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Section : **PART - A**

Q.1 On a spherical balloon of 10 cm radius, a circular colour patch has an area of 25 cm^2. If the balloon is uniformly expanded to a sphere of 50 cm radius, the area of the colour patch in cm^2 would be

1. 125
2. 625
3. 50
4. 500

Q.2 Average age of 20 students of a class is 10 years. Average age of these students together with their five teachers is 14. The age of Ramesh Sir, one of their five teachers, is exactly the same as the average age of all their five teachers. The sum of the ages (in years) of all the students and Ramesh Sir is

1. 214
2. 224
3. 230
4. 241

4. 4

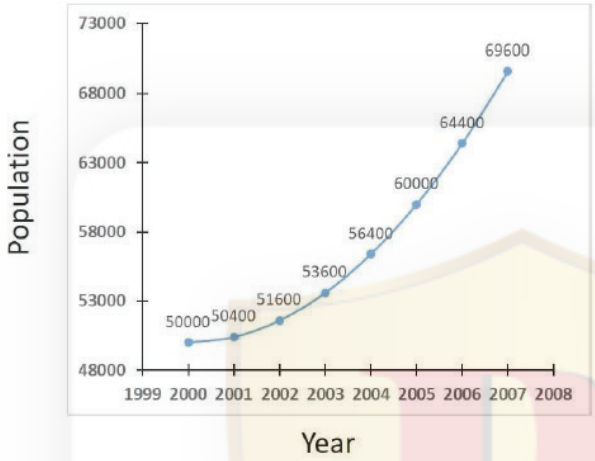
Q.3 A pilgrim starts walking for a journey of 115 km. On the first day he covers 7 km, the next day 9 km, and likewise keeps adding 2 km everyday till he reaches 15 km per day which he maintains for the rest of the journey. How many days in all will he take to complete the journey?

1. 7
2. 8
3. 9
4. 10

Q.4 A 2 cm wide wooden strip is to be fixed on a photo of 40 cm × 30 cm size all along its four sides. What is the minimum length of the wooden strip required?

1. 124 cm
2. 128 cm
3. 132 cm
4. 140 cm

Q.5 The population of a town over the years 2000-2007 is shown in the given figure.



It can be inferred that during 2000-2007,

1. the population increased linearly
2. the rate of increase of the population increased linearly
3. the rate of increase of the rate of increase of the population increased linearly
4. the population increased exponentially

Q.6

If any 9 papers are drawn from a both side printed book, the sum of their page numbers can NEVER be _____.

1. $\frac{9\times(9+1)}{2}$
2. divisible by 3
3. 179
4. 171

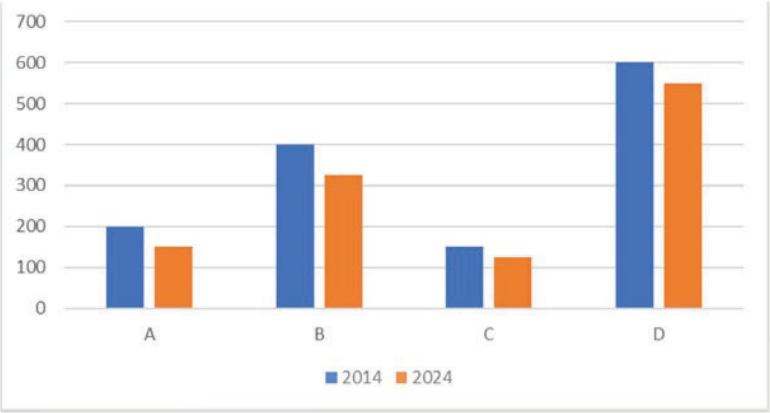
Q.7

Which of the following is true?

1. $\pi^{\pi^{\pi}} < e^{e^{e}} < 3^{3^{3}}$
2. $\pi^{\pi^{\pi}} < 3^{3^{3}} < e^{e^{e}}$
3. $3^{3^{3}} < e^{e^{e}} < \pi^{\pi^{\pi}}$
4. $e^{e^{e}} < 3^{3^{3}} < \pi^{\pi^{\pi}}$

Q.8

The areas (in km^2) under forests in four countries A, B, C and D for the years 2014 and 2024 are shown in the given bar chart:



The minimum percentage of deforestation during 2014-2024 was in country

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

Q.9 A block of marble 5 m × 4 m × 2 m in size is cut into rectangular tiles of 1 m x 0.5 m size having thickness of 10 cm. Assuming 10% wastage in cutting, how many tiles will be made?

1. 240
2. 360
3. 480
4. 720

Q.10 What is the remainder when $2023^{2024} + 2025^{2024}$ is divided by 2024?

1. 0
2. 2
3. 223
4. 2023

Q.11 If there is rainfall in a village, flowers will bloom. If flowers bloom, celebrations will definitely take place. Flowers did not bloom. Which of the following is certain?

1. Celebrations took place
2. Celebrations did not take place
3. It did not rain
4. It rained too much

Q.12 MAN is to CROWD is as TREE is to _____

1. FOREST
2. FRUIT
3. BRANCH
4. ROOT

Q.13 A man on a cycle is travelling on a terrain whose height (h) vs distance (d) can be described by a function $10\,d^4 - 5d^2$ in a certain unit (h can be negative). Starting at d = 0, the cycle will have the maximum velocity without pedaling at:

1 $d = 1/2$

2. $d = 2$

3. $d = 1$

4 $d = \sqrt{2}$

Q.14 $\sqrt[3]{0.99}$ is closest to

1. 0.33
2. 0.14
3. 0.99
4. 0.45

Q.15 In a box there are 4 white balls and 6 black balls. A ball is drawn at random. If it is white, it is put back along with two more white balls in the box. If it is black, it is put back in the box and then two black balls are thrown out of the box. Now a ball is drawn again at random from the box. Then, what is the probability that it is black?

1. $\frac{1}{2}$
2. $\frac{1}{3}$
3. $\frac{1}{4}$
4. $\frac{1}{5}$

Q.16 If a map is placed in such a manner that east becomes southeast, then what will northeast become?

1. North
2. East
3. West
4. South

Q.17 The sixth largest three-digit odd number among those with all digits distinct is

1. 989
2. 987
3. 973
4. 971

Q.18 A fresh water tap fills a fish tank in 40 minutes. The same tank is filled by a salt water tap in 120 minutes. If both the taps are open, how many minutes will it take to fill the tank?

1. 45 minutes
2. 30 minutes
3. 25 minutes
4. 20 minutes

Q.19 "Amit is a businessman, so he must be rich". From which of the following statements does the implication follow?

1. Only businessmen are rich
2. If one is not a businessman, he cannot be rich
3. All businessmen are rich
4. Some businessmen are rich

Q.20

An empty plastic mug floats in a bucket of water. When a solid iron ball is kept in the mug it doesn't sink. When the ball is put in the water it sinks. Compared to when the ball is in water, the water level in the bucket when the ball is in the mug is

1. the same
2. higher
3. lower
4. higher or lower depending on the surface area of the ball.

Section : **PART - B**

Q.21 Which one of the following enzymes can unwind short stretches of DNA helix immediately ahead of a replication fork?

1. Helicase
2. Topoisomerase
3. DNA polymerase
4. DNA gyrase

Q.22

Which one of the following is an example of asymmetric cell division in plants?

1. Formation of stomatal guard cells from a guard mother cell
2. First mitotic division of a microspore
3. First mitotic division of a megaspore
4. Cell division in the root elongation zone

Q.23 Which one of the following are NOT glial cells?

1. Schwann cells
2. Ependymal cells
3. Satellite cells of nervous system
4. Basket cells

Q.24

A 16S rRNA gene-based maximum-likelihood tree of soil isolates shows a long branch at the node connecting a clade of Actinobacteria to a clade of Proteobacteria. Which artefact is most likely to be present here?

1. Compositional heterogeneity causing long-branch attraction
2. Homoplasy in peptidoglycan cross-link pattern
3. Inaccurate rooting due to midpoint placement causing long-branch attraction
4. Over-parametrization of the GTR+G model

Q.25 Which one of the following carotenoids is NOT involved in the nonphotochemical quenching of chlorophyll fluorescence in plants?

1. Zeaxanthin
2. Violaxanthin
3. Antheraxanthin
4. Canthaxanthin

Q.26 Steroidogenic acute regulatory protein (StAR) facilitates transfer of cholesterol in which of the following sub-cellular organelles?

1. Nucleus
2. Golgi bodies
3. Mitochondria
4. Endoplasmic reticulum

Q.27 Which one of the following is the correct chronological order of major eras from oldest to youngest?

1. Proterozoic → Archean → Phanerozoic
2. Archean → Proterozoic → Phanerozoic
3. Archean → Phanerozoic → Proterozoic
4. Proterozoic → Phanerozoic → Archean

Q.28 Tomato plants in a subtropical field began to show progressive wilting, interveinal chlorosis, and root rot. The subsequent laboratory analysis indicated coenocytic hyphae along with the presence of thick-walled oospores. Additionally, the disease progressed rapidly in humid conditions. Which one of the following organisms is NOT likely to be responsible for the infection?

1. *Pythium aphanidermatum*
2. *Phytophthora nicotianae*
3. *Fusarium oxysporum*
4. *Phytophthora infestans*

Q.29 Which one of the following statements about glycosaminoglycans (GAGs) is INCORRECT?

1. GAGs are distinguished by their sugars, the type of linkage between the sugars, and the number and location of sulphate groups.
2. They are one of the most anionic molecules made by animal cells.
3. They are branched polysaccharides, usually made up of repeating units of a sulphated amino sugar and a uronic acid.
4. Severe loss of GAGs can lead to premature aging.

Q.30 In the classical metapopulation model as articulated by Richard Levins (1969, 1970), the metapopulation is considered to be a collection of subpopulations occupying different patches. Which one of the following conditions should be met for a population to be considered as a metapopulation?

1. Individual subpopulations should have realistic chances of extinction and recolonization.
2. The dynamics of the subpopulations should be dependent on each other.
3. Recolonization of a patch after extinction should be mainly through dispersal from the mainland patch.
4. Population dynamics in the various patches should be synchronous.

Q.31 In a study on honey bee foraging, researchers investigated how dopamine release in the mushroom bodies affects the bee's ability to learn floral odours associated with a nectar reward. Which of Tinbergen's Four Questions does this study primarily address?

1. What is the evolutionary origin of odour-based learning in hymenopterans?
2. How does floral odour learning improve foraging efficiency and reproductive success?
3. What mechanism underlies the association between floral odour and reward in bees?
4. How does floral odour learning change over the lifespan of a honey bee?

Q.32 The subclasses of terpenes that are generally volatile and often stored in glandular hairs or secretory cavities of leaves and fruits of herb and spice plants are

1. monoterpenes and sesquiterpenes
2. sesquiterpenes and triterpenes
3. diterpenes and triterpenes
4. triterpenes and tetraterpenes

Q.33 A student exposed a plant to a herbicide that blocks electron transport both in Photosystem II and Photosystem I. What is the likely outcome?

1. Increased production of NADPH and ATP
2. Only ATP would be produced but not NADPH
3. Neither ATP nor NADPH would be produced
4. The Calvin cycle would operate more efficiently

Q.34 The Cre-lox system is used to successfully delete a gene specifically in T cells in mice. Which one of the following options is correct?

1. Lox P recombination sequences were introduced in tandem at the 5' end of the gene.
2. Lox P recombination sequences were introduced at the 3' end of the gene.
3. Mutant Lox P sites were introduced on either side of the gene and mice were infected with bacteriophage P1 to provide Cre recombinase.
4. Mice containing Lox P sites on both 5' and 3' ends of the gene were mated with mice that are transgenic for Cre recombinase under control of an inducible promoter.

Q.35 Which one of the following phytopathogenic bacteria is predominantly transmitted through insects?

1. *Xanthomonas oryzae*
2. *Ralstonia solanacearum*
3. *Xylella fastidiosa*
4. *Pseudomonas syringae*

Q.36 Ectopic expression of the Vestigial protein in developing eye, antennae and leg discs of Drosophila converts the normal structure into wing tissue. Which one of the following statements is true based on the above information?

1. Vestigial expression is essential for wing development.
2. Cells in the eye, antennae and leg discs are incompetent for wing tissue specification.
3. Vestigial is downstream of the same *Hox* genes in all developing segments.
4. Leg and wing discs originate from distinct embryonic precursors.

Q.37

Which one of the following features differentiates bacteria from archaea?

1. Presence of a cell wall made up of peptidoglycan
2. Absence of a nuclear membrane
3. Presence of a single circular chromosome
4. Presence of multi-cistronic operons

Q.38 Which one of the following relationships correctly represents the narrow sense heritability? (V_A - additive variance, V_D - dominance variance, V_I - interaction variation, V_{GE} - genotype x environmental variance, V_T - total variance)

1. V_A / V_T
2. V_A / V_{GE}
3. $V_A+V_D+V_I / V_T$
4. V_D / V_T

Q.39

The activation of Cdk2 in vertebrates is dependent on

1. dissociation of the inhibitory subunit
2. association with cyclin A
3. inactivation of CAK
4. activity of Wee1 kinase

Q.40 Two temperature-sensitive mutants of *Escherichia coli* were mated with each other and none of the resulting exconjugants showed the wild-type phenotype. These mutations are:

1. Allelic
2. Non-allelic
3. Recessive
4. Dominant-negative

Q.41

For a given organism, which one of these life history attributes is associated with the broadest range of environmental tolerance?

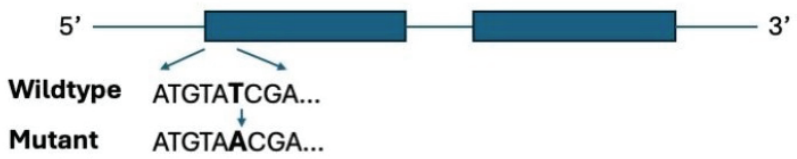
1. Survival
2. Growth
3. Reproduction
4. Fecundity

Q.42 *Drosophila melanogaster* has 4 pairs of chromosomes. There is no recombination in males of this species. What is the number of possible combinations of chromosomes in gametes of males?

1. Four
2. Eight
3. Sixteen
4. Thirty-two

Q.43

A transcript of a gene is shown below, with lines showing introns and rectangles showing exons. A mutation from 'T' at the 6th nucleotide position to 'A' in the 1st exon of the transcript is isolated.



Which one of the following options accurately describes the outcome of this mutation?

1. Gain of function
2. Loss of function
3. No change
4. Formation of an altered protein

Q.44 The levels of which one of the following parameters of blood are measured to check cardiac damage?

1. Creatine
2. Creatine kinase
3. Peroxidase
4. Urea

Q.45 Which of the following features establishes stromatolites as a source of early evidence for life on earth?

1. Fossilized bones that have been deeply embedded in a silica-rich matrix
2. Layered accretion structures that have been formed as a result of mineral precipitation
3. Biogenic laminated structures that have been influenced by phototrophic microbial mats
4. Conical limestone mounds that were created by reduced volcanic geothermal activity

Q.46 Which one of the following does NOT promote aging in humans?

1. Increased oxidative stress
2. Defects in DNA repair enzymes
3. Activation of telomerase
4. Reduced biosynthesis of leukotrienes

Q.47 In the catalytic triad of trypsin protease, serine forms a hydrogen bond with the histidine side chain. What will be the effect of this interaction on the pK_a of the serine side chain?

1. The pK_a decreases because the hydrogen bonding with histidine stabilises serine side chain's protonated state.
2. The pK_a increases because the hydrogen bonding with histidine stabilises serine side chain's deprotonated state.
3. The pK_a decreases because the hydrogen bonding with histidine stabilises serine side chain's deprotonated state.
4. The pK_a increases because the hydrogen bonding with histidine stabilises serine side chain's protonated state.

Q.48 Which one of the following would be most suitable to study early embryogenesis event using live microscopy of unstained *C. elegans* embryos?

1. Confocal microscope
2. Fluorescence microscope
3. Differential Interference Contrast microscope
4. Super-resolution microscope

Q.49

Which one of the following statements about human papillomavirus is correct?

1. The viral structural protein-encoding genes occasionally integrate into the host genome, leading to cervical cancer.
2. The viral protein E7 promotes Rb binding to the E2F, which allows uncontrolled entry into the S Phase of the cell cycle.
3. The viral protein E6 binds to p53 and prevents its degradation.
4. They infect cervical epithelial cells and maintain themselves in a latent phase as extrachromosomal plasmids.

Q.50 Which one of the following options best represents cholesterol distribution as a percentage of total membrane lipid in a typical animal cell?

1. lysosomal membrane > smooth ER > plasma membrane > inner mitochondrial membrane
2. smooth ER > plasma membrane > lysosomal membrane > inner mitochondrial membrane
3. plasma membrane > lysosomal membrane > smooth ER > inner mitochondrial membrane
4. plasma membrane > inner mitochondrial membrane > smooth ER > lysosomal membrane

Q.51

The heterotrimeric G-protein signaling component that is uniquely present in the plant lineage is

1. GTPase-accelerating protein
2. G-protein-coupled receptor
3. regulator of G-protein signaling
4. extra-large Gα subunit

Q.52 Why might a plant species evolve cleistogamous flowers in addition to chasmogamous ones?

1. To avoid inbreeding depression, a characteristic feature of cleistogamy
2. To ensure cross-pollination, a key objective of cleistogamy
3. To increase reproductive success in response to uncertainty in pollination
4. To enhance the phenomenon of pollinator attraction

Q.53 If 19% of the nucleotides in a genome are “A”, what percent are “C”, “G”, and “T”?

1. C = 31%, G = 31%, and T = 19%
2. C = 19%, G = 19%, and T = 31%
3. C = 31%, G = 19%, and T = 31%
4. C = 19%, G = 31%, and T = 31%

Q.54 According to the Oparin-Haldane hypothesis, which one of the following statements best describes the Earth's early atmosphere?

1. Rich in oxygen and nitrogen
2. Composed primarily of carbon dioxide and oxygen
3. Reducing atmosphere with gases such as methane and ammonia
4. Similar to the current atmosphere of Earth

Q.55 Which of the following chemical modifications of uridine residue occur after transcription of tRNA?

1. Ribothymidine and pseudouridine
2. Ribothymidine and N3-methyluridine
3. N3-methyluridine and pseudouridine
4. Pseudouridine and N1-Methylpseudouridine

Q.56 Which one of the following is NOT a microbe-associated molecular pattern (MAMP) of phytopathogens?

1. flg22, a 22 amino-acid peptide
2. pep13, a 13 amino-acid peptide
3. elf26, a 26 amino-acid peptide
4. systemin, an 18 amino-acid peptide

Q.57 Which one of the following datasets (expressed as mean ± SD) is most likely to follow a Gaussian (normal) distribution, considering that the data cannot have any negative values?

1. 296 ± 190 picomolar concentration of insulin in human blood samples
2. 58 ± 45 number of a particular species of bacteria in the rhizosphere
3. 160 ± 20 mg/dL of blood cholesterol concentration in human athletes
4. 4 ± 8 number of insects caught in a trap from an agricultural field

Q.58 Which one of the following habitats harbors the critically endangered Great Indian Bustard (*Ardeotis nigriceps*)?

1. Sal forests of Madhya Pradesh
2. Desert grasslands of Rajasthan
3. Shola grasslands of southern India
4. Terai grasslands of northeastern India

Q.59 Under the current rules of taxonomy, which one of the following organismal lineages can legitimately receive genus names either under the ICN or under the ICNP, based on the authors' choice?

1. Chlorophyta (Green algae)
2. Bacillariophyta (Diatoms)
3. Cyanobacteria (Blue-green algae)
4. Mycetozoa (Slime moulds)

Q.60 Which one of the following statements depicts the correct function of TFIIB?

1. It binds to the TATA box and helps in the proper positioning of RNA pol II.
2. It plays an important role in the elongation phase of transcription.
3. It forms the transcription initiation complex by interacting with RNA pol II and TBP.
4. It acts as a coactivator that facilitates the binding of enhancers to the promoter.

Q.61 All of the following are covered by lipid monolayers, EXCEPT

1. lipid droplet
2. very low-density lipoprotein
3. endocytic vesicles
4. chylomicrons

Q.62 Which one of the following proteins is responsible for the permeability of Mg^{2+} through the tight junctions of tubular cells in the thick ascending limb of Henle?

1. Claudin - 2
2. ZO - 1
3. Claudin - 16
4. ZO - 3

Q.63 Which of the following statements indicates the relationship between basal metabolic rate and body size for organisms within a taxonomic group?

1. Basal metabolic rate increases linearly with body size
2. Weight-specific basal metabolic rate is independent of body size
3. Weight-specific basal metabolic rate decreases non-linearly with body size
4. Basal metabolic rate increases non-linearly with body size.

Q.64 The reactions of the urea cycle occur in two different cellular compartments and generate the following intermediates.

A. Argininosuccinate
B. Citrulline
C. Ornithine

Which intermediate(s) must be transported across the mitochondrial inner membrane?

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

Q.65 Which one of the following is the correct arrangement of amino acid dipeptides in increasing order of the area of allowed regions in the Ramachandran map?

1. Gly-Gly < Pro-Pro < Ala-Ala ~ Phe-Phe
2. Phe-Phe < Ala-Ala < Pro-Pro ~ Gly-Gly
3. Pro-Pro < Phe-Phe ~ Ala-Ala < Gly-Gly
4. Ala-Ala < Phe-Phe < Gly-Gly < Pro-Pro

Q.66 Which one of the following biofuels is classified as a first-generation biofuel?

1. Cellulosic ethanol
2. Bio-ethanol
3. Lignin-based biofuels
4. Algal biofuels

Q.67

Ribosomes attach to the endoplasmic reticulum via

1. differing surface ribosomal protein composition that allow it to interact with polar headgroups on the ER lipid bilayer.
2. 5'UTR of mRNA being translated that directs the localization of the ribosomes to the ER.
3. the translated nascent chain which carries a signal allowing interaction with SRP-receptor on the ER.
4. tethered mRNAs that interact with rRNA.

Q.68 Which one of the following molecules is transported into enterocytes from intestinal lumen by GLUT5?

1. Glucose
2. Galactose
3. Fructose
4. Lactose

Q.69 Mutation of homeotic genes often results in which one of the following developmental defects in *Drosophila*?

1. Polarity defects in every segment along the A-P axis
2. Absence of every other segment along the A-P axis
3. Transformation of one segment into another
4. Absence of a group of contiguous segments

Q.70 In the circular synteny maps of Poaceae family, providing insights into the origin and evolution of grass genomes, which one of the following genomes should represent the "innermost" circle?

1. *Arabidopsis thaliana* chromosomes (n = 5)
2. maize chromosomes (n = 10)
3. rice chromosomes (n = 12)
4. ancestral chromosomes (n = 12)

Section : **PART - C**

Q.71

An embryo lethal recessive mutation in a plant gene "R" located on chromosome 1 was rescued by an ectopically integrated GFP-tagged wild type "R" transgene (R-comp) which is inserted in chromosome 4. When a female homozygous R-comp plant is crossed to a male purple-coloured recessive mutant, some of the resultant F1 embryos showed chromosome segregation defects. The plants regenerated from these embryos were purple and sterile, and found to contain the wild type gene "R" but not the R-comp transgene. What is the ploidy of the above F1 plants?

1. Triploid
2. Haploid
3. Chromosome 4 trisomy
4. Monosomic diploid

Q.72 Gastric juice (pH 1.5) is produced by pumping HCl from blood plasma (pH 7.4) into the stomach. Calculate the amount of free energy required for H^+ transport to produce one litre of gastric juice at 37°C. How many moles of ATP must be hydrolyzed to provide this amount of energy? (The free energy change for ATP hydrolysis under cellular conditions is about –58 kJ/mol.) (R = 8.315 J/mol/K)

1. 34 - 36 kJ/mol and 0.6 - 0.61 mol
2. 3.4 - 3.6 kJ/mol and 6.0 - 6.1 mol
3. 22 - 23 kJ/mol and 0.3 - 0.31 mol
4. 17 - 18 kJ/mol and 3.0 - 3.1 mol

Q.73 Spindle assembly requires the formation of numerous new microtubules. To meet this demand, the spindle contains a large number of regulatory factors. A few protein/protein complexes are mentioned below:

A. γ-TuRCs
B. Augmin
C. TPX2
D. Dynein

Which one of the following options includes all the factors that directly impact microtubule nucleation for spindle assembly?

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

Q.74 The baroreceptors present in the carotid sinus and aortic arch are stretch receptors that provide neural signals to the brain stem for the maintenance of normal blood pressure. The activity of baroreceptors in the regulation of blood pressure and heart rate are proposed in the following statements:

A. The increased baroreceptor discharge due to high blood pressure in the carotid sinus and aortic arch stimulates the tonic discharge of sympathetic nerves to blood vessels and heart.
B. A decline in the pulse pressure without a change in mean pressure increases the rate of baroreceptor discharge.
C. Baroreceptors are more sensitive to pulsatile change of blood pressure than to constant blood pressure.
D. The increased baroreceptor discharge excites the vagal innervations to the heart.

Which one of the following options represents all correct statements?

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

Q.75 The following statements are made regarding vesicle formation, transport, and fusion in cells expressing a mutant Arf protein. This mutant Arf protein is constitutively bound to GTP but is defective for GTP hydrolysis.

A. COPI-coated vesicles are only formed from their normal location.
B. Arf is constitutively bound to a membrane.
C. COPII-coated vesicle fusion with the target membrane is aberrant.
D. COPI-coated vesicle fusion with the target membrane is disrupted.

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

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

Q.76

The operation of the photorespiratory (C_2) pathway involves cooperative interaction among three separate subcellular organelles, namely, chloroplast, mitochondria and peroxisomes. Following are certain statements regarding C_2 pathway:

A. 2-phosphoglycolate formed in the chloroplast is converted to glycolate by the action of phosphoglycolate phosphatase.
B. Glycolate exits chloroplast by diffusion and enters peroxisome through a glycolate transporter.
C. In the peroxisomes, glycolate reacts with O_2 and produces glyoxylate and H_2O_2.
D. Only serine:glyoxylate aminotransferase is involved in the conversion of glyoxylate into serine in a peroxisomal reaction.

Which one of the following options correctly marks the above statements as TRUE (T) of FALSE (F)?

1. A-T, B-T, C-F, D-T
2. A-F, B-T, C-F, D-T
3. A-F, B-T, C-T, D-T
4. A-T, B-F, C-T, D-F

Q.77 The following statements are related to airway resistance of lungs in healthy humans:

A. The resistance to airflow increases with increasing lung volume.
B. The major site of airway resistance is in the first eight generations of airways.
C. The smallest airways contribute very little to the overall total resistance of the bronchial tree.
D. Breathing a mixture of oxygen-helium instead of oxygen-nitrogen results in a decrease of airway resistance.

Which one of the following options represents all correct statements?

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

Q.78 As per the 2020 FAO Global Forest Resources Assessment, the climatic domains ranked in descending order based on their proportion and distribution of global forest area are:

1. Tropical, Subtropical, Temperate, Boreal
2. Tropical, Boreal, Temperate, Subtropical
3. Boreal, Tropical, Subtropical, Temperate
4. Boreal, Temperate, Subtropical, Tropical

Q.79 Given below is a table listing the names of compounds/products derived from animals or plants (Column X) and their use/application (Column Y).

Column X		Column Y	
A.	Bacoside	i.	Chemotherapy for leukaemia and lymphoma
B	Vincristine	ii.	Coating for pills and food glazing
C.	Lanolin	iii.	Cognitive enhancer
D.	Shellac	iv.	Skin creams and moisturizers

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

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

Q.80 The table below lists genes (Column X) and their encoded proteins (Column Y) that play an important role in plant response to biotic stress.

Column X		Column Y	
A.	*SID1*	i.	Isochorismate synthase
B.	*SID2*	ii.	Cytochrome P450 monooxygenase
C.	*PAD3*	iii.	ABC transporter
D.	*PEN3*	iv.	MATE transporter

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

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

Q.81

The activity of two promoters (A and B) upstream of a luciferase reporter in response to transcription factor TF-X in a cell line was studied. Luciferase activity was measured in cells following overexpression and RNAi silencing of TF-X and compared to control (Native TF-X level). The luciferase enzyme activity is tabulated below.

Condition	pGene A: Luciferase activity (Arbitrary Units)	pGene B: Luciferase activity (Arbitrary Units)
Native TF-X levels	9	2
Overexpression of TF-X	2	9
RNAi-silenced TF-X	2	2

Based on the above table, following statements were made

A. TF-X is needed for basal activity of promoter A.
B. TF-X is needed for basal activity of promoter B.
C. TF-X functions both as a positive and negative regulator for promoter A.

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

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

Q.82

A network of genes regulates vertebrate eye development. The loss or gain of function of select genes are listed in Column X, and their effects or phenotypes are listed in Column Y.

Column X		Column Y	
A.	Loss of function of *Shh*	i.	No eyes
B.	Elevated levels of *Shh* in the prechordal plate	ii.	Disruption of anterior neural tube specification
C.	Loss of function of *Otx2*	iii.	Defective pigmented retina
D.	Loss of function of *Mitf*	iv.	Failure to split the eye field to form bilateral eye fields

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

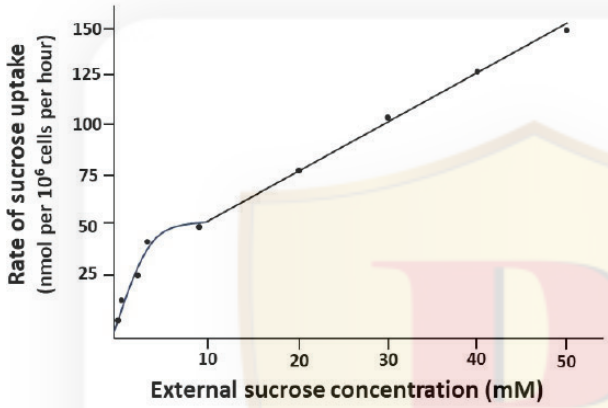
1. A - iv, B - i, C - ii, D - iii
2. A - ii, B - iii, C - i, D - iv
3. A - iii, B - ii, C - iv, D - i
4. A - iv, B - ii, C - i, D - iii

Q.83 The Red List of the IUCN categorises species (Column X) under multiple threat levels (Column Y). Match the following species with their IUCN status (as of the latest reports):

Column X		Column Y	
A.	Jerdon's Courser (*Rhinoptilus bitorquatus*)	i.	Critically Endangered
B.	Indian Star Tortoise (*Geochelone elegans*)	ii.	Endangered
C.	Indian Dwarf Banana (*Musa mannii*)	iii.	Least Concern
D.	Teak (*Tectona grandis*)	iv.	Vulnerable

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

Q.84 Sucrose transport in plant cells follows both active transport and diffusion mechanisms. The given figure shows the rate of sucrose uptake by soybean protoplasts as a function of the external sucrose concentrations.



Based on the given information, a researcher made following interpretations:

A. Sucrose uptake at low concentration (<10 mM) is facilitated by an energy-dependent process.

B. Sucrose uptake at low concentrations is a carrier-independent process.

C. At higher concentrations, sucrose enters the cells by diffusion down its concentration gradient.

D. Inhibition of ATP synthesis with metabolic poison can block only the linear component.

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

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

Q.85 In a dioecious plant species, a single gene is responsible for petal colour. A cross between a true breeding red female and a true breeding white male gave rise to all red male and all white female F1 progeny. However, the reciprocal cross produced all red males and all red females.

Which one of the following explains the inheritance of petal colour?

1. The gene is located in the mitochondrial genome.
2. Males are homogametic; gene is located on the sex chromosome.
3. Females are homogametic; gene is located on the sex chromosome.
4. The gene is located on an autosome.

Q.86 A population of Indian wolf shows logistic growth. Let the carrying capacity (K) be 200 and intrinsic rate of increase, r = 0.05. What is the maximum possible growth rate for the population (in terms of individuals per time unit)?

1. 2.0
2. 2.5
3. 3.5
4. 5.0

Q.87 Equal numbers of particles of a mutant viral strain 'A' and the wild-type strain (WT) were used to separately infect equal numbers of synchronized compatible host mammalian cells. RNA from host mammalian cells were subjected to real-time quantitative PCR to analyze levels of the viral *gag* gene and host *beta-tubulin* after 24 hrs. C_t values for the above measurements are listed below.

	C_t values of transcript		
	Infected with 'A'	Infected with 'WT'	Uninfected
gag	22	23	36
beta-tubulin	17	18	17

By how much have the *gag* transcripts in 'A'-infected cells changed with respect to 'WT'-infected cells?

1. Reduced to 1/32 of WT
2. Reduced to 1/4 of WT
3. Reduced to 1/2 of WT
4. No change

Q.88

Given below is the list of molecules that target the nervous system (Column X) and their modes of action (Column Y).

	Column X		Column Y
A	Lidocaine	i	is composed of two polypeptides: one helps to release acetylcholine at synapses with muscle cells, facilitating entry of a protease into the cytosol of the axon terminus.
B	Botulinum toxin	ii	blocks norepinephrine reuptake and prolongs the stimulation of postsynaptic neurons.
C	Cocaine	iii	binds to amino acid residues that line the channel pore and prevent the influx of Na^+, and thus the generation of an action potential.
D	Desipramine	iv	binds to the dopamine transporter and inhibits the reuptake of dopamine, prolonging the stimulation of postsynaptic neurons.

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

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

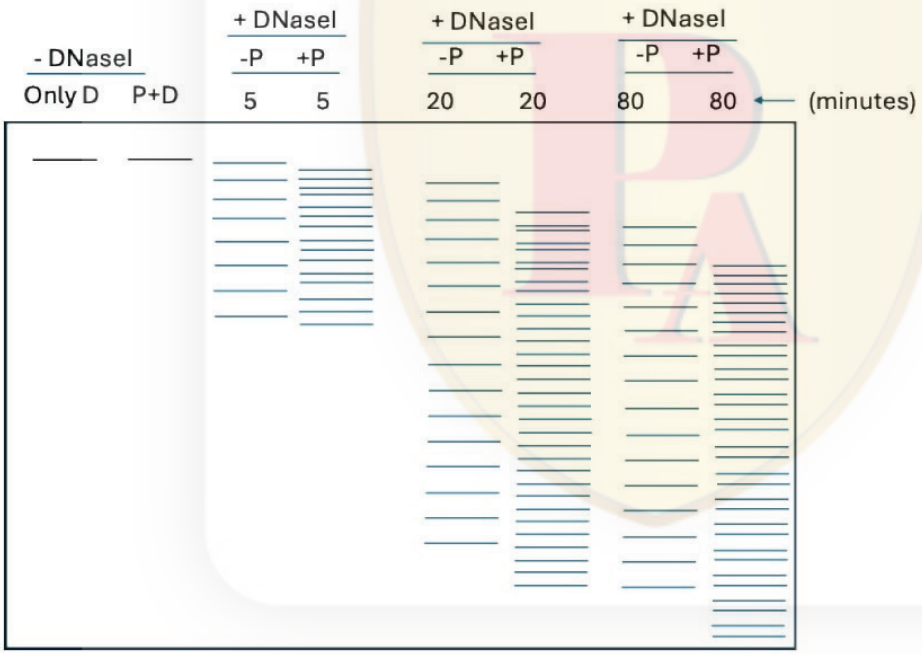
Q.89 Given below are a few biological lipids (Column X) and their chemical nature (Column Y).

Column X		Column Y	
a	Sphingomyelin	i	Galactose linked to ceramide
b	Archaeal membrane lipid	ii	Ether-linked alkene
c	Non-polar lipids	iii	Triacylglycerol
d	Plasmalogens	iv	Phosphocholine head group
e	Cerebrosides	v	Very long branched chain fatty acids

Which one of the following options correctly matches the lipid to its chemical nature?

1. a:v; b:iv; c:i; d:iii; e: ii
2. a:v; b:i; c:iii; d:ii; e: iv
3. a:iv; b:v; c:iii; d:ii; e: i
4. a:iv; b:iii; c:ii; d:i; e: v

Q.90 A novel DNA-binding protein (P) was tested for its mode of binding with DNA (D), for which a DNase I assay was performed. P was incubated with DNA to form a **P-D** complex, to which DNase I was added. Assume constant concentration of P, D, and DNase I. The reaction was terminated at increasing time-points (minutes) and resolved on a sequencing-grade polyacrylamide gel.



Based on the results of the DNase I digest, which one of the following options is the correct interpretation?

1. P does not bind to D, thereby generating a banding pattern of D.
2. P binds to D at a specific site, generating a banding pattern of D.
3. P binds and exposes multiple sites on D, generating a banding pattern of D.
4. P binds to only the 5' and 3' ends of D, generating a banding pattern of D.

Q.91 The following statements are made about transgenic mice technologies:

A. Catalytically inactive Cas9 fused to a transcription activator can be used to activate specific gene expression.

B. Using CRISPR/Cas9, a precise gene replacement in a target locus can be accomplished by non-homologous end joining repair.

C. Using CRISPR/Cas9, many genes can be targeted at once by expressing many guide RNAs in the same cell.

D. All chimeric mice derived by injecting engineered mouse embryonic stem cells into blastocysts will carry the transgene in the germ line.

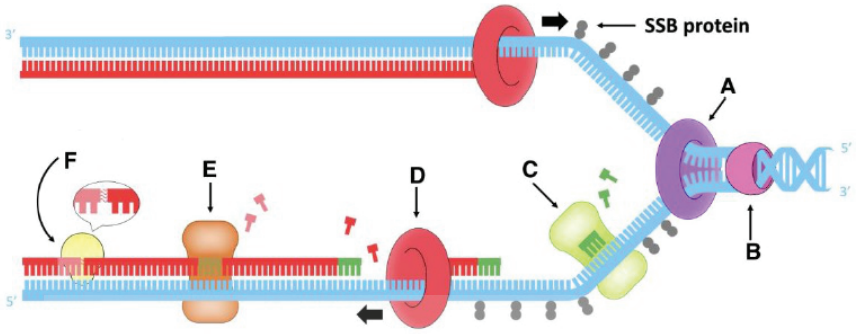
E. In the Cre-lox conditional system, the Cre recombinase is inserted into the gene to be knocked out.

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

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

Q.92

The figure below is a schematic representation of the replication fork. The different proteins associated with DNA replication are marked by A, B, C, D, E, and F.



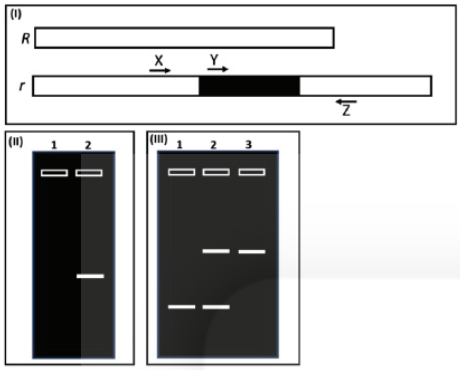
Which one of the following options correctly represents the names of these proteins?

1. A: DNA Helicase; B: DNA Gyrase; C: DNA Primase; D: DNA pol III; E: DNA pol I; F: DNA Ligase
2. A: DNA Gyrase; B: DNA Helicase; C: DNA Primase; D: DNA pol II; E: DNA pol I; F: DNA Ligase
3. A: DNA Helicase; B: DNA Gyrase; C: DNA Primase; D: DNA pol III; E: DNA pol II; F: DNA Ligase
4. A: DNA Gyrase; B: DNA Helicase; C: DNA Primase; D: DNA pol II; E: DNA pol III; F: DNA Ligase

Q.93

Panel (I) represents two alleles of a gene. The coding region of the wild type allele (*R*) is 3 Kb long while the mutant allele (*r*) has a 0.5 Kb insertion. The black box indicates insertion in the *r* allele. Three primers indicated as X, Y and Z were designed to develop PCR based DNA markers associated with the gene.

A cross was carried out between lines with the genotypes *RR* and *rr*. The F_1 progeny was selfed. Panel (II) and (III) represent the probable patterns of DNA markers observed in the F_2 progeny using different primer combinations.

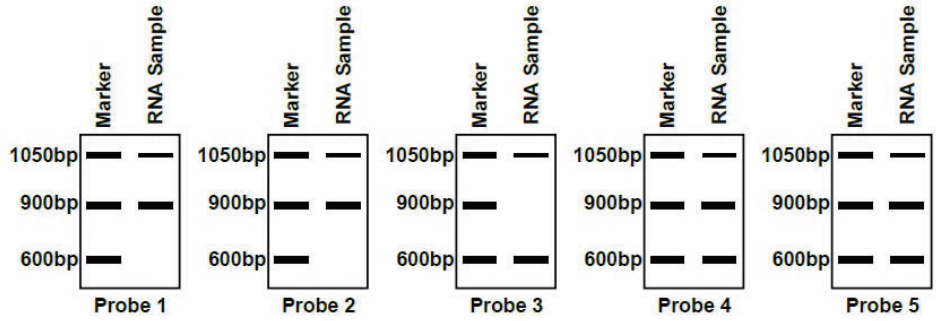


Which one of the following statements is correct?

1. Panel III represents the pattern when primers Y and Z are used for amplification.
2. Panel II is an example of a dominant DNA marker.
3. The F_2 progeny as represented in Panel II, will have 50% of the progeny showing no amplified fragment (lane 1).
4. A rare recombination event between the regions represented by primers X and Y will lead to changes in the amplification patterns observed in Panels II and III.

Q.94

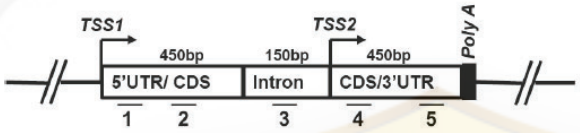
Shown below is a Northern blot profile with five independent probes representing the transcript from a single genetic locus.



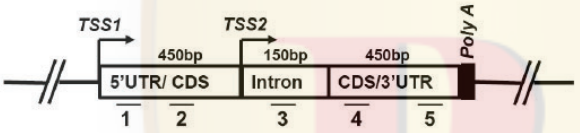
Note: The thickness of the line denotes band intensity

Based on the Northern blots, which of the diagrams below best represents the order of genes encoded in the genetic locus? Note: Exon and intron junctions are given only for the transcript from TSS1. For options 2,3 & 4, the mature transcript from TSS2 retains the intron.

1. Option 1:

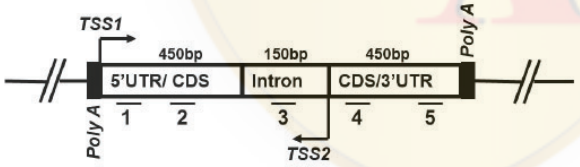


2. Option 2:



3. Option 3:

4. Option 4:



Q.95

A glucose biosensor exhibits Michaelis-Menten kinetics with a maximum current response, Imax = 250 μA, and a Michaelis constant, Km = 5.2 mM. If the glucose concentration in a sample is 3.4 mM, what is the current response (I) of the biosensor?

1. 98.83 μA
2. 250 μA
3. 29.06 μA
4. 73.52 μA

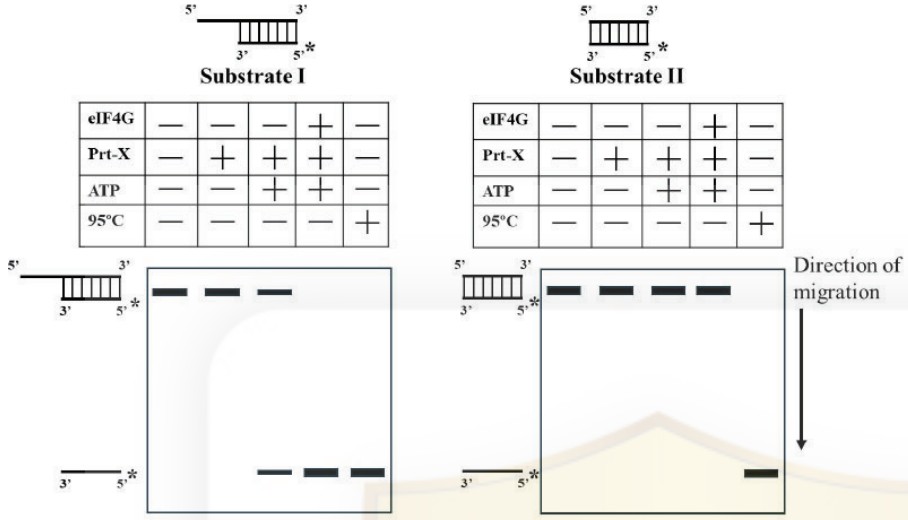
Q.96 The following statements are made about body temperature regulation in humans:

A. As the skin temperature falls, the hypothalamic set point for sweating decreases.
B. Acclimatization to cold activates the uncoupling protein (UCP) in mitochondria.
C. Acclimatization to heat decreases aldosterone secretion.
D. Sodium ion concentration in sweat decreases upon acclimatization to heat.
E. When the body temperature becomes high, the skin blood vessels undergo vasodilation.

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

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

Q.97 The ability to unwind RNA substrates I and II by translation regulator 'X' was studied. RNA substrates with radiolabeled antisense strand (*) were incubated with purified 'X' under the conditions listed below. Subsequently, RNA species were separated by polyacrylamide gel electrophoresis (PAGE), followed by autoradiography. The results are shown below:



The following statements are made purely based on the observed gel patterns:

A. X unwinds substrates with a 5′ overhang.
B. Substrates which can be unwound by 'X' need ATP for efficient RNA unwinding.
C. X unwinding activity is enhanced by the presence of eIF4G.

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

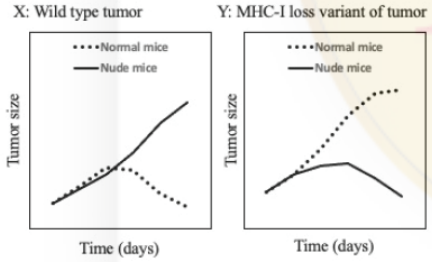
1. A and B only
2. B and C only
3. A and C only
4. A, B and C

Q.98

Which one of the following statements best describes the function of magnetite in animal migration?

1. Magnetite crystals generate electrical signals that amplify visual landmarks that guide flight.
2. Magnetite acts as a biological compass.
3. Magnetite stores magnetic energy that provides energy for long-distance flights.
4. Magnetite emits magnetic pulses to keep the group together.

Q.99 Lab-grown cells of a tumor (Wild type) expressing a novel cancer antigen, and a variant of the same tumor that has lost MHC class I expression, were injected subcutaneously into normal mice (dotted line) and into nude mice (solid line). The growth of the tumors in the two mouse strains is shown below.



The following statements were made based on the results observed:

A. In normal mice, CTLs recognize tumor cells in the presence, but not absence, of MHC-I.
B. In nude mice, NK cells recognize tumor cells in the absence, but not in the presence, of MHC-I.
C. CTLs and NK cells inhibit each other if MHC-I is present, but not if it is absent.
D. In mice injected with tumors lacking MHC-I, antibodies generated with the help of CD4 cells restrain the growth of the tumor in nude mice.

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

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

Q.100 Eukaryotes regulate gene expression via histone modifications. In the table given below, the histone modification (column X), its association with chromatin type (column Y), and their impact on gene expression (column Z) is listed.

Histone modification (X)		Association with chromatin type (Y)		Gene expression (Z)	
(A)	H4K4me3	(a)	highly accessible open chromatin	(i)	ON
(B)	H3K9me3	(b)	only facultative heterochromatin	(ii)	OFF
(C)	H3K9ac	(c)	both constitutive and facultative heterochromatin		
(D)	H3K27me3				

Which one of the following options correctly matches all terms in the most appropriate combination?

1. (A)-(a)-(i); (B)-(c)-(ii); (C)-(a)-(i); (D)-(b)-(ii)
2. (A)-(b)-(i); (B)-(b)-(ii); (C)-(c)-(i); (D)-(a)-(ii)
3. (A)-(c)-(ii); (B)-(a)-(i); (C)-(a)-(i); (D)-(c)-(ii)
4. (A)-(c)-(i); (B)-(a)-(ii); (C)-(a)-(ii); (D)-(b)-(i)

Q.101

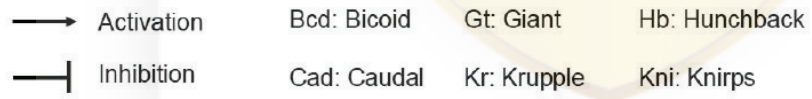
Given below are statements about the action of glucagon in human body:

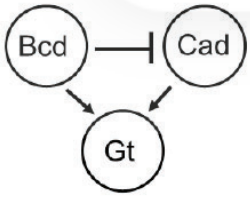
A. It does not cause glycogenolysis in muscle.
B. It decreases ketone bodies formation in the liver.
C. It does not cause lipolysis in the liver.
D. It inhibits conversion of phosphoenolpyruvate to pyruvate in the liver.

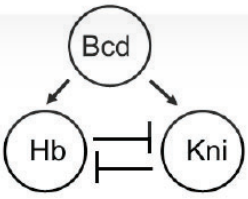
Which one of the following options represents both correct statements?

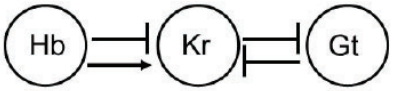
1. A and B
2. B and C
3. C and D
4. A and D

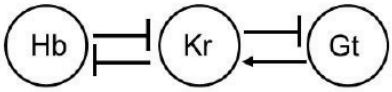
Q.102 Interactions among 'maternal effect gene' and 'gap gene' products are crucial for establishing embryonic domains in the *Drosophila* embryo. Which one of the following options DOES NOT show the correct interactions?



1.


2.


3.


4.


Q.103 Lettuce seed germination is a typical photo-reversible response controlled by phytochrome. Seeds in a petridish were exposed to Red light (R), Far-Red light (FR) or kept in the dark (black bar) according to the schedule in **Column X**. The effect on seed germination is provided in **Column Y**.

	Column X		**Column Y**
A.		(i)	stimulates seed germination
B.		(ii)	inhibits seed germination
C.			
D.			
E.			

Which one of the following combinations represents the correct match between Column X and Column Y?

1. A-i, B-ii, C-i, D-ii, E-i
2. A-i, B-i, C-i, D-i, E-ii
3. A-ii, B-ii, C-ii, D-ii, E-i
4. A-ii, B-i, C-ii, D-i, E-ii

Q.104

Proteins possess a sorting signal known as a nuclear localization signal (NLS) for their import into the nucleus. A few statements are given below on the import of proteins destined for the nucleus.

A. The import receptor binds to the nuclear localization signal.
B. The import receptor contains several low-affinity binding sites for the nucleoporins.
C. The nuclear import receptor-cargo complex is dissociated by RanGDP in the nucleus.
D. The nuclear import receptor-cargo complex binds to RanGTP in the cytosol and traverses the nuclear envelope.

Which one of the following options has all the correct statements about nuclear protein import?

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

Q.105 The following statements are made regarding leaf development in plants:

A. The activity of KNOX1 and ARP are mutually repressive to help establish a separate identity for emerging leaf primordium.
B. PHANTASTICA is required for adaxial cell fate during leaf development.
C. KANADI genes promote abaxial cell fate during leaf development.
D. miR166 binds to KANADI mRNA and degrades it on the abaxial side of the leaf primordium.
E. Overexpression of KNOX1 increases leaf complexity and indeterminacy.

Which one of the following options represents all correct statements?

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

Q.106 Different segments of the renal tubule (Column X) and the sodium transporter in the apical membrane of tubular cells (Column Y) are given below:

Column X		Column Y	
a.	Proximal tubule	i.	Na^+ channel (ENaC)
b.	Collecting duct	ii.	Na^+-K^+-$2Cl^-$ co-transporter
c.	Thick ascending limb	iii.	Na^+-Cl^- co-transporter
d.	Distal convoluted tubule	iv.	Na^+-amino acid co-transporter

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

1. a – iv, b – i, c – ii, d - iii
2. a – ii, b – iv, c – i, d - iii
3. a – i, b – ii, c – iii, d - iv
4. a – iii, b – iv, c – i, d - ii

Q.107

The Satpura Hypothesis suggests that the Satpura Range in central India acted as a bridge for the migration of Malayan taxa into peninsular India. However, empirical observations do not fully support this hypothesis. Consider the following statements made in the context of biogeographic patterns.

A. The shared characteristics of some Malayan fauna and that of peninsular India is due to convergent evolution in similar environments.

B. The said flora and fauna originated in the Indian subcontinent and then dispersed to south-east Asia ('out-of-India').

C. Vicariance biogeography split ancestral populations, leading to the diversification of species.

D. Pleistocene glaciation created conditions for the dispersal of high-altitude Himalayan taxa to the Western Ghats.

Which combination of the above statements have been proposed as alternative explanations for the Satpura hypothesis?

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

Q.108 Izumo and Juno are two proteins that are expressed in sperm and egg, respectively and play critical roles in mediating interactions between them. The following experiments were carried out with Izumo and Juno:

A. Sperms from a male mouse, where Izumo has been knocked out, could not fertilize eggs from a normal female.

B. Two independent kidney cell lines were developed, one expressing Izumo and the other expressing Juno. If the two cells are mixed, the cells will tend to aggregate with each other.

C. Whole mount immunostaining for Izumo and Juno indicated specific staining on the sperm and egg, respectively.

Which one of the following options lists experiment(s) that demonstrate(s) interactions between Izumo and Juno?

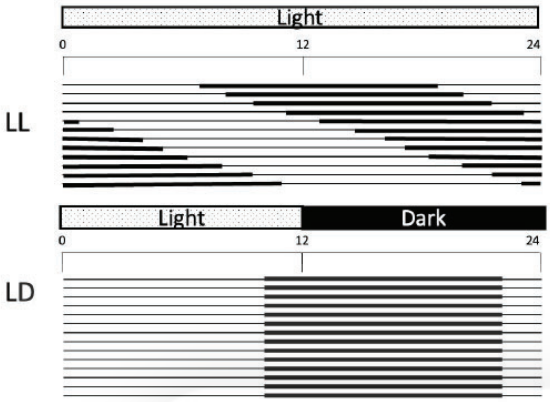
1. A only
2. B only
3. A and C
4. C only

Q.109 A canonical Watson-Crick G:C base pair is stabilized by three hydrogen bonds formed between a donor (+0.25e) and acceptor (–0.35e) atom located at a distance r = 2.9 Å. Assume that the dielectric constant 'D' in the DNA core is 4, and in water is 78.5. Which one of the following options correctly represents the total difference in electrostatic interaction energy for all 3 hydrogen bonds when buried in the DNA core versus fully exposed to solvent?
(Modified Coulomb's constant, k = 1389 kJ/mol·nm·e^{-2})

1. –298.3 kJ/mol
2. –104.7 kJ/mol
3. –99.4 kJ/mol
4. –5.338 kJ/mol

Q.110

Male crickets call at dusk when the light intensity falls below a certain level. A researcher kept these insects in the laboratory under two light regimes: i) constant light condition for 24 hours (LL) and ii) 12 hours Light and 12 hours Dark cycle (LD). The calling activity pattern of the crickets in these two regimes across all experimental days is represented in the figure below.



The statements below represent inferences that one can draw about circadian control of calling activity in these animals.

A. Calling activity under LL represents free-running cycle and LD represents entrained cycle.
B. Calling activity under LL represents entrained cycle and LD represents free-running cycle.
C. The circadian control of calling activity is endogenous only.
D. The circadian control of calling activity is exogenous only.
E. The circadian control of calling activity has both endogenous and exogenous components.

Which one of the following options gives all correct statements about the inferences we can draw from this experiment?

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

Q.111

Given below are a few statements related to genetics and linkage mapping in plants.

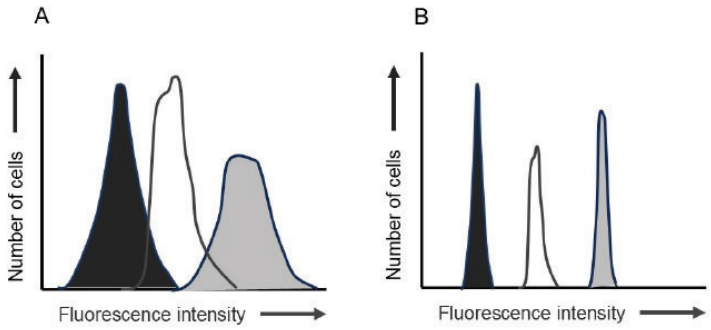
A. Near Isogenic Lines are immortal populations.
B. The physical distance between two polymorphic markers is not linearly related to their genetic distance.
C. QTLs identified for a particular phenotype or trait of interest always contribute equally to the trait value.
D. Association mapping is performed using unrelated individuals of the same population.

Which one of the following options correctly describes the above statements as "True" or "False"?

1. A: True; B: False; C: True; D: False
2. A: False; B: True; C: False; D: False
3. A: True; B: True; C: False: D: True
4. A: False; B: False; C: True; D: True

Q.112

Two samples were run on a flow cytometer and the data were plotted as histograms A and B, as shown below.



The following statements were made:

A. Figure A represents three normal distributions with more variation within groups than between groups.

B. Figure B represents three normal distributions with more variation between groups than within groups.

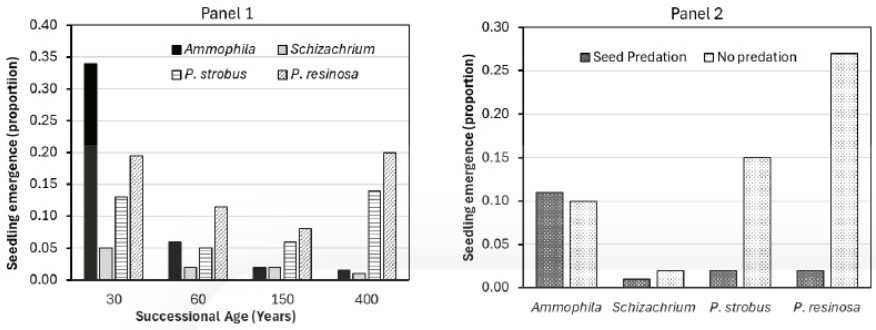
C. The ANOVA-F test is likely to be statistically significant when applied to Figure B, but not to Figure A.

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

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

Q.113

In a successional chronosequence (30 – 400 years) on a sand dune, *Ammophilia* dune grass dominates the youngest dunes, the prairie bunch grass *Schizachrium* dominates at 60 years, followed by *Pinus* species at later stages. Experimental seed additions were done to study **seedling emergence** (as a proportion of viable seeds) of all species on all the dunes (Panel 1). In addition, the effect of seed predation on seedling emergence (across dune ages) was also tested (Panel 2). The following figure presents results on seedling emergence.



Based on the above, consider the following statements regarding the possible interpretation of the results.

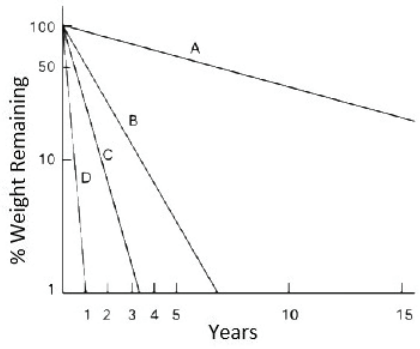
A. Late successional species can establish on younger dunes but may be limited by seed dispersal.
B. Seed predation reduces the establishment of late successional species on younger dunes.
C. Facilitation has stronger influence than colonization or seed predation on successional change.
D. Late successional species cannot establish on younger dunes because of the sandy substrate.

Which combination of the above statements represents valid inference that can be drawn purely from the data presented above?

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

Q.114

The following figure shows the decomposition of selected plant litter constituents.



In the above, the correct identities of the symbols A, B, C and D are:

1. A-Lignin, B-Phenols, C-Sugars, D-Cellulose
2. A-Phenols, B-Lignin, C-Cellulose, D-Sugars
3. A-Cellulose, B-Lignin, C-Sugars, D-Phenols
4. A-Cellulose, B-Phenols, C-Lignin, D-Sugars

Q.115

Match the animal phyla/classes (Column X) with their defining set of characteristics (Column Y).

Column X		Column Y	
A.	Phylum Platyhelminthes	i.	Bilateral symmetry, pseudocoelomate, complete digestive tract, often microscopic with a corona of cilia.
B.	Phylum Annelida	ii.	Radial symmetry (often pentamerous as adults), water vascular system, exclusively marine, deuterostomes.
C.	Class Insecta	iii.	Bilateral symmetry, acoelomate, triploblastic, usually with a flattened body and an incomplete digestive tract (if present).
D.	Phylum Echinodermata	iv.	Segmented body (metamerism) with a true coelom, chitinous chaetae (typically), closed circulatory system.
		v.	Exoskeleton of chitin, three main body parts (head, thorax, abdomen), six legs, usually with wings in the adult stage.

1. A-iii, B-iv, C-v, D-ii
2. A-i, B-iv, C-v, D-ii
3. A-iii, B-i, C-v, D-iv
4. A-v, B-ii, C-iii, D-i

Q.116 Given below are certain plant diseases and the pathogens responsible.

Disease		Pathogen Type	
A.	Panama disease of Banana	i.	Bacterial
B.	Red ring disease of Coconut	ii.	Fungal
C.	Malformation of Mango	iii.	Nematode
D.	Citrus Canker	iv.	Viral

Which one of the following options correctly matches the disease with its pathogen?

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

4. 4

Q.117 Human prostate cancer cells expressing urokinase Plasminogen Activator (uPA) readily metastasize when injected into experimental animals. A scientist genetically modified prostate cancer cells and injected them into experimental animals. The possible observations are listed below:

A. Overexpressing a mutant version of the uPA protein that does not bind to its receptor led to tumour formation but reduced metastasis.
B. Overexpressing a mutant version of the uPA protein that does not bind to its receptor led to enhanced tumour formation as well as metastasis.
C. Overexpressing a secreted version of the uPA receptor led to tumour formation but reduced metastasis.
D. Overexpressing a secreted version of the uPA receptor reduced tumour formation as well as metastasis.

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

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

Q.118

Which one of the following matrices represents the correct choice regarding the two types of errors made in statistical hypothesis testing? H_0 = Null hypothesis.

A

	Fail to reject H_0	Reject H_0
H_0 = True	Correct decision	Type I Error ($\propto$ Error)
H_0 = False	Type II Error (β Error)	Correct Decision

B

	Fail to reject H_0	Reject H_0
H_0 = True	Type I Error ($\propto$ Error)	Correct Decision
H_0 = False	Correct decision	Type II Error (β Error)

C

	Fail to reject H_0	Reject H_0
H_0 = True	Correct decision	Type II Error (β Error)
H_0 = False	Type I Error ($\propto$ Error)	Correct Decision

D

	Fail to reject H_0	Reject H_0
H_0 = True	Type II Error (β Error)	Correct decision
H_0 = False	Correct Decision	Type I Error ($\propto$ Error)

Choose the correct option.

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

Q.119

A transformation experiment is performed with two Pneumococcal strains. One strain is resistant to four drugs - A, B, C, and D, whereas the other is sensitive to all the drugs. Both strains are mixed and the mixture is plated on media containing various combinations of the drugs. The colonies obtained on these plates are given below:

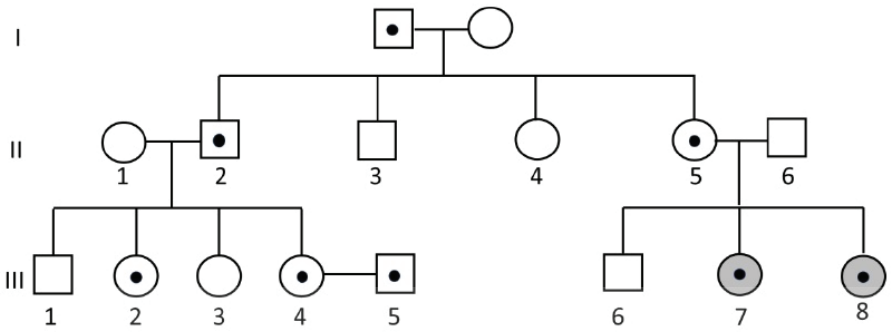
Drugs added	No. of colonies	Drugs added	No. of colonies
A	1156	CD	786
B	1148	ABC	30
C	1161	ABD	42
D	1139	ACD	630
AB	46	BCD	36
AC	640	ABCD	30
AD	942		
BC	51		

Based on the above results, which one of the below options represents the most likely order of the drug-resistance genes?

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

Q.120

The below pedigree shows the inheritance pattern of gene **X**. A loss of function mutation of the gene leads to a disorder in adults. Further, gene **X** is imprinted leading to its inactivation. Individuals who carry the mutant allele are marked with a dot, while individuals who show the disorder are shaded.



The following statements were made:

A. Gene **X** is maternally imprinted.
B. Individual **III.6** carries an imprinted allele.
C. If individuals **III.4** and **III.5** have a child, the probability that it will carry at least one mutant allele is **0.75.**
D. If individuals **III.4** and **III.5** have a child, the probability that it will show the disorder is **0.75**.

Which one of the following options represents all correct statements?

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

Q.121

The table below presents the energy transfer values for various activities exhibited by three herbivores inhabiting a grassland with a net primary productivity (NPP) of 10000 kJ/m²/year.

Herbivore	Activity Energy Value (kJ/m²/year)		
	Ingestion	Egestion	Respiration
A	4000	2000	1000
B	6000	3000	1000
C	8000	6000	1000

Based on the information provided, which one of the following options is NOT correct?

1. C has the highest consumption efficiency but the lowest assimilation efficiency.
2. B has the highest consumption efficiency, but C has the highest assimilation efficiency.
3. A and B have the highest assimilation efficiencies.
4. A has the lowest consumption efficiency.

Q.122 Given below are names of techniques (Column X) and their characteristic features measured for molecular characterization (Column Y).

Column X		**Column Y**	
A.	X-ray crystallography	i.	Fluorescence
B	NMR spectroscopy	ii.	Polarization
C.	Raman spectroscopy	iii.	Diffraction
D.	CD spectroscopy	iv.	Wave number
E.	Colorimetry	v.	Chemical shift
		vi.	Ellipticity
		vii	Absorbance

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

1. A (iii) B (v) C (iv) D (vi) E (vii)
2. A (ii) B (iii) C (i) D (vii) E (vii)
3. A (v) B (iv) C (iii) D (ii) E (i)
4. A (iii) B (i) C (ii) D (vi) E (iv)

Q.123 The following statements are made about the subcellular localization of steroid synthesizing enzymes in adrenal cortical cells.

A. 3β-Hydroxysteroid dehydrogenase is present in mitochondria.
B. 17α-Hydroxylase is present in the smooth endoplasmic reticulum.
C. 11β-Hydroxylase is present in mitochondria.
D. 21β-Hydroxylase is present in smooth endoplasmic reticulum.

Which one of the following options represents both correct statements?

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

Q.124 Which one of the following options correctly represents mass extinction events in increasing order of percentage loss of species?

1. Triassic, Devonian, Ordovician, Permian
2. Permian, Triassic, Devonian, Ordovician
3. Devonian, Triassic, Ordovician, Permian
4. Permian, Ordovician, Triassic, Devonian

4. 4

Q.125 In early amphibian development, the ectodermal cells with BMP4 activity leads to epidermal ectoderm fate. If cells lack BMP4 activity, they take up a fate of neural ectoderm. BMP inhibitors like noggin dorsalize the ectodermal cells and give rise to neural ectoderm.

The following statements are made with reference to the above:

A. The default fate of the ectoderm is to become neural tissue.

B. Noggin mRNA will be depleted in lithium chloride treated gastrula.

C. Injection of *noggin* mRNA into UV-radiated embryos at 1-cell stage rescued dorsal development.

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

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

Q.126

The table below lists insect sensory structures (Column X) with their function (Column Y).

Column X		Column Y	
A	Dorsal rim area	i	Learning and memory
B	Mushroom body	ii	Polarisation vision
C	Antennal lobe	iii	Motor control
D	Central complex	iv	Mechanosensation

Which one of the following options correctly matches column X and column Y?

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

Q.127 Given below are four niche-oriented models proposed to explain species-abundance distributions in ecological communities.

A. The *dominance-preemption* model involves successive species preempting a dominant portion (50% or more) of the remaining niche-space.

B. In the *random fraction* model, successive species invade and take over an arbitrary portion of the niche space of any species previously present. Here, irrespective of their dominance status, all species are subjected to niche division with equal probability.

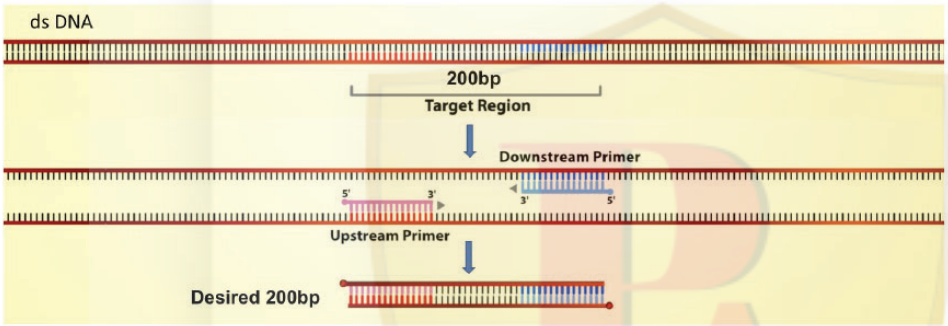
C. The *MacArthur fraction* model assumes that larger niches are *more likely* to be invaded by new species.

D. The *dominance-decay* model postulates that the largest niche in an existing assemblage is *always* subject to a subsequent (random) division.

Assuming a process of community assembly that involves successive species invading and establishing in the community, what would be the correct order of *evenness* in community structure produced by these mechanisms?

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

Q.128 A polymerase chain reaction (PCR) with all necessary reagents was carried out to amplify a 200 bp target region of a human Y chromosome. PCR was started with 100 copies of double stranded DNA (ds DNA) as template.

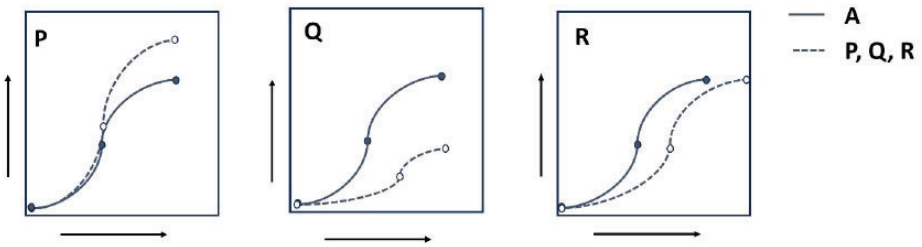


Assuming 100% PCR efficiency, how many copies of the desired 200bp fragment consisting of ONLY the target region would be produced at the end of the third PCR cycle?

1. 100
2. 200
3. 1000000
4. 0

Q.129

Given below are thermal melting curves for proteins A, P, Q and R. The X-axis denotes temperature, while the Y-axis indicates the concentration of unfolded protein.



Which one of the following options is true regarding comparative thermostability of protein A with respect to P, Q and R?

1. A < P; A > Q; A > R
2. A < P; A > Q; A = R
3. A ~ P; A < Q; A < R
4. A ~ P; A < Q; A > R

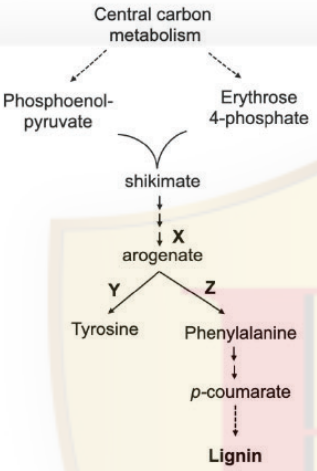
Q.130 A child injures his toe, which then becomes infected with *Staphylococcus aureus*. The following statements are made about the events that follow over the course of a week:

A. The pathogen is conveyed to draining lymph nodes by macrophages.
B. Danger signals are conveyed to high endothelial venules of draining lymph nodes through the fibroblastic reticular conduit system.
C. Naïve B cells and T cells enter draining lymph nodes from high endothelial venules by a process that is initiated by ICAM-1-mediated rolling.
D. Naïve B cells exit circulation at the site of injury and undergo clonal expansion in response to bacterial LPS.

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

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

Q.131 Shown below is a hypothetical metabolic pathway leading to the production of lignin metabolite, and the three pathway enzymes (X, Y and Z), of which Z is regulated by feedback inhibition.



Which one of the following strategies will lead to the generation of plants with the highest level of lignin?

1. Overexpression of the genes expressing enzyme X.
2. Knockout of the gene expressing enzyme Y.
3. Overexpression of the genes expressing enzymes X and Z.
4. Overexpression of gene expressing enzyme X and knockout of gene expressing enzyme Y.

Q.132 The table below describes the effect of various antibiotics on protein translation in bacteria.

Column X		Column Y	
Antibiotic		Mechanism of action	
A.	Erythromycin	i.	Binds to 23S rRNA in the 50S subunit of the ribosome
B	Chloramphenicol	ii.	Binds to 50S ribosomal subunit and inhibits elongation of peptide chain
C.	Tetracycline	iii.	Binds to 30S ribosomal subunit interfering with binding of aminoacyl tRNA
D.	Streptomycin	iv.	Binds to 16S rRNA in the 30S subunit of the ribosome

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

Q.133

Caterpillars produce defensive vibrations that travel through plant stems to deter its predators. The table below summarises data collected from three plant species, including vibration amplitude measured 10 cm from the caterpillar, predator response time, and the Young's modulus of the stem.

Plant Species	Vibration Amplitude (μm)	Latency to attack (sec)	Young's modulus (MPa)
A	2.3	3.0	250
B	1.8	2.1	110
C	0.7	1.3	45

Choose the option that correctly provides a mechanistic explanation for the data presented in the above table.

1. A is a herbaceous plant and its stem dissipates energy faster compared to B and C which are woody plants.
2. C is a woody plant, and predators detect vibrations on it more easily compared to A and B which are herbaceous plants.
3. Predators are more inefficient on herbaceous plant species A and B, and more efficient on woody plant species C.
4. C is an herbaceous plant and its stem is more likely to transmit vibrations more effectively when compared to plant species A and B which are woody.

Q.134 An alpha helix formed by 30 residues is stabilized by 25 backbone hydrogen bonds in its folded state. Assume that the average energy of a hydrogen bond is ~10 kJ/mol, and the disruption in the peptide resonance causes a partial loss of 205 kJ/mol per peptide bond. Assume that the folding and unfolding process only changes peptide resonance stabilization partially and the loss of hydrogen bonding upon unfolding (ignore side-chain interactions and entropy losses). Which one of the following options represents the correct magnitude of the net energetic difference between the folded and unfolded state of the helix?

1. 6195 kJ/mol
2. 5945 kJ/mol
3. 250 kJ/mol
4. 5695 kJ/mol

Q.135 The following statements are related to different signaling pathways involved in tetrapod limb development.

A. Shh released by the ZPA inhibits Fgf8 signaling in the AER.

B. FGFs released by the AER activate Shh expression in the ZPA.

C. Wnt7a expression in the dorsal ectoderm plays a role in limiting Shh expression in the ZPA.

D. Overactivation of Wnt signaling in the ventral ectoderm causes an overgrowth of AER and formation of extra digits.

Which one of the following options represent all correct statements?

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

Q.136 A 19th century phycologist described a soil dwelling cyanobacterium *Nostoc arcus* and cited three herbarium sheets (X, Y and Z) collected from different deserts, but no holotype was designated in that work. In 2024, a taxonomist intended to stabilize the name and hence selected sheet Z as the reference specimen due to the better morphological clarity and preservation of the sample.

What nomenclatural task is the taxonomist performing under the ICN?

1. Designating a neotype because the original material was not sufficient.
2. Designating a holotype because the best specimen is being chosen.
3. Designating a lectotype because the original material consisted of syntypes.
4. Designating an epitype because morphological details are clear.

Q.137 Following are a few statements regarding mapping populations and principles of genetic mapping in crop species.

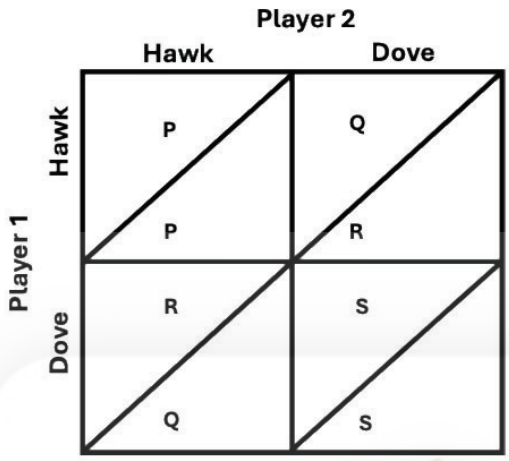
A. For self-pollinating species, both F2 and F1-derived doubled haploids can serve as mapping populations.
B. For cross-pollinating species, F1 population can be used for mapping studies.
C. Bulk segregant analysis (BSA) is often used to identify linked markers for complex traits with multiple genes and environmental influences.
D. In crop plants, sets of different breeding lines can be exploited for trait mapping.
E. Breeding methods such as single-seed descent and pedigree selection promote genetic variability.

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

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

Q.138

The Hawk-Dove game serves as a model for conflict resolution in evolutionary game theory, wherein players 1 and 2 have the option of employing either an aggressive (Hawk) or a peaceful (Dove) strategy. The diverse interaction scenarios and their corresponding payoffs (P, Q, R, S) are presented in the following matrix:



If V = the value of the resource (the benefit), C = the cost of losing a fight in the above matrix, which one of the following options correctly represents the payoffs?

1. P = V, Q = 0, R = (V/2), S = (V-C)/2
2. P = (V-C)/2, Q = V, R = 0, S = (V/2)
3. P = V, Q = 0, R = (V-C)/2, S = (V/2)
4. P = (V/2), Q = (V-C)/2, R = V, S = 0

Q.139 If 10 μg of pure carbonic anhydrase catalyzes the hydration of 0.30 g of CO_2 in 1 min at 37°C at V_{max}, what is the turnover number (k_{cat}) of carbonic anhydrase (in units of min^{-1})? (M_r of carbonic anhydrase is 30,000)

1. 3.2×10^3 min^{-1} to 3.3×10^3 min^{-1}
2. 2.0×10^7 min^{-1} to 2.1×10^7 min^{-1}
3. 0.30×10^7 min^{-1} to 0.31×10^7 min^{-1}
4. 2.0×10^3 min^{-1} to 2.1×10^3 min^{-1}

Q.140 The following statements are made regarding TAL effectors that play an important role during bacterial pathogenesis in plants.

A. They are bacterial proteins that are translocated into the host plant cells using the type IV secretion system.
B. They harbour a central DNA-binding region comprising a tandem array of nearly identical repeats.
C. They can act as both virulence factors as well as avirulence factors.
D. They are only restricted to members of the Xanthomonas species that infect rice.

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

Q.141

Shown in the table are some cultivated crops (Column X) and the chromosomal ploidy (Column Y).

Column X		Column Y	
A.	Banana	i.	Diploid
B	Breadwheat	ii.	Triploid
C.	Brown mustard	iii.	Tetraploid
D.	Cauliflower	iv.	Hexaploid
E.	Sugarcane	v.	Octaploid

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

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

Q.142 Human lymphocytes were incubated with increasing concentrations of NaCl. Which one of the following options represents the correct response of the nucleus and the chromatin to increase in salt concentrations?

1. The nucleus bursts at low NaCl concentrations, liberating the chromatin into the cytosol.
2. At higher salt concentration the heterochromatin gets converted into euchromatin and comes out of the nucleus.
3. The nucleus does not burst but the heterochromatin leaches out first.
4. The nucleus does not burst but the euchromatin leaches out first.

Q.143 A researcher simultaneously disrupted the activities of "Ferrochelatase" and "Chlorophyllide *a* oxygenase" enzymes involved in the biosynthesis of heme and chlorophyll, respectively in Arabidopsis. The researcher made the following predictions about the outcomes of the above experiments.

A. The synthesis of "Chlorophyll a" from "Chlorophyllide a" will be inhibited.
B. The synthesis of "Chlorophyll b" will be completely inhibited.
C. The content of "Heme" molecule will be higher compared to wild-type plants.
D. The metabolic flux will shift towards the biosynthesis of "Chlorophyll a".

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

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

Q.144 The primary sequence of a miRNA is given below.

5' - UAGCUUAUCAGACUGAUGUUGA - 3'

The seed region of miRNA starts from the 2nd position to the 8th position.
Which one of the following mRNA sequences would be targeted by the above miRNA?

1. 5' - CUCGAGGCAACAUCAGUCUGAUAAGCUAGAGCUC - 3'
2. 5' - CUCGAGUAGCUUAUUAGACUAAUGUUGAGAGCUC - 3'
3. 5' - CUCGAGAUUUGGUAUGCGCGAAUACCAAUCUCGA - 3'
4. 5' - CUCGAGGAGAUUGGUAUUCGCGCAUACCAAAUCU - 3'

Q.145 Following statements are made regarding the biosynthesis of phytohormones.

A. Indole-3-butyric acid is converted to IAA by β-oxidation in peroxisomes.
B. The gibberellin precursor, geranyl geranyl diphosphate is synthesized in the plastids.
C. Cytokinins are synthesized from adenine nucleotides and dimethylallyl diphosphate in the mitochondria.
D. The oxidative reactions that convert xanthoxin to abscisic acid occur in the cytosol.
E. Cytochrome P450 monooxygenase enzyme family associated with endoplasmic reticulum catalyzes most of the reactions in brassinosteroid biosynthesis.

Which one of the following combinations contains all correct statements?

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

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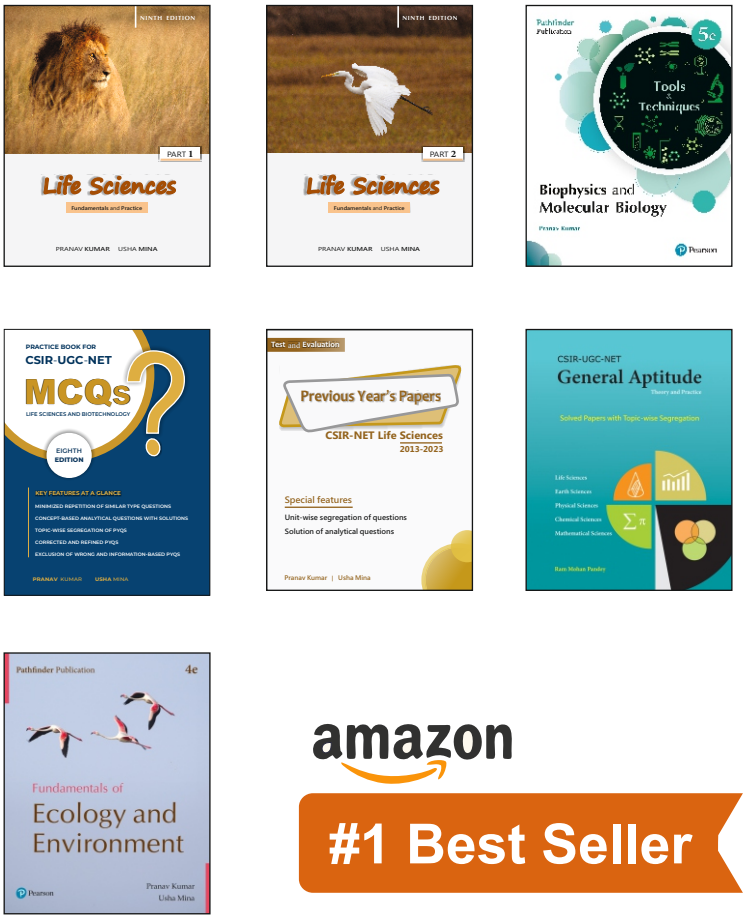

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SR No.	Question ID	Correct Options/Answers
1	835594656	2
2	835594657	3
3	835594658	3
4	835594659	4
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