THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

034/1 **AGRICULTURE SCIENCE 1**

(For Both School and Private Candidates)

Time: 3 Hours **ANSWERS** **Year: 2014**

Instructions

1. This paper consists of sections A, B and C with a total of **thirteen (13)** questions.

2. Answer **all** questions in sections A and B and **one (1)** question from section C.

3. Sections A and C carry **fifteen (15)** marks each and section B carries **seventy (70)** marks.

4. Cellular phones and any unauthorised materials are **not** allowed in the examination room.

5. Write your **Examination Number** on every page of your answer booklet(s).

1. For each of the items (i)–(x), choose the correct answer among the given alternatives and write its letter beside the item number.

(i) The factors which are most advisable for the selection of dairy cattle are
A. Physical appearance and breed
B. Physical appearance and age
C. Colour and age
D. Colour and breed
E. Age and breed

Answer: A. Physical appearance and breed
Explanation: Physical appearance indicates health and productivity, while breed determines genetic traits favorable for dairy production.

(ii) If a soil sample has a bulk density of 1.3 g/cm³ and a particle density of 2.65 g/cm³, then its pore space is
A. 31%
B. 41%
C. 51%
D. 61%
E. 71%

Answer: B. 51%
Explanation: Pore space (%) = [(Particle density - Bulk density) / Particle density] × 100
Pore space = [(2.65 - 1.3) / 2.65] × 100 ≈ 51%.

(iii) A free market in agricultural production may arise as a result of
A. Monopoly
B. Pure competition
C. Monopsony
D. Oligopoly
E. Imperfect competition

Answer: B. Pure competition
Explanation: In a free market, numerous buyers and sellers interact without significant barriers, leading to pure competition.

(iv) The characteristic that innovations which are perceived by farmers to be consistent with their farming practices, objectives, and level of technology is known as
A. Complexity
B. Observability
C. Trialability
D. Oligopoly

E. Imperfect competition

Answer: B. Observability
Explanation: Observability refers to how easily farmers can see the results of an innovation in practice, influencing adoption.

(v) The most suitable method of irrigation in a leveled farm with highly permeable soil having a source of plenty of water is
A. Overhead irrigation
B. Furrow irrigation
C. Check irrigation
D. Subsurface irrigation
E. Sprinkler irrigation

Answer: E. Sprinkler irrigation
Explanation: Sprinkler irrigation evenly distributes water over highly permeable soils, reducing water loss and ensuring efficient use.

(vi) The plant which is an alternate host for cotton strainers is
A. Groundnut
B. Kapok
C. Sisal
D. Citrus
E. Tomato

Answer: B. Kapok
Explanation: Kapok plants serve as alternate hosts for cotton strainers, harboring pests that attack cotton crops.

(vii) Which of the following is not the function of the harrow?
A. Leveling the seed-bed
B. Breaking the hard soil pans
C. Breaking the soil
D. Stir the soil
E. Destroy weeds

Answer: B. Breaking the hard soil pans
Explanation: Breaking hard soil pans is the function of subsoilers, not harrows, which primarily level and prepare seedbeds.

(viii) The purpose of using smoke at a bee-hive is to
A. Catch bees
B. Kill bees

C. Chase bees
D. Make bees docile
E. Frighten bees

Answer: D. Make bees docile
Explanation: Smoke calms bees by masking their alarm pheromones, making them less aggressive during hive inspection.

(ix) The type of erosion whereby small channels are observed on the soil surface after it has rained is called
A. Sheet erosion
B. Splash erosion
C. Gully erosion
D. Surface erosion
E. Rill erosion

Answer: E. Rill erosion
Explanation: Rill erosion forms small channels on the soil surface caused by water runoff after heavy rain.

(x) Given similar environmental conditions, which of the following poultry breeds can generally lay more eggs than the other breeds?
A. Rhode Island Red
B. Light Sussex
C. New Hampshire
D. White Leghorn
E. Black Australorp

Answer: D. White Leghorn
Explanation: White Leghorns are renowned for their high egg production under optimal conditions.

2. Match the items in List A with the responses in List B by writing the letter of the correct response beside the item number in your answer booklet.

List A
(i) Serves as guide for the pistons as they move up and down.
(ii) Changes reciprocating action of the pistons to rotating motion.
(iii) Provides the place to mount the clutch.
(iv) Provides eccentric action for opening the valves.
(v) Forms combustion chamber in the engine.
(vi) Provides the engine with the proper air-fuel ratio to meet demands of engine load and speed.
(vii) Transmits power to crankshaft.
(viii) Exposes heated water to airflow for cooling.
(ix) Confines the lubricating oil near the engine's moving parts.
(x) Open and close the ports in the combustion chamber.

List B
A. Cylinder head
B. Flywheel
C. Crankcase
D. Radiator
E. Crankshaft
F. Camshaft
G. Piston
H. Connecting rod
I. Carburetor
J. Clutch plate
K. Bearing
L. Valve
M. Cylinder
N. Engine block
O. Piston ring

Answers
(i) M
(ii) E
(iii) C
(iv) F
(v) A
(vi) I
(vii) H
(viii) D
(ix) C
(x) O

3. The following symptoms were observed in the school dairy farm:
- One milking cow had a fever of up to 42°C.
- All lymph glands were swollen, especially along the dewlap.
- The animal was weak, kept lying down, could not rise, and eventually died.

(a) (i) Identify the disease which caused the death of the cow.

Answer: East Coast Fever (ECF)

(ii) Name the causative agent and the vector for the disease in (a) (i) above.

Answer:
Causative agent: Theileria parva

Vector: Brown ear tick (Rhipicephalus appendiculatus)

(b) (i) Briefly describe the life cycle of the vector in (a) (ii) above.

Answer:
The life cycle of the brown ear tick consists of four stages:
- Egg: The female tick lays eggs in the environment, usually in grass or soil.
- Larva: The eggs hatch into larvae, which climb vegetation and attach to a host to feed on blood.
- Nymph: After feeding, the larvae drop off the host, molt into nymphs, and repeat the feeding process.
- Adult: The nymphs molt into adults, which attach to a host, mate, and feed. The female lays eggs to complete the cycle.

(ii) Suggest three methods which can be used to control the vector.

Answer:
- Tick control: Use of acaricides through spraying or dipping to kill ticks on livestock.
- Rotational grazing: Prevents tick infestation by separating livestock from tick-infested areas.
- Tick-resistant breeds: Breeding and rearing livestock breeds with natural resistance to ticks.

4. (a) Define

(i) Variable inputs

Variable inputs are resources used in production whose quantities can be changed in the short run depending on the level of production, such as seeds, fertilizers, and labor.

(ii) Fixed inputs

Fixed inputs are resources whose quantities remain constant regardless of the level of production, such as land, machinery, and buildings.

(b) Briefly explain any four characteristics of variable inputs.

Answer:
i. Flexibility: Their quantities can be adjusted based on production needs. For example, the amount of fertilizer can be increased or decreased depending on crop requirements.
ii. Short-term usage: They are consumed during one production cycle and need replenishment for subsequent cycles. For example, seeds and feed for livestock.
iii. Direct impact on output: Changes in their quantities directly affect the level of production. For instance, increasing the labor force can increase harvested output.
iv. Cost variability: Costs associated with variable inputs fluctuate with production levels. For example, higher production requires more inputs, leading to increased costs.

5. (a) Name and briefly explain the agricultural practices in vegetable production shown by letter X and Y.

X: Staking – Supporting tomato plants with stakes or trellises to keep fruits off the ground, reduce pest attacks, and promote healthy growth.
Y: Mulching – Covering the soil surface with organic or synthetic materials to retain moisture, suppress weeds, and regulate soil temperature.

(b) Give any four advantages and any three disadvantages of the practice shown by letter Y.

Advantages:
i. Retains soil moisture, reducing the need for frequent irrigation.
ii. Suppresses weed growth, minimizing competition for nutrients.
iii. Regulates soil temperature, creating a conducive environment for plant roots.
iv. Reduces soil erosion by protecting the surface from raindrop impact.

Disadvantages:
i. High initial cost for materials such as plastic mulch.
ii. May harbor pests and diseases if not properly managed.
iii. Organic mulch can decompose quickly, requiring frequent replacement.

6. (a) Elaborate four conditions which must exist in order to undertake a successful oxenization.

i. Availability of suitable oxen breeds – Select strong and healthy breeds like Zebu.
ii. Proper training of oxen – Train the animals to respond to commands and work efficiently.
iii. Access to appropriate implements – Use suitable equipment such as ploughs and carts.
iv. Adequate feeding and health care – Ensure oxen are well-fed and vaccinated to maintain their strength and productivity.

(b) Before an oxen is selected for training, several desirable characteristics are looked upon. Point out four of these characteristics.

i. Good health – Free from diseases and physical deformities.
ii. Temperament – Calm and responsive to training commands.
iii. Strength – Physically strong to handle heavy workloads.
iv. Age – Young but mature enough to withstand training and work.

7. (a) What is meant by adoption of an innovation?

Adoption of an innovation refers to the process by which farmers or individuals accept and implement new practices, technologies, or ideas in their farming systems.

(b) Account for five stages in the process of adoption of an innovation.

i. Awareness – Farmers learn about the existence of the innovation through extension services or media.
ii. Interest – Farmers seek more information to understand the innovation's benefits and applications.
iii. Evaluation – Farmers assess the innovation's suitability for their specific conditions.
iv. Trial – Farmers test the innovation on a small scale to observe its performance.
v. Adoption – Farmers fully integrate the innovation into their farming practices.

8. (a) Examine ten ways in which forests are beneficial to our daily life.

i. Provide timber and wood for construction and furniture.
ii. Serve as a source of fuelwood and charcoal for energy.
iii. Supply non-timber products such as honey, fruits, and medicinal plants.
iv. Regulate the climate by storing carbon and producing oxygen.
v. Conserve biodiversity by serving as habitats for various species.
vi. Prevent soil erosion by stabilizing the soil with tree roots.
vii. Improve water cycles by enhancing groundwater recharge.
viii. Offer recreational spaces for tourism and relaxation.
ix. Protect agricultural lands from strong winds by acting as windbreaks.
x. Generate employment in forestry-related industries.

(b) (i) What is the difference between cropping and harvesting of fish?

Cropping refers to the partial removal of fish from a pond to regulate population density and growth.
Harvesting involves the complete removal of all fish from a pond or water body for consumption or sale.

(ii) Give three advantages of using seine nets over the hook and line in fishing.

i. Seine nets cover a larger area, allowing for higher fish catches.
ii. Less time-consuming compared to using hooks and lines.
iii. Reduces the need for skilled labor as the technique is straightforward.

9. The following figure represents the Nitrogen Cycle. Study it carefully and answer the questions that follow.

(a) (i) Name the compounds A and B.

A: Ammonium (NH_4^+)
B: Nitrate (NO_3^-)

(ii) Briefly explain the processes taking place at C and D.

C: Nitrification – Conversion of ammonium to nitrate by nitrifying bacteria (Nitrosomonas and Nitrobacter).
D: Denitrification – Conversion of nitrate back to nitrogen gas (N_2) by denitrifying bacteria, releasing it into the atmosphere.

(b) (i) Name the species of bacteria involved in E and F and briefly explain their roles.

E: Rhizobium – Fixes atmospheric nitrogen into ammonia in legume root nodules.
F: Azotobacter – Fixes atmospheric nitrogen into ammonia in free-living conditions.

(ii) Account for what happens in G and H.

G: Atmospheric nitrogen (N_2) is fixed into ammonia by nitrogen-fixing bacteria or industrial processes.
H: Ammonia is assimilated into plant proteins and enters the food chain through crop consumption.

10. (a) What is digestibility of animal feeds?

Digestibility refers to the proportion of nutrients in animal feed that can be broken down and absorbed by the digestive system for use in the body.

(b) Assess seven factors which affect the digestibility of animal feeds.

i. Feed composition – Feeds high in fiber are less digestible than those rich in protein and carbohydrates.
ii. Processing – Chopping, grinding, or pelleting increases digestibility by making feeds easier to consume.
iii. Animal species – Ruminants digest fibrous feeds better than non-ruminants.
iv. Age of the animal – Younger animals have less developed digestive systems, reducing digestibility.
v. Feed additives – Enzymes and probiotics improve feed breakdown and nutrient absorption.
vi. Water content – Excess water dilutes nutrients, reducing overall digestibility.
vii. Feeding frequency – Regular feeding optimizes digestion by maintaining consistent gut activity.

11. Integrated Pest Management is the most effective and efficient way of controlling crop pests.

Integrated Pest Management (IPM) is a sustainable approach to managing pests by combining multiple methods to minimize economic, health, and environmental risks. IPM focuses on reducing pest populations to acceptable levels rather than complete eradication.

Key principles of IPM:

i. Monitoring – Regular observation of pest populations and crop conditions to identify potential problems early.
ii. Prevention – Employing cultural practices like crop rotation, intercropping, and using resistant varieties to minimize pest risks.
iii. Biological control – Using natural predators, parasites, and pathogens to control pest populations. For example, ladybirds to control aphids.
iv. Mechanical control – Employing physical methods like traps and barriers to prevent pest damage.
v. Chemical control – Applying pesticides only when necessary and selecting those with minimal environmental impact.

vi. Decision thresholds – Taking action only when pest populations exceed economic injury levels.

Advantages of IPM:
i. Reduces pesticide use, lowering costs and environmental pollution.
ii. Promotes biodiversity by preserving beneficial organisms.
iii. Prevents pest resistance by combining multiple control methods.
iv. Ensures safer food production and reduced health risks to farmers and consumers.

Conclusion: IPM is effective and efficient because it offers a balanced approach that protects crops, minimizes costs, and ensures long-term agricultural sustainability.

12. Explain on bloat as one of the nutritional disorders in animals using the following guidelines:

(a) Meaning
Bloat is a nutritional disorder in ruminant animals characterized by excessive accumulation of gas in the rumen, causing distension and discomfort.

(b) Animals affected
Ruminants such as cattle, sheep, and goats are commonly affected by bloat.

(c) Cause
Bloat occurs due to the rapid fermentation of feed in the rumen, producing excessive gas. Causes include:
i. Consumption of lush, leguminous pastures like clover or alfalfa.
ii. Eating high-grain diets without sufficient roughage.
iii. Obstruction of the esophagus, preventing gas release.

(d) Symptoms
i. Swollen abdomen, especially on the left side.
ii. Discomfort, restlessness, and kicking at the belly.
iii. Difficulty breathing due to pressure on the lungs.
iv. Reduced appetite and inability to lie down.

(e) Control and treatment
Control:
i. Avoid sudden dietary changes and provide adequate roughage.
ii. Limit access to lush pastures and feed bloat-preventive supplements.
iii. Monitor animals for early signs of bloat.

Treatment:
i. Encourage movement to stimulate rumen activity and gas release.
ii. Administer anti-bloating agents like mineral oil or poloxalene.
iii. Use a stomach tube or trocar to release gas in severe cases.

13. Argue for the statement that 'the effects of microbial activities in the soil are both beneficial and harmful'.

Microbial activities in the soil play a crucial role in maintaining soil health and fertility, but they can also have negative effects under certain conditions.

Beneficial effects:
i. Nutrient cycling – Microbes decompose organic matter, releasing essential nutrients like nitrogen, phosphorus, and sulfur for plant growth. For example, nitrogen-fixing bacteria like Rhizobium enrich the soil.
ii. Soil structure improvement – Fungi and bacteria produce polysaccharides that bind soil particles, enhancing water retention and aeration.
iii. Biocontrol agents – Some microbes suppress soil-borne diseases by outcompeting or directly attacking pathogens. For instance, Trichoderma controls fungal infections.
iv. Detoxification – Microbes break down toxic compounds, such as pesticides, into less harmful substances.
v. Symbiotic relationships – Mycorrhizal fungi enhance plant nutrient uptake by extending root systems.

Harmful effects:
i. Pathogenic microbes – Certain bacteria, fungi, and nematodes cause diseases like root rot, wilt, and damping-off, leading to crop losses.
ii. Nutrient immobilization – Some microbes temporarily lock up nutrients in their biomass, making them unavailable to plants.
iii. Production of toxins – Microbial metabolites like aflatoxins can contaminate soil and crops, posing health risks.
iv. Nitrification and denitrification – These processes by soil microbes can lead to nitrogen losses through leaching and gas emissions, reducing soil fertility.
v. Competition – Excessive microbial activity can deplete soil organic matter, creating competition for nutrients.

Conclusion: While microbial activities in the soil are vital for nutrient cycling and ecosystem balance, their harmful effects highlight the need for proper soil management practices to maximize benefits and minimize risks.