

G12 ECZ AGRICULTURAL SCIENCE 2016 SPECIMEN PAPER 1 SOLUTIONS

Grade 12 ECZ Agricultural Science 2016 Specimen 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 (after the syllabus preamble) — worked answers follow.

Preamble for Agricultural Science

The Examinations Council of Zambia has made adjustments to the assessment of **Agricultural Science** at Grade 12 level so as to be in line with the revised **Agricultural Science** Senior Secondary School Syllabus of 2013 developed by Curriculum Development Centre (CDC) of the Ministry of General Education.

Purpose

The purpose of assessing Agricultural Science at Grade 12 will be to evaluate candidates' knowledge skills and values across the Agricultural Science syllabus as well as certification of candidates. Furthermore, the purpose will be to give feedback to educators on the effectiveness of instructions, prepare learners for tertiary and vocational training, and determine the extent to which school graduates are ready for the job market and for survival.

Assessment Objectives

Candidates will be assessed against the following aspects:

Knowledge with Understanding

1. agricultural science symbols, quantities and units of measurement
2. agricultural science terms, facts, concepts and principles.

Problems Solving

1. organise and present information from a variety of sources (words, symbols, graphs, numbers, etc.)
2. translate information given in one form to another. (e.g. numerical data to graphical data)
3. use information to observe trends and draw conclusions
4. present explanations for observed facts and relate them to each other
5. make predictions based on observations
6. use knowledge to solve problems.

Practical Activities

Competences and Techniques

1. follow instructions
2. choose suitable techniques, equipment and materials
3. use equipment and materials safely and correctly
4. make and record observations, measurements and estimates

Investigations

- identify problems and plan investigations
- organise and carry out investigations in a systematic way
- interpret and evaluate observations and experimental data
- evaluate methods and suggest improvements

Skills and Techniques in Livestock Production

- handle single or groups of farm animals in a safe and correct manner

- maintain the health of a farm animal
- calculate maintenance and production rations of farm animals
- plan, manage and implement a feeding programme for different stages of the life cycle of a farm animal
- identify types and breeds of animals
- market farm animals and their products
- maintain accurate physical and financial records of a livestock enterprise

Skills and Techniques in Crop Production and Entrepreneurship

- identify cultivars and varieties of crops
- calculate fertiliser/manure requirements of a crop and estimate crop yield
- plan, implement and manage a cropping programme
- harvest and market a crop
- maintain accurate physical and financial records of a crop enterprise

Test Design

The examination will comprise three papers

Paper 1 (2 hours) will consist of two sections, A and B. Section A will comprise five compulsory semi-structured questions carrying 8 marks each. Section B will consist of five essay questions each carrying 20 marks. Candidates will be required to attempt three questions from section B.

Paper 2 is a school-based project carrying 20 marks. Candidates are expected to carry out a project in either crop or livestock production. The project should start when candidates are in the third term of grade 11 and should be completed in the second term of grade 12. Candidates will each maintain and submit for the purpose of the final examination a project report.

Paper 3 (1 hour 30 minutes) is a practical test comprising four compulsory questions carrying 10 marks each. This is designed to test appropriate skills in all assessment objectives. Each question will consist of sub-components requiring candidates to read instructions carefully, carry out experiments, make observations, draw diagrams, measure, record data and make conclusions.

Paper Name and Code	Paper Duration	Marks	Number of Questions	Overall Weight of Paper
Agricultural Science paper 1	2 hours	100	Section A: 5	63%
			Section B: 5	
Agricultural Science paper 2	2 hours	20		12%
Agricultural Science paper 3	1 hour 30 minutes	40	4	25%
Total				100%

Candidate Name _____

Centre Number				Candidate Number									

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for School Certificate Ordinary Level

Agricultural Science

5037/1

Paper 1 Theory

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 root system of a groundnut crop and the root system of a maize crop.

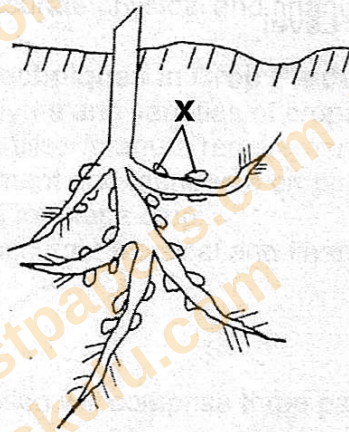


Figure 1A

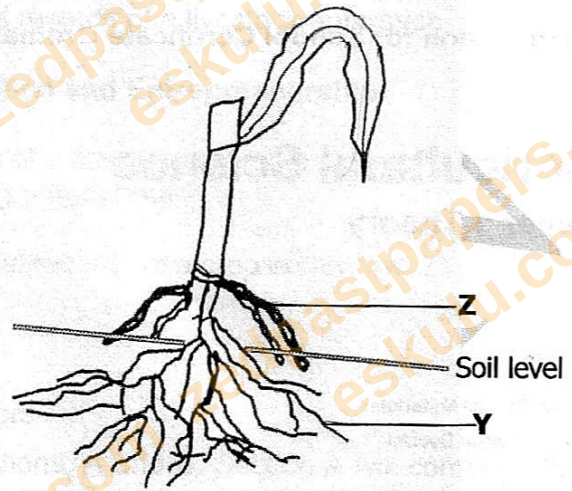


Figure 1B

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

Figure 1 A

Figure 1 B [2]

- (b) Name the structures labelled **X**, **Y** and **Z**.

X

Y

Z [3]

- (c) State the importance of the structure labelled **X** in soil fertility.

.....

.....

..... [3]

[8 marks]

2 **Figure 2** shows types of moisture movements.

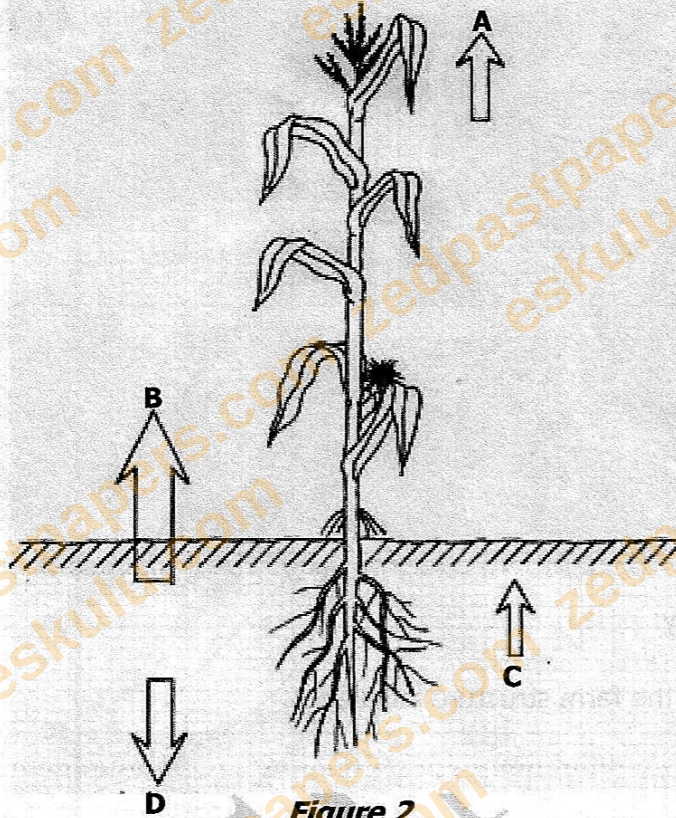


Figure 2

(a) Identify the movements of moisture at **A**, **B**, **C** and **D**.

A

B

C

D [4]

(b) Name the types of soil moisture at **C** and **D**.

C

D [2]

(c) State **two** uses of soil moisture in crop production.

(i)

(ii)

[2]

[8 marks]

[Turnover]

3 **Figure 3** shows a farm structure for water supply.

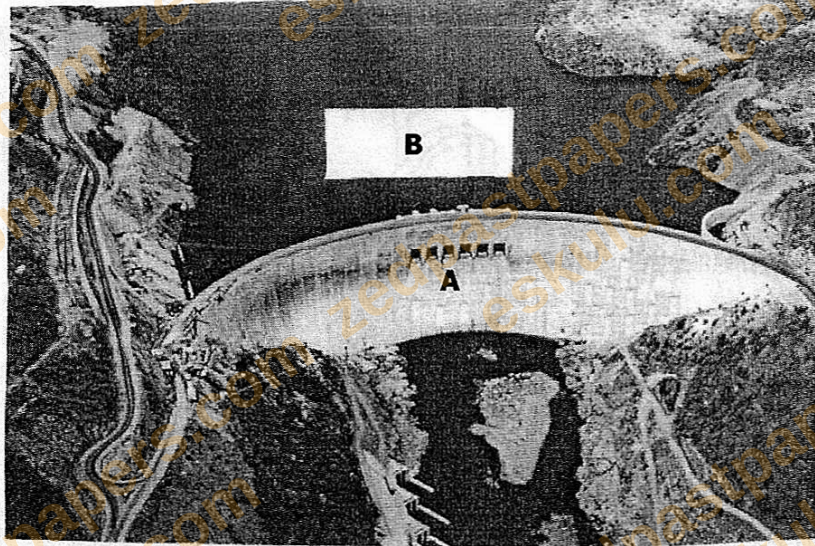


Figure 3

(a) Identify:

(i) the farm structure labelled **A**.

..... [1]

(ii) part **B** of the farm structure.

..... [1]

(b) State a local material used to construct the farm structure.

..... [1]

(c) Name any **two** other farm structures for water supply.

(i)

(ii) [2]

(d) (i) What is water pollution?

..... [1]

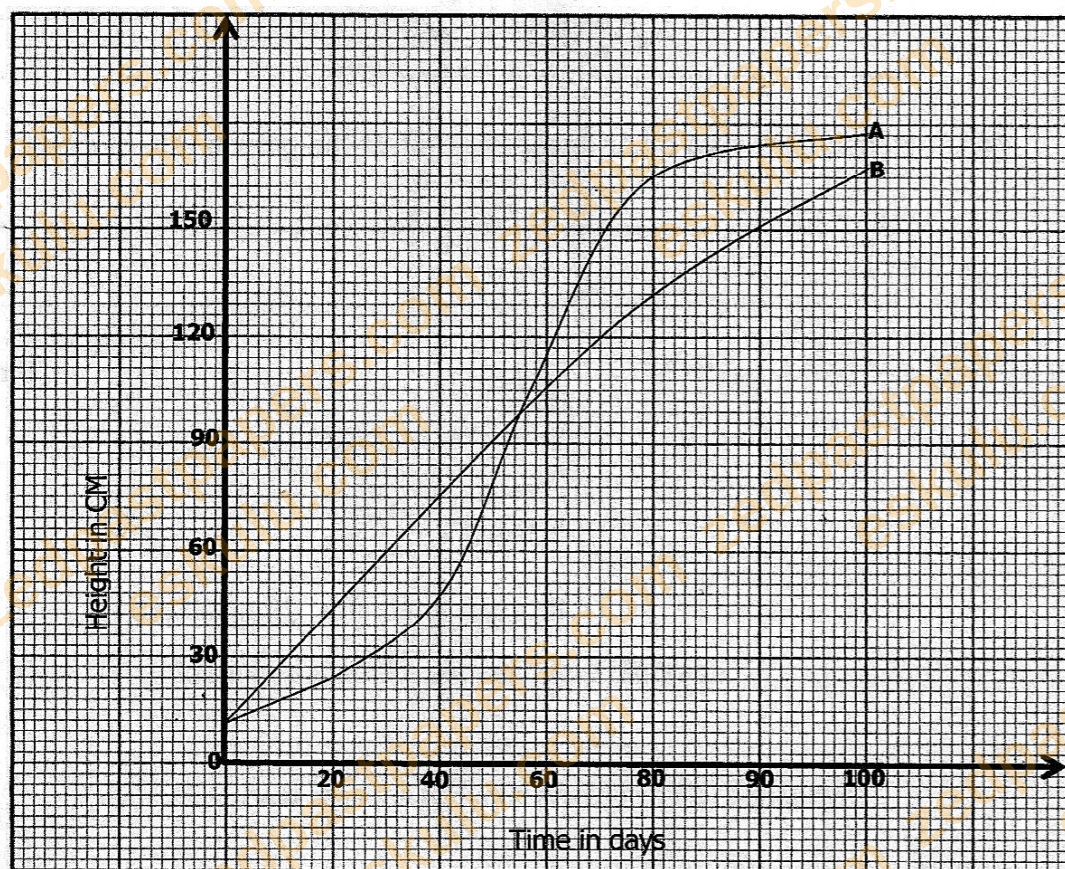
(ii) Describe **two** ways in which water supplies on the farm may be polluted.

1

2 [2]

[8 marks]

- 4 **Graph 1** shows average growth of crop **A** and crop **B**. Organic fertilizer was applied to crop **A** while inorganic fertilizer was applied to crop **B**.



Graph 1

- (a) What was the average height of crop **A** and **B** on the 20th day of growth?

A

B [2]

- (b) Explain why crop **A** had a slower growth rate than crop **B** between 10 days and 40 days.

.....

.....

..... [2]

(c) Explain why crops **B** started growing slowly after 60 days.

.....
.....
.....

[2]

(d) Mention any **two** other factors that affect the growth rate of crops.

(i)

(ii)

[2]

[8 marks]

5 **Figure 4** shows part of the diesel engine.

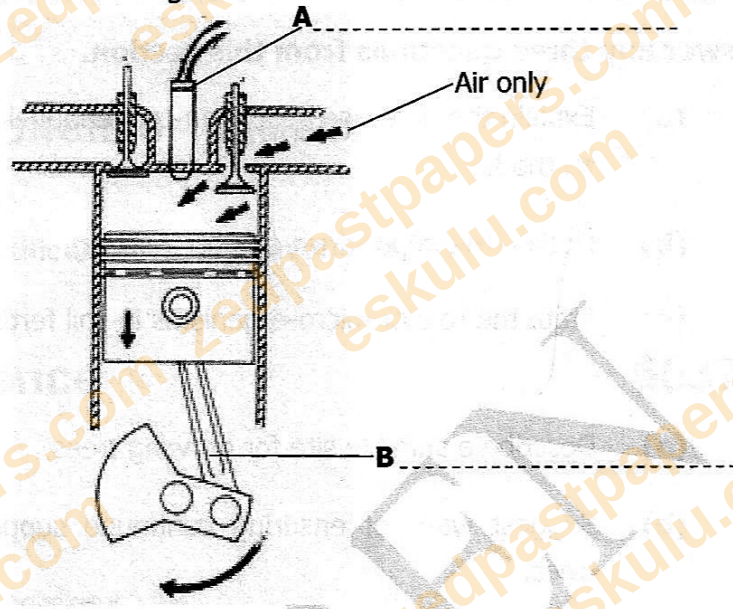


Figure 4

(a) On the diagram, label parts **A** and **B**. [2]

(b) (i) Identify the stroke shown in the diagram. [1]

..... [1]

(ii) Give **two** reasons for your answer in (b) (i) above.

1

.....

2

..... [2]

(c) What would you expect to happen when the following parts are not functional in a petrol engine?

(i) Radiator

..... [1]

(ii) Carburettor

..... [1]

(iii) Spark plug

..... [1]

[8 marks]

[Turnover]

Section B

Answer any three questions from this section.

- 6 (a) Explain the difference between conventional and conservation farming methods. [10]
- (b) Outline the importance of intercropping. [5]
- (c) State the role of micro-organisms in soil fertility. [5]
- [Total: 20]
- 7 (a) Describe a suitable site for growing trees. [5]
- (b) Suggest ways of ensuring continued supply of poles and handles from trees. [6]
- (c) Outline how trees reduce soil erosion. [9]
- [Total: 20]
- 8 (a) State the economic importance of cattle. [11]
- (b) Outline the advantages of a mixture of grasses and legumes on a pasture. [9]
- [Total: 20]
- 9 (a) With the aid of a diagram, describe the induction stroke of a petrol engine. [12]
- (b) State the differences between petrol and diesel engines. [8]
- [Total: 20]
- 10 (a) Suggest ways of increasing sales of agricultural products in the local area. [10]
- (b) Distinguish between gross-margin of an enterprise and depreciation of farm machinery. [7]
- (c) State **three** methods used to calculate depreciation of farm machinery. [3]
- [Total: 20]

Question 1. Figure 1 shows the root system of a groundnut crop (1A) and of a maize crop (1B), with structures X, Y and Z.

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

Answer: (b) Structures: X = ROOT NODULES (on the groundnut roots); Z = PROP (adventitious) ROOTS of maize, growing from the stem above the soil level; Y = FIBROUS ROOTS of maize.

(c) Importance of structure X (root nodules) in soil fertility:

Answer: The nodules contain nitrogen-fixing bacteria (Rhizobium) that fix atmospheric nitrogen into compounds the plant can use, adding nitrogen to the soil (especially when the residues decompose) and so improving fertility for later crops.

Question 2. Figure 2 shows types of moisture movement around a maize plant, with arrows A, B, C and D.

Answer: (a) Moisture movements: A = TRANSPIRATION (water vapour leaving the leaves); B = EVAPORATION (from the soil surface); C = CAPILLARITY (water rising up through the soil to the roots); D = DRAINAGE / percolation (water moving downward through the soil under gravity).

Answer: (b) Types of soil moisture: C = CAPILLARY water (held in the soil pores, available to plants); D = GRAVITATIONAL water (drains away under gravity).

(c) Two uses of soil moisture in crop production:

Answer: (i) It dissolves soil nutrients and carries them into the plant through the roots.

Answer: (ii) It is needed for photosynthesis and keeps plant cells turgid (and helps seeds to germinate).

Question 3. Figure 3 shows a farm structure for water supply (an aerial view of a dam), with parts A and B.

Answer: (a)(i) Structure A: a DAM (the dam wall).

Answer: (a)(ii) Part B: the RESERVOIR — the water stored/held back by the dam.

Answer: (b) A local material used to construct it: compacted EARTH/SOIL (also clay, stones).

Answer: (c) Two other farm structures for water supply: (i) a WELL; (ii) a BOREHOLE (also a weir, tank or pond).

Answer: (d)(i) Water pollution: the contamination of water with harmful substances, making it unfit or dangerous for use.

(d)(ii) Two ways water supplies on the farm may be polluted:

Answer: 1. Run-off of agro-chemicals (fertilizers and pesticides) into the water.

Answer: 2. Animal droppings/dung and eroded soil (siltation) entering the water (also sewage or fuel spills).

Question 4. Graph 1 shows the average growth of crop A (given organic fertilizer) and crop B (given inorganic fertilizer) over 100 days.

Answer: (a) Average height on the 20th day (read from the graph): crop A $\approx$ 20 cm; crop B $\approx$ 30 cm.

(b) Why crop A grew more slowly than crop B between days 10 and 40:

Answer: The ORGANIC fertilizer given to A must first decompose (be broken down by soil organisms) before its nutrients are released, so the nutrients are not immediately available. The INORGANIC fertilizer on B is readily soluble and immediately available, giving B faster early growth.

(c) Why crop B started growing slowly after 60 days:

Answer: The inorganic fertilizer is soluble and is quickly used up or leached (washed) away, so by about 60 days its nutrients are depleted and growth slows — whereas the organic fertilizer keeps releasing nutrients steadily (so A overtakes B).

Answer: (d) Two other factors that affect the growth rate of crops: (i) the amount of water/rainfall available; (ii) temperature (also light, soil fertility, pests and diseases).

Question 5. Figure 4 shows part of a diesel engine (a piston in a cylinder; 'Air only' is being drawn in), with parts A and B.

Answer: (a) Labels: A = INLET (intake) VALVE; B = CONNECTING ROD.

Answer: (b)(i) Stroke shown: the INDUCTION (intake/suction) stroke.

(b)(ii) Two reasons for this answer:

Answer: 1. Only AIR is being drawn in (a diesel engine takes in air only on the induction stroke) through the open inlet valve.

Answer: 2. The piston is moving DOWN, creating suction that draws the air into the cylinder.

(c) What happens in a PETROL engine when these parts are not functional:

Answer: (i) Radiator not functional → the engine OVERHEATS (no cooling) and may seize.

Answer: (ii) Carburettor not functional → no proper air-fuel mixture is formed, so the engine will not start/run.

Answer: (iii) Spark plug not functional → no ignition spark, so the fuel mixture is not ignited and the engine will not run.

Question 6. [SECTION B] (a) Explain the difference between conventional and conservation farming methods. (b) Outline the importance of intercropping. (c) State the role of micro-organisms in soil fertility.

(a) CONVENTIONAL vs CONSERVATION FARMING:

Answer: Conventional farming uses intensive, deep tillage (ploughing), removes or burns crop residues, often leaves the soil bare and mono-crops — leading to more erosion and moisture loss. Conservation farming uses minimum/zero tillage and planting basins, RETAINS crop residues as a soil cover, and uses crop rotation — conserving soil and water and reducing

erosion.

(b) IMPORTANCE OF INTERCROPPING:

Answer: It makes maximum use of the land; reduces the risk of total crop failure and spreads income; a legume intercrop fixes nitrogen; and the ground cover suppresses weeds and reduces soil erosion.

(c) ROLE OF MICRO-ORGANISMS IN SOIL FERTILITY:

Answer: They decompose organic matter into humus and release plant nutrients; some fix atmospheric nitrogen (e.g., Rhizobium); nitrifying bacteria convert ammonia into nitrates that plants absorb; and they help improve soil structure as they recycle nutrients.

Question 7. (a) Describe a suitable site for growing trees. (b) Suggest ways of ensuring a continued supply of poles and handles from trees. (c) Outline how trees reduce soil erosion.

Answer: (a) A SUITABLE SITE: deep, well-drained, fertile soil; an area with adequate rainfall and a suitable climate; gentle slopes; and protection from fire and stray animals, away from arable land.

(b) ENSURING A CONTINUED SUPPLY OF POLES AND HANDLES:

Answer: Replant/afforest after cutting; harvest selectively and cut only mature trees; practise coppicing so stumps re-sprout; protect the woodlot from fire and animals; and thin and prune to encourage straight regrowth (sustainable management).

(c) HOW TREES REDUCE SOIL EROSION:

Answer: Their roots bind the soil; the canopy intercepts rain and reduces raindrop impact; leaf litter forms a protective mulch; trees act as windbreaks against wind erosion; and they slow run-off while increasing infiltration.

Question 8. (a) State the economic importance of cattle. (b) Outline the advantages of a mixture of grasses and legumes on a pasture.

(a) ECONOMIC IMPORTANCE OF CATTLE:

Answer: They provide meat (beef) and milk; hides and skins for leather; draught power for ploughing and transport; manure for fertilizer and fuel/biogas; a source of income and savings; by-products (blood, bones, horns); social/cultural value (dowry, status); and they create employment.

(b) ADVANTAGES OF A GRASS-LEGUME MIXTURE ON A PASTURE:

Answer: The legumes fix nitrogen, which benefits the grasses and improves soil fertility; the mixture gives a higher-protein, more balanced and palatable feed; it produces a higher total yield and better ground cover (less erosion); and it lengthens the grazing season.

Question 9. (a) With the aid of a diagram, describe the induction stroke of a petrol engine. (b) State the differences between petrol and diesel engines.

(a) INDUCTION STROKE OF A PETROL ENGINE (label on the diagram: cylinder, piston, open inlet valve, closed exhaust valve, connecting rod, crankshaft):

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

(b) DIFFERENCES BETWEEN PETROL AND DIESEL ENGINES:

Answer: Petrol engine: draws in an air-FUEL mixture; ignites the mixture with a **SPARK PLUG**; uses a carburettor; has a lower compression ratio; uses petrol.

Answer: Diesel engine: draws in **AIR ONLY**; the fuel is **INJECTED** and ignites by the heat of **COMPRESSION** (no spark plug); uses an injector; has a higher compression ratio; uses diesel and is generally more fuel-efficient/powerful.

Question 10. (a) Suggest ways of increasing sales of agricultural products in the local area. (b) Distinguish between gross-margin of an enterprise and depreciation of farm machinery. (c) State three methods used to calculate depreciation of farm machinery.

(a) WAYS OF INCREASING SALES OF AGRICULTURAL PRODUCTS LOCALLY:

Answer: Advertise and promote the products; improve and grade the quality; package attractively; charge competitive prices; add value by processing; supply at the right time; sell at accessible market points; diversify the products; keep good customer relations; and market jointly through cooperatives.

(b) GROSS-MARGIN vs DEPRECIATION:

Answer: GROSS MARGIN is the gross income (output value) of an enterprise LESS its variable costs.

Answer: DEPRECIATION is the loss in value of a fixed asset (such as machinery) over time due to wear and tear, age or obsolescence.

Answer: (c) Three methods of calculating depreciation: the **STRAIGHT-LINE** method; the **REDUCING** (diminishing) **BALANCE** method; and the **REVALUATION** method.

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