



Province of the  
**EASTERN CAPE**  
EDUCATION

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**NOVEMBER 2020**

**AGRICULTURAL SCIENCES P1  
EXEMPLAR**

**MARKS: 150**

**TIME: 2½ hours**



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This question paper consists of 14 pages.

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**INSTRUCTIONS AND INFORMATION**

1. Answer ALL the questions in the ANSWER BOOK.
2. Start EACH question on a NEW page.
3. Read ALL the questions correctly and answer only what is asked.
4. Number the answers correctly according to the numbering system used in this question paper.
5. You may use a non- programmable calculator.
6. Show ALL your calculations, including units and formulae, where applicable.
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 write only the letter (A–D) next to the question number (1.1.1–1.1.10) in the ANSWER BOOK. for example, 1.1.11 A.

1.1.1 The subatomic particle of an atom that is neither negatively nor positively charged is a/an ...

- A electron.
- B isotope.
- C neutron.
- D proton.

1.1.2 A propane is an alkane consisting of ... atoms.

- A 2 carbon and 5 hydrogen
- B 4 carbon and 10 hydrogen
- C 1 carbon and 4 hydrogen
- D 3 carbon and 8 hydrogen

1.1.3 The following are the characteristics of a carbon atom.

- (i) Is common in the food we grow and fibre we produce.
- (ii) Can bond with itself to form a long chain.
- (iii) Has six valence electrons.
- (iv) Is found in most pesticides used in the farming industry.

Choose the correct combination

- A (i), (iii), and (iv)
- B (ii), (iii) and (iv)
- C (i), (ii) and (iv)
- D (i), (ii) and (iii)

1.1.4 The soil texture with a diameter between 10,00 – 2,00 mm has ...

- A high permeability and low plasticity.
- B low drainage and aeration.
- C low permeability and high plasticity.
- D high degree of plasticity and high cohesion.

1.1.5 The following is NOT a factor influencing the development of soil structure.

- A Presence of organic matter
- B Activity of earthworms
- C Unchanged soil moisture condition
- D High clay content

1.1.6 The mottled appearance in soil is an indication of the following:

- (i) The reduction of red ferric iron to bluish-grey ferrous iron
- (ii) Many flecks in the subsoil
- (iii) Patches of rust, yellow and grey colours
- (iv) Waterlogging for part of the day

Choose the correct combination

- A (i), (iii) and (iv)
- B (ii), (iii) and (iv)
- C (i), (ii) and (iv)
- D (i), (ii) and (iii)

1.1.7 The movement of liquid in a narrow space against the force of gravity is caused by ... forces.

- A cohesion and adhesion
- B cohesion and gravitational
- C saturation and percolation
- D seepage and adhesion

1.1.8 A hole dug in soil to expose all the horizons is a ...

- A horizon hole.
- B profile hole.
- C pit hole.
- D horizon pit.

1.1.9 A unique vertical succession of diagnostic horizons.

- A Soil series
- B Soil classification
- C Soil profile
- D Soil form

1.1.10 The conversion of nutrients from organic form to inorganic form during decomposition.

- A Ammonification
- B Mineralisation
- C Immobilisation
- D Solubilisation

(10 x 2) (20)

- 1.2 Indicate whether each of the descriptions in COLUMN B applied to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN A Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.2.1–1.2.5) in the ANSWER BOOK, for example 1.2.6 B only.

COLUMN A			COLUMN B
1.2.1	A:	Complex protein	A protein which when hydrolised yields only to amino acids
	B:	Simple protein	
1.2.2	A:	Ethanol	Alcohol formed as a result of fermentation process caused by micro-organisms
	B:	Methanol	
1.2.3	A:	Black colour	Presence of limonite
	B:	Light colour	
1.2.4	A:	Evapocapillarity	Loss of water from the dams and through the stomata in the leaves of plants
	B:	Evapotranspiration	
1.2.5	A:	Gleying conditions	G-horizon
	B:	Signs of reduction	

(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 numbers (1.3.1–1.3.5) in the ANSWER BOOK.

1.3.1 The common name of elements in the periodic table that need only one electron to obtain a full outer shell

1.3.2 The structure in which the outer electron(s) of an atom is/are represented by dots or crosses

1.3.3 A texture in which sand, clay and silt are present in favourable proportions

1.3.4 The gas that reduces oxidation process by diluting oxygen

1.3.5 A very small negatively charged particle that can be suspended in water

(5 x 2) (10)

- 1.4 Change the UNDERLINED word(s) in EACH of the following statements. Write only the answer next to the question numbers (1.4.1–1.4.5) in the ANSWER BOOK.

1.4.1 An anion is formed when an atom loses one or more electron.

1.4.2 Capillary moisture forms a very thin film around soil particles and is held tightly by adhesion forces.

1.4.3 Neutral soils are dominated by aluminium and hydrogen.

1.4.4 Rhizobium is the fungus that forms symbiosis with plant roots helping them to absorb more phosphorus.

1.4.5 Eluviation is the process whereby material from a A-horizon is deposited to a B-horizon.

(5 x 1) (5)

**TOTAL SECTION A: 45**

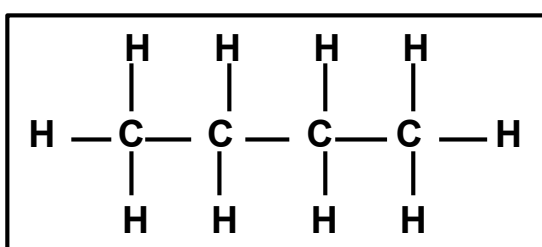
## SECTION B

## QUESTION 2: BASIC AGRICULTURAL CHEMISTRY

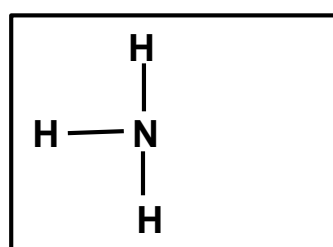
Start this question on a NEW page.

2.1 The diagrams below show the structural formula of different compounds.

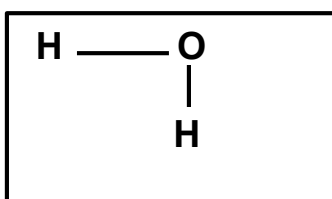
STRUCTURE A



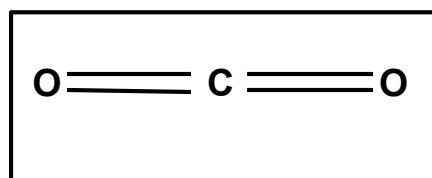
STRUCTURE B



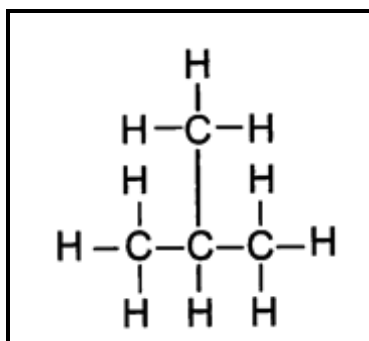
STRUCTURE C



STRUCTURE D

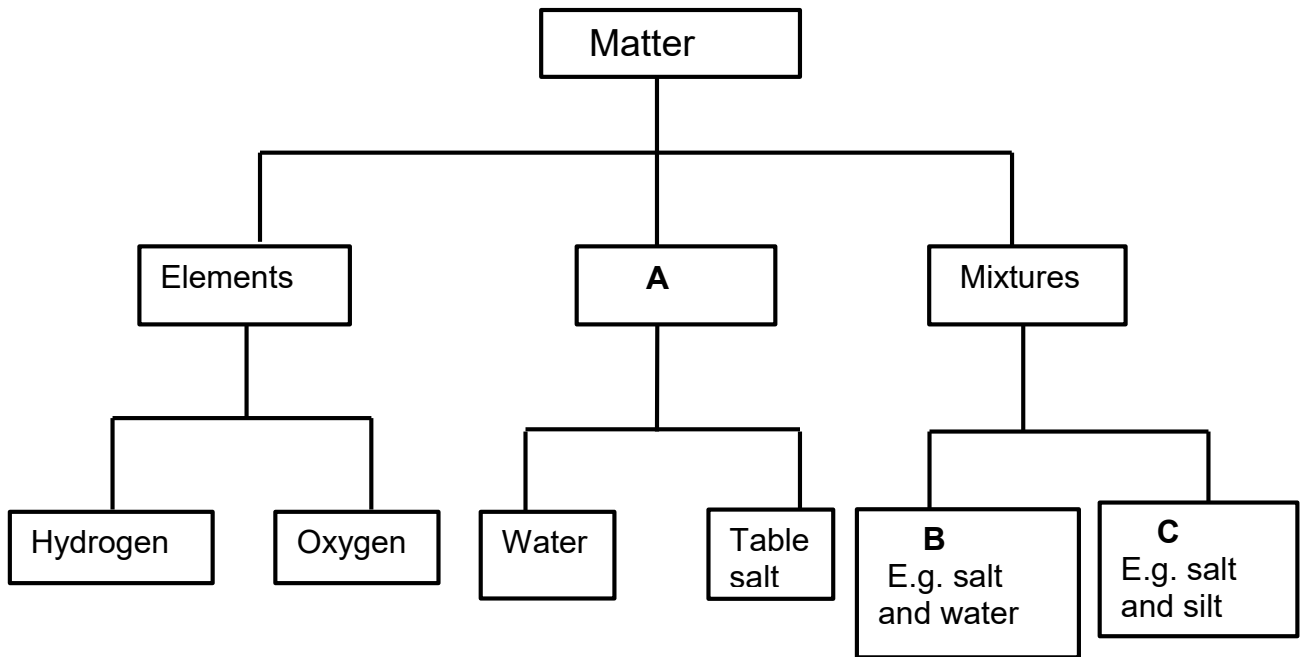


STRUCTURE E



- 2.1.1 Classify the compounds represented by structures **A** and **B** into two categories. (2)
- 2.1.2 Give a reason for your answer in QUESTION 2.1.1 based on their structures. (2)
- 2.1.3 The structures labelled **A** and **E** have the same molecular formula but different structures. Give the name of such compounds. (1)
- 2.1.4 Write the chemical formula of the compound represented by structure **A** (2)
- 2.1.5 Identify the letter of the compound responsible for the following:
- (a) Catalyst in many chemical reactions
- (b) Used as a cleaning product (2)

2.2 Analyse the flow chart below and answer the questions based on it.

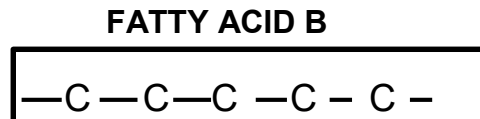
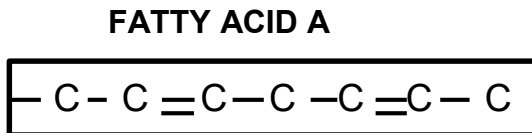


2.2.1 Identify the substances labelled in **A**, **B** and **C**. (3)

2.2.2 Explain the difference between an element and a substance in **A**. (2)

2.2.3 Distinguish between mixtures **B** and **C**. (2)

2.3 The structures below show the bonding of carbon atoms in fatty acids:



2.3.1 Identify the type of fatty acid labelled **A** and **B**. (2)

2.3.2 Indicate the letter representing the fatty acid that matches each of the descriptions below:

- (a) Originates from plants (1)
- (b) Solid at room temperature (1)
- (c) Has a high melting point (1)
- (d) Liquid at room temperature (1)

2.3.3 Name TWO reasons why fats are important in living organisms. (2)

2.4 Below are substances with different pH values.

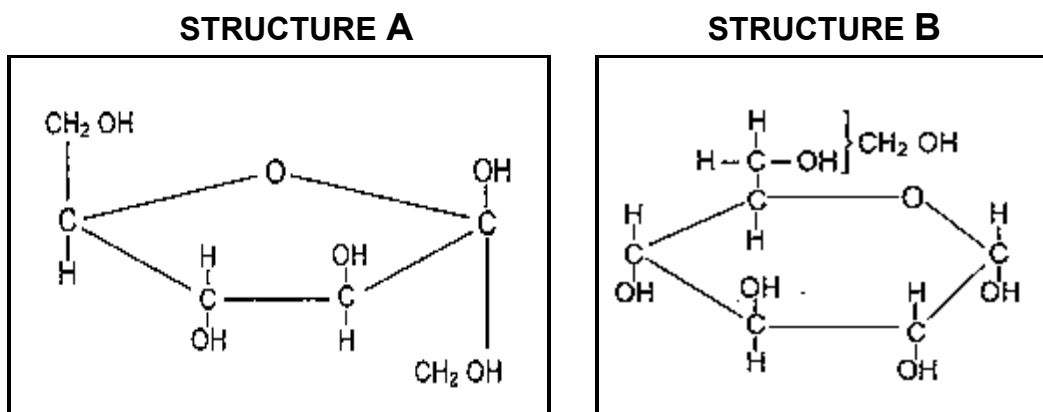
- Baking powder
- Orange juice
- Milk
- Battery acid

2.4.1 Indicate whether each of the substances above is neutral, acidic, strongly acidic, alkaline or strongly alkaline. Write the substance and the pH indicator. (4)

2.4.2 Indicate the substance in QUESTION 2.4 that has a high concentration of the following:

- (a) Hydroxide ion (1)  
 (b) Hydrogen ion (1)

2.5 The structural formula below represents monosaccharides.



2.5.1 Name structure **A** and structure **B**. (2)

2.5.2 Indicate the compound formed when structure **A** and **B** are joined together. (1)

2.5.3 Give TWO elements that are the basic composition of all carbohydrates. (2)

[35]



**QUESTION 3: SOIL SCIENCE**

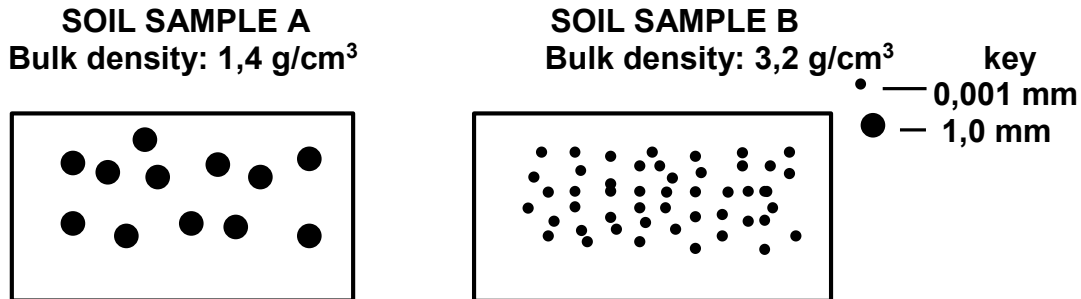
Start this question on a NEW page.

3.1 The illustrations below represent soil samples with different sizes of soil particles and bulk density.

**SOIL SAMPLE A**  
Bulk density:  $1,4 \text{ g/cm}^3$

**SOIL SAMPLE B**  
Bulk density:  $3,2 \text{ g/cm}^3$

key  
● — 0,001 mm  
● — 1,0 mm



3.1.1 Identify the soil sample that matches each of the characteristics below:

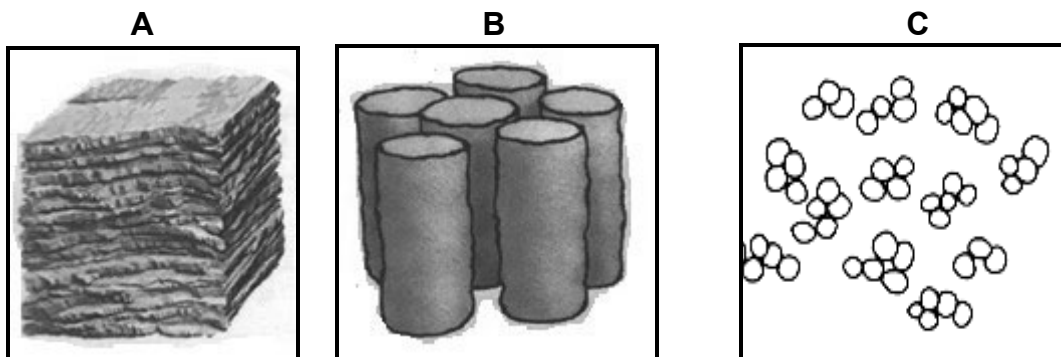
- (a) Difficult to till
  - (b) Low ability to retain moisture and nutrients
  - (c) High cation exchange capacity
  - (d) Erode easily
- (4)

3.1.2 Comment on the pore space of soil sample **B** by referring to its bulk density.

(2)

3.2 The illustrations below show different soil structures based on their shape.

**A** **B** **C**



3.2.1 Identify the soil structures labelled **A**, **B** and **C**.

(3)

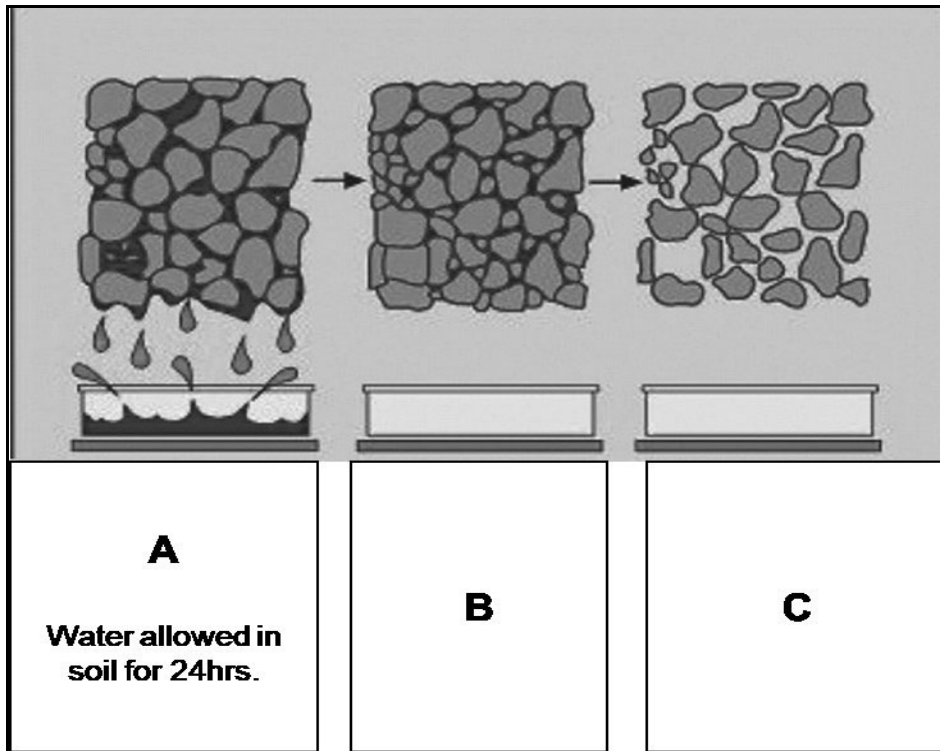
3.2.2 Indicate the letter representing the structure that is:

- (a) Commonly found in clay pan soils. (1)
- (b) Suitable for crop production. (1)

3.2.3 Name TWO malpractices by a farmer that can lead to destruction of the soil structure.

(2)

3.3 Analyse the illustration on soil water below and answer questions that follow.



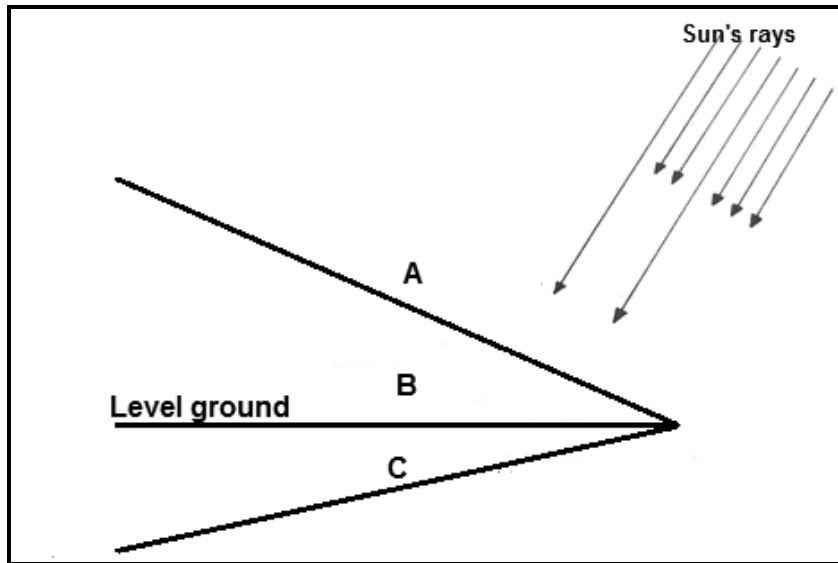
- 3.3.1 Name the appropriate term referring to the illustrations labelled **A** and **B**. (2)
- 3.3.2 Justify with a reason the answer to QUESTION 3.3.1. (2)
- 3.3.3 Explain the plant response when grown in soils in the illustrations labelled **B** and **C**. (2)
- 3.3.4 Differentiate between *temporal* and *permanent wilting points*. (2)
- 3.4 Soil colour is important in agriculture because it indicates the particular characteristics and conditions of the soil.
- 3.4.1 Distinguish between *homogeneous* and *non-homogeneous soil colour*. (2)
- 3.4.2 Name TWO factors that determine the colour of soil. (2)
- 3.5 A soil scientist conducted an experiment to test the influence of soil gas in plants.

EXPERIMENT No.	No. 1	No. 2
Conditions under which seeds are planted on soil	Planted seeds in soil and kept soil waterlogged	Planted seeds in soil with a well-rotted organic matter and watered when needed
RESULTS	No growth occurred	Luxurious growth

- 3.5.1 Indicate the gas that is deficient in experiment No.1. (1)

- 3.5.2 Explain the role that the gas mentioned in QUESTION 3.5.1 could have played if it was not deficient. (1)
- 3.5.3 Name the gas that is high in soil as a result of activities in experiment No 2. (1)
- 3.5.4 Explain the reason for the high amount of gas mentioned in QUESTION 3.5.3. (2)

3.6 The diagram below shows the orientation of land as a factor influencing soil temperature.



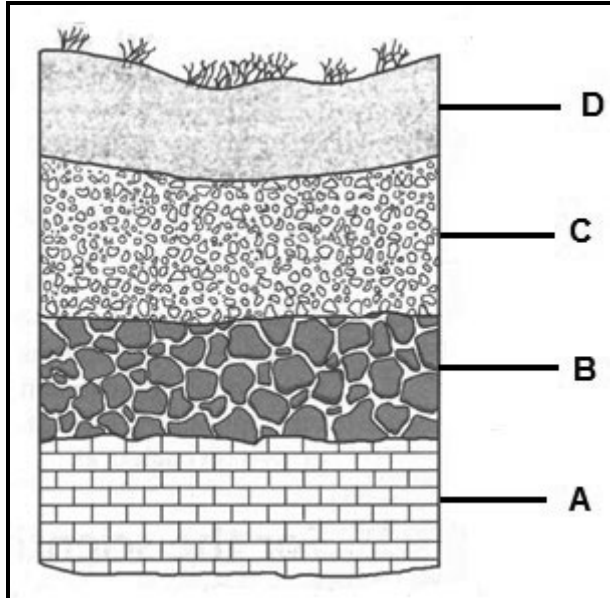
- 3.6.1 Indicate the letter that represents the land where the following occurs:
  - (a) Increased seed germination and germination percentage (1)
  - (b) Retard microbe activity (1)
  - (c) Faster chemical reaction (1)
- 3.6.2 Give TWO methods the farmer can apply to manipulate soil temperature. (2)

**[35]**

**QUESTION 4: SOIL SCIENCE**

Start this question on a NEW page.

4.1 The diagram below shows horizontal layers of a soil.



- 4.1.1 Sketch the profile of the soil with horizontal layers in the diagram above. (2)
- 4.1.2 Indicate the horizon that will be visible if the soil above can be subjected to the following: (1)
- (a) High degree of leaching (1)
  - (b) Very wet conditions (1)
- 4.1.3 Mention TWO diagnostic horizons of the horizon labelled **D**. (2)
- 4.2 Soil classification is the method used by soil scientists to group soil into different classes according to particular characteristics. (3)
- 4.2.1 State THREE reasons why classification of soil is important in agriculture. (3)
- 4.2.2 Name the system which is used in South Africa to classify soil. (1)

4.3 The table below shows the soil pH values and molybdenum availability.

SOIL PH	AVAILABILITY OF MOLYBDENUM (g)
2	0
4	1
6	3
8	4
10	8
12	14

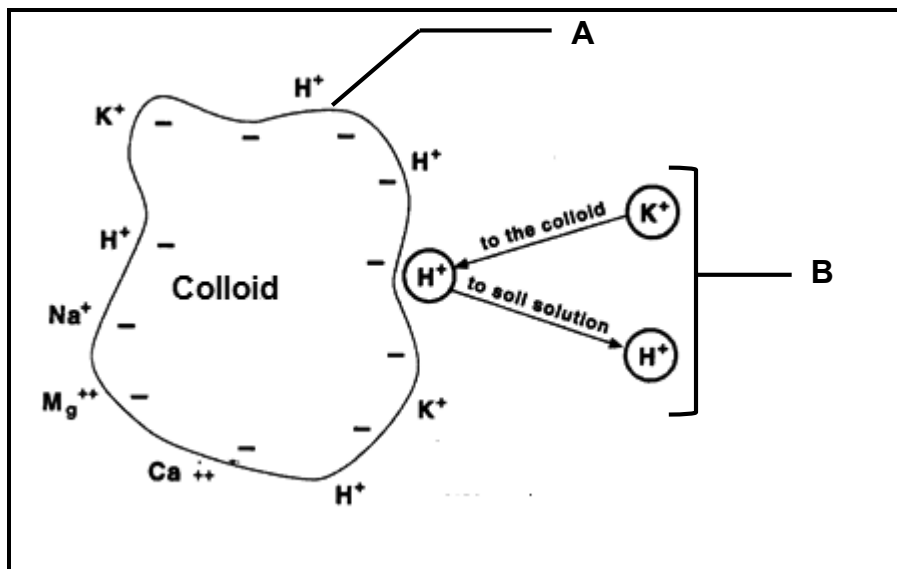
4.3.1 Present the information above in the form of a line graph. (6)

4.3.2 Deduce the influence of acidity and alkalinity on the availability of molybdenum. (2)

4.3.3 Indicate the measures a farmer can take to solve the following problems

- (a) Decreased availability of molybdenum in soils with a pH of between 2 and 4 (1)
- (b) Toxic quantities of molybdenum in soil with a pH of 14 (1)

4.4 The schematic representation below shows cation in soil solution and soil colloid.



4.4.1 Deduce the term that applies to the process occurring in label **A** and **B**. (2)

4.4.2 Provide a reason for the process in QUESTION 4.4.1 **B**. (1)

4.4.3 Indicate the hydrogen cation that can have an effect on plants from the schematic representation above. (1)

- 4.4.4 Name TWO types of colloid in which the processes mentioned in QUESTION 4.4.1 occurs. (2)
- 4.4.5 Differentiate between *sodic* and *saline soils* with regard to the dominant salts. (2)
- 4.5 A group of young farmers interested in organic farming received a donation of worms to use when producing fertilisers.
- 4.5.1 Classify the worms into groups of soil organisms. (1)
- 4.5.2 State TWO conditions that this group should create to ensure survival of these worms. (2)
- 4.5.3 Explain how these worms could assist these farmers. (2)
- 4.6 Name the nutrient cycle that will increase the following in plants:
- (a) Protein content (1)
- (b) Carbohydrate content (1)

**[35]**

**TOTAL SECTION B: 105**  
**GRAND TOTAL: 150**



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**AGRICULTURAL SCIENCES P1  
MARKING GUIDELINE  
EXEMPLAR**

**MARKS: 150**

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This marking guideline consists of 9 pages.

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**SECTION A****QUESTION 1**

- 1.1 1.1.1 C ✓✓  
1.1.2 D ✓✓  
1.1.3 C ✓✓  
1.1.4 A ✓✓  
1.1.5 C ✓✓  
1.1.6 D ✓✓  
1.1.7 A ✓✓  
1.1.8 B ✓✓  
1.1.9 D ✓✓  
1.1.10 B ✓✓ (10 x 2) (20)
- 1.2 1.2.1 B only ✓✓  
1.2.2 A only ✓✓  
1.2.3 None ✓✓  
1.2.4 B only ✓✓  
1.2.5 Both A and B ✓✓ (5 x 2) (10)
- 1.3 1.3.1 Halogen ✓✓  
1.3.2 Lewis structure ✓✓  
1.3.3 Loam ✓✓  
1.3.4 Nitrogen ✓✓  
1.3.5 Colloid ✓✓ (5 x 2) (10)
- 1.4 1.4.1 Cation ✓  
1.4.2 Hygroscopic ✓  
1.4.3 Acid ✓  
1.4.4 Mycorrhiza ✓  
1.4.5 Illuviation ✓ (5 x 1) (5)

**TOTAL SECTION A: 45**



**SECTION B****QUESTION 2: BASIC AGRICULTURAL CHEMISTRY****2.1 Compounds****2.1.1 Classification of compounds**

A – Organic ✓

B – Inorganic ✓

(2)

**2.1.2 Reason**

A – Presence of carbon atom ✓

B – Absence of carbon atom ✓

(2)

**2.1.3 Name of compounds with the same molecular formula but different structure**

Isomers ✓

(1)

**2.1.4 Chemical formula of a compound represented by structure A**•  $C_4H_{10}$  ✓✓**OR**•  $CH_3(CH_2)_2CH_3$  ✓✓

(2)

**2.1.5 Identification of the letter**

(a) C ✓

(b) B ✓

(2)

**2.2 Matter/elements/compounds/mixtures****2.2.1 Identification of substances****A** – Compound ✓**B** – Homogeneous mixture ✓**C** – Heterogeneous mixture ✓

(3)

**2.2.2 Difference between an element and a compound**

Element is a substance that cannot be broken down by chemical means ✓

Compound is a substance formed when two or more elements are chemically combined ✓

(2)

**2.2.3 Distinguishing between homogeneous and heterogeneous mixtures****Homogeneous** – mixture in which the dissolved solute cannot be separated from the solvent by physical means ✓**Heterogeneous** – mixture in which the components can be separated by physical means ✓

(2)

## 2.3 Fatty acids

### 2.3.1 Identification of the fatty acid

A – Unsaturated fatty acid ✓

B – Saturated fatty acid ✓

(2)

### 2.3.2 Indication of the letter representing the fatty acid

(a) Originating from plants – A ✓

(b) Solid at room temperature – B ✓

(c) Has a high melting point – B ✓

(d) Liquid at room temperature – A ✓

(4)

### 2.3.3 TWO importance of fats in living organisms

• Provide a source of stored energy ✓

• Source of insulation and temperature control ✓

• Vital part of membrane structure ✓

• Play a role in the flow of energy in and out of living cells ✓

• Assist in signal transduction ✓

(Any 2)

(2)

## 2.4 pH values

### 2.4.1 Indicating the pH of substances

**Baking powder** – Alkaline ✓

**Orange juice** – Acidic ✓

**Milk** – Neutral ✓

**Battery acid** – Strongly acidic ✓

(4)

### 2.4.2 Indicating the substance with a high concentration of

(a) **Hydroxide ion** – Baking powder ✓

(b) **Hydrogen ion** – Battery acid ✓

(2)

## 2.5 Monosaccharide

### 2.5.1 Names of the structures

A – Fructose ✓

B – Glucose ✓

(2)

### 2.5.2 Indication of the compound formed from fructose and glucose

Sucrose ✓

(1)

### 2.5.3 TWO elements that are basic composition of carbohydrates

• Carbon ✓

• Hydrogen ✓

• Oxygen ✓

(Any 2)

(2)

[35]

**QUESTION 3: SOIL SCIENCE****3.1 Soil texture****3.1.1 Indication of the sample**

- (a) Sample B ✓
- (b) Sample A ✓
- (c) Sample B ✓
- (d) Sample A ✓

(4)

**3.1.2 Commenting on the pore space of soil sample B by referring to bulk density**

Soil sample B has a high bulk density /  $3,2 \text{ g/cm}^3$  ✓ and therefore lower pore space ✓

(2)

**3.2 Soil structure****3.2.1 Identification of the structure**

- A – Platy ✓
- B – Prism-like/columnar/prismatic ✓
- C – Crumb/spheroid ✓

(3)

**3.2.2 Indicating the letter representing the structure**

- (a) A ✓
- (b) C ✓

(2)

**3.2.3 TWO malpractices leading to the destruction of structure**

- Flood irrigation ✓
- Cultivation of soil when it is too dry or wet ✓
- Ploughing and other tilling methods ✓
- Overgrazing / burning / removal of plant material ✓
- Movement of animals and equipment over wet soil ✓
- Irrigation leading to salt accumulation ✓

(Any 2) (2)

**3.3 Soil moisture****3.3.1 Naming the term**

- A – Saturation point ✓
- B – Field water capacity ✓

(2)

**3.3.2 Reason**

- A – Soil is completely filled with water ✓
- B – Amount of water held in soil after saturation and drainage ✓

(2)

**3.3.3 Plant response grown in soils in Container C and D**

- (a) B – Plants will grow optimally ✓
- (b) C – Plants will wither/die ✓

(2)

**3.3.4 Differentiation between *temporal* and *permanent wilting points***

**Temporal wilting** – The point when plants appear wilted only during the hottest part of the day and recover ✓

**Permanent wilting** – Plants do not recover from wilting ✓

(2)

### 3.4 Soil colour

#### 3.4.1 Differentiation between *homogeneous* and *non-homogeneous* soil colour

**Homogeneous** – Single dominant colour in soil ✓

**Non-homogeneous** – Mixture of soil colours ✓ (2)

#### 3.4.2 TWO factors determining the colour of soil

- Presence of water ✓
- Gleying conditions ✓
- Organic material ✓
- Presence of oxides ✓
- Presence of carbonates ✓

(Any 2) (2)

### 3.5 Soil gas

#### 3.5.1 Indication of the gas deficient in experiment 1

Oxygen ✓ (1)

#### 3.5.2 Role the gas could have played if not deficient

Influenced seed germination ✓ (1)

#### 3.5.3 Gas high in soil as a result of activities in experiment 2

Carbon dioxide ✓ (1)

#### 3.5.4 Reason for the high amount of carbon dioxide

Released during respiration ✓ of plant roots and soil micro – organisms ✓ (2)

### 3.6 Soil temperature

#### 3.6.1 Indication of the letter

(a) A ✓

(b) C ✓

(c) A ✓

(3)

#### 3.6.2 TWO methods to manipulate soil temperature

- Irrigation ✓
- Mulching ✓
- Clear plastic covers ✓
- Shading ✓

(Any 2) (2)

[35]

**QUESTION 4: Soil science****4.1 Soil horizons****4.1.1 Sketching the soil profile**
$$\begin{array}{c} \underline{A} \\ \underline{B} \checkmark \checkmark \\ \underline{C} \\ \underline{R} \end{array}$$

(2)

**4.1.2 Indication of the horizon**

(a) E ✓

(b) G ✓

(2)

**4.1.3 TWO diagnostic horizons of A horizon**

- Humic ✓
- Vertic ✓
- Melanic ✓
- Orthic ✓

(Any 2) (2)

**4.2 Soil classification****4.2.1 THREE reasons for classification of soil**

- Optimal utilisation of country's natural resources ✓
- Scientific planning of farm ✓
- Determining the crop production potential of the soil ✓
- Improved soil science communication ✓
- Development of new regions ✓
- Valuation of soils ✓

(Any 3) (3)

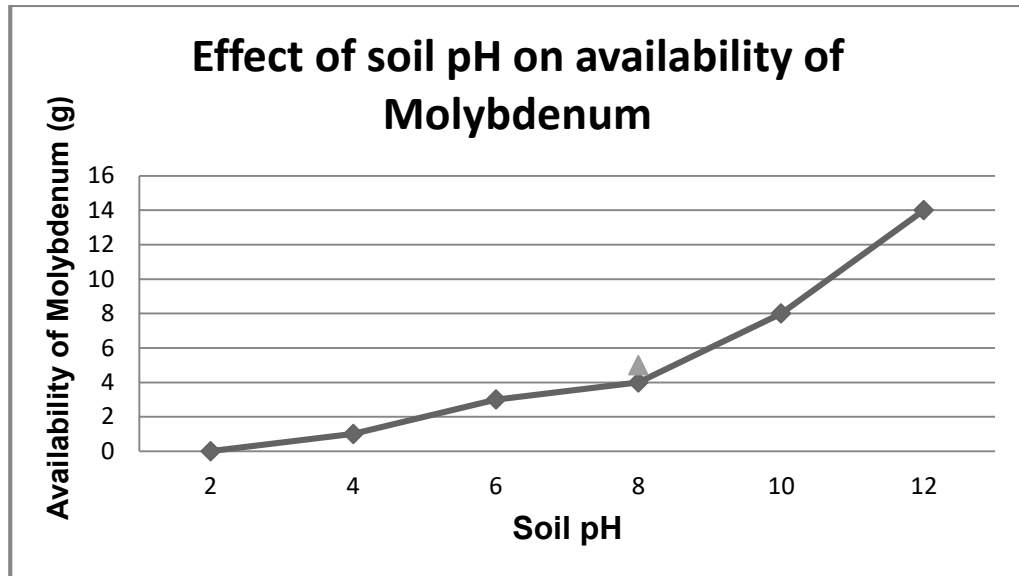
**4.2.2 System used in South Africa to classify soil**

Binomial system ✓

(1)

### 4.3 Soil pH

#### 4.3.1 Line graph



#### Criteria/rubric/marketing guideline

- Correct heading ✓
  - X-axis : Correctly calibrated and labelled (Soil pH) ✓
  - Y-axis : Correctly calibrated and labelled (Availability of molybdenum) ✓
  - Line graph ✓
  - Accuracy ✓
  - Correct unit (g) ✓
- (6)

#### 4.3.2 Deduction of the influence of acidity and alkalinity on the availability of molybdenum

- In acid soil/low pH molybdenum is not available ✓
- In alkaline soil / high pH molybdenum is more available ✓
- (2)

#### 4.3.3 Measures to solve problems of:

- (a) **Decreased availability of molybdenum in soils with a pH of between 2 and 4**  
Application of basic fertilisers such as lime/ $\text{CaCO}_3$  ✓
- (1)
- (b) **Toxic quantities of molybdenum in soil with pH of 14**  
Application of gypsum/ $\text{CaSO}_4$  ✓
- (1)

### 4.4 Soil colloid

#### 4.4.1 Deduction of the process

- A – Cation adsorption ✓
- B – Cation exchange ✓
- (2)

#### 4.4.2 Reason for cation exchange

- Potassium cation from the soil solution exchanges with the hydrogen adsorbed in the colloid ✓
- (1)

- 4.4.3 **Indication of the hydrogen cation having an effect on plants**  
Hydrogen in the soil solution ✓ (1)
- 4.4.4 **TWO types of colloids**  
Organic colloid ✓  
Inorganic colloid ✓ (2)
- 4.4.5 **Differentiation between *sodic* and *saline soils* with regard to dominant salts**  
**Sodic soil** – Sodium carbonates ✓  
**Saline soil** – Chlorides and sulphates of sodium, calcium and magnesium ✓ (2)
- 4.5 **Soil organisms**
- 4.5.1 **Classification of the worms into groups of soil organisms**  
Macro-organisms ✓ (1)
- 4.5.2 **TWO conditions for the survival of worms**
- Organic nutrients ✓
  - Mineral nutrients (nitrogen/phosphorus/potassium) ✓
  - Soil moisture close to field water capacity ✓
  - Soil air for respiration ✓
  - Optimum temperature (temperature between 25 °C and 30 °C ✓
  - Optimum soil pH ✓ (Any 2) (2)
- 4.5.3 **Explanation of how worms will assist farmers**
- Break down plant and animal remains ✓ to liberate plant nutrients ✓
  - Improve soil structure ✓ for increased water retention capacity ✓
  - Worm casts is rich in organic matter ✓ which improves soil fertility ✓
  - Maintain CO<sub>2</sub> concentration ✓ which is used by plants during photosynthesis ✓ (Any 1) (2)
- 4.6 **Nutrient cycle**
- Nutrient cycle increasing nutrient content in plants**
- (a) **Protein content** – Nitrogen cycle ✓ (1)
- (b) **Carbohydrate content** – Carbon cycle ✓ (1)
- [35]

**TOTAL SECTION B: 105**  
**GRAND TOTAL: 150**

