education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

AGRICULTURAL SCIENCES P1

NOVEMBER 2008

MARKS: 150

TIME: 2 hours

This question paper consists of 17 pages and a 1-page answer sheet.

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. SECTION A (QUESTION 1) must be answered on the attached ANSWER SHEET.
3. SECTION B (QUESTIONS 2 to 4) must be answered in the ANSWER BOOK.
4. Start each question in SECTION B on a NEW page.
5. Read the questions carefully and make sure that you answer only what is asked.
6. Number the answers correctly according to the numbering system used in this question paper.
7. 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. NO marks will be awarded if more than one cross (X) appears for an answer.

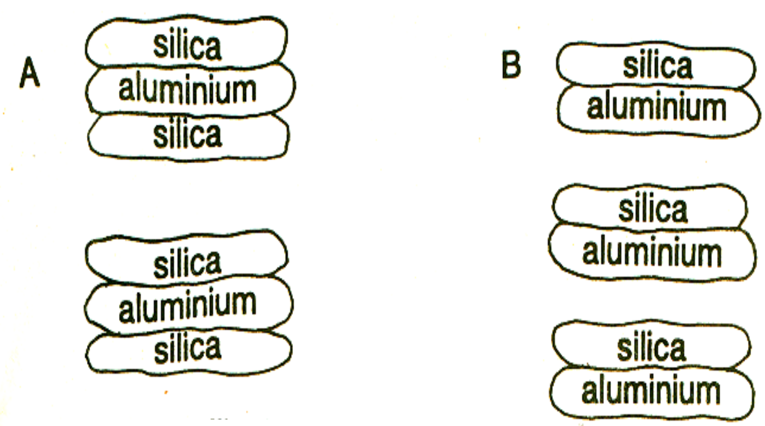
1.1.1 The upward movement of water from the soil water table through micropores takes place due to …

A adhesion forces.
B capillarity.
C cohesion forces.
D root pressure.

1.1.2 A soil containing iron in ferric form has …

A no oxygen.
B a yellow colour.
C enough oxygen.
D a large quantity of calcium.

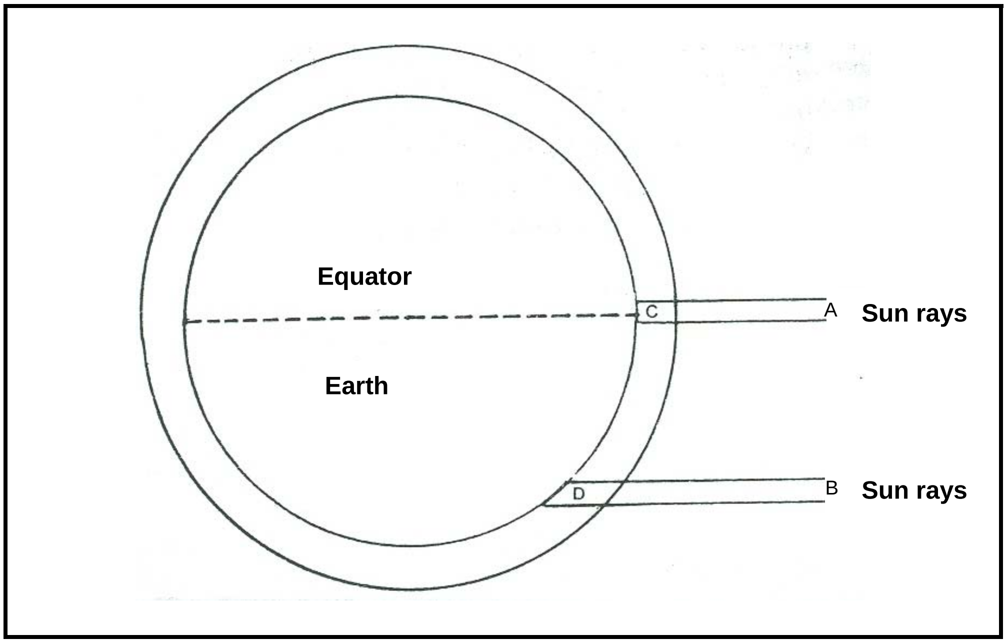
1.1.3 The diagrams below represent two different clay minerals marked A and B.



Which ONE of the following statements with regard to the above diagrams is TRUE?

A Clay mineral A has a higher cation adsorption capacity (CAC) value than clay mineral B.
B Clay mineral A holds the platelets stronger than clay mineral B.
C Clay mineral A has a lower CAC value than clay mineral B.
D Clay A is found more often in older soils and clay B is found more often in younger soils.

1.1.4 The following diagram illustrates two equal bundles of radiation from the sun reaching the earth at different positions.



Choose the statement below that best describes the difference in soil temperature due to the degree of latitude.

A C is warmer than D, because the sun rays move through a relatively smaller volume of atmosphere (air particles).
B D is warmer than C because it is further away from the equator.
C The bundle of sun rays at A strikes the earth over a larger surface area.
D D is warmer than C because more sun rays are reflected and dispersed.

1.1.5 If the cost of a ton of LAN (28%) is R868, then the unit price will be …

A R11,00.
B R21,00.
C R31,00.
D R41,00.

1.1.6 Genetic engineering and genetically modified organisms (GMO) are transforming new breeds of crops for the agricultural industry. ONE of the following statements is NOT associated with GMO crops:

A Most GMO crops render higher yield than conventional crops.
B Many crops that have been genetically modified are more pest resistant.
C Crops that have been genetically modified hold a health risk mostly because of a lack of long-term research into these crops.
D Most of the poorer countries are world leaders in the development of GMO technology.

1.1.7 At a recent Agricultural Expo a patent for a unique small plough was exhibited. It can be used to till soil by a pushing action from the operator. This plough was developed from knowledge gained from primitive ploughs used by indigenous people. This plough has commercial value because it …

A can be used by a commercial farmer who plants large areas.
B can be used by a researcher who investigates tillage practices for deep-rooted crops.
C can be used by a subsistence or small farmer for the tillage of small pieces of land.
D is a local patent, developed and built in South Africa.

1.1.8 The main aim of an integrated pest-control programme is to …

A use chemicals as the only way to control pests and diseases on crops.
B restrict the use of chemicals in a crop-protection programme to the minimum.
C use biological control measures as the only way to control pests on crops.
D ignore pest damage and the yield decrease on crops.

1.1.9 … is a factor that determines the spacing of drainage pipes in a pipe drainage system.

A The slope of the soil
B Permeability of soil
C Soil colour
D The run-off rate

1.1.10 The artificial removal of excess free water from the soil surface and root zone of crops is called …

A drainage.
B seepage.
C evaporation.
D transpiration. (10 x 2) (20)

1.2 Choose a word/term from COLUMN B that matches a description in COLUMN A. Write only the letter (A – M) next to the question number (1.2.1 – 1.2.5) on the attached ANSWER SHEET, for example 1.2.6 N.

COLUMN A		COLUMN B	
1.2.1	A process where new compounds are formed during decomposition	A	mineralisation
		B	maize stalk borer
1.2.2	That quantity of water that is held at a moisture tension between field water capacity and wilting point	C	penetro-meter
		D	dead water
1.2.3	A pest that mainly damages the root system of crops	E	humification
1.2.4	The leaves of a plant that show the symptoms of a nitrogen deficiency first	F	accessible water
		G	eelworm
1.2.5	Equipment used to assist the crop farmer in irrigation scheduling	H	cutworm
		I	older leaves
		J	microjets
		K	wilting point
		L	younger leaves
		M	evaporation pan

(5 x 2) (10)

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

1.3.1 The soil water content where plants do not get enough water for their transpiration needs but recover during the night

1.3.2 The term that describes the attraction of cations to the negative surface of clay colloids

1.3.3 The joining of the stem of one plant to the buds of another enabling them to grow together as one

1.3.4 The type of weed control done by rural women using a hoe to clean their maize fields around their homesteads

1.3.5 A system of agricultural production that involves the use of advanced technology including computers and satellite images to optimise farming operations (5 x 2) (10)

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

1.4.1 When <u>sodium</u> is the predominant cation, the soil will be acidic.

1.4.2 <u>Autotrophic</u> fungi in the soil refer to fungi which cannot produce their own food.

1.4.3 <u>Rhizomes</u> are stems that grow just below the soil surface and form new plants along their nodes or joints.

1.4.4 Insects that are responsible for the transmission of viral diseases in plants are called <u>pathogens.</u>

1.4.5 <u>Permaculture</u> is a system of crop production in a controlled environment without using soil as a growth medium. (5 x 1) (5)

TOTAL SECTION A: 45

SECTION B

START THIS QUESTION ON A NEW PAGE.

QUESTION 2

2.1 Saline soils contain high levels of soluble salts. A soluble salt refers to a salt that readily dissolves in water. Some of these salts occur naturally from minerals in the rocks that have undergone weathering, some from solutes in irrigation water and some from fertilisation. Salts accumulate in soils mainly in areas with a warm climate and low rainfall. In hot, dry conditions evaporation rates are very high and it leads to capillary rise. The salt crystals form a white crust on the soil surface.

The pictures below illustrate the white crust that forms due to high levels of soluble salts.

2.1.1 Explain the meaning of *capillary rise* as mentioned above. (2)

2.1.2 Describe THREE conditions that may lead to the formation of white-brack conditions by referring to the information and pictures above. (3)

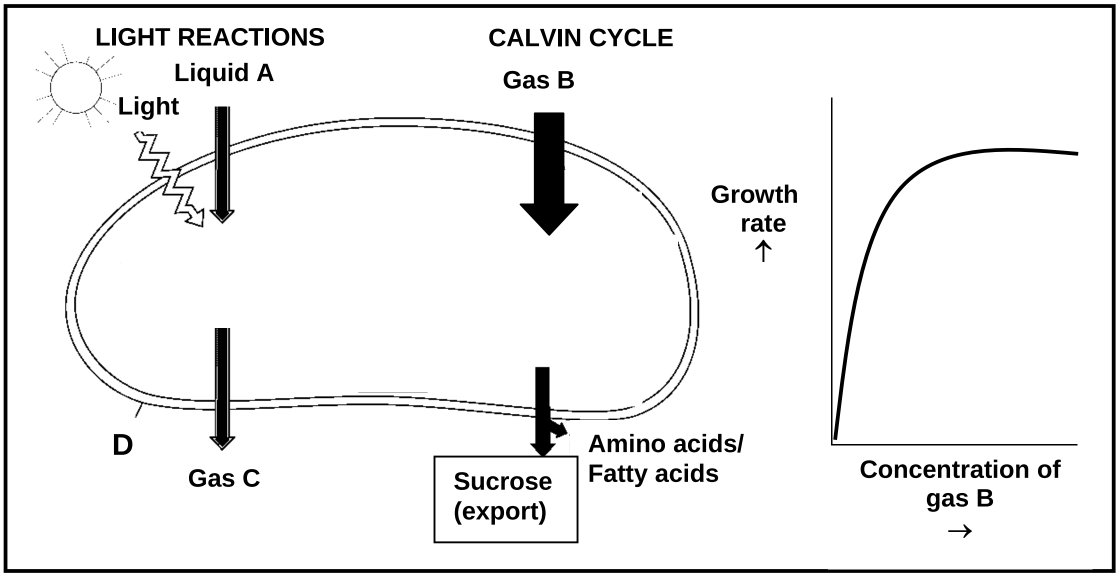
2.1.3 Using the pictures, state TWO disadvantages of white-brack conditions on crop production. (2)

2.1.4 Explain how a farmer can prevent or control the situation as illustrated in the pictures. (4)

2.1.5 Name a fertiliser that is used mainly to correct a high level of sodium in the soil. (1)

2.1.6 Draw a simple schematic representation of the exchange reaction that takes place when the fertiliser mentioned in QUESTION 2.1.5 is used on that soil. (2)

2.2 The schematic representation below illustrates a process that occurs in some of the cells of a plant.



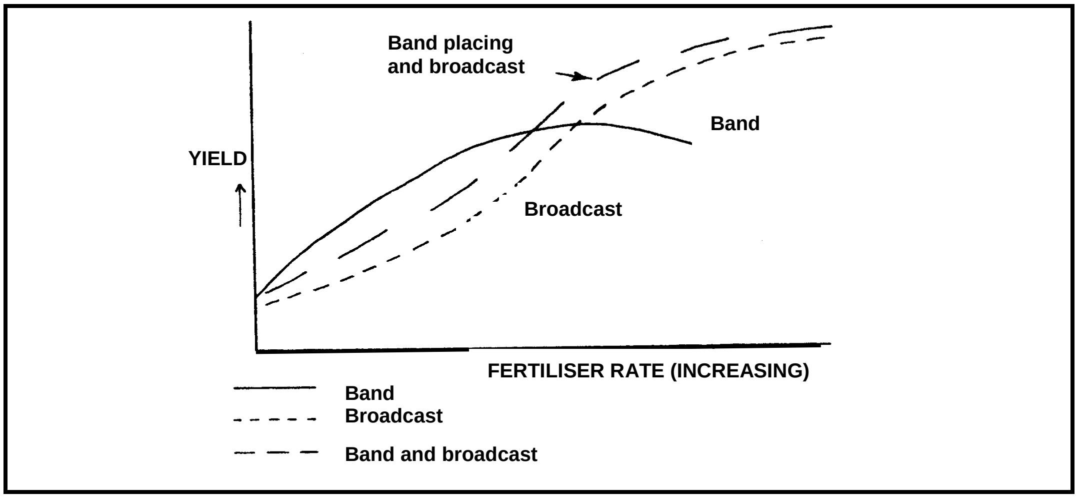
2.2.1 State the process that is illustrated in the schematic representation. (1)

2.2.2 Name the labels indicated by liquid A, gas B and gas C in the schematic representation. (3)

2.2.3 Name the organelle labelled D in the above representation. (1)

2.2.4 Discuss the growth rate of plants at different concentration levels of gas B. (2)

2.3 The graph below represents the broadcasting of fertilisers compared to the band placing of fertilisers at different fertiliser rates.



2.3.1 Briefly explain the practice of broadcasting a fertiliser. (2)

2.3.2 State the variable against which the fertiliser rate is compared in the graph for band placing and broadcasting of fertilisers. (1)

2.3.3 Name a soil condition where the band placing of fertilisers would be more suitable than the broadcasting of fertilisers. Explain your answer. (2)

2.3.4 With reference to the graph, compare the band placing of fertilisers to the broadcasting of fertilisers. (2)

2.4 Read the following passage about no-till and answer the questions that follow.

> No-till practices in crop production have taken root all around the world, transforming dust bowls into productive land. Crop production is made practical and economical in areas that were formerly useless for conventional tillage. No-till is getting a lot of publicity as a cropping system for field crops but for some reason it's not considered for vegetables. Bill Kerr uses no-till to grow magnificent vegetables that are sweeter, with a lot less cost and effort and a multitude of advantages.
>
> [Source: *Farmer's Weekly,* 31 August 2007]

2.4.1 State the difference between the above-mentioned tillage practice and conventional tillage practices. (2)

2.4.2 Convince local vegetable growers in your area to adopt this tillage practice by indicating at least ONE advantage of using this tillage practice with regard to the following:

(a) Economic
(b) Crop (2)

2.5 Livestock enterprises are not the only agricultural enterprises that impact on the natural vegetation. List THREE other enterprises that have greater impact on the natural vegetation. (3)
[35]

START THIS QUESTION ON A NEW PAGE.

QUESTION 3

3.1 A soil scientist gathered the data below. It represents part of a soil profile form (data recording sheet) that was used while he was doing some field work.

Sonto Soil Surveyance: Soil profile form

Location: 113B (Mpumalanga)
Owner: Mr P Naidoo
Size: 560 ha
Profile number: 0023

Top soil: Vertic A horizon
- A horizon with a high clay content and a predominance of smectic clay minerals. Consistency is highly plastic when moist and sticky when wet. Plasticity index is greater than 20.

Subsoil: Red apedal B horizon
- Plasticity index is greater than 32.

Soil colour: Dark red (YR 5)
Subsoil: (25% of farm consists of a yellow-brown apedal B)
Soil structure: No evidence of structure formation

3.1.1 Name THREE different factors that determine the development of a homogenous colour (red) in soil. (3)

3.1.2 Describe at least FOUR interpretations that could be made from the colour of the soil above. (4)

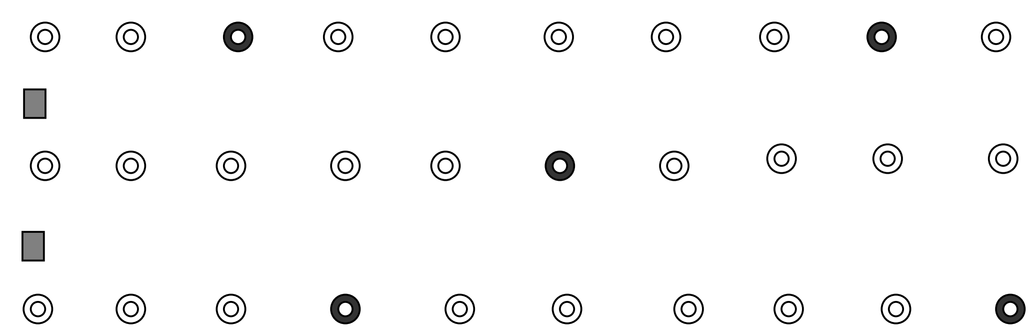
3.1.3 Explain why the clay % in the subsoil increases. (2)

3.1.4 The structural development of the soil is very poor. Name TWO ways to improve the structure. (2)

3.1.5 Use the data supplied above and state measures a farmer has to take with regard to the following:

(a) Fertilisation (1)
(b) Irrigation (2)

3.2 A small fruit farmer wants to plant an orchard of plum trees. He learned that the process of cross-pollination is essential for effective pollination and fruit setting of plum trees. He consults with many experts and other farmers in the same area and decides that the long-term marketing prospects for a cultivar A will be the most secure. He also aims to plant a cultivar B that will not be planted for fruit production (other purpose). He then draws the following sketch plan of his orchard:



Spacing of trees in the rows: 2,4 m
Spacing of trees between the rows: 4 m

KEY:

Trees representing cultivar A: ◎

Trees representing cultivar B: ◉

Beehives: ■

3.2.1 Give a possible reason for the inclusion of cultivar B in this orchard. (1)

3.2.2 Justify the even distribution or placement of the cultivar B trees in this orchard. (1)

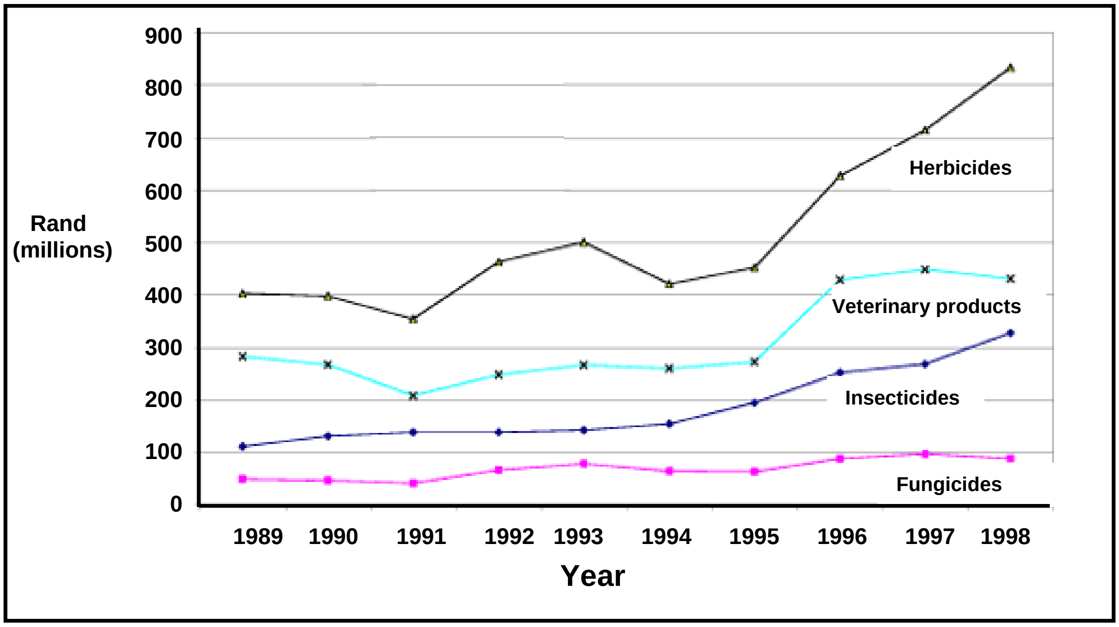
3.2.3 Give TWO possible reasons for placing beehives in this orchard. (2)

3.2.4 Give a reason why the spacing between rows is larger than the spacing in the rows. (2)

3.2.5 State a natural growth process in the plant that is influenced by the spacing of the individual plants of a crop. (2)

3.2.6 Apart from spacing, which other TWO measures could this small farmer consider for improvement of the natural process mentioned in QUESTION 3.2.5? (2)

3.3 The following graph shows expenditure on insecticides, fungicides and herbicides (including veterinary products) in a region of the world where modern agriculture and mechanisation are practised. From 1995 many farmers decided to minimise traffic in their fields and this has led to fewer farmers using mechanical methods of weed control.



3.3.1 Describe the difference between a *fungicide* and a *herbicide*. (2)

3.3.2 Indicate the farm chemical that had the biggest increase in expenditure from 1995 to 1998. Give a possible reason for this tendency. (2)

3.4 You have recently started a soil surveyance business. Design a page which will market your service. Use the following headings:

3.4.1 Aim of the survey (1)

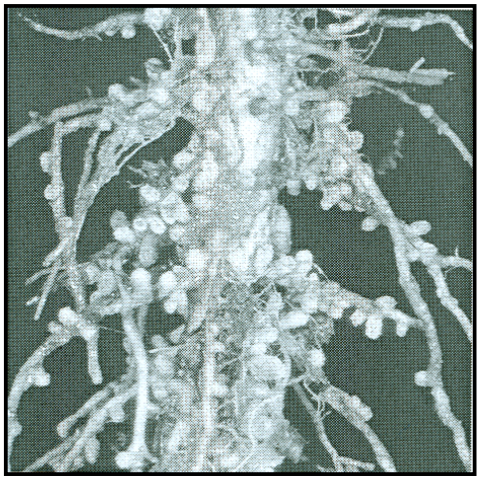
3.4.2 SIX steps taken during the surveying process (6)

[35]

START THIS QUESTION ON A NEW PAGE.

QUESTION 4

4.1 The photograph below indicates soil bacteria that play an important role with regard to the nitrogen balance in soil.



4.1.1 Name the type of bacteria that has formed inside the root nodules. (1)

4.1.2 Give TWO examples of plants where the relationship illustrated above can be found. (2)

4.1.3 State and describe the type of symbiosis that exists between the bacteria and the roots of the above plant. (2)

4.1.4 In your own words, summarise the process that takes place in the root nodules. (4)

4.2 A group of Agricultural Sciences learners decided to do a unique project for their formal research task. Their topic was on the impact of agricultural practices on soil organisms.

The group identified three different locations on the school grounds:

Location A: A rose garden at the entrance to the school
Location B: A patch of grass behind a classroom
Location C: A patch of grass next to the hockey fields

They dug out a square metre of soil with a spade and garden fork and carefully counted all the earthworms. This was done on four different occasions during the first part of the year.

During their investigation they were given the following information about the different locations they were using:

All three locations received basically similar rainfall and irrigation. The soil in location A was often overturned and worked with a garden fork by the school gardener. He wanted to remove weeds to create a neat garden and often applied chemicals to kill pests on the roses. Location B was never raked, but the grass was cut and left on the soil surface to decompose and become part of the soil. Location C, next to the hockey fields, was often cut and raked.

A part of their results was summarised in the following table:

Date	Number of earthworms		
	Location A	**Location B**	**Location C**
Date 1	2	10	4
Date 2	1	15	6
Date 3	3	12	2
Date 4	0	18	5

4.2.1 Calculate the average number of earthworms for location B (with the highest average) and location A (with the lowest average). Write down only the answers. (2)

4.2.2 The earthworms were used as an indicator for the total number of organisms in the soil. Explain the differences in the number of organisms in the soil by referring to the data produced by the group. (2)

4.2.3 This group wants to make a recommendation to the school gardener based on their results. State ONE such possible recommendation that is based on their results. (1)

4.3 A crop farmer has to plan his fertilisation programme. Assist this farmer by using the following data:

The following fertilisers are available in the storeroom of this farmer:

- Rock phosphate
- Superphosphate
- Dolomitic lime
- Potassium chloride
- 3:2:5 (35)
- Urea

On this farm a fertilisation trial revealed the following optimum nitrogen applications per year for wheat production:

Rainfall (mm)	**N – recommendation per season (kg/ha)**
350	75
400	85
450	100
500	110
550	120
600	130
650	140

4.3.1 Recommend a suitable fertiliser available in the storeroom of this farmer for each of the following situations. Give a reason for your answer in each case.

(a) A nitrogen fertiliser that can be applied through a centre-pivot irrigation system. (2)

(b) A phosphate fertiliser that is normally applied to very acidic soil. (2)

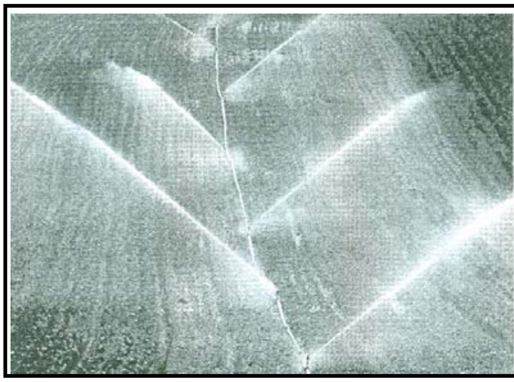
(c) A plant analysis reveals low levels of magnesium in relation to calcium in plants that are growing in an acidic soil. (2)

4.3.2 State the required nitrogen application needed in kg/ha for a 400 mm and a 550 mm rainfall scenario. Give TWO reasons for the difference in values for these rainfall scenarios. (4)

4.3.3 Nitrogen levels in the soil are not mentioned in a soil analysis report. Give a reason for not adding the nitrogen levels in this report. (1)

4.3.4 Calculate the percentage of nitrogen (N) in the fertiliser mixture (in the storeroom). Show ALL your calculations. (3)

4.4 The following pictures illustrate two different irrigation systems, marked A and B. The table that follows represents the efficiency of water use ratings measured for the different irrigation systems.



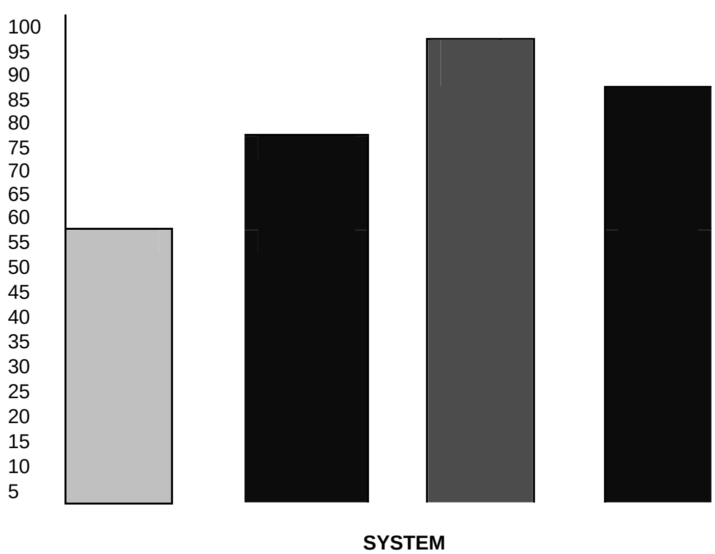
Irrigation system A **Irrigation system B**

System	Efficiency (%)
Standard sprinkler	55 – 65
Mechanical sprinkler	75 – 84
Drip	93 – 95
Micro	85 – 90

4.4.1 Name each of these systems, marked A and B, as illustrated above. (2)

4.4.2 Use the information in the table provided above and redraw the bar graph below. This graph will then be assessed for the following criteria:

- Heading
- Indicators
- Descriptors/Labels
- Neatness, size and proportion



(5)

[35]

TOTAL SECTION B: 105

GRAND TOTAL: 150

ANSWER SHEET

EXAMINATION NUMBER:													

SECTION A

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

1.2.1	
1.2.2	
1.2.3	
1.2.4	
1.2.5	

(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