

Rajasthan JET Biology Sample Paper-12

Duration: 40 Minutes

Maximum Marks: 160

Instructions

- This paper contains **40** Multiple Choice Questions (Single Correct).
- Each correct answer carries **+4 marks**.
- Each incorrect answer carries: **–1 marks**.
- Use of mobile phones, smartwatches, calculators, or any electronic gadgets is strictly prohibited.

Q1. A farmer in western Rajasthan notices a distinct white rust-like pustule formation on the leaves of his mustard crop, leading to structural deformities. Which of the following organisms is the causative agent of this disease?

- (A) *Albugo candida*
- (B) *Puccinia graminis*
- (C) *Xanthomonas oryzae*
- (D) *Alternaria solani*

Q2. Which of the following features is uniquely diagnostic of the Phylum Arthropoda, distinguishing it completely from Phylum Annelida?

- (A) Presence of a true coelom lined by mesoderm
- (B) Metameric segmentation throughout the body length
- (C) Chitinous exoskeleton and jointed appendages
- (D) Presence of a closed circulatory system

Q3. In the process of recombinant DNA technology, which specific enzyme is critically required to form a phosphodiester bond between the sticky ends of a foreign gene insert and a linearized plasmid vector?

- (A) EcoRI
- (B) DNA Ligase



- (C) DNA Polymerase I
- (D) Alkaline Phosphatase

Q4. In the standard Z-scheme of light-dependent reactions in plant photosynthesis, what is the primary role of the Oxygen Evolving Complex (OEC) associated with Photosystem II?

- (A) To reduce NADP^+ to NADPH using protons from the stroma
- (B) To split water molecules, providing electrons to replace those lost by P680
- (C) To pump protons directly across the thylakoid membrane to synthesize ATP
- (D) To transfer high-energy electrons from Plastoquinone to Cytochrome b_6f

Q5. Identify the devastating polyphagous insect pest frequently found in Rajasthan that damages various Kharif crops by voraciously feeding on leaves and shoots, and possesses a life cycle passing through an egg, five to six nymphal instars, and an adult stage.

- (A) *Sitophilus oryzae*
- (B) *Schistocerca gregaria*
- (C) *Tribolium castaneum*
- (D) *Callosobruchus maculatus*

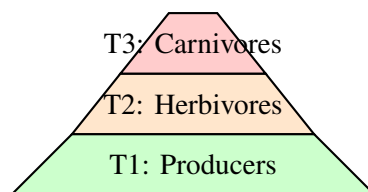
Q6. Consider the sequence of hormonal triggers in the vertebrate male reproductive system. If the secretion of Luteinizing Hormone (LH) is selectively blocked, which of the following immediate physiological consequences will occur?

- (A) Sertoli cells will fail to secrete androgen-binding protein (ABP).
- (B) Spermatogonia will immediately undergo abnormal meiotic arrest.
- (C) Leydig cells will fail to synthesize and secrete testosterone.
- (D) The anterior pituitary will increase the secretion of GnRH via positive feedback.

Q7. In a stable terrestrial ecosystem such as a grassland in semi-arid zones, which of



the following statements accurately characterizes the structural properties of its ecological pyramids?



- (A) The pyramid of biomass is always inverted because primary consumers outweigh producers.
- (B) The pyramid of energy can occasionally be inverted during seasonal population crashes.
- (C) The pyramid of numbers is upright, showing a progressive decrease in individual counts at higher trophic levels.
- (D) The pyramid of energy is inverted because top carnivores consume energy more efficiently.
- Q8.** Which of the following pairs correctly matches a highly prized medicinal plant cultivated in Rajasthan with its true botanical family?
- (A) Ashwagandha — Fabaceae
- (B) Isabgol — Plantaginaceae
- (C) Aloe vera — Brassicaceae
- (D) Safed Musli — Solanaceae
- Q9.** During the extraction of genomic DNA from an onion bulb tissue sample, what is the specific purpose of adding chilled ethanol at the final step of the isolation protocol?
- (A) To denature cellular proteins and RNA molecules completely
- (B) To precipitate the purified DNA out of the aqueous solution
- (C) To lyse the rigid cellulosic plant cell walls mechanically
- (D) To activate restriction endonucleases present in the extract



- Q10.** A particular heterosporous, vascular plant group produces naked seeds that are not enclosed within an ovary wall. The leaves may be simple or compound, and the roots in some genera exhibit a symbiotic association with nitrogen-fixing cyanobacteria. Identify this plant group.
- (A) Pteridophytes
 - (B) Bryophytes
 - (C) Gymnosperms
 - (D) Angiosperms
- Q11.** Which type of bio-fertilizer consists of symbiotic nitrogen-fixing cyanobacteria that live inside the dorsal cavities of the floating aquatic fern leaves, making it highly effective for waterlogged paddy fields?
- (A) *Azotobacter*
 - (B) *Azospirillum*
 - (C) *Azolla–Anabaena* complex
 - (D) Rhizobium culture
- Q12.** The historical "Chipko Movement" and the earlier sacrificial protection of *Prosopis cineraria* trees by Amrita Devi in Rajasthan are classic, globally recognized examples of which conservation strategy?
- (A) Ex-situ conservation via community seed banks
 - (B) In-situ community-led biodiversity conservation
 - (C) Cryopreservation of endangered wild germplasm
 - (D) Establishment of formal biosphere reserves
- Q13.** In the vertebrate gastrointestinal tract, the inactive proenzyme pepsinogen is converted into active pepsin by the action of hydrochloric acid. Which specific cells of the gastric glands are responsible for secreting this proenzyme?
- (A) Parietal cells
 - (B) Oxyntic cells

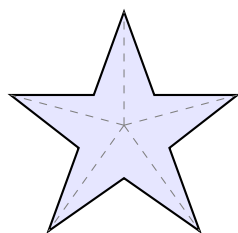


- (C) Chief cells
- (D) Goblet cells

Q14. The destructive disease known as "Loose Smut of Wheat" is categorized as a systemic infection where the grain heads are completely replaced by black, dusty spore masses. What is the correct name of its causative pathogen?

- (A) *Ustilago nuda tritici*
- (B) *Tilletia indica*
- (C) *Claviceps purpurea*
- (D) *Erysiphe graminis*

Q15. Which of the following features is exclusively shared by all members belonging to the Phylum Echinodermata?

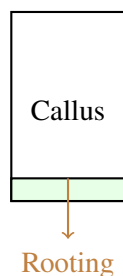


Pentaradial Symmetry

- (A) Bilateral symmetry in adult stages and a chitinous endoskeleton
- (B) Water vascular system and radial symmetry in adults
- (C) Metameric segmentation and a well-developed closed circulatory system
- (D) Schizocoelic coelom development and pseudopodia for locomotion

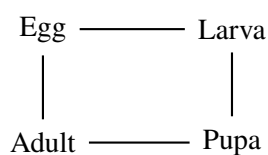
Q16. During the preparation of synthetic growth media for plant tissue culture experiments, which of the following combinations of phytohormones must be adjusted to have a high ratio of auxin relative to cytokinin in order to induce optimal morphogenesis?





- (A) Root initiation from the callus mass
- (B) Shoot differentiation from the explant
- (C) Complete inhibition of cell division activity
- (D) Premature senescence of the cultured tissue

Q17. In the life cycle of the Red Flour Beetle (*Tribolium castaneum*), a major stored grain pest in local warehouses, which developmental stage is directly responsible for causing extensive feeding damage and contaminating the flour with foul-smelling secretions?



- (A) The adult stage only
- (B) The egg stage only
- (C) Both the larval and adult stages
- (D) The pupal stage only

Q18. A distinct anatomical feature known as "Kranz Anatomy" is observed in the leaves of certain plants, which allows them to minimize photorespiration effectively under high temperature conditions. Which of the following crop plants possesses this leaf anatomy?

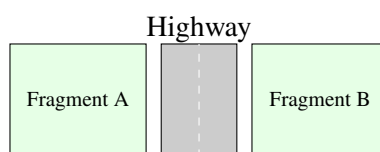


- (A) Rice (*Oryza sativa*)



- (B) Wheat (*Triticum aestivum*)
- (C) Maize (*Zea mays*)
- (D) Mustard (*Brassica campestris*)

Q19. Suppose an isolated population of an endangered deer species is located within a small wildlife sanctuary in Rajasthan. If a highway divides this habitat, restricting movement, which ecological threat is most likely to reduce the genetic fitness of this population over generations?



- (A) Competitive exclusion by invasive weeds
 - (B) Inbreeding depression due to habitat fragmentation
 - (C) Biomagnification of heavy metals in the food web
 - (D) Increased primary productivity of the ecosystem
- Q20.** What is the correct botanical name and primary economic classification of the widely grown oilseed crop commonly known as Sesamum or Til?
- (A) *Sesamum indicum*, Pedaliaceae
 - (B) *Ricinus communis*, Euphorbiaceae
 - (C) *Brassica nigra*, Brassicaceae
 - (D) *Helianthus annuus*, Asteraceae
- Q21.** Under conditions of acute physiological stress, such as a sudden drop in blood pressure or a perceived threat, the vertebrate endocrine system coordinates a rapid response. Which pair of hormones is released directly into the bloodstream by the adrenal medulla to mediate this "fight-or-flight" response?
- (A) Cortisol and Aldosterone
 - (B) Epinephrine and Norepinephrine
 - (C) Insulin and Glucagon



(D) Thyroxine and Triiodothyronine

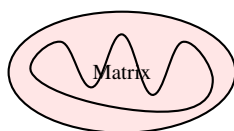
Q22. Transgenic Bt cotton varieties have been engineered to express specific insecticidal crystal proteins derived from the bacterium *Bacillus thuringiensis*. Against which group of destructive agricultural pests are these specific traits primarily targeted?

- (A) Root-knot nematodes
- (B) Sucking aphids and whiteflies
- (C) Lepidopteran bollworms
- (D) Plant-parasitic fungi

Q23. The devastating disease known as "Green Ear Disease" or Downy Mildew of Pearl Millet (Bajra) is a major constraint in Rajasthan's agriculture. Which of the following organisms causes this disease?

- (A) *Sclerospora graminicola*
- (B) *Sphacelia sorghi*
- (C) *Tolysporium penicillariae*
- (D) *Pyricularia oryzae*

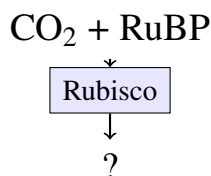
Q24. In the architectural hierarchy of a eukaryotic cell, which organelle is characterized by possessing its own double-stranded circular DNA molecule, 70S ribosomes, and is the site of the Citric Acid Cycle?



- (A) Rough Endoplasmic Reticulum
- (B) Golgi Apparatus
- (C) Mitochondrion
- (D) Lysosome



- Q25.** Which of the following physiological features is structurally unique to members of the Class Mammalia, distinguishing them from all other classes within the Subphylum Vertebrata?
- (A) Presence of a four-chambered heart
 - (B) Homeothermic regulation of internal body temperature
 - (C) Presence of mammary glands and a muscular diaphragm
 - (D) Excretion of nitrogenous wastes in the form of urea
- Q26.** Which of the following statements correctly explains the mechanism of the Integrated Pest Management (IPM) tool known as "Pheromone Trapping" used against the pink bollworm?
- (A) It introduces natural insect predators into the crop fields to consume the larval stages.
 - (B) It uses synthetic chemical formulations that directly kill insects upon contact with the cuticle.
 - (C) It utilizes synthetic sex attractants to disrupt mating cycles and monitor adult male moth populations.
 - (D) It alters the soil pH, making the crop roots toxic to boring larvae.
- Q27.** During the dark reactions of photosynthesis in C_3 plants, the initial fixation of carbon dioxide (CO_2) is catalyzed by the enzyme Rubisco. What is the immediate stable chemical product formed after this carboxylation step?



- (A) Oxaloacetic acid (OAA)
- (B) 3-Phosphoglyceric acid (3-PGA)
- (C) Phosphoenolpyruvate (PEP)
- (D) Ribulose-1,5-bisphosphate (RuBP)



Q28. The keystone tree species of the Thar Desert, *Prosopis cineraria* (Khejri), belongs to which of the following botanical families?

- (A) Fabaceae
- (B) Solanaceae
- (C) Malvaceae
- (D) Poaceae

Q29. In an ecological community, what type of biological interaction is demonstrated when epiphytic orchids grow on the branches of large mango trees to secure structural support without absorbing nutrients or causing harm to the tree?

Species A (Orchid)	→	(+)
Species B (Mango)	→	(0)

- (A) Mutualism
- (B) Parasitism
- (C) Amensalism
- (D) Commensalism

Q30. In the process of plant tissue culture, an unorganized, actively dividing mass of undifferentiated parenchymatous cells derived from an explant is known as:

- (A) Somatic embryo
- (B) Callus
- (C) Protoplast
- (D) Hybrid clone

Q31. Citrus Canker is a severe bacterial disease affecting citrus orchards across northwestern India, causing necrotic lesions on fruits, leaves, and twigs. How is this pathogen primarily transmitted from infected trees to healthy ones within an orchard?

- (A) Through wind-splashed rain droplets and mechanical pruning tools
- (B) By subterranean root-knot nematodes moving through dry soil



- (C) Through the feeding activity of specific aphid vectors during winter
- (D) By airborne fungal ascospores traveling long distances

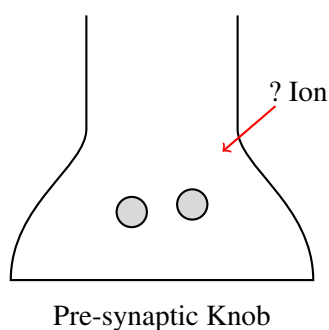
Q32. While examining a biological sample, a student notes the following characteristics: multicellular body structure, heterotrophic nutrition, lack of a rigid cell wall, absence of tissues, and a body wall perforated by numerous ostia leading into a central spongocoel.

- (A) Coelenterata
- (B) Porifera
- (C) Platyhelminthes
- (D) Annelida

Q33. Which of the following internal insect pests is notorious for boring into stored pulse seeds like chickpea (Gram) and green gram, leaving characteristic round exit holes in the seed coat?

- (A) *Corcyra cephalonica*
- (B) *Callosobruchus maculatus*
- (C) *Rhyzopertha dominica*
- (D) *Trogoderma granarium*

Q34. During the transmission of a nerve impulse across a chemical synapse, which specific ion must influx rapidly into the pre-synaptic axon terminal to trigger the exocytosis of neurotransmitter vesicles into the synaptic cleft?



- (A) Sodium (Na^+)



- (B) Potassium (K^+)
- (C) Calcium (Ca^{2+})
- (D) Chloride (Cl^-)

Q35. When a cell with an osmotic potential of -12 bars and a turgor pressure of $+4$ bars is placed in a solution with a water potential of -5 bars, what will be the direction of net water movement?

- (A) Water will move out of the cell because the cell's water potential is higher than the solution.
- (B) Water will move into the cell because the cell's water potential (-8 bars) is lower than the solution (-5 bars).
- (C) There will be no net movement of water because the system is already at dynamic equilibrium.
- (D) Water will move out of the cell because the turgor pressure pushes water molecules into the external environment.

Q36. Which of the following protected areas in Rajasthan is designated as a UNESCO World Heritage Site and is globally renowned for hosting thousands of migratory waterfowl, including the Siberian Crane?

- (A) Ranthambore National Park
- (B) Keoladeo Ghana National Park
- (C) Sariska Tiger Reserve
- (D) Desert National Park

Q37. Identify the major cash crop of India whose economic product consists of epidermal seed hairs, and which is botanically classified under the family Malvaceae.

- (A) Jute (*Corchorus capsularis*)
- (B) Cotton (*Gossypium hirsutum*)
- (C) Sunn hemp (*Crotalaria juncea*)



(D) Sugarcane (*Saccharum officinarum*)

Q38. In a molecular biology laboratory, a specific vector is required to clone large fragments of foreign DNA into plant cells using a natural tumor-inducing mechanism. Which of the following vectors is best suited for this application?

(A) pBR322 plasmid vector

(B) Ti plasmid of *Agrobacterium tumefaciens*

(C) Lambda (λ) phage vector

(D) Simian Virus 40 (SV40)

Q39. The disease known as "Tikka Disease of Groundnut", which causes dark brown circular spots surrounded by a yellow halo on leaves, is caused by which fungal pathogen genus?

(A) *Cercospora*

(B) *Fusarium*

(C) *Colletotrichum*

(D) *Helminthosporium*

Q40. Which of the following structural modifications is a characteristic adaptation found in the digestive tract of herbivorous vertebrates, such as ruminants, to facilitate the breakdown of complex structural plant cellulose?

(A) A highly simplified, short stomach with extremely high concentrations of proteolytic pepsin

(B) A multi-chambered stomach containing a symbiotic microbial flora of ciliates and bacteria

(C) A complete absence of the large intestine to speed up the passage of fibrous material

(D) Secretion of endogenous cellulase enzymes directly from the salivary glands



Detailed Solutions**Q1.****Solution**

Concept: Plant pathology principles in agriculture focus on identification of specific fungal pathogens based on symptomatic presentations on crop hosts, particularly members of the Brassicaceae family.

Solution: Step 1: Analyze the symptoms described by the farmer, which include the appearance of distinct white rust-like pustules on the leaves and structural deformities of the mustard crop.

Step 2: Identify the characteristic disease associated with these exact features in mustard, which is known as White Rust of Crucifers.

Step 3: Evaluate the causative organisms listed in the options. The obligate oomycete pathogen responsible for causing white rust in cruciferous hosts like mustard is *Albugo candida*.

Step 4: Differentiate from other options: *Puccinia graminis* causes black stem rust in wheat, *Xanthomonas oryzae* is a bacterium causing bacterial leaf blight in rice, and *Alternaria solani* causes early blight in solanaceous crops.

Step 5: Conclude that *Albugo candida* is the correct organism responsible for the observed white pustules and associated hypertrophy or hyperplastic deformities.

Final Answer:

Answer: (A)

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Q2.

Solution

Concept: Animal Kingdom taxonomic classification relies on distinguishing key anatomical markers and structural features that separate major invertebrate phyla, such as Annelida and Arthropoda.

Solution: Step 1: Examine the basic anatomical structures shared between Phylum Annelida and Phylum Arthropoda. Both groups exhibit a true coelom and metameric segmentation.

Step 2: Identify unique features that evolved specifically within Phylum Arthropoda to allow them to adapt to diverse ecological niches.

Step 3: Evaluate the option involving the exoskeleton and limbs. Arthropods are defined by the possession of a rigid chitinous exoskeleton that undergoes ecdysis, along with paired, jointed appendages.

Step 4: Contrast this with Annelids, which lack jointed appendages and a chitinous outer exoskeleton, possessing instead a hydrostatic skeleton and a closed circulatory system.

Step 5: Confirm that the combination of a chitinous exoskeleton and jointed limbs serves as the definitive diagnostic feature distinguishing arthropods from annelids.

Final Answer: Chitinous exoskeleton and jointed appendages

Answer: (C)

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Q3.

Solution

Concept: Recombinant DNA technology tools involve the sequential action of specific enzymes to manipulate DNA molecules, creating stable phosphodiester linkages between vector and foreign fragments.

Solution: Step 1: Trace the mechanical steps involved in inserting a target gene into a plasmid vector. The vector and the gene insert are first cleaved using restriction endonucleases to generate compatible ends.

Step 2: Identify the enzyme necessary to permanently seal the physical gaps between the adjacent nucleotides of the foreign DNA and the plasmid.

Step 3: Analyze the role of DNA Ligase. This enzyme catalyzes the formation of a covalent phosphodiester bond between the 3'-hydroxyl group of one nucleotide and the 5'-phosphate group of another.

Step 4: Eliminate other tools: EcoRI is a restriction enzyme that cuts DNA, DNA Polymerase I synthesizes new strands, and Alkaline Phosphatase removes terminal phosphate groups to prevent self-ligation.

Step 5: Establish that DNA Ligase is the specific molecular glue required for this enzymatic linkage step.

Final Answer: DNA Ligase

Answer: (B)

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Q4.

Solution

Concept: Plant physiological processes during the light-dependent phase of photosynthesis rely on a continuous supply of electrons to drive photophosphorylation and the reduction of electron carriers.

Solution: Step 1: Understand the mechanism of the Z-scheme of photosynthesis, where light absorption causes Photosystem II (P680) to eject high-energy electrons into an electron transport chain.

Step 2: Determine how the electron deficiency created at the reaction center of Photosystem II is remediated to keep the photosynthetic mechanism functioning continuously.

Step 3: Analyze the function of the Oxygen Evolving Complex (OEC), which is bound to the luminal side of the thylakoid membrane.

Step 4: The OEC splits water molecules (H_2O) into oxygen (O_2), protons (H^+), and electrons (e^-). These extracted electrons are directly transferred to the oxidized P680 reaction center.

Step 5: Conclude that splitting water molecules to replace lost electrons is the primary biological role of this complex.

Final Answer: To split water molecules, providing electrons to replace those lost by P680

Answer: (B)

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Q5.

Solution

Concept: Agricultural entomology focuses on identifying polyphagous insect pests in semi-arid zones like Rajasthan, based on their life cycle characteristics and feeding patterns.

Solution: Step 1: Note the key details given: the pest is highly polyphagous, destructive to multiple Kharif crops in Rajasthan, and has an incomplete metamorphic life cycle consisting of egg, multiple nymphal instars, and adult.

Step 2: Identify the type of metamorphosis. The presence of nymphal stages instead of larvae and pupae indicates hemimetabolous development.

Step 3: Evaluate the options based on their taxonomic group and life cycle. **Schistocerca gregaria** (the desert locust) matches this description, possessing nymphal instars and feeding heavily on foliage.

Step 4: Compare with other options: **Sitophilus oryzae**, **Tribolium castaneum**, and **Callosobruchus maculatus** are all beetles (Coleoptera) that exhibit holometabolous development with distinct larval and pupal stages, and are primarily stored grain pests.

Step 5: Conclude that **Schistocerca gregaria** is the correct answer.

Final Answer: Schistocerca gregaria

Answer: (B)

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Q6.

Solution

Concept: Vertebrate endocrine regulation of the reproductive system involves a tightly controlled feedback cascade between the hypothalamus, anterior pituitary gland, and gonadal tissues.

Solution: Step 1: Trace the normal hormonal pathway in the male reproductive system. Gonadotropin-Releasing Hormone (GnRH) stimulates the anterior pituitary to secrete Luteinizing Hormone (LH) and Follicle-Stimulating Hormone (FSH).

Step 2: Identify the specific target cells of LH within the testes, which are the interstitial Leydig cells located in the intertubular spaces.

Step 3: Determine the functional consequence of LH binding to Leydig cells, which is the synthesis and secretion of testosterone.

Step 4: Predict the impact of a selective block in LH secretion. Without LH stimulation, Leydig cells will fail to produce testosterone, disrupting spermatogenesis.

Step 5: Contrast this with FSH, which targets Sertoli cells to induce androgen-binding protein secretion; hence Sertoli cells are not the direct target of LH.

Final Answer: Leydig cells will fail to synthesize and secrete testosterone.

Answer: (C)

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Q7.

Solution

Concept: Ecosystem structural dynamics and trophic relationships are quantitatively represented via ecological pyramids of numbers, biomass, and energy across different biomes.

Solution: Step 1: Define the ecological pyramid configurations for a stable terrestrial grassland ecosystem located in a semi-arid zone.

Step 2: Analyze the pyramid of numbers, which charts the absolute count of individual organisms at each successive trophic level. In a grassland, numerous primary producers (grasses) support fewer herbivores, which support even fewer carnivores.

Step 3: This relationship results in a classic upright pyramid structure for numbers, where the base is broad and the apex is narrow.

Step 4: Evaluate the other options: the pyramid of energy can never be inverted in any stable ecosystem due to the second law of thermodynamics, and the pyramid of biomass in a grassland is upright, not inverted.

Step 5: Confirm that the pyramid of numbers is upright, demonstrating a progressive decrease in counts.

Final Answer: The pyramid of numbers is upright, showing a progressive decrease in individual counts at higher trophic levels.

Answer: (C)

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Q8.

Solution

Concept: Economic botany and medicinal plant classification require accurate knowledge of taxonomic families and corresponding botanical names of major cultivated species.

Solution: Step 1: Review the botanical classifications of the major economic and medicinal crops commonly grown in the semi-arid regions of Rajasthan.

Step 2: Examine option A: Ashwagandha is **Withania somnifera**, which belongs to the Solanaceae family, making the match with Fabaceae incorrect.

Step 3: Examine option B: Isabgol is **Plantago ovata**, which is a member of the Plantaginaceae family. This represents a correct botanical match.

Step 4: Examine options C and D: Aloe vera belongs to the Asphodelaceae/Liliaceae family, not Brassicaceae, and Safed Musli (**Chlorophytum borivillianum**) belongs to the Asparagaceae/Liliaceae family, not Solanaceae.

Step 5: Conclude that the pair matching Isabgol to Plantaginaceae is the only accurate classification.

Final Answer: Isabgol — Plantaginaceae

Answer: (B)

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Q9.

Solution

Concept: Biotechnological methods for nucleic acid isolation include standard biochemical protocols designed to change the solubility of DNA molecules within an aqueous lysate.

Solution: Step 1: Understand the chemical composition of a cellular lysate during DNA extraction. The solution contains dissolved proteins, polysaccharides, RNA, and genomic DNA.

Step 2: Identify the purpose of the final step, which involves the addition of ice-cold or chilled ethanol or isopropanol to the mixture.

Step 3: Because DNA is a highly polar molecule due to its phosphate backbone, it remains soluble in hydrophilic aqueous environments.

Step 4: The addition of chilled ethanol decreases the dielectric constant of the solvent, causing the dissolved DNA molecules to aggregate and precipitate out of the solution as visible threads.

Step 5: Verify that the specific purpose of the chilled ethanol is to precipitate the purified DNA from the aqueous medium.

Final Answer: To precipitate the purified DNA out of the aqueous solution

Answer: (B)

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Q10.

Solution

Concept: Plant kingdom classification relies on distinguishing characteristics such as vascular tissue organization, seed structural exposure, and specialized symbiotic adaptations.

Solution: Step 1: Extract the diagnostic features provided in the problem: heterosporous, vascular tissue present, seeds are naked (not enclosed in an ovary), compound or simple leaves, and coralloid roots with nitrogen-fixing cyanobacteria.

Step 2: Analyze the term "naked seeds". The absence of an ovary wall wrapping the ovules is the defining evolutionary hallmark of Gymnosperms.

Step 3: Correlate the root adaptation. Genera like *Cycas* possess specialized coralloid roots that harbor symbiotic cyanobacteria (*Anabaena cycadeae*) for nitrogen fixation.

Step 4: Eliminate other groups: Bryophytes lack vascular tissue and seeds, Pteridophytes have vascular tissue but do not produce seeds, and Angiosperms produce enclosed seeds within fruits.

Step 5: Confirm that the plant group described is Gymnosperms.

Final Answer:

Answer: (C)

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Q11.

Solution

Concept: Agricultural microbiology and bio-fertilizer applications involve utilizing symbiotic relationships between nitrogen-fixing microorganisms and specific plant hosts to improve crop yields.

Solution: Step 1: Note the specific parameters given in the question: a bio-fertilizer composed of a symbiotic association involving cyanobacteria living within the leaf cavities of a floating aquatic fern.

Step 2: Identify the floating aquatic fern genus, which is *Azolla*.

Step 3: Recall the specific cyanobacterial endosymbiont that populates the dorsal leaf cavities of this fern, which is *Anabaena azollae*.

Step 4: This *Azolla*–*Anabaena* complex fixes atmospheric nitrogen highly efficiently in waterlogged conditions, making it an ideal green bio-fertilizer for paddy (rice) cultivation.

Step 5: Match this with option C, ruling out free-living or rhizospheric nitrogen fixers like *Azotobacter*, *Azospirillum*, or root-nodulating *Rhizobium*.

Final Answer:

Answer: (C)

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Q12.

Solution

Concept: Environmental conservation strategies are divided into in-situ (on-site) and ex-situ (off-site) approaches depending on where the protection of biological diversity occurs.

Solution: Step 1: Analyze the historical conservation events mentioned: the Chipko Movement and the sacrifice of Amrita Devi Bishnoi to protect *Prosopis cineraria* (Khejri) trees in their natural habitat.

Step 2: Determine if these methods involve moving organisms to an artificial setting or protecting them within their native ecosystems. Since the organisms are protected where they naturally grow, it is an in-situ mechanism.

Step 3: Characterize the driving force of these movements, which were led entirely by local human communities acting as protectors of their native forests.

Step 4: Match this pattern to "In-situ community-led biodiversity conservation," which highlights public participation in protecting indigenous flora.

Step 5: Eliminate ex-situ strategies such as seed banking or cryopreservation, which occur outside natural environments.

Final Answer:

Answer: (B)

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Q13.

Solution

Concept: Vertebrate digestive physiology relies on specialized cellular distributions within the gastric mucosal glands to secrete specific enzymes and acid activators.

Solution: Step 1: Identify the cell types located within the functional unit of the gastric pits in the vertebrate stomach wall.

Step 2: Recall the nature of pepsinogen, which is an inactive zymogen or proenzyme requiring an acidic environment (HCl) to be cleaved into its active proteolytic form, pepsin.

Step 3: Identify the specific cells responsible for synthesizing and releasing this zymogen. Chief cells, also called peptic cells or zymogenic cells, secrete pepsinogen.

Step 4: Differentiate from other gastric gland cells: Parietal or oxyntic cells secrete hydrochloric acid and intrinsic factor, while goblet cells produce protective mucus.

Step 5: Conclude that chief cells are the source of the inactive proenzyme pepsinogen.

Final Answer:

Answer: (C)

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Q14.

Solution

Concept: Plant pathology and crop disease identification focus on classifying fungal pathogens that cause systemic floral infections in cereal crops.

Solution: Step 1: Analyze the specific diagnostic signs of the disease called "Loose Smut of Wheat." The primary symptom is the replacement of normal healthy grain heads with black, powdery masses of fungal teliospores.

Step 2: Identify the class of fungi responsible for smut diseases, which belong to the Basidiomycota, specifically the genus *Ustilago*.

Step 3: Evaluate the specific fungal pathogen variety that targets wheat (*Triticum aestivum*). The precise causative pathogen name is *Ustilago nuda tritici*.

Step 4: Compare with other options: *Tilletia indica* causes Karnal bunt of wheat, *Claviceps purpurea* causes ergot of rye, and *Erysiphe graminis* causes powdery mildew.

Step 5: Select *Ustilago nuda tritici* as the correct causative agent.

Final Answer:

Answer: (A)

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Q15.

Solution

Concept: Invertebrate taxonomy relies on identifying unique morphological traits that define a phylum exclusively, separating its members from all other animal groups.

Solution: Step 1: Examine the definitive biological traits associated with Phylum Echinodermata. This phylum consists entirely of marine organisms.

Step 2: Analyze their structural symmetry. While echinoderm larvae possess bilateral symmetry, adult echinoderms exhibit a distinctive radial (specifically pentaradial) symmetry.

Step 3: Identify the unique internal physiological structure characteristic of this phylum, which is the water vascular (ambulacral) system used for locomotion, respiration, and food capture.

Step 4: Evaluate the options to find the one combining these traits. Option B accurately couples the water vascular system with adult radial symmetry.

Step 5: Rule out options containing chitinous skeletons (Arthropoda) or metameric segmentation with closed circulation (Annelida).

Final Answer:

Answer: (B)

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Q16.

Solution

Concept: Plant biotechnology and tissue culture principles utilize shifting ratios of phytohormones to guide organogenesis from undifferentiated cell masses.

Solution: Step 1: Recall the classical experiments on morphogenesis conducted by Skoog and Miller, which demonstrated that organ differentiation in a callus culture is governed by the relative concentrations of auxins and cytokinins.

Step 2: Analyze the specific ratio configuration presented in the prompt, which specifies a high concentration of auxin relative to cytokinin.

Step 3: Determine the physiological effect of this high auxin-to-cytokinin ratio. High auxin levels promote the differentiation and initiation of roots from the unorganized callus mass (rhizogenesis).

Step 4: Contrast this with the opposite configuration: a low auxin-to-cytokinin ratio promotes shoot differentiation (caulogenesis), while balanced levels promote unorganized callus growth.

Step 5: Conclude that root initiation from the callus mass is the correct outcome.

Final Answer:

Answer: (A)

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Q17.

Solution

Concept: Economic entomology of stored product pests involves tracking the biology, life cycle stages, and damage characteristics of insects infesting post-harvest commodities.

Solution: Step 1: Analyze the pest species identified: the Red Flour Beetle, scientifically named *Tribolium castaneum*, which commonly infests stored flour and milled grains.

Step 2: Determine its developmental lineage. Being a member of the order Coleoptera, it undergoes complete metamorphosis (holometabolous lifecycle: egg, larva, pupa, adult).

Step 3: Evaluate which structural stages possess functional mouthparts capable of chewing and consuming stored flour products. Both the active larval stages and the long-lived adult beetles feed on the product.

Step 4: Both stages contribute to economic loss by directly devouring the food supply and contaminating it with toxic, foul-smelling benzoquinones.

Step 5: Conclude that both the larval and adult stages are directly responsible for causing this damage.

Final Answer:

Answer: (C)

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Q18.

Solution

Concept: Plant anatomy and photosynthetic adaptations differentiate C_3 and C_4 pathways based on cellular spatial organization within the leaf tissue.

Solution: Step 1: Define "Kranz Anatomy." It is a specialized leaf structure where vascular bundles are surrounded by a concentric ring of large bundle sheath cells, which are further surrounded by mesophyll cells.

Step 2: Identify the carbon fixation pathway associated with Kranz anatomy. This spatial arrangement is characteristic of C_4 plants, allowing them to isolate Rubisco from high oxygen concentrations, minimizing photorespiration.

Step 3: Screen the listed crop plants to identify which species utilizes the C_4 photosynthetic pathway. Maize (*Zea mays*) is a well-known tropical C_4 grass.

Step 4: Evaluate the remaining choices: Rice, wheat, and mustard are all classic temperate or subtropical C_3 plants that lack Kranz anatomy and exhibit significant photorespiration.

Step 5: Select Maize as the correct crop plant showing this anatomical adaptation.

Final Answer: Maize (Zea mays)

Answer: (C)

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Q19.

Solution

Concept: Conservation biology and population genetics analyze the impact of physical barriers on genetic exchange within small, isolated wildlife populations.

Solution: Step 1: Analyze the situation described: a small, isolated population of an endangered deer species becomes divided into two separate, non-overlapping sub-populations by a highway barrier.

Step 2: Identify the ecological term for this phenomenon, which is habitat fragmentation.

Step 3: Evaluate the genetic consequences of cutting off gene flow between small populations. When population sizes shrink and individuals are forced to mate with close relatives, homozygosity increases.

Step 4: This accumulation of deleterious recessive alleles leads directly to a decline in fertility, survival, and overall biological fitness, a condition known as inbreeding depression.

Step 5: Match this sequence of events with option B, which correctly attributes the threat to inbreeding depression stemming from fragmentation.

Final Answer: Inbreeding depression due to habitat fragmentation

Answer: (B)

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Q20.

Solution

Concept: Economic botany requires matching commercial field crops with their verified binomial scientific nomenclature and taxonomic family classifications.

Solution: Step 1: Focus on the specific agricultural crop given, which is Sesamum or Til, an important oilseed crop grown widely during the Kharif season in arid and semi-arid regions of India.

Step 2: Identify the correct botanical genus and species name for Til. The valid binomial name is **Sesamum indicum**.

Step 3: Determine the taxonomic family assignment for this genus. The genus **Sesamum** is classified within the family Pedaliaceae.

Step 4: Evaluate the alternative options provided: **Ricinus communis** belongs to Euphorbiaceae (Castor), **Brassica nigra** belongs to Brassicaceae (Black Mustard), and **Helianthus annuus** belongs to Asteraceae (Sunflower).

Step 5: Conclude that option A correctly pairs the botanical name and family for the Til crop.

Final Answer: Sesamum indicum, Pedaliaceae

Answer: (A)

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Q21.

Solution

Concept: Vertebrate endocrinology involves identifying the tissue origins and physiological roles of hormones during acute homeostatic disruptions or stress events.

Solution: Step 1: Identify the endocrine organ responsible for managing acute physiological stress, which is the adrenal gland located superior to the kidneys.

Step 2: Divide the adrenal gland into its two structural zones: the outer adrenal cortex and the inner adrenal medulla.

Step 3: Recall the secretions of the inner adrenal medulla. It synthesizes and secretes catecholamines directly into circulation under stimulation from the sympathetic nervous system.

Step 4: Identify these specific catecholamines, which are Epinephrine (adrenaline) and Norepinephrine (noradrenaline). They accelerate heart rate, elevate blood glucose, and divert blood flow to muscles during a "fight-or-flight" response.

Step 5: Differentiate from corticoids like cortisol/aldosterone (cortex), insulin/glucagon (pancreas), or thyroxine (thyroid).

Final Answer: Epinephrine and Norepinephrine

Answer: (B)

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Q22.

Solution

Concept: Agricultural biotechnology uses transgenic expressions of bacterial endotoxins to target specific orders of destructive insect pests damaging commercial field crops.

Solution: Step 1: Analyze the design of transgenic Bt cotton. It contains genes isolated from the soil bacterium *Bacillus thuringiensis* that code for specific crystalline (Cry) endotoxins.

Step 2: Understand the physiological mechanism of these Cry proteins. Once ingested by a susceptible insect, the alkaline environment of the insect midgut solubilizes and activates the toxin, creating pores in the epithelial lining.

Step 3: Identify the specific agricultural pest group most destructive to cotton that is highly sensitive to these Cry proteins. These are the larvae of lepidopteran insects, commonly called bollworms (e.g., *Helicoverpa armigera*).

Step 4: Note that standard Bt cotton configurations do not target sucking pests like aphids or whiteflies, nor do they target nematodes or fungi.

Step 5: Select lepidopteran bollworms as the target group.

Final Answer:

Answer: (C)

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Q23.

Solution

Concept: Crop disease epidemiology focuses on matching endemic fungal and oomycete pathogens with specific diseases affecting major cereal crops like pearl millet.

Solution: Step 1: Identify the diagnostic signs of "Green Ear Disease" or Downy Mildew affecting Pearl Millet (Bajra), a critical staple crop in Rajasthan. The disease converts floral parts into green, leaf-like structures, rendering the ear sterile.

Step 2: Review the taxonomic classifications of pathogens known to induce downy mildews, which are oomycetes that cause systemic infections.

Step 3: Identify the specific pathogen genus that targets pearl millet. The obligate oomycete responsible for this disease is *Sclerospora graminicola*.

Step 4: Examine the alternative choices: *Sphacelia sorghi* is linked to ergot of sorghum, *Tolysporium penicillariae* causes grain smut of bajra, and *Pyricularia oryzae* causes blast disease in rice.

Step 5: Conclude that *Sclerospora graminicola* is the correct causative organism.

Final Answer:

Answer: (A)

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Q24.

Solution

Concept: Cell biology and organelle autonomy focus on identifying specific cytoplasmic structures that contain independent genetic machinery and coordinate metabolic pathways.

Solution: Step 1: Analyze the structural criteria listed in the prompt: a eukaryotic organelle containing its own double-stranded circular DNA, prokaryotic-like 70S ribosomes, and hosting the enzymes for the Citric Acid Cycle.

Step 2: Associate the Citric Acid Cycle (also known as the Krebs Cycle or Tricarboxylic Acid Cycle) with its precise subcellular site, which is the matrix of the mitochondrion.

Step 3: Correlate this with the endosymbiotic theory, which states that mitochondria evolved from ancestral prokaryotes, explaining why they retain circular DNA and 70S ribosomes.

Step 4: Evaluate the alternatives: the rough endoplasmic reticulum and Golgi apparatus lack circular DNA and do not run the Krebs cycle, while lysosomes contain hydrolytic enzymes.

Step 5: Confirm that the mitochondrion is the organelle matching all criteria.

Final Answer:

Answer: (C)

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Q25.

Solution

Concept: Vertebrate taxonomy involves identifying unique anatomical and physiological features that characterize a class exclusively, differentiating it from other classes.

Solution: Step 1: Evaluate the key characteristics of Class Mammalia within the Subphylum Vertebrata.

Step 2: Examine option A: a four-chambered heart is present in mammals, but it is also shared with birds (Class Aves) and crocodilians, meaning it is not unique to mammals.

Step 3: Examine option B: homeothermy (warm-blooded regulation) is shared by both mammals and birds, so it cannot serve as an exclusive identifier for mammals.

Step 4: Examine option C: the presence of specialized milk-producing mammary glands to nourish newborns, along with a muscular diaphragm separating the thoracic and abdominal cavities, are diagnostic features found only in mammals.

Step 5: Conclude that option C represents the unique suite of features diagnostic of mammals.

Final Answer:

Answer: (C)

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Q26.

Solution

Concept: Integrated Pest Management (IPM) practices utilize species-specific behavioral disruptions to manage insect pest populations without relies solely on chemical applications.

Solution: Step 1: Understand the biological basis of "Pheromone Trapping" as applied in modern IPM schedules against destructive lepidopteran larvae like the pink bollworm.

Step 2: Define pheromones. They are chemical signals released by insects to communicate with members of the same species, often to attract mates.

Step 3: Analyze how synthetic pheromones are utilized in fields. Traps are baited with synthetic female sex pheromones to attract and capture adult male moths.

Step 4: This action prevents successful mating cycles, reducing the number of fertile eggs laid, while allowing farmers to monitor pest density to time other interventions.

Step 5: Match this description with option C, which correctly identifies the disruption of mating cycles and population monitoring.

Final Answer: It utilizes synthetic sex attractants to disrupt mating cycles and monitor adult male moth populations.

Answer: (C)

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Q27.

Solution

Concept: Plant biochemistry of the Calvin Cycle (C_3 pathway) involves analyzing sequential carbon fixation steps to track intermediate and stable enzymatic products.

Solution: Step 1: Follow the initial reaction step of the Calvin Cycle occurring in the chloroplast stroma of a standard C_3 plant.

Step 2: The primary carbon dioxide acceptor molecule is Ribulose-1,5-bisphosphate (RuBP), a 5-carbon sugar.

Step 3: The enzyme Rubisco catalyzes the carboxylation of this RuBP molecule by binding one molecule of atmospheric CO_2 . This forms an unstable 6-carbon intermediate.

Step 4: This unstable intermediate is immediately cleaved into two molecules of a stable 3-carbon compound known as 3-Phosphoglyceric acid (3-PGA).

Step 5: Because the first stable product contains three carbon atoms, the pathway is named the C_3 pathway, identifying 3-PGA as the correct product.

Final Answer: 3-Phosphoglyceric acid (3-PGA)

Answer: (B)

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Q28.

Solution

Concept: Economic botany and desert ecology require precise taxonomic matching of indigenous regional tree species with their botanical families.

Solution: Step 1: Identify the target plant species, *Prosopis cineraria*, known locally as Khejri, which is the state tree of Rajasthan and serves as an important keystone species in the Thar Desert. Step 2: Analyze its structural features. It is a deep-rooted, nitrogen-fixing woody tree that produces seed pods.

Step 3: Determine its taxonomic family assignment based on its floral morphology and pod production. The genus *Prosopis* is classified under the family Fabaceae (specifically within the traditional subfamily Mimosoideae).

Step 4: Eliminate alternative options: Solanaceae consists primarily of herbaceous nightshades, Malvaceae includes mallows and cotton, and Poaceae contains the true agricultural grasses.

Step 5: Select Fabaceae as the correct botanical family for Khejri.

Final Answer:

Answer: (A)

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Q29.

Solution

Concept: Community ecology and biological interactions classify relationships between co-existing species based on whether the outcomes are positive, negative, or neutral.

Solution: Step 1: Analyze the specific biological interaction details provided: epiphytic orchids growing on the sturdy branches of large mango trees.

Step 2: Determine the impact on the orchid (Species A). The orchid gains a favorable position high in the canopy to access sunlight and air, resulting in a positive benefit (+).

Step 3: Determine the impact on the host mango tree (Species B). Since the epiphyte is non-parasitic and does not extract nutrients or moisture from the tree's vascular system, the tree is unaffected (0).

Step 4: Identify the ecological term for an interaction where one species benefits while the other remains entirely unaffected. This relationship is defined as Commensalism.

Step 5: Contrast this with Mutualism (both benefit), Parasitism (one harmed), or Amensalism (one harmed, one unaffected).

Final Answer:

Answer: (D)

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Q30.

Solution

Concept: Plant tissue culture terminology defines structural stages of cell differentiation and proliferation occurring within in-vitro growth media.

Solution: Step 1: Review the laboratory steps involved in initiating a micropropagation or plant tissue culture experiment. An excised tissue piece, called an explant, is placed on a nutrient-rich agar medium containing specific phytohormones.

Step 2: Identify the term for the unorganized, structural mass of actively dividing, undifferentiated cells that forms as a response to wound healing and hormonal stimulation.

Step 3: This undifferentiated parenchymatous tissue mass is called a callus.

Step 4: Differentiate from other terms: a somatic embryo is a organized bipolar structure, a protoplast is a cell stripped of its cell wall, and a clone is an identical genetic copy.

Step 5: Conclude that a callus is the correct term for this cell mass.

Final Answer:

Answer: (B)

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Q31.

Solution

Concept: Plant bacteriology and epidemiology study transmission vectors and physical pathways that spread bacterial infections inside orchard ecosystems.

Solution: Step 1: Identify the pathogen responsible for Citrus Canker, which is the rod-shaped bacterium *Xanthomonas citri*.

Step 2: Analyze the nature of the disease symptoms, which manifest as raised, corky, necrotic lesions on leaves, stems, and citrus fruits.

Step 3: Determine how these bacterial cells move from infected tissues to establish new infections within an orchard. Bacteria require a liquid medium to move across plant surfaces.

Step 4: The primary epidemiological pathways are wind-blown rain splashes, which physically carry bacterial cells to nearby trees, and the mechanical use of contaminated pruning tools by workers.

Step 5: Match this mode of spread with option A, ruling out options that involve insect vectors like aphids or fungal spores.

Final Answer:

Answer: (A)

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Q32.

Solution

Concept: Invertebrate classification utilizes fundamental body architecture criteria, such as cellular organization level and the presence of specialized pore systems, to identify a phylum.

Solution: Step 1: Systematically list the anatomical characteristics observed in the sample: multicellular, heterotrophic, lacks a rigid cell wall, lacks true tissue organization, and possesses a body wall perforated by microscopic pores called ostia that lead into a spongocoel.

Step 2: Use the absence of true tissues to narrow the search. The cellular level of organization coupled with a porous body plan is the defining characteristic of Phylum Porifera (sponges).

Step 3: Verify the water flow path: water enters through numerous ostia into the central spongocoel cavity and exits via a larger opening called the osculum.

Step 4: Eliminate alternative phyla: Coelenterata exhibits tissue-level organization, while Platyhelminthes and Annelida possess organ and organ-system levels of organization.

Step 5: Confirm that the animal sample belongs to Phylum Porifera.

Final Answer:

Answer: (B)

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Q33.

Solution

Concept: Post-harvest entomology focuses on identifying internal grain and pulse pests based on host plant preferences and distinct structural damage patterns.

Solution: Step 1: Analyze the specific diagnostic clues provided: an internal insect pest that targets stored leguminous pulse seeds like chickpea (Gram) and green gram, creating neat circular exit holes in the seed coat.

Step 2: Recognize the group of insects known as pulse beetles, which belong to the family Chrysomelidae.

Step 3: Identify the correct scientific name for the cowpea/pulse beetle. The major pest species responsible for this damage is **Callosobruchus maculatus**.

Step 4: Compare with other options: **Corcyra cephalonica** is the rice moth (Lepidoptera), **Rhyzopertha dominica** is the lesser grain borer targeting cereals, and **Trogoderma granarium** is the Khapra beetle, which prefers wheat grains.

Step 5: Select **Callosobruchus maculatus** as the correct pulse-boring pest.

Final Answer:

Answer: (B)

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Q34.

Solution

Concept: Vertebrate neurophysiology tracks the ion fluxes that control electrochemical signaling along axons and across chemical synapses.

Solution: Step 1: Trace the physiological events that occur when an action potential propagates down an axon and arrives at the pre-synaptic bulb.

Step 2: The depolarization of the pre-synaptic membrane activates voltage-gated calcium channels embedded within the membrane.

Step 3: Determine the direction of ion movement. Because the extracellular concentration of calcium is higher than the intracellular level, calcium ions (Ca^{2+}) rapidly influx into the axon terminal.

Step 4: This sudden elevation of intracellular calcium triggers synaptic vesicles containing neurotransmitters to fuse with the pre-synaptic membrane, releasing their contents into the synaptic cleft via exocytosis.

Step 5: Establish that calcium (Ca^{2+}) is the specific ion required to trigger this exocytosis step.

Final Answer: Calcium (Ca^{2+})

Answer: (C)

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Q35.

Solution

Concept: Plant water relations use thermodynamic equations to determine the water potential (Ψ_w) of cells, which dictates the direction of spontaneous water movement.

Solution: Step 1: Recall the core water potential formula for a plant cell: $\Psi_w = \Psi_s + \Psi_p$, where Ψ_s is the solute (osmotic) potential and Ψ_p is the turgor (pressure) potential.

Step 2: Calculate the internal water potential of the plant cell using the values provided: $\Psi_s = -12$ bars and $\Psi_p = +4$ bars. This yields:

$$\Psi_w = -12 + 4 = -8 \text{ bars}$$

Step 3: Identify the water potential of the surrounding external solution, which is given as -5 bars.

Step 4: Determine the rule governing net water movement. Water always moves spontaneously from an area of higher water potential (less negative) to an area of lower water potential (more negative).

Step 5: Compare the values: -5 bars (solution) is higher than -8 bars (cell). Therefore, net water movement will occur from the solution into the cell, matching option B.

Final Answer: Water will move into the cell because the cell's water potential (-8 bars) is lower than the solution (-5 bars).

Answer: (B)

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Q36.

Solution

Concept: Environmental geography and wildlife conservation involve identifying protected areas based on international recognition status and specific faunal protection profiles.

Solution: Step 1: Review the prominent wildlife sanctuaries and national parks located within the state of Rajasthan.

Step 2: Focus on the specific criteria listed: designated as a UNESCO World Heritage Site and globally recognized as an important wintering ground for migratory waterfowl like the Siberian Crane.

Step 3: Evaluate Keoladeo Ghana National Park, situated in Bharatpur. This wetland ecosystem was inscribed as a UNESCO World Heritage site due to its immense avian diversity and role as a migratory flyway hub.

Step 4: Contrast with other sites: Ranthambore and Sariska are primarily terrestrial tiger reserves, and Desert National Park protects semi-arid fauna like the Great Indian Bustard.

Step 5: Conclude that Keoladeo Ghana National Park is the correct protected area matching all criteria.

Final Answer: Keoladeo Ghana National Park

Answer: (B)

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Q37.

Solution

Concept: Economic botany requires linking agricultural industrial fiber crops with their unique anatomical source products and taxonomic families.

Solution: Step 1: Identify the economic product described: epidermal seed hairs used as an important textile fiber worldwide.

Step 2: Determine the plant genus that produces fibers as outgrowths from the seed coat. This is characteristic of cotton plants.

Step 3: Review the botanical name and family classification for cultivated cotton. The major cultivated species is *Gossypium hirsutum*, and it belongs to the family Malvaceae.

Step 4: Check alternative options: Jute (*Corchorus capsularis*) and Sunn hemp (*Crotalaria juncea*) produce bast (phloem) fibers from their stems, not seed hairs, and sugarcane belongs to the Poaceae family.

Step 5: Confirm that Cotton (*Gossypium hirsutum*) matching Malvaceae is the correct choice.

Final Answer: Cotton (*Gossypium hirsutum*)

Answer: (B)

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Q38.

Solution

Concept: Plant biotechnology vectors utilize specialized bacterial plasmids capable of integrating foreign genetic sequences into host plant genomes via natural infection mechanisms.

Solution: Step 1: Identify the requirements for the molecular vector: must clone large fragments into plant cells and must operate via a natural tumor-inducing or transferring mechanism.

Step 2: Recall the soil bacterium *Agrobacterium tumefaciens*, often described as nature's genetic engineer due to its ability to transfer a segment of its plasmid into host plant cells.

Step 3: Identify the specific plasmid involved, which is the Tumor-inducing (Ti) plasmid. The modified, disarmed versions of this Ti plasmid are widely used as cloning vectors for plant transformation.

Step 4: Eliminate other vectors: pBR322 is a standard bacterial plasmid vector, Lambda is a bacteriophage for cloning in *E. coli*, and SV40 is a virus vector used for mammalian cell systems.

Step 5: Select the Ti plasmid of *Agrobacterium tumefaciens* as the correct answer.

Final Answer: Ti plasmid of *Agrobacterium tumefaciens*

Answer: (B)

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Q39.

Solution

Concept: Crop disease identification and mycology involve matching common economic plant diseases with the correct fungal genera responsible for the infection.

Solution: Step 1: Analyze the specific diagnostic symptoms: "Tikka Disease of Groundnut," which produces characteristic dark brown circular spots with yellow halos on the leaves of peanut crops.

Step 2: Recall the fungal pathogen group responsible for causing tikka or leaf spot disease in groundnuts (*Arachis hypogaea*).

Step 3: The disease is caused by species belonging to the deuteromycete genus *Cercospora* (specifically *Cercospora personata* and *Cercospora arachidicola*).

Step 4: Evaluate alternative fungal genera: *Fusarium* is typically associated with vascular wilts, *Colletotrichum* causes anthracnose diseases, and *Helminthosporium* causes leaf blights in cereals.

Step 5: Conclude that *Cercospora* is the correct genus responsible for Tikka disease.

Final Answer: Cercospora

Answer: (A)

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Q40.

Solution

Concept: Vertebrate comparative anatomy examines structural modifications in the digestive tracts of animals to understand how they adapt to specific dietary regimes.

Solution: Step 1: Analyze the target group: herbivorous ruminants (e.g., cattle, sheep) whose primary diet consists of fibrous plant material rich in complex structural cellulose.

Step 2: Note that higher vertebrates lack endogenous genes encoding cellulase enzymes required to break the beta-1,4-glycosidic bonds of cellulose.

Step 3: Identify the evolutionary adaptation that overcomes this limitation: a complex, multi-chambered stomach (comprising the rumen, reticulum, omasum, and abomasum).

Step 4: The largest chamber, the rumen, functions as a large fermentation vat housing an extensive symbiotic microbial flora of anaerobic bacteria and ciliates that ferment cellulose into volatile fatty acids.

Step 5: Select option B as the choice that accurately describes this multi-chambered stomach and its symbiotic microbial mechanism.

Final Answer: A multi-chambered stomach containing a symbiotic microbial flora of ciliates and bacteria

Answer: (B)

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Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	C	3	B	4	B	5	B
6	C	7	C	8	B	9	B	10	C
11	C	12	B	13	C	14	A	15	B
16	A	17	C	18	C	19	B	20	A
21	B	22	C	23	A	24	C	25	C
26	C	27	B	28	A	29	D	30	B
31	A	32	B	33	B	34	C	35	B
36	B	37	B	38	B	39	A	40	B

