

UPCATET Agriculture Zoology Sample Paper-3

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. The destructive phase of the Desert Locust (*Schistocerca gregaria*) that exhibits high mobility, gregarious behavior, and causes widespread devastation to agricultural crops is known as the:

- (A) Solitary phase
- (B) Migratory phase (gregarious phase)
- (C) Pupal phase
- (D) Resting phase

Q2. Which type of animal tissue covers the external surfaces of the body and lines the internal visceral organs, acting as a primary barrier against mechanical injury and pathogen invasion?

- (A) Muscular tissue
- (B) Connective tissue
- (C) Epithelial tissue
- (D) Nervous tissue

Q3. In the Indian earthworm *Pheretima posthuma*, typhlosole is a highly significant internal anatomical feature located in the intestine. Its primary physiological function is to:



- (A) Secrete digestive enzymes for cellulose breakdown
- (B) Store calcium ions absorbed from the soil
- (C) Increase the effective surface area for food absorption
- (D) Excrete nitrogenous waste products out of the body

Q4. Termites, often classified as destructive agricultural and structural pests, belong to which of the following insect orders?

- (A) Isoptera
- (B) Lepidoptera
- (C) Orthoptera
- (D) Hemiptera

Q5. A farmer observes tiny, unsegmented worms damaging the roots of his crop, leading to characteristic root-knot formations. These agricultural pests belong to which animal phylum?

- (A) Annelida
- (B) Nematoda (Aschelminthes)
- (C) Platyhelminthes
- (D) Arthropoda

Q6. In the digestive system of the cockroach (*Periplaneta americana*), hepatic caeca are present as a ring of blind tubules at the junction of the gizzard and mesenteric intestine. What is their primary function?

- (A) Grinding coarse food particles
- (B) Secreting digestive juice to aid chemical digestion
- (C) Storing excess undigested food material
- (D) Absorbing water from the fecal matter

Q7. Which of the following cellular structures is known as the power plant of the animal cell, responsible for generating adenosine triphosphate (ATP) via aerobic cellular respiration?



- (A) Lysosome
- (B) Ribosome
- (C) Mitochondrion
- (D) Centrosome

Q8. Earthworms are highly celebrated in sustainable agriculture as 'friends of the farmers'. Their burrowing and feeding activities directly improve soil quality by:

- (A) Decreasing the water-holding capacity to prevent waterlogging
- (B) Increasing soil aeration, water infiltration, and mixing organic matter
- (C) Raising the soil toxicity to suppress competitive weed growth
- (D) Compacting loose topsoil to prevent wind erosion

Q9. The phylum Arthropoda holds immense significance in agriculture. Which unique anatomical feature characterizes all members belonging to this phylum?

- (A) Presence of a muscular foot and calcareous shell
- (B) Jointed appendages and a chitinous exoskeleton
- (C) Segmented body with a water vascular system
- (D) Diploblastic body wall with cnidocytes

Q10. During the life cycle of the notorious crop pest *Helicoverpa armigera* (Gram pod borer), which specific developmental stage is directly responsible for feeding on crops and causing severe economic loss?

- (A) Adult moth
- (B) Egg
- (C) Pupa
- (D) Larva (Caterpillar)

Q11. In the circulatory system of the earthworm, the blood glands are structurally located in which of the following segments?



- (A) 4th, 5th, and 6th segments
- (B) 10th, 11th, and 12th segments
- (C) 14th, 15th, and 16th segments

Q12. Which of the following phyla consists entirely of asymmetric or radially symmetric aquatic animals lacking true organs, commonly found encrusting farm pond substrates or marine environments?

- (A) Porifera
- (B) Mollusca
- (C) Chordata
- (D) Nematoda

Q13. The caste system in a subterranean termite colony ensures high survival. Which caste is structurally adapted with large, highly chitinized mandibles specifically to defend the colony against predatory ants?

- (A) Workers
- (B) Soldiers
- (C) King
- (D) Queen

Q14. The gizzard (proventriculus) of a cockroach contains specialized internal structural modifications designed to mechanically crush tough food particles. These modifications consist of:

- (A) Four delicate brush-like cilia
- (B) Six highly chitinous teeth
- (C) Calcareous plates lined with enzymes
- (D) Circular smooth muscles with microvilli

Q15. Which of the following cell organelles contains hydrolytic enzymes operating at an acidic pH, responsible for intracellular digestion and recycling damaged cellular components in animal tissues?



- (A) Peroxisome
- (B) Lysosome
- (C) Glyoxysome
- (D) Centrosome

Q16. The White Grub (*Holotrichia consanguinea*) is a highly destructive polyphagous pest in Indian agriculture. The damaging larval stage resides primarily in the:

- (A) Soil, feeding destructively on plant roots
- (B) Aerial foliage, mining through succulent leaves
- (C) Internal vascular bundles of the main stem
- (D) Ripening grains inside the storage bins

Q17. Earthworms are classical examples of hermaphrodite animals. However, self-fertilization does not occur in earthworms primarily due to which biological phenomenon?

- (A) Protandry (maturation of testes before ovaries)
- (B) Protogyny (maturation of ovaries before testes)
- (C) Physical separation of reproductive organs by 50 segments
- (D) Complete absence of functional reproductive ducts

Q18. Snails and slugs that damage horticultural crops and serve as intermediate hosts for livestock parasites belong to which animal phylum?

- (A) Echinodermata
- (B) Mollusca
- (C) Annelida
- (D) Coelenterata

Q19. The respiratory system of a cockroach opens to the exterior through small, paired lateral apertures situated on the thorax and abdomen. These apertures are known as:



- (A) Tracheoles
- (B) Nephridiopores
- (C) Spiracles
- (D) Malpighian tubules

Q20. The Mustard Aphid (*Lipaphis erysimi*) causes widespread damage to cruciferous crops. Its mode of feeding and crop damage is characterized by:

- (A) Chewing big circular holes into leaf blades
- (B) Boring deep into the main roots to cause wilting
- (C) Sucking cell sap from leaves and stems, secreting honey-dew
- (D) Cutting down young seedlings at the ground surface level

Q21. In earthworms, the excretion of nitrogenous waste and osmoregulation are efficiently carried out by coiled, segmentally arranged tubular structures called:

- (A) Malpighian tubules
- (B) Flame cells
- (C) Nephridia
- (D) Green glands

Q22. Which animal phylum is characterized by a water vascular system, a calcareous endoskeleton of ossicles, and includes marine organisms that are occasionally studied for biochemical impacts on coastal mariculture?

- (A) Echinodermata
- (B) Arthropoda
- (C) Platyhelminthes
- (D) Porifera

Q23. Termites rely on symbiotic microorganisms residing inside their digestive tracts to break down the tough complex organic polymers of wood and dry crops. What do these symbionts break down?



- (A) Lignin into proteins
- (B) Cellulose into simple sugars
- (C) Starch into heavy lipids
- (D) Glycogen into amino acids

Q24. The exoskeleton of a cockroach is composed of hardened plates called sclerites. The dorsal sclerites on each segment are specifically designated as:

- (A) Sternites
- (B) Pleurites
- (C) Tergites
- (D) Coxae

Q25. The Rice Gundhi Bug (*Leptocorisa acuta*) is a severe threat to rice cultivation. It inflicts maximum economic damage to the paddy crop during which specific botanical phase?

- (A) Early nursery seedling stage
- (B) Vegetative tillering stage
- (C) Milky stage of the grain development
- (D) Post-harvest storage phase



Detailed Solutions**Q1.****Solution****Concept:**

The Desert Locust (*Schistocerca gregaria*) is a highly destructive insect pest exhibiting phase polymorphism, transitioning between solitary and gregarious behavioral states driven by population density and environmental triggers.

Solution:

- (a) When ecological conditions favor rapid breeding, increased physical contact triggers a hormonal shift, converting the harmless solitary individuals into the highly mobile, coordinated gregarious phase.
- (b) The migratory phase is characterized by distinct morphological alterations, including a brighter yellow coloration in mature adults, longer wings, and an aggregation behavior leading to the formation of massive swarms.
- (c) These swarms display high flight endurance and can cover hundreds of kilometers daily, stripping entire agricultural fields of foliage, fruits, and stems, culminating in devastating economic crises and regional food insecurity.
- (d) Unlike holometabolous insects, locusts undergo incomplete metamorphosis; hence, terms like pupal or resting phases are biologically invalid for describing their active, destructive adult swarming stage.
- (e) Managing this pest requires extensive monitoring of breeding zones to intercept the transition into the migratory phase before large-scale agricultural devastation occurs across crop boundaries.

Final Answer: Migratory phase (gregarious phase)

Answer: (B)

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Q2.

Solution**Concept:**

Animal bodies are composed of four fundamental categories of specialized tissues, each serving dedicated anatomical roles. Structural protection, selective absorption, and lining functions are exclusively handled by epithelial tissues.

Solution:

- (a) Epithelial tissue forms a continuous sheets of tightly packed cells with minimal extracellular matrix, resting securely on a specialized non-cellular basement membrane.
- (b) It forms the outermost protective layer of the skin, shielding internal cellular structures from mechanical abrasion, chemical injury, desiccation, and infiltration by harmful agricultural pathogens.
- (c) Internally, epithelial layers line the luminal tracts of visceral organs such as the stomach and intestines, regulating the active transport of nutrients and managing metabolic waste exchange.
- (d) Connective tissue structurally supports organs, muscular tissue drives physical locomotion, and nervous tissue conducts electrochemical impulses; none form protective surface linings.
- (e) Its regenerative capacity is exceptionally high, enabling rapid tissue repair when agricultural workers or livestock experience surface injuries or physical epithelial shearing.

Final Answer: Epithelial tissue

Answer: (C)

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Q3.

Solution**Concept:**

The internal anatomy of the Indian earthworm (*Pheretima posthuma*) is structurally optimized to maximize nutritional efficiency from poor organic matter and soil ingested during burrowing activities.

Solution:

- (a) The typhlosole is a distinctive internal median fold of the dorsal wall of the intestine, running longitudinally from the 26th segment to the pre-anal zone.
- (b) Because soil contains a low percentage of usable organic nutrients, a standard tubular gut would provide inadequate absorption surface area for survival.
- (c) By creating an extensive internal fold, the typhlosole drastically expands the effective absorbing surface area, ensuring efficient uptake of digested food molecules into the bloodstream.
- (d) This structure does not secrete cellulose-digesting enzymes, store calcium ions, or handle nitrogenous excretion, which are managed by the calciferous glands and nephridial networks respectively.
- (e) This adaptation underpins the earthworm's high metabolic conversion rate, converting decaying agricultural waste into highly nutritious, vermicomposted cast excretions.

Final Answer: Increase the effective surface area for food absorption

Answer: (C)

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Q4.

Solution**Concept:**

Taxonomic classification within the class Insecta relies heavily on wing morphology, mouthpart structures, and developmental life histories to segregate economically significant agricultural pests.

Solution:

- (a) Termites are social insects that belong to the order Isoptera, characterized by two pairs of identical, membranous wings present temporarily during the reproductive swarming phase.
- (b) Members of Isoptera live in highly organized subterranean colonies and feed on cellulose-rich substrates, causing severe structural damage to farm buildings, wooden posts, and crop root zones.
- (c) The order Lepidoptera comprises moths and butterflies with scaled wings; Orthoptera includes grasshoppers with leathery forewings; Hemiptera contains true bugs possessing piercing-sucking mouthparts.
- (d) Correct ordinal identification is vital in agricultural entomology for selecting targeted systemic insecticides or biological controls specific to the target insect's physiological traits.
- (e) Modern phylogenetic schemes sometimes group Isoptera as an infraorder within Blattodea, but standard agricultural curricula treat it as a distinct order based on traditional functional classification.

Final Answer: Isoptera

Answer: (A)

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Q5.

Solution**Concept:**

Plant-parasitic worms present in agrarian ecosystems often target root systems, disrupting hydraulic conductance and nutrient transport, leading to visible diagnostic pathologies across fields.

Solution:

- (a) The description points to root-knot nematodes (*Meloidogyne* species), which are unsegmented, pseudocoelomate, microscopic roundworms belonging strictly to the phylum Nematoda.
- (b) Upon infecting a host plant, these parasites inject salivary secretions that stimulate abnormal cell division, producing characteristic galls or root-knots that choke the plant's vascular tissue.
- (c) Phylum Annelida encompasses true metamerically segmented worms like earthworms; Platyhelminthes includes dorsoventrally flattened acoelomate flatworms; Arthropoda consists of organisms possessing jointed chitinous limbs.
- (d) Understanding this distinction helps farmers realize that conventional antibacterial or antifungal applications are ineffective against these specialized unsegmented roundworms.
- (e) Managing root-knot nematodes requires integrated pest strategies, including nematicide applications, solarization of seedbeds, and rotating susceptible crops with non-host marigold plants.

Final Answer: Nematoda (Aschelminthes)

Answer: (B)

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Q6.

Solution**Concept:**

The alimentary canal of the common cockroach (*Periplaneta americana*) features specialized accessory structures designed to optimize the digestion of complex omnivorous dietary items.

Solution:

- (a) Hepatic or gastric caeca are a ring of six to eight blind-ended, finger-like tubular outgrowths situated at the boundary where the foregut meets the midgut.
- (b) These specialized tubules synthesize and pour a rich mixture of digestive enzymes into the mesenteron, enabling the chemical breakdown of carbohydrates, lipids, and proteins.
- (c) The mechanical grinding of tough food materials is performed upstream by the heavily armed cuticular teeth inside the gizzard (proventriculus).
- (d) Food storage happens inside the crop, while water absorption is restricted to the hindgut components like the colon and rectum.
- (e) Identifying the specific role of hepatic caeca highlights how anatomical compartmentalization supports high metabolic efficiency in omnivorous household and storage pests.

Final Answer: Secreting digestive juice to aid chemical digestion

Answer: (B)

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Q7.

Solution**Concept:**

Cellular biochemistry depends heavily on specialized membrane-bound organelles that partition metabolic pathways, ensuring optimal energy capture and utilization within animal cells.

Solution:

- (a) Mitochondria are double-membraned organelles that serve as the main sites for aerobic respiration, including the Krebs cycle and the electron transport chain.
- (b) The inner mitochondrial membrane is folded into cristae to maximize the surface area for ATP synthase complexes, which generate usable chemical energy.
- (c) Lysosomes function in waste degradation, ribosomes organize translation for protein synthesis, and centrosomes coordinate the spindle fibers required during mitotic division.
- (d) Because they convert chemical energy from nutrients into ATP, mitochondria are universally termed the powerhouses of eukaryotic animal cells.
- (e) High metabolic tissues, such as the flight muscles of agricultural pests, possess an exceptionally large number of mitochondria to meet high energy requirements.

Final Answer: Mitochondrion

Answer: (C)

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Q8.

Solution**Concept:**

Soil macro-fauna play an important role in modifying the physical, chemical, and biological architecture of the rhizosphere, directly impacting agricultural productivity.

Solution:

- (a) Earthworms ingest organic debris along with soil, creating deep burrows that break up compacted earth, thereby facilitating superior root penetration.
- (b) These burrowing pathways act as natural macro-pores, increasing soil aeration and boosting water infiltration rates while preventing surface runoff and erosion.
- (c) Earthworm castings are enriched with highly bioavailable nitrogen, phosphorus, and potassium, which enhances the overall nutrient profile of the topsoil.
- (d) They do not increase soil toxicity or decrease water-holding capacity; instead, they convert dense clay soils into porous, well-aggregated loam structures.
- (e) Their activity stimulates beneficial microbial populations, making earthworms indispensable indicators of soil health and sustainability in agro-ecosystems.

Final Answer: Increasing soil aeration, water infiltration, and mixing organic matter

Answer: (B)

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Q9.

Solution**Concept:**

Phylum Arthropoda constitutes the largest group within the animal kingdom, encompassing diverse agricultural organisms ranging from essential insect pollinators to destructive crop pests.

Solution:

- (a) The defining evolutionary innovations shared by all arthropods are jointed appendages and a tough, chitinous exoskeleton covering their segmented bodies.
- (b) This rigid exoskeleton provides structural support, prevents desiccation in terrestrial fields, and serves as an anchor for powerful locomotion muscles.
- (c) A muscular foot paired with a calcareous shell is a diagnostic trait of Mollusca, while a water vascular system is found in Echinodermata.
- (d) Cnidocytes are specialized stinging cells unique to Coelenterata, and are completely absent from the triploblastic body plan of arthropods.
- (e) The chitinous cuticle must be periodically shed via ecdysis to permit growth, a vulnerable stage frequently targeted by insect growth regulators.

Final Answer: Jointed appendages and a chitinous exoskeleton

Answer: (B)

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Q10.

Solution**Concept:**

The management of polyphagous pests requires a thorough understanding of holometabolous life cycles to identify the specific developmental stages that inflict economic damage.

Solution:

- (a) *Helicoverpa armigera* undergoes complete metamorphosis, transitioning through four distinct phases: egg, larva (caterpillar), pupa, and adult moth.
- (b) The larval phase possesses strong, chewing mandibles and an insatiable appetite, allowing it to bore into cotton bolls and gram pods.
- (c) The adult stage feeds primarily on nectar and is responsible for dispersal and oviposition, but does not cause direct structural crop damage.
- (d) Eggs represent a non-feeding, embryonic stage, while the pupa is a quiescent transitional phase enclosed within the soil or debris.
- (e) Targeting the early larval instars with biological agents like NPV or specific insecticides is crucial for effective crop protection.

Final Answer: Larva (Caterpillar)

Answer: (D)

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Q11.

Solution**Concept:**

The closed circulatory system of the Indian earthworm (*Pheretima posthuma*) features specialized structures for the synthesis of respiratory pigments and immune cells, which are localized within specific anterior segments.

Solution:

- (a) Blood glands are small, spherical, pinkish cellular aggregates located dorsally in the fourth, fifth, and sixth segments of the earthworm's alimentary tract, positioned above the pharyngeal mass.
- (b) These specialized glands serve a dual physiological purpose, primary among which is the production of hemoglobin, the respiratory pigment responsible for oxygen carriage.
- (c) Unlike vertebrates where hemoglobin is bound inside red blood cells, the earthworm's blood glands secrete this pigment directly into the circulating blood plasma where it dissolves completely.
- (d) Additionally, these glands manufacture amoebocytic blood cells, which are released into the coelomic fluid and vascular pathways to phagocytose foreign micro-organisms and agricultural soil pathogens.
- (e) The distinct segmentation of these organs distinguishes them from other vascular anomalies, such as the lateral hearts found in segments seven, nine, twelve, and thirteen.

Final Answer: 4th, 5th, and 6th segments

Answer: (A)

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Q12.

Solution**Concept:**

Taxonomic segregation of the animal kingdom is based on structural complexity, body symmetry, and the presence or absence of true germ layers, tissues, and organizational systems.

Solution:

- (a) Phylum Porifera represents the most primitive group of multicellular animals, characterized by a cellular level of organization where cells function independently without aggregating into tissues.
- (b) Poriferans exhibit an asymmetric body plan, though a few species demonstrate radial symmetry, and they completely lack specialized digestive, nervous, circulatory, or reproductive organs.
- (c) Their body walls are perforated by numerous microscopic inhalant pores called ostia, which lead into a central spongocoel cavity lined by flagellated choanocytes that drive water currents.
- (d) In agrarian ecosystems, freshwater sponges inhabit clean farm ponds, irrigation channels, and silt beds, acting as biological filters by consuming microscopic organic debris and bacteria.
- (e) Members of Mollusca, Chordata, and Nematoda display advanced organ-system levels of organization paired with bilateral symmetry, making them highly complex compared to the primitive poriferans.

Final Answer: Porifera

Answer: (A)

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Q13.

Solution**Concept:**

Social insects exhibit polymorphism, where a single colony is partitioned into distinct morphological castes that execute highly specialized labor to ensure the collective survival of the population.

Solution:

- (a) The soldier caste in subterranean termite colonies consists of sterile, wingless individuals whose morphology is heavily modified for defense against predatory threats like foraging ants.
- (b) These soldiers possess disproportionately large, sclerotized heads equipped with elongated, powerful, and sharp mandibles that can slash, pierce, or crush invading predators near tunnel breaches.
- (c) Due to the extreme structural modifications of their mouthparts, soldiers are unable to feed themselves and must rely entirely on the worker caste for nutrition via trophallaxis.
- (d) Workers handle foraging, nest construction, and brood care, while the king and queen focus exclusively on reproduction to maintain the colony's expanding population density.
- (e) Understanding caste dynamics allows agricultural entomologists to formulate baits that disrupt colony equilibrium by targeting specific behavioral dependencies between workers and soldiers.

Final Answer: Soldiers

Answer: (B)

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Q14.

Solution**Concept:**

The foregut of the common cockroach (*Periplaneta americana*) contains specialized anatomical adaptations that mechanically treat food particles before chemical digestion in the midgut.

Solution:

- (a) The gizzard, or proventriculus, is a small, spherical, muscular chamber situated immediately posterior to the distended, thin-walled food storage crop within the insect's thoracic cavity.
- (b) Internally, the thick circular muscular wall of the gizzard is lined with a tough cuticular layer that is modified into six prominent, highly chitinous teeth.
- (c) As the powerful circular muscles contract rhythmically, these six teeth act as an internal mill, crushing and grinding coarse agricultural grains and organic debris into a fine paste.
- (d) Posterior to these teeth, a specialized cushion-like arrangement of fine cuticular bristles acts as a sieve, allowing only thoroughly pulverized material to advance into the midgut.
- (e) This mechanical arrangement reduces the workload of the delicate mesenteric cells down the line, ensuring rapid absorption of nutrient complexes.

Final Answer: Six highly chitinous teeth

Answer: (B)

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Q15.

Solution**Concept:**

Eukaryotic cells distribute their metabolic activities among distinct membrane-bound organelles that maintain unique internal biochemical environments optimal for specific enzymatic reactions.

Solution:

- (a) Lysosomes are spherical, single-membrane vesicles that function as the primary intracellular digestive and recycling centers within animal tissues and organ structures.
- (b) These organelles are packed with a diverse array of hydrolytic enzymes, such as proteases, nucleases, and glycosidases, which break down proteins, nucleic acids, and complex carbohydrates.
- (c) To function efficiently, these acid hydrolases require an internal acidic environment with a pH between four and five, maintained by specialized proton pumps embedded in the lysosomal membrane.
- (d) When cells undergo senescence or sustain injury from pathogen attacks, the lysosomal membrane ruptures, releasing enzymes that digest the host cell in a process called autolysis.
- (e) Peroxisomes and glyoxysomes manage oxidative pathways and lipid conversions, whereas centrosomes organize the microtubule arrays needed for cellular division.

Final Answer: Lysosome

Answer: (B)

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Q16.

Solution**Concept:**

Managing underground agricultural pests requires a clear understanding of their life history, developmental biology, and micro-habitat preferences within the soil profile.

Solution:

- (a) The White Grub (*Holotrichia consanguinea*) is a highly destructive, polyphagous pest that damages major field crops such as groundnut, sugarcane, and pearl millet across India.
- (b) Following monsoon rains, adult beetles emerge from the soil at dusk to mate and feed briefly on nearby tree foliage before depositing eggs deep into sandy loam soils.
- (c) The resulting white, C-shaped larvae hatch underground and spend their entire developmental period in the soil, feeding heavily on the root systems of crops.
- (d) By severing the primary and secondary roots, these grubs disrupt the plant's vascular network, leading to patch wilting, yellowing, and eventual lodging of the crop.
- (e) Because the destructive larval stage is subterranean, aerial insecticide applications are ineffective, requiring farmers to implement soil drenching or deep summer plowing instead.

Final Answer: Soil, feeding destructively on plant roots

Answer: (A)

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Q17.

Solution**Concept:**

Evolutionary strategies in hermaphroditic organisms include anatomical or chronological mechanisms designed to prevent self-fertilization, thereby maximizing genetic recombination and population resilience.

Solution:

- (a) The Indian earthworm contains both male and female reproductive systems 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 testes and male reproductive structures mature earlier than the ovaries.
- (c) Because the sperm mature and are stored in the seminal vesicles long 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, where two individuals align in opposite directions to exchange sperm packets called spermatophores.
- (e) This mandatory genetic exchange ensures variation, allowing earthworm populations to adapt to changing soil chemistry and varying cultivation practices.

Final Answer: Protandry (maturation of testes before ovaries)

Answer: (A)

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Q18.

Solution**Concept:**

Phylum Mollusca includes diverse macro-invertebrates that inhabit terrestrial and aquatic agricultural environments, functioning as direct crop pests and vectors for livestock diseases.

Solution:

- (a) Snails and slugs belong to the class Gastropoda within the phylum Mollusca, characterized by unsegmented, soft bodies that are often protected by a hard, calcareous shell.
- (b) In damp agricultural fields, these organisms act as nocturnal pests, using their rasping organ, the radula, to scrap and chew young seedlings and horticultural crops.
- (c) Beyond causing direct foliage damage, certain freshwater snails serve as mandatory intermediate hosts for digenetic trematodes, such as liver flukes (*Fasciola hepatica*).
- (d) Livestock grazing near contaminated farm ponds ingest these parasite larvae, leading to severe fascioliasis outbreaks that cause major economic losses in milk and meat production.
- (e) Phyla like Echinodermata comprise marine organisms, while Annelida and Coelenterata do not possess the structural traits or host suitability found in mollusc species.

Final Answer: Mollusca

Answer: (B)

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Q19.

Solution**Concept:**

The respiratory architecture of terrestrial arthropods relies on an internal network of tubules that delivers oxygen directly to metabolic tissues without using the circulatory system.

Solution:

- (a) The respiratory system of the cockroach consists of an intricate network of internal trachea that opens to the outside through ten pairs of small, slit-like lateral apertures called spiracles.
- (b) These spiracles are positioned on the lateral margins of the body, with two pairs located on the thoracic segments and eight pairs distributed along the abdominal segments.
- (c) The opening and closing of these spiracles are regulated by muscular sphincters, which minimize moisture loss from the internal respiratory surfaces during dry conditions.
- (d) Air enters through the spiracles, passes into the tracheal trunks, and travels down to thin, fluid-filled tracheoles where direct gas exchange with individual cells occurs.
- (e) Nephridiopores and Malpighian tubules handle nitrogenous excretion, whereas the respiratory tubules are dedicated entirely to systemic ventilation.

Final Answer: Spiracles

Answer: (C)

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Q20.

Solution**Concept:**

Managing sucking pests in agriculture requires an understanding of their mouthpart adaptations, feeding behaviors, and indirect impacts on crop health.

Solution:

- (a) The Mustard Aphid (*Lipaphis erysimi*) is a destructive pest of cruciferous crops, possessing specialized piercing-sucking mouthparts called a rostrum or proboscis.
- (b) Both nymphs and adults pierce the epidermis of leaves, stems, and inflorescences to extract nutrient-rich phloem sap, depriving the plant of essential photo-assimilates.
- (c) This extraction causes symptoms such as leaf curling, yellowing, stunting, and a severe reduction in pod formation and oil content across mustard fields.
- (a) Additionally, aphids excrete a sticky, sugar-rich fluid known as honeydew, which coats the foliage and provides a substrate for the growth of sooty mold fungus.
- (b) This black fungal layer blocks sunlight, reducing photosynthesis and lowering the commercial value of the harvested crop.

Final Answer: Sucking cell sap from leaves and stems, secreting honey-dew

Answer: (C)

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Q21.

Solution**Concept:**

Excretory physiology in the terrestrial annelid *Pheretima posthuma* is highly adapted to regulate water loss and eliminate nitrogenous metabolic by-products based on dynamic subterranean environmental conditions.

Solution:

- (a) Nephridia are micro-tubular, segmentally arranged excretory structures that form the primary homeostatic and osmoregulatory networks throughout the coelomic compartments of the earthworm.
- (b) Anatomically, earthworms possess three distinct structural types of nephridia: septal nephridia attached to intersegmental septa, integumentary nephridia fixed inside the body wall, and pharyngeal nephridia located anteriorly.
- (c) These organs work by drawing in excess coelomic fluid or filtering vascular capillaries, actively reabsorbing crucial salts and water while concentrating nitrogenous waste compounds like urea and ammonia.
- (d) Malpighian tubules perform similar functions in terrestrial insects, flame cells are characteristic of platyhelminths, and green glands serve as the main excretory systems in aquatic crustaceans.
- (e) By maintaining fluid balance, nephridia allow the earthworm to keep its skin moist, which is essential for cutaneous respiration in agricultural soils.

Final Answer: Nephridia

Answer: (C)

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Q22.

Solution**Concept:**

The structural architecture of marine macro-invertebrates relies on unique physiological systems for locomotion, circulation, and structural integrity that distinguish them from terrestrial invertebrates.

Solution:

- (a) Phylum Echinodermata consists exclusively of marine organisms characterized by a distinctive water vascular or ambulacral system derived from the coelom, which drives locomotion, food capture, and gas exchange.
- (b) Their internal body framework is supported by a calcareous endoskeleton composed of individual plates or spines called ossicles, which project outward through the epidermal layers.
- (c) While highly relevant to marine ecology, certain echinoderms like sea stars impact coastal mariculture and seaweed farms by preying directly on commercial bivalves and farmed bivalve beds.
- (d) Members of Arthropoda are characterized by chitinous exoskeletons, Platyhelminthes comprises acoelomate flatworms, and Porifera displays a primitive cellular grade of organization lacking any ossicle networks.
- (e) Identifying these traits underscores the radical differences in body plans that emerged as animals adapted to marine, terrestrial, and agricultural environments.

Final Answer: Echinodermata

Answer: (A)

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Q23.

Solution**Concept:**

Nutritional biochemistry in wood-boring and structural agricultural pests often requires specialized symbiotic relationships to degrade complex structural polymers found in plant tissue.

Solution:

- (a) Termites ingest large quantities of dry wood, stubble, and structural timber composed primarily of cellulose, a tough polysaccharide that most animals cannot break down on their own.
- (b) To bypass this limitation, their hindgut harbors dense populations of symbiotic flagellated protozoans, such as *Trichonympha*, alongside specific anaerobic bacterial strains.
- (c) These endosymbionts synthesize and secrete the cellulase enzyme complex, which cleaves the complex beta-glycosidic bonds of cellulose, converting it into simple, absorbable sugars.
- 4. The termite absorbs these converted monosaccharides and volatile fatty acids to power its high metabolism.
- (d) Lignin remains largely indigestible and is excreted, while starch, glycogen, and proteins follow alternative metabolic routes within the insect's midgut architecture.

Final Answer: Cellulose into simple sugars

Answer: (B)

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Q24.

Solution**Concept:**

The outer skeleton of the common cockroach (*Periplaneta americana*) is partitioned into individual hardened units that protect the insect while maintaining flexibility for movement.

Solution:

- (a) The chitinous exoskeleton of each body segment is divided into four main hardened cuticular plates known as sclerites, which are joined together by flexible arthrodial membranes.
- (b) The prominent plates situated on the dorsal aspect of each thoracic and abdominal segment are specifically termed tergites, which shield the dorsal blood vessel and internal organs.
- (c) Conversely, the ventral plates on each segment are designated as sternites, while the lateral plates anchoring the sides of the segment are called pleurites.
- (d) Coxae represent the large, thick basal segments of the insect's walking legs and do not form part of the main segmental body wall armor.
- (e) Distinguishing these structural regions is essential when studying how contact insecticides penetrate the thin arthrodial membranes compared to the thick sclerites.

Final Answer: Tergites

Answer: (C)

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Q25.

Solution**Concept:**

Economic entomology requires matching the population dynamics and feeding behaviors of key insect pests with the vulnerable growth stages of host crops to time control measures effectively.

Solution:

- (a) The Rice Gundhi Bug (*Leptocorisa acuta*) is a major pest in rice-growing regions, recognized by its characteristic pungent odor emitted from defensive scent glands.
- (b) The nymphs and adults use their long piercing-sucking mouthparts to target the developing paddy crop, specifically during the milky stage of grain formation.
- (c) They pierce the tender, unhardened grains to suck out the sweet internal milky sap, causing the grains to shrivel and turn into empty, chalky husks known as gundhi chaff.
- (d) While the bug can feed on young succulent leaves during the vegetative phase, this behavior does not cause significant economic loss compared to grain destruction.
- (e) Monitoring field populations prior to the milky stage is crucial for implementing timely insecticidal dustings or traditional botanical deterrents across farming communities.

Final Answer: Milky stage of the grain development

Answer: (C)

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Answer Key

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

