Rajasthan JET Agriculture Sample Paper-6

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. Which of the following statements correctly distinguishes soil fertility from soil productivity?

(A) Soil fertility and soil productivity are synonymous terms used interchangeably in soil science.

(B) Soil fertility refers to the nutrient-supplying capacity of soil, while soil productivity is the actual yield obtained from that soil.

(C) Soil productivity is the inherent capacity of soil to supply nutrients, while fertility refers to yield output.

(D) A highly productive soil is always a highly fertile soil, and vice versa.

Q2. Which one of the following is NOT a primary function of potassium in plants?

(A) Regulation of stomatal opening and closing via guard cell osmoregulation.

(B) Activation of more than 60 enzymes involved in photosynthesis and respiration.

(C) Phloem loading and translocation of sugars from source to sink.

(D) Synthesis of chlorophyll and maintenance of leaf greenness.

Q3. "Hollow heart" disease of cauliflower curd is associated with the deficiency of which nutrient, and what is the recommended method of correction?

(A) Boron; corrected by foliar spray of 0.1–0.2% borax solution.

(B) Calcium; corrected by soil application of gypsum at 200 kg/ha.

(C) Zinc; corrected by foliar spray of 0.5% zinc sulphate solution.

(D) Molybdenum; corrected by soil drench with sodium molybdate.

Q4. Which type of soil pores is primarily responsible for gaseous exchange (aeration) in soils, and what is the approximate threshold diameter for these pores?

(A) Micropores with diameter less than 0.2 μm support aeration by capillary action.

(B) Mesopores with diameter between 0.2–30 μm facilitate gaseous exchange.

(C) Macropores with diameter greater than 0.06 mm (60 μm) facilitate gaseous exchange.

(D) Ultramicropores with diameter less than 0.1 nm support rapid gas diffusion.

Q5. In the context of green manuring before transplanted paddy, which of the following statements about *Sesbania aculeata* (Dhaincha) is correct?

(A) Dhaincha is sown 15–20 days before paddy transplanting and adds approximately 20–30 kg N/ha.

(B) Dhaincha is sown 45–50 days before paddy transplanting, incorporated at flowering, and adds approximately 60–80 kg N/ha.

(C) Dhaincha is sown simultaneously with paddy and incorporated at tillering stage.

(D) Dhaincha is sown only as a border crop and is not incorporated into the soil.

Q6. Earthworms are called “nature’s ploughmen”. Which combination of benefits do earthworms provide to agricultural soils?

(A) They fix atmospheric nitrogen and directly supply it to plant roots.

(B) They secrete hormones that stimulate rapid root elongation in plants.

(C) They compact the soil by forming dense burrows, reducing erosion.

(D) They produce nutrient-rich castings, increase macroporosity by burrowing, and stimulate microbial activity.

Q7. In check basin irrigation, the field is:

(A) Divided into small, level basins surrounded by low bunds, and water is applied to fill each basin completely before moving to the next.

(B) Divided into long furrows, and water flows continuously along the furrow length.

(C) Irrigated by buried perforated pipes that release water directly to the root zone.

(D) Flooded from one end and drained from the other, suitable only for rice cultivation.

Q8. The IW:CPE ratio used for scheduling irrigation in wheat refers to the ratio of:

(A) Irrigation water to cumulative potential evaporation; irrigation is applied when the ratio reaches 1.2–1.5.

(B) Irrigation water to crop potential evapotranspiration; value used is 1.0 for wheat.

(C) Irrigation water to cumulative pan evaporation; irrigation is applied when the ratio reaches 0.6–0.8 for wheat.

(D) Irrigation water to critical plant evaporation; value used is 0.3–0.4 for wheat.

Q9. Vernalization in wheat refers to:

(A) The requirement of long days (more than 12 hours of light) to initiate flowering in Rabi wheat varieties.

(B) The requirement of a prolonged low temperature period (2–6°C for 4–8 weeks) to break dormancy and enable flowering.

(C) The hardening process of seeds at 40–45°C before sowing to improve germination.

(D) The application of growth hormones to replace the cold requirement in spring wheat.

Q10. Paddy (*Oryza sativa*) is classified as a short-day plant (SDP). What does this imply for its cultivation at high latitudes?

(A) Paddy flowers freely at high latitudes because long nights are available throughout the year.

(B) Paddy is a day-neutral plant and photoperiod does not affect its flowering.

(C) Paddy requires a day length greater than the critical length to initiate flowering.

(D) Paddy requires a night length exceeding the critical dark period to flower; at high latitudes during summer, long days (short nights) prevent flowering.

Q11. In hybrid maize seed production, the process of detasseling involves:

(A) Manual removal of the tassel (male inflorescence) from the female parent rows to prevent self-pollination and ensure cross-pollination from the male parent.

(B) Removal of the silk (female parts) from all plants to direct energy to vegetative growth.

(C) Cutting of the entire male parent plant after pollen shedding is complete.

(D) Application of a chemical pollen suppressant to the entire field to control pollination.

Q12. Among the following, which group correctly classifies bajra (pearl millet), sorghum, and maize as **large millets**?

(A) Ragi, kangni, and kodo are large millets; bajra, sorghum, and maize are small millets.

(B) Bajra and sorghum are small millets; maize and ragi are large millets.

(C) Bajra (*Pennisetum glaucum*), sorghum (*Sorghum bicolor*), and maize (*Zea mays*) are large millets, while ragi, kangni, kodo, sanwa, and kutki are small millets.

(D) All millets including bajra, sorghum, maize, ragi, and kangni are classified under the same group of small millets.

Q13. Chickpea (*Cicer arietinum*) requires a cool and dry climate during its growth period. What happens to yield when sowing is delayed beyond 15 November?

(A) Yield increases because delayed sowing allows more vegetative growth before flowering.

(B) Yield is unaffected as chickpea is insensitive to sowing date.

(C) Yield increases due to reduced disease pressure in late-sown crops.

(D) Yield decreases significantly because the shortened cool vegetative phase reduces biomass accumulation before the warmer conditions hasten maturity.

Q14. *Brassica juncea* (Indian mustard) is generally frost-tolerant during vegetative stages. However, at which growth stage does frost cause the most severe damage?

(A) Germination stage, where low temperature prevents seed imbibition.

(B) Flowering stage, where frost causes flower drop, pollen sterility, and siliqua abortion, severely reducing seed set.

(C) Harvesting stage, when mature siliquae shatter due to freezing.

(D) Seedling stage, because frost kills young leaves before the plant establishes.

Q15. Which of the following correctly describes bunch-type groundnut varieties?

(A) Bunch types such as Somnath and TG-26 are erect, short-duration (90–110 days), and suitable for mechanical harvesting due to their compact growth habit.

(B) Bunch types are spreading runner varieties with pods formed along long horizontal branches.

(C) Bunch types like CO-1 are long-duration varieties requiring more than 150 days to mature.

(D) Bunch types fix more nitrogen than runner types due to a larger number of nodules per plant.

Q16. Which of the following statements about sugarcane ratoon crop management is correct?

(A) Ratoon crops are raised from seeds and require fresh planting every season.

(B) Ratoon crop management includes deep ploughing after each harvest to eliminate stubble.

(C) The ratoon crop is raised from the stubble left after main crop harvest; internode borer (*Chilo sacchariphagus*) is a major pest, and Uttar Pradesh is the largest sugar-producing state in India.

(D) Sugarcane ratoon crops have higher yield than plant crops in the first ratoon but require double the fertilizer dose.

Q17. In grape (*Vitis vinifera*) cultivation in India, which of the following correctly matches the variety with its fruit colour and identifies a major training system used?

(A) Thompson Seedless is a dark-coloured variety; Bangalore Blue is a green variety.

(B) The kniffin trellis system is used exclusively for Thompson Seedless varieties in Maharashtra.

(C) Bower trellis system is not recommended for Indian grape cultivation as it reduces sunlight penetration.

(D) Thompson Seedless and Pusa Seedless are green varieties; Bangalore Blue is a dark-coloured variety; bower and kniffin are two major training systems used in India.

Q18. Tissue culture (TC) plants are preferred over sword suckers for banana propagation because:

(A) TC plants produce fruits with more seeds, making them commercially more valuable.

(B) TC plants are virus-free and disease-free, genetically uniform, and give higher initial uniformity of crop establishment compared to suckers.

(C) TC plants mature 2–3 years later than sucker-propagated plants.

(D) TC plants are cheaper to produce and do not require any hardening before transplanting.

Q19. Which of the following statements about strawberry (*Fragaria* $\times$ *ananassa*) cultivation is correct?

(A) Strawberry is vegetatively propagated through stolons (runners); day-neutral varieties like Chandler and Sweet Charlie produce flowers regardless of photoperiod and are widely grown in polyhouse cultivation.

(B) Strawberry is propagated through seed germination; short-day varieties dominate commercial cultivation.

(C) Stolons of strawberry are used only for rootstock purposes, while fruiting plants are raised from seeds.

(D) Day-neutral strawberry varieties require a vernalization period of 8 weeks at 10°C before flowering.

Q20. In okra (*Abelmoschus esculentus*) cultivation, if fruits are not harvested at the recommended interval, which problem arises and what is the recommended harvest frequency?

(A) Fruits split open and drop; harvesting every 10–12 days is recommended.

(B) Fruits become too small and underdeveloped; daily harvesting is required.

(C) Fruits become fibrous and tough, rendering them unmarketable; harvesting every 4–5 days is recommended.

(D) Fruits lose their green colour and turn yellow; harvesting every 8–10 days prevents this.

Q21. In approach grafting, which feature distinguishes it from other grafting methods such as tongue grafting and cleft grafting?

(A) In approach grafting, the scion is completely detached from its parent before the union is made.

(B) Approach grafting requires the rootstock to be much older than the scion plant.

(C) Approach grafting is used exclusively for conifer trees and is not practised in fruit crops.

(D) In approach grafting, both the scion and the rootstock remain attached to their respective parent plants until the graft union is complete; they are only separated after successful union.

Q22. Potato tubers stored below 3°C experience a phenomenon called "cold sweetening". What causes this and at what temperature range should potato be stored to avoid it?

(A) Cold sweetening is caused by increased protein denaturation; storage at 0–1°C prevents it.

(B) Cold sweetening results from the conversion of starch to reducing sugars at temperatures below 3°C; recommended storage is at 3–4°C with 90–95% relative humidity to prevent this.

(C) Cold sweetening is caused by ice crystal formation in cells; storage at 8–10°C prevents it.

(D) Cold sweetening is a beneficial process that improves potato flavour; lower temperatures enhance it further.

Q23. Backcross breeding is most commonly used to:

(A) Transfer a single dominant or recessive gene (such as disease resistance) from a donor parent into an agronomically superior recurrent parent; approximately 6 backcross generations are needed to recover the recurrent parent genome.

(B) Create entirely new varieties with multiple improved traits simultaneously.

(C) Develop hybrid varieties with high heterosis for yield improvement.

(D) Improve quantitative traits like yield potential that are controlled by many genes.

Q24. In the bulk breeding method used for self-pollinated crops, selection among individual plants is:

(A) Done in the F2 generation by selecting the best individual plants and advancing them separately.

(B) Done continuously from F2 to F8 in every generation to purify lines rapidly.

(C) Deferred until the F5 or F6 generation; from F2 to F5/F6, the entire population is harvested in bulk without individual plant selection.

(D) Not done at all; an entire segregating population is released as a variety.

Q25. The tetrazolium (TZ) test is a rapid seed viability test. The basis of this test is:

(A) Viable seeds produce CO_2 when incubated in tetrazolium solution, turning the solution red.

(B) Tetrazolium reacts with seed protein to produce a yellow colour in viable seeds.

(C) Viable seeds absorb tetrazolium and turn blue due to chlorophyll activation.

(D) Dehydrogenase enzymes in living (viable) seed tissues reduce tetrazolium chloride to red-coloured formazan; dead tissues remain unstained.

Q26. The Seed Vigor Index (SVI) is calculated using which formula, and what does it measure?

(A) SVI = germination percentage ÷ (root length + shoot length); it measures seed moisture content.

(B) SVI = germination percentage × (root length + shoot length); it measures the seedling establishment ability and overall seed quality beyond simple germination percentage.

(C) SVI = (root length × shoot length) ÷ 100; it measures the speed of germination only.

(D) SVI = germination percentage − (root length + shoot length); it measures seed deterioration rate.

Q27. Termites (*Odontotermes* spp.) are soil pests that damage crops by:

(A) Feeding on roots, underground stems, and germinating seeds; controlled by soil drenching or seed treatment with chlorpyrifos at the time of planting.

(B) Feeding exclusively on stored grain in warehouses; not a field pest.

(C) Attacking only mature plants above the soil surface through leaf mining.

(D) Feeding on nitrogen-fixing bacteria in the soil, reducing soil fertility.

Q28. The “dead heart” symptom in young sorghum plants is caused by:

(A) Fusarium stalk rot pathogen entering through roots and blocking water transport.

(B) Aphid feeding on the central leaf causing it to die and turn brown.

(C) Shoot fly (*Atherigona soccata*) larvae boring into the central shoot of young sorghum plants; the growing point dies, causing the dead heart symptom.

(D) Cutworm cutting the main stem at ground level, toppling the plant.

Q29. Early blight of potato caused by *Alternaria solani* is characterised by:

(A) Water-soaked lesions on young leaves that rapidly turn white with a powdery surface coating.

(B) Purple-coloured spots at leaf margins indicating phosphorus toxicity rather than a disease.

(C) Pale yellow to white angular spots on lower leaf surface with a downy mould growth.

(D) Dark brown circular spots with concentric rings (target-board pattern) appearing first on older leaves; favoured by warm humid weather; managed by mancozeb spray.

Q30. Bacterial wilt of solanaceous crops caused by *Ralstonia solanacearum* is identified in the field by:

(A) Yellow mosaic pattern on leaves followed by leaf curl and stunting.

(B) Rapid wilting of the entire plant; a cross-section of the stem shows vascular discolouration, and a milky bacterial ooze flows from the cut stem when placed in water.

(C) White cottony growth on stems and leaves followed by hard black sclerotia formation.

(D) Necrotic ring spots on leaves with concentric brown bands indicating a viral infection.

Q31. Knock-down resistance (kdr) in insects such as whitefly against pyrethroid insecticides is an example of:

(A) Target site modification, where a mutation in the voltage-gated sodium channel reduces binding affinity of pyrethroid molecules, rendering them ineffective.

(B) Metabolic resistance caused by increased esterase enzyme production that degrades pyrethroids.

(C) Behavioural resistance where insects avoid treated plant surfaces.

(D) Penetration resistance where thickened cuticle prevents pyrethroid entry into the insect body.

Q32. Integrated Disease Management (IDM) combines multiple strategies. Which of the following correctly lists the three main components of IDM?

(A) Chemical fungicides alone applied at multiple doses at different crop growth stages.

(B) Chemical control combined with insecticide sprays to eliminate all disease vectors.

(C) Cultural methods (crop rotation, use of resistant varieties), chemical methods (fungicide application), and biological methods (use of *Trichoderma* spp. as a biocontrol agent).

(D) Genetic modification of crops to express antifungal proteins combined with soil sterilisation.

Q33. Which of the following correctly describes the composition and nutritional properties of buffalo milk compared to cow milk?

(A) Buffalo milk has lower fat content (2–3%) than cow milk (5–6%).

(B) Buffalo milk has higher cholesterol than cow milk, making it nutritionally inferior.

(C) Buffalo milk contains A1 beta-casein, while cow milk (from desi breeds) contains A2 beta-casein.

(D) Buffalo milk has higher fat content (6–8%) than cow milk (3.5–4%), lower cholesterol, and desi breeds produce milk with A2 beta-casein protein.

Q34. The Surti buffalo breed is characterised by which of the following?

(A) It is a dual-purpose breed from Gujarat (Kheda and Vadodara districts), with greyish body colour and a moderate milk yield of 1500–1800 litres per lactation.

(B) It is a draft-type breed from Rajasthan, with black body colour, primarily used for field work.

(C) It is the highest milk-yielding buffalo breed in India with an annual yield exceeding 3000 litres.

(D) It is a breed found in Uttar Pradesh, characterised by spiral horns and white skin patches.

Q35. The Marwari sheep breed of Rajasthan is primarily known for:

(A) Fine Merino-type wool with a staple length of 8–10 cm, used for making premium woollen textiles.

(B) High milk production (3–4 L/day), making it a dual-purpose dairy and wool breed.

(C) Coarse carpet-type wool; it is the predominant sheep breed in Rajasthan, well-adapted to arid desert conditions and mainly found in the Jaisalmer–Barmer region.

(D) Being a recently developed synthetic breed with highest body weight among Indian sheep breeds.

Q36. Which of the following is correct about the Jamunapari goat breed?

(A) Jamunapari is the smallest Indian goat breed, mainly raised for meat in southern India.

(B) Jamunapari is the tallest Indian goat breed, originated at Etawah district (UP) near the Jamuna river, is a high milk producer (2–3 L/day), and is also known as the Patiala goat.

(C) Jamunapari is a Rajasthani breed known for carpet wool production rather than milk.

(D) Jamunapari is a crossbred variety developed by CIRG to improve dairy traits of local goats.

Q37. In agricultural cost accounting, Cost A2 (also written as Cost A_2) includes:

(A) Only the cost of hired human labour and hired machinery; family labour and land rent are excluded.

(B) Only the cost of seeds, fertilisers, plant protection chemicals, and irrigation charges (paid-out expenses).

(C) All paid-out expenses (A1 cost) plus imputed value of family labour, giving a comprehensive total cost.

(D) All paid-out expenses including hired labour (A1 cost) plus the imputed value of owned land (rent equivalent) and imputed depreciation of owned capital assets.

Q38. Land consolidation (Chak bandi) in India aims to address which major agricultural problem?

(A) Fragmentation of agricultural holdings: scattered small plots are merged into a compact block, improving irrigation efficiency, enabling mechanisation, and reducing boundary disputes.

(B) Soil degradation caused by continuous monoculture cropping systems.

(C) Waterlogging of irrigated areas through construction of drainage channels.

(D) Encroachment of agricultural land by forest areas through legal demarcation.

Q39. Primary Agricultural Credit Societies (PACS) operate at which level in the cooperative credit structure, and at what interest rate are crop loans provided under the Kisan Credit Card (KCC) scheme?

(A) PACS operate at district level and provide crop loans at 10% interest rate.

(B) PACS operate at state level and are the apex body of the short-term cooperative credit structure.

(C) PACS operate at village (grass-root) level; under the KCC scheme, crop loans are provided at a concessional interest rate of 4% per annum (after interest subvention).

(D) PACS operate at national level and refinance district cooperative banks.

Q40. Under the PM-KISAN (Pradhan Mantri Kisan Samman Nidhi) scheme, the financial benefit provided to eligible farmers is:

(A) Rs. 10,000 per year paid in two equal instalments of Rs. 5,000 each directly to the farmer's bank account.

(B) Rs. 6,000 per year paid in three equal instalments of Rs. 2,000 each directly to the bank account of all landholding farmer families.

(C) Rs. 4,000 per year paid in four quarterly instalments of Rs. 1,000 each to marginal farmers only.

(D) Rs. 8,000 per year paid as a lump sum amount annually to small and marginal farmers only.

Detailed Solutions

Q1.

Solution

Concept: Soil fertility vs soil productivity

Soil fertility is defined as the inherent capacity (potential) of a soil to supply essential plant nutrients in adequate amounts and in appropriate ratios for plant growth. It is an intrinsic property of the soil.

Soil productivity is defined as the capacity of a soil to produce a specified crop under a defined set of management practices; it is measured as the actual yield obtained per unit area.

Key difference: A highly fertile soil is one that has a high nutrient-supplying capacity. However, it may not be productive if other yield-limiting factors are present, such as:

- Poor physical conditions (waterlogging, hardpan)
- Adverse pH (highly acidic or alkaline)
- Absence of proper crop management (no irrigation, poor varieties)
- Presence of toxic elements

Therefore, fertility is a **necessary but not sufficient** condition for productivity. A fertile soil can become productive when all limiting factors are overcome.

Option A is wrong: they are not synonymous.
Option C is wrong: the definitions are reversed.
Option D is wrong: a highly productive soil is not always fertile (it may be managed intensively).

Final Answer: Soil fertility is the nutrient-supplying capacity of soil, while soil productivity is the actual yield obtained; a fertile soil is not always productive if other limiting factors are present.

Answer: (B) Go Back to Q1

Q2.

Solution

Concept: Functions of potassium (K) in plants

Potassium (K) is a macronutrient that plays multiple essential roles:

- **Stomatal regulation:** K^+ ions accumulate in guard cells, causing them to swell and open stomata (osmoregulation); K^+ efflux causes stomatal closure.
- **Enzyme activation:** K^+ is a cofactor for more than 60 plant enzymes, including those involved in photosynthesis (pyruvate kinase) and respiration.
- **Phloem loading:** K^+ facilitates the loading of sucrose into phloem vessels for translocation from source (leaves) to sink (fruits, roots).
- **Fruit quality:** Adequate K improves fruit size, colour, taste, and shelf life.

Option D — Synthesis of chlorophyll — Chlorophyll contains magnesium (Mg) at its centre. K has no direct role in chlorophyll biosynthesis. This is therefore **NOT a function of potassium**.

Note: Iron (Fe) is needed for chlorophyll synthesis; Nitrogen (N) is part of the porphyrin ring; Mg is the central atom.

Final Answer: Synthesis of chlorophyll is NOT a function of potassium; chlorophyll requires magnesium at its centre, while K regulates stomata, activates enzymes, and facilitates phloem loading.

Answer: (D) Go Back to Q2

Q3.

Solution

Concept: Boron deficiency symptoms and correction

Boron (B) is a micronutrient essential for:

- Cell wall formation and pollen germination
- Sugar transport and lignification

Hollow heart (Brown Curd) of cauliflower:

- Boron deficiency causes internal browning and water-soaked areas in the cauliflower curd
- The curd becomes hollow with brown discolouration inside
- External symptoms include thick, brittle leaves with tip burn in beet

Correction: Foliar spray of **borax ($Na_2B_4O_7 \cdot 10H_2O$)** at 0.1–0.2% concentration, or soil application of borax at 10–15 kg/ha.

Options B, C, D are incorrect:

- Calcium deficiency causes tip burn/blossom end rot
- Zinc deficiency causes Khaira disease in rice, little leaf in cotton
- Molybdenum deficiency causes whiptail of cauliflower (different from hollow heart)

Final Answer: "Hollow heart" disease of cauliflower is caused by boron deficiency and is corrected by foliar spray of 0.1–0.2% borax solution.

Answer: (A) Go Back to Q3

Q4.

Solution

Concept: Soil pore classification and aeration

Soil pores are classified by diameter:

- **Macropores:** diameter $>$ 0.06 mm (60 μm) — responsible for gaseous exchange and rapid water drainage (gravitational water)
- **Mesopores (capillary pores):** 0.2–60 μm — hold plant-available water
- **Micropores:** $<$ 0.2 μm — hold water unavailable to plants

Role of macropores in aeration:

- Gaseous exchange occurs through macropores: O_2 diffuses in; CO_2 (from root respiration and microbial activity) diffuses out
- Adequate O_2 supply is essential for aerobic root respiration
- Compacted soils (reduced macroporosity) lead to O_2 depletion and accumulation of toxic gases

Options A, B, D are incorrect:

- Micropores and mesopores retain water via capillarity; they do not support gaseous exchange
- Ultramicropores are theoretical pores; they do not facilitate gas movement

Final Answer: Macropores with diameter greater than 0.06 mm (60 μm) are primarily responsible for gaseous exchange (aeration) in soils, allowing O_2 to diffuse in and CO_2 to diffuse out.

Answer: (C) Go Back to Q4

Q5.

Solution

Concept: Green manuring with Sesbania aculeata (Dhaincha) before paddy

Sesbania aculeata (Dhaincha) is the most widely recommended green manure crop in India for rice-based cropping systems.

Key management facts:

- **Sowing time:** 45–50 days before paddy transplanting (to allow sufficient biomass accumulation)
- **Incorporation time:** At or just before flowering stage (maximum N and biomass)
- **Nitrogen contribution:** Approximately 60–80 kg N/ha, equivalent to about 2 bags of urea
- **Additional benefits:** Improves soil organic matter, suppresses weeds, improves soil physical properties

Why at flowering stage? At full flowering, the green matter has maximum N content and the C:N ratio is favourable for rapid decomposition.

Option A is incorrect: 15–20 days is too short for adequate biomass; N addition of 20–30 kg is too low.
Options C and D are incorrect: simultaneous sowing or border-crop use defeats the purpose of green manuring.

Final Answer: *Sesbania aculeata* (Dhaincha) is sown 45–50 days before paddy transplanting, incorporated at flowering stage, and adds approximately 60–80 kg N/ha to the soil.

Answer: (B) Go Back to Q5

Q6.

Solution

Concept: Role of earthworms in soil improvement

Charles Darwin famously called earthworms "nature's ploughmen" and devoted his last major work to studying their effects on soil.

Beneficial effects of earthworms:

- **Castings (vermicast):** Earthworm excreta are rich in available N, P, K, micronutrients, and beneficial microorganisms; nutrient content is 5–11 times higher than surrounding soil
- **Burrowing:** Creates channels (macropores) that increase soil porosity, improve water infiltration, aeration, and root penetration
- **Microbial stimulation:** Gut passage of soil through earthworms stimulates beneficial microbial populations; microorganisms in castings are more active
- **Mixing:** Earthworms mix organic matter with mineral soil layers, improving humus formation

Options A, B, C are incorrect:

- Earthworms do not fix atmospheric nitrogen (that is done by Rhizobium, Azotobacter etc.)
- They do not secrete plant hormones
- They increase macroporosity, not compaction

Final Answer: Earthworms benefit agricultural soils by producing nutrient-rich castings, increasing macroporosity through burrowing, and stimulating microbial activity, earning them the title "nature's ploughmen."

Answer: (D) Go Back to Q6

Q7.

Solution

Concept: Check basin irrigation method

Check basin irrigation is a **surface irrigation** method where:

- The field is divided into small, **level basins** of uniform size by constructing low earthen bunds (checks) around each plot
- Water is applied to fill the basin completely, flooding the entire basin surface

uniformly

- Once one basin is filled, water moves to the next basin through a breach in the bund
- Suitable for: close-growing crops (wheat, paddy, vegetables), soils with medium to slow permeability

Advantages:

- Good water distribution efficiency
- Simple to construct and operate
- Suitable for soils of varying texture

Comparison with other methods:

- Option B describes furrow irrigation (for row crops)
- Option C describes sub-surface drip irrigation
- Option D describes border strip or flood irrigation; paddy is grown in check basins, not just by flooding one end

Final Answer: In check basin irrigation, the field is divided into small, level basins surrounded by low bunds, and water is applied to fill each basin completely before moving to the next.

Answer: (A) Go Back to Q7

Q8.

Solution

Concept: IW:CPE ratio for irrigation scheduling

IW:CPE ratio stands for:

- **IW** = Irrigation Water (depth of water applied)
- **CPE** = Cumulative Pan Evaporation (measured using a standard Class A evaporation pan)

How it is used:

- A pan is kept in the field to measure daily evaporation
- Evaporation is cumulated from the time of last irrigation

- When the cumulative pan evaporation reaches a threshold value relative to the irrigation water applied, the next irrigation is due

For wheat:

- IW:CPE ratio of **0.6–0.8** is recommended
- This means irrigation is applied when CPE = 1.25 to 1.67 times the last irrigation depth
- At the critical stages (crown root initiation, jointing, heading, milking), the ratio is kept at 0.8

Options A, B, D are incorrect: the ratio of 1.2–1.5 or 1.0 is too high; 0.3–0.4 is too low and would cause water stress.

Final Answer: The IW:CPE ratio stands for Irrigation Water to Cumulative Pan Evaporation; for wheat, irrigation is scheduled when this ratio reaches 0.6–0.8.

Answer: (C) Go Back to Q8

Q9.

Solution

Concept: Vernalization in wheat

Vernalization is the process by which a prolonged period of low temperature promotes or accelerates the transition from vegetative to reproductive phase in plants.

In wheat (*Triticum aestivum*):

- Temperature requirement: **2–6°C** for **4–8 weeks**
- The meristematic tissue (shoot apex) perceives the cold stimulus
- **Winter wheat** has a high vernalization requirement and cannot flower without adequate cold
- **Spring wheat** has no or very low vernalization requirement
- In India, Rabi wheat experiences natural vernalization during Dec–Jan cool nights

Molecular basis: Cold temperature causes epigenetic silencing of FLC (Flowering Locus C) gene, which is a flowering repressor. This allows activation of floral integrator genes.

Option A is incorrect: long-day requirement is separate from vernalization (photoperiodism, not vernalization).
Option C is incorrect: seed hardening at high temperature is not vernalization.
Option D is incorrect: while GA can partially substitute vernalization, the process itself is cold-induced.

Final Answer: Vernalization in wheat is the requirement of a prolonged low temperature period (2–6°C for 4–8 weeks) to break dormancy and enable the transition from vegetative to flowering phase.

Answer: (B) Go Back to Q9

Q10.

Solution

Concept: Paddy as a short-day plant

Photoperiodism is the response of plants to the relative length of day and night.

Short-day plants (SDP) like paddy:

- Flower when the **night length exceeds the critical dark period**
- Technically, they are "long-night plants" — the continuous dark period triggers flowering
- Critical night length for most paddy varieties: approximately 10–12 hours

Implication at high latitudes (e.g., above 50°N):

- During summer, days are very long (16–20 hours), nights are very short (4–8 hours)
- Night length falls **below** the critical dark period
- Therefore, paddy cannot initiate flowering ⇒ remains in vegetative phase
- Paddy cultivation at high latitudes is impractical for photo-sensitive varieties

Option A is wrong: long nights are not available during high-latitude summers.
Options B and C are wrong: paddy is an SDP, not a day-neutral plant or LDP.

Final Answer: Paddy (a short-day plant) requires night length exceeding the critical dark period to flower; at high latitudes during summer, the very long days (short nights) prevent flowering, making cultivation of photo-sensitive varieties impractical.

Answer: (D) Go Back to Q10

Q11.

Solution

Concept: Hybrid maize seed production and detasseling

In maize (*Zea mays*):

- **Tassel** = male inflorescence at the top of the plant; sheds pollen
- **Silk** = female inflorescence (styles and stigmas) emerging from the ear (cob)
- Maize is monoecious (separate male and female flowers on the same plant)

Hybrid seed production layout:

- Rows of **female parent** (4 rows) alternated with rows of **male parent** (2 rows)
- Female parent rows: tassels are **removed (detasseled)** before pollen shed to prevent self-pollination
- Detasseling is done manually when 1/3 of the tassel has emerged but before pollen shed
- Female parent is then cross-pollinated by wind-blown pollen from male parent rows

Why detassel: Maize lacks self-incompatibility; without detasseling, female plants would self-pollinate, ruining hybrid purity.

Option B is incorrect: silks are not removed; they must remain to receive pollen. **Options C and D** are incorrect: chemical pollen suppressants (GMCs) are used in some cases, but manual detasseling is the traditional and question-specific method.

Final Answer: Detasseling in hybrid maize seed production involves manual removal of the tassel (male inflorescence) from female parent rows before pollen shed to ensure cross-pollination and maintain hybrid purity.

Answer: (A) Go Back to Q11

Q12.

Solution

Concept: Classification of millets

Millets are classified into two groups based on grain size:

Large millets (coarse grains/major millets):

- **Bajra** (*Pennisetum glaucum* / pearl millet)
- **Jowar/Sorghum** (*Sorghum bicolor*)
- **Maize** (*Zea mays*)

Small millets (minor millets):

- **Ragi** (finger millet, *Eleusine coracana*)
- **Kangni** (foxtail millet, *Setaria italica*)
- **Kodo** (*Paspalum scrobiculatum*)
- **Sanwa** (barnyard millet, *Echinochloa frumentacea*)
- **Kutki** (little millet, *Panicum sumatrense*)

Memory tip: BSM = Big 3 millets (Bajra, Sorghum, Maize) are large millets; all others are small millets.

Options A, B, D are incorrect classifications.

Final Answer: Bajra (*Pennisetum glaucum*), sorghum (*Sorghum bicolor*), and maize (*Zea mays*) are classified as large millets, while ragi, kangni, kodo, sanwa, and kutki are small millets.

Answer: (C) Go Back to Q12

Q13.

Solution

Concept: Chickpea agronomy and sowing time sensitivity

Chickpea (*Cicer arietinum*) is a Rabi pulse crop requiring:

- Cool (15–30°C), dry climate during vegetative phase
- Freedom from frost during flowering (frost at flowering causes flower drop)
- Dry weather at maturity (prevents seed rot)

Effect of late sowing (after 15 November):

- Vegetative phase is shortened because warm temperatures arrive earlier
- Less biomass is accumulated before flowering
- Flowering coincides with increasing temperatures ⇒ heat stress at pod filling
- Result: Fewer pods per plant, lower 100-seed weight ⇒ **significant yield reduction**
- Optimum sowing: Late October to 15 November in North India

Options A, B, C are incorrect:

- Delayed sowing **reduces**, not increases, vegetative growth
- Chickpea is sensitive to sowing date
- Disease pressure is not necessarily lower in late-sown crops

Final Answer: Sowing chickpea after 15 November significantly reduces yield because the shortened cool vegetative phase limits biomass accumulation and flowering coincides with heat stress during pod filling.

Answer: (D) Go Back to Q13

Q14.

Solution

Concept: Frost sensitivity of mustard at different growth stages

Brassica juncea (Indian mustard, rai) is a Rabi oilseed crop generally considered frost-tolerant during vegetative stages because:

- Young plants can withstand light frost (–2 to –3°C) during vegetative growth
- Cells accumulate solutes (cryoprotectants) during cold hardening

Frost damage at flowering stage:

- Flowers and developing siliquae have **no frost hardening ability**
- Frost at flowering causes: flower drop, pollen sterility (pollen wall ruptures), pistil damage
- Result: **Failure of fertilisation ⇒ poor siliqua set ⇒ severe yield loss**
- Even a mild frost event during full bloom can reduce yield by 30–50%

Agronomic implication:

- Sowing time (October–November) is adjusted so that flowering (50 DAS) falls in February, when frost risk has passed in most Rajasthan districts

Options A, C, D are incorrect: frost at germination, harvesting, or seedling stage is less damaging than frost at flowering.

Final Answer: Frost causes the most severe damage to Indian mustard (*Brassica juncea*) at the flowering stage, causing flower drop, pollen sterility, and siliqua abortion, which drastically reduces seed set and yield.

Answer: (B) Go Back to Q14

Q15.

Solution

Concept: Groundnut growth habit and variety classification

Groundnut (*Arachis hypogaea*) varieties are classified by growth habit into:

Bunch type (erect):

- Erect, compact growth; stems do not spread on the ground
- Short duration: 90–110 days
- Suitable for **mechanical harvesting**
- Examples: **Somnath, TG-26, TAG-24, GG-2, GG-20**
- Popular in Saurashtra (Gujarat) and Rajasthan

Runner/spreading type:

- Prostrate, spreading growth habit; branches spread along the ground
- Long duration: 130–160 days
- Examples: CO-1, SB-11
- Pods form along long branches, making mechanical harvesting difficult

Option B is incorrect: it reverses the descriptions.
Option C is incorrect: CO-1 is a runner type, not a bunch type; 150 days is too long for bunch types.
Option D is incorrect: nitrogen fixation varies with rhizobial infection, not growth habit.

Final Answer: Bunch-type groundnut varieties such as Somnath and TG-26 are erect, short-duration (90–110 days), and compact in growth habit, making them suitable for mechanical harvesting.

Answer: (A) Go Back to Q15

Q16.

Solution

Concept: Sugarcane ratoon crop management

Ratoon cropping in sugarcane:

- After the main plant crop is harvested, the stubble (underground portion) is allowed to re-sprout
- New shoots emerge from eyes on the stubble nodes
- Saves cost of replanting; ratoon crop ready earlier (10–11 months vs 12–14 months for plant crop)

Ratoon crop management:

- Stubble shaving (protrash) to encourage tillers at soil level
- Gap filling for uniform stand
- Higher nitrogen dose than plant crop
- **Internode borer (*Chilo sacchariphagus indicus*):** bores into the internodes, forming characteristic "dead heart" in young tillers and reducing juice quality
- Managed by releasing *Trichogramma* parasitoids or applying carbofuran granules

Uttar Pradesh contributes approximately 35–40% of India's total sugar production, making it the largest sugar-producing state.

Options A, B, D are incorrect: ratoon is from stubble (not seeds); stubble is not ploughed out after each harvest; ratoon yield is typically lower than plant crop, not higher.

Final Answer: Sugarcane ratoon crop is raised from the stubble left after main crop harvest; internode borer (*Chilo sacchariphagus*) is a major pest, and Uttar Pradesh is the largest sugar-producing state in India.

Answer: (C) Go Back to Q16

Q17.

Solution

Concept: Grape cultivation in India — varieties and training systems

Major grape varieties in India:

- **Thompson Seedless** — green, seedless; most widely grown in Maharashtra
- **Pusa Seedless** — green, seedless; developed at IARI
- **Bangalore Blue** — dark purple-black, seeded; traditional variety of Karnataka; used for juice and wine
- **Sharad Seedless** — black, seedless; premium export variety

Training systems used in India:

- **Bower (Pandal) trellis:** Horizontal overhead trellis; vines trained upward and spread horizontally; maximum sunlight interception; preferred for Bangalore Blue and seedless varieties in south India
- **Kniffin trellis:** Vertical trellis with wires at 2 heights; used for varieties in cooler climates; common in north India

Option A is incorrect: Thompson Seedless is green; Bangalore Blue is dark-coloured — the option reverses them.
Option B is incorrect: kniffin is not exclusive to Thompson Seedless in Maharashtra.
Option C is incorrect: bower system is widely recommended and used in India.

Final Answer: Thompson Seedless and Pusa Seedless are green grape varieties, Bangalore Blue is a dark-coloured variety, and bower and kniffin are the two major training systems used in Indian grape cultivation.

Answer: (D) Go Back to Q17

Q18.

Solution

Concept: Tissue culture (TC) plants vs sucker propagation in banana

Traditional propagation of banana:

- **Sword suckers:** Vegetative shoots arising from the rhizome with narrow sword-shaped leaves; preferred over water suckers
- Risk: suckers may carry **viruses** (Banana Bunchy Top Virus — BBTV, Banana

Mosaic Virus — CMV) and nematodes (*Radopholus similis*)

Advantages of TC (tissue culture) plants:

- **Disease-free:** Produced from meristem tip culture under sterile conditions; free from BBTV, Fusarium wilt, nematodes
- **Genetic uniformity:** All plants are clones of the mother plant; uniform growth and fruiting
- **Better crop stand:** Higher uniformity of establishment; plants mature at the same time
- **Higher yield:** 20–30% higher bunch weight reported in Cavendish varieties

Option A is incorrect: TC banana (Cavendish types) are **triploid and seedless**; no seeds.
Option C is incorrect: TC plants mature slightly earlier or at the same time.
Option D is incorrect: TC plants require hardening in shade nets before field transplanting.

Final Answer: Tissue culture plants are preferred over suckers for banana propagation because they are virus-free, disease-free, genetically uniform, and give higher initial uniformity of crop establishment.

Answer: (B) Go Back to Q18

Q19.

Solution

Concept: Strawberry propagation and photoperiodic response

Vegetative propagation of strawberry:

- Strawberry plants produce **stolons (runners)**: horizontal stems that root at nodes, producing daughter plants
- Commercial propagation is almost entirely through runners; seeds are used only in breeding programs

Photoperiodic classification of strawberry varieties:

- **Short-day varieties:** Flower when day length < 12 hours; one flowering flush (autumn/winter in hills)
- **Day-neutral varieties:** Flower regardless of photoperiod; produce flowers and fruit continuously throughout the season

- **Day-neutral examples: Chandler, Sweet Charlie, Camarosa** — widely grown in polyhouse/protected cultivation in India

Polyhouse cultivation: Day-neutral varieties are particularly suited to polyhouse growing as controlled temperature and continuous fruiting maximise returns.

Options B, C, D are incorrect:

- Strawberry is not propagated through seed commercially
- Stolons are propagation material, not rootstock
- Day-neutral varieties do not require vernalization for flowering (that is specific to some short-day varieties)

Final Answer: Strawberry is vegetatively propagated through stolons (runners), and day-neutral varieties like Chandler and Sweet Charlie produce flowers regardless of photoperiod, making them ideal for polyhouse cultivation.

Answer: (A) Go Back to Q19

Q20.

Solution

Concept: Okra (Bhindi) post-harvest quality and harvest frequency

Okra (*Abelmoschus esculentus*) pods are harvested at the **immature tender** stage:

- Pods are ready for harvest 4–6 days after fruit set
- At the tender stage, pods are soft, mucilaginous, and marketable

What happens if harvest is delayed:

- Pods rapidly accumulate cellulose and lignin in the fibrovascular bundles
- Within 2–3 days beyond optimal harvest window, pods become **tough and fibrous**
- Fibrous pods are unacceptable to consumers and fetch no market value
- Also, if mature pods are left on the plant, it signals the plant to slow down new pod production (reduces productivity)

Recommended harvest frequency:

- **Every 4–5 days** (in cool weather) to **every 2–3 days** in hot summer conditions

- Varieties: **Pusa A-4** (tolerant to yellow vein mosaic, high-yielding), **Arka Anamika** (YVMV resistant)

Options A, B, D are incorrect: split pods (10–12 days) and colour change (8–10 days) do not apply to okra management; daily harvesting is not required.

Final Answer: If okra fruits are not harvested at the recommended interval of every 4–5 days, they become fibrous and tough due to lignin accumulation, rendering them unmarketable.

Answer: (C) Go Back to Q20

Q21.

Solution

Concept: Grafting methods — approach grafting vs other methods

Comparison of major grafting methods:

Tongue (saddle/whip) grafting:

- Scion is detached from parent plant before union
- Used for young stems of similar diameter
- Both scion and stock are cut with matching diagonal cuts with interlocking tongues

Cleft grafting:

- Scion is detached; a cleft is made in the stock and scion(s) inserted
- Used for older, larger-diameter rootstocks

Approach grafting (inarching):

- **Both scion and rootstock plants remain in their own pots/roots throughout the union process**
- Matching cuts are made on the approaching stems; they are brought together and bound
- After union forms (4–8 weeks), the scion stem is severed below the union, and the rootstock stem is severed above the union
- Used for difficult-to-root species and for plants susceptible to wilting after detachment
- Common in mango, guava, and some ornamental plants

Options A, B, C are incorrect:

- In approach grafting, scion is NOT detached before union
- Rootstock age is not a defining criterion
- Approach grafting is widely used in fruit crops, not just conifers

Final Answer: In approach grafting (inarching), both the scion and the rootstock remain attached to their respective parent plants until the graft union is complete, and only then are they separated – making it suitable for difficult-to-root species.

Answer: (D) Go Back to Q21

Q22.

Solution

Concept: Cold sweetening in potato during storage

Recommended cold storage conditions for potato:

- Temperature: **3–4°C**
- Relative humidity: **90–95%**
- Ventilation: adequate to remove CO_2 and ethylene

Cold sweetening phenomenon:

- At temperatures **below 3°C**, amylase enzymes become active and convert stored starch to **reducing sugars** (glucose + fructose)
- Accumulation of reducing sugars causes:
  - Sweet taste (undesirable in processing varieties)
  - **Maillard reaction** during frying: sugars react with amino acids at high temperature $\Rightarrow$ dark brown colour in chips/French fries (caramelisation + Maillard browning)
  - Makes potato unsuitable for processing/frying industry
- This is the reason processing potato varieties require storage at exactly 3–4°C, not lower

Options A, C, D are incorrect:

- Cold sweetening is biochemical (starch $\rightarrow$ sugar), not protein-based

- 8–10°C promotes sprouting; too high
- Cold sweetening is **detrimental** to processing quality, not beneficial

Final Answer: Cold sweetening in potato occurs below 3°C when starch converts to reducing sugars; recommended storage at 3–4°C with 90–95% relative humidity prevents this phenomenon and maintains processing quality.

Answer: (B) Go Back to Q22

Q23.

Solution

Concept: Backcross breeding method

Purpose: Backcross breeding is used to transfer a **single specific gene** (particularly a simply inherited resistance gene) from a **donor parent** into a commercially adapted **recurrent parent** variety.

Procedure:

- **F1:** Cross recurrent parent (RP) $\times$ donor parent (DP)
- **BC1F1:** F1 $\times$ RP; select plants carrying the desired gene
- Repeat backcrossing: **BC2, BC3, BC4, BC5, BC6**
- After each backcross, select for the desired trait (disease resistance)
- After BC6, approximately **99.2%** of the genome is from the recurrent parent

Recovery formula: After n backcrosses, recurrent parent genome recovery = $(1-(1/2)^{n+1}) \times 100\%$

After 6 backcrosses: $(1-(1/2)^7) \times 100\% = 99.2\%$

Why 6 backcrosses? The resulting line is **Near-Isogenic Line (NIL)** – essentially the recurrent parent with only the desired gene replaced.

Options B, C, D are incorrect: backcross breeding is for **single gene transfer**, not multiple trait improvement, hybrid development, or polygenic traits.

Final Answer: Backcross breeding is most commonly used to transfer a single dominant or recessive gene (such as disease resistance) from a donor parent into an agronomically superior recurrent parent, requiring approximately 6 backcross generations to recover 99.2% of the recurrent parent genome.

Answer: (A) Go Back to Q23

Q24.

Solution

Concept: Bulk method of breeding for self-pollinated crops

Bulk breeding procedure:

- **F1:** Single cross between two parents
- **F2 to F5 or F6:** The entire segregating population is grown and **bulk-harvested as a whole** without individual plant selection
  - Natural selection acts: inferior genotypes have lower fitness and survival
  - Deliberate individual selection is NOT practised in early generations
- **F5 or F6 generation:** When most loci have become homozygous, individual plant selection is **finally practiced**
- Selected plants are progeny-tested to identify superior lines

Advantages of bulk method:

- Inexpensive (no individual pedigree records maintained)
- Natural selection eliminates poorly adapted genotypes
- Suitable for large breeding programs with limited resources

Disadvantage: Takes longer (F5–F6 before selection); no genealogical record.

Options A, B, D are incorrect:

- F2 selection is characteristic of **pedigree method**, not bulk method
- Continuous selection from F2 onward is the pedigree method
- No variety is released without individual selection in any standard method

Final Answer: In bulk breeding, individual plant selection is deferred until the F5 or F6 generation; from F2 to F5/F6, the entire segregating population is harvested in bulk, allowing natural selection to eliminate poorly adapted genotypes.

Answer: (C) Go Back to Q24

Q25.

Solution

Concept: Tetrazolium (TZ) test for seed viability

Principle:

- **2,3,5-triphenyl tetrazolium chloride (TTC)** is a pale yellow, water-soluble compound
- In living (viable) cells, dehydrogenase enzymes of the respiratory chain **reduce TTC** to **triphenyl formazan (TTF)**, which is bright **red in colour**
- Dead cells lack dehydrogenase activity $\Rightarrow$ TTC is NOT reduced $\Rightarrow$ tissues remain **unstained or white**

Procedure:

- Seeds are pre-soaked and cut to expose embryo
- Placed in 0.5–1.0% TTC solution for 24–48 hours at 30°C in darkness
- Viability interpreted based on colour pattern of embryo staining

Advantage: Rapid (24–48 hrs vs 7–10 days for standard germination test); can test dormant seeds that would not germinate in a standard test.

Options A, B, C are incorrect:

- CO_2 is not involved in the colour reaction
- No protein-based yellow reaction occurs
- Blue colour and chlorophyll are not part of the TZ test

Final Answer: The tetrazolium (TZ) test works because dehydrogenase enzymes in living seed tissues reduce tetrazolium chloride to red-coloured formazan, while dead tissues lacking enzymatic activity remain unstained.

Answer: (D) Go Back to Q25

Q26.

Solution

Concept: Seed Vigor Index (SVI)

Definition: Seed vigor refers to the sum total of properties that determine the potential for rapid, uniform emergence and development of normal seedlings under a wide range of field conditions.

Formula:

$$\text{SVI} = \text{Germination percentage} \times (\text{Root length} + \text{Shoot length})$$

Units: SVI is dimensionless (germination % $\times$ cm)

What SVI measures:

- Both the **proportion of seeds** that germinate AND the **vigour of resulting seedlings**
- A seed lot with 95% germination but very short seedlings has lower SVI than one with 90% germination but robust seedlings
- Predicts seedling establishment ability in the field better than germination % alone

Example calculation:

- Germination = 90%, Root length = 8 cm, Shoot length = 5 cm
- SVI = $90 \times (8 + 5) = 90 \times 13 = 1170$

Options A, C, D use incorrect formulas (division, different combination, subtraction).

Final Answer: The Seed Vigor Index is calculated as SVI = Germination percentage $\times$ (Root length + Shoot length), measuring both the proportion of seeds that germinate and the vigour of the resulting seedlings to predict field establishment ability.

Answer: (B) Go Back to Q26

Q27.

Solution

Concept: Termites (Odontotermes spp.) as soil pests

White ants / Termites (*Odontotermes* spp., *Microtermes* spp.):

- Social insects living in underground colonies (subterranean termites)
- Feed on: roots, underground stems, germinating seeds, stem base near soil level
- Damage pattern: plants suddenly wilt and die; on uprooting, roots are hollowed out
- More severe in: newly broken sandy soils, fields with undecomposed organic matter, sugarcane, groundnut, wheat, maize

Management:

- **Soil drench:** Chlorpyrifos 20 EC @ 3 litres/ha in 1000 litres water, applied at planting time along furrows
- **Seed treatment:** Chlorpyrifos 20 EC @ 4 ml per kg seed (for groundnut, wheat)
- **Cultural:** Remove undecomposed organic matter; avoid poorly drained soils

Chlorpyrifos is an organophosphate insecticide that inhibits acetylcholinesterase in insects.

Options B, C, D are incorrect:

- Termites are destructive field pests, not only stored-grain pests
- They attack underground plant parts, not leaves
- They do not feed on soil bacteria

Final Answer: Termites (*Odontotermes* spp.) damage crops by feeding on roots, underground stems, and germinating seeds, and are managed by soil drenching or seed treatment with chlorpyrifos at the time of planting.

Answer: (A) Go Back to Q27

Q28.

Solution

Concept: Shoot fly (Atherigona soccata) on sorghum

Shoot fly (*Atherigona soccata*) is one of the most destructive pests of sorghum (jowar) in India.

Life cycle and damage mechanism:

- Adult female lays eggs on undersurface of lower leaves of young sorghum plants (7–21 days old)
- Larvae hatch and **bore into the central shoot (growing point)**
- Growing point is killed $\Rightarrow$ the central leaf turns yellow, then brown, and **wilts**: this is the "**dead heart**" symptom
- Dead heart can be pulled out easily from the plant

Management:

- **Early sowing** (before July 1 in Kharif) to escape peak fly population
- **Resistant varieties:** IS-18551, ICSV-745 (hairy leaf surface deters oviposition)
- **Seed treatment:** Imidacloprid 70 WS @ 7 g/kg seed
- **Roguing** of dead heart plants

Options A, B, D are incorrect:

- Fusarium stalk rot causes stalk rotting in mature plants, not dead heart in seedlings
- Aphids do not cause dead heart
- Cutworm damage is at soil level (stem cutting), not internal boring

Final Answer: The "dead heart" symptom in young sorghum plants is caused by shoot fly (*Atherigona soccata*) larvae boring into the central shoot and killing the growing point, which can be distinguished from other damage by the ease with which the dead central leaf pulls out.

Answer: (C) Go Back to Q28

Q29.

Solution

Concept: Early blight of potato (Alternaria solani)

Causal organism: *Alternaria solani* (fungus, Deuteromycetes)

Symptoms:

- **Characteristic lesions:** Dark brown to black, circular spots of 3–5 mm diameter
- **Target-board / concentric ring pattern:** The spot enlarges with distinct concentric rings, giving a "bullseye" or target-board appearance
- **Distribution on plant:** Starts on **older (lower) leaves** first; progresses upward (unlike late blight which may start anywhere)
- Spots are surrounded by a yellow halo
- In severe cases, leaves turn yellow, dry up, and drop prematurely

Favourable conditions: Warm (24–29°C) and humid weather; periods of alternate wet and dry conditions; nutrient-stressed plants are more susceptible.

Management:

- **Mancozeb** (M-45) @ 2.5 g/litre spray at fortnightly intervals
- Iprodione or chlorothalonil as alternates

Options A, B, C are incorrect:

- Water-soaked white lesions: powdery mildew (different pathogen)
- Purple leaf margins: P deficiency, not disease
- Pale yellow with downy mould: downy mildew (Peronospora)

Final Answer: Early blight of potato caused by *Alternaria solani* is characterised by dark brown circular spots with concentric rings (target-board pattern) appearing first on older leaves, favoured by warm humid weather, and managed by mancozeb spray.

Answer: (D) Go Back to Q29

Q30.

Solution

Concept: Bacterial wilt (Ralstonia solanacearum) of solanaceous crops

Causal organism: *Ralstonia solanacearum* (formerly *Pseudomonas solanacearum*) – a soil-borne bacterium.

Symptoms and diagnostic features:

- **Rapid wilting:** Entire plant (or branch) wilts suddenly even when soil has adequate moisture
- **Vascular discolouration:** Brown streaking visible in xylem when stem is cut cross-sectionally
- **Bacterial ooze test:** When a freshly cut stem is placed in a glass of clear water, a **milky white ooze** (bacterial streaming) flows from the cut end – diagnostic confirmation
- Roots may show brown discolouration; in advanced stages, hollow pith

Important features:

- Soil-borne: spreads through infected soil, irrigation water, and implements
- **No curative chemical control** is available for infected plants
- Management: Crop rotation (avoid solanaceous crops for 3–4 years), resistant varieties, soil solarisation, biocontrol with *Bacillus subtilis*

Options A, C, D are incorrect (these describe viral mosaic, white mould/Sclerotinia, and viral ring-spot respectively).

Final Answer: Bacterial wilt caused by *Ralstonia solanacearum* is identified by rapid wilting of the entire plant, vascular discolouration in cross-sectioned stem, and milky white bacterial ooze streaming from the cut stem when placed in water.

Answer: (B) Go Back to Q30

Q31.

Solution

Concept: Mechanisms of insecticide resistance

Knock-down resistance (kdr):

- Kdr is a classic example of **target site modification** (TSM) resistance
- Target site: **Voltage-gated sodium channels (VGSC)** on nerve cell membranes
- Pyrethroids work by binding to and keeping sodium channels open, causing continuous nerve firing $\Rightarrow$ paralysis
- In kdr-resistant insects: a **point mutation** in the VGSC gene alters the channel protein structure (e.g., Leu-Phe substitution at position 1014)
- Result: Reduced binding affinity of pyrethroid molecule to the channel $\Rightarrow$ pyrethroids fail to block nerve conduction
- Observed in whitefly (*Bemisia tabaci*), house fly, Colorado potato beetle against pyrethroids

Comparison of resistance mechanisms:

- **Metabolic resistance** (Option B): Increased enzyme (esterase, monooxygenase, GST) activity degrades insecticide
- **Behavioural resistance** (Option C): Insects avoid treated surfaces
- **Penetration resistance** (Option D): Thicker cuticle slows insecticide entry

Kdr is specifically target site modification, not metabolic.

Final Answer: Knock-down resistance (kdr) is an example of target site modification, where a point mutation in the voltage-gated sodium channel reduces the binding affinity of pyrethroid insecticides, rendering them ineffective against resistant insects.

Answer: (A) Go Back to Q31

Q32.

Solution

Concept: Integrated Disease Management (IDM)

IDM is a science-based strategy that uses multiple compatible methods to manage plant diseases while minimising economic, health, and environmental risks.

Three main components of IDM:

1. Cultural control:

- Crop rotation to break disease cycles
- Use of resistant/tolerant varieties
- Seed treatment, sanitation, roguing infected plants
- Adjusting sowing date to avoid peak infection periods

2. Chemical control:

- Fungicide application (preventive or curative)
- Examples: mancozeb, copper oxychloride (contact); carbendazim, propiconazole (systemic)

3. Biological control:

- Use of ***Trichoderma viride / T. harzianum*** as soil amendment or seed treatment – mycoparasite of fungal pathogens
- *Bacillus subtilis* for bacterial and fungal diseases
- *Pseudomonas fluorescens* for soil-borne pathogens

Options A, B, D are incorrect:

- A single strategy (chemicals only) is not IDM
- Insecticides are part of IPM (insects), not IDM (diseases)
- Genetic modification + soil sterilisation is not the standard IDM framework

Final Answer: Integrated Disease Management (IDM) combines cultural methods (crop rotation, resistant varieties), chemical methods (fungicide application), and biological methods (use of *Trichoderma* spp.) to manage plant diseases while minimising economic and environmental risks.

Answer: (C) Go Back to Q32

Q33.

Solution

Concept: Composition and nutritional properties of buffalo milk

Comparison of buffalo milk vs cow milk:

Component	Buffalo milk	Cow milk
Fat	6–8%	3.5–4%
Protein	3.8–4.5%	3.2–3.5%
Lactose	4.5–5.0%	4.7–4.8%
SNF	9.5–10.5%	8.5–9.0%
Cholesterol	Lower	Higher

A2 beta-casein protein:

- **Desi Indian breeds** (both cattle and buffalo): produce milk with **A2 beta-casein**
- A2 milk is considered easier to digest; associated with fewer digestive discomforts
- European crossbred cows produce A1 beta-casein milk (associated with BCM-7 release)
- Buffalo milk from all breeds contains A2 beta-casein

Option A is incorrect: buffalo has higher fat (6–8%), not lower.
Option B is incorrect: buffalo milk has **lower** cholesterol than cow milk.
Option C is incorrect: the casein types are reversed in the statement.

Final Answer: Buffalo milk has higher fat content (6–8%) and lower cholesterol than cow milk, and desi breeds of both cattle and buffalo produce milk with A2 beta-casein protein, which is considered easier to digest.

Answer: (D) Go Back to Q33

Q34.

Solution

Concept: Surti buffalo breed of India

Surti buffalo (also called Deccani or Surti):

- **Origin/Home tract:** Gujarat state; **Kheda and Vadodara (Baroda)** districts along the Narmada and Tapti rivers

- **Breed type:** Dual-purpose (milk + draft)
- **Body colour:** Rusty brown or copper-coloured when young; turns dark grey/brownish in adults; greyish is a common description
- **Milk yield:** Moderate — approximately **1500–1800 litres per lactation** (270–310 days)
- **Fat percentage:** 7.5–8.5% (high fat content)
- **Other features:** Well-adapted to Deccan climate; medium body size; upward, sickle-shaped horns

Distinguishing from Murrah buffalo:

- Murrah: highest milk yield (1800–2500 L), jet black colour, tight coiled horns, Haryana/UP
- Surti: moderate yield, brownish-grey, sickle-shaped horns, Gujarat

Options B, C, D are incorrect:

- Not a Rajasthan breed; not primarily draft; not the highest yielder; not found in UP

Final Answer: The Surti buffalo is a dual-purpose breed from Kheda and Vadodara districts of Gujarat, characterised by greyish body colour and a moderate milk yield of 1500–1800 litres per lactation with high fat content (7.5–8.5%).

Answer: (A) Go Back to Q34

Q35.

Solution

Concept: Marwari sheep of Rajasthan

Marwari sheep is the most important sheep breed of **Rajasthan**:

- **Distribution:** Jaisalmer, Barmer, Jodhpur, Bikaner and surrounding arid districts of western Rajasthan
- **Wool type: Coarse carpet wool**; used in weaving carpets and coarse blankets; NOT fine wool
- **Staple length:** 5–7 cm; fibre diameter 35–45 microns (coarse)
- **Annual wool yield:** 0.5–1.0 kg per animal per shearing

- **Adaptation:** Extremely well-adapted to arid and semi-arid desert conditions; can survive on sparse desert vegetation and tolerate extreme heat
- **Body features:** Medium-sized, long pendulous ears, Roman nose, reddish-brown to white body colour

Note: Do not confuse with **Marwari goat** (which is a separate breed). The question specifically asks about **Marwari sheep**.

Options A, B, D are incorrect:

- Option A: Marwari is NOT fine Merino-type wool; it is coarse carpet wool
- Option B: Marwari sheep is not a dairy breed; milk yield is minimal
- Option D: It is an ancient breed, not a synthetic variety

Final Answer: Marwari sheep of Rajasthan is primarily known for coarse carpet-type wool and is the predominant breed in the Jaisalmer–Barmer arid region, being extremely well-adapted to desert conditions.

Answer: (C) Go Back to Q35

Q36.

Solution

Concept: Jamunapari goat breed

Jamunapari goat:

- **Origin:** Etawah district, Uttar Pradesh; the breed is named after the **Jamuna (Yamuna) river**
- **Synonyms:** Also called **Patiala goat** (as it was introduced into the Punjab and Pakistan border regions); also called Ram Sagar or Calcuttia in some areas
- **Physical characteristics:** Tallest Indian goat breed; Roman nose (convex profile); pendulous ears (30–35 cm long); both sexes horned
- **Body colour:** White with tan patches on head and neck; some entirely white
- **Milk production:** High milker — produces **2–3 litres per day** (200–250 days lactation)
- **Breed type:** Primarily dairy; also used for meat (chevon)
- **Significance:** Parent breed for **Anglo-Nubian** (UK) and **Beetal** (Punjab) breeds; has influenced many dairy goat breeds worldwide

Options A, C, D are incorrect:

- Not the smallest breed; not from south India; not for carpet wool; not a crossbred variety

Final Answer: Jamunapari is the tallest Indian goat breed, originated at Etawah district (UP) near the Yamuna river, produces 2–3 litres of milk per day, and is also known as the Patiala goat.

Answer: (B) Go Back to Q36

Q37.

Solution

Concept: Cost concepts in agricultural economics

The CACP (Commission for Agricultural Costs and Prices) defines the following cost categories:

- **Cost A1:** All actual paid-out expenses — hired human labour, hired animal/machine labour, seeds (purchased), fertilisers, plant protection chemicals, irrigation charges, depreciation on owned implements, interest on working capital, miscellaneous expenses
- **Cost A2 (= A1 + imputed land rent + depreciation on owned capital):** A1 + **imputed value of owned land** (rent forgone) + **imputed depreciation of owned capital assets** (e.g., farm machinery)
- **Cost B1 (= A2 + interest on fixed capital):** A2 + imputed interest on owned fixed capital
- **Cost B2 (= A2 + family labour):** A2 + imputed value of family labour (at market rates)
- **Cost C2 (= B2 + land rent):** B2 + actual rent paid (if land is rented); comprehensive total cost

Summary for A2: A2 = A1 (all paid-out costs) + imputed land rent (ownership cost) + imputed depreciation of fixed capital.

Options A, B, C are incorrect:

- Option A: A2 is not limited to hired inputs only
- Option B: That is only part of A1 (variable cash costs)
- Option C: A2 + family labour = **B2**, not A2

Final Answer: Cost A2 in agricultural accounting includes all paid-out expenses (Cost A1) plus the imputed value of owned land (rent equivalent) and imputed depreciation of owned capital assets.

Answer: (D) Go Back to Q37

Q38.

Solution

Concept: Land consolidation (Chak bandi) in India

Problem addressed — Land fragmentation:

- In India, joint family inheritance laws led to agricultural land being divided among heirs over generations
- A farmer might own 10–15 scattered small plots in different locations across a village
- Average holding size in India is about 1.1 ha, comprising multiple fragments

Chak bandi (Land consolidation):

- All scattered plots of a farmer are **merged into one or two compact blocks (chaks)** of equivalent total area
- Governed by: **Punjab Land Consolidation Act (1936)** extended to many states; **Rajasthan Chak Bandi Act**
- **Benefits:**
  - Easier and cheaper **irrigation** infrastructure (one channel serves one compact field)
  - Economical use of **farm machinery** (no time wasted moving between plots)
  - **Reduced boundary disputes** between neighbours
  - Better **supervision and management**
  - More rational use of inputs (fertiliser, pesticides)

Options B, C, D are incorrect: soil degradation, waterlogging management, and encroachment issues are addressed by different programmes.

Final Answer: Land consolidation (Chak bandi) addresses the problem of land fragmentation by merging scattered small plots of a farmer into a compact block, improving irrigation efficiency, enabling mechanisation, and reducing boundary disputes.

Answer: (A) Go Back to Q38

Q39.

Solution

Concept: PACS and crop loans under KCC scheme

Three-tier Short-term Cooperative Credit Structure:

- **National level:** NABARD (apex refinancing body)
- **State level:** State Cooperative Banks (SCBs) — 1 per state
- **District level:** District Central Cooperative Banks (DCCBs) — 1 per district
- **Village (grass-root) level: Primary Agricultural Credit Societies (PACS)** — direct contact with farmers

Role of PACS:

- First point of institutional credit contact for the farmer
- Provides short-term crop loans, input supply, storage
- About 95,000 PACS functioning across India

Kisan Credit Card (KCC) scheme:

- Launched in 1998–99 by NABARD
- Provides crop loans through PACS, commercial banks, and RRBs
- **Interest rate:** 7% per annum (with 3% interest subvention from Government of India = effective rate **4% per annum** for prompt repayers)
- Credit limit based on crop area, input costs, and crop insurance

Options A, B, D are incorrect: PACS operate at village level, not district, state, or national level.

Final Answer: Primary Agricultural Credit Societies (PACS) operate at the village grass-root level, and under the Kisan Credit Card (KCC) scheme, crop loans are provided at a concessional interest rate of 4% per annum after government interest subvention.

Answer: (C) Go Back to Q39

Q40.

Solution

Concept: PM-KISAN (Pradhan Mantri Kisan Samman Nidhi) scheme

PM-KISAN scheme details:

- **Launched:** February 2019, Government of India (Ministry of Agriculture & Farmers Welfare)
- **Financial benefit: Rs. 6,000 per year** per farmer family
- **Instalments:** Three equal instalments of **Rs. 2,000 each** — April–July, August–November, December–March
- **Mode of payment:** Direct Benefit Transfer (DBT) directly to the farmer's **Aadhaar-linked bank account**
- **Eligibility:** All landholding farmer families (with cultivable land in their name); excludes income taxpayers, constitutional post holders, government employees (except class IV/peons), professionals earning $>$ Rs. 10,000/month
- **Aim:** Supplement financial needs of farmers for purchasing inputs and reduce dependence on moneylenders
- As of 2024, more than 11 crore farmers enrolled

Options A, C, D are incorrect:

- Rs. 10,000 in 2 instalments is wrong
- Rs. 4,000 in 4 instalments is wrong
- Rs. 8,000 in lump sum, limited to marginal farmers, is wrong

Final Answer: Under PM-KISAN, all landholding farmer families receive Rs. 6,000 per year paid in three equal instalments of Rs. 2,000 each, transferred directly to their Aadhaar-linked bank accounts.

Answer: (B) Go Back to Q40

Answer Key

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