

G12 ECZ AGRICULTURAL SCIENCE 2017 PAPER 1 SOLUTIONS

Grade 12 ECZ Agricultural Science 2017 Paper 1 (5037/1) — Theory

Tuesday 21 November 2017 | 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 School Certificate Ordinary Level

Agricultural Science

5037/1

Paper 1 Theory

Tuesday

21 NOVEMBER 2017

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	

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Section A

Answer all questions in this section

- 1 **Figure 1** shows water holding capacity in different types of soils.

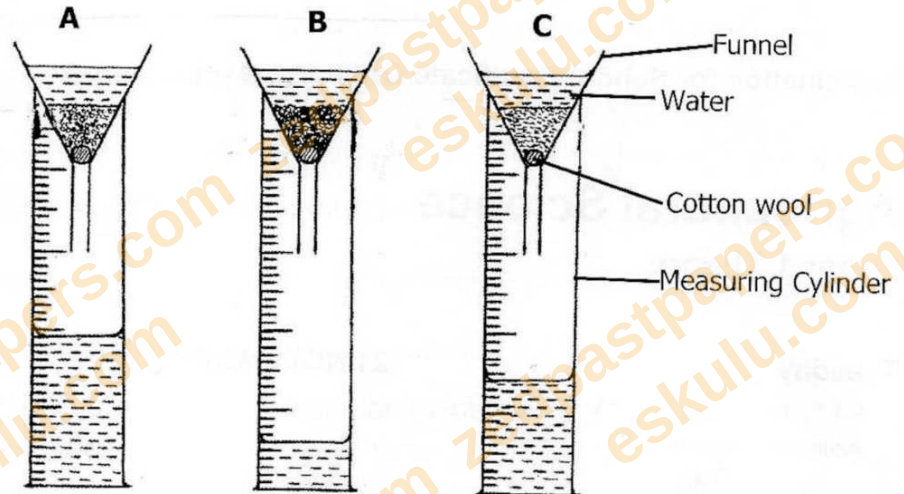


Figure 1

- (a) Name the samples of soil used in funnels **A** and **B**.

A.....

B..... [2]

- (b) (i) From the above experiment identify **two** characteristics that the different soil types have.

1

.....

2

..... [2]

- (ii) Why would you advise farmers to have a soil that has a loose friable structure?

.....

.....

..... [2]

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(c) Explain why farmers are encouraged to use conservation farming.

.....

.....

[1]

(d) How is agricultural lime made beneficial to crops on a farm?

.....

.....

[1]

[8 marks]

2 Figure 2 shows the water cycle.

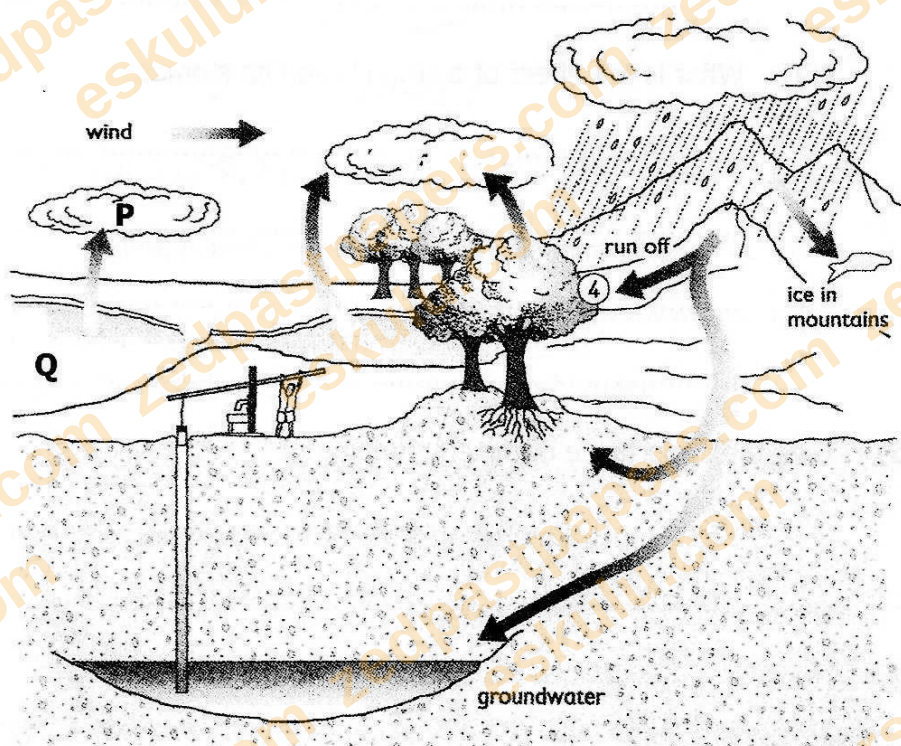


Figure 2

(a) Name the soil component this diagram represents as a source.

..... [1]

(b) Identify the processes at P and Q.

P www.zedpastpapers.com

Q [2]

- (c) (i) Explain the importance of the duration of rainfall to the farmer.

.....

.....

..... [1]

- (ii) Why is it advisable for farmers to grow crops in higher attitudes than in lower altitudes?

.....

.....

..... [1]

- (iii) What is the effect of a crop closing its stomata?

.....

.....

.....

..... [2]

- (d) Give the importance of mixed cropping.

.....

..... [1]

[8 marks]

3 **Figure 3** shows the artificial insemination in a cow.

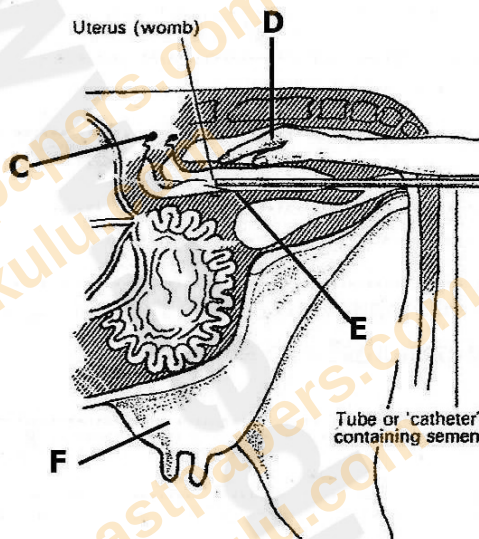


Figure 3

(a) Using letters in **figure 3**, identify:

(i) where semen is released during insemination.

..... [1]

(ii) the structure that releases an egg (ovum).

..... [1]

(b) State the function of structure **F** in **figure 3**.

..... [1]

(c) (i) Why are dairy farmers advised to use correct mating systems on their farms?

..... [1]

(ii) What does the term parturition mean?

..... www.zedpastpapers.com [1]

- (d) (i)** Explain why structure **F** in **figure 3** of a dairy cow should be washed with warm water before milking.

.....

.....

.....

.....

[2]

- (ii)** Why do dairy farmers rest pastures?

.....

.....

.....

[1]

[8 marks]

- 4 (a)** What does the term gross margin mean?

.....

.....

.....

[1]

- (b) (i)** How is the income (profit) of an enterprise calculated?

.....

.....

.....

.....

[2]

- (ii)** Why is capital important on a farm?

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21

(c) Describe depreciation.

.....

.....

.....

..... [2]

(d) Explain how farm records can help to show where improvements could be made on a farm.

.....

.....

.....

..... [1]

[8 marks]

5 Figure 4 shows the four stroke cycle.

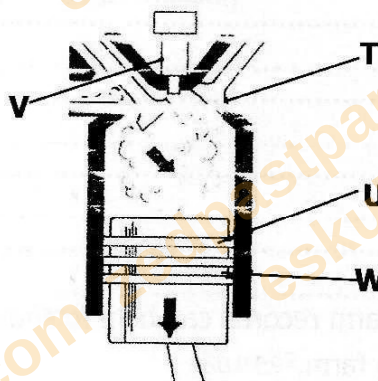


Figure 4

(a) Name the parts labelled T and U.

T

U [2]

(b) State the function of parts labelled V and W.

V

.....

W

..... [2]

(c) How would a farmer maintain the air cleaner of a tractor?

.....

.....

..... [3]

(d) Why are pulleys used on farms?

.....

..... www.zedpastpapers.com [1]

[8 marks]

Section B

Answer any three questions from this section.

6 (a) List the components of soil. [6]

(b) Explain how inorganic soil particles are formed from rocks by the following physical weathering agents:

(i) Temperature,

(ii) Wind action. [11]

(c) Describe how planting appropriate trees improve soil fertility and reduce soil erosion. [3]

[Total: 20]

7 (a) State the importance of agriculture. [6]

(b) State the problems facing cattle farmers in Zambia. [9]

(c) Give the advantages of rearing local breeds of cattle. [5]

[Total: 20]

8 (a) (i) List the first **three** components of a ruminant stomach. [3]

(ii) Compare digestion in a gizzard and in a rumen of a cow. [6]

(b) (i) Why is continuous close grazing discouraged in a pasture? [5]

(ii) How can you control ticks on a farm? [5]

(c) Why is a farmer who keeps cattle advised to ensure that feed for the livestock does not contain objects like nails and glass. [1]

[Total: 20]

9 (a) List **three** factors of production on a farm. [3]

(b) Define demand. [2]

(c) Describe overhead (fixed) costs and give **one** example of a fixed cost on a farm. [4]

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- (d) A farmer made the following transactions for a maize enterprise. Purchased 4 bags of compound D of mass 50 kg at K260.00 each, 4 bags of urea of mass 50 kg at K250.00 each.

Paid K400.00 and K200.00 for ploughing and weeding respectively for the field to be done. The farmer paid K100.00 and K150.00 for harvesting and shelling respectively. The farmer harvested 200 bags of mass 50 kg each and paid K100.00 for transportation of the maize to the nearest Food Reserve Agency depot. The farmer was paid K100.00 for each 50kg bag of maize sold.

- (i) Calculate how much the farmer spent on basal dressing fertilizer, top dressing fertilizer and transport. [3]

- (ii) What was the farmer's total expenditure, income and profit? [3]

- (e) (i) Outline the law of diminishing returns. [2]

- (ii) Explain factors to consider when determining how much produce or product to produce from an enterprise. [3]

[Total: 20]

- 10 (a) (i) Mention the disadvantages of using a disc plough to prepare a seedbed. [5]

- (ii) Explain how rusting could be prevented on a disc plough. [3]

- (b) (i) Illustrate the inlet stroke of a spark ignition four-stroke cycle (petrol engine). [5]

- (ii) What are the uses of an engine on a farm? [3]

- (c) (i) What is the velocity ratio of a machine? [2]

- (ii) Why is the block and tackle pulley system not a perfect machine? [2]

[Total: 20]



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Question 1. Figure 1 shows an experiment on the water-holding capacity of different soils, with equal samples in funnels A, B and C draining through cotton wool into measuring cylinders.

Answer: (a) Soil samples: A = SANDY soil (it drains fastest, so it collects the most water); B = LOAM soil (moderate). [C = clay, which holds the most water and drains least.]

(b)(i) Two characteristics that the different soil types have:

Answer: 1. They have different water-holding capacities (clay holds most, sand least).

Answer: 2. They have different rates of drainage/permeability (sand drains fastest, clay slowest).

(b)(ii) Why advise farmers to have a soil with a loose, friable structure:

Answer: It allows good drainage and aeration, lets roots penetrate easily, is easy to cultivate, takes in water readily and warms up quickly — giving good germination and crop growth.

Answer: (c) Why farmers are encouraged to use conservation farming: it conserves soil and moisture, reduces erosion and maintains soil fertility, giving better and more reliable yields.

Answer: (d) How agricultural lime benefits crops: it raises (corrects) the soil pH, reducing acidity so that nutrients become more available to the crops (and it supplies calcium).

Question 2. Figure 2 shows the water cycle, with processes labelled P and Q.

Answer: (a) Soil component the diagram represents as a source: WATER (soil water).

Answer: (b) Processes: P = CONDENSATION (water vapour cooling to form clouds); Q = INFILTRATION (water soaking down into the soil/ground).

Answer: (c)(i) Importance of the duration of rainfall to the farmer: a longer duration lets more water soak into the soil (less run-off) for crops and helps the farmer plan the growing season and the crops to grow.

Answer: (c)(ii) Why farmers are advised to grow crops at higher altitudes than lower altitudes: higher altitudes are cooler and usually wetter, so there is less evaporation and more moisture for crops (and often fewer pests/diseases).

(c)(iii) Effect of a crop closing its stomata:

Answer: It reduces transpiration and so conserves water, but it also cuts down gas exchange (less carbon dioxide enters), which reduces photosynthesis and slows the plant's growth.

Answer: (d) Importance of mixed cropping: it makes maximum use of the land, reduces the risk of total crop failure, and (with a legume) adds nitrogen while the cover reduces weeds and erosion.

Question 3. Figure 3 shows artificial insemination in a cow (a catheter introducing semen), with structures C, D, E and F.

Answer: (a)(i) Where semen is released during insemination: D (the body of the uterus, where the catheter tip lies).

Answer: (a)(ii) The structure that releases an egg (ovum): C (the OVARY).

Answer: (b) Function of structure F (the vagina): it receives the male organ/semen during natural mating and is the canal through which the calf passes at birth.

Answer: (c)(i) Why dairy farmers are advised to use correct mating systems: to avoid inbreeding and to keep improving the herd's genetic quality, giving healthy offspring and higher milk production.

Answer: (c)(ii) Parturition: the act of giving birth (calving) — the expulsion of the young from the uterus.

(d)(i) Why structure F should be washed with warm water before milking:

Answer: To keep it clean (hygiene) so that dirt and bacteria do not contaminate the milk or spread disease — and the warmth helps stimulate milk let-down.

Answer: (d)(ii) Why dairy farmers rest pastures: to allow the grass to recover and regrow (avoiding overgrazing) and to help break the life cycles of pests and parasites, keeping the pasture productive.

Question 4. Farm economics.

Answer: (a) Gross margin: the gross income (output value) of an enterprise LESS its variable costs.

Answer: (b)(i) How the income (profit) of an enterprise is calculated: Profit = Total income (returns) – Total costs (expenses).

Answer: (b)(ii) Why capital is important on a farm: it is needed to buy inputs (seed, fertilizer, feed), land, machinery and livestock, to pay labour and to finance and expand the farm's operations.

Answer: (c) Depreciation: the loss/decline in value of a fixed asset (such as machinery or buildings) over time, due to wear and tear, age or obsolescence.

Answer: (d) How farm records help show where improvements could be made: they reveal which enterprises are profitable or making losses and where costs are high or wasteful, guiding the farmer on where to make improvements.

Question 5. Figure 4 shows the four-stroke cycle of a petrol engine, with parts T, U, V and W.

Answer: (a) Parts: T = EXHAUST VALVE; U = PISTON.

(b) Functions of parts V and W:

Answer: V = INLET (intake) VALVE — opens to admit the air-fuel mixture into the cylinder and closes to seal it during compression and combustion.

Answer: W = CONNECTING ROD — links the piston to the crankshaft and converts the up-and-down (reciprocating) motion of the piston into the rotary motion of the crankshaft.

(c) How a farmer would maintain the air cleaner of a tractor:

Answer: Remove and clean/wash the air-filter element regularly to remove dust; re-oil the oil-bath type; and replace the element when it is clogged or worn, checking that it seals properly.

Answer: (d) Why pulleys are used on farms: to transmit power (by belt) from the engine to machines, to lift heavy loads, and to change the speed or direction of motion (giving mechanical advantage).

Question 6. [SECTION B] (a) List the components of soil. (b) Explain how inorganic soil particles are formed from rocks by (i) temperature and (ii) wind action. (c) Describe how planting appropriate trees improves soil fertility and reduces soil erosion.

(a) COMPONENTS OF SOIL:

Answer: Mineral particles (sand, silt and clay); organic matter (humus); soil water; soil air; living organisms (micro- and macro-organisms); and dissolved mineral salts/nutrients.

(b) PHYSICAL WEATHERING:

Answer: (i) Temperature: rocks expand when heated during the day and contract when they cool at night; this repeated expansion and contraction sets up stresses that crack and break the rock into smaller particles (exfoliation).

Answer: (ii) Wind action: wind carries sand and grit which rub against (abrade) the rock surfaces, gradually wearing them down into smaller particles.

Answer: (c) HOW TREES IMPROVE FERTILITY AND REDUCE EROSION: leguminous trees fix nitrogen and fallen leaves decompose into humus and nutrients, while the roots bind the soil and the canopy and litter reduce raindrop impact and run-off, cutting erosion.

Question 7. (a) State the importance of agriculture. (b) State the problems facing cattle farmers in Zambia. (c) Give the advantages of rearing local breeds of cattle.

(a) IMPORTANCE OF AGRICULTURE:

Answer: It provides food for the people; raw materials for industry; employment; income and foreign exchange (through exports); a market for industrial goods; and revenue for the government.

(b) PROBLEMS FACING CATTLE FARMERS IN ZAMBIA:

Answer: Livestock diseases (e.g., East Coast Fever, foot-and-mouth) and parasites (ticks); shortage of pasture and water in the dry season; lack of capital; poor breeds; cattle theft; poor markets/prices; drought; and inadequate veterinary services.

(c) ADVANTAGES OF REARING LOCAL BREEDS OF CATTLE:

Answer: They are hardy and tolerant of local diseases and parasites (e.g., ticks); they withstand heat and harsh climate; they can survive on poor pasture; they are useful for draught work; and they are cheaper to manage.

Question 8. (a)(i) List the first three components of a ruminant stomach. (ii) Compare digestion in a gizzard and in a rumen of a cow. (b)(i) Why is continuous close grazing discouraged in a pasture? (ii) How can you control ticks on a farm? (c) Why is a farmer who keeps cattle advised to ensure feed does not contain objects like nails and glass?

Answer: (a)(i) The first three components of a ruminant stomach: the RUMEN, the RETICULUM and the OMASUM (the abomasum is the true stomach).

(a)(ii) DIGESTION IN A GIZZARD vs IN A RUMEN:

Answer: In the GIZZARD (of a bird) digestion is MECHANICAL — the muscular walls and swallowed grit grind and crush the food, since birds have no teeth. In the RUMEN (of a cow) digestion is mainly MICROBIAL — micro-organisms ferment and break down cellulose/fibrous food (and the cow regurgitates and re-chews the cud).

Answer: (b)(i) Why continuous close grazing is discouraged: it overgrazes and damages the pasture (removing the growing points so the grass regrows poorly or dies), exposes the soil to erosion and helps spread parasites — lowering pasture productivity.

Answer: (b)(ii) Controlling ticks: dip or spray the animals regularly with an acaricide; practise rotational grazing and pasture spelling; hand-pick ticks; and keep the animals and kraal clean.

Answer: (c) Why feed must not contain nails and glass: such hard, sharp objects injure the digestive tract (causing 'hardware disease'/traumatic reticulitis) and can sicken or kill the animal.

Question 9. (a) List three factors of production on a farm. (b) Define demand. (c) Describe overhead (fixed) costs and give one example of a fixed cost on a farm. (d) A maize enterprise: compound D 4 bags @ K260; urea 4 bags @ K250; ploughing K400; weeding K200; harvesting K100; shelling K150; transport K100; 200 bags sold @ K100 each. (i) Spending on basal, top dressing and transport; (ii) total expenditure, income and profit. (e)(i) State the law of diminishing returns; (ii) factors when deciding how much to produce.

Answer: (a) Three factors of production: Land, Labour and Capital (plus Management).

Answer: (b) Demand: the quantity of a good or service that consumers are willing and able to buy at a given price over a period of time.

Answer: (c) Overhead (fixed) costs do NOT change with the level of output and are incurred regardless of how much is produced. Example: rent/land rates, depreciation of machinery, or a permanent worker's salary.

(d)(i) Spending on basal dressing, top dressing and transport:

Answer: Basal dressing (Compound D) = $4 \times K260 = K1,040$; Top dressing (Urea) = $4 \times K250 = K1,000$; Transport = K100. (Total of these three = K2,140.)

(d)(ii) Total expenditure, income and profit:

Answer: Total expenditure = $K1,040 + K1,000 + K400 + K200 + K100 + K150 + K100 = K2,990$.

Answer: Income = $200 \text{ bags} \times K100 = K20,000$. Profit = $K20,000 - K2,990 = K17,010$.

Answer: (e)(i) Law of diminishing returns: as more and more units of a variable input are added to a fixed input, the extra (marginal) output eventually begins to fall.

Answer: (e)(ii) Factors when deciding how much to produce: the market demand and price; the cost of production; the resources available (land, labour, capital); the expected profit; and the risk involved.

Question 10. (a)(i) Mention the disadvantages of using a disc plough to prepare a seedbed; (ii) explain how rusting could be prevented on a disc plough. (b)(i) Illustrate the inlet stroke of a spark-ignition four-stroke (petrol) engine; (ii) what are the uses of an engine on a farm? (c)(i) What is the velocity ratio of a machine? (ii) Why is the block and tackle pulley system not a perfect machine?

(a)(i) DISADVANTAGES OF A DISC PLOUGH FOR A SEEDBED:

Answer: It leaves a rough, cloddy surface (not a fine tilth); it does not fully invert and bury weeds and residues; it can smear or compact the soil; it tends to leave ridges; and it works poorly in light soils.

Answer: (a)(ii) Preventing rust on a disc plough: clean off soil and dry it after use, oil/grease the discs and metal parts, paint the surfaces, and store it under shelter.

(b)(i) INLET (INDUCTION) STROKE OF A PETROL ENGINE:

Answer: The piston moves DOWN; the inlet valve is OPEN and the exhaust valve CLOSED; the downward movement draws a mixture of AIR AND PETROL VAPOUR (from the carburettor) into the cylinder; the crankshaft turns half a revolution.

Answer: (b)(ii) Uses of an engine on a farm: to power tractors and machinery (mills, threshers, pumps), to generate electricity, to pump water, and for transport.

Answer: (c)(i) Velocity ratio: the ratio of the distance moved by the effort to the distance moved by the load ($VR = \text{distance moved by effort} \div \text{distance moved by load}$).

Answer: (c)(ii) Why the block and tackle is not a perfect machine: because of friction in the pulleys and the weight of the moving parts, some of the effort is used to overcome these, so the work output is less than the work input (efficiency is below 100%).

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