IFFCO AGT 19 November 2026 Shift 1 Memory Based Paper

Q1. On a pesticide label, a yellow triangle indicates which toxicity category?
(a) Moderately toxic (Class II)
(b) Slightly toxic (Class IV)
(c) Highly toxic (Class II)
(d) Extremely toxic (Class I)
S1. Ans (c)
Explanation:
Pesticide toxicity is classified into different categories based on the degree of toxicity. In India, pesticide labels use colour codes and warning symbols to indicate their toxicity levels.

- **Red triangle:** Extremely toxic (Class I)
- **Yellow triangle:** Highly toxic (Class II)
- **Blue triangle:** Moderately toxic (Class III)
- **Green triangle:** Slightly toxic (Class IV)

The yellow colour indicates highly toxic pesticides, which require strict precautions during handling, storage and application.

Q2. In vegetable crops of the sandy alluvial tracts of North Bihar, root-knot nematode infestation is diagnosed by which root symptom?
(a) Dark lesions girdling the root collar
(b) Rotted roots with foul odour
(c) Thread-like root proliferation
(d) Swollen galls on fine feeder roots
S2. Ans (d)
Explanation:
Root-knot disease is caused by plant-parasitic nematodes belonging to the genus *Meloidogyne*.

- The most characteristic symptom is the formation of swollen galls or knots on the roots.
- These galls develop due to the feeding activity of female nematodes inside the root tissues.
- Infected plants show poor growth, yellowing, wilting and reduced nutrient uptake.
- Fine feeder roots become distorted, resulting in reduced water and nutrient absorption.

Important Information:
Common species of *Meloidogyne* include:
1. *Meloidogyne incognita*
2. *Meloidogyne javanica*
3. *Meloidogyne arenaria*

Q3. Fruit fly infestation in mango (Malda) and guava is characterised by which symptom?
(a) Nymphs of sap-sucking insects feeding on the fruit
(b) Caterpillars boring straight tunnels in the pulp
(c) Maggots feeding on the pulp with oozing resin
(d) Grubs feeding on the outer rind
S3. Ans (c)
Explanation:
Fruit fly infestation in mango and guava is caused by fruit flies belonging to the family Tephritidae.

- Female fruit flies lay eggs inside developing or ripening fruits using their ovipositor.
- Eggs hatch into maggots, which feed on the fruit pulp.
- Their feeding activity damages the internal tissues of fruits.

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- Infested fruits become soft, develop rotting symptoms and may show oozing of fluid or resin.
- Severe infestation results in premature fruit drop and considerable economic losses.

Important Information:
- Scientific name of oriental fruit fly: *Bactrocera dorsalis*.
- The damaging stage is the larval stage (maggot).
- Fruit flies are important pests of mango, guava and several other fruit crops.

Q4. Operation Greens aims to stabilise prices of which produce?
(a) Cotton, jute and pulses
(b) Milk and dairy products
(c) Tomato, onion and potato
(d) Wheat, rice and maize
S4. Ans (c)
Explanation:
Operation Greens is a Government of India initiative launched under the Ministry of Food Processing Industries (MoFPI).
- It was launched in 2018–19 to stabilise the supply and prices of three major vegetables: Tomato, Onion and Potato (TOP).
- The scheme aims to reduce price fluctuations and ensure better returns to farmers.
- It promotes value-chain development, post-harvest infrastructure, processing and storage facilities.
- In 2020, the scheme was expanded from TOP crops to 22 perishable crops under the TOP to TOTAL initiative.

Important Information:
TOP stands for:
- T – Tomato
- O – Onion
- P – Potato

The scheme focuses on strengthening agricultural supply chains and reducing post-harvest losses.

Q5. Regulated markets (APMC mandis) achieve efficient price discovery mainly through:
(a) Direct bargaining between the farmer and buyer
(b) Open auction and competitive bidding
(c) Barter exchange of produce
(d) Fixed government-determined price lists
S5. Ans (b)
Explanation:
Agricultural Produce Market Committee (APMC) markets are established to regulate the marketing of agricultural produce and protect farmers from unfair trade practices.
- Open auction is an important mechanism for price discovery in regulated agricultural markets.
- In this system, different buyers participate in competitive bidding for agricultural produce.
- The competition among buyers helps determine the market price based on demand and supply.
- It promotes transparency and enables farmers to obtain better prices for their produce.

Important Information:
Major functions of APMC markets include:
1. Regulation of agricultural trade.
2. Providing a transparent marketing platform.
3. Preventing exploitation of farmers by intermediaries.
4. Facilitating competitive price discovery.

Q6. In citrus orchards of the NE Hills, selecting a particular rootstock among helps achieve which benefit?
(a) Dwarfing effect and disease resistance
(b) Faster fruit colour development
(c) Increased flower petal count
(d) Higher pollen viability
S6. Ans (a)
Explanation:
Rootstocks play an important role in citrus cultivation because they influence plant growth, productivity, fruit quality and resistance to various stresses.
- Certain rootstocks induce a dwarfing effect, resulting in smaller and more manageable trees.
- Dwarfing helps facilitate orchard management, pruning, spraying and harvesting.
- Rootstocks also provide resistance or tolerance against important soil-borne diseases.
- For example, *Poncirus trifoliata* is valued for its cold tolerance and resistance to Phytophthora-related problems.

Important Information:
Rootstocks influence several characteristics of grafted plants, including:
1. Tree vigour and size.
2. Nutrient and water absorption.
3. Tolerance to soil and climatic stresses.
4. Resistance to soil-borne diseases.
5. Fruit yield and quality.

Q7. If pesticide splashes into a worker's eyes, what is the correct first aid?
(a) Apply antibiotic ointment
(b) Rub eyes gently to remove chemical
(c) Wash eyes with a soap solution
(d) Flush eyes with clean water
S7. Ans (d)
Explanation:
Pesticide exposure to the eyes is a medical emergency because certain chemicals can cause irritation, inflammation and serious eye damage.
The correct immediate first-aid measure is to flush the affected eyes with clean running water.
- Immediately rinse the eyes with clean, gently flowing water.
- Continue flushing for at least 15 minutes, or longer if directed by the pesticide label.
- Keep the eyelids open during washing to ensure proper removal of the chemical.
- Remove contact lenses if they are present and can be removed easily.
- Seek medical attention and carry the pesticide label or container information.

Important: Never rub the eyes or apply ointments or other substances without medical advice.

Q8. In the basic communication model, decoding refers to the receiver's:
(a) Encoding of the original message
(b) Interpretation of the message received
(c) Selection of communication channel
(d) Transmission of feedback signal

S8. Ans (b)
Explanation:
Decoding is the process through which the receiver interprets and understands the message transmitted by the sender.
The basic communication process involves the following elements:
1. **Sender:** The person who initiates the communication.
2. **Encoding:** Converting ideas or information into words, symbols or gestures.
3. **Message:** The information being communicated.
4. **Channel:** The medium through which the message is transmitted.
5. **Receiver:** The person who receives the message.
6. **Decoding:** Interpreting and understanding the received message.
7. **Feedback:** The receiver's response to the sender.

Example: A teacher explains a concept to students. Students understand and interpret the explanation. This process of understanding is called decoding.

Q9. An enterprise budget is prepared primarily to estimate the costs and returns of:
(a) A regional agricultural market
(b) A cooperative marketing society
(c) The entire farm business
(d) A single farm enterprise
S9. Ans (d)
Explanation:
An enterprise budget is an important farm management tool used to estimate the expected costs and returns associated with a particular agricultural enterprise.
- It considers the total variable and fixed costs involved in producing a specific crop or livestock product.
- It estimates the expected gross returns from the enterprise.
- It helps farmers determine the expected profitability of an individual enterprise.
- It supports decisions regarding resource allocation and enterprise selection.

Important Information:
Farm budgeting is generally classified into three major types:
1. **Enterprise Budget:** Estimates costs and returns of an individual enterprise, such as wheat cultivation or dairy farming.
2. **Partial Budget:** Evaluates the financial impact of making a specific change in an existing farm business.
3. **Whole-Farm Budget:** Estimates the total costs and returns of the entire farm business.

Q10. A test cross is primarily performed to determine whether an individual's genotype is:
(a) Fully linked to a marker gene
(b) Diploid or polyploid
(c) Homozygous or heterozygous for a trait
(d) Resistant to induced mutations
S10. Ans (c)
Explanation:
A test cross is a genetic technique used to determine the unknown genotype of an individual showing a dominant phenotype.
In this method, an individual with an unknown genotype is crossed with a homozygous recessive individual.
There are two possible outcomes:

Case 1: Unknown individual is homozygous dominant (TT)

TT × tt

- All offspring will have the genotype Tt.
- All offspring will show the dominant phenotype.

Case 2: Unknown individual is heterozygous (Tt)

Tt × tt

- 50% offspring will be Tt.
- 50% offspring will be tt.
- The phenotypic ratio will be 1:1.

Therefore, a test cross helps determine whether an individual showing a dominant character is homozygous dominant or heterozygous.

Important Information:

- Test cross: Cross between an individual with an unknown genotype and a homozygous recessive individual.
- Back cross: Cross between an F1 hybrid and either of its parents.

Q11. In North Bihar, splitting a sugarcane stalk for red rot diagnosis reveals which internal symptom?

(a) Brown rot with foul smell at nodes
(b) Black sooty mould
(c) Yellow streaks in vascular bundles
(d) Reddened tissue with white cross-bands

S11. Ans (d)

Explanation:

Red rot is one of the most destructive fungal diseases of sugarcane. It is caused by *Colletotrichum falcatum*.

The characteristic internal symptoms are observed when an infected sugarcane stalk is split longitudinally.

- The internal tissues show characteristic red discolouration.
- White transverse patches or cross-bands are visible within the reddened tissues.
- Infected canes may develop a characteristic alcoholic smell.
- Severe infection causes deterioration of cane quality and reduction in sugar recovery.

Important Information:

- Disease: Red rot of sugarcane.
- Causal organism: *Colletotrichum falcatum*.
- Common name: Cancer of sugarcane.
- Important symptom: Reddening of internal tissues with white transverse patches.

Q12. In potato crops of the North Eastern hills, death of the terminal growing point along with hollow heart signals deficiency of:

(a) Boron (B)
(b) Manganese (Mn)
(c) Calcium (Ca)
(d) Molybdenum (Mo)

S12. Ans (a)

Explanation:
Boron is an essential micronutrient required for normal plant growth, cell wall formation and meristematic activity.
- Boron plays an important role in cell wall development and structural integrity.
- It is essential for the proper functioning of growing points and meristematic tissues.
- Boron deficiency may cause the death of terminal growing points, resulting in a condition known as the growing-point disorder.
- In potato, boron deficiency can also be associated with internal disorders such as hollow heart.

Important Functions of Boron:
1. Helps in cell wall formation and stability.
2. Supports cell division and meristematic growth.
3. Plays an important role in pollen germination and pollen tube growth.
4. Helps in sugar translocation.
5. Supports reproductive growth and seed development.

Important Information: Boron is relatively immobile in many plant species. Therefore, its deficiency symptoms commonly appear in young leaves and growing points.

Q13. Seed treatment with Rhizobium culture before sowing (lentil, chickpea in Rabi) is most beneficial for:
(a) Leguminous crops
(b) Vegetable crops
(c) Oilseed crops
(d) Cereal grain crops

S13. Ans (a)
Explanation:
Rhizobium is a beneficial soil bacterium that establishes a symbiotic association with the roots of leguminous plants. It plays an important role in biological nitrogen fixation.
- Rhizobium enters the root hairs of leguminous plants and induces the formation of root nodules.
- Inside these nodules, the bacteria convert atmospheric nitrogen (N_2) into ammonia (NH_3), which can be utilised by plants.
- This process reduces the requirement for externally applied nitrogenous fertilisers.
- Seed treatment with Rhizobium culture ensures the availability of effective bacterial strains near the developing roots.
- It improves plant growth, nitrogen availability and soil fertility.

Important Information:
Examples of important leguminous crops:
1. Lentil – *Lens culinaris*
2. Chickpea – *Cicer arietinum*
3. Pigeon pea – *Cajanus cajan*
4. Green gram – *Vigna radiata*
5. Black gram – *Vigna mungo*
6. Soybean – *Glycine max*

Important: Rhizobium is associated with legumes, whereas *Azotobacter* is a free-living nitrogen-fixing bacterium commonly used for non-leguminous crops.

Q14. 6 harvesters can harvest a rice field in 5 days. How many days will 4 harvesters take?
(a) 10 days
(b) 8 days
(c) 7.5 days
(d) 6 days
S14. Ans (c)
Explanation:
This question is based on the concept of inverse proportion between the number of workers or machines and the time required to complete a particular task.
When the number of harvesters decreases, the number of days required to complete the same work increases.
Step 1: Calculate the total work.
Total work = Number of harvesters × Number of days
= 6 × 5
= 30 harvester-days
Step 2: Calculate the number of days required by 4 harvesters.
Required days = Total work / Number of harvesters
= 30 / 4
= 7.5 days
Therefore, 4 harvesters will require 7.5 days to harvest the same rice field.
Important Mathematical Concept:
For a fixed amount of work:
$$M_1 \times D_1 = M_2 \times D_2$$
Where:
- M_1 = Initial number of machines
- D_1 = Initial number of days
- M_2 = New number of machines
- D_2 = Required number of days

This relationship is known as inverse proportion.

Q15. Heavy aphid infestation on vegetable crops in North Bihar promotes a condition leading to which secondary disease?
(a) Powdery mildew on young shoots
(b) Anthracnose on fruit surface
(c) Sooty mould on honeydew-coated leaves
(d) Capnodium growth, reducing photosynthesis
S15. Ans (c)
Explanation:
Aphids are important sucking pests of vegetable crops. They damage plants by sucking cell sap and also promote the development of sooty mould through the secretion of honeydew.
- Aphids feed on the phloem sap of plants using their piercing and sucking mouthparts.
- During feeding, they excrete a sugary substance known as honeydew.
- Honeydew accumulates on leaves, stems and other plant surfaces.
- Sooty mould fungi develop on this honeydew, producing a black, soot-like coating.
- This black coating reduces the amount of sunlight reaching the leaf surface and interferes with photosynthesis.

Important Information:

- Sooty mould is generally associated with honeydew-producing insects such as aphids, whiteflies, mealybugs and scale insects.
- *Capnodium* species are commonly associated with sooty mould.
- Sooty mould is a secondary problem because its development is facilitated by honeydew secreted by insect pests.

Difference between aphid damage and sooty mould:

1. Aphids directly damage plants by sucking phloem sap.
2. Sooty mould indirectly affects plants by covering the leaf surface and reducing photosynthetic efficiency.

Q16. The Kisan Call Centre service primarily provides farmers with:

(a) Toll-free telephonic farm advisory in local languages
(b) On-farm demonstration plots
(c) Subsidised credit disbursal
(d) Door-to-door seed distribution

S16. Ans (a)

Explanation:

Kisan Call Centre (KCC) is an initiative of the Government of India designed to provide agricultural information and advisory services to farmers through telephone-based communication.

- The service enables farmers to obtain information about agricultural practices and farming-related problems.
- Farmers can seek guidance regarding crop production, plant protection, soil management, weather-related issues and animal husbandry.
- The service provides agricultural advice in different regional languages to overcome language barriers.
- It helps farmers access expert guidance without physically visiting agricultural offices.
- The service is accessible through the toll-free number **1800-180-1551**.

Important Information:

- Launched: 21 January 2004.
- Toll-free number: 1800-180-1551.
- Implemented to improve access to agricultural information and advisory services.
- It provides assistance through a network of agricultural experts and call-centre representatives.

Important: Kisan Call Centres provide advisory services; they do not directly distribute seeds or provide agricultural credit.

Q17. Inbreeding depression in cross-pollinated crops results mainly from increased expression of:

(a) Homozygous deleterious recessive alleles
(b) Linked marker gene combinations
(c) Heterozygous favourable alleles
(d) Cytoplasmic male sterility

S17. Ans (a)

Explanation:

Inbreeding depression refers to the reduction in vigour, fertility, productivity and overall fitness of plants resulting from repeated self-pollination or mating between closely related individuals.

It is particularly prominent in cross-pollinated crops because these crops generally maintain a high degree of heterozygosity.

Why does inbreeding depression occur?

- Cross-pollinated crops generally contain several harmful recessive alleles in a heterozygous condition.
- During repeated self-pollination, heterozygosity decreases and homozygosity increases.
- Harmful recessive alleles become expressed in the homozygous condition.
- The expression of these deleterious alleles leads to reduced plant vigour, fertility and yield.

Major effects of inbreeding depression:

1. Reduced plant height and vegetative growth.
2. Decreased seed production.
3. Reduced fertility.
4. Poor reproductive performance.
5. Reduced yield and adaptability.

Important Information:

- Inbreeding: Mating between genetically related individuals or repeated self-pollination.
- Inbreeding depression: Reduction in biological fitness due to increased homozygosity.
- Heterosis: Superiority of F1 hybrids over their parents in one or more characters.

Examples: Maize, pearl millet and other cross-pollinated crops are commonly studied for inbreeding depression and heterosis.

Q18. Which type of tillage inverts and breaks up compacted subsoil surfaces later through deep ploughing?

(a) Minimum tillage
(b) Conservation tillage
(c) Secondary tillage
(d) Primary tillage

S18. Ans (d)

Explanation:

Primary tillage is the initial major soil-working operation performed after harvesting the previous crop or before establishing a new crop.

- It involves breaking, loosening and, in many cases, inverting the soil.
- It helps break compacted soil layers and prepares the field for subsequent agricultural operations.
- It incorporates crop residues, weeds and organic materials into the soil.
- It improves soil aeration and creates favourable conditions for root growth.

Common implements used in primary tillage:

1. Mouldboard plough
2. Disc plough
3. Chisel plough
4. Subsoiler

Difference between primary and secondary tillage:

Primary tillage	Secondary tillage
Initial major soil-working operation	Operations performed after primary tillage
Generally deeper soil disturbance	Generally shallow soil disturbance
Breaks and loosens the soil	Breaks clods and prepares a fine seedbed
Uses ploughs and subsoilers	Uses harrows, cultivators and planks

Important: Subsoiling is a deep tillage operation used to break compacted subsoil layers, particularly hardpans.

Q19. Pomology, as a branch of horticulture, specifically deals with:
(a) Plantation and spice crops
(b) Cultivation of ornamental flowering plants
(c) Production and management of fruit crops
(d) Vegetable crops
S19. Ans (c)
Explanation:
Pomology is a specialised branch of horticulture that deals with the scientific study, cultivation, production, improvement, harvesting and management of fruit crops.

- It includes the selection of suitable fruit varieties and rootstocks.
- It deals with propagation techniques such as budding, grafting and layering.
- It covers orchard establishment, pruning, training, irrigation and nutrient management.
- It also includes harvesting, grading, storage and post-harvest management of fruits.

Important Branches of Horticulture:

Branch	**Area of study**
Pomology	Fruit crops
Olericulture	Vegetable crops
Floriculture	Flower crops
Arboriculture	Trees and their cultivation
Viticulture	Grapevine cultivation
Plantation crop science	Plantation crops
Landscape horticulture	Planning and management of landscapes

Examples of fruit crops studied under pomology:

- Mango – *Mangifera indica*
- Guava – *Psidium guajava*
- Apple – *Malus domestica*
- Banana – *Musa* spp.
- Citrus – *Citrus* spp.

Q20. A 'change agent' in agricultural extension primarily functions as:
(a) A link between the client system and the resource system
(b) Replacing farmers' traditional leaders
(c) Conducting independent agricultural research
(d) Supervising subsidy disbursal
S20. Ans (a)
Explanation:
A change agent is an individual who influences and facilitates the adoption of new ideas, technologies, practices and innovations within a social system.
In agricultural extension, an extension worker generally performs the role of a change agent.

- A change agent acts as a connecting link between the client system (farmers) and the resource system (research institutions, scientists and other technical organisations).
- The agent identifies farmers' problems and communicates them to the relevant technical institutions.
- The agent transfers improved agricultural technologies and scientific knowledge to farmers.
- The agent encourages farmers to adopt beneficial innovations and improved farming practices.
- The agent also provides guidance, motivation and feedback during the adoption process.

Important Information:
According to the agricultural extension communication framework:
1. **Client System:** Farmers or individuals who are expected to adopt innovations.
2. **Resource System:** Research institutions, scientists, subject-matter specialists and other sources of technical knowledge.
3. **Change Agent:** The person who facilitates communication and interaction between the client and resource systems.

Example: An agricultural extension officer introducing improved seed varieties, integrated pest management and modern irrigation techniques to farmers acts as a change agent.

Q21. For commercial multiplication of Khasi mandarin in the NE Hills, which vegetative method is most commonly used?
(a) Simple layering of mature shoots
(b) Budding onto trifoliate rootstock
(c) Air layering of mature shoots
(d) Simple layering of low branches
S21. Ans (b)
Explanation:
Khasi mandarin is an important citrus fruit crop cultivated in the North-Eastern Hill region of India.
Commercial propagation of citrus crops is generally carried out through vegetative methods to maintain the genetic characteristics and desirable qualities of the parent plant.
Budding onto trifoliate rootstock:
- Budding is a vegetative propagation technique in which a single bud from a desired variety is inserted onto a suitable rootstock.
- Trifoliate orange (*Poncirus trifoliata*) is used as a rootstock in citrus cultivation.
- It provides useful characteristics such as cold tolerance, dwarfing effect and tolerance to certain soil-borne diseases.
- Budding helps maintain varietal purity and uniformity in commercial orchards.
- It generally results in earlier bearing compared with raising plants through seeds.

Important Information:
Common methods of vegetative propagation in citrus include:
1. T-budding.
2. Patch budding.
3. Shield budding.
4. Grafting.

Important: Seed propagation may result in genetic variation and does not always maintain the desirable characteristics of the parent variety.

Q22. In rice-based systems, crop rotation helps manage soil-borne diseases mainly through which mechanism?
(a) Increasing weed seed bank
(b) Increasing soil organic matter
(c) Improving nitrogen fixation capacity
(d) Breaking the pathogen life cycle by host absence
S22. Ans (d)
Explanation:
Crop rotation is an important cultural method of managing soil-borne diseases. It involves growing different crops in a planned sequence on the same field over successive seasons.

- Many soil-borne pathogens survive in the soil or crop residues and depend on specific host plants for multiplication.
- Continuous cultivation of the same susceptible crop provides favourable conditions for the survival and multiplication of pathogens.
- Growing a non-host or resistant crop interrupts the pathogen's life cycle.
- The absence of a suitable host reduces pathogen multiplication and may gradually lower the pathogen population in the soil.
- Crop rotation also improves soil health and helps maintain agricultural sustainability.

Examples:

1. Rotating cereals with legumes helps diversify the cropping system.
2. Rice-based systems can include suitable non-host crops depending on the disease problem.
3. Rotation with non-host crops helps manage certain soil-borne fungal pathogens and nematodes.

Important Information:

Other cultural methods of disease management include:

- Field sanitation.
- Removal of infected crop residues.
- Use of disease-free seeds.
- Soil solarisation.
- Selection of resistant varieties.
- Proper drainage and water management.

Important: Crop rotation is particularly effective when the selected crop is a non-host of the pathogen being managed.

Q23. Onion and garlic are classified as vegetables based on which edible plant part?

(a) Bulb formed from thickened leaf bases
(b) Rhizome
(c) Modified underground stem tuber
(d) Fleshy swollen taproot

S23. Ans (a)

Explanation:

Onion and garlic are classified as bulb vegetables because their edible portions consist mainly of fleshy, modified leaf bases arranged around a short underground stem.

Structure of a bulb:

- A bulb is an underground storage organ.
- It consists of a short, flattened stem known as the basal plate.
- Fleshy scale leaves or leaf bases develop around the basal plate.
- These fleshy leaf bases store reserve food materials.
- The outer dry scale leaves provide protection against mechanical damage and water loss.

Examples of bulb vegetables:

1. Onion – *Allium cepa*
2. Garlic – *Allium sativum*
3. Shallot – *Allium cepa* Aggregatum Group

Important Difference between Underground Storage Organs:

Plant part	Example	Botanical nature
Bulb	Onion, garlic	Fleshy leaf bases
Rhizome	Ginger	Underground modified stem
Stem tuber	Potato	Swollen underground stem
Tuberous root	Sweet potato	Swollen storage root
Corm	Colocasia	Solid underground stem

Important: Potato is a stem tuber, whereas sweet potato is a modified storage root.

Q24. In transplanted rice, which growth stage is most critical for irrigation scheduling?
(a) Seedling nursery stage
(b) Land preparation stage
(c) Panicle initiation stage
(d) Post-maturity stage
S24. Ans (c)
Explanation:
Panicle initiation is an important reproductive transition stage in rice when the growing point begins developing into a panicle.
Proper water management during this stage is essential for reproductive development and grain yield.
- Panicle initiation marks the beginning of reproductive growth in rice.
- During this stage, the developing panicle and spikelet structures are highly sensitive to environmental stress.
- Water stress can negatively affect panicle development and reduce the number of potential grains.
- Adequate soil moisture supports normal growth and reproductive development.
- Water management should ensure that the crop does not experience moisture stress during this critical period.

Important Growth Stages of Rice:
1. Germination stage.
2. Seedling stage.
3. Active tillering stage.
4. Panicle initiation stage.
5. Booting stage.
6. Heading and flowering stage.
7. Grain filling stage.
8. Maturity stage.

Important Information:
- Panicle initiation: Beginning of panicle development.
- Booting: Developing panicle becomes enclosed within the flag leaf sheath.
- Heading: Panicle emerges from the flag leaf sheath.
- Anthesis: Flowering and opening of the florets.
- Grain filling: Accumulation of starch and other food materials in developing grains.

Q25. The National Food Security Act, 2013 primarily aims to provide what?
(a) Subsidised grain to poor households
(b) Interest subvention on farm loans
(c) Minimum support price guarantee
(d) Crop insurance to all farmers
S25. Ans (a)
Explanation:
The National Food Security Act (NFSA), 2013 was enacted to provide food and nutritional security by ensuring access to adequate quantities of quality food at affordable prices.
Its major objective is to provide subsidised foodgrains to eligible households.
Major provisions of NFSA, 2013:
- It provides coverage to up to 75% of the rural population and 50% of the urban population.
- Eligible persons under the Priority Household category are entitled to 5 kg of foodgrains per person per month.

- Antyodaya Anna Yojana (AAY) households are entitled to 35 kg of foodgrains per household per month.
- It gives special importance to nutritional support for pregnant women, lactating mothers and children.
- It also provides for nutritional support through the Integrated Child Development Services and school meal programmes.

Important Information:

Category	Monthly foodgrain entitlement
Priority Household (PHH)	5 kg per person
Antyodaya Anna Yojana (AAY)	35 kg per household

Under the Pradhan Mantri Garib Kalyan Anna Yojana (PMGKAY), eligible NFSA beneficiaries have been provided free foodgrains from January 2024 for five years.

Important: NFSA is a food-security legislation, not a crop insurance or agricultural credit scheme.

Q26. Maize seed rate is 20 kg/ha. A farmer sows 7.5 ha using 15 kg seed bags. How many bags are needed?

(a) 9
(b) 10
(c) 12
(d) 8

S26. Ans (b)

Explanation:

This question is based on the calculation of total seed requirement using the recommended seed rate and total cultivated area.

Step 1: Calculate the total seed requirement.

Seed rate = 20 kg/ha
Cultivated area = 7.5 ha
Total seed requirement:
$$=20\times7.5$$
$$=150\text{ kg}$$

Step 2: Calculate the number of seed bags required.

Weight of one seed bag = 15 kg
$$\text{Number of bags}=\frac{150}{15}$$
$$=10\text{ bags}$$
Therefore, the farmer requires 10 bags of maize seeds.

Important Formula:

$$\text{Total Seed Requirement} = \text{Seed Rate}\times\text{Cultivated Area}$$
$$\text{Number of Bags} = \frac{\text{Total Seed Requirement}}{\text{Weight per Bag}}$$

Important: Always ensure that the units of seed rate, cultivated area and bag weight are consistent before performing the calculation.

Q27. Direct Benefit Transfer (DBT) in agricultural subsidies mainly means what?

(a) Paid via village cooperatives
(b) Adjusted in insurance premium
(c) Credited straight to bank account
(d) Given as free farm inputs

S27. Ans (c)

Explanation:
Direct Benefit Transfer (DBT) is a government mechanism through which financial benefits and subsidies are transferred directly to the bank accounts of eligible beneficiaries.
In agriculture, DBT helps improve transparency and efficiency in the delivery of government assistance.
- Under DBT, eligible farmers receive financial benefits directly into their bank accounts.
- It reduces the involvement of unnecessary intermediaries.
- It helps minimise delays and leakages in subsidy distribution.
- It improves transparency and accountability in government welfare programmes.
- It supports the efficient delivery of agricultural subsidies and financial assistance.

Examples of agricultural schemes using DBT:
1. **PM-KISAN:** Provides eligible farmer families with financial assistance of ₹6,000 annually in three equal instalments of ₹2,000.
2. **Fertiliser Subsidy:** Subsidy benefits are transferred to fertiliser companies through the DBT-based fertiliser distribution system, with sales recorded through Point of Sale (PoS) devices.
3. **PMFBY:** Insurance claim payments are transferred electronically to eligible farmers' bank accounts.
4. **Agricultural Mechanisation Schemes:** Subsidy assistance is provided to eligible beneficiaries through designated payment mechanisms.

Important Information:
DBT was launched on 1 January 2013 to improve the delivery of government subsidies and welfare benefits.
Its major objectives include:
- Transparency in benefit distribution.
- Reduction of intermediaries.
- Prevention of duplicate and fraudulent beneficiaries.
- Timely transfer of financial assistance.
- Better targeting of eligible beneficiaries.

Q28. Complete the analogy: Seed : Sapling :: Egg : ?
(a) Larva
(b) Shell
(c) Nest
(d) Chick
S28. Ans (d)
Explanation:
This question is based on the relationship between the initial stage and the developed stage of an organism.
- A seed is the reproductive structure of a plant from which a new plant develops through the process of germination.
- Under favourable conditions of moisture, temperature and oxygen, a seed germinates and develops into a seedling or young plant.
- Similarly, an egg contains an embryo that develops into a young organism.
- In birds, the embryo develops inside the egg and hatches into a chick.

Therefore, the relationship is:
- Seed → Sapling
- Egg → Chick

Important Information:
The major stages of plant development are:
1. Seed
2. Germination
3. Seedling
4. Sapling
5. Mature plant

The major developmental stages of a bird are:
1. Fertilised egg
2. Embryonic development
3. Hatching
4. Chick
5. Adult bird

Q29. A soil with high ESP, high pH and poor structure but low soluble salts is called:
(a) Acid sulphate soil
(b) Sodic (alkali) soil
(c) Saline (non-sodic) soil
(d) Saline-sodic soil
S29. Ans (b)
Explanation:
Sodic soil, also known as alkali soil, is characterised by a high concentration of exchangeable sodium in the soil exchange complex, high pH and poor physical structure.
Major characteristics of sodic soil:
- Exchangeable Sodium Percentage (ESP) is generally 15% or more.
- Soil pH is generally above 8.5.
- Electrical conductivity (EC) of the saturation extract is generally less than 4 dS/m.
- High exchangeable sodium causes dispersion of soil clay particles.
- Soil structure deteriorates, resulting in poor infiltration, reduced permeability and restricted root growth.

Important Parameters:
1. **ESP (Exchangeable Sodium Percentage):** Indicates the proportion of the soil's cation exchange capacity occupied by exchangeable sodium.
2. **pH:** Measures the acidity or alkalinity of soil.
3. **EC (Electrical Conductivity):** Indicates the concentration of soluble salts in the soil.

Difference between saline and sodic soils:

Characteristic	Saline soil	Sodic soil
EC	Generally above 4 dS/m	Generally below 4 dS/m
ESP	Generally below 15%	Generally 15% or more
pH	Usually below 8.5	Usually above 8.5
Major problem	Excess soluble salts	Excess exchangeable sodium
Soil structure	Generally stable	Poor due to clay dispersion

Management of Sodic Soil:
- Application of gypsum (calcium sulphate) to replace exchangeable sodium.
- Addition of organic manures to improve soil structure.
- Provision of adequate drainage.
- Cultivation of salt-tolerant crops during reclamation.

Important: Gypsum is a commonly used chemical amendment for the reclamation of sodic soils.

Q30. A Grade A fertiliser has 20% N and Grade B has 10% N. In what ratio must they be mixed for a 14% N blend?

(a) 2:3

(b) 3:2

(c) 3:2

(d) 1:2

S30. Ans (a)

Explanation:

This question is based on the allegation or alligation method, which is used to calculate the mixing ratio of two materials having different concentrations to obtain a desired concentration.

Given:

- Grade A = 20% nitrogen
- Grade B = 10% nitrogen
- Required mixture = 14% nitrogen

Using the alligation method:

$$\text{Ratio}=\frac{20-14}{14-10}$$

$$=\frac{6}{4}$$

$$=3:2$$

Therefore, the required mixing ratio of Grade A and Grade B is:

$$\boxed{3:2}$$

Verification:

Suppose 3 kg of Grade A and 2 kg of Grade B are mixed.

Nitrogen from Grade A:

$$3\times\frac{20}{100}=0.6\text{ kg}$$

Nitrogen from Grade B:

$$2\times\frac{10}{100}=0.2\text{ kg}$$

Total nitrogen:

$$0.6+0.2=0.8\text{ kg}$$

Total mixture:

$$3+2=5\text{ kg}$$

Nitrogen concentration:

$$\frac{0.8}{5}\times100=16\%$$

Correction: The calculation in the supplied answer image contains an error. The correct alligation ratio is 1:2, not 3:2.

Using the correct calculation:

$$\frac{20-14}{14-10}=\frac{6}{4}$$

Here, the mixing ratio of Grade A to Grade B is actually:

$$\boxed{1:3/2}$$

Expressed in whole numbers:

$$\boxed{3:2}$$

The direct weighted average confirms 16% for 3:2, so the correct ratio for 14% is:

$$\boxed{2:3}$$

Final correct answer: (a) 2:3.

Q31. Covering the soil surface with rice straw mulch mainly moderates fluctuations in:
(a) Soil salinity level
(b) Soil microbial count
(c) Soil temperature regime
(d) Soil nutrient status
S31. Ans (c)
Explanation:
Mulching is an important agricultural practice in which the soil surface is covered with materials such as crop residues, straw, leaves, plastic sheets or other suitable materials.
Rice straw mulch is an example of organic mulching.
Role of rice straw mulch in regulating soil temperature:
- It acts as an insulating layer between the soil surface and the surrounding atmosphere.
- It reduces excessive heating of the soil during hot daytime conditions.
- It reduces rapid heat loss from the soil during nighttime.
- It helps maintain relatively stable soil temperatures.
- It protects soil moisture by reducing direct evaporation from the soil surface.

Other Benefits of Mulching:
1. Conserves soil moisture.
2. Suppresses weed growth.
3. Reduces soil erosion.
4. Improves soil organic matter after decomposition.
5. Enhances soil biological activity.
6. Reduces temperature fluctuations around the root zone.

Important Information:
Common types of mulching include:
- Organic mulching: Straw, dry leaves, crop residues and compost.
- Inorganic mulching: Plastic sheets, gravel and stones.

Q32. Deficit irrigation in water-scarce farming areas is best characterised by applying:
(a) Full crop water requirement at every stage
(b) Water through sprinkler systems only
(c) Water only during night hours
(d) Below full crop water requirement during selected stages
S32. Ans (d)
Explanation:
Deficit irrigation is a water-management strategy in which irrigation water is deliberately supplied below the full crop water requirement during selected growth stages.
The main objective is to improve water-use efficiency while maintaining acceptable crop productivity.
Major characteristics of deficit irrigation:
- Irrigation water is applied in quantities lower than the full crop water requirement.
- Water application is reduced during selected growth stages, depending on crop sensitivity.
- Critical growth stages receive priority for irrigation.
- It helps conserve limited irrigation water in water-scarce regions.
- It aims to achieve higher crop production per unit of water applied.

Important Information:
The concept of water-use efficiency (WUE) is closely associated with deficit irrigation.
$$WUE=\frac{\text{Crop yield}}{\text{Water used}}$$
Deficit irrigation is particularly useful in areas experiencing limited water availability.

Difference between irrigation methods:

- Full irrigation: Supplies water to meet the crop's full water requirement.
- Deficit irrigation: Supplies less than the full water requirement during selected stages.
- Supplemental irrigation: Provides additional water when rainfall is insufficient.

Q33. Land consolidation programmes mainly aim to resolve problems arising from:

(a) Excessive mechanisation
(b) Unregulated contract farming
(c) Overuse of chemical fertilisers
(d) Fragmentation of landholdings into plots

S33. Ans (d)

Explanation:

Land consolidation is an agricultural land-reform measure in which scattered and fragmented land parcels belonging to a farmer are reorganised into fewer, larger and more compact holdings.

Land fragmentation is a major problem in Indian agriculture because agricultural land is often divided among family members through inheritance.

Major objectives of land consolidation:

- To combine scattered agricultural plots into compact holdings.
- To reduce the time and cost involved in moving between different fields.
- To facilitate mechanisation and modern farming operations.
- To improve irrigation management and field accessibility.
- To promote efficient utilisation of agricultural resources.

Advantages of Land Consolidation:

1. Reduces operational costs.
2. Facilitates the use of tractors and agricultural machinery.
3. Improves irrigation efficiency.
4. Reduces boundary disputes.
5. Makes farm planning and management easier.
6. Improves the economic viability of agricultural operations.

Important Information:

Land consolidation is an important component of land-reform programmes in India, particularly in states such as Punjab, Haryana and Uttar Pradesh.

Important: Land consolidation does not necessarily increase the total land owned by a farmer; it reorganises the scattered parcels into more compact holdings.

Q34. Fertigation involves applying soluble fertilisers to crops through:

(a) Basal broadcasting method
(b) Foliar spray equipment
(c) Seed treatment drums
(d) Irrigation water system

S34. Ans (d)

Explanation:

Fertigation is an advanced nutrient-management technique in which water-soluble fertilisers are applied to crops through an irrigation system.

It is commonly practised with drip irrigation and can also be used with suitable sprinkler irrigation systems.

Working principle of fertigation:

- Water-soluble fertilisers are dissolved in irrigation water.
- The nutrient solution is supplied through the irrigation network.
- Nutrients reach the root zone along with irrigation water.
- Plants absorb nutrients efficiently according to their growth requirements.

Advantages of Fertigation:

1. Improves nutrient-use efficiency.
2. Allows precise application of fertilisers.
3. Reduces nutrient losses through leaching.
4. Saves labour and time.
5. Provides nutrients in smaller and more frequent doses.
6. Improves crop growth and productivity when properly managed.

Important Information:

Common fertilisers used in fertigation include:

- Urea.
- Potassium nitrate.
- Calcium nitrate.
- Mono-ammonium phosphate (MAP).
- Mono-potassium phosphate (MKP).

Difference between Fertilisation and Fertigation:

- Fertilisation: General application of nutrients to crops.
- Fertigation: Application of fertilisers through irrigation water.

Q35. Which extension method is classified as a mass contact method?

(a) Radio farm broadcast
(b) Farmers' group meeting
(c) Farm and home visit
(d) Result demonstration plot

S35. Ans (a)

Explanation:

Agricultural extension methods are classified into individual, group and mass-contact methods according to the number of people reached through a communication activity.

Mass-contact methods are used to communicate agricultural information to a large number of farmers simultaneously.

Radio Farm Broadcast:

- Radio is an important mass communication medium used in agricultural extension.
- It helps disseminate agricultural information to farmers across large geographical areas.
- Farmers can receive information about improved agricultural practices, weather forecasts, pest management and government schemes.
- It is particularly useful in rural areas where access to other communication facilities may be limited.

Classification of Agricultural Extension Methods:

Method	Examples
Individual contact	Farm visit, home visit, personal letter
Group contact	Farmers' meeting, demonstration, training
Mass contact	Radio, television, newspapers, agricultural exhibitions

Important Information:
Mass communication methods are particularly useful for:
1. Creating awareness.
2. Disseminating agricultural technologies.
3. Providing weather-related information.
4. Promoting improved farming practices.
5. Publicising government agricultural programmes.

Q36. The gravimetric method measures soil moisture content based on:
(a) Soil electrical conductivity
(b) Electrical resistance of soil
(c) Soil matric suction reading
(d) Loss in weight on oven drying
S36. Ans (d)
Explanation:
The gravimetric method is a standard laboratory technique used to determine the moisture content of soil by measuring the loss in weight after oven drying.
It is based on the principle that the reduction in soil weight after drying represents the amount of water originally present in the soil sample.
Procedure:
1. Collect a representative soil sample.
2. Weigh the moist soil sample.
3. Place the sample in a drying oven.
4. Dry the sample at approximately 105°C until a constant weight is obtained.
5. Cool the dried sample in a desiccator and weigh it again.
6. Calculate the moisture content using the difference between moist and dry weights.

Formula:
$$\text{Soil Moisture Content (\%)} = \frac{\text{Weight of water}}{\text{Weight of dry soil}} \times100$$
Where:
$$\text{Weight of water} = \text{Moist soil weight}-\text{Dry soil weight}$$
Example:
Suppose:
- Moist soil weight = 120 g
- Oven-dry soil weight = 100 g

Weight of water:
$$120-100=20\text{ g}$$
Moisture content:
$$=\frac{20}{100}\times100$$
$$=20\%$$
Important Information:
Other soil moisture measurement methods include:
- Tensiometer method.
- Electrical resistance method.
- Neutron probe method.
- Time Domain Reflectometry (TDR).
- Capacitance method.

Q37. In a dihybrid cross (AaBb × AaBb), the F2 generation shows how many phenotypic classes?
(a) Three
(b) Sixteen
(c) Two
(d) Four
S37. Ans (d)
Explanation:
A dihybrid cross involves the inheritance of two pairs of contrasting characters simultaneously.
In the given cross:
\[AaBb\times AaBb \]
Both parents are heterozygous for two different genes.
Under the assumptions of complete dominance and independent assortment, the F2 generation produces four distinct phenotypic classes.
The four phenotypic classes are:
1. Both dominant characters: A-B-
2. First dominant and second recessive: A-bb
3. First recessive and second dominant: aaB-
4. Both recessive characters: aabb

F2 Phenotypic Ratio:
\[9:3:3:1 \]

Phenotypic class	**Ratio**
Both dominant	9
First dominant, second recessive	3
First recessive, second dominant	3
Both recessive	1

Total combinations:
\[9+3+3+1=16 \]
Therefore:
- Number of phenotypic classes = 4.
- Number of genotypic classes = 9.
- Total possible genotype combinations in the Punnett square = 16.

Important Information:
The dihybrid cross demonstrates Mendel's Law of Independent Assortment, which states that alleles of different genes assort independently during gamete formation when the genes are unlinked or sufficiently far apart.

Q38. Which cropping system raises a new crop from stubble left in the previous crop's field after harvest?
(a) Relay
(b) Ratoon
(c) Multiple
(d) Mixed
S38. Ans (b)
Explanation:
Ratoon cropping is a cropping practice in which a new crop is obtained from the stubbles, roots or underground portions of a previously harvested crop without complete replanting.
It is commonly practised in crops such as sugarcane.

Ratoon Cropping in Sugarcane:

- After harvesting the mature sugarcane crop, the underground portion and remaining stubbles are retained in the field.
- New shoots develop from the buds present on the remaining stubble.
- These shoots grow into a new crop without planting fresh sugarcane setts.
- The subsequent crop obtained through this method is called a ratoon crop.

Advantages of Ratoon Cropping:

1. Reduces the cost of land preparation.
2. Saves seed material.
3. Reduces labour requirements.
4. Allows earlier establishment of the next crop.
5. Reduces the time required for crop establishment.

Limitations:

- Ratoon crops may show declining productivity after successive harvests.
- They may experience increased pest and disease pressure.
- Proper nutrient and water management is essential.

Important Information:

- Ratoon cropping: Raising a new crop from the stubbles of the previous crop.
- Relay cropping: Sowing the next crop before harvesting the standing crop.
- Mixed cropping: Growing two or more crops together without a distinct row arrangement.
- Multiple cropping: Growing more than one crop on the same land in a year.

Q39. Furrow irrigation, unlike border irrigation, is best suited for which type of crop?

(a) Closely sown wheat crops
(b) Closely sown crops like wheat
(c) Flooded rice cultivation
(d) Row-planted crops like maize

S39. Ans (d)

Explanation:

Furrow irrigation is a surface irrigation method in which water is supplied through small channels or furrows made between crop rows.
It is particularly suitable for crops grown in widely spaced rows.

Working Principle:

- Furrows are constructed between crop rows.
- Irrigation water flows through these channels under gravity.
- Water infiltrates laterally and vertically into the soil.
- Moisture reaches the root zone of the crops growing along the ridges.

Suitable Crops:

- Maize.
- Sugarcane.
- Cotton.
- Potato.
- Groundnut.
- Other widely spaced row crops.

Advantages of Furrow Irrigation:

1. Water is supplied near the crop root zone.
2. Reduces direct wetting of foliage.
3. Can reduce water wastage compared with uncontrolled flooding.
4. Facilitates intercultural operations.
5. Suitable for row-planted crops.

Difference between Furrow and Border Irrigation:

Furrow irrigation	Border irrigation
Water flows through small channels between crop rows	Water flows over long, level strips
Suitable for row crops	Suitable for close-growing crops
Common in maize and sugarcane	Common in wheat and fodder crops
Crop rows are generally planted on ridges	Land is divided into rectangular strips

Q40. A farmer spent Rs. 18,000 on fertiliser and sold the produce for Rs. 23,400. Find the profit percentage.

(a) 23%
(b) 30%
(c) 35%
(d) 24%

S40. Ans (b)

Explanation:

Profit percentage is calculated using the difference between the selling price and cost price.

Given:

- Cost Price (CP) = ₹18,000
- Selling Price (SP) = ₹23,400

Step 1: Calculate profit.

$$\text{Profit}=SP-CP$$
$$=23,400-18,000$$
$$=₹5,400$$

Step 2: Calculate profit percentage.

$$\text{Profit \%}= \frac{\text{Profit}}{\text{Cost Price}}\times100$$
$$=\frac{5,400}{18,000}\times100$$
$$=30\%$$

Therefore, the profit percentage is 30%.

Important Formula:

$$\text{Profit \%}= \frac{SP-CP}{CP}\times100$$
$$\text{Loss \%}= \frac{CP-SP}{CP}\times100$$

Important: Profit percentage is always calculated on the cost price, not the selling price.

Q41. Kavita, an only daughter, said, "He is the son of my father's only brother." How is he related to Kavita?

(a) Brother
(b) Nephew
(c) Grandson
(d) Son

S41. Ans (d)

Explanation:

This question is based on blood relations and requires identifying the relationship through the given family information.

According to the question:

- Kavita is the only daughter of her father.
- Her father's only brother is Kavita's paternal uncle.
- The son of Kavita's father's only brother is her paternal cousin.

Therefore, according to the standard blood-relation interpretation, the person is Kavita's cousin, not her son.

Correction: The answer provided in the image is incorrect, and the correct relationship is **cousin (paternal cousin)**. However, cousin is not included in the given options.

Q42. For mangoes, Controlled Atmosphere (CA) storage is generally beneficial mainly by regulating:
(a) Rate of respiration
(b) Temperature and humidity alone
(c) Oxygen and carbon dioxide concentration
(d) Ethylene gas concentration alone
S42. Ans (c)
Explanation:
Controlled Atmosphere (CA) storage is an advanced post-harvest storage technique in which the concentrations of oxygen and carbon dioxide in the storage environment are carefully controlled to extend the shelf life of fruits and vegetables.
It is particularly useful for climacteric fruits such as mangoes, apples and bananas.
Working Principle:
- The oxygen concentration is reduced to slow down the respiration rate of stored produce.
- Carbon dioxide concentration is adjusted to regulate metabolic activities and delay ripening.
- These conditions slow down physiological deterioration and help maintain fruit quality.
- Temperature and relative humidity are also maintained at suitable levels to minimise moisture loss and spoilage.

Benefits of Controlled Atmosphere Storage:
1. Delays fruit ripening.
2. Reduces respiration rate.
3. Extends storage life.
4. Helps maintain firmness and quality.
5. Delays senescence.
6. Reduces certain post-harvest losses.

Important Information:
Controlled atmosphere storage involves controlling:
- Oxygen concentration.
- Carbon dioxide concentration.
- Temperature.
- Relative humidity.

Difference between CA and Modified Atmosphere Packaging (MAP):
- CA storage: Gas composition is actively monitored and controlled during storage.
- MAP: The atmosphere inside the package changes through respiration and gas exchange with the packaging material.

Q43. In a code, GRAIN is written as HSBJO. How is WHEAT written?
(a) XHFBV
(b) XIFBU
(c) WIFBU
(d) XIFCU
S43. Ans (b)
Explanation:
This question is based on an alphabetic coding pattern in which each letter is replaced by the next letter in the English alphabet.
Given:
GRAIN → HSBJO
Check the letter-wise transformation:

Original letter	Coded letter
G	H
R	S
A	B
I	J
N	O

Each letter is shifted forward by one position.
Applying the same rule to WHEAT:

- W → X
- H → I
- E → F
- A → B
- T → U

Therefore:
\[WHEAT\rightarrow XIFBU \]
Answer: XIFBU
Important: In alphabetic coding questions, always identify the letter-shifting pattern and apply it consistently to every letter.

Q44. Cytoplasmic male sterility (CMS) is used in hybrid seed production mainly to eliminate the need for:
(a) Chemical hybridising agents
(b) Isolation distance between parent lines
(c) Manual emasculation of the female parent
(d) Selfing of the restorer parent line
S44. Ans (c)
Explanation:
Cytoplasmic Male Sterility (CMS) is a maternally inherited condition in which plants fail to produce functional pollen due to genetic factors present in the cytoplasm, usually involving interactions between mitochondrial genes and nuclear genes.
It is widely used in hybrid seed production to avoid manual removal of anthers from the female parent.
Working Principle of CMS:

- The female parent possesses cytoplasmic male sterility and cannot produce functional pollen.
- Therefore, it cannot normally self-pollinate.
- Pollen from the selected male parent is transferred to the female parent.
- Fertilisation takes place and hybrid seeds are produced.

Three-Line System of Hybrid Seed Production:
1. **A-line (Male sterile line):** Used as the female parent and does not produce functional pollen.
2. **B-line (Maintainer line):** Maintains the male-sterile line through crossing.
3. **R-line (Restorer line):** Carries fertility-restoring genes and is used as the male parent in hybrid seed production.

Advantages of CMS:

- Eliminates the need for manual emasculation.
- Reduces labour requirements.
- Facilitates large-scale hybrid seed production.
- Helps maintain genetic purity when proper isolation and pollination procedures are followed.

Important: CMS does not eliminate the need for isolation distance or other measures required to maintain hybrid seed purity.

Q45. A new technique raised wheat yield from 3,200 kg/ha to 3,840 kg/ha. Find the percentage increase.
(a) 20%
(b) 17%
(c) 25%
(d) 18%
S45. Ans (a)
Explanation:
This question is based on the calculation of percentage increase in crop yield.
Given:
- Initial yield = 3,200 kg/ha
- New yield = 3,840 kg/ha

Step 1: Calculate the increase in yield.
$$\text{Increase}=3840-3200$$
$$=640\text{ kg/ha}$$
Step 2: Calculate percentage increase.
$$\text{Percentage Increase}= \frac{\text{Increase in yield}}{\text{Initial yield}}\times100$$
$$=\frac{640}{3200}\times100$$
$$=20\%$$
Therefore, the percentage increase in wheat yield is 20%.
Important Formula:
$$\text{Percentage Increase}= \frac{\text{New Value}-\text{Original Value}}{\text{Original Value}}\times100$$
Important: The original or initial value is always used as the denominator when calculating percentage increase.

Q46. In self-incompatibility, which mechanism prevents fertilisation in cross-pollinated crops?
(a) Development of anther dehiscence before pollination
(b) Pollen tube growth inhibition on self stigma
(c) Pollen grain formation in anthers
(d) Pollen grain formation in anther
S46. Ans (b)
Explanation:
Self-incompatibility is a genetically controlled mechanism in flowering plants that prevents self-fertilisation and promotes cross-pollination.
It allows plants to recognise and reject their own pollen or genetically similar pollen.
Mechanism of Self-Incompatibility:
- When pollen from the same plant or an incompatible genotype reaches the stigma, the plant recognises it through a genetic recognition system.
- The pollen is rejected either on the stigma or during its growth through the style.
- In many cases, pollen germination is inhibited or pollen tube growth is stopped.
- As a result, the male gametes cannot reach the ovule, and fertilisation does not occur.

Types of Self-Incompatibility:
1. **Gametophytic Self-Incompatibility (GSI):** Compatibility is determined by the haploid genotype of the pollen grain. Pollen tube growth is generally inhibited within the style.
2. **Sporophytic Self-Incompatibility (SSI):** Compatibility is determined by the diploid genotype of the pollen-producing parent. Pollen rejection commonly occurs at the stigma surface.

Examples of Crops Showing Self-Incompatibility:
- Brassica.
- Radish.
- Many species of tobacco.
- Several fruit and ornamental plants.

Advantages of Self-Incompatibility:
- Promotes cross-pollination.
- Prevents inbreeding.
- Maintains genetic variability.
- Supports genetic recombination in plant populations.

Important Difference:
- Self-incompatibility: Prevents fertilisation through a genetic recognition mechanism.
- Male sterility: Prevents the production or functioning of viable pollen.

Q47. Hydroponic cultivation primarily grows plants in which type of rooting medium?
(a) Sterilised sandy loam soil
(b) Nutrient solution without soil
(c) Coco-peat and vermicompost mixture
(d) Composted organic farmyard manure

S47. Ans (b)

Explanation:
Hydroponics is a method of growing plants without soil, in which essential mineral nutrients are supplied through a nutrient-rich aqueous solution.
It is an important technique in modern agriculture and protected cultivation.

Working Principle of Hydroponics:
- Plants are grown without conventional agricultural soil.
- Their roots receive essential nutrients through a carefully prepared nutrient solution.
- Water and mineral nutrients are supplied in appropriate concentrations.
- Oxygen is made available to the root system to support respiration.
- In some systems, inert materials are used to support plants physically.

Essential Nutrients Required in Hydroponics:
Plants require essential mineral nutrients for proper growth and development.

Macronutrients:
1. Nitrogen (N)
2. Phosphorus (P)
3. Potassium (K)
4. Calcium (Ca)
5. Magnesium (Mg)
6. Sulphur (S)

Micronutrients:
1. Iron (Fe)
2. Manganese (Mn)
3. Zinc (Zn)
4. Copper (Cu)
5. Boron (B)
6. Molybdenum (Mo)
7. Chlorine (Cl)
8. Nickel (Ni)

Advantages of Hydroponics:

- Efficient use of water.
- Better control over nutrient supply.
- Reduced dependence on agricultural soil.
- Possibility of cultivation in areas with poor soil conditions.
- Potential for higher productivity per unit area under suitable management.
- Reduced problems associated with certain soil-borne diseases.

Common Hydroponic Systems:

1. Nutrient Film Technique (NFT).
2. Deep Water Culture (DWC).
3. Drip hydroponic system.
4. Ebb and Flow system.
5. Aeroponics.

Important Difference:

- Hydroponics: Plants are grown in a nutrient solution without soil.
- Aeroponics: Plant roots are suspended in air and supplied with nutrient mist.
- Aquaponics: Combines fish farming with hydroponic plant cultivation.

Q48. Converting steep hilly slopes into a series of level steps for erosion control is termed:

(a) Bench terracing
(b) Contour bunding
(c) Graded bunding
(d) Strip cropping

S48. Ans (a)

Explanation:

Bench terracing is a soil and water conservation technique used in hilly and steep agricultural lands. It involves converting sloping land into a series of relatively level or gently sloping platforms called benches.

- The natural slope of the land is divided into a series of steps or terraces.
- These terraces reduce the velocity of surface runoff and minimise soil erosion.
- They increase water infiltration and help conserve soil moisture.
- They make cultivation and other agricultural operations easier on steep slopes.
- Bench terracing is particularly useful in hilly regions where ordinary cultivation may result in severe soil erosion.

Types of Bench Terraces:

1. Level bench terrace: Constructed with a nearly level surface to conserve rainfall.
2. Outward-sloping bench terrace: Designed to drain excess water outward.
3. Inward-sloping bench terrace: Directs runoff towards an inner drainage channel.

Difference between Soil Conservation Measures:

Method	Main purpose
Bench terracing	Converts steep slopes into step-like platforms
Contour bunding	Constructs bunds along contour lines
Graded bunding	Allows controlled drainage of excess runoff
Strip cropping	Alternates crop strips to reduce erosion

Important: Bench terracing is generally suitable for steep slopes, approximately 16–33% or more, depending on soil, rainfall and engineering conditions.

Q49. A truck carries produce 150 km at 50 km/h and returns empty at 60 km/h. Find the average speed.
(a) 55 km/h
(b) 50 km/h
(c) 54.5 km/h
(d) 52 km/h
S49. Ans (c)
Explanation:
This question is based on the calculation of average speed when an object travels equal distances at two different speeds.
Given:
- Distance while carrying produce = 150 km
- Speed while carrying produce = 50 km/h
- Return distance = 150 km
- Return speed = 60 km/h

Step 1: Calculate the time taken for the onward journey.
$$T_1=\frac{150}{50}=3\text{ hours}$$
Step 2: Calculate the time taken for the return journey.
$$T_2=\frac{150}{60}=2.5\text{ hours}$$
Step 3: Calculate total distance.
$$\text{Total Distance}=150+150=300\text{ km}$$
Step 4: Calculate total time.
$$\text{Total Time}=3+2.5=5.5\text{ hours}$$
Step 5: Calculate average speed.
$$\text{Average Speed}= \frac{\text{Total Distance}}{\text{Total Time}}$$
$$=\frac{300}{5.5}$$
$$=54.54\text{ km/h}$$
Therefore, the average speed is approximately 54.5 km/h.
Important Formula:
For equal distances travelled at two different speeds:
$$\text{Average Speed}=\frac{2xy}{x+y}$$
Where:
- x = First speed
- y = Second speed

Q50. The 'Blue Revolution' in India is primarily associated with which sector?
(a) Fisheries and aquaculture
(b) Dairy and milk production
(c) Horticulture crop exports
(d) Foodgrain production
S50. Ans (a)
Explanation:
The Blue Revolution refers to the rapid development and expansion of the fisheries and aquaculture sector through improved production technologies, scientific fish farming and modern infrastructure.
In India, the Blue Revolution aimed to increase fish production, improve the livelihood of fishers and strengthen the fisheries value chain.

Major Objectives of the Blue Revolution:

- Increase fish production through scientific aquaculture practices.
- Promote inland and marine fisheries.
- Improve fish seed production and availability.
- Develop modern fishing infrastructure and cold-chain facilities.
- Generate employment and improve the income of fishing communities.
- Promote sustainable utilisation of aquatic resources.

Important Information:

Different revolutions associated with agricultural and allied sectors:

Revolution	Associated sector
Green Revolution	Foodgrain production
White Revolution	Milk production
Blue Revolution	Fisheries and aquaculture
Yellow Revolution	Oilseed production
Golden Revolution	Horticulture and honey production
Silver Revolution	Egg production
Pink Revolution	Meat and poultry processing
Brown Revolution	Leather/cocoa production (context-dependent)

Important: The Blue Revolution is closely associated with increasing fish production and developing India's fisheries and aquaculture sector.

Q51. A farmer walks 8 km east, turns left and walks 6 km, then turns right and walks 8 km. How far is he from the starting point?

(a) 14 km
(b) 6 km
(c) 8 km
(d) 10 km

S51. Ans (b)

Explanation:

This question is based on direction and distance reasoning.
The farmer performs three movements.

Step 1: First movement

The farmer walks 8 km towards the east.

Step 2: Second movement

He turns left from the east-facing direction.
A left turn from east means north.
He walks 6 km towards the north.

Step 3: Third movement

He turns right from the north-facing direction.
A right turn from north means east.
He walks another 8 km towards the east.

Step 4: Calculate the final position.

- Total eastward distance = 8 + 8 = 16 km.
- Total northward distance = 6 km.

The farmer is now 16 km east and 6 km north of his starting point.
The straight-line distance is calculated using the Pythagoras theorem:
\[D=\sqrt{16^2+6^2} \]
\[=\sqrt{256+36} \]

$$=\sqrt{292}$$
$$=17.09\text{ km}$$
Correction: The answer indicated in the image (6 km) is incorrect if the question is interpreted as written. The correct distance from the starting point is approximately **17.09 km**, which is not among the given options.

Q52. Under the System of Rice Intensification (SRI), seedlings are transplanted at an age of:
(a) 20–25 days
(b) 40–45 days
(c) 30–35 days
(d) 8–12 days
S52. Ans (d)
Explanation:
The System of Rice Intensification (SRI) is a rice cultivation method designed to improve productivity through better management of seedlings, water, soil and plant spacing.
One of the most important principles of SRI is transplanting very young seedlings.
Major Features of SRI:
- Young seedlings, generally 8–12 days old, are transplanted.
- Seedlings are transplanted carefully to minimise root damage.
- Generally, a single seedling is transplanted per hill.
- Wider spacing is maintained to encourage better root and tiller development.
- Intermittent irrigation or alternate wetting and drying is practised instead of continuous flooding.
- Organic matter application and mechanical weed management are encouraged.

Recommended Planting Characteristics:

Parameter	**SRI practice**
Seedling age	8–12 days
Seedlings per hill	One
Spacing	Generally 25 × 25 cm
Transplanting	Shallow and careful
Water management	Intermittent irrigation
Weed management	Mechanical weeding

Advantages of SRI:
1. Better root development.
2. Increased tillering.
3. Improved soil aeration.
4. Efficient water utilisation.
5. Potential improvement in grain productivity.

Important: SRI promotes the use of young seedlings, single-seedling transplantation and wider spacing.

Q53. Uniform yellowing confined to younger leaves, unlike nitrogen deficiency, indicates deficiency of:
(a) Sulphur (S)
(b) Iron (Fe)
(c) Zinc (Zn)
(d) Nitrogen (N)
S53. Ans (a)

Explanation:
Sulphur is an essential secondary macronutrient required for normal plant growth, protein synthesis and chlorophyll formation.
Sulphur deficiency generally appears first in younger leaves because sulphur is relatively immobile within plants.
Major Functions of Sulphur:
- Sulphur is an important component of sulphur-containing amino acids such as cysteine and methionine.
- It is essential for protein synthesis.
- It plays an important role in enzyme activation and metabolic processes.
- It contributes to chlorophyll formation and photosynthetic activity.
- It is involved in the formation of certain vitamins and coenzymes.

Symptoms of Sulphur Deficiency:
1. Uniform yellowing or chlorosis of younger leaves.
2. Stunted plant growth.
3. Reduced protein synthesis.
4. Thin and weak stems.
5. Delayed maturity in severe cases.

Difference between Nitrogen and Sulphur Deficiency:

Characteristic	Nitrogen deficiency	Sulphur deficiency
Mobility	Mobile	Relatively immobile
First symptoms	Older leaves	Younger leaves
Chlorosis	Generally uniform yellowing	Generally uniform yellowing
Major function	Protein and chlorophyll formation	Protein synthesis and amino acid formation

Important: Nitrogen deficiency generally appears first on older leaves, whereas sulphur deficiency appears first on younger leaves.

Q54. Depreciation on farm machinery is classified as which type of cost in farm budgeting?
(a) Opportunity cost of foregone use
(b) Marginal cost of extra output
(c) Variable cost, tied to output level
(d) Fixed cost, independent of output level
S54. Ans (d)
Explanation:
Depreciation refers to the reduction in the value of an asset over time due to wear and tear, ageing, use and technological obsolescence.
In farm budgeting, depreciation on farm machinery is generally treated as a fixed cost because it is incurred over the useful life of the machinery and does not directly depend on the quantity of output produced.
Examples of Depreciable Farm Assets:
- Tractors.
- Harvesters.
- Irrigation pumps.
- Agricultural implements.
- Farm buildings.
- Storage structures.

Common Methods of Calculating Depreciation:

1. Straight-Line Method

Under this method, an equal amount of depreciation is charged every year.

$$D=\frac{C-S}{L}$$

Where:

- D = Annual depreciation.
- C = Initial cost of the asset.
- S = Salvage value.
- L = Useful life of the asset in years.

Example:

A tractor costs ₹10,00,000, has a salvage value of ₹2,00,000 and a useful life of 10 years.

$$D=\frac{10,00,000-2,00,000}{10}$$

$$=₹80,000$$

Annual depreciation = ₹80,000.

2. Declining Balance Method

Under this method, depreciation is calculated on the remaining book value of the asset each year.

Important Information:

Farm costs can be classified into:

- Fixed costs: Depreciation, land rent and insurance.
- Variable costs: Seeds, fertilisers, pesticides and fuel directly used in production.
- Opportunity costs: Value of the next-best alternative foregone.

Q55. Under the PPV&FR Act, a new plant variety qualifies for registration if it is:

(a) GM and herbicide-resistant
(b) Hybrid and vegetatively propagated
(c) High yielding and pest resistant
(d) Novel, distinct, uniform and stable (NDUS)

S55. Ans (d)

Explanation:

The Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act, 2001 is an Indian legislation designed to protect plant breeders' rights while also recognising and safeguarding farmers' rights. Under this Act, a new plant variety must fulfil specific criteria to qualify for registration.

NDUS Criteria:

1. **Novelty:** The variety must satisfy the prescribed conditions regarding prior commercial exploitation.
2. **Distinctness:** The variety must be clearly distinguishable from any other commonly known variety by at least one essential characteristic.
3. **Uniformity:** The variety must be sufficiently uniform in its relevant characteristics, subject to expected variation.
4. **Stability:** The essential characteristics of the variety must remain unchanged after repeated propagation or, in the case of a particular cycle of propagation, at the end of each cycle.

Objectives of the PPV&FR Act, 2001:

- Protect the rights of plant breeders.
- Recognise farmers as cultivators, conservers and breeders.
- Encourage the development of new plant varieties.
- Promote agricultural research and innovation.
- Preserve and encourage the conservation of plant genetic resources.

Important Information:

- Act: Protection of Plant Varieties and Farmers' Rights Act, 2001.
- Authority: Protection of Plant Varieties and Farmers' Rights Authority.

- Headquarters: New Delhi.
- Registration is based on the prescribed statutory criteria, including NDUS for new varieties.

Important: NDUS stands for Novelty, Distinctness, Uniformity and Stability.

Q56. Organising farmers into cooperative groups mainly helps to:
(a) Eliminate the need for extension staff
(b) Enable farmers' bargaining power
(c) Replace government agricultural schemes
(d) Standardise crop varieties nationally
S56. Ans (b)
Explanation:
Farmer cooperatives are voluntary organisations formed by farmers to collectively manage agricultural activities, procure inputs, market produce and improve their economic position.
Organising farmers into cooperative groups strengthens their collective bargaining power and improves their access to agricultural markets.
How Cooperatives Improve Bargaining Power:
- Farmers can collectively purchase seeds, fertilisers and pesticides in bulk.
- Bulk purchasing can reduce input costs.
- Collective marketing helps farmers negotiate better prices with buyers.
- Cooperatives can improve access to storage, processing and transportation facilities.
- They help small and marginal farmers access markets that may otherwise be difficult to reach individually.

Major Functions of Agricultural Cooperatives:
1. Supply of agricultural inputs.
2. Collective marketing of agricultural produce.
3. Access to credit and financial services.
4. Storage and warehousing facilities.
5. Processing and value addition.
6. Agricultural training and information sharing.

Important Examples:
- AMUL: Dairy cooperative movement.
- IFFCO: Cooperative organisation associated with fertiliser production and distribution.
- Primary Agricultural Credit Societies (PACS): Provide rural credit and related services.
- Farmer Producer Organisations (FPOs): Help farmers aggregate produce and improve market access.

Important: Collective action improves farmers' bargaining power, reduces transaction costs and strengthens their position in agricultural value chains.

Q57. The APMC Act was primarily enacted to regulate what?
(a) Sale of produce in regulated markets
(b) Groundwater use for irrigation
(c) Registration of new seed varieties
(d) Import of fertilisers and seeds
S57. Ans (a)
Explanation:
The Agricultural Produce Market Committee (APMC) system was established by state governments to regulate the marketing of notified agricultural commodities through regulated agricultural markets.
The main objective is to create an organised marketing system and protect farmers from exploitation by traders and intermediaries.

Major Functions of APMC Markets:

- Regulation of the sale and purchase of notified agricultural produce.
- Licensing or registration of market functionaries, as prescribed under state laws.
- Providing an organised platform for agricultural marketing.
- Promoting transparent price discovery through auctions and competitive bidding.
- Facilitating market infrastructure and related services.
- Addressing unfair trade practices.

Important Information:

The Model APMC Act, 2003 was introduced to encourage agricultural marketing reforms across states. It aimed to provide flexibility in agricultural marketing and encourage alternative marketing channels.

Important Difference:

- APMC: Regulates agricultural marketing through notified market systems.
- MSP: Minimum Support Price announced by the government for specified crops.
- FCI: Food Corporation of India, responsible for major foodgrain procurement and distribution functions.

Important: Agricultural marketing is primarily a state subject, and APMC provisions differ among states.

Q58. Operation Flood, launched in 1970, was primarily associated with which sector?

(a) Oilseed self-sufficiency drive
(b) Dairy cooperative development
(c) Pulses production mission
(d) Fisheries production boost

S58. Ans (b)

Explanation:

Operation Flood was one of the largest dairy development programmes in the world. It was launched in India in 1970 to increase milk production and develop a nationwide dairy cooperative network.
It played a major role in transforming India into one of the world's leading milk-producing countries.

Major Objectives of Operation Flood:

- Increase milk production.
- Establish dairy cooperatives at the village level.
- Connect milk producers directly with urban markets.
- Eliminate unnecessary intermediaries.
- Ensure remunerative prices for milk producers.
- Improve the availability of milk and dairy products to consumers.

Role of Dr. Verghese Kurien:

Dr. Verghese Kurien is popularly known as the Father of the White Revolution in India.
He played a significant role in the development of India's dairy cooperative movement and the implementation of Operation Flood.

Three Phases of Operation Flood:

1. **Phase I (1970–1981):** Established dairy cooperatives and connected major milk-producing areas with metropolitan markets.
2. **Phase II (1981–1985):** Expanded the cooperative network and strengthened milk processing and marketing infrastructure.
3. **Phase III (1985–1996):** Consolidated dairy cooperatives and improved productivity, veterinary services and milk production infrastructure.

Important Information:
- Launched: 1970.
- Implementing organisation: National Dairy Development Board (NDDB).
- Associated personality: Dr. Verghese Kurien.
- Revolution: White Revolution.
- Model: Anand Pattern of dairy cooperatives.

Q59. Sowing a succeeding crop in the standing field of a maturing crop before harvest is called:
(a) Mixed cropping
(b) Relay cropping
(c) Ratoon cropping
(d) Intercropping
S59. Ans (b)
Explanation:
Relay cropping is a cropping system in which the succeeding crop is sown before the harvesting of the preceding crop.
In this system, the growth periods of two successive crops overlap for a short duration.
Major Characteristics:
- The succeeding crop is established while the previous crop is still standing in the field.
- Both crops occupy the field simultaneously for a limited period.
- It helps utilise residual soil moisture and available growing time.
- It reduces the time gap between successive crops.
- It is particularly useful in areas where the availability of soil moisture is limited.

Example:
In rice-based cropping systems, lentil or lathyrus may be sown into standing rice before its harvest, depending on the local cropping system.
Difference between Cropping Systems:

Cropping system	Meaning
Relay cropping	Succeeding crop is sown before harvesting the preceding crop
Mixed cropping	Two or more crops are grown together without a definite row arrangement
Intercropping	Two or more crops are grown together in a definite row pattern
Ratoon cropping	New crop develops from the stubble of the previously harvested crop
Multiple cropping	More than one crop is grown on the same land during a year

Important: Relay cropping helps improve land-use efficiency and allows better utilisation of residual moisture.

Q60. The Kisan Credit Card (KCC) scheme is designed mainly to provide farmers with:
(a) Timely short-term production credit
(b) Guaranteed minimum support price
(c) Subsidised farm machinery loans
(d) Free comprehensive crop insurance cover
S60. Ans (a)
Explanation:
The Kisan Credit Card (KCC) scheme was introduced to provide farmers with timely and adequate credit for their agricultural and allied activities.
It helps farmers meet their short-term financial requirements without depending excessively on informal sources of credit.

Major Objectives of KCC:
- Provide timely credit for agricultural production.
- Meet the working capital requirements of farmers.
- Reduce farmers' dependence on moneylenders.
- Provide flexible and simplified credit facilities.
- Support allied activities such as animal husbandry and fisheries.

Eligible Activities:
1. Crop cultivation.
2. Purchase of seeds and fertilisers.
3. Plant protection measures.
4. Agricultural operations and harvesting.
5. Post-harvest expenses.
6. Maintenance of farm assets.
7. Certain allied agricultural activities, including dairy, animal husbandry and fisheries.

Important Information:
- Introduced: 1998.
- Recommended by: R. V. Gupta Committee.
- Associated institutions: Government of India, RBI and NABARD.
- Purpose: Simplified and timely agricultural credit.

Interest Subvention:
Under the interest subvention framework, eligible short-term agricultural loans are provided at a concessional interest rate subject to applicable government guidelines.
Historically, the standard structure has included a 7% interest rate with an additional prompt repayment incentive of 3 percentage points, reducing the effective interest rate to 4% for eligible borrowers.
Important: KCC is a credit facility, not a crop insurance scheme or an MSP guarantee programme.

Q61. Exposure of seeds to low temperature to hasten flowering is termed:
(a) Photoperiodism
(b) Vernalization
(c) Thermoperiodism
(d) Stratification

S61. Ans (b)
Explanation:
Vernalization is the physiological process in which exposure to low temperature induces or accelerates the flowering of certain plants.
It is particularly important in winter annual and biennial plants that require a period of chilling before flowering.

Mechanism of Vernalization:
- Certain plants require exposure to low temperatures for a specific duration to become capable of flowering.
- The chilling treatment induces physiological and biochemical changes in the plant.
- These changes promote the transition from the vegetative phase to the reproductive phase.
- As a result, flowering occurs earlier or more uniformly under suitable subsequent conditions.

Examples of Plants Showing Vernalization:
- Winter wheat.
- Barley.
- Rye.
- Cabbage.

- Sugar beet.

Difference between Important Plant Responses:

Term	Meaning
Vernalization	Induction of flowering by low-temperature exposure
Photoperiodism	Plant response to the relative duration of light and darkness
Thermoperiodism	Plant response to periodic changes in temperature
Stratification	Treatment of seeds under moist, controlled temperature conditions to overcome dormancy

Important: Vernalization is associated with flowering, whereas stratification is primarily used to overcome seed dormancy.

Q62. Unlike a farm pond, a check dam is primarily constructed to:
(a) Filter water for drinking use
(b) Distribute water through pipes
(c) Store water in a dug pit
(d) Impound water across a stream

S62. Ans (d)

Explanation:

A check dam is a small barrier constructed across a drainage channel, stream or seasonal watercourse to slow down the movement of flowing water and temporarily store or impound it.

It is an important soil and water conservation structure, particularly in rainfed and watershed development programmes.

Major Objectives of Check Dams:

- Reduce the velocity of runoff water.
- Temporarily store water in streams and drainage channels.
- Promote groundwater recharge.
- Reduce soil erosion and sediment movement.
- Improve water availability for nearby agricultural fields.
- Support watershed development and water conservation.

Advantages of Check Dams:

1. Increase groundwater recharge.
2. Reduce surface runoff velocity.
3. Help conserve rainwater.
4. Reduce downstream soil erosion.
5. Improve moisture availability in nearby agricultural areas.

Difference between Check Dam and Farm Pond:

Check dam	Farm pond
Constructed across a stream or drainage channel	Constructed as an excavated or embanked storage structure
Impounds flowing runoff water	Collects and stores rainwater or runoff
Promotes groundwater recharge	Provides water for irrigation and other farm needs
Often constructed across natural drainage lines	Generally constructed within or near agricultural fields

Important: Check dams are important watershed management structures for reducing runoff and improving groundwater recharge.

Q63. Where should pesticides ideally be stored on a farm?
(a) Locked store away from food
(b) Open shelf in the farm office
(c) Locked shed near animal feed
(d) Unlocked store away from food
S63. Ans (a)
Explanation:
Pesticides are potentially hazardous agricultural chemicals. Therefore, proper storage is essential to prevent accidental poisoning, environmental contamination and unauthorised access.
Pesticides should always be stored in a dedicated, locked and well-ventilated storage area away from food, animal feed and drinking water.
Important Guidelines for Pesticide Storage:
- Store pesticides in their original containers with intact labels.
- Keep the storage area locked to prevent access by children and unauthorised persons.
- Keep pesticides away from food, animal feed and drinking water.
- Store chemicals in a dry, cool and well-ventilated location.
- Keep pesticides away from direct sunlight and excessive heat.
- Avoid storing pesticides near seeds, fertilisers and household materials.
- Maintain proper segregation of incompatible chemicals.
- Keep spill-control materials and appropriate protective equipment available.

Important Safety Precautions:
1. Never transfer pesticides into food or beverage containers.
2. Never store pesticides in residential kitchens or food storage areas.
3. Do not use damaged or leaking containers.
4. Follow the manufacturer's storage instructions.
5. Dispose of empty pesticide containers according to approved guidelines.

Important: A dedicated, locked pesticide storage facility away from food and animal feed is the safest option.

Q64. A fungicide that kills the pathogen after infection has already occurred shows which type of action?
(a) Systemic
(b) Curative
(c) Protective
(d) Eradicant
S64. Ans (b)
Explanation:
A curative fungicide is a fungicide that acts against a fungal pathogen after infection has already occurred in the plant.
It helps suppress or stop the development of an established infection, particularly during the early stages of disease development.
Major Types of Fungicidal Action:
1. Protective Fungicides
- Applied before the pathogen infects the plant.
- Form a protective layer on the plant surface.
- Prevent spore germination and penetration.
- Generally act at the site of application.

Examples: Mancozeb and copper-based fungicides.

2. Curative Fungicides

- Applied after infection has occurred.
- Suppress the development of the pathogen within infected plant tissues.
- Are most effective when applied during the early stages of infection.
- Help prevent further disease development.

3. Eradicant Fungicides

- Act against established pathogens or their structures.
- Help eliminate or destroy existing infections or pathogen propagules, depending on the product and disease.
- Their effectiveness depends on the pathogen, crop and application stage.

4. Systemic Fungicides

- Absorbed by plant tissues.
- Translocated within the plant through vascular or other transport pathways.
- Protect plant tissues beyond the immediate application surface.
- May have preventive or curative activity depending on the active ingredient.

Difference between Fungicidal Actions:

Type	Main function
Protective	Prevents infection before it occurs
Curative	Suppresses infection after it occurs
Eradicant	Destroys established pathogen or pathogen structures
Systemic	Absorbed and transported within plant tissues

Important: Curative describes the timing and effect against an existing infection, whereas systemic describes the movement of the fungicide within the plant. A fungicide may possess both systemic and curative properties.

Q66. Phosphate Solubilising Bacteria (PSB) used as biofertiliser primarily act by:

(a) Converting insoluble phosphate to soluble form
(b) Fixing atmospheric nitrogen
(c) Solubilising fixed potassium
(d) Producing phytohormones exclusively

S66. Ans (a)

Explanation:

Phosphate Solubilising Bacteria (PSB) are beneficial soil microorganisms that convert insoluble forms of phosphorus into soluble forms that can be absorbed by plants.

- A considerable amount of phosphorus present in soil remains unavailable to plants because it becomes fixed with calcium, iron and aluminium compounds.
- PSB produce organic acids such as gluconic acid, citric acid and oxalic acid.
- These organic acids lower the pH of the surrounding soil environment and help dissolve insoluble phosphate compounds.
- PSB also produce phosphatase enzymes that help mineralise organic phosphorus into inorganic phosphate.
- The released phosphate becomes available for absorption by plant roots.

Important Examples of PSB:

1. *Pseudomonas striata*
2. *Bacillus megaterium* var. *phosphaticum*
3. *Bacillus subtilis*
4. *Aspergillus niger* (phosphate-solubilising fungus)

Important Functions of Phosphorus in Plants:

- Essential for ATP and energy transfer.
- Plays an important role in root development.
- Required for flowering, fruiting and seed formation.
- Forms an important component of nucleic acids and phospholipids.
- Promotes early plant growth and maturity.

Difference between Important Biofertilisers:

Biofertiliser	Major function
Rhizobium	Symbiotic nitrogen fixation in legumes
Azotobacter	Free-living nitrogen fixation
Azospirillum	Associative nitrogen fixation
PSB	Solubilisation of insoluble phosphate
KSB	Solubilisation of unavailable potassium
Mycorrhiza	Improves phosphorus and water absorption

Q67. Find the next number in the series: 2, 5, 10, 17, 26, ?

(a) 36
(b) 35
(c) 37
(d) 38

S67. Ans (c)

Explanation:

The given number series follows a pattern based on consecutive odd-number additions.
Given series:
2, 5, 10, 17, 26, ?

Step 1: Calculate the differences between consecutive terms.

- 5 − 2 = 3
- 10 − 5 = 5
- 17 − 10 = 7
- 26 − 17 = 9

The differences are:
3, 5, 7, 9

Step 2: Identify the pattern.

The differences increase by 2 each time.
Therefore, the next difference will be:
$$9+2=11$$

Step 3: Calculate the next term.

$$26+11=37$$
Therefore, the next number is 37.

Alternative Method:

The series can also be expressed as:
$$1^2+1=2$$
$$2^2+1=5$$
$$3^2+1=10$$
$$4^2+1=17$$
$$5^2+1=26$$
$$6^2+1=37$$

Answer: 37

Q68. A combine harvester's header and reel pose the greatest entanglement risk when:
(a) The operator checks it with the harvester running
(b) The field has a gentle slope
(c) The machine runs at low speed
(d) Safety guards are removed in use
S68. Ans (d)
Explanation:
A combine harvester is a multifunctional agricultural machine used for harvesting, threshing and cleaning grain crops.
Its header and reel contain moving components that can create serious entanglement hazards during operation.
Understanding the Risk:
- The header cuts standing crops and feeds them into the machine.
- The reel rotates to guide standing crops towards the cutting mechanism.
- Moving belts, chains, shafts and rotating components can catch clothing, hands or other body parts.
- Removal of safety guards exposes workers to dangerous moving machinery.
- Contact with these components can result in severe injuries.

Important Agricultural Machinery Safety Precautions:
1. Never remove or bypass safety guards during operation.
2. Switch off the engine before cleaning or inspecting moving components.
3. Engage the parking brake before performing maintenance.
4. Keep a safe distance from rotating shafts and moving belts.
5. Never attempt to remove crop blockages while machinery is running.
6. Follow the manufacturer's operating and maintenance instructions.

Important: Entanglement hazards are particularly associated with rotating shafts, reels, belts and other moving machinery components.

Q69. In mangoes, the main horticultural purpose of pruning mature trees is to achieve:
(a) Increased seed germination rate
(b) Improved canopy shape and light entry
(c) Faster root system establishment
(d) Higher soil moisture retention
S69. Ans (b)
Explanation:
Pruning is an important horticultural operation involving the removal of selected branches, shoots and other plant parts to regulate plant growth, improve canopy structure and maintain productivity.
In mature mango trees, pruning is primarily used to improve canopy architecture, light penetration and air circulation.
Major Objectives of Pruning in Mango:
- Removal of dead, diseased and damaged branches.
- Improvement of canopy shape and structure.
- Better penetration of sunlight into the inner canopy.
- Improvement in air circulation.
- Removal of overcrowded and crossing branches.
- Rejuvenation of old and unproductive trees.
- Facilitation of orchard management and harvesting.

Benefits of Improved Light Penetration:

1. Improves photosynthetic activity in inner canopy leaves.
2. Helps maintain productive shoots.
3. Reduces excessive shading.
4. Improves canopy uniformity.
5. Helps create favourable conditions for flowering and fruit development.

Important Information:

Common horticultural operations include:

- **Training:** Developing the desired shape and framework of a plant.
- **Pruning:** Removing selected plant parts to regulate growth and productivity.
- **Thinning:** Removing excess fruits, flowers or shoots to improve the development of remaining plant parts.
- **Rejuvenation:** Restoring productivity in old and unproductive trees through appropriate pruning.

Q70. The opportunity cost of a farm's land or equipment is best described as:

(a) Depreciation cost of land improvement
(b) Market sale price of farm land
(c) Total annual rental value
(d) Income foregone from the next best alternative use

S70. Ans (d)

Explanation:

Opportunity cost refers to the value of the next-best alternative that is sacrificed when a particular resource is used for another purpose.

In agricultural economics, land, labour, capital and machinery have alternative uses. When a farmer chooses one use, the benefits that could have been obtained from the next-best alternative are considered the opportunity cost.

Example:

Suppose a farmer owns one hectare of land and has two alternatives:

- Growing wheat, which provides an expected return of ₹50,000.
- Growing mustard, which provides an expected return of ₹40,000.

If the farmer chooses wheat cultivation, the opportunity cost is ₹40,000, representing the return foregone from the next-best alternative (mustard cultivation).

Important Characteristics:

- It represents the value of the next-best alternative.
- It is relevant in farm resource allocation.
- It helps farmers make economically efficient decisions.
- It may involve both explicit and implicit costs.

Important Types of Farm Costs:

Cost	Meaning
Fixed cost	Cost that generally does not change with output
Variable cost	Cost that changes with the level of production
Opportunity cost	Value of the next-best alternative foregone
Depreciation	Reduction in the value of an asset over time
Marginal cost	Additional cost of producing one more unit

Important: Opportunity cost is not necessarily an actual cash expenditure; it can represent an income or benefit that has been sacrificed.

Q71. Meena ranks 7th from the top and 15th from the bottom. How many students are in the class?
(a) 22
(b) 21
(c) 23
(d) 20
S71. Ans (b)
Explanation:
This question is based on ranking and position calculations.
Given:
- Rank from the top = 7
- Rank from the bottom = 15

To calculate the total number of students, add both ranks and subtract 1 because Meena is counted in both positions.
Formula:
$$\text{Total Students} = \text{Rank from Top} + \text{Rank from Bottom} -1$$
Substituting the values:
$$=7+15-1$$
$$=22-1$$
$$=21$$
Therefore, there are 21 students in the class.
Important Concept:
When a person's position is counted from both ends, that person is counted twice. Hence, 1 must be subtracted from the sum of the two ranks.

Q72. In rice, what is the typical symptom of blast disease?
(a) Spindle-shaped lesions with grey centre
(b) Orange-brown pustules on parallel strips
(c) Black blast on panicle branches
(d) Reddish-brown sheath rot streaks
S72. Ans (a)
Explanation:
Rice blast is one of the most destructive fungal diseases of rice. It is caused by *Magnaporthe oryzae* (synonym: *Pyricularia oryzae*).
The disease can affect leaves, nodes, collars, panicles and other aerial parts of rice plants.
Characteristic Symptoms:
- Leaf blast produces spindle-shaped or diamond-shaped lesions.
- Lesions generally have grey or whitish centres surrounded by brown margins.
- Under favourable environmental conditions, lesions enlarge and may coalesce.
- Infection at the neck region of the panicle causes neck blast.
- Severe neck infection may result in incomplete grain filling or empty panicles.

Important Information:
- Disease: Rice blast.
- Causal organism: *Magnaporthe oryzae*.
- Important symptom: Spindle-shaped leaf lesions with grey centres.
- Favourable conditions: High humidity, leaf wetness and suitable temperatures.

Other Important Rice Diseases:

Disease	Causal organism
Rice blast	*Magnaporthe oryzae*
Bacterial leaf blight	*Xanthomonas oryzae* pv. *oryzae*
Brown spot	*Bipolaris oryzae*
Sheath blight	*Rhizoctonia solani*
False smut	*Ustilaginoidea virens*
Bakanae disease	*Fusarium fujikuroi*

Important: The spindle-shaped lesion with a grey centre is the characteristic symptom of rice blast.

Q73. Blossom end rot in tomato and tip burn in cabbage indicate deficiency of which nutrient?
(a) Magnesium (Mg)
(b) Boron (B)
(c) Potassium (K)
(d) Calcium (Ca)
S73. Ans (d)
Explanation:
Calcium is an essential secondary macronutrient that plays a major role in cell wall formation, membrane stability and normal growth of plant tissues.
Calcium deficiency commonly affects rapidly growing tissues, particularly fruits, young leaves and growing points.
Blossom End Rot in Tomato:
- It appears as a water-soaked spot near the blossom end of the fruit.
- The affected region gradually becomes brown or black and develops a sunken appearance.
- It occurs due to inadequate calcium supply to the developing fruit.
- Irregular water availability and rapid plant growth can aggravate the condition.

Tip Burn in Cabbage:
- Brown or necrotic patches develop along the margins and tips of young inner leaves.
- It is associated with inadequate calcium accumulation in rapidly developing tissues.
- High growth rates and restricted calcium movement can increase the incidence.

Major Functions of Calcium:
1. Essential for cell wall formation through calcium pectate.
2. Maintains cell membrane stability.
3. Regulates cell division and elongation.
4. Supports root and shoot development.
5. Participates in intracellular signalling.
6. Maintains the structural integrity of plant tissues.

Important Information:
Calcium is relatively immobile in the phloem. Therefore, deficiency symptoms generally appear first in young leaves, growing points and developing fruits.
Other Nutrient Deficiency Symptoms:

Nutrient	Common deficiency symptom
Nitrogen	Yellowing of older leaves
Phosphorus	Stunted growth and purplish leaves in some crops
Potassium	Marginal scorching of older leaves
Calcium	Blossom end rot and tip burn
Magnesium	Interveinal chlorosis of older leaves
Sulphur	Yellowing of younger leaves
Boron	Death of growing points and reproductive abnormalities

Q74. In canal systems, conveyance efficiency measures water losses occurring:
(a) Within the root zone profile
(b) During crop evapotranspiration
(c) Between the source and field channel
(d) At the leaf stomatal surface
S74. Ans (c)
Explanation:
Conveyance efficiency is an important parameter used to evaluate the efficiency of an irrigation water distribution system.
It measures the proportion of water delivered to the field compared with the total water released from the source into the conveyance system.
Formula:
$$E_c=\frac{W_f}{W_s}\times100$$
Where:
- E_c = Conveyance efficiency.
- W_f = Water delivered to the field.
- W_s = Water released at the source.

Example:
Suppose 1,000 cubic metres of water are released from a canal head and only 800 cubic metres reach the field.
$$E_c=\frac{800}{1000}\times100$$
$$=80\%$$
Therefore, the conveyance efficiency is 80%.
Causes of Conveyance Losses:
1. Seepage through canal beds and sides.
2. Leakage through damaged canal structures.
3. Evaporation from exposed water surfaces.
4. Unauthorised withdrawals.
5. Poor maintenance of irrigation channels.

Important Difference between Irrigation Efficiencies:

Efficiency	Meaning
Conveyance efficiency	Water reaching the field compared with water released at the source
Application efficiency	Water stored in the root zone compared with water delivered to the field
Storage efficiency	Water stored in the root zone compared with the water required to refill the root zone
Distribution efficiency	Uniformity of water application across the field

Important: Conveyance efficiency focuses on water losses during transportation from the source to the field.

Q75. Late blight of potato, caused by *Phytophthora infestans*, first appears as which leaf symptom?
(a) Brown concentric rings on leaflets
(b) Dark brown pustules on stems
(c) Water-soaked lesions with white sporulation on lower leaf surfaces
(d) Powdery white patches on leaves

S75. Ans (c)
Explanation:
Late blight of potato is a destructive disease caused by the oomycete *Phytophthora infestans*.
It affects potato leaves, stems and tubers and can cause severe crop losses under favourable environmental conditions.
Characteristic Symptoms on Leaves:
- Initial symptoms generally appear as small, pale-green or water-soaked lesions.
- These lesions enlarge rapidly under cool and humid conditions.
- Infected areas become brown or dark brown.
- Under high humidity, a white cottony growth of sporangiophores and sporangia develops near the margins of lesions, particularly on the lower leaf surface.
- Severe infection causes leaves to collapse and dry rapidly.

Symptoms on Other Plant Parts:
- Stems develop dark brown to black lesions.
- Tubers develop brownish or reddish-brown internal discolouration.
- Infected tuber tissues may become firm and granular.

Important Information:
- Disease: Late blight of potato.
- Causal organism: *Phytophthora infestans*.
- Nature: Oomycete disease.
- Favourable conditions: Cool temperatures, high humidity and prolonged leaf wetness.

Difference between Early Blight and Late Blight:

Characteristic	Early blight	Late blight
Causal organism	*Alternaria solani*	*Phytophthora infestans*
Typical lesion	Brown lesions with concentric rings	Water-soaked lesions turning brown
Common appearance	Target-board appearance	Irregular, rapidly enlarging lesions
Favourable conditions	Warm and humid conditions	Cool and humid conditions
Sporulation	Dark sporulation	White sporulation under humid conditions

Important: Concentric rings are characteristic of early blight, whereas water-soaked lesions with white sporulation are characteristic of late blight.

Q76. EMS is widely used in mutation breeding to induce which type of chemical mutation?
(a) Ethylation of DNA bases, alkylating agent
(b) Gibberellic acid, a plant growth hormone
(c) 2,4-D, a synthetic auxin herbicide
(d) Colchicine, a mitotic spindle inhibitor
S76. Ans (a)
Explanation:
Ethyl Methane Sulphonate (EMS) is a widely used chemical mutagen in plant mutation breeding.
It belongs to the group of alkylating agents and induces mutations primarily by transferring ethyl groups to DNA bases.
Mechanism of EMS:
- EMS reacts with DNA and introduces ethyl groups into nucleotide bases.
- It commonly modifies guanine and other DNA bases.
- O^6-ethylguanine is an important DNA lesion induced by EMS.
- Such modifications can result in incorrect base pairing during DNA replication.

- This can lead to point mutations, particularly base substitutions.

Major Features of EMS:

1. It is a chemical mutagen.
2. It is an alkylating agent.
3. It commonly induces point mutations.
4. It is widely used in plant mutation breeding.
5. It can generate genetic variability for crop improvement.

Important Examples of Mutagens:

Mutagen	Type
EMS	Chemical alkylating agent
Sodium azide	Chemical mutagen
MNU	Chemical alkylating agent
Gamma rays	Physical mutagen
X-rays	Physical mutagen
UV radiation	Physical mutagen

Important Difference:

- EMS induces mutations through DNA alkylation.
- Colchicine interferes with spindle formation and is used to induce chromosome doubling or polyploidy.
- Gamma rays induce mutations through ionising radiation.

Important: EMS is particularly important in mutation breeding because it can generate a wide range of point mutations.

Q77. River-fed canals generally carry water containing which characteristic material?

(a) Dissolved ion content
(b) Suspended silt and sediment
(c) Water temperature fluctuations
(d) High dissolved soluble salts

S77. Ans (b)

Explanation:

River-fed canals receive irrigation water directly from rivers. Such water often contains suspended particles of silt, clay and other sediments transported by river flow.

Why does river water contain suspended sediments?

- Rivers transport soil particles from their catchment areas.
- Surface runoff carries eroded soil into river channels.
- High-flow conditions increase the movement of suspended sediments.
- During floods, sediment concentration may increase considerably.
- These particles are transported into canals along with irrigation water.

Effects of Suspended Sediments in Canals:

1. Sedimentation and silting of canal beds.
2. Reduction in canal carrying capacity.
3. Increased maintenance requirements.
4. Blockage of irrigation outlets.
5. Deposition of fine particles in downstream channels.

Important Information:

Canal irrigation systems generally require regular maintenance to remove deposited sediments and maintain hydraulic efficiency.

Difference between Suspended and Dissolved Materials:

- Suspended materials: Soil particles, silt and clay carried in water.
- Dissolved materials: Soluble salts and ions such as calcium, magnesium, sodium and chloride.

Q78. Powdery mildew needs high humidity but not free water; which weather condition favours it most?

(a) Cloudy humid weather without rainfall
(b) High temperature with intense sunlight
(c) Continuous rainfall with waterlogged soil
(d) Low humidity with strong dry winds

S78. Ans (a)

Explanation:

Powdery mildew is a group of fungal diseases caused by obligate biotrophic fungi belonging to the order Erysiphales.

These fungi grow on the surface of plant tissues and obtain nutrients from living host cells through specialised structures called haustoria.

Favourable Conditions for Powdery Mildew:

- High relative humidity.
- Moderate temperatures.
- Cloudy weather.
- Poor air circulation in dense crop canopies.
- Absence of prolonged free water on leaf surfaces.

Why is free water generally not required?

- Powdery mildew fungi produce conidia that can germinate under conditions of high atmospheric humidity.
- Unlike many other fungal pathogens, free water on leaf surfaces may inhibit conidial germination in several powdery mildew species.
- Therefore, humid conditions without continuous rainfall often favour disease development.

Major Symptoms:

1. White powdery patches on leaves.
2. Powdery growth on stems and young shoots.
3. Yellowing and drying of infected leaves.
4. Reduced photosynthetic efficiency.
5. Premature leaf drop in severe infections.

Important Examples:

- Powdery mildew of wheat – *Blumeria graminis* f. sp. *tritici*.
- Powdery mildew of grapes – *Erysiphe necator*.
- Powdery mildew of cucurbits – *Podosphaera xanthii*.

Difference between Powdery Mildew and Downy Mildew:

Characteristic	Powdery mildew	Downy mildew
Common growth	White powdery coating	Downy growth, often on lower leaf surface
Humidity	High humidity favours development	High humidity and leaf wetness favour development
Free water	Generally not required	Often favourable
Pathogen group	Erysiphales	Oomycetes
Growth	Mostly superficial	Sporulation often occurs through stomata

Q79. Choose the odd one out: Spade, Sickle, Plough, Tractor.
(a) Plough
(b) Sickle
(c) Spade
(d) Tractor
S79. Ans (d)
Explanation:
This question is based on identifying the item that belongs to a different category.
The given items are:
- Spade: A manually operated agricultural tool used for digging and turning soil.
- Sickle: A manually operated harvesting tool used for cutting crops and grasses.
- Plough: A traditional agricultural implement used for primary tillage and soil preparation.
- Tractor: A self-propelled agricultural power machine used to operate implements and perform various farm operations.

The tractor is different because it is a power-operated agricultural machine, whereas the other three are agricultural tools or implements.
Important Information:
Examples of Hand Tools:
1. Spade.
2. Sickle.
3. Hoe.
4. Khurpi.
5. Hand fork.

Examples of Agricultural Implements and Machines:
1. Mouldboard plough.
2. Disc harrow.
3. Seed drill.
4. Tractor.
5. Combine harvester.

Answer: Tractor.

Q80. Parthenium suppresses nearby plant growth by releasing allelochemicals, illustrating:
(a) Allelopathy
(b) Competition
(c) Symbiosis
(d) Mutualism
S80. Ans (a)
Explanation:
Allelopathy is a biological phenomenon in which one plant releases chemical substances known as allelochemicals that influence the germination, growth, development or survival of other plants.
These chemicals may have inhibitory or stimulatory effects on neighbouring plants.
Allelopathy in Parthenium:
Parthenium hysterophorus, commonly known as Congress grass or carrot weed, is an invasive weed that can suppress the growth of neighbouring vegetation through allelopathic effects.
- It releases allelochemicals through root exudates, decomposing plant residues and other plant parts.
- These chemicals can interfere with seed germination and seedling growth of susceptible plants.
- They may affect root and shoot development.
- They can reduce the establishment and growth of neighbouring crops and plant species.

Important Allelochemical:
Parthenium contains several bioactive compounds, including:
- Parthenin.
- Phenolic acids.
- Other sesquiterpene lactones.

Parthenin is one of the important compounds associated with its allelopathic activity.
Other Examples of Allelopathy:
1. *Eucalyptus* species: Leaf litter and root-associated compounds can suppress the growth of certain neighbouring plants.
2. Sorghum: Produces sorgoleone, an important allelochemical associated with weed suppression.
3. Black walnut (*Juglans nigra*): Produces juglone, which affects the growth of susceptible plants.
4. Rice: Certain rice varieties produce compounds with allelopathic potential against weeds.

Difference between Important Ecological Interactions:

Interaction	Meaning
Allelopathy	Chemical influence of one plant on another
Competition	Organisms compete for limited resources
Symbiosis	Close and prolonged association between different organisms
Mutualism	Both interacting organisms benefit

Important: Allelopathy is a form of chemical interference, whereas competition generally involves the utilisation of limited resources such as light, water, nutrients and space.

Q81. Numerous small, finger-like channels that can be smoothed out by normal tillage describe:
(a) Gully erosion
(b) Rill erosion
(c) Sheet erosion
(d) Wind erosion
S81. Ans (b)
Explanation:
Rill erosion is a type of water erosion in which running water forms numerous small, shallow channels on the soil surface.
- It occurs when surface runoff concentrates into small streams and removes soil particles.
- These small channels are known as rills.
- Rills are generally shallow enough to be removed or levelled through normal tillage operations.
- It commonly occurs on sloping agricultural fields where runoff is not properly controlled.
- If rill erosion continues unchecked, the channels may enlarge and develop into gullies.

Different Types of Soil Erosion:
1. **Sheet Erosion:** Uniform removal of a thin layer of topsoil over a large area by surface runoff.
2. **Rill Erosion:** Formation of small, shallow channels due to concentrated surface runoff.
3. **Gully Erosion:** Formation of large and deep channels that cannot be removed by ordinary tillage.
4. **Splash Erosion:** Detachment and movement of soil particles due to the impact of raindrops.
5. **Wind Erosion:** Detachment and transportation of soil particles by wind.

Difference between Rill and Gully Erosion:

Rill erosion	Gully erosion
Forms small, shallow channels	Forms large, deep channels
Can be removed by normal tillage	Cannot be removed by normal tillage
Usually an early stage of channel erosion	Represents a more advanced stage
Causes relatively less soil loss	Can cause substantial soil loss

Important: Contour farming, strip cropping, terracing and vegetative barriers are important measures for controlling water erosion.

Q82. Training Needs Assessment (TNA) in extension programmes is conducted primarily to:
(a) Select extension staff for promotion
(b) Finalize annual departmental budgets
(c) Evaluate crop yield performance
(d) Identify skill and knowledge gaps
S82. Ans (d)
Explanation:
Training Needs Assessment (TNA) is a systematic process used to identify the gaps between the existing knowledge, skills and competencies of individuals and the competencies required to perform their jobs effectively.
In agricultural extension, TNA helps identify the training requirements of farmers, extension workers and other agricultural stakeholders.
Major Objectives of TNA:
- Identify gaps in existing agricultural knowledge and skills.
- Determine the specific training requirements of farmers and extension personnel.
- Design relevant and need-based training programmes.
- Improve the effectiveness of agricultural extension services.
- Ensure the efficient utilisation of training resources.
- Improve the adoption of improved agricultural technologies.

Steps Involved in Training Needs Assessment:
1. **Identification of Performance Gaps:** Determine the difference between existing and desired performance.
2. **Data Collection:** Collect information through surveys, interviews, observations and discussions.
3. **Analysis of Training Needs:** Identify the specific knowledge and skill deficiencies.
4. **Prioritisation:** Rank training requirements according to their importance.
5. **Training Programme Design:** Develop appropriate training content and methods.
6. **Evaluation:** Assess whether the training has improved knowledge and performance.

Methods of TNA:
- Interviews.
- Questionnaires.
- Focus group discussions.
- Direct observation.
- Performance analysis.
- Knowledge and skill tests.

Important Information:
Training needs can be assessed at three levels:
1. **Organisational Analysis:** Identifies training needs according to organisational objectives.
2. **Task Analysis:** Identifies the knowledge and skills required to perform specific tasks.
3. **Individual Analysis:** Identifies the training requirements of individual employees or participants.

Important: TNA is conducted before designing a training programme to ensure that training addresses actual knowledge and skill gaps.

Q83. Atropine is used as an emergency antidote for poisoning by which class of pesticide?
(a) Phenoxy herbicides
(b) Pyrethroid insecticides
(c) Organophosphate insecticides

(d) Triazole fungicides

S83. Ans (c)

Explanation:

Atropine is an important antidote used in the medical management of organophosphate insecticide poisoning.

Organophosphate insecticides inhibit the enzyme acetylcholinesterase, resulting in the accumulation of acetylcholine at nerve endings.

Mechanism of Organophosphate Poisoning:

- Acetylcholinesterase is an enzyme responsible for breaking down the neurotransmitter acetylcholine.
- Organophosphate compounds inhibit this enzyme.
- As a result, acetylcholine accumulates at cholinergic synapses.
- Excessive stimulation of muscarinic, nicotinic and central nervous system receptors occurs.
- This produces characteristic symptoms of cholinergic poisoning.

Major Symptoms of Organophosphate Poisoning:

1. Excessive salivation.
2. Excessive sweating.
3. Increased lacrimation.
4. Pinpoint pupils (miosis).
5. Difficulty in breathing due to bronchoconstriction and increased bronchial secretions.
6. Muscle twitching and weakness.
7. Convulsions in severe cases.

Role of Atropine:

- Atropine is a competitive antagonist of muscarinic acetylcholine receptors.
- It helps control excessive salivation and bronchial secretions.
- It reduces bronchoconstriction.
- It helps manage other muscarinic manifestations of organophosphate poisoning.

Other Important Information:

- Pralidoxime (2-PAM) may also be used to reactivate inhibited acetylcholinesterase, particularly when administered early.
- Atropine does not directly reactivate acetylcholinesterase.
- Severe poisoning requires immediate hospital treatment and respiratory support when necessary.

Important Safety Note: Suspected pesticide poisoning is a medical emergency. Do not attempt self-treatment or administer atropine without medical supervision. Move away from exposure, avoid direct contact with contaminated clothing and seek emergency medical assistance immediately.

Important: Atropine is particularly associated with organophosphate and certain carbamate insecticide poisoning.

Q84. The break-even area for an Odisha tractor owner is the area beyond which owning a farm machine becomes:

(a) Irrelevant to hiring decisions

(b) Cheaper than custom hiring

(c) Costlier than custom hiring

(d) Always equal to hiring charges

S84. Ans (b)

Explanation:

Break-even area is the minimum area of land that must be cultivated using an owned agricultural machine to make its ownership economically comparable to custom hiring.

It helps farmers decide whether purchasing agricultural machinery is more economical than hiring machinery from another farmer or service provider.

Understanding Break-Even Area:

- Owning agricultural machinery involves fixed costs such as depreciation, interest on investment, insurance and housing.
- It also involves variable operating costs such as fuel, lubricants, repairs and labour.
- Custom hiring generally involves paying a specified charge per unit of area or operating hour.
- At a particular level of machine utilisation, the total cost of owning and operating the machine becomes equal to the total cost of hiring it.
- This level is called the break-even point or break-even area.

Formula:

$$\text{Break-even Area} = \frac{\text{Annual Fixed Cost}}{\text{Custom Hiring Cost per ha}-\text{Operating Cost per ha}}$$

Where:

- Annual fixed cost = Annual depreciation, interest, insurance and other fixed costs.
- Custom hiring cost per hectare = Cost of hiring the machine.
- Operating cost per hectare = Variable cost of operating an owned machine.

Example:

Suppose:

- Annual fixed cost = ₹1,00,000.
- Custom hiring charge = ₹2,000/ha.
- Operating cost of owned machinery = ₹1,000/ha.

$$BEA=\frac{1,00,000}{2,000-1,000}$$

$$=100\text{ ha}$$

Therefore:

- Below 100 ha, custom hiring is comparatively economical.
- At 100 ha, both alternatives have equal total costs.
- Beyond 100 ha, owning the machine becomes comparatively economical, assuming the cost structure remains unchanged.

Important: Break-even area helps determine the economic feasibility of purchasing tractors, harvesters, seed drills and other agricultural machinery.

Q85. Rashtriya Krishi Vikas Yojana (RKVY) mainly aims to incentivize:

(a) Direct cash transfer to farmers
(b) States' agricultural investment
(c) Export of surplus foodgrains
(d) Crop residue burning control

S85. Ans (b)

Explanation:

Rashtriya Krishi Vikas Yojana (RKVY) is a centrally sponsored scheme launched to encourage states to increase investment in agriculture and allied sectors.

It aims to promote agricultural development through state-specific planning and investment.

Major Objectives of RKVY:

- Encourage states to increase public investment in agriculture.
- Promote comprehensive development of agriculture and allied sectors.
- Improve agricultural productivity.
- Strengthen agricultural infrastructure.
- Promote innovation and entrepreneurship in agriculture.
- Support state-specific agricultural development priorities.

- Encourage value addition and post-harvest management.

Important Features:

- Launched in 2007.
- Initially designed to incentivise states to increase agricultural investment.
- Provides flexibility to states to select agricultural development projects according to their specific requirements.
- Covers agriculture and allied sectors such as horticulture, animal husbandry, dairy, fisheries and agricultural marketing.

RKVY-RAFTAAR:

The scheme was revamped in 2017–18 as Rashtriya Krishi Vikas Yojana – Remunerative Approaches for Agriculture and Allied Sector Rejuvenation (RKVY-RAFTAAR).

Its objectives included:

1. Strengthening agricultural infrastructure.
2. Promoting agripreneurship and innovation.
3. Supporting pre- and post-harvest infrastructure.
4. Encouraging agricultural start-ups.
5. Improving farmers' income through agricultural development.

Important Information:

- Full form: Rashtriya Krishi Vikas Yojana.
- Launch year: 2007.
- Ministry: Ministry of Agriculture and Farmers Welfare.
- Nature: Centrally Sponsored Scheme.
- Primary focus: Encouraging states' investment in agriculture and allied sectors.

Important: RKVY is primarily an investment-oriented agricultural development scheme, not a direct cash-transfer scheme.

Q86. Narrow-sense heritability differs from broad-sense heritability in that it accounts only for which variance component?

(a) Environment interaction variance
(b) Dominance genetic variance
(c) Total genotypic variance
(d) Additive genetic variance

S86. Ans (d)

Explanation:

Heritability is a quantitative genetic parameter that measures the proportion of phenotypic variation in a population that is attributable to genetic variation.

It is important in plant breeding because it helps determine the effectiveness of selection for improving desirable traits.

There are two major types of heritability: broad-sense and narrow-sense heritability.

1. Broad-Sense Heritability (H^2)

Broad-sense heritability represents the proportion of total phenotypic variance explained by total genotypic variance.

Formula:

$$H^2=\frac{V_G}{V_P}$$

Where:

- V_G = Genotypic variance.
- V_P = Phenotypic variance.

Genotypic variance includes:

- Additive genetic variance.

- Dominance genetic variance.
- Epistatic or interaction genetic variance.

Therefore:

$$V_G=V_A+V_D+V_I$$

2. Narrow-Sense Heritability (h^2)

Narrow-sense heritability represents the proportion of phenotypic variance attributable specifically to additive genetic variance.

Formula:

$$h^2=\frac{V_A}{V_P}$$

Where:

- V_A = Additive genetic variance.
- V_P = Phenotypic variance.

Difference between Broad-Sense and Narrow-Sense Heritability:

Broad-sense heritability	Narrow-sense heritability
Includes total genetic variance	Includes only additive genetic variance
Includes additive, dominance and epistatic effects	Considers additive genetic effects
Represented by H^2	Represented by h^2
Useful in evaluating total genetic contribution	Particularly useful in predicting response to selection

Importance in Plant Breeding:

- Narrow-sense heritability helps predict the response to selection.
- Traits with high narrow-sense heritability are generally more effectively improved through selection.
- Additive genetic effects are transmitted relatively predictably from parents to offspring.

Important Formula:

$$R=h^2\times S$$

Where:

- R = Response to selection.
- h^2 = Narrow-sense heritability.
- S = Selection differential.

Important: Narrow-sense heritability considers only additive genetic variance, whereas broad-sense heritability considers total genotypic variance.

Q87. In Rogers' diffusion of innovations theory, which category adopts an innovation immediately after the innovators?

(a) Laggards
(b) Early adopters
(c) Late majority
(d) Early majority

S87. Ans (b)

Explanation:

Everett M. Rogers developed the Diffusion of Innovations theory to explain how new ideas, technologies and innovations spread within a social system over time.

In agricultural extension, this theory helps explain how farmers adopt improved agricultural technologies, varieties and farming practices.

Rogers classified adopters into five categories based on their willingness and speed of adopting innovations.

Five Categories of Adopters:

Adopter categories

1. Innovators

2.5%

First individuals to adopt new ideas; willing to take risks.

2. Early adopters

13.5%

Adopt innovations soon after innovators; often serve as opinion leaders.

3. Early majority

34%

Adopt innovations before the average member of society.

4. Late majority

34%

Adopt innovations after the average member; often influenced by social pressure.

5. Laggards

16%

Last group to adopt innovations; generally cautious about change.

Explanation of Early Adopters:

- Early adopters adopt an innovation immediately after the innovators.
- They are generally respected members of their communities.
- They often act as opinion leaders and influence other individuals.
- Their acceptance of an innovation helps build confidence among the early majority.
- Agricultural extension workers frequently approach progressive farmers to demonstrate new technologies.

Example in Agriculture:

When a new high-yielding crop variety is introduced:

1. Innovators experiment with it first.
2. Early adopters accept it and demonstrate its benefits.
3. Early majority farmers adopt it after observing successful results.
4. Late majority farmers adopt it after wider acceptance.
5. Laggards adopt it last.

Important Information:

The adopter categories and their approximate proportions are:

- Innovators: 2.5%.
- Early adopters: 13.5%.
- Early majority: 34%.
- Late majority: 34%.
- Laggards: 16%.

Important: Early adopters are the second category in Rogers' Diffusion of Innovations theory.

Q88. Interveinal chlorosis of older leaves in a "Christmas tree" pattern points to deficiency of:

(a) Magnesium (Mg)

(b) Potassium (K)

(c) Manganese (Mn)

(d) Nitrogen (N)

S88. Ans (a)

Explanation:

Magnesium is an essential secondary macronutrient required for chlorophyll formation, photosynthesis and several enzymatic activities in plants.

Magnesium deficiency commonly produces interveinal chlorosis, particularly in older leaves, because magnesium is relatively mobile within plants.

Why Does Magnesium Deficiency Affect Older Leaves?

- Magnesium is mobile in the phloem.
- When the supply of magnesium from the soil becomes inadequate, the plant transfers magnesium from older leaves to younger growing tissues.
- As a result, chlorophyll degradation occurs in older leaves.
- The leaf tissue between the veins becomes yellow, while the veins may remain relatively green.
- This produces characteristic interveinal chlorosis.

Christmas Tree Pattern:

In certain crops, particularly maize, magnesium deficiency may produce a distinctive interveinal chlorosis pattern resembling a Christmas tree.

This pattern is associated with yellowing along the central region and between the leaf veins.

Major Functions of Magnesium:

1. Central constituent of the chlorophyll molecule.
2. Essential for photosynthesis.
3. Activates several enzymes involved in carbohydrate metabolism.
4. Plays an important role in ATP-related biochemical reactions.
5. Supports phosphate metabolism.
6. Helps in protein synthesis.

Important Comparison of Nutrient Deficiencies:

Nutrient	Mobility	Common deficiency symptom
Nitrogen	Mobile	Uniform yellowing of older leaves
Magnesium	Mobile	Interveinal chlorosis of older leaves
Potassium	Mobile	Marginal chlorosis and scorching of older leaves
Iron	Immobile	Interveinal chlorosis of younger leaves
Sulphur	Relatively immobile	Uniform yellowing of younger leaves
Calcium	Immobile	Death of growing points and tip burn

Important: Magnesium deficiency generally appears first on older leaves, whereas iron deficiency commonly appears first on younger leaves.

Q89. A farmer needs 32 kg P_2O_5/ha using SSP (16% P_2O_5) on 3 hectares. How many 50 kg bags are needed?

(a) 16
(b) 9
(c) 12
(d) 15

S89. Ans (c)

Explanation:

This question is based on calculating the quantity of Single Super Phosphate (SSP) required to fulfil the phosphorus requirement of a given agricultural area.

Given:

- Recommended phosphorus dose = 32 kg P_2O_5/ha.
- SSP contains = 16% P_2O_5.
- Total cultivated area = 3 hectares.
- Weight of one SSP bag = 50 kg.

Step 1: Calculate the total phosphorus requirement.

$$\text{Total P}_2\text{O}_5 =32\times3$$
$$=96\text{ kg}$$

Step 2: Calculate the total quantity of SSP required.
SSP contains 16% P_2O_5.
Therefore:
$$\text{SSP Required} =\frac{96\times100}{16}$$
$$=600\text{ kg}$$
Step 3: Calculate the number of bags required.
Weight of one bag = 50 kg.
$$\text{Number of Bags}=\frac{600}{50}$$
$$=12\text{ bags}$$
Correct answer: 12 bags
Important Fertiliser Information:
Single Super Phosphate (SSP) is a phosphatic fertiliser containing approximately:
- 16% available P_2O_5.
- 11–12% sulphur.
- Approximately 19% calcium.

Major Functions of SSP:
1. Supplies phosphorus for root development.
2. Supports flowering and seed formation.
3. Supplies sulphur for protein synthesis.
4. Provides calcium for normal plant development.

Important Formula:
$$\text{Fertiliser Requirement} = \frac{\text{Required Nutrient}\times100}{\text{Nutrient Percentage in Fertiliser}}$$

Q90. Commercial mango orchards prefer vegetative propagation by grafting mainly because of:
(a) Higher root vigour in seedlings
(b) Greater genetic variability among seedlings
(c) Faster germination from stone seed
(d) True-to-type fruit quality retention
S90. Ans (d)
Explanation:
Vegetative propagation through grafting is widely used in commercial mango cultivation because it helps maintain the desirable genetic and horticultural characteristics of selected mother plants.
Mango is generally propagated commercially through methods such as veneer grafting, stone grafting and epicotyl grafting.
Why is Grafting Preferred in Mango?
- Mango seedlings raised from seeds may show considerable variation in fruit quality, yield and other characteristics, particularly when derived from cross-pollinated seeds.
- Grafting combines a selected scion variety with a suitable rootstock.
- The scion retains the desirable characteristics of the selected mother plant.
- It helps maintain uniform fruit size, colour, taste and quality.
- Grafted plants generally come into bearing earlier than seedling plants.
- It facilitates commercial orchard establishment with uniform varieties.

Major Advantages of Grafting:
1. Maintains true-to-type varietal characteristics.
2. Ensures uniform fruit quality.
3. Reduces the juvenile period compared with seedling propagation.
4. Facilitates multiplication of superior commercial varieties.
5. Allows the use of suitable rootstocks for improved adaptability and vigour.

Important Methods of Vegetative Propagation in Mango:

1. Veneer grafting.
2. Epicotyl grafting.
3. Softwood grafting.
4. Inarching.
5. Approach grafting.

Important Information:

Some important commercial mango varieties include:

- Alphonso.
- Dashehari.
- Langra.
- Chausa.
- Kesar.
- Amrapali.
- Mallika.

Difference between Seed Propagation and Grafting:

Seed propagation	Grafting
Sexual method of propagation	Vegetative method of propagation
May produce genetic variation	Maintains characteristics of the selected scion
Generally longer juvenile period	Generally earlier bearing
Fruit quality may vary	More uniform fruit quality
Used for raising rootstocks and breeding populations	Commonly used for commercial orchards

Important: Grafting is preferred in commercial mango orchards because it preserves the desirable characteristics of the selected variety and produces relatively uniform, true-to-type plants.

Q91. Statements: Some tractors are red. All red things are expensive.

Conclusions:

I. Some tractors are expensive.

II. All expensive things are tractors.

(a) Neither conclusion follows

(b) Both conclusions follow

(c) Only conclusion I follows

(d) Only conclusion II follows

S91. Ans (c)

Explanation:

This question is based on the principles of syllogism and logical reasoning.

Given Statements:

1. Some tractors are red.
2. All red things are expensive.

Analysis of Conclusion I: Some tractors are expensive.

- According to the first statement, at least some tractors are red.
- According to the second statement, all red things are expensive.
- Therefore, the tractors that are red must also be expensive.
- Hence, some tractors are definitely expensive.

Conclusion I follows.

Analysis of Conclusion II: All expensive things are tractors.

- The statement establishes that all red things are expensive.
- However, it does not establish that all expensive things are tractors.
- Expensive things may include cars, machinery, buildings and other objects.
- Therefore, this conclusion does not follow.

Important Syllogism Rules:

- All A are B: Every member of A belongs to B.
- Some A are B: At least one member of A belongs to B.
- No A is B: A and B have no common members.
- Some A are not B: At least one member of A does not belong to B.

Q92. In flood-prone rainfed lowlands of Bihar/West Bengal, compared with transplanted rice, direct seeded rice (DSR) generally faces which problem?

(a) Lodging at maturity
(b) Blast disease spread
(c) Panicle sterility
(d) Weed infestation levels

S92. Ans (d)

Explanation:

Direct Seeded Rice (DSR) is a rice cultivation method in which seeds are sown directly into the field instead of raising seedlings in a nursery and subsequently transplanting them.
Although DSR offers several advantages, weed management is one of its major challenges.

Why is weed infestation higher in DSR?

- In transplanted rice, standing water and transplanted seedlings provide an initial competitive advantage over weeds.
- In DSR, rice seeds and weed seeds germinate in the field under relatively similar conditions.
- There is generally no transplanting shock or nursery-stage separation to provide an initial advantage to the rice crop.
- Weeds compete with rice plants for nutrients, water, sunlight and growing space.
- Early weed competition can significantly reduce crop establishment and yield.

Major Problems Associated with DSR:

1. Increased weed infestation.
2. Greater dependence on effective weed-management practices.
3. Risk of poor crop establishment under unsuitable soil moisture conditions.
4. Greater sensitivity to early-season moisture stress in certain establishment systems.
5. Difficulty in managing weeds under heavy rainfall and uncontrolled flooding.

Advantages of Direct Seeded Rice:

- Saves labour required for transplanting.
- Reduces nursery preparation requirements.
- Saves irrigation water under suitable conditions.
- Allows faster crop establishment.
- Reduces cultivation costs in suitable production systems.

Difference between DSR and Transplanted Rice:

Direct Seeded Rice	Transplanted Rice
Seeds are directly sown in the field	Seedlings are raised in a nursery and transplanted
Higher weed-management challenges	Initial weed competition is often reduced

Generally requires less labour for establishment	Requires additional transplanting labour
No transplanting shock	Seedlings experience transplanting shock
Water management depends on establishment method	Often established under puddled conditions

Important: Weed infestation is one of the most important constraints limiting the adoption and productivity of direct-seeded rice.

Q93. In an extension communication system, "feedback" primarily helps the change agent to:
(a) Recruit additional field staff
(b) Print more extension literature
(c) Increase the broadcast transmission range
(d) Assess farmers' response to the message
S93. Ans (d)
Explanation:
Feedback is an essential component of the agricultural extension communication process. It refers to the response or reaction of the receiver to the message communicated by the sender.
In agricultural extension, feedback helps the change agent understand whether farmers have received, understood and accepted the information being communicated.
Importance of Feedback in Agricultural Extension:
- It helps determine whether farmers have understood the message correctly.
- It allows extension workers to identify farmers' doubts and difficulties.
- It provides information about farmers' attitudes towards new agricultural technologies.
- It helps assess the acceptance or rejection of recommended practices.
- It allows the change agent to modify communication strategies according to farmers' needs.
- It improves the effectiveness of extension programmes.

Example:
An agricultural extension officer explains the benefits of a new wheat variety to farmers.
- Farmers listen to the information.
- They ask questions about seed rate, irrigation and fertiliser application.
- They express their willingness or unwillingness to adopt the variety.
- The extension officer evaluates their responses and provides additional clarification.

This response from farmers is called feedback.
Elements of the Communication Process:
1. Sender: Person who initiates communication.
2. Encoding: Converting ideas into symbols or messages.
3. Message: Information being communicated.
4. Channel: Medium used to transmit the message.
5. Receiver: Person who receives the message.
6. Decoding: Interpretation of the message.
7. Feedback: Response of the receiver to the message.

Important: Feedback makes communication a two-way process and helps the change agent evaluate the effectiveness of the communication.

Q94. For rice irrigation scheduling in Odisha, the IW/CPE ratio in irrigation water management is primarily used for:
(a) Irrigation timing frequency

(b) Canal water conveyance loss
(c) Soil moisture depletion rate
(d) Field drainage coefficient

S94. Ans (a)

Explanation:

The IW/CPE ratio is an important method used for scheduling irrigation based on the relationship between the depth of irrigation water applied and cumulative pan evaporation.

It helps determine when irrigation should be applied according to atmospheric evaporative demand.

Full Form:

- IW = Irrigation Water.
- CPE = Cumulative Pan Evaporation.

Formula:

$$\text{IW/CPE Ratio}= \frac{\text{Depth of Irrigation Water Applied}} {\text{Cumulative Pan Evaporation}}$$

Working Principle:

- Pan evaporation indicates the evaporative demand of the atmosphere.
- As evaporation increases, the crop loses more water through evapotranspiration.
- Cumulative pan evaporation is monitored after irrigation.
- Irrigation is applied when the predetermined IW/CPE ratio is reached.
- The selected ratio helps determine the interval or frequency of irrigation.

Example:

Suppose:

- Irrigation water depth = 50 mm.
- Selected IW/CPE ratio = 1.0.

The irrigation trigger occurs when cumulative pan evaporation reaches:

$$\frac{50}{1.0}=50\text{ mm}$$

Therefore, irrigation is scheduled after 50 mm of cumulative pan evaporation.

Importance of IW/CPE Ratio:

1. Helps schedule irrigation scientifically.
2. Prevents unnecessary irrigation.
3. Improves water-use efficiency.
4. Helps maintain suitable soil moisture.
5. Supports better crop growth and productivity.

Important Information:

IW/CPE ratios are crop-, soil- and climate-specific. A higher ratio generally indicates more frequent irrigation, whereas a lower ratio indicates a longer interval between irrigations.

Important: IW/CPE is primarily an irrigation scheduling method, not a measure of canal conveyance efficiency or field drainage.

Q95. Which precaution is essential while mixing and loading concentrated pesticide, before dilution?

(a) A raincoat without gloves
(b) Cotton gloves without an apron
(c) Rubber gloves and an apron
(d) Only a cotton dust mask

S95. Ans (c)

Explanation:

Mixing and loading concentrated pesticides are among the most hazardous stages of pesticide application because workers may come into direct contact with highly concentrated chemical formulations.
Therefore, appropriate personal protective equipment (PPE) must be used to prevent pesticide exposure.

Importance of Rubber Gloves and Aprons:

- Chemical-resistant gloves protect hands from direct contact with concentrated pesticides.
- A chemical-resistant apron protects the body and clothing against accidental splashes.
- These protective measures reduce the risk of skin absorption and contamination.
- Concentrated formulations may cause serious irritation, poisoning or other harmful effects following exposure.

Essential Safety Precautions During Mixing and Loading:

1. Wear chemical-resistant gloves.
2. Use a suitable chemical-resistant apron or protective coverall.
3. Wear protective goggles or a face shield to protect the eyes.
4. Use appropriate respiratory protection when required by the pesticide label.
5. Mix pesticides in a well-ventilated designated area.
6. Avoid splashing, spilling or direct contact with concentrated formulations.
7. Follow the manufacturer's instructions for dilution and handling.
8. Wash exposed skin and equipment after completing the operation.

Important Information:

Different PPE components provide protection to different body parts:

PPE	**Purpose**
Chemical-resistant gloves	Protect hands
Protective apron or coverall	Protect body and clothing
Safety goggles	Protect eyes
Face shield	Protect face from splashes
Respirator	Protect against hazardous inhalation exposure
Chemical-resistant footwear	Protect feet

Important: PPE requirements depend on the pesticide formulation and its label. Ordinary cotton gloves are not an adequate substitute for suitable chemical-resistant gloves.

Q96. A cooperative society in Burdwan, West Bengal, gives a farmer a loan of Rs. 1,20,000 at 8% simple interest for 15 months. Find the interest.

(a) Rs. 12,000
(b) Rs. 14,400
(c) Rs. 13,200
(d) Rs. 9,600

S96. Ans (a)

Explanation:

This question is based on the calculation of simple interest.
Simple interest is the interest calculated only on the original principal amount throughout the loan period.

Given:

- Principal (P) = ₹1,20,000
- Annual Rate of Interest (R) = 8%

- Time (T) = 15 months

Step 1: Convert months into years.

Since the interest rate is given annually, the time must be converted into years.

$$T=\frac{15}{12}$$

$$T=1.25\text{ years}$$

Step 2: Apply the simple interest formula.

$$SI=\frac{P\times R\times T}{100}$$

Substituting the values:

$$SI=\frac{1,20,000\times8\times1.25}{100}$$

$$SI=12,000$$

Therefore, the simple interest is ₹12,000.

Correct answer: (a) ₹12,000

Step 3: Calculate the total repayment amount.

$$\text{Amount}=P+SI$$

$$=1,20,000+12,000$$

$$=₹1,32,000$$

Important Formula:

$$SI=\frac{P\times R\times T}{100}$$

Where:

- P = Principal amount.
- R = Annual rate of interest.
- T = Time in years.

Important: Always convert months into years when the interest rate is expressed annually.

Q97. The lime requirement of an acid soil is determined mainly by its:

(a) Organic carbon content

(b) Available phosphorus level

(c) Exchangeable soil acidity

(d) Cation exchange capacity

S97. Ans (c)

Explanation:

Lime requirement refers to the quantity of liming material needed to neutralise soil acidity and raise soil pH to a suitable level for crop growth.

The lime requirement of an acidic soil is primarily determined by its exchangeable acidity and reserve acidity.

Understanding Soil Acidity:

Soil acidity develops due to the presence of hydrogen ions (H^+) and aluminium ions (Al^{3+}) in the soil system.

- Exchangeable hydrogen and aluminium contribute to soil acidity.
- Aluminium toxicity can restrict root growth and nutrient absorption.
- Acidic soils may also show reduced availability of phosphorus.
- Liming helps neutralise acidity and improves the chemical environment of the root zone.

Role of Exchangeable Soil Acidity:

- Exchangeable acidity represents acidity associated with exchangeable hydrogen and aluminium ions on soil colloids.
- Higher exchangeable acidity generally indicates a greater requirement for lime.
- Aluminium toxicity is an important limitation in strongly acidic soils.

- Lime supplies calcium and, depending on the material, magnesium to the soil.
- It helps reduce aluminium toxicity and improves nutrient availability.

Common Liming Materials:

1. Calcium carbonate ($CaCO_3$).
2. Dolomite [$CaMg(CO_3)_2$].
3. Calcium oxide (CaO).
4. Calcium hydroxide [$Ca(OH)_2$].

Major Benefits of Liming:

- Raises soil pH.
- Reduces aluminium toxicity.
- Supplies calcium and sometimes magnesium.
- Improves phosphorus availability in many acidic soils.
- Promotes beneficial microbial activities.
- Improves conditions for root growth.

Important Information:

Different methods used to determine lime requirement include:

- Buffer pH method.
- Exchangeable acidity method.
- SMP buffer method.
- Soil incubation method.

Important: Lime requirement is not determined by soil pH alone. Exchangeable and reserve acidity are important because they indicate how much acidity must be neutralised.

Q98. Mass selection improves population performance by selecting plants based on:

(a) Pedigree records across several generations
(b) Phenotype alone, without progeny testing
(c) Progeny performance in replicated trials
(d) Molecular marker genotyping results

S98. Ans (b)

Explanation:

Mass selection is one of the oldest and simplest methods of plant breeding. It involves selecting a large number of desirable individual plants based on their observable characteristics (phenotypes) and mixing their seeds to raise the next generation.

It is commonly used for improving heterogeneous, open-pollinated crop populations.

Procedure of Mass Selection:

1. A large population of plants is grown in the field.
2. Individual plants are observed for desirable phenotypic characteristics.
3. Superior plants are selected based on their appearance and performance.
4. Seeds from the selected plants are harvested.
5. The seeds are mixed together to form the seed lot for the next generation.
6. The selected population is grown and evaluated in subsequent cycles.

Important Selection Criteria:

- Plant height.
- Grain yield.
- Disease resistance.
- Maturity duration.
- Seed size and quality.

- Other desirable agronomic characteristics.

Characteristics of Mass Selection:

- Selection is primarily based on phenotype.
- Generally, no separate progeny testing is required in the basic method.
- It is relatively simple and economical.
- It helps improve the average performance of a population.
- It is particularly useful in cross-pollinated crops.

Advantages:

1. Simple breeding procedure.
2. Requires less time and resources.
3. Maintains genetic variability within the population.
4. Can improve desirable population characteristics.
5. Useful for improving local varieties and landraces.

Limitations:

- Phenotypic performance is influenced by environmental conditions.
- It is difficult to distinguish genetic superiority from environmental effects.
- Selection may be less effective for traits with low heritability.

Difference between Mass Selection and Pure-Line Selection:

Mass selection	**Pure-line selection**
Selects several superior plants	Selects a single superior plant
Seeds are generally mixed	Progeny of selected plant is maintained separately
Population remains genetically variable	Produces a relatively homozygous and uniform line
Based mainly on phenotype	Includes evaluation of progeny

Important: Mass selection is primarily based on phenotypic selection without individual progeny testing in its conventional form.

Q99. To prevent pesticide spray drift near a water body, a sprayer operator should mainly do what?

(a) Maintain an adequate buffer distance
(b) Use the finest nozzle available
(c) Increase spray pressure fast
(d) Spray during peak afternoon winds

S99. Ans (a)

Explanation:

Spray drift refers to the movement of pesticide droplets or vapours away from the intended application area during or after spraying.

It can result in contamination of nearby water bodies, non-target crops, wildlife and surrounding environments.

Maintaining an adequate buffer distance is an important measure for reducing pesticide contamination of water bodies.

Importance of Buffer Zones:

- A buffer zone is an untreated area maintained between the pesticide application site and a sensitive location.
- It helps reduce the possibility of pesticide droplets reaching nearby water bodies.
- It protects aquatic organisms from pesticide exposure.
- It reduces contamination of surface water and surrounding vegetation.

- The required buffer distance depends on the pesticide label, formulation, application equipment and environmental conditions.

Other Measures to Reduce Spray Drift:

1. Avoid spraying during strong or gusty winds.
2. Follow the wind-speed restrictions specified on the pesticide label.
3. Avoid spraying during temperature inversion conditions.
4. Use suitable low-drift nozzles where permitted by the label.
5. Maintain the recommended nozzle pressure.
6. Avoid unnecessarily fine droplets.
7. Follow prescribed buffer-zone requirements.
8. Avoid spraying when rainfall or runoff could carry pesticides into nearby water bodies.

Important Information:

Spray drift is influenced by:

- Wind speed and direction.
- Droplet size.
- Spray pressure.
- Nozzle type.
- Application height.
- Temperature and humidity.
- Atmospheric stability.

Important: Maintaining an adequate buffer distance and following label-specific application restrictions are essential for protecting water bodies from pesticide contamination.

Q100. The Market Intervention Scheme (MIS) mainly supports prices for commodities that are:

(a) Perishable crops not under MSP
(b) Dairy and poultry products exclusively
(c) Staple food grains under MSP
(d) Export-oriented plantation crops only

S100. Ans (a)

Explanation:

The Market Intervention Scheme (MIS) is a government intervention mechanism designed to protect farmers from distress sales when market prices of certain agricultural commodities fall sharply.

It primarily covers perishable agricultural commodities that are not covered under the Minimum Support Price (MSP) procurement mechanism.

Major Objectives of MIS:

- Protect farmers from distress sales.
- Provide price support during periods of sharp market decline.
- Stabilise prices of selected perishable agricultural commodities.
- Help farmers obtain remunerative returns.
- Reduce the impact of sudden market fluctuations.

How the Scheme Works:

- A state government or Union Territory identifies a situation in which market prices of a particular eligible commodity have fallen significantly.
- A proposal for market intervention is submitted according to the prescribed guidelines.
- The Central Government considers the proposal and applicable eligibility conditions.
- Procurement or other approved market intervention arrangements are undertaken to support farmers.

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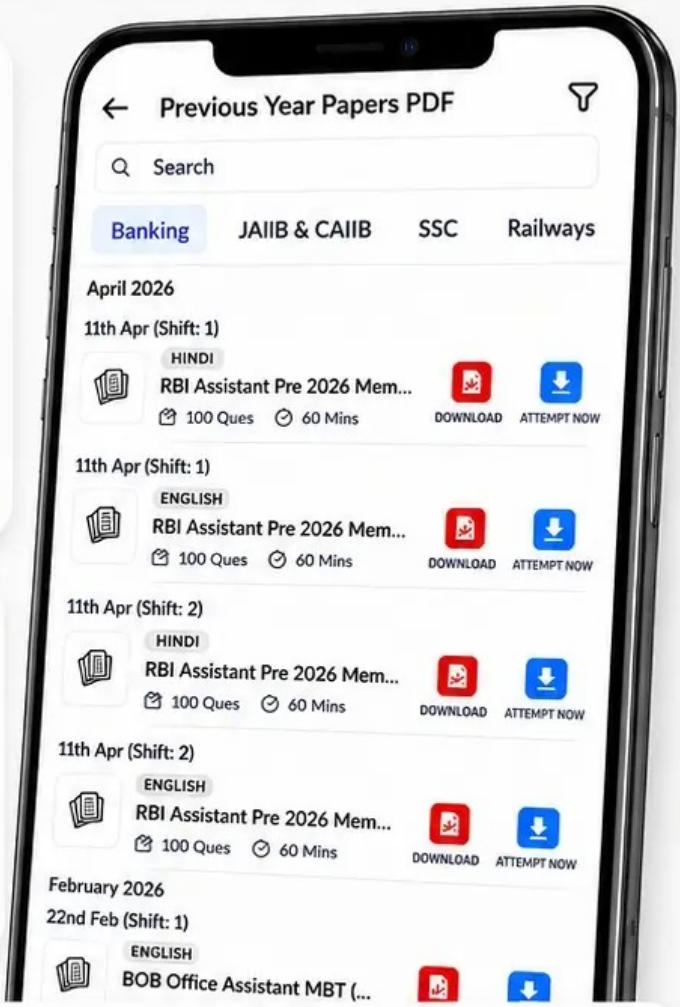
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- The scheme helps prevent farmers from being forced to sell their produce at distressingly low prices.

Examples of Commodities Covered:

The scheme may cover perishable commodities such as:

1. Tomato.
2. Onion.
3. Potato.
4. Other eligible fruits and vegetables.

The actual coverage depends on the applicable scheme guidelines and government approval.

Difference between MIS and MSP:

Market Intervention Scheme (MIS)	Minimum Support Price (MSP)
Primarily covers eligible perishable commodities not covered under MSP	Announced for specified agricultural crops
Intended to address sharp price declines and distress sales	Intended to provide price assurance to farmers
Intervention is generally undertaken when specified conditions are met	MSP is announced for crops before their marketing seasons
Operates through approved market intervention arrangements	Procurement is undertaken through designated agencies, subject to applicable arrangements

Important Information:

- Scheme: Market Intervention Scheme.
- Ministry: Ministry of Agriculture and Farmers Welfare.
- Main purpose: Protect farmers growing eligible perishable commodities from distress sales.

Important: MIS is different from MSP. It primarily provides market-price intervention support for eligible perishable agricultural commodities that are not covered under MSP.