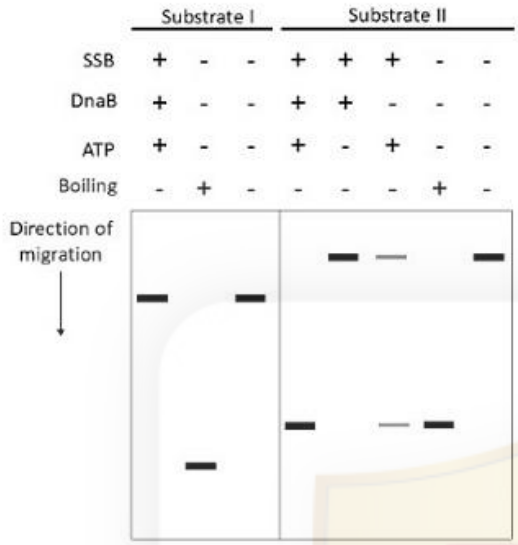
A. Drugs should target the N-terminal domain of the AR.
B. Drugs should not target the NLS domain of the AR.
C. The drug should bind to the ligand-binding domain of the AR.
D. The drug should activate CYP17A1 to facilitate conversion of pregnenolone to DHEA.

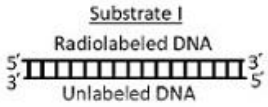
Which one of the following combinations of considerations will develop the best drug for treatment of enlarged prostate?

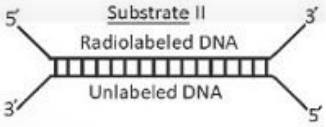
1. A and B
2. B and C
3. C and D
4. A and C

**Question No. 21 / Question ID 703183** Marks: 4.00

The helicase activity of *E. coli* DnaB was investigated using the following two substrates (I and II) under various conditions, followed by gel electrophoresis and autoradiography. The results of these experiments are depicted below:




The following statements are made purely from the results shown above:

A. DnaB can unwind only a partially unwound DNA.
B. SSB inhibits the unwinding activity of DnaB.
C. DnaB unwinds DNA in the 5′ to 3′ direction.
D. DnaB requires ATP for DNA unwinding.

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

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

**Question No. 22 / Question ID 703223** Marks: 4.00

Two closely related sympatric ladybird beetle species in a rainforest have evolved to specialise on different insect prey. Which one of the following statements does NOT explain the speciation process in these beetle species?

1. Populations exploited different diets in the rainforests.
2. Over time, natural selection favoured traits that allowed the consumption of distinct diets.
3. Diverging populations developed differences in diet. However, it did not lead to reproductive isolation.
4. Temporal differentiation in their foraging activity led to their distinct diets.

**Question No. 23 / Question ID 703215** Marks: 4.00

Given below are a few statements regarding gene actions observed in plants.

A. In terms of pollination, self-pollinated species often exhibit additive gene action.
B. Non-additive gene action is less prevalent in cross-pollinated species.
C. Simply inherited (qualitative, oligogenic) traits predominantly exhibit non-additive and epistatic gene action.
D. Genetic fixation of superior genes will be more difficult with dominance gene action.

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

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

**Question No. 24 / Question ID 703219** Marks: 4.00

The table given below provides a comprehensive list of selected plant diseases (Column X) and possible causal pathogens (Column Y).

| Column X | | Column Y | |
|---|---|---|---|
| Plant Disease | | Pathogen | |
| A. | Apple scab | I. | *Claviceps purpurea* |
| B. | Ergot of cereals | II. | *Erwinia amylovora* |
| C. | Fire blight | III. | *Meloidogyne spp.* |
| D. | Root-Knot | IV. | *Venturia inaequalis* |

Which one of the following options represents all correct matches between Column X and Column Y?

1. A-IV B-II C-III D-I
2. A-II B-I C-IV D-III
3. A-I B-IV C-III D-II
4. A-IV B-I C-II D-III

**Question No. 25 / Question ID 703206** Marks: 4.00

A researcher obtained a loss-of-function mutant of plasmodesmata protein synaptotagmin (SYTA) in Arabidopsis and infected the plants with cabbage leaf curl virus (CaLCuV). The following statements represent possible outcomes of the above experiment.

A. The CaLCuV infection will be slower in the mutant plants.
B. The mutant plants will be completely resistant to the viral infection.
C. The endocytic recycling pathway in the infected cells will be compromised in the mutant plants.
D. The disease symptoms will be more severe in the mutant plants.

Which one of the following options represents all correct statement(s)?

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

**Question No. 26 / Question ID 703175** Marks: 4.00

If a 0.1 M solution of glucose 1-phosphate is incubated with a catalytic amount of phosphoglucomutase, the glucose 1-phosphate is transformed to glucose 6-phosphate. At equilibrium, the concentrations of the reaction components are:

Glucose 1-phosphate $\rightleftharpoons$ Glucose 6-phosphate

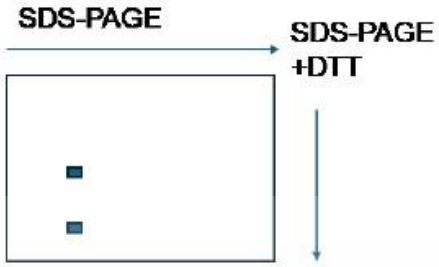
$(4.5 \times 10^{-3}$ M) $(9.6 \times 10^{-2}$ M)

What would be the calculated values for $K'_{eq}$ and $\Delta G^{o'}$ for this reaction at 25°C?

1. (0.0045 to 0.096) and (-0.7 to -0.8) kJ/mol
2. (21 to 22) and (-7.5 to -7.7) kJ/mol
3. (0.1 to 0.2) and (-17.6 to -17.7) kJ/mol
4. (21 to 22) and (-27.7 to -27.8) kJ/mol

**Question No. 27 / Question ID 703245** Marks: 4.00

A purified 150 kDa protein species from gel filtration column was run on a 2-dimensional SDS-PAGE as shown below:

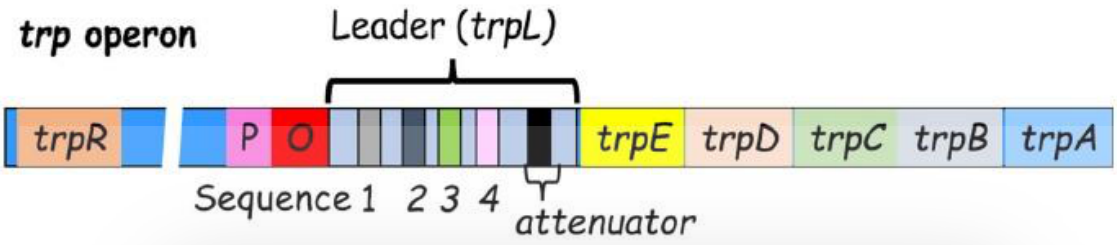



What is the likely form of the 150 kDa protein species from this observation?

1. There are at least two proteins that are linked through non-covalent interactions.
2. There are at least two proteins in the complex that are linked through covalent bonds.
3. There are two proteins in the mixture without forming a complex.
4. There is only one protein that has a disulfide bond.

**Question No. 28 / Question ID 703186** Marks: 4.00

Given below are different types of genetic manipulations of *E. coli trp* operon (Column X) and their consequences on its transcription (Column Y) under high tryptophan concentration.




| Column X | | Column Y | |
|---|---|---|---|
| A. | Inserting bases between the leader peptide gene and sequence 2 | i. | Complete attenuation |
| B. | Inserting bases between sequences 2 and 3 | ii. | Less attenuation |
| C. | Deleting sequence 4 | iii. | More attenuation |
| D. | Elimination of ribosome-binding site for the leader peptide | iv. | No attenuation |

Which one of the following options represents all correct matches between Column X and Column Y?

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

**Question No. 29 / Question ID 703194** Marks: 4.00

Lethally irradiated mice were split into 4 groups and experiments were conducted as described below:

Group 1 was not given any cells.
Group 2 was given thymus-derived cells from a syngeneic donor, and two months later, immunized with a polysaccharide antigen.
Group 3 was given bone marrow cells from a syngeneic donor, and two months later, immunized with a polysaccharide antigen.
Group 4 was given bone marrow cells from a syngeneic donor, and two months later, immunized with a T-dependent antigen.

Four possible outcomes, listed below, were suggested.

A. Group 1 mice are unlikely to survive.
B. Group 2 mice are likely to produce antibodies in response to polysaccharide antigens.
C. Group 3 mice are likely to produce antibodies in response to polysaccharide antigens.
D. Group 4 mice are likely to produce antibodies in response to T-dependent antigens.

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

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

**Question No. 30 / Question ID 703230** Marks: 4.00

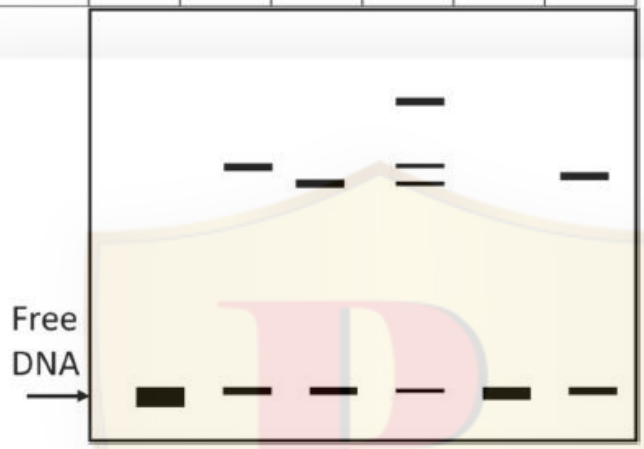
Which statement about studies on succession is INCORRECT?

1. Succession studies can reveal the effects of non-native species on the ecological structures and functions of a community.
2. Studies of succession can indicate threshold conditions for the 'invasion window'.
3. Non-native invasion can divert succession by out-competing existing species.
4. Succession studies show that coevolved native species always outcompete invasive species.

**Question No. 31 / Question ID 703241** Marks: 4.00

Two newly identified proteins, X and Y, are tested for sequence-specific DNA binding activity. The results of an electrophoretic mobility shift assay (EMSA) with a labeled DNA fragment and proteins X and Y in various combinations are shown below.

| | | | | | | |
|---|---|---|---|---|---|---|
| Poly dI:dC | - | - | - | - | + | + |
| Y | - | - | + | + | - | + |
| X | - | + | - | + | + | - |
| DNA | + | + | + | + | + | + |




Poly dI:dC is a DNA duplex of polyinosine and polycytosine. Which one of the following options represents the correct interpretation of the results obtained?

1. Both X and Y are sequence-specific DNA binding proteins.
2. X does not bind to DNA and Y binds to specific sequence.
3. Both proteins bind to DNA but Y binds in a sequence-specific manner.
4. X competes with Y to bind the same sequence.

**Question No. 32 / Question ID 703235** Marks: 4.00

The following statements are about parental care and variance in reproductive success in a bird species.

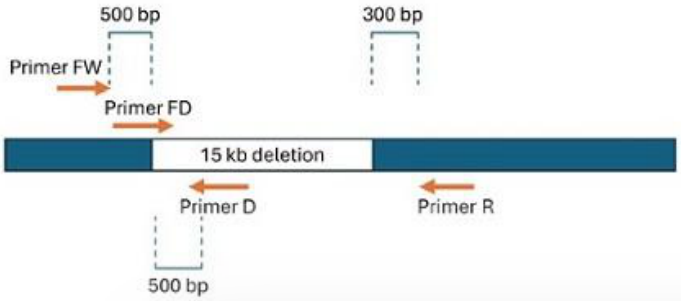
A. If females provide more parental care than males, the variance in male reproductive success is significantly greater than that of females.
B. Where only males provide parental care, the variance in female reproductive success is significantly higher than that of males.
C. In the case of biparental care, the variance in male reproductive success is significantly greater than that of females.
D. In the case of biparental care, the variance in female reproductive success is significantly greater than that of males.

Select the option that identifies the combination of all correct statements.

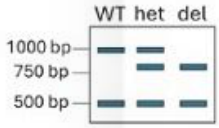
1. A and B
2. A and C
3. B and D
4. C and D

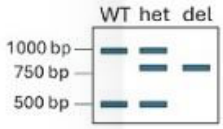
**Question No. 33 / Question ID 703242** Marks: 4.00

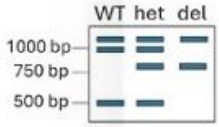
A student used four 20-mer oligos to amplify DNA (using a regular Taq DNA polymerase) from a wild type (WT), a homozygous mutant having a deletion of the gene (del), and from the heterozygous mutant (het), as shown in the figure below.

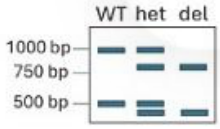



Agarose gel electrophoresis profiles, using all four primers simultaneously, on each template are shown below. Which one of the options given below represents the correct profile?

1.



2.



3.



4.



**Question No. 34 / Question ID 703221** Marks: 4.00

The table below lists selected bird species (Column X) and their possible habitats (Column Y).

| | Column X | | Column Y |
|---|---|---|---|
| A. | Bugun liocichla (*Liocichla bugunorum*) | I. | High altitude Western Himalayas |
| B. | Grey-headed Bulbul (*Pycnonutus priocephalus*) | II. | Northeast India |
| C. | Brooks's leaf-Warbler (*Phylloscopus subviridis*) | III. | Western Ghats |
| | | IV. | Andaman and Nicobar Islands |

Which one of the following options represents all correct matches between Column X and Column Y?

1. A-I B-II C-III
2. A-III B-I C-IV
3. A-IV B-II C-III
4. A-II B-III C-I

**Question No. 35 / Question ID 703204** Marks: 4.00

Shown in the table below are the enzymes (Column X) involved in the biosynthesis of listed phytohormones (Column Y).

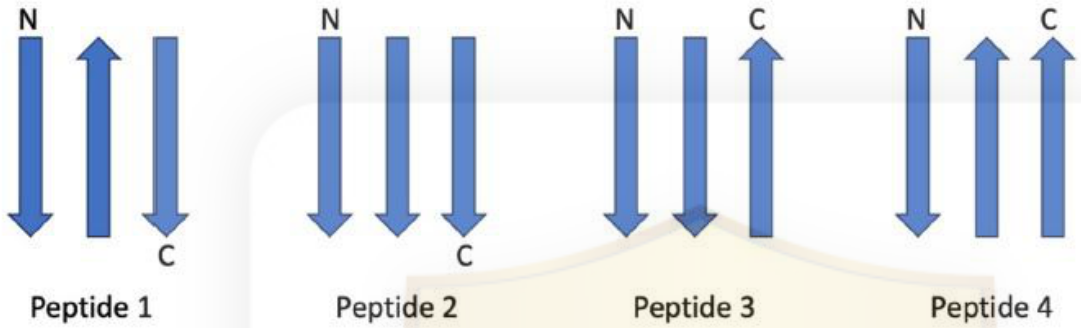
| Column X | | Column Y | |
|---|---|---|---|
| A. | Carotenoid cleavage dioxygenase | i. | Brassinosteroid |
| B | ER localized cytochrome P450 monoxygenase | ii. | Strigolactone |
| C. | ACC oxidase | iii. | Abscisic acid |
| D. | 9-*cis*-epoxycarotenoid dioxygenase | iv. | Ethylene |

Which one of the following options represents all correct matches between Column X and Column Y?

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

**Question No. 36 / Question ID 703172** Marks: 4.00

Three strands of a beta-sheet of 4 peptides are hydrogen bonded with the orientation of the strands (parallel or antiparallel denoted by the arrowheads) as shown in the figure. Each strand consists of identical residues, where N and C represent terminal residues of the peptide. The three strands of each peptide are linked by amino acid sequences of the smallest length possible.




Which one of the following options is correct regarding the length of the peptides 1 to 4?

1. (Peptide 1 = Peptide 2) < Peptide 3 < Peptide 4
2. Peptide 1 < (Peptide 3 = Peptide 4) < Peptide 2
3. Peptide 1 < Peptide 3 < Peptide 4 < Peptide 2
4. Peptide 1 < Peptide 2 < Peptide 3 < Peptide 4

**Question No. 37 / Question ID 703244** Marks: 4.00

The magnetic field generated from an electromagnet is used in the transcranial magnetic stimulation (TMS) of the brain. The following statements suggest some features of TMS:

A. The magnetic field generated in TMS induces an electrical field in the underlying brain area.
B. The electrical field in the brain area alters the membrane potential of the neurons in that locality causing them to depolarize synchronously, which in turn, may change the probability of the firing of neurons.
C. In cognitive neuroscience research, TMS may be used as a tool to induce a 'virtual lesion' in a selected region of the cerebral cortex.
D. TMS is safe and non-invasive but the neuronal activity of the stimulated area is disrupted for a long period of time.

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

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

**Question No. 38 / Question ID 703227** Marks: 4.00

The table below gives the avian community composition of three communities (X, Y, Z), where '1' indicates the presence of the species in the community and '0' indicates its absence.

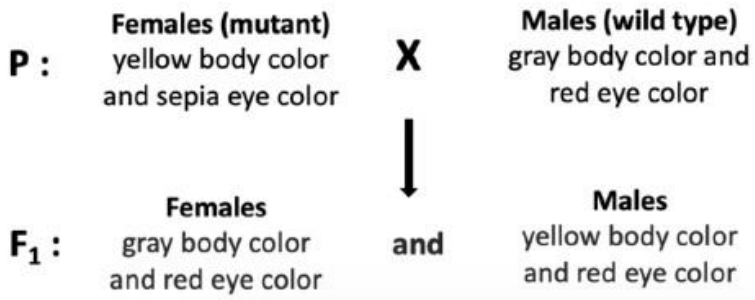
| | X | Y | Z |
|---|---|---|---|
| Red-vented bulbul | 1 | 0 | 1 |
| Purple sunbird | 0 | 0 | 1 |
| Common Babbler | 0 | 1 | 1 |
| Rufous treepie | 1 | 1 | 1 |
| Red-naped Ibis | 1 | 1 | 0 |
| Scarlet minivet | 0 | 0 | 1 |
| Spotted Owlet | 0 | 1 | 0 |

Select the option that lists the correct order of similarity between pairs of communities based on Sorensen's coefficient of similarity.

1. (X,Y) > (Y,Z) > (X,Z)
2. (X,Y) > (X,Z) > (Y,Z)
3. (Y,Z) > (X,Z) > (X,Y)
4. (X,Y) = (X,Z) = (Y,Z)

**Question No. 39 / Question ID 703216** Marks: 4.00

In *Drosophila melanogaster*, a cross was performed, and the resulting progeny are indicated below.




The $F_1$ progeny were sib-mated and the $F_2$ progeny were analysed. The following statements were made based on the above crosses and analysis of the progeny:

A. The mutation leading to sepia eye color is located on an autosome.
B. Yellow body is a dominant phenotype.
C. One fourth of the $F_2$ progeny will be males with yellow body color.
D. In this dihybrid cross, as the $F_2$ progeny do not show a 9:3:3:1 typical Mendelian ratio, the two genes can be assumed to be linked.

Which one of the following options correctly identifies each statement as True (T) or False (F) from A to D, respectively?

1. T, F, T, F
2. F, T, T, F
3. T, T, F, F
4. F, F, T, T

**Question No. 40 / Question ID 703192** Marks: 4.00

A researcher placed plant cells in a hypertonic solution to cause the cells to shrink. The following statements are made regarding the plasmolysed cells.

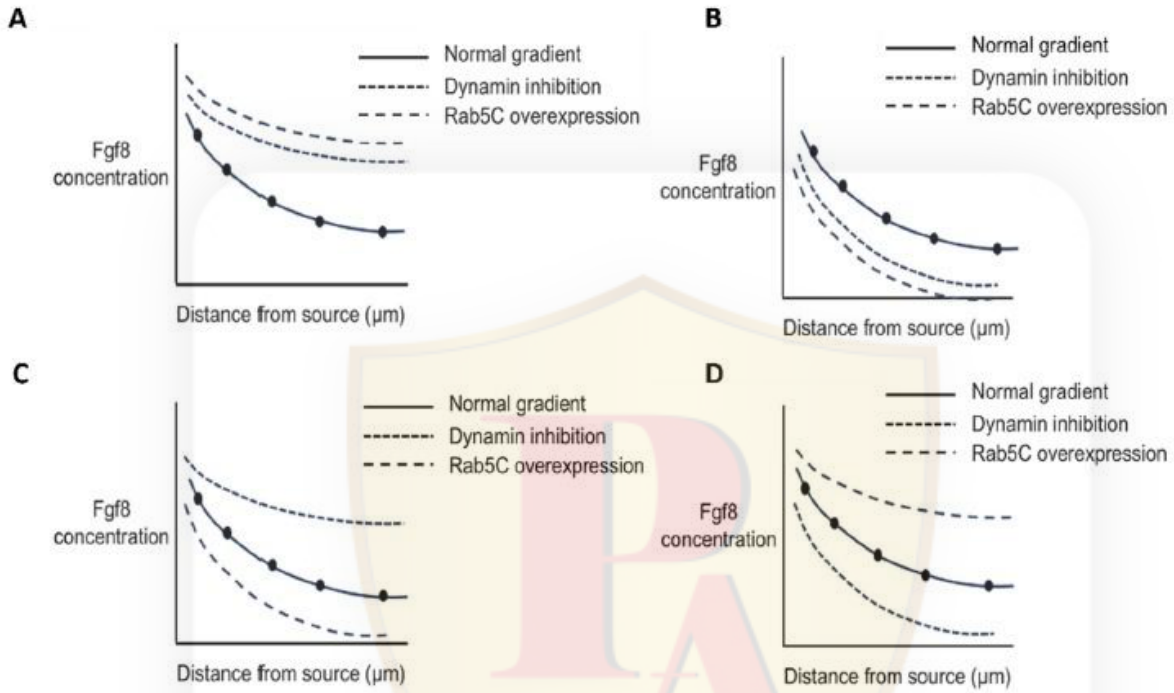
A. Microtubules are lost in the plasmolysed cells.
B. Protoplasts are retracted in the plasmolysed cells.
C. Hechtian strands are lost during plasmolysis.
D. Patches of plasma membrane remain affixed to the wall.

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

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

**Question No. 41 / Question ID 703198** Marks: 4.00

Gradient formation of Fgf8 is governed by both diffusion from a localized source and removal of Fgf8 ligand through endocytosis. Both Rab5C and dynamin promote endocytosis. What would happen to the Fgf8 concentration gradient when Rab5C is overexpressed or dynamin is inhibited?




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

**Question No. 42 / Question ID 703208** Marks: 4.00

Given below are some statements regarding growth hormone (GH) secretion in humans.

A. Fasting increases GH secretion.
B. REM sleep decreases GH secretion.
C. Cortisol increases GH secretion.
D. Hypoglycemia decreases GH secretion.

Which one of the options given below represents both correct statements?

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

**Question No. 43 / Question ID 703225** Marks: 4.00

A parasitoid infects a host to complete its life cycle. Which of the following life-history traits typically characterizes this parasitoid, assuming that only one parasitoid infects one host?

1. Intrinsic rate of population growth faster than hosts; Eventually fatal for the host
2. Intrinsic rate of population growth slower than hosts; Immediately fatal for the host
3. Intrinsic rate of population growth comparable to hosts; Eventually fatal for the host
4. Intrinsic rate of population growth faster than hosts; Immediately fatal for the host

**Question No. 44 / Question ID 703209** Marks: 4.00

When blood is forced into aorta from left ventricle during systole, a pressure wave is set up in aorta which is called pulse. Some features of the pulse are proposed in the following statements:

A. The rate of travel of the pulse wave is lower than the velocity of blood flow in arteries.
B. The pulse wave moves slower with advancing age as the arteries become more rigid.
C. The pulse wave is strong when the stroke volume is large as in exercise.
D. The strength of the pulse depends on the magnitude of pulse pressure and not on the mean arterial pressure.

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

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

**Question No. 45 / Question ID 703189** Marks: 4.00

The statements below are made about some animal pathogens that may evade innate and inflammatory responses by the following mechanisms:

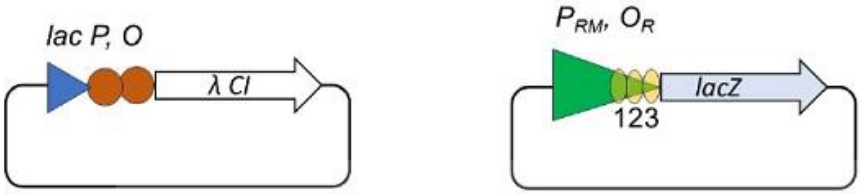
A. The flagellin of Proteobacteria has a mutation that prevents it from being recognized by Toll-like receptors (TLRs).
B. The lipopolysaccharides of *Helicobacter* have mutations that prevent it from being recognized by TLRs.
C. *M. tuberculosis* escapes from the phagosome to the cytosol, thereby avoiding degradation by lysosomal enzymes.
D. Influenza virus produces Yop protein that inhibits inflammasome activity.
E. *S. typhi* encodes a protein that binds Type I IFNs and prevents them from binding to the IFN receptor.

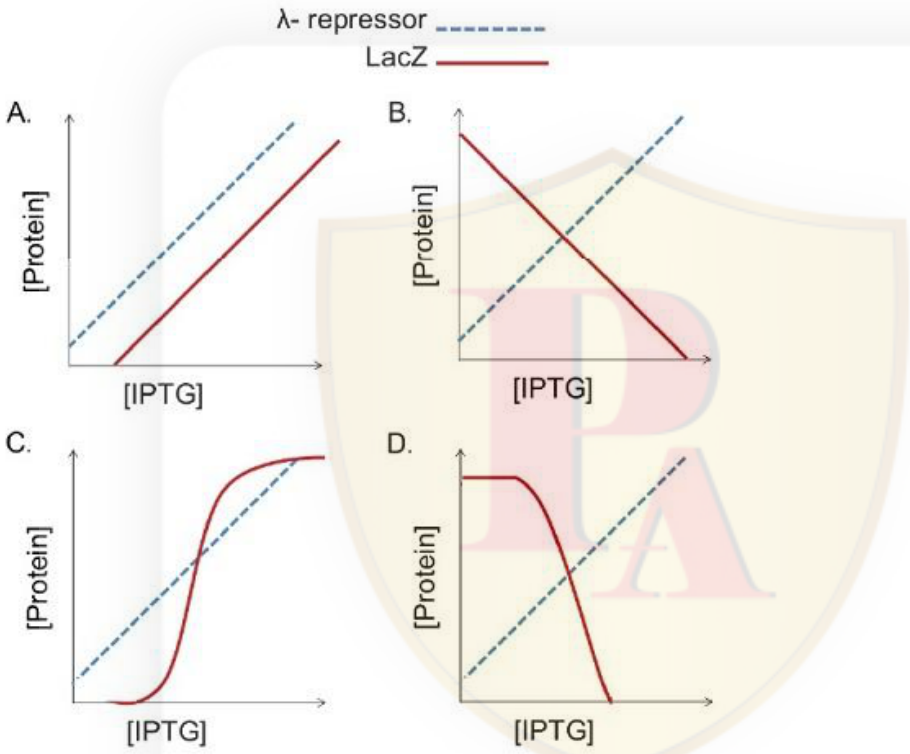
Which one of the following options represents the combination of all correct statements?

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

**Question No. 46 / Question ID 703184** Marks: 4.00

A lac-lambda hybrid system is developed to study the λ-repressor protein, in which the *λ CI* gene is under the control of *E. coli lac* promoter and operator, and the *lacZ* gene is under the control of *λ-$P_{RM}$* promoter and $O_R$ operator of λ-phage. Both the plasmids are introduced in *E. coli* and the concentrations of the proteins are determined upon the addition of IPTG.




Which graph correctly represents the expected results?

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

**Question No. 47 / Question ID 703179** Marks: 4.00

Actin dynamics in cells is dependent on several actin-binding proteins. Given below are actin-binding proteins in Column X and their typical function in Column Y.

| Column X | | Column Y | |
|---|---|---|---|
| A | Formin | I | nucleates assembly to form a branched network |
| B | Arp2/3 complex | II | stabilizes filament, modulates binding of other accessory proteins |
| C | Cofilin | III | nucleates assembly and remains associated with the growing plus end |
| D | Tropomyosin | IV | binds ADP-actin filaments, accelerates disassembly |

Which one of the following options represents all correct matches between Column X and Column Y?

1. A-(I) B-(II) C-(IV) D-(III)
2. A-(III) B-(I) C-(IV) D-(II)
3. A-(III) B-(II) C-(IV) D-(I)
4. A-(II) B-(I) C-(IV) D-(III)

**Question No. 48 / Question ID 703243** Marks: 4.00

A researcher needs to identify if Protein A is localized in the ER in a human cell line. The cell has an RFP-tagged protein that marks the ER in this cell. Following are the proposed experiments.

A. Express Protein A fused to GFP at the N-terminus in the cells, followed by microscopy to check for colocalization with RFP.
B. Express Protein A fused to GFP at the C-terminus in the cells, followed by microscopy to check for colocalization with RFP.
C. Immunofluorescence staining of A, followed by microscopy to check for colocalization with RFP.
D. Isolating the ER by differential centrifugation and checking for co-purification of Protein A with RFP.

Which one of the following options represents experiments that would most likely identify localization of Protein A in the ER?

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

**Question No. 49 / Question ID 703211** Marks: 4.00

Urine volume is increased in osmotic diuresis which may be experimentally produced by the intravenous administration of mannitol that is filtered in the glomerulus but not reabsorbed in the renal tubule. The following statements suggest some of the physiological mechanisms of osmotic diuresis.

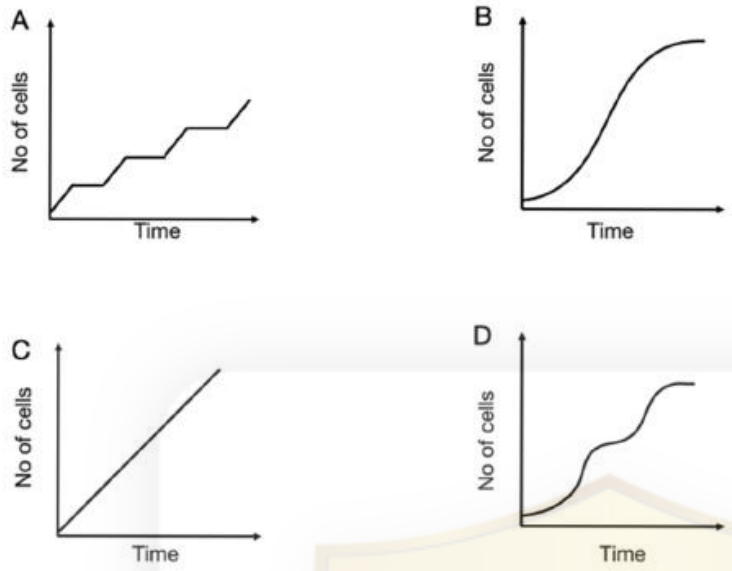
A. In the proximal tubule, water reabsorption falls due to presence of mannitol in tubular fluid and concentration of $Na^+$ is decreased in this fluid.
B. In the descending loop of Henle, reabsorption of water is increased as medullary hypertonicity is decreased in osmotic diuresis.
C. In the thin ascending loop of Henle, reabsorption of $Na^+$ is increased as the concentration gradient for $Na^+$ is decreased.
D. In the collecting duct, reabsorption of water is less because of decrease in osmotic gradient along the medullary pyramid in osmotic diuresis.

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

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

**Question No. 50 / Question ID 703180** Marks: 4.00

Given below are different types of bacterial growth curves.




Which one of the following options represents all correct matches between the growth curves and the type of culture?

1. A: Continuous; B: Asynchronous; C: Synchronous; D: Diauxic
2. A: Synchronous; B: Continuous; C: Asynchronous; D: Diauxic
3. A: Continuous; B: Asynchronous; C: Diauxic; D: Synchronous
4. A: Synchronous; B: Asynchronous; C: Continuous; D: Diauxic

**Question No. 51 / Question ID 703177** Marks: 4.00

Protein X can be extracted from disrupted erythrocyte plasma membranes with high salt concentrations. Treatment of intact erythrocytes with protease followed by extraction led to intact protein X. Treatment of disrupted erythrocyte plasma membranes with protease followed by extraction led to fragmented protein X.

The following interpretations were made:

A. Protein X is a peripheral membrane protein
B. Protein X is an integral membrane protein
C. Protein X is on the extracellular matrix face of the plasma membrane
D. Protein X is on the cytosolic face of the plasma membrane

Which one of the following options best represents the combination of all correct interpretations?

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

**Question No. 52 / Question ID 703210** Marks: 4.00

The muscle spindles are the stretch receptors that initiate stretch reflex in skeletal muscles. The following statements are proposed to describe the structural and functional characteristics of the different components of a muscle spindle.

A. The specialized intrafusal fibers in muscle spindles have non-contractile polar ends and a contractile centre.
B. The intrafusal fibers do not contribute to the overall contractile force of the muscle.
C. The primary sensory ending in a muscle spindle is formed by group Ia afferent fibers.
D. The axons of α-motor neurons having a diameter of 12-20 μm innervate the muscle spindles as the motor nerve.

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

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

**Question No. 53 / Question ID 703197** Marks: 4.00

Pollen tube growth in the transmission tract (TT) of the style and its attraction to the embryo sac are directed by chemical cues in plants, as discovered in Lily and Torenia. Which one of the following statements about the proteins/peptides secreted in the process is correct?

1. TT epidermis secretes cysteine-rich defensin-like peptides, whereas synergids (SY) secrete cysteine-rich adhesins.
2. TT epidermis secretes cysteine-rich adhesins, whereas SY secrete cysteine-rich defensin-like peptides.
3. TT epidermis secretes proline- and hydroxyproline-rich glycoproteins, whereas SY secrete cysteine-rich adhesin and chemocyanin.
4. TT epidermis secretes arabinogalactan proteins and chemocyanin, whereas the central cell of the embryo sac secretes cysteine-rich LURE peptides.

**Question No. 54 / Question ID 703205** Marks: 4.00

A researcher simultaneously inhibited the activities of Triose-Phosphate Translocator (TPT) and Xylulose 5-Phosphate Translocator (XPT) in a plant and made the following assumptions:

A. Triose phosphate will be accumulated more in the chloroplast.
B. Triose phosphate will be accumulated more in the cytosol.
C. Xylulose 5-phosphate will be accumulated more in the chloroplast.
D. Xylulose 5-phosphate will be accumulated more in the cytosol.

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

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

**Question No. 55 / Question ID 703203** Marks: 4.00

Following statements are made regarding methyl erythritol phosphate (MEP) and mevalonate pathways for plant terpenoid biosynthesis.

A. The MEP pathway occurs in plastids whereas mevalonate pathway occurs in cytosol.
B. The mevalonate pathway supplies most of the $C_5$ units of terpenoids for the biosynthesis of monoterpenes and diterpenes.
C. The MEP pathway supplies most of the $C_5$ units of terpenoids for the biosynthesis of sesquiterpenes.
D. Certain genes of the plant MEP pathway are believed to have been acquired from the cyanobacterial symbiont.

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

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

**Question No. 56 / Question ID 703226** Marks: 4.00

A student studying tree species diversity uses a large number of sampling quadrats (each of 1-hectare area) to cover >50% of the area of a 200-hectare tropical forest patch. Consider the statements in the options below:

A. Species numbers increase with sampling area following a power-law relationship with exponent >0 and <1.
B. The log of species numbers increases linearly with the log of the sampling area.
C. Species numbers increase with sampling area following a power-law relationship with exponent >1.
D. Species numbers increase linearly with the log of the sampling area.

Which combination of the statements above describes the expected pattern?

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

**Question No. 57 / Question ID 703239** Marks: 4.00

The following statements describe a few basic features of the interferometric reflectance imaging sensor used as a biosensing platform:

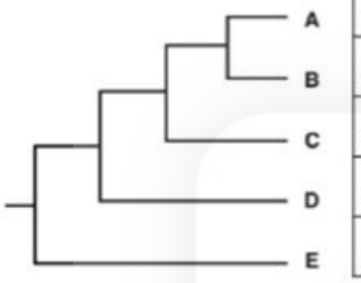
A. This biosensing platform is capable of high-throughput multiplexing of protein-protein, protein-DNA and DNA-DNA interactions.
B. The sensing surface is prepared by robotic spotting of biological probes that are immobilized on functionalised $Si/SiO_2$ substrate.
C. As biomass accumulates on the substrate surface, a change in the interferometric signature occurs and the change can be correlated to a quantifiable mass.
D. Using this technique, picometer changes in biomass may be detected.

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

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

**Question No. 58 / Question ID 703236** Marks: 4.00

A researcher uses taxon weighting and complementarity as criteria to prioritise communities for biodiversity conservation. The diagram below shows the distributions of five taxa (A to E) among four regions (R1–R4). Column W represents the weightage given to these five taxa based on their taxonomic uniqueness.




| | W | R1 | R2 | R3 | R4 |
|---|---|---|---|---|---|
| A | 1 | • | | | |
| B | 1 | • | • | • | • |
| C | 2 | • | • | | • |
| D | 3 | | • | • | |
| E | 4 | | | • | • |

Select the option that lists the appropriate order of regions that should be prioritised (from highest to lowest) for conservation.

1. R1 > R3 > R4 > R2
2. R2 > R1 > R3 > R4
3. R3 > R1 > R4 > R2
4. R4 > R2 > R1 > R3

**Question No. 59 / Question ID 703185** Marks: 4.00

The following statements were made regarding the roles of histone modifications in transcriptional regulation.

A. Acetylation of histones is generally associated with transcriptional repression by making the chromatin more compact.
B. Methylation of histones can either activate or repress transcription depending on the specific residue modified.
C. Phosphorylation of histones occurs in response to DNA damage and can influence gene expression.
D. Histone modifications influence the recruitment of RNA polymerase complex but not transcription factors.

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

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

**Question No. 60 / Question ID 703224** Marks: 4.00

The evolution of algal lineages is closely linked to endosymbiotic events. Which of the following statements best explains the origin and diversification of plastids in different algal groups?

1. Primary plastids originated from a eukaryotic host cell engulfing a red algal ancestor, followed by secondary endosymbiosis leading to the diversification of green and brown algal lineages.
2. Primary plastids evolved through the engulfment of a cyanobacterium by a eukaryotic host, while secondary and tertiary endosymbiosis involving red and green algae gave rise to plastids in diverse algal lineages such as diatoms and dinoflagellates.
3. All algal lineages acquired plastids through multiple independent primary endosymbiosis events, with cyanobacteria being engulfed by both red and green algal ancestors.
4. Secondary endosymbiosis was responsible for the origin of primary plastids in green algae, while tertiary endosymbiosis involving diatoms led to the evolution of plastids in red algae.

**Question No. 61 / Question ID 703176** Marks: 4.00

Given below are two columns depicting structural features (Column X) and the DNA/RNA conformation (Column Y).

| Column X | | Column Y | |
|---|---|---|---|
| Structural features | | DNA/RNA conformation | |
| A. | Left-handed | i. | A form |
| B | Number of base pairs per turn is 10 | ii. | B form |
| C. | The base pairs are off-centered | iii. | Z form |
| D. | RNA double helix | | |

Which one of the following options represents all correct matches between Column X and Column Y?

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

**Question No. 62 / Question ID 703222** Marks: 4.00

The statements given below describe an angiosperm flower.

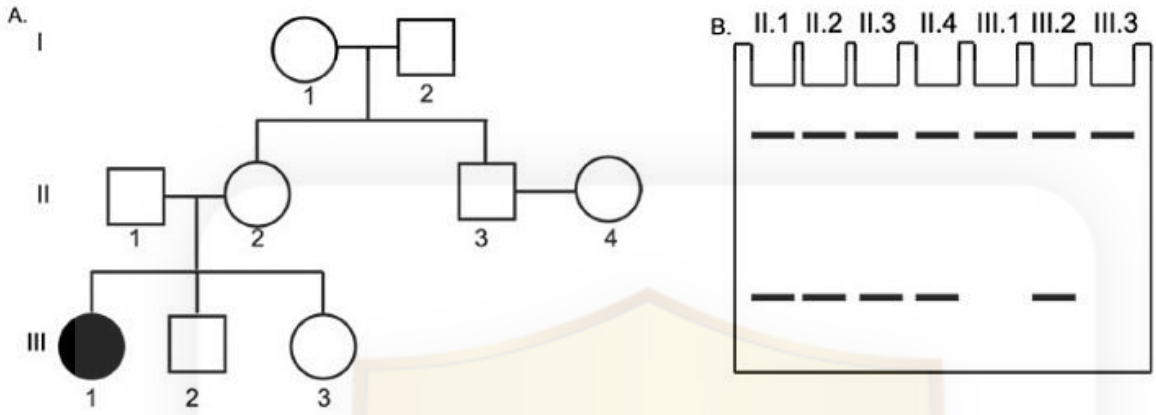
A. A flower develops in the axils of bracts like axillary shoots.
B. The floral pedicel is the elongated node and the axis is condensed, like in a shoot.
C. Floral parts like calyx, corolla, androecium and gynoecium are modified leaves.
D. Floral buds may sometimes get modified into vegetative buds or bulbils.

Select the option with all correct statements that support the idea that a flower is a modified shoot.

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

**Question No. 63 / Question ID 703218** Marks: 4.00

The pedigree (Fig A) represents the inheritance of a monogenic disorder, caused by a defective enzyme encoded by a mutant allele. The functional and defective enzymes can be resolved by PAGE. The allozyme pattern observed in some of the individuals in the family is represented in Fig B. The frequency of the mutant allele in the population is 0.04.




Based on the above information, the following statements were made:

A. The allele encoding the functional enzyme is haplo-sufficient.
B. The trait shows 100% penetrance.
C. The probability that a child born to individuals II.3 and II.4 will be homozygous for the gene is 1/4.
D. Both individuals I.1 and I.2 are necessarily heterozygous for the gene.

Which one of the following options correctly identifies each statement as True (T) or False (F) from A to D, respectively?

1. T, F, F, F
2. T, F, T, F
3. F, T, T, F
4. F, F, F, T

**Question No. 64 / Question ID 703190** Marks: 4.00

The insulin receptor is a receptor tyrosine kinase that engages the PI3 kinase pathway to regulate a FOXO transcription factor. A student uses qRT-PCR to determine the expression of a direct FOXO target gene (GeneX) in a mammalian cell line under different conditions and makes the following observations.

A. Treating the cells with a PTEN inhibitor increases GeneX expression.
B. A cell line with an AKT (S308A) mutation has increased GeneX expression.
C. Change in GeneX expression due to a ligand-binding defective insulin receptor is partly reversed by a PTEN inhibitor.
D. Phosphorylation of FOXO by PDK1 creates a phosphoserine binding site for 14-3-3 protein, reducing GeneX expression.

Which one of the following options represents all correct statements?

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

**Question No. 65 / Question ID 703238** Marks: 4.00

Following statements are made with respect to the production of transgenic plants.

A. Auxin can be used as a negative selection marker in plant transgenesis as it can be lethal to germinating seedlings at higher concentrations.
B. Agrobacterium inserts T-DNA at random locations in the plant genome and thus, it cannot be targeted to a desired location.
C. The antibiotic kanamycin interferes with the cytoplasmic ribosomal protein synthesis machinery, thereby acting as a positive selection marker.
D. Gene transfer by biolistic/particle gun bombardment usually results in lower transgene copy number and less DNA rearrangement than Agrobacterium-mediated transformation.

Which one of the following options represents all INCORRECT statements?

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

**Question No. 66 / Question ID 703178** Marks: 4.00

Spindle assembly in animal cells requires nuclear envelope breakdown (NEBD). NEBD is a multistep process, which begins when Cdk1/cyclinB phosphorylates multiple components of the nuclear envelope. Given below are some components that are directly phosphorylated by Cdk1/cyclinB:

A. Nuclear Pore Complexes
B. Nuclear lamina
C. Greatwall kinase
D. Histone H3

Choose the option with correct Cdk1/cyclinB substrate/s that are directly associated with NEBD.

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

**Question No. 67 / Question ID 703228** Marks: 4.00

Which one of the following is INCORRECT regarding Hill numbers ($q$), a family of diversity indices?

1. As $q$ increases, the index puts increasing weight on the most common species in the assemblage, with the contribution of rare species gradually reducing in the summation.
2. As $q$ increases, the index puts increasing weight on the rare species in the assemblage, with the contribution of common species gradually reducing in the summation.
3. As $q$ increases, the diversity index decreases, unless all species are equally abundant.
4. Once $q \gtrapprox 5$, Hill numbers rapidly converge to the inverse of the relative abundance of the most common species.

**Question No. 68 / Question ID 703207** Marks: 4.00

The following statements are made about hematopoiesis in humans.

A. Bone marrow stem cells are not the source of osteoclast and mast cells.
B. Normally, three fourths of the cells in the marrow cavities mature to white blood cells and one fourth to red blood cells.
C. In adults, blood cells are not actively produced in the marrow cavities of all the bones.
D. Hematopoietic stem cells are derived from committed cells.

Which one of the following options represents all correct statements?

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

**Question No. 69 / Question ID 703188** Marks: 4.00

Cells have both reversible and non-reversible post-translational modifications. The following statements were made regarding the reversibility of post-translational modifications.

A. Ubiquitination of proteins is reversible, but ADP-ribosylation of DNA is irreversible.
B. Ubiquitination of proteins is reversible, but myristoylation of proteins is irreversible.
C. Ubiquitination of proteins is irreversible, but ADP-ribosylation of DNA is reversible.
D. Both ADP-ribosylation of DNA and prenylation of proteins are reversible.
E. Both prenylation and myristoylation of proteins are irreversible.

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

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

**Question No. 70 / Question ID 703201** Marks: 4.00

RuBisCO enzyme catalyzes carboxylation or oxygenation of RuBP in five steps. Following are certain statements regarding the catalysis carried out by RuBisCO:

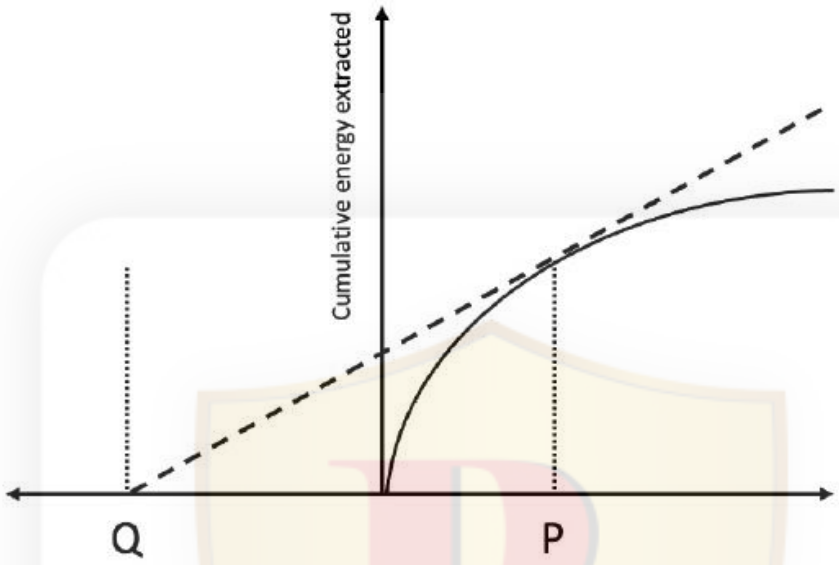
A. The first step of catalysis is enolization of RuBP.
B. The carbon-carbon bond between C3 and C4 of RuBP is cleaved.
C. Carboxylase activity produces only one molecule of 3-phosphoglycerate.
D. Oxygenase activity produces one molecule of 3-phosphoglycerate and one molecule of 2-phosphoglycolate.

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

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

**Question No. 71 / Question ID 703233** Marks: 4.00

The Marginal Value Theorem describes the behaviour of an animal foraging in a habitat where resources occur in patches. A major prediction of the theorem is how long an animal must stay in a patch to optimize the energy extracted, depending on its travel time to reach the patch, which is depicted in the figure below.




Based on this information, choose the option that correctly describes what both P and Q represent.

1. P= Optimum cumulative energy extracted; Q= Optimum patch residence time
2. P= Time taken to travel between patches; Q= Optimum cumulative energy extracted
3. P= Optimum cumulative energy extracted; Q= Time taken to travel between patches
4. P= Optimum patch residence time; Q= Time taken to travel between patches

**Question No. 72 / Question ID 703200** Marks: 4.00

Embryos of a species display conditional specification at 16-cell stage, and gastrulation begins at a later stage. In the 16-cell embryo, the prospective fate of vegetal blastomere is endoderm, while that of animal pole blastomere is ectoderm. In a 16-cell stage, a vegetal pole blastomere was grafted to the animal pole.

Which one of the following outcomes is true for the grafted cell?

1. It organizes the surrounding tissue to generate a secondary body axis.
2. It completely disrupts development.
3. It develops into endoderm.
4. It develops into ectoderm.

**Question No. 73 / Question ID 703213** Marks: 4.00

Six mutant yeast haploids (His1-6) requiring histidine supplementation for viability were fused in pair-wise combinations to form diploids. Requirement for histidine was tested for the diploids. The results are shown below where '+' indicates diploid combinations yielding histidine prototrophs.

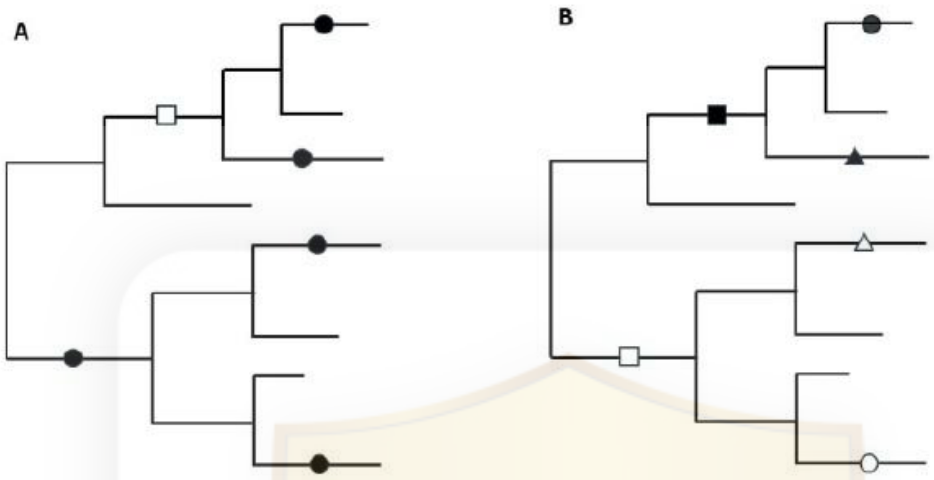
| | His1 | His2 | His3 | His4 | His5 | His6 |
|---|---|---|---|---|---|---|
| His1 | - | + | - | + | + | - |
| His2 | + | - | + | - | - | + |
| His3 | - | + | - | + | + | - |
| His4 | + | - | + | - | - | + |
| His5 | + | - | + | - | - | + |
| His6 | - | + | - | + | + | - |

How many different histidine biosynthesis genes are represented among the six mutants?

1. One
2. Two
3. Three
4. Four

**Question No. 74 / Question ID 703234** Marks: 4.00

Synonymous mutations (solid black circle) and non-synonymous mutations (different symbols) are plotted on two hypothetical phylogenies (A and B) given below.

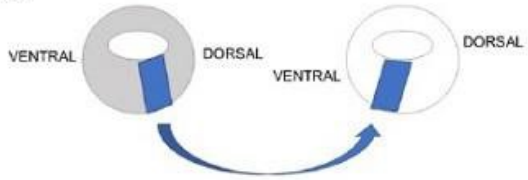
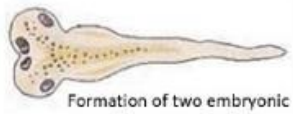
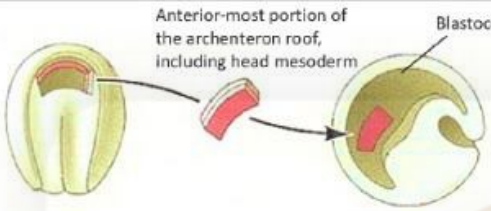
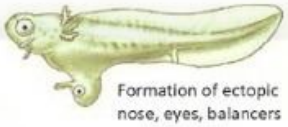
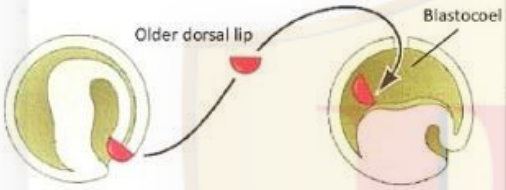
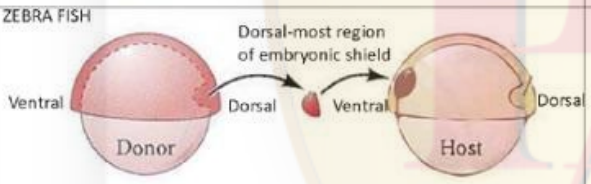



The phylogenies above may represent the following types of selection - positive, negative or neutral. Which one of the options given below gives the correct combination of the types of selection observed in phylogenies A and B?

1. A shows negative selection, B shows positive selection.
2. A shows positive selection, B shows negative selection.
3. A shows neutral selection, B shows positive selection.
4. A shows positive selection, B shows neutral selection.

**Question No. 75 / Question ID 703199** Marks: 4.00

Given below are the outcomes of transplantation experiments.

| | Transplantation experiment | Outcome |
|---|---|---|
| A. | XENOPUS   |  Formation of two embryonic axes with same anterior-posterior polarity |
| B. | NEWT   |  Formation of ectopic nose, eyes, balancers and otic vesicles |
| C. | NEWT   |  Formation of a secondary tail |
| D. | ZEBRA FISH   |  Formation of two embryonic axes with opposite anterior-posterior polarity |

Which one of the following options correctly depicts the outcome of the transplantation experiments?

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

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# NATIONAL TESTING AGENCY

## CSIR-UGC NET December 2024 - Final Answer Keys on which result generated

**Subject : Life Science**

**Exam Date : 01-03-2025** **Shift : 1**

| Question ID | Correct Key | Question ID | Correct Key | Question ID | Correct Key |
|---|---|---|---|---|---|
| 703101 | 3 | 703155 | 4 | 703209 | 3 |
| 703102 | 4 | 703156 | 3 | 703210 | 2 |
| 703103 | 3 | 703157 | 2 | 703211 | 4 |
| 703104 | 3 | 703158 | 2 | 703212 | 4 |
| 703105 | 2 | 703159 | 2 | 703213 | 2 |
| 703106 | 4 | 703160 | 2 | 703214 | 1 |
| 703107 | 3 | 703161 | 3 | 703215 | 2 |
| 703108 | 1 | 703162 | 2 | 703216 | 1 |
| 703109 | 1 | 703163 | 2 | 703217 | 1 |
| 703110 | 3 | 703164 | 2 | 703218 | 1 |
| 703111 | 4 | 703165 | 4 | 703219 | 4 |
| 703112 | 2 | 703166 | 3 | 703220 | 1 |
| 703113 | 3 | 703167 | 3 | 703221 | 4 |
| 703114 | 2 | 703168 | 2 | 703222 | 4 |
| 703115 | 3 | 703169 | 1 | 703223 | 3 |
| 703116 | 1 | 703170 | 3 | 703224 | 2 |
| 703117 | 4 | 703171 | 1 | 703225 | 3 |
| 703118 | 1 | 703172 | 2 | 703226 | 1 |
| 703119 | 1 | 703173 | 3 | 703227 | 2 |
| 703120 | 3 | 703174 | 4 | 703228 | 2 |
| 703121 | 1 | 703175 | 2 | 703229 | 2 |
| 703122 | 2 | 703176 | 1 | 703230 | 4 |
| 703123 | 3 | 703177 | 2 | 703231 | 2 |
| 703124 | 4 | 703178 | 3 | 703232 | 4 |
| 703125 | 1 | 703179 | 2 | 703233 | 4 |
| 703126 | 1 | 703180 | 4 | 703234 | 1 |
| 703127 | 1 | 703181 | 4 | 703235 | 1 |
| 703128 | 2 | 703182 | 1 | 703236 | 3 |
| 703129 | 1 | 703183 | 4 | 703237 | 1 |
| 703130 | 3 | 703184 | 3 | 703238 | 2 |
| 703131 | 3 | 703185 | 2 | 703239 | 1 |
| 703132 | 1 | 703186 | 4 | 703240 | 2 |
| 703133 | 2 | 703187 | 3 | 703241 | 3 |
| 703134 | 2 | 703188 | 4 | 703242 | 2 |
| 703135 | 4 | 703189 | 4 | 703243 | 2 |
| 703136 | 2 | 703190 | 3 | 703244 | 1 |
| 703137 | 3 | 703191 | 4 | 703245 | 2 or 4 |
| 703138 | 4 | 703192 | 4 | | |
| 703139 | 1 | 703193 | 3 | | |
| 703140 | 2 | 703194 | 4 | | |
| 703141 | 4 | 703195 | 1 | | |
| 703142 | 2 | 703196 | 1 | | |
| 703143 | 2 | 703197 | 2 | | |
| 703144 | 3 | 703198 | 3 | | |
| 703145 | 4 | 703199 | 1 | | |
| 703146 | 4 | 703200 | 4 | | |
| 703147 | 3 | 703201 | 4 | | |
| 703148 | 3 | 703202 | 3 | | |
| 703149 | 3 | 703203 | 4 | | |
| 703150 | 3 | 703204 | 4 | | |
| 703151 | 2 | 703205 | 2 | | |
| 703152 | 4 | 703206 | 1 | | |
| 703153 | 1 | 703207 | 2 | | |
| 703154 | 1 | 703208 | 1 | | |