UPCATET Agriculture Zoology Sample Paper-9

Duration: 20 Minutes **Maximum Marks: 100**

Instructions

- This paper contains **25** Multiple Choice Questions.
- Each correct answer carries **+4** mark. Incorrect answer: **−1** marks. Only **one** correct option.
- Unattempted questions carry **0** marks.
- Use of mobile phones, smartwatches, or any electronic gadgets is strictly prohibited.

Q1. Which of the following insect pests belongs to the order Orthoptera and is known for forming massive, devastating swarms that cause catastrophic damage to green vegetation and agricultural fields across arid regions?

(A) Desert Locust (Schistocerca gregaria)

(B) Sugarcane Pyrilla (Pyrilla perpusilla)

(C) Mustard Aphid (Lipaphis erysimi)

(D) Rice Gundhi Bug (Leptocorisa varicornis)

Q2. In the anatomical organization of the earthworm (Pheretima posthuma), the prominent muscular gizzard, which plays a vital role in grinding soil particles and organic debris, is located in which of the following body segments?

(A) Segments 5–7

(B) Segments 8–9

(C) Segments 11–13

(D) Segments 14–16

Q3. The phase in the life cycle of the Desert Locust characterized by solitary behavior, low respiration rate, and a predominantly greenish or sandy color matching the background environment is known as the:

(A) Gregarious phase

(B) Migratory phase

(C) Solitary phase

(D) Transient phase

Q4. Which of the following phyla contains triploblastic, pseudocoelomate animals, many of which are parasitic on economically important crops and are commonly referred to as roundworms or root-knot nematodes?

(A) Platyhelminthes

(B) Aschelminthes (Nematoda)

(C) Annelida

(D) Arthropoda

Q5. The specialized type of animal tissue that forms the inner lining of blood vessels, lymph vessels, and alveoli of lungs, facilitating the rapid diffusion of gases and nutrients, is:

(A) Simple cuboidal epithelium

(B) Simple squamous epithelium

(C) Stratified squamous epithelium

(D) Ciliated columnar epithelium

Q6. Termites (Odontotermes obesus) possess a symbiotic relationship with specific microorganisms in their gut to digest cellulose present in dead wood and crop residues. These symbiotic microorganisms are primarily:

(A) Cyanobacteria

(B) Flagellated protozoans (e.g., Trichonympha)

(C) Methanogenic archaebacteria

(D) Endophytic fungi

Q7. In the circulatory system of the cockroach (Periplaneta americana), how many pairs of funnel-shaped chambers with ostia make up the elongated, muscular heart situated along the mid-dorsal line of the thorax and abdomen?

(A) 9 pairs

(B) 10 chambers total

(C) 13 chambers total

(D) 5 pairs

Q8. Earthworms are widely considered "friends of farmers" in agricultural ecosystems because their burrowing and feeding activities directly lead to:

(A) Increasing the soil pH towards highly alkaline levels

(B) Enhancing soil aeration, water infiltration, and mixing humic substances

(C) Eradicating pathogenic fungi and predatory soil nematodes

(D) Decreasing the water-holding capacity of topsoil to avoid waterlogging

Q9. Which cell organelle is known as the "protein factory" of both animal and plant cells, consists of RNA and proteins, and lacks any surrounding membrane boundary?

(A) Lysosome

(B) Ribosome

(C) Peroxisome

(D) Centrosome

Q10. The dynamic process of "casting" in earthworms refers to the excretion of undigested soil and organic residues. These castings are highly beneficial for crop growth because they are rich in:

(A) Available nitrogen, phosphorus, potassium, and beneficial soil microbes

(B) Heavy metals that retard weed development

(C) Synthetic growth hormones like gibberellins

(D) Calcium carbonate deposits that solidify sandy soils

Q11. Which of the following insect pests causes significant economic damage to cruciferous crops (like mustard, cabbage, and cauliflower) by sucking cell sap from leaves and inflorescences, leading to curling and yellowing of foliage?

(A) Lipaphis erysimi (Mustard Aphid)

(B) Helicoverpa armigera (Cotton Bollworm)

(C) Sitophilus oryzae (Rice Weevil)

(D) Leucinodes orbonalis (Brinjal Shoot and Fruit Borer)

Q12. Animals belonging to the Phylum Mollusca that are highly relevant to farm aquatic environments, such as apple snails (Pila globosa), serve what dual significance in agricultural biology?

(A) They serve as vector hosts for certain livestock trematode parasites and can act as agricultural pests of young rice seedlings

(B) They fix atmospheric nitrogen in deep-water paddy fields

(C) They actively hunt and control locust nymphs during swarming seasons

(D) They decompose plastic and synthetic mulches in modern farms

Q13. The respiratory organs of the cockroach (Periplaneta americana) consist of a network of internal tubes called trachea that open to the exterior environment through small, regulated apertures called spiracles. How many pairs of spiracles are present on the body of a cockroach?

(A) 2 pairs thoracic and 8 pairs abdominal

(B) 3 pairs thoracic and 7 pairs abdominal

(C) 1 pair thoracic and 9 pairs abdominal

(D) 4 pairs thoracic and 6 pairs abdominal

Q14. In earthworms, the female genital pore through which mature eggs are released is situated mid-ventrally in which specific segment of the body?

(A) 14th segment

(B) 18th segment

(C) 19th segment

Q15. Which of the following architectural features of the cell membrane is accurately described by the Fluid Mosaic Model proposed by Singer and Nicolson?

(A) A solid, rigid carbohydrate sheet embedded with lipids

(B) A semi-fluid phospholipid bilayer with integral and peripheral proteins moving laterally within it

(C) A triple-layered protein sheath surrounding a static core of neutral fats

(D) A continuous cellulose membrane perforated by vast open channels

Q16. The caste system in a mature termite colony (Odontotermes obesus) exhibits advanced social organization. Which of the following functional roles is correctly matched with its biological caste?

(A) Workers — Fully fertile males that specialize in colony defense

(B) Soldiers — Sterile individuals with large modified mandibles or nasutes for defense

(C) Queen — Tiny winged foraging insects that hunt for cellulose food supplies

(D) King — A sterile drone dedicated exclusively to maintaining fungus gardens

Q17. Which phylum of the animal kingdom includes organisms characterized by a water vascular system, a calcareous endoskeleton of ossicles, and exclusive marine habitats, making them absent from terrestrial agro-ecosystems?

(A) Porifera

(B) Echinodermata

(C) Coelenterata

(D) Platyhelminthes

Q18. During its life cycle, the destructive crop pest White Grub (Holotrichia consanguinea) spends its highly damaging larval stage feeding primarily on which part of the host plants?

(A) Underground roots and rootlets of crops like groundnut and pearl millet

(B) Apical meristems and developing flower buds

(C) The soft parenchymatous tissue inside mature leaves

(D) The woody bark of mature forest and orchard trunks

Q19. The type of cell junction that forms an impermeable barrier between adjacent animal epithelial cells, preventing fluids and ions from leaking across the tissue layer, is known as a:

(A) Gap junction

(B) Tight junction

(C) Adhering junction (desmosome)

(D) Synaptic junction

Q20. Earthworms are hermaphrodite (bisexual) animals, meaning both male and female gonads are present in the same individual. Despite this condition, they undergo cross-fertilization instead of self-fertilization because:

(A) They are protandrous, meaning male organs mature earlier than female organs

(B) They are protogynous, meaning female organs degenerate before male organs appear

(C) Mechanical blockages prevent their sperm from reaching their own eggs

(D) Eggs and sperm are shed at completely different seasons of the year

Q21. The insect pest Pyrilla perpusilla, commonly known as the Sugarcane Leafhopper, inflicts damage upon sugarcane crops by which of the following feeding mechanisms?

(A) Chewing and biting large circular holes in mature stalks

(B) Sucking cell sap from the under-surface of leaves and excreting honeydew, which promotes sooty mold growth

(C) Boring internal galleries inside the roots, causing the "dead heart" symptom

(D) Constructing silken webs around apical leaves to consume chlorophyll

Q22. Which of the following body segments or regions of the cockroach body contains the specialized pairing of jointed, filamentous sensory structures called anal styles, which are unique to male cockroaches?

(A) 9th sternum of males only

(B) 10th tergum of both males and females

(C) 7th sternum of females only

(D) 5th abdominal pleuron of males only

Q23. To which class of the Phylum Arthropoda do ticks and mites belong? Ticks and mites are of significant agricultural importance because they act as ectoparasites on farm livestock and vectors of plant diseases.

(A) Insecta

(B) Arachnida

(C) Crustacea

(D) Myriapoda

Q24. The process of egg-laying or oviposition by female Desert Locusts requires specific environmental conditions. They preferentially deposit their egg pods inside:

(A) Damp, sandy soils at a depth of several centimeters

(B) The standing water of swampy marshlands

(C) Small crevices in the bark of tall orchard trees

(D) The upper surfaces of wide leaves near crop fields

Q25. Which of the following phyla contains bilaterally symmetrical, dorsoventrally flattened, acoelomate worms, such as the Liver Fluke (Fasciola hepatica), which causes severe health issues in farm grazing animals?

(A) Annelida

(B) Aschelminthes

(C) Platyhelminthes

(D) Arthropoda

Detailed Solutions

Q1.

Solution

Concept:
Taxonomic classification within the phylum Arthropoda depends closely on specific structural traits and behavioral patterns that identify economically destructive insect populations across agricultural zones.

Solution:

(a) The Desert Locust (*Schistocerca gregaria*) belongs to the order Orthoptera, a group characterized by biting and chewing mouthparts, leathery forewings called tegmina, and specialized hind legs adapted for jumping.

(b) Environmental triggers and high population density prompt a physiological shift that drives these insects from a harmless solitary state into a highly coordinated gregarious phase.

(c) The resulting swarms travel vast distances across arid and semi-arid regions, descending upon agricultural landscapes with high flight stamina.

(d) Once settled, a swarm strips all available green vegetation, including crop leaves, stems, and fruits, causing widespread economic damage and threatening food security.

(e) In contrast, the Sugarcane Pyrilla and Mustard Aphid belong to the order Hemiptera and have piercing-sucking mouthparts, while the Rice Gundhi Bug also belongs to Hemiptera and targets developing grains rather than stripping total green vegetation.

Final Answer: Desert Locust (Schistocerca gregaria)

Answer: (A)

Go Back to Question 1

Q2.

Solution

Concept:
The digestive tract of the Indian earthworm (*Pheretima posthuma*) features specialized, compartmentalized organs designed to mechanically break down coarse material ingested during burrowing.
Solution:

(a) The alimentary canal of the earthworm runs as a straight tube from the anterior mouth to the posterior anus, with each region adapted to handle detritus-rich soil.

(b) The gizzard is a prominent, highly muscular, and oval chamber positioned structurally within segments eight and nine, immediately following the thin-walled, muscular pharynx.

(c) The lining of the gizzard contains a thick cuticular layer that works alongside strong circular muscle contractions to grind up coarse soil particles and organic matter.

(d) This mechanical processing reduces the particle size of ingested leaf litter and humus, maximizing the efficiency of chemical digestion down the line in the stomach and intestine.

(e) Other segments house different structures: segments five to seven contain the muscular esophagus, segments eleven to thirteen host the calciferous glands, and the intestinal tract begins further back in segment fifteen.

Final Answer: Segments 8–9

$\boxed{\textbf{Answer: (B)}}$

Go Back to Question 2

Q3.

Solution

Concept:
Phase polymorphism in the Desert Locust allows individuals to alter their behavior, morphology, and physiology in response to changes in local population density.
Solution:

(a) The solitary phase occurs when population densities are low, leading individuals to live independently and actively avoid contact with other locusts.

(b) In this phase, nymphs and adults display a green or sandy coloration that blends into the background desert vegetation, providing effective camouflage against predators.

(c) Physiologically, solitary individuals exhibit a lower metabolic and respiration rate compared to their gregarious counterparts, which helps conserve energy in resource-scarce habitats.

(d) When environmental shifts trigger rapid breeding and crowd these insects together, physical contact prompts a transformation into the active, warning-colored gregarious phase.

(e) The transient phase serves as an intermediate step during this transition, but the stable, camouflaged form optimized for independent survival is strictly the solitary phase.

Final Answer: Solitary phase

$\boxed{\textbf{Answer: (C)}}$

Go Back to Question 3

Q4.

Solution

Concept:
Structural classification within the kingdom Animalia segregates worm-like phyla based on embryonic germ layers, coelom organization, and body segmentation.

Solution:

(a) Phylum Aschelminthes, commonly known as Nematoda, comprises triploblastic, unsegmented, bilaterally symmetrical roundworms that possess a characteristic pseudocoelom derived from the embryonic blastocoel.

(b) This group includes several high-impact, plant-parasitic species like the root-knot nematode (*Meloidogyne* species) that target agricultural crop systems.

(c) These microscopic worms infect plant root tissues, injecting salivary secretions that induce abnormal cellular growth and form distinct root galls or knots.

(d) These structural distortions choke the vascular bundles, blocking the upward transport of water and essential nutrients, which leads to patch wilting and reduced crop yields.

(e) In comparison, Platyhelminthes consists of acoelomate flatworms, Annelida comprises coelomate segmented worms, and Arthropoda contains organisms with jointed appendages and chitinous exoskeletons.

Final Answer: Aschelminthes (Nematoda)

Answer: (B)

Go Back to Question 4

Q5.

Solution

Concept:
Epithelial tissues are categorized by cell shape and layer arrangement, with each type optimized for specialized physiological functions across different organ boundaries.
Solution:

(a) Simple squamous epithelium consists of a single layer of flattened, scale-like cells with irregular boundaries resting on a thin basement membrane.

(b) This tissue type provides a minimal physical barrier, making it ideal for sites where the rapid, passive transport of gases and nutrients is necessary.

(c) Consequently, it forms the delicate inner lining of blood vessels, endothelial pathways, lymph channels, and the microscopic alveoli of the lungs.

(d) Simple cuboidal and columnar epithelia feature thicker cells optimized for active secretion and absorption, as seen in kidney tubules and intestinal tracts.

(e) Stratified squamous epithelium consists of multiple cell layers designed to resist mechanical wear and abrasion, making it unsuited for rapid diffusion barriers.

Final Answer: Simple squamous epithelium

$\boxed{\textbf{Answer: (B)}}$

Go Back to Question 5

Q6.

Solution

Concept:
Nutritional adaptation in wood-feeding social insects relies on a symbiotic microbiome within the digestive tract to break down complex structural plant polymers.
Solution:

(a) Termites (*Odontotermes obesus*) ingest large quantities of dead wood, stubble, and dry crop residues composed primarily of structural cellulose.

(b) While termites produce some endogenous cellulase, they cannot completely digest complex wood polymers without help from specialized hindgut microflora.

(c) To solve this, their expanded hindgut fermentation chambers house dense populations of symbiotic, flagellated protozoans like *Trichonympha*.

(d) These protozoans engulf fine wood fragments and secrete active cellulase enzymes that cleave glycosidic bonds, converting cellulose into absorbable simple sugars.

(e) This mutualistic relationship allows termites to derive energy from tough organic matter, making them key decomposers in nature and destructive structural pests on farms.

Final Answer: Flagellated protozoans (e.g., Trichonympha)

Answer: (B)

Go Back to Question 6

Q7.

Solution

Concept:

The open circulatory system of the common cockroach (*Periplaneta americana*) relies on a multi-chambered dorsal vessel to propel hemolymph through the hemocoelic sinuses.

Solution:

(a) The cockroach possesses an elongated, muscular, and pulsatile heart situated along the mid-dorsal line of the body, just beneath the tergal plates.

(b) This dorsal heart is divided into thirteen distinct, funnel-shaped chambers arranged sequentially along the thoracic and abdominal regions.

(c) Each individual chamber is equipped with a pair of small, lateral, valve-regulated apertures called ostia that allow hemolymph to enter from the perivisceral sinus.

(d) Specialized segmental alary muscles contract rhythmically to pump hemolymph forward through the chambers and out into the head sinuses.

(e) Because the options distinguish between pairs and total counts, specifying thirteen total chambers aligns with standard insect anatomical studies.

Final Answer: 13 chambers total

Answer: (C)

Go Back to Question 7

Q8.

Solution

Concept:
Soil macro-fauna modify the physical, chemical, and biological features of the rhizosphere, directly affecting agricultural productivity and soil health.
Solution:

(a) Earthworms ingest large quantities of organic debris and soil, creating extensive networks of subterranean burrows as they move through the upper soil layers.

(b) These burrowing pathways act as natural macro-pores that increase soil aeration, facilitate rapid water infiltration, and reduce surface runoff.

(c) This activity breaks up compacted clay layers, allowing crop root systems to penetrate deeper into the soil profile to access moisture and nutrients.

(d) Additionally, their movement mixes humic substances from surface litter into deeper mineral layers, distributing organic matter uniformly through the root zone.

(e) They do not create highly alkaline conditions or reduce water-holding capacity; instead, they convert dense fields into porous, well-aggregated loam structures.

Final Answer: Enhancing soil aeration, water infiltration, and mixing humic substances

Answer: (B)

Go Back to Question 8

Q9.

Solution

Concept:
Eukaryotic cell biology relies on non-membrane-bound macromolecular complexes to carry out protein synthesis across both plant and animal kingdoms.
Solution:

(a) Ribosomes are small, granular organelles composed of ribosomal RNA (rRNA) molecules and specific structural proteins, working together to translate genetic code into polypeptides.

(b) Unlike organelles such as lysosomes, peroxisomes, and mitochondria, ribosomes completely lack an outer lipid membrane boundary.

(c) This structural simplicity allows them to exist freely within the cytoplasm or attached to the membrane sheets of the rough endoplasmic reticulum.

(d) Because they coordinate the assembly of amino acids into functional proteins, they are universally termed the protein factories of the cell.

(e) Centrosomes also lack a lipid membrane but function exclusively in organizing spindle fibers during cell division, rather than participating in protein synthesis pathways.

Final Answer: Ribosome

Answer: (B)

Go Back to Question 9

Q10.

Solution

Concept:
Vermicomposting and natural soil enrichment depend on the chemical and biological composition of excreted matter produced by soil-dwelling annelids.

Solution:

(a) Worm castings are the excreted organic waste products of earthworms, consisting of pulverized soil thoroughly processed by the insect's digestive tract.

(b) As soil passes through the gut, complex organic compounds are broken down and enriched with enzymes, making key plant nutrients highly bioavailable.

(c) Consequently, these castings contain high concentrations of exchangeable nitrogen, soluble phosphorus, and available potassium compared to the surrounding topsoil.

(d) The castings are also packed with beneficial soil microbes that stimulate organic matter decomposition and fix ambient nutrients within the rhizosphere.

(e) They do not accumulate harmful heavy metals or deposit dense calcium layers that harden sandy fields, acting instead as an ideal biological fertilizer.

Final Answer: Available nitrogen, phosphorus, potassium, and beneficial soil microbes

$\boxed{\textbf{Answer: (A)}}$

Go Back to Question 10

Q11.

Solution

Concept:
Management of insect populations in cruciferous crop fields requires exact taxonomic identification and an understanding of the specific feeding mechanics of hemipteran agricultural pests.
Solution:

(a) *Lipaphis erysimi*, commonly known as the Mustard Aphid, is a highly destructive soft-bodied pest belonging to the family Aphididae within the order Hemiptera.

(b) Both nymphs and adults are equipped with specialized piercing-sucking mouthparts called a rostrum, which they insert into tender tissues to extract vital phloem sap.

(c) This heavy feeding behavior deprives the host plant of essential photo-assimilates, leading to diagnostic leaf curling, distinct yellowing, stunting, and reduced seed production.

(d) Additionally, aphids continuously excrete a sticky, sugar-rich fluid known as honeydew over the leaf surfaces, blocking sunlight and reducing overall photosynthetic capacity.

(e) Other options like *Helicoverpa armigera* and *Leucinodes orbonalis* belong to Lepidoptera and possess chewing mouthparts as larvae, while *Sitophilus oryzae* is a coleopteran pest restricted to stored food grains.

Final Answer: Lipaphis erysimi (Mustard Aphid)

$\boxed{\textbf{Answer: (A)}}$

Go Back to Question 11

Q12.

Solution

Concept:
Terrestrial and freshwater gastropods interacting with agrarian environments have a dual economic impact, acting as direct agricultural pests and biological vectors for livestock diseases.
Solution:

(a) The apple snail (*Pila globosa*) is a common freshwater mollusc that inhabits swampy lowlands, irrigation networks, and deep-water rice cultivation systems.

(b) During early cropping seasons, these snails emerge to feed aggressively on tender young rice seedlings using their rasping radula, causing significant stand losses.

(c) Beyond direct crop damage, these molluscs serve as mandatory intermediate hosts for digenetic trematode parasites, including the liver fluke (*Fasciola hepatica*).

(d) The fluke larvae develop and multiply inside the snail before emerging to encyst on surrounding semi-aquatic forage grasses as infectious metacercariae.

(e) When farm livestock graze near these wet areas and ingest the contaminated grass, they contract fascioliasis, which leads to chronic liver damage and reduced milk production.

Final Answer: They serve as vector hosts for certain livestock trematode parasites and can act as agricultural pests of young rice seedlings

$\boxed{\textbf{Answer: (A)}}$

Go Back to Question 12

Q13.

Solution

Concept:
The tracheal respiratory framework of terrestrial arthropods utilizes segmentally arranged, muscularly controlled external apertures to balance oxygen intake with water conservation.
Solution:

(a) The respiratory system of the common cockroach (*Periplaneta americana*) is independent of its circulatory hemolymph, relying on an internal network of air tubes.

(b) This respiratory network connects directly to the outside environment through exactly ten pairs of small, slit-like lateral apertures known as spiracles.

(c) Anatomical distribution reveals that the first two pairs are situated laterally on the thoracic segments, specifically within the mesothoracic and metathoracic regions.

(d) The remaining eight pairs are distributed sequentially along the lateral margins of the first eight abdominal segments, providing localized gas exchange.

(e) Each spiracle is regulated by an internal muscular sphincter that opens and closes to control ventilation while minimizing moisture loss from respiratory surfaces.

Final Answer: 2 pairs thoracic and 8 pairs abdominal

Answer: (A)

Go Back to Question 13

Q14.

Solution

Concept:
The reproductive biology of the metamerically segmented earthworm (*Pheretima posthuma*) requires precise positioning of its monoecious openings along the ventral surface.

Solution:

(a) Although earthworms are hermaphroditic animals containing both male and female gonads, their respective genital ducts open externally through separate, non-overlapping segments.

(b) The female reproductive system includes a pair of ovaries attached to the intersegmental septum between the twelfth and thirteenth segments of the body.

(c) Mature ova pass into the ovarian oviducts, which run posteriorly and join together to open through a single mid-ventral aperture.

(d) This single female genital pore is located mid-ventrally on the fourteenth segment, positioned squarely within the glandular clitellar region.

(e) In contrast, the male genital pores are larger, paired apertures situated ventrolaterally on the eighteenth segment, ensuring physical separation to facilitate cross-fertilization.

Final Answer: 14th segment

Answer: (A)

Go Back to Question 14

Q15.

Solution

Concept:
Modern cytological frameworks describe the plasma membrane as a highly dynamic, variable structure that regulates selective molecular transport while maintaining cellular integrity.
Solution:

(a) The Fluid Mosaic Model, proposed by Jonathan Singer and Garth Nicolson, describes the cell membrane as a semi-fluid phospholipid bilayer matrix.

(b) This structural matrix has a fluid consistency, allowing individual lipid molecules and embedded proteins to perform lateral rotation and translation.

(c) Integral proteins span across the core, while peripheral proteins remain loosely associated with the outer or inner hydrophilic surfaces.

(d) This dynamic arrangement is vital for maintaining homeostatic control, assisting membrane fusion, and coordinating hormone receptor signaling across animal cells.

(e) The alternative models describe the cell membrane as a static or rigid sheet, which fails to account for active transport processes and temperature-dependent structural shifts.

Final Answer: A semi-fluid phospholipid bilayer with integral and peripheral proteins moving laterally within it

Answer: (B)

Go Back to Question 15

Q16.

Solution

Concept:
Social insects maintain structured colonies split into distinct behavioral and morphological castes to maximize efficiency and protect resources from predators.

Solution:

(a) Termites (*Odontotermes obesus*) are highly organized social insects that exhibit clear polymorphism, dividing labor among reproductive and sterile castes.

(b) The soldier caste consists of wingless, sterile individuals whose morphology is highly specialized to defend the nest against predatory organisms like ants.

(c) These individuals possess large, heavily sclerotized heads equipped with elongated, powerful mandibles or specialized nasute tubes that secrete chemical deterrents.

(d) Due to these heavy structural adaptations, soldiers cannot feed themselves and rely entirely on the worker caste for nutrition via trophallaxis.

(e) Workers are sterile and handle nest building and foraging, while the queen and king are fertile individuals dedicated solely to reproduction.

Final Answer: Soldiers — Sterile individuals with large modified mandibles or nasutes for defense

Answer: (B)

Go Back to Question 16

Q17.

Solution

Concept:
The structural classification of the animal kingdom separates distinct invertebrate groups based on specialized physiological mechanisms, skeletal structures, and habitat preferences.
Solution:

(a) Phylum Echinodermata consists exclusively of marine organisms characterized by a unique water vascular or ambulacral system derived from the embryonic coelom.

(b) This coelomic network operates a series of hydraulic tube feet that drive locomotion, assist food capture, and coordinate respiratory gas exchange.

(c) Their internal body architecture is supported by a calcareous endoskeleton composed of individual plates or spines called ossicles, which project outward.

(d) Because they lack osmoregulatory mechanisms to handle fluctuating salinity, echinoderms are absent from terrestrial ecosystems and freshwater irrigation channels.

(e) Phyla like Porifera, Coelenterata, and Platyhelminthes do not possess an internal ossicle matrix or a hydraulic water vascular system.

Final Answer: Echinodermata

Answer: (B)

Go Back to Question 17

Q18.

Solution

Concept:
Developing effective management strategies for root-feeding pests requires identifying the micro-habitat preferences and feeding behaviors of their destructive larval stages.

Solution:

(a) The White Grub (*Holotrichia consanguinea*) is a highly destructive, polyphagous pest that targets major field crops like groundnut, sugarcane, and sorghum across India.

(b) Adult beetles emerge from the soil at dusk following monsoon rains to mate and feed briefly on tree canopy foliage before returning underground.

(c) The females deposit eggs deep into sandy loam soils, where the hatching C-shaped larvae spend their entire developmental period.

(d) These grubs feed on the roots and rootlets of crops, severing the plant's vascular connection to the soil.

(e) This root destruction causes patch wilting, yellowing, and lodging, which prevents nutrient uptake and necessitates subterranean management strategies like soil drenching.

Final Answer: Underground roots and rootlets of crops like groundnut and pearl millet

Answer: (A)

Go Back to Question 18

Q19.

Solution

Concept:
Animal epithelial layers use specialized cell junctions to regulate paracellular transport, provide mechanical support, and facilitate chemical communication.

Solution:

(a) Tight junctions, or zonulae occludentes, are specialized intercellular connections where the plasma membranes of adjacent epithelial cells are fused together.

(b) This close seal forms an impermeable physical barrier across the tissue sheet, preventing the leakage of fluids, ions, and pathogens.

(c) These junctions are essential in organs that hold harsh fluids, such as the digestive tract, preventing digestive enzymes from slipping between cells.

(d) Gap junctions contain open channels called connexons that permit the direct passage of small ions and signaling molecules between adjacent cells.

(e) Adhering junctions act like rivets to mechanically anchor cells together, while synaptic junctions are specialized structures restricted to neurotransmitter signaling pathways.

Final Answer: Tight junction

$\boxed{\textbf{Answer: (B)}}$

Go Back to Question 19

Q20.

Solution

Concept:
Hermaphroditic organisms often use chronological reproductive barriers to avoid self-fertilization, preserving genetic variation and adaptability across populations.
Solution:

(a) The Indian earthworm possesses both male and female gonads within a single individual, featuring two pairs of testes and one pair of ovaries.

(b) Despite having both systems, self-fertilization is prevented by protandry, a biological phenomenon where the male reproductive organs mature before the female organs.

(c) Because sperm mature and move into the seminal vesicles well before the ova develop within the fourteenth segment, an individual cannot fertilize its own eggs.

(d) Consequently, earthworms must engage in reciprocal cross-fertilization during copulation, aligning in opposite directions to exchange spermatophores.

(e) This mandatory genetic exchange introduces variation, helping earthworm populations adapt to changing soil chemistry and varying cultivation practices.

Final Answer: They are protandrous, meaning male organs mature earlier than female organs

Answer: (A)

Go Back to Question 20

Q21.

Solution

Concept:
Effective management of plant-sucking hemipteran pests in commercial monocultures requires a clear understanding of their feeding adaptations, behavioral dynamics, and indirect impacts on leaf physiology.

Solution:

(a) *Pyrilla perpusilla*, commonly known as the Sugarcane Leafhopper, is a destructive fulgorid pest that infests commercial sugarcane plantations.

(b) Both the nymphal and adult stages are equipped with specialized piercing-sucking mouthparts designed to puncture the leaf epidermis and extract nutrient-rich phloem sap from the under-surface of the leaves.

(c) This continuous removal of vital sap deprives the host plant of essential photo-assimilates, resulting in yellowing, localized wilting, and a severe reduction in sucrose content.

(d) Furthermore, these insects excrete large quantities of a sugary fluid called honeydew, which spreads across the foliage and serves as a medium for the growth of sooty mold fungus.

(e) This opportunistic black fungus covers the leaf blades, blocking sunlight and reducing the plant's overall photosynthetic capacity, which leads to poor crop yields.

Final Answer: Sucking cell sap from the under-surface of leaves and excreting honeydew, which promotes sooty mold growth

Answer: (B)

Go Back to Question 21

Q22.

Solution

Concept:
Sexual dimorphism in the common cockroach (*Periplaneta americana*) is determined by analyzing specialized, non-overlapping cuticular appendages located on the posterior abdominal segments.
Solution:

(a) The posterior abdomen of the cockroach features distinct modifications that allow for precise differentiation between male and female individuals during population monitoring.

(b) Anal styles are a pair of short, unjointed, thread-like sensory structures found exclusively in male cockroaches, protruding backward from the ventral surface.

(c) Anatomically, these anal styles are securely anchored to the ninth abdominal sternum, serving as an explicit diagnostic marker for the male gender.

(d) In contrast, both male and female cockroaches possess anal cerci, which are longer, multi-jointed filamentous structures that arise dorsally from the tenth tergum.

(e) The female abdomen lacks anal styles entirely, and its seventh sternum is uniquely modified into a broad, boat-shaped structure that forms the brood or oothecal pouch.

Final Answer: 9th sternum of males only

Answer: (A)

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Q23.

Solution

Concept:
Taxonomic segregation within the phylum Arthropoda depends on structural features such as body regionalization, tagmosis, the number of walking appendages, and the presence or absence of antennae.

Solution:

(a) Ticks and mites are high-impact agricultural organisms belonging to the subclass Acari within the class Arachnida, separating them from true field insects.

(b) Unlike members of the class Insecta, which possess three distinct body regions and six walking legs, adult arachnids are characterized by an unsegmented or fused cephalothorax and abdomen bearing eight walking legs.

(c) Additionally, arachnids lack compound eyes and sensory antennae, features that are universally distributed among agricultural insect pests.

(d) In livestock management, these organisms act as specialized ectoparasites, causing skin irritation, systemic anemia, and transmitting dangerous pathogens like *Babesia*.

(e) In horticultural systems, phytophagous mites use piercing mouthparts to drain chlorophyll from crop leaves, causing broad russeting and significant yield losses.

Final Answer: Arachnida

Answer: (B)

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Q24.

Solution

Concept:
The reproductive ecology and population dynamics of the Desert Locust depend on specific micro-climatic and edaphic conditions that support egg survival and embryonic development.

Solution:

(a) Following a shift to the gregarious phase, female Desert Locusts begin synchronized oviposition flights to locate optimal egg-laying sites across arid landscapes.

(b) The female utilizes a specialized, muscular abdominal ovipositor to drill a deep, vertical tunnel into loose, sandy soil rather than depositing eggs exposed on foliage.

(c) She preferentially selects damp, sandy soils, inserting her abdomen to a depth of several centimeters to deposit a foam-protected egg pod containing up to one hundred eggs.

(d) The moisture present within the sandy soil matrix is absorbed by the developing embryos, which is a physiological requirement for successful hatching.

(e) Understanding these strict soil moisture requirements allows agricultural teams to monitor specific desert zones and target hatchling bands before they form destructive swarms.

Final Answer: Damp, sandy soils at a depth of several centimeters

Answer: (A)

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Q25.

Solution

Concept:
The architectural classification of worm-like invertebrates uses structural criteria such as body symmetry, dorsoventral configuration, and the presence or absence of an internal coelomic cavity.
Solution:

(a) Phylum Platyhelminthes comprises triploblastic, bilaterally symmetrical, unsegmented organisms that are uniquely characterized by a dorsoventrally flattened body plan, earning them the common name flatworms.

(b) These organisms are strictly acoelomate, meaning the space between the outer epidermal layer and the inner endodermal gut lining is filled with a solid parenchyma tissue matrix rather than a fluid-filled cavity.

(c) This group includes the Liver Fluke (*Fasciola hepatica*), a specialized parasite that targets the hepatic bile ducts of grazing farm livestock such as sheep and cattle.

(d) Chronic infections lead to liver rot, severe internal anemia, weight loss, and high mortality rates, which can disrupt livestock production systems.

(e) In comparison, Aschelminthes contains pseudocoelomate roundworms, Annelida contains truly coelomate segmented worms, and Arthropoda includes animals with chitinous skeletons and jointed limbs.

Final Answer: Platyhelminthes

Answer: (C)

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Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	B	3	C	4	B	5	B
6	B	7	C	8	B	9	B	10	A
11	A	12	A	13	A	14	A	15	B
16	B	17	B	18	A	19	B	20	A
21	B	22	A	23	B	24	A	25	C