

G12 ECZ AGRICULTURAL SCIENCE 2016 GCE PAPER 1 SOLUTIONS

Grade 12 ECZ Agricultural Science 2016 GCE Paper 1 (5037/1) — Theory

2 hours | Section A (Q1–5, answer all) + Section B (Q6–10, answer any three)

The full question paper appears first — worked answers follow.

Candidate Name: _____

Centre Number		Candidate Number									

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for General Certificate of Education Ordinary Level

Agricultural Science

5037/1

Paper 1 Theory

Tuesday

19 JULY 2016

Additional materials:

Answer Booklet

Time: 2 hours

Instructions to candidates

Write your name, centre number and candidate number in the spaces at the top of this page and on the Answer Booklet.

There are **Ten** questions in this paper.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **three** questions.

Write your answers in the Answer Booklet provided.

At the end of the examination:

- 1** fasten the Answer Booklet securely to the question paper.
- 2** enter the numbers of the Section B questions you have answered in the grid for Examiner's use.

Information for candidates

The number of marks is given in brackets [] at the end of each question or part question.

You are advised to spend no longer than 40 minutes on Section A.

Cell phones are not allowed in the examination room.

FOR EXAMINER'S USE	
Section A	
Section B	
Total	

Section A

Answer all questions in this section

- 1 **Figure 1** shows the maize and groundnut root systems.

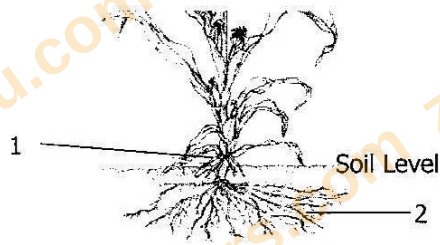


Figure 1A

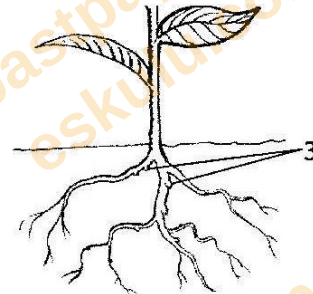


Figure 1B

- (a) Identify the type of the root system in:

(i) **Figure 1A**

(ii) **Figure 1B** [2]

- (b) Name the structures labelled 1 to 3.

1

2

3 [3]

- (c) What is the importance of the structures labelled 3 in soil fertility?

.....

.....

..... [3]

[Total: 8]

- 2 Study the diagram in **Figure 2** and answer the following questions.

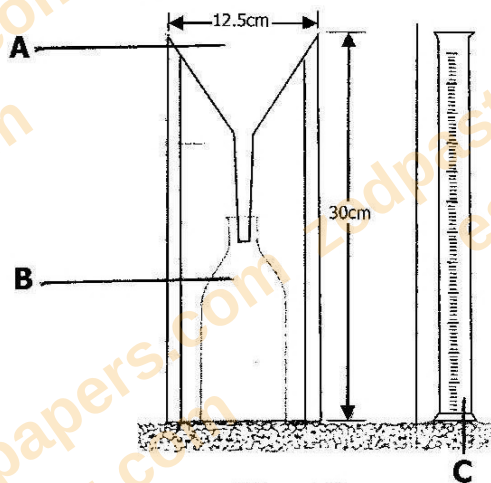


Figure 2

- (a) Identify the instrument in **Figure 2** above.

..... [1]

- (b) Mention the functions of the parts labelled **A**, **B** and **C**.

A

B

C [3]

- (c) State the effect of the amount of water received in an area on pasture.

.....

.....

..... [4]

[Total: 8]

- 3 **Figure 3** shows the result of an experiment carried out by a pupil on a sample of soil.

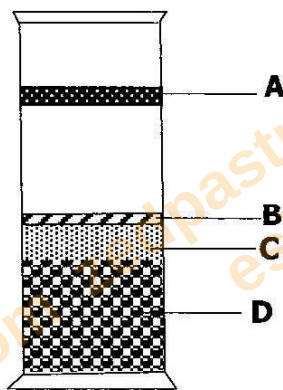


Figure 3

- (a) Name the soil particles labelled **B**, **C** and **D**.

B

C

D [3]

- (b) Why is substance **A** important in soil?

.....

.....

.....

.....

..... [5]

[Total: 8]

4 **Figure 4** shows a traditional maize storage structure.

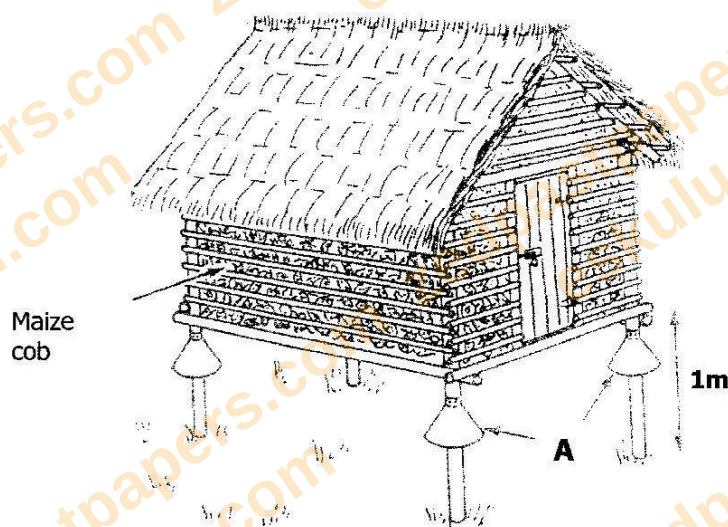


Figure 4

(a) Identify the maize storage structure represented by **Figure 4** above.

..... [1]

(b) (i) Name the part of the maize storage labelled **A**.

..... [1]

(ii) State the function of the part labelled **A**.

..... [1]

(c) List local available materials used to construct the farm structure represented in **Figure 4** above.

(i)

(ii) [3]

(d) Describe a structure suitable for storing a crop.

..... [2]

[Total: 8]

5 **Figure 5** shows an animal drawn cultivator.

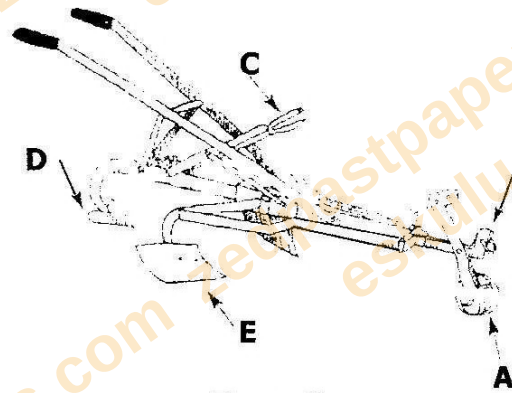


Figure 5

(a) Label the parts **A** to **E**.

A

B

C

D

E [5]

(b) How can you prepare the farm implement in **Figure 5** for storage?

(i)

.....

(ii)

.....

(iii)

.....

.....

..... [3]

[Total: 8]

Section B**Answer any three questions from this section.****6 (a)** State the advantages of crop rotation. [4]**(b)** Distinguish clearly between:**(i)** mixed cropping, and**(ii)** mixed farming. [6]**(c)** Explain how intercrops maintain the soil fertility and reduce soil erosion. [10]**[Total: 20]****7 For Maize:****(a)** State the usual time of the year when the seed is sown and the reason for this. [2]**(b)** Describe the desirable conditions of the soil prior to seed sowing and explain how this is achieved. [10]**(c)** Describe how you would decide when the crop is ready for harvest. [2]**(d)** Explain how the crop is stored and the conditions necessary for proper storage. [6]**[Total: 20]****8 (a)** State the functions of the following in a bird;**(i)** crop, [2]**(ii)** proventriculus; [2]**(b)** Explain how the gizzard carries out its functions. [8]**(c)** Outline how you would feed day-old broiler chicks until they are eight weeks. [8]**[Total: 20]****9 (a) (i)** Explain how the water cooling system of a four stroke internal combustion engine works. [7]**(ii)** Why should an engine have a cooling system? [5]**(b) (i)** What is meant by centre of gravity? [2]**(ii)** Why is it important for a tractor to have a low centre of gravity? [6]**[Total: 20]****10 (a)** State the factors of production. [4]**(b)** Explain the advantages of keeping farm records. [10]**(c)** Outline the decisions a farmer makes in crop production on the farm. [6]**[Total: 20]**



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Question 1. Figure 1 shows the maize root system (1A) and the groundnut root system (1B), with structures 1, 2 and 3.

Answer: (a) Root system: (i) Figure 1A (maize) = FIBROUS root system; (ii) Figure 1B (groundnut) = TAP root system.

Answer: (b) Structures: 1 = PROP (adventitious) ROOTS — roots growing from the stem base above the soil; 2 = FIBROUS ROOTS; 3 = ROOT NODULES (on the groundnut roots).

(c) Importance of the structures labelled 3 (root nodules) in soil fertility:

Answer: The nodules contain nitrogen-fixing bacteria (Rhizobium) that fix atmospheric nitrogen into nitrogen compounds the plant can use. This adds nitrogen to the soil (especially when the legume residues decompose), enriching it and benefiting later crops.

Question 2. Figure 2 is an instrument (with a 0.5 cm opening and a 30 cm body) set into the ground, with parts A, B and C.

Answer: (a) Instrument: a RAIN GAUGE (measures rainfall).

(b) Functions of the parts:

Answer: A = FUNNEL — catches the rain and directs it into the bottle while reducing evaporation.

Answer: B = COLLECTING BOTTLE (jar) — collects and holds the rainwater for measuring.

Answer: C = OUTER CYLINDER/CAN — the container sunk in the ground that holds and protects the funnel and bottle.

(c) Effect of the amount of water (rainfall) received in an area on pasture:

Answer: Adequate rainfall gives lush, abundant pasture for grazing; too little rainfall gives sparse, poor pasture that withers (drought); too much causes water-logging and leaching, also giving poor pasture. So the amount of rainfall determines the quantity and quality of pasture available.

Question 3. Figure 3 shows the result of a soil experiment (shaking soil with water and letting it settle), with layers A, B, C and D.

Answer: (a) Soil particles: B = CLAY (finest); C = SILT; D = SAND (coarsest, settles first at the bottom). [A is the floating organic matter.]

(b) Why substance A (organic matter / humus) is important in soil:

Answer: It improves soil structure and binds particles (reducing erosion); increases water-holding capacity; releases plant nutrients as it decomposes; feeds soil micro-organisms; improves aeration and drainage; helps buffer soil pH; and its dark colour helps warm the soil.

Question 4. Figure 4 shows a traditional maize storage structure raised about 1 m on legs, with part A on the legs.

Answer: (a) Storage structure: a (maize) CRIB / GRANARY (traditional raised crib, nkhoekwe).

Answer: (b)(i) Part A: the RAT (rodent) GUARD on the supporting legs.

Answer: (b)(ii) Function of A: it stops rats and other rodents from climbing up the legs into the crib to eat or spoil the maize.

(c) Local materials used to construct the structure:

Answer: (i) Wooden poles/timber for the legs and frame; (ii) thatch grass for the roof (and reeds/sticks/bark fibre for the walls and ties).

Answer: (d) A structure suitable for storing a crop: a raised, well-ventilated crib/granary with rat guards on the legs and a waterproof (thatch or iron-sheet) roof, keeping the crop dry and safe from moisture and pests.

Question 5. Figure 5 shows an animal-drawn cultivator, with parts A to E (two handles at the top for guiding).

(a) Labels A to E:

Answer: A = CLEVIS / HITCH (the point of attachment to the animals' draught chain).

Answer: B = DEPTH (gauge) WHEEL — regulates and maintains the depth of cultivation.

Answer: C = REGULATING LEVER — adjusts the spacing/spread (working width) of the tines.

Answer: D = LAND WHEEL — supports the implement and helps it move smoothly.

Answer: E = SHOVEL / TINE (cultivator share) — loosens the soil and uproots weeds between the rows.

(b) How to prepare the implement for storage:

Answer: (i) Clean off all soil and plant trash.

Answer: (ii) Oil or grease the metal parts (and sharpen or replace worn tines) to prevent rust.

Answer: (iii) Tighten loose bolts and store it under a shelter, resting on blocks.

Question 6. [SECTION B] (a) State the advantages of crop rotation. (b) Distinguish clearly between (i) mixed cropping and (ii) mixed farming. (c) Explain how intercrops maintain soil fertility and reduce soil erosion.

(a) ADVANTAGES OF CROP ROTATION:

Answer: Maintains soil fertility (legumes fix nitrogen for following crops); controls pests and diseases by breaking their life cycles; helps control weeds; improves soil structure; and makes varied use of nutrients from different soil depths, spreading labour and risk.

Answer: (b)(i) MIXED CROPPING: growing two or more crops together on the same piece of land at the same time.

Answer: (b)(ii) MIXED FARMING: keeping livestock AND growing crops together on the same farm.

(c) HOW INTERCROPS MAINTAIN FERTILITY AND REDUCE EROSION:

Answer: A legume intercrop fixes nitrogen and enriches the soil; the dense ground cover shields the soil from raindrop impact and slows run-off, cutting erosion; different rooting depths use nutrients and water efficiently; crop residues add organic matter; and the canopy suppresses weeds and reduces evaporation.

Question 7. [For Maize] (a) State the usual time of year the seed is sown and the reason. (b) Describe the desirable conditions of the soil prior to seed sowing and how this is achieved. (c) Describe how you decide when the crop is ready for harvest. (d) Explain how the crop is stored and the conditions for proper storage.

Answer: (a) Maize is sown at the **ONSET** of the rainy season (around November/December) so that the crop has enough moisture for germination and steady growth.

(b) **DESIRABLE SOIL CONDITIONS AND HOW THEY ARE ACHIEVED:**

Answer: The soil should be a deep, well-drained, fertile loam, moist, warm, weed-free and worked to a fine tilth at about pH 6. This is achieved by ploughing and harrowing to a fine seedbed, applying manure/fertilizer, removing weeds and timing land preparation so the soil is moist at planting.

Answer: (c) The crop is ready for harvest when the cobs and grain are **MATURE** and **DRY** — the leaves and husks turn brown/yellow, the grain is hard with a black layer at its base, and the cobs droop downwards.

(d) **STORAGE AND CONDITIONS FOR PROPER STORAGE:**

Answer: Shell the maize and dry the grain to a safe moisture content (about 12–13%); store it in clean, dry, well-ventilated structures (cribs, silos or treated bags) raised off the ground, in cool dry conditions, and protect it from insect pests and rodents (e.g., with an approved insecticide).

Question 8. (a) State the functions of: (i) crop, (ii) proventriculus, in a bird. (b) Explain how the gizzard carries out its functions. (c) State how you would feed day-old broiler chicks until they are eight weeks.

Answer: (a)(i) **CROP:** it temporarily stores and softens/moistens the food before it passes on for digestion.

Answer: (a)(ii) **PROVENTRICULUS:** the true (glandular) stomach — it secretes digestive juices (acid and enzymes) that begin the digestion of food, especially protein.

(b) **HOW THE GIZZARD CARRIES OUT ITS FUNCTIONS:**

Answer: The gizzard is thick and muscular and holds grit/small stones the bird has swallowed. Because birds have no teeth, its strong muscular walls contract and rub the food against the grit, grinding and crushing it into a fine paste (mechanical digestion). This greatly increases the surface area for enzymes to act on further down the gut.

(c) **FEEDING DAY-OLD BROILER CHICKS TO EIGHT WEEKS:**

Answer: Give broiler **STARTER** mash (high in protein) for the first weeks, then change gradually to **FINISHER** mash; provide clean water at all times; feed ad libitum (free choice) with enough feeders and drinkers; and keep the chicks warm so they feed well, supplying grit where needed.

Question 9. (a)(i) Explain how the water cooling system of a four-stroke internal combustion engine works; (ii) why should an engine have a cooling system? (b)(i) What is meant by centre of gravity? (ii) Why is it important for a tractor to have a low centre of gravity?

(a)(i) HOW THE WATER COOLING SYSTEM WORKS:

Answer: Water circulates through water jackets around the hot cylinders and absorbs heat. A water pump drives the circulation; the hot water flows to the radiator where a fan blows air through it to cool it; a thermostat controls the temperature; and the cooled water returns to the engine, repeating the cycle.

Answer: (a)(ii) WHY AN ENGINE NEEDS A COOLING SYSTEM: to remove the excess heat of combustion, prevent overheating and seizure, keep the engine at its best working temperature, protect the parts from warping/damage, and so ensure efficiency and a long life.

Answer: (b)(i) CENTRE OF GRAVITY: the point in a body at which its whole weight appears to act (where it is balanced).

(b)(ii) IMPORTANCE OF A LOW CENTRE OF GRAVITY FOR A TRACTOR:

Answer: A low centre of gravity gives the tractor **STABILITY** — it is less likely to overturn or topple, especially on slopes, uneven ground, when turning sharply, or when pulling/carrying loads — making it safer and better balanced to operate.

Question 10. (a) State the factors of production. (b) Explain the advantages of keeping farm records. (c) Outline the decisions a farmer makes in crop production on the farm.

Answer: (a) FACTORS OF PRODUCTION: Land, Labour, Capital, and Management (entrepreneurship).

(b) ADVANTAGES OF KEEPING FARM RECORDS:

Answer: They show income and expenditure (whether the farm makes a profit or loss); aid planning, budgeting and decision-making; help in obtaining loans/credit; allow the performance of different enterprises to be monitored and compared; help detect theft or losses; serve tax and legal purposes; and (breeding/health records) improve livestock management.

(c) DECISIONS A FARMER MAKES IN CROP PRODUCTION:

Answer: Which crop to grow and on how large an area; when to plant; which inputs (seed varieties, fertilizers) to use and in what quantity; how to control weeds, pests and diseases; when to harvest; how and where to market the produce; and how to finance the enterprise.

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