education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

AGRICULTURAL SCIENCES P1

PREPARATORY EXAMINATION 2008

MARKS: 150

TIME: 2 hours

This question paper consists of 19 pages and 1 answer sheet.

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. SECTION A (QUESTION 1) must be answered on the attached ANSWER SHEET.
3. Place your ANSWER SHEET for SECTION A (QUESTION 1) inside the ANSWER BOOK.
4. SECTION B (QUESTIONS 2, 3 and 4) must be answered in the ANSWER BOOK.
5. Start EACH question from SECTION B on a NEW page.
6. Read ALL the questions carefully and make sure you answer what is asked.
7. Number the answers correctly according to the numbering system used in this question paper.
8. DO NOT SPLIT the answers to the questions.
9. Write neatly and legibly.

SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the answer and make a cross (X) in the block (A – D) next to the question number (1.1.1 – 1.1.10) on the attached ANSWER SHEET.

1.1.1 The sub-soil which becomes very wet for part of the year usually develops a … colour.

A yellow
B dark
C mottled
D red

1.1.2 Clay colloids have a number of negative charges which make them capable of adsorbing cations. Which of the following situations has the highest cation adsorption capacity?

A Clay particles with a 1:1 layered structure
B Clay particles with a large internal surface area
C Clay particles with strong bonds between the layers
D Clay particles that developed from the kaolinite clay minerals

1.1.3 Which ONE of the following is NOT a characteristic of sandy soils?

A Difficult to cultivate
B Low water-holding capacity
C Poor in plant nutrients
D Usually acidic under high rainfall conditions

1.1.4 The quantity of capillary water in the soil is dependent on …

A soil colour.
B soil temperature.
C soil reaction.
D cohesion forces.

1.1.5 Eelworms, which are parasitic to plants, are also called …

A slugs.
B mites.
C nematodes.
D arthropods.

1.1.6 Pawpaws are plants that bare unisexual flowers. In a pawpaw plantation a farmer, through ignorance, cuts down all the male plants leaving only the female plants to grow and mature. This action could result in …

A self-pollination.
B ablactation.
C early fruiting.
D premature ripening of fruits.

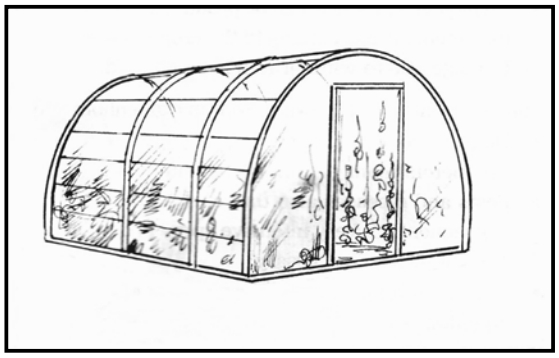
1.1.7 An important requirement for pesticides to be registered is the …

A degradability of these natural substances.
B higher toxicity levels for effective control.
C longer toxicity periods for effective control.
D applicability of the pesticides.

1.1.8 Although irises or ginger do flower, they propagate by using a …

A leaf.
B bulb.
C seed.
D rhizome.

1.1.9 The diagram below represents a structure that is used for controlled agricultural production. The main reason for using this structure is to improve (optimise) the process of … in plants.



A geotropism
B photosynthesis
C transpiration
D gutation

1.1.10 … is a type of farming where living organisms are reared in water.

A Hydrology
B Permaculture
C Aquaculture
D Horticulture (10 x 2) (20)

1.2 In the table below, a statement with two possible answers is given. Decide whether the statement in COLUMN B relates to ONE, BOTH or NONE of the answers in COLUMN A. Choose the correct answer and make a cross (X) in the block (A – D) next to the question number (1.2.1 – 1.2.5) on the attached ANSWER SHEET.

Example:

COLUMN A		COLUMN B
A	Budding	sexual reproduction
B	Grafting	

Answer:

The statement refers to:			
ONLY A	**ONLY B**	**A AND B**	**NONE**
A	B	C	~~D~~

		COLUMN A	COLUMN B
1.2.1	A	Fresh and partly decomposed organic matter	sub-soil
	B	Accumulation of clay, $A\ell_2O_3$ and Fe_2O_3	
1.2.2	A	'Whiptail' in cauliflower	occurs as a result of molybdenum deficiency in plants
	B	'Saucer leaf' in vines	
1.2.3	A	Urea	fertiliser used during land preparation to rectify low soil pH
	B	$(NH_4)_2SO_4$	
1.2.4	A	Conversion of atmospheric carbon dioxide into plant carbon	NOT part of the nitrogen cycle
	B	Conversion of animal protein to ammonia	
1.2.5	A	Land is left fallow for a year	a system where different crops are grown alternately on the same land year after year
	B	A legume is mostly included	

(5 x 2) (10)

1.3 Give ONE term for each of the following descriptions. Write only the term next to the question number (1.3.1 – 1.3.5) on the attached ANSWER SHEET.

1.3.1 The component of soil which has the most stabilising effect on the temperature of the soil

1.3.2 A particular combination and succession of diagnostic horizons

1.3.3 The process of conversion of light energy into chemical potential energy

1.3.4 The chemicals used to kill ONLY the unwanted plants in a crop field

1.3.5 The system used to remove the access water in the soil in a field which is water-logged (5 x 2) (10)

1.4 Change the underlined words in the following statements to make the statements TRUE. Write the appropriate word(s) next to the question number (1.4.1 – 1.4.5) on the attached ANSWER SHEET.

1.4.1 <u>Permaculture</u> is the growing of plants in a medium other than soil by supplying the roots with complete nutrient solution.

1.4.2 More or less uniform spreading of fertiliser over the area planted or to be planted is called <u>band placement</u>.

1.4.3 <u>Passive</u> ion absorption is the absorption of plant nutrient elements from soil against the concentration gradient.

1.4.4 The formation of dark coloured, amorphous, colloidal matter from organic material is called <u>nitrification</u>.

1.4.5 The component of soil air which dilutes the active element oxygen is <u>carbon dioxide</u>. (5 x 1) (5)

TOTAL SECTION A: 45

SECTION B

Start this question on a NEW page in the ANSWER BOOK provided.

QUESTION 2

2.1 Before digging a compost pit, a farmer removed all organic debris from the surface of the soil. The farmer dug the pit until cutting through a part of the underlying rock. Before filling the pit with organic material for the compost, a soil scientist passed by and noticed that four major horizons had been exposed in this soil with different degrees of deviation from the mother material.

2.1.1 In a sequential order (from top to bottom), write down the FOUR major horizons visible in the exposed compost pit which caught the attention of the soil scientist. (4)

2.1.2 Deduce the composition of the organic debris which was removed prior to the digging of the pit. (2)

2.2 Imagine a non-waterlogged soil with a complete absence of oxygen. Suggest ONE consequence this condition in the soil may have with regard to the following processes:

2.2.1 Soil formation (1)

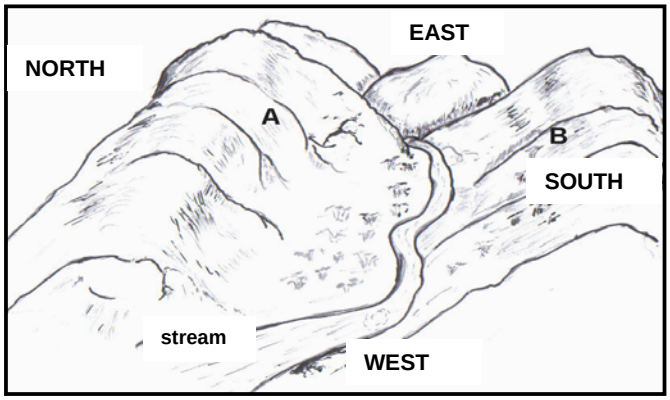
2.2.2 Germination (1)

2.2.3 Decomposition of organic matter (1)

2.2.4 Microbic activity (1)

2.3 There are two major types of spheroid structures, namely granular and crumb structure. Indicate the ONE you will recommend for the cultivation of vegetables at your school garden. (1)

2.4 The drawing (simple map) below represents a valley in a part of South Africa. Directions have been indicated on this drawing.



2.4.1 Indicate on which aspect (slope), A or B, the soils will be warmer. (1)

2.4.2 Explain the reason for your answer to QUESTION 2.4.1. (2)

2.5 Read the extract below and answer the questions that follow.

> Billions of tons of sugar are produced each year through photosynthesis, and yet the light-powered reactions in photosynthesis do not actually make any sugar. All they produce to assist in the formation of sugar is ATP and NADPH. From this point, the enzymes in the stroma, or space outside the thylakoids, use the ATP and NADPH to make sugar. In the stroma the enzymes pass partially complete sugar molecules around with incredible speed, rearranging them, energising them with ATP, adding carbon dioxide, attaching hydrogen, and, finally, sending off a three-carbon sugar to be further modified elsewhere in the cell into glucose and a host of variations.

2.5.1 Name the specific site in the chloroplast where the light-powered reactions take place. (1)

2.5.2 In addition to ATP and NADPH, name the gas which is formed during the light-powered reaction. (1)

2.5.3 Write down the name that is given to the sugar molecule that is formed at the end of photosynthesis. (1)

2.5.4 Indicate ONE inorganic compound which serves as a reactant in the process of photosynthesis. (1)

2.6 Studies have shown that mixing peat (wet, pure organic matter) with fertilisers increases the retention of nitrates in the soil.

2.6.1 Distinguish between *leaching* and *adsorption* of plant nutrients. (4)

2.6.2 Explain what might have brought about the retention of nitrate ions. (2)

2.6.3 Write down the chemical name of an available nitrogen source in the soil which is less exposed to leaching. (1)

2.7 Read the extract below and answer the questions that follow.

The science behind GM food is called food biotechnology – the use of modern genetics to improve plants, animals and micro-organisms for food production. It enables the transfer of genes between completely unrelated organisms, allowing for combinations unlikely to occur by conventional means. Breeders can now take qualities from other organisms and put them into the genome of a plant – for instance frost tolerance from fish, disease resistance from viruses and insects.

Suppose that farmers do not want their potatoes or apples to turn brown when they are cut or bruised. Researchers come to the rescue by removing the gene that is responsible for this browning and replacing it with an altered version that blocks browning. Or let us assume that a beet grower would like to plant earlier in order to reap a better harvest. Ordinarily the farmer could not plant so early because the beets would freeze in the cold weather. Biotechnology comes into play when genes from fish that easily survive in cold water are transplanted into the beets. The result is a GM beet that can withstand temperatures as low as -6,5 °C, more than twice as cold as the lowest temperature beets can typically withstand.

[Adapted from: *Awake!* 22 April 2000]

2.7.1 What does the abbreviation *GM* stand for? (1)

2.7.2 Plant breeders make use of biotechnology to improve plants. Give TWO examples from the extract indicating how plants are improved using such a technique. (2)

2.8 The table below shows the composition of a typical nutrient solution for growing tomatoes in a soilless medium.

CODE (A – J)	CHEMICAL SUBSTANCE	GRAMS PER LITRE OF WATER
A	Potassium nitrate	**0,4 g/ℓ**
B	Calcium nitrate	**0,3 g/ℓ**
C	Potassium hypophosphate	**0,2 g/ℓ**
D	Magnesium sulphate	**0,2 g/ℓ**
E	Iron citrate	**50 mg/ℓ**
F	Manganese sulphate	**5 mg/ℓ**
G	Zinc sulphate	**0,5 mg/ℓ**
H	Copper sulphate	**0,1 mg/ℓ**
I	Boric acid	**1,0 mg/ℓ**
J	Sodium molybdate	**0,05 mg/ℓ**

2.8.1 Indicate the code of the chemical substance with the highest concentration and name TWO macro-elements contained in the chemical. (3)

2.8.2 Which micro-element is supplied by the chemical coded J? (1)

2.8.3 Indicate the code of the chemical which contains the nutrient apart from nitrogen that forms part of the chlorophyll molecule. (1)

2.9 Marginal land is not suited for crop production in the long term because it has a low productivity (low average yields). An important principle in farm planning involves separation of grazing camps from the tillable land. Many crop farmers have withdrawn some of their marginal fields from crop production. On these fields they planted pastures.

Name TWO criteria of soil that would contribute to the classification of the field/land as being marginal. (2)

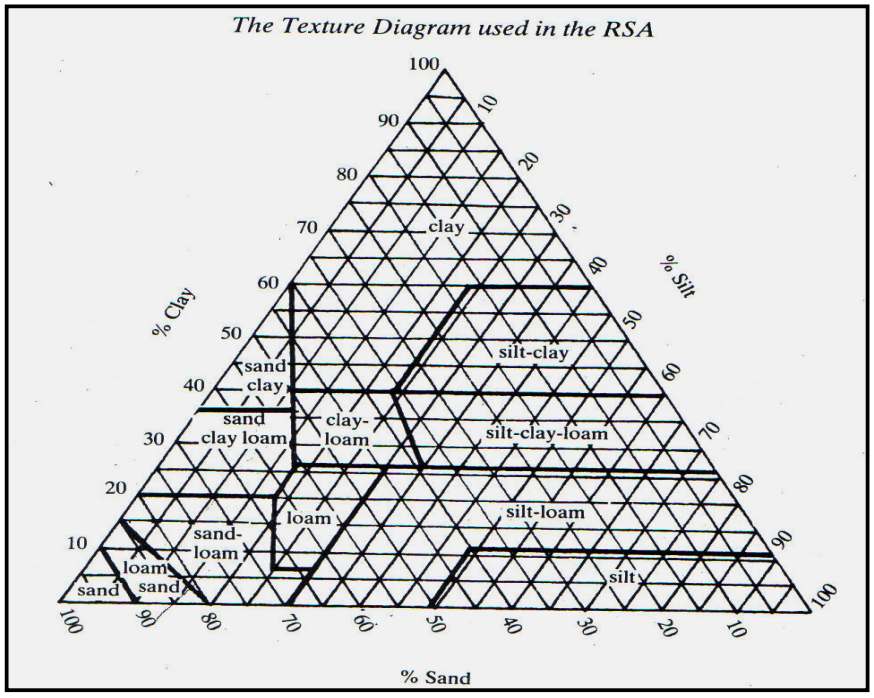
[35]

Start this question on a NEW page.

QUESTION 3

3.1 A group of learners in Grade 12 were given the equipment to do physical analysis of the soils on a certain farm.

After obtaining the percentages of the three major soil fractions, they had to use the texture diagram (shown below) to determine the various textural classes of the soils.



The table below shows some of the results they obtained.

SOIL SAMPLE	% SAND	% SILT	% CLAY
A	55	25	20
B	95	3	2
C	30	20	50

3.1.1 Determine the textural class for soil sample B and critically discuss FOUR practical ways in which a farmer will be able to make such a soil more productive. (5)

3.1.2 Which of the soil samples in the table above would you recommend as the most suitable for cultivation? (1)

3.1.3 Indicate the soil sample (A, B or C) indicated above that will have the highest capillarity. Give a reason for your answer. (2)

3.2 A prospective farmer was made to choose between two plots of land, A and B. The characteristics of the soils of the two plots are shown in the table below.

PLOT	COLOUR	TEXTURE	STRUCTURE
A	Light	Sand-loam	50% single grain 35% crumb 15% blocky
B	Grey	Clay	50% columnar 40% platy 10% single grain

3.2.1 Suggest which plot mentioned above is waterlogged. (1)

3.2.2 Local farmers usually use ox-driven ploughs to till the land. Deduce which one of the above plots will be easier to till. (1)

3.2.3 Consistent cultivation will lead to low productivity and resultant poverty. Give FOUR reasons why there will be a decrease in production on plot A due to consistent exploitive (inappropriate) cultivation. (4)

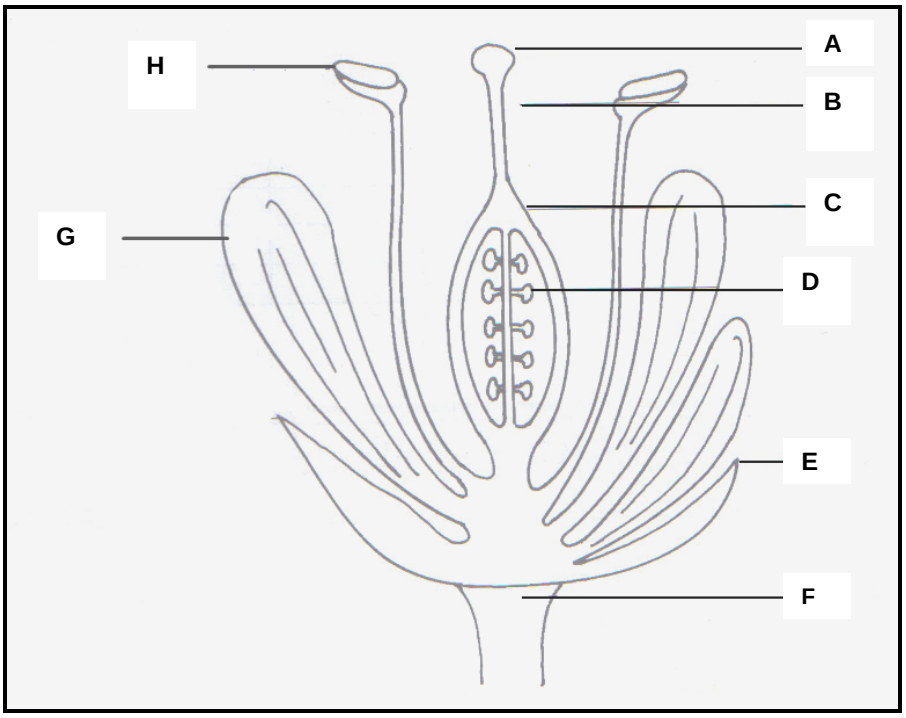
3.3 Besides harbouring pest and diseases, weeds also compete with crops for resources such as nutrients, water, light and space. It is therefore essential to control weeds to ensure high crop yield.

3.3.1 Name TWO major weed control measures. (2)

3.3.2 Identify any TWO principles on which integrated pest control is based. (2)

3.4 Sexual reproduction in plants involves production of flowers and seeds which are eventually used for propagation.

The diagram below shows the longitudinal section of a dicotyledonous flower. Answer the questions based on the diagram.



3.4.1 Write down a combined term for parts A, B, C and D. (1)

3.4.2 Indicate the letter which refers to the specific site where fusion of the male and female gametes takes place. (1)

3.4.3 Assume the androecium of the above flower was completely removed before maturity, but pollination and fertilisation took place. What type of pollination will take place? (1)

3.4.4 Describe the phenomenon of double fertilisation in such flowers. (4)

3.5 Lack of rainfall, deforestation, over-cultivation and numerous other factors are globally contributing to a shortage of water for agricultural purposes.

Name THREE effects a shortage of water will have on plant physiology and crop production globally. (3)

3.6 Case study

A boarding school has a farmland of 180 hectares. About 120 hectares of the land is used to produce vegetables for the market. Nearly 30 hectares of the land is swampy and cannot be used for cultivation.

A few years ago the local community negotiated with the school and used the rest of the land (about 30 hectares) to plant wattle and gum trees. The trees now cover most of the land right up to the banks of the stream that flows onto the school farm.

Before the trees were planted, the land was grassland that was grazed by cattle. There were also many bucks and guinea fowls on the grassland, but now they have disappeared from the area.

Traditional healers used to visit the area to collect 'muthi' plants. Besides, people used to harvest thatch grass from the area in winter. Unfortunately, however, the grass and 'muthi' plants are all gone now.

The stream that used to flow on the school farm has now dried up because of the wattle and gum plantation. This has left the school with no source of water for irrigation of the vegetable field.

Though planting of the wattle and gum trees had some benefits for the community, it also had a negative impact on the vegetation, water resources and wildlife of the area.

3.6.1 Suggest a way to reach the underground water and indicate how it could be moved to serve as a source of irrigation on the vegetable field. (2)

3.6.2 Which plant mentioned in the case study has medicinal value? Name the group of people that use these plants. (2)

3.6.3 Indicate the plant mentioned in the case study which was used to provide shelter for the indigenous people. Give a reason for your answer. (2)

3.6.4 Name ONE negative effect that the wattle and gum trees (invader plants) in the case study had on the vegetable field. (1)

[35]

Start this question on a NEW page.

QUESTION 4

4.1 Investigations on a farm in your area was done by a soil scientist. The report below was made at a later stage and made available to the community head.

	SOIL PROFILE FORM
Location	135 Sisulu Park
Owner	John Martins
Size	98 hectares
Profile number	00187
Topsoil	Vertic A-horizon
Sub-soil	Soft plinthic B-horizon
Soil colour	Dark
Soil structure	Blocky
Organic matter content	1%

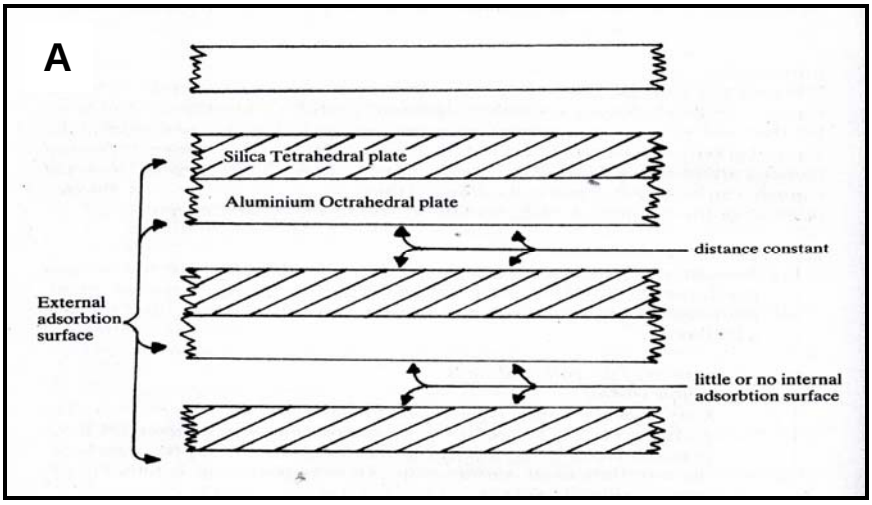
4.1.1 Name the TWO master horizons mentioned in this report. (2)

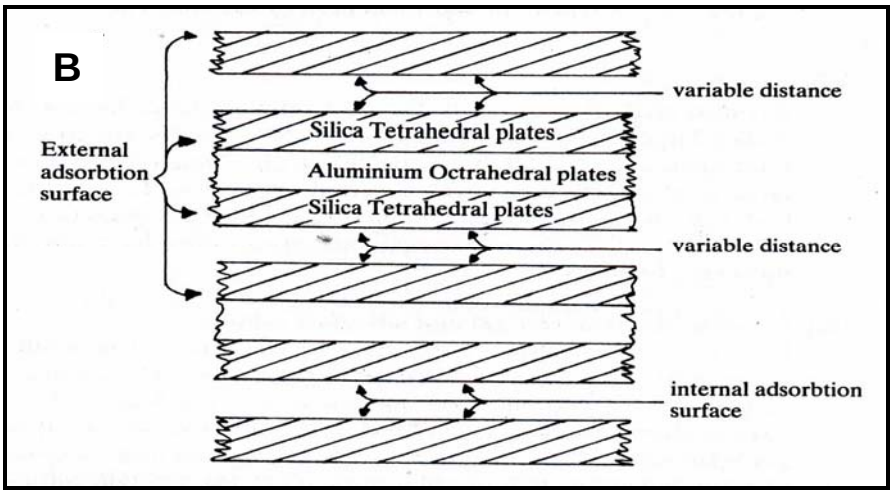
4.1.2 Though the soil colour is dark, the dark colour is not due to the organic matter content. Justify this statement by reffering to other possible causes for the dark colour. (2)

4.2 Ammonification, denitrification and nitrification are stages in the nitrogen cycle. The cycle involves the conversion of nitrogen compounds, particularly proteins in the soil by soil microbes.

Indicate the end product of EACH of the stages of the nitrogen cycle mentioned above. (3)

4.3 The two major forms of soil colloidal matter are humus and clay. The silicate clay minerals are classified as either 1:1 or 2:1, depending on the arrangement and sequence of the silica tetrahedral and aluminium octahedral plates, as shown in the diagrams below.





4.3.1 Deduce which type of clay mineral (A or B) has a higher cation adsorption capacity and give a specific example of it. (2)

4.3.2 The 1:1 clay minerals are less sticky when wet and also do not crack when dry. Name TWO uses of these clays, apart from the use as a growth medium, which are agriculturally related. (2)

4.3.3 Discuss how the presence of the 2:1 clay minerals will influence the availability of cations (nutrients) in the soil. (3)

4.4 About 14 million people in South Africa do not always have enough food to eat. In about 20% of these people, the percentage of children who are too small for their age is approximately 40%. This situation has been worsened by using good arable lands for the cultivation of bio-fuel crops.

A greater proportion of them live in rural areas as subsistence farmers. These farmers use indigenous farming methods where production systems are not adapted to scientific methods and farming is rain-fed.

4.4.1 Name TWO examples of crops that are cultivated as bio-fuels. (2)

4.4.2 Critically discuss TWO ways through which agricultural output among the rural farming community can be improved. (2)

4.5 The data below represents lettuce production by a farmer alternating different types of inorganic fertilisers. The fertiliser application was as follows:

Limestone ammonium nitrate: during week 1 to 4
Raw phosphate: during week 5 to 7
Urea: during week 8 to 12

WEEK	AVERAGE HEIGHT OF PLANTS (mm)	FERTILISER APPLIED
1	2,6	LAN
2	4,5	
3	6,3	
4	8,2	
5	8,4	Raw phosphate
6	8,5	
7	8,5	
8	8,6	Urea
9	10,5	
10	12,8	
11	14,7	
12	16,3	

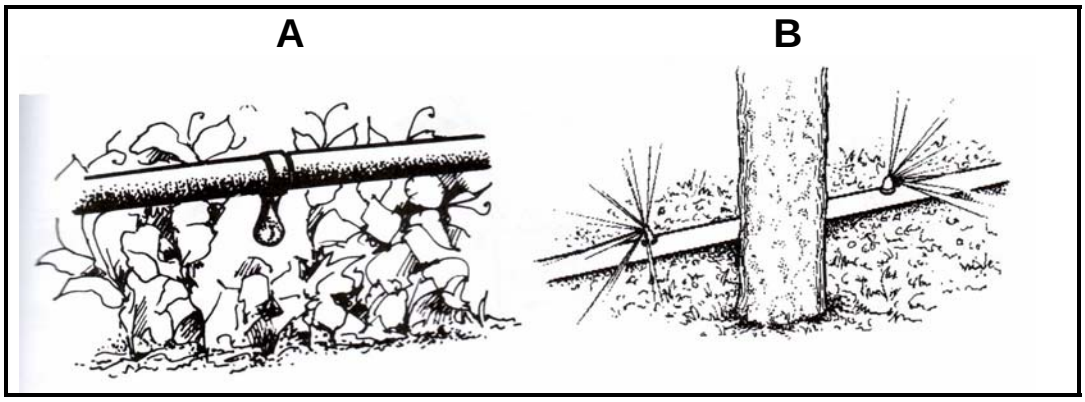
4.5.1 Name TWO fertilisers in the data which are suitable for lettuce. (2)

4.5.2 Identify the nutrient present in the fertilisers mentioned in QUESTION 4.5.1 which made the lettuce plants grow faster. (1)

4.6 A bag of fertiliser mixture 2:3:2 (28) has a mass of 100 kg. A farmer wants to apply 42 kg of phosphorus on 3 hectares (14 kg of phosphorus per hectare) of land. How many bags of the fertiliser mixture will be required? (5)

4.7 It has been established through research that the incorporation of ginger and garlic in the diets of humans boost their immune systems a great deal. You see the entrepreneurial opportunity to plant these crops on a piece of land close to your home. Rewrite the name of each plant and next it to the specific method of propagation you would use. (2)

4.8 The following diagrams represent different forms of micro-irrigation:

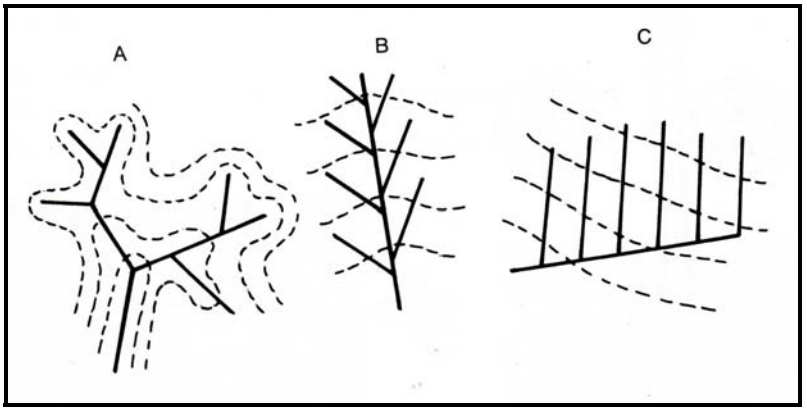


Identify the type of micro-irrigation most suited for:

4.8.1 Plum trees with a wide and shallow root system on very sandy soil (1)

4.8.2 A vineyard that grows on clay soil with little water available for irrigation (1)

4.9 The following diagrams illustrate the lay-out of three different types of drainage systems commonly used:

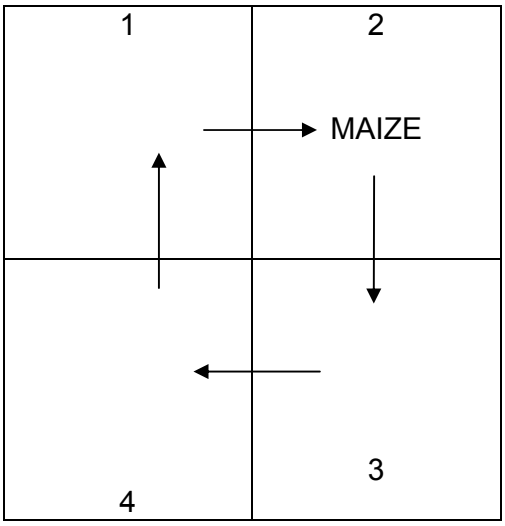


Deduce from the systems which are labelled A – C the one that would be the most suitable to use on a sports field at a school (for example a soccer field). Give a valid reason for your answer. (2)

4.10 A farmer practised monoculture for many years and noticed a gradual decline in yield. After contacting an Agricultural Extension Officer about the problem, the farmer was advised to engage in crop rotation to restore and utilise the fertility of the soil using the following crops: sweet potato, groundnut (peanut), beans and maize.

Design a crop rotational programme by re-drawing the following grid and inserting in the appropriate crops.

HINT: There is a health risk for plants that belong to the peanut (groundnut) family to be planted in succession.



(3)
[35]

TOTAL SECTION B: 105

GRAND TOTAL: 150

ANSWER SHEET FOR SECTION A

NAME: _____

QUESTION 1.1

1.1.1	A	B	C	D
1.1.2	A	B	C	D
1.1.3	A	B	C	D
1.1.4	A	B	C	D
1.1.5	A	B	C	D
1.1.6	A	B	C	D
1.1.7	A	B	C	D
1.1.8	A	B	C	D
1.1.9	A	B	C	D
1.1.10	A	B	C	D

(10 x 2) (20)

QUESTION 1.2

	ONLY A	**ONLY B**	**A AND B**	**NONE**
1.2.1	A	B	C	D
1.2.2	A	B	C	D
1.2.3	A	B	C	D
1.2.4	A	B	C	D
1.2.5	A	B	C	D

(5 x 2) (10)

QUESTION 1.3

1.3.1 _____

1.3.2 _____

1.3.3 _____

1.3.4 _____

1.3.5 _____

(5 x 2) (10)

QUESTION 1.4

1.4.1 _____

1.4.2 _____

1.4.3 _____

1.4.4 _____

1.4.5 _____

(5 x 1) (5)

TOTAL SECTION A: 45