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GRADE 11

NOVEMBER 2022

AGRICULTURAL SCIENCES P1

MARKS: 150

TIME: 2½ hours

This question paper consists of 15 pages.

INSTRUCTIONS AND INFORMATION

1. This question paper consists of TWO sections, namely SECTION A and SECTION B.
2. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page.
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 calculations, including 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 numbers (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11 A.

1.1.1 ... is an example of an inorganic compound.

- A Glucose
- B Ammonia
- C Fats
- D Alkanes

1.1.2 The type of bond formed when two amino acids are joined resulting in the loss of water.

- A Covalent
- B Ionic
- C Peptide
- D Hydrogen

1.1.3 The following are properties of acids.

- (i) They release hydrogen ions into water to form a hydronium.
- (ii) They corrode active metals.
- (iii) They are proton acceptors.
- (iv) They have a high concentration of hydrogen ions.

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 An advantage of a good soil structure for a farmer is ...

- A improved emergence of seedling due to increased soil crusting.
- B increased waterlogging for root penetration.
- C increase soil crusting with improved biological activity.
- D reduced salt imbalances due to enhanced buffering capacity of soil.

- 1.1.5 The following statement is TRUE about the difference between soil air and atmospheric air.
- A Soil air contains ten times less carbon dioxide than atmospheric air.
 - B Soil air contains less oxygen and a greater amount of water as compared to atmospheric air.
 - C Atmospheric air is much more concentrated with carbon dioxide and nitrogen than soil air.
 - D Atmospheric air is more concentrated with moisture than soil air.
- 1.1.6 The mottled appearance in soil is an indication of the following:
- (i) The reduction of red ferric ion to bluish-grey ferrous ion.
 - (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 bulk density of soil is influenced by the following factors except ...
- A heat capacity of soil.
 - B mineral composition
 - C degree of compaction.
 - D size of soil particles.
- 1.1.8 The exposed cross-section, from top to bottom, of all the layers making up a particular soil is known as ...
- A soil form.
 - B soil family.
 - C soil horizon.
 - D soil profile.
- 1.1.9 The ... is the point at which plants wither and die.
- A permanent wilting
 - B temporal wilting
 - C field capacity
 - D water saturation
- 1.1.10 The following is the physical influence of organic matter on soil.
- A Increased CAC value
 - B Improved aeration
 - C Increased microbe activity
 - D Increased availability of nutrients

(10 x 2) (20)

- 1.2 Indicate whether each of the descriptions in COLUMN B applies 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 numbers (1.2.1 to 1.2.5) in the ANSWER BOOK, for example 1.2.6 B only.

COLUMN A			COLUMN B
1.2.1	A:	Period	Elements with the same number of electrons in their outer orbital
	B:	Group	
1.2.2	A:	Ionic bonds	The bonding in which the atoms that are bonded share electrons
	B:	Electrovalent bonds	
1.2.3	A:	Prismatic	The structural units are vertically longer than they are broad, with an either rounded or flat top
	B:	Columnar	
1.2.4	A:	Sodium carbonate	Organic matter is dispersed and deposited on the upper layers of soil
	B:	Calcium carbonate	
1.2.5	A:	Assimilation	The process whereby a substance is made soluble
	B:	Ammonification	

(5 x 2) (10)

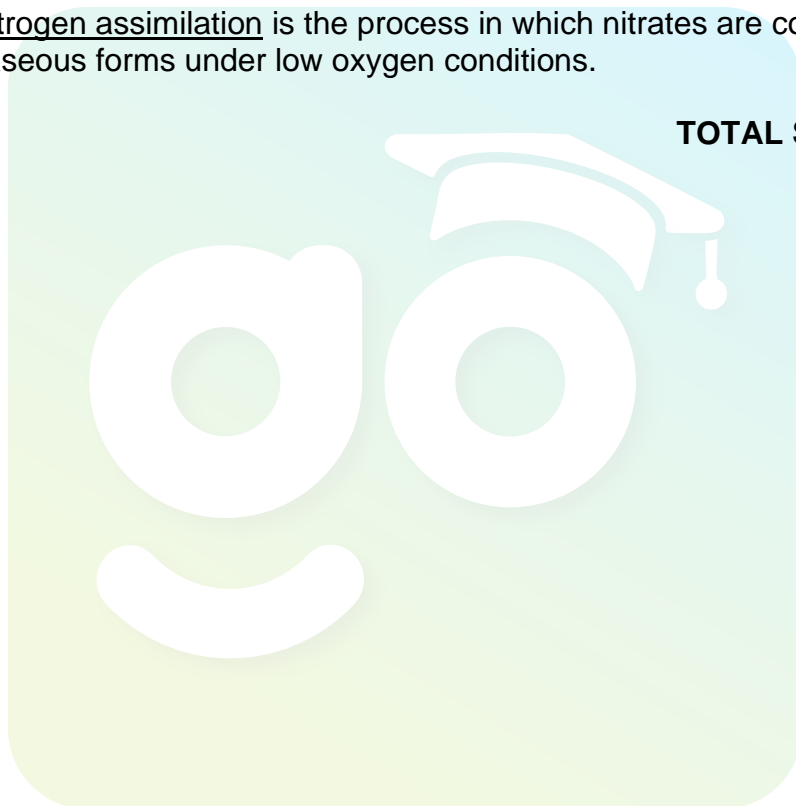
- 1.3 Give ONE word/term for each of the following descriptions. Write only the word/term next to the question numbers (1.3.1 to 1.3.5) in the ANSWER BOOK.

- 1.3.1 The disaccharide formed when a glucose molecule bonds with fructose
- 1.3.2 A characteristic of a carbon atom that enables it to bond with itself to form a long chain
- 1.3.3 The gas that reduces the oxidation process caused by oxygen
- 1.3.4 The horizon characterised by anaerobic soil conditions
- 1.3.5 Conversion of ammonium compounds to nitrites and nitrates

(5 x 2) (10)

- 1.4 Change the UNDERLINED WORD(S) in EACH of the following statements to make it TRUE. Write only the answer next to the question numbers (1.4.1 to 1.4.5) in the ANSWER BOOK.
- 1.4.1 Propanol is the product of fermentation of sugar in alcoholic drinks.
- 1.4.2 Soil compaction is the arrangement of soil particles into units to give a distinctive characteristic pattern.
- 1.4.3 Cation exchange is the collection of the substance on the surface of the colloid.
- 1.4.4 The moisture that is held tightly by the soil particles and cannot be used by plants is capillary.
- 1.4.5 Nitrogen assimilation is the process in which nitrates are converted into gaseous forms under low oxygen conditions. (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 table below shows substances used in agriculture.

SUBSTANCE A	SUBSTANCE B	SUBSTANCE C
Water and NaCl	Sand and Salt	NH ₃

2.1.1 Identify the **SUBSTANCE A**, **B** and **C** from the table above that suit each of the descriptions below:

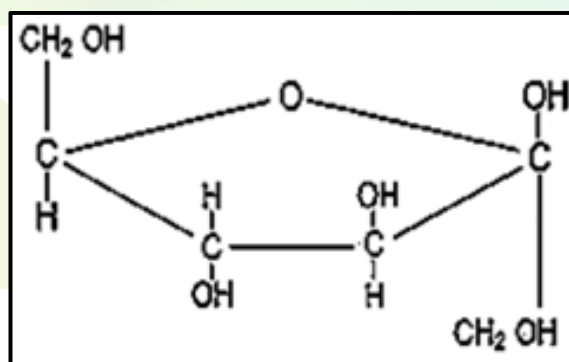
- (a) Components can be separated by physical means
- (b) Used as a household cleaning product
- (c) Can form a homogenous mixture (3)

2.1.2 Indicate the role of water in **SUBSTANCE A**. (1)

2.1.3 Write the structural formula of **SUBSTANCE C**. (2)

2.1.4 Components in **SUBSTANCE A** are regarded as compounds. Justify this statement. (2)

2.2 The structure below shows a carbohydrate.

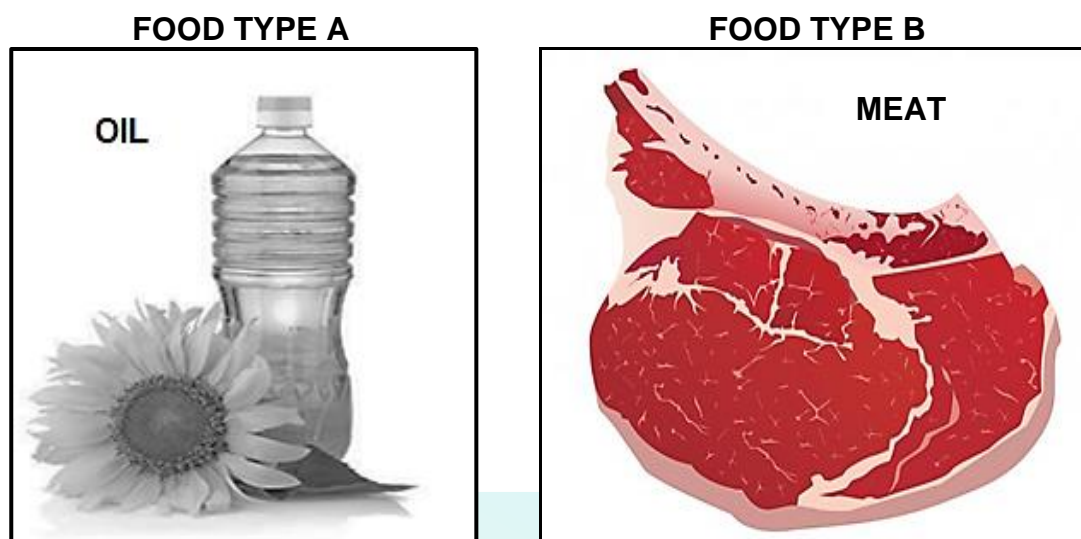


2.2.1 Classify the carbohydrate illustrated by the structure above. (1)

2.2.2 Write the chemical formula of a carbohydrate in the structure above. (2)

2.2.3 Name TWO important functions of the carbohydrate illustrated in the above structure. (2)

2.3 Below are food types containing different fats.



2.3.1 Classify the fat in the food types above as saturated and unsaturated. (2)

2.3.2 Identify the fat from the food types above that is recommended to be included in a diet. (1)

2.3.3 Give TWO reasons for the answer in QUESTION 2.3.2. (2)

2.3.4 Distinguish between the fat found in **food type A** and in **food type B** with regard to the following:

(a) Reaction at room temperature (2)

(b) Bond between the carbon atoms (2)

2.4 Proteins are complex organic compounds and have different functions depending on their shape.

2.4.1 Name the building block of a protein molecule. (1)

2.4.2 What is the difference between *simple* and *complex* proteins? (2)

2.4.3 Indicate the reason for giving animals protein in each of the following situations:

(a) Injured animal (1)

(b) Newly born animal (1)

- 2.5 The table below shows basic groups of organic compounds, structural formula as well as molecular formula.

NAME OF A COMPOUND	FUNCTIONAL GROUP	STRUCTURAL FORMULA	MOLECULAR FORMULA
A (1)	Hydrocarbon	$ \begin{array}{ccccc} & \text{H} & & \text{H} & & \text{H} \\ & & & & & \\ \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - \text{H} \\ & & & & & \\ & \text{H} & & \text{H} & & \text{H} \end{array} $	B (1)
Ethanol	C (1)	D (2)	C ₂ H ₅ OH
E (1)	Carboxyl	$ \begin{array}{ccccc} & \text{H} & & \text{O} & & \\ & & & & & \\ \text{H} & - \text{C} & - & \text{C} & - & \text{OH} \\ & & & & & \\ & \text{H} & & & & \end{array} $	CH ₃ COOH

2.5.1 Complete the table by providing labels **A** to **E**. (6)

2.5.2 Identify the compound that can be used in alcoholic beverages. (1)

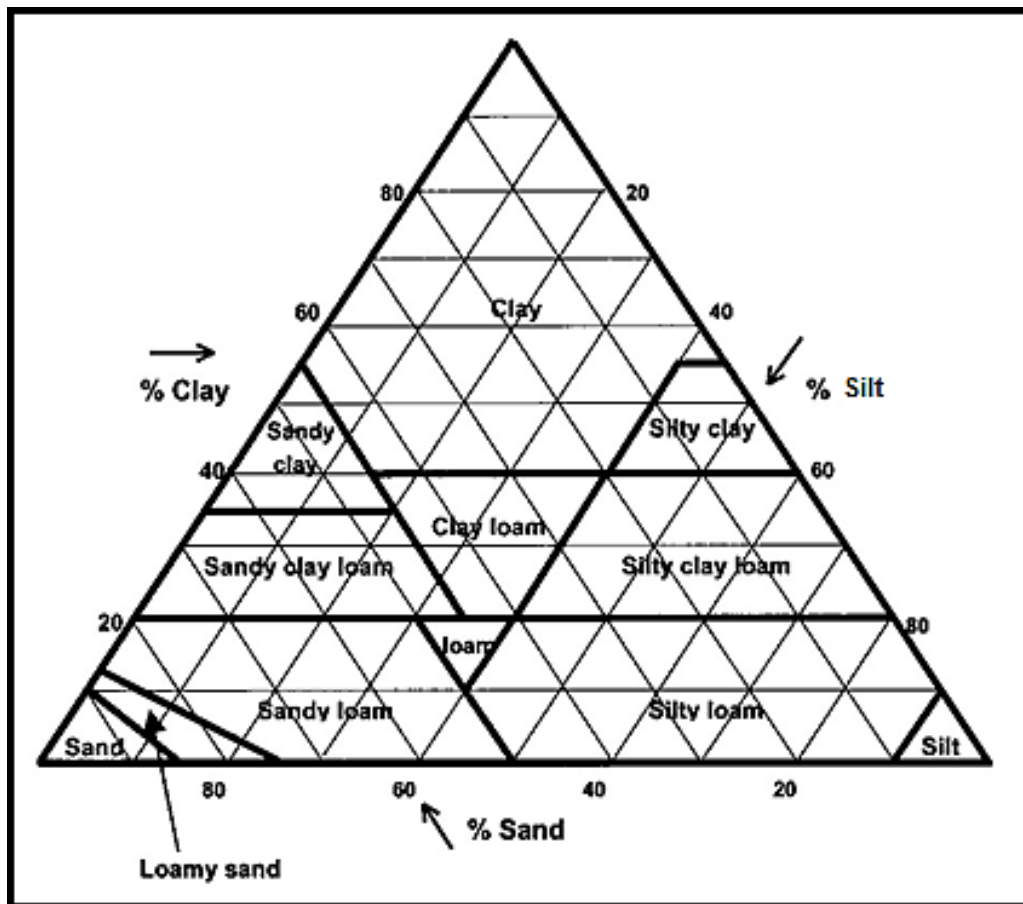
2.5.3 Indicate ONE importance of the compound labelled **A** for rural communities. (1)

[35]

QUESTION 3: SOIL SCIENCE

Start this question on a NEW page.

- 3.1 The texture diagram below is used by soil analysts to classify the soil into different texture classes, based on the relative proportion of particles.



- 3.1.1 Use the texture diagram above to determine the texture class of the following samples:

- (a) 60% clay, 20% sand and 20% silt (1)
- (b) 30% clay, 40% sand and 30% silt (1)

- 3.1.2 Compare the texture class mentioned in QUESTION 3.1.1(a) with a texture class on the texture diagram above containing 90% sand particles with regard to the following:

- (a) Tillability of soil (2)
- (b) Degree of plasticity (2)

- 3.1.3 Give TWO reasons why it is important for the farmer to know the texture class of the soil on the farm. (2)

- 3.2 An experiment was conducted to determine the movement of water in the soil. Three soil samples containing sand, silt and clay were set up and placed in a pan with water. The following observations were made:

SAMPLE A	SAMPLE B	SAMPLE C
Water took 5 hours to rise and reached the highest level of the container	Water took 30 minutes to rise and reached the lowest level of the container	Water took an hour to reach half the level of the container

- 3.2.1 Indicate the water movement that was demonstrated in the experiment. (1)
- 3.2.2 Give a reason for the answer in QUESTION 3.2.1. (1)
- 3.2.3 Based on the observation, identify soil SAMPLES **A** and **C**. (2)
- 3.2.4 Name the way in which the water can be lost in SAMPLE **B**. (1)
- 3.2.5 Advise the farmer on a method to put in place to reduce the water loss stated in QUESTION 3.2.4. (1)

- 3.3 A soil scientist conducted an experiment to test the influence of soil gas on seed germination and growth. Same seeds were planted in two containers labelled **A** and **B**. In container **A** seeds were planted in a well aerated soil rich in fresh organic matter and given water when required. In container **B** seeds were planted in waterlogged soil conditions.

- 3.3.1 Predict the results of the experiment in container **A** and **B**. (2)
- 3.3.2 Explain a reason for the answer in QUESTION 3.3.1 for container **B** by referring to the gas. (2)
- 3.3.3 Activities in container **A** can result in the accumulation of a gas. Give the name of this gas. (1)
- 3.3.4 Give TWO reasons for the high amount of gas mentioned in QUESTION 3.3.3. (2)

- 3.4 The data below shows the soil temperature readings from 06:00 until 18:00.

TIME	TEMPERATURE READING 5 cm DEEP (°C)	TEMPERATURE READING 30 cm DEEP (°C)
06:00	08	04
08:00	10	04
10:00	14	05
12:00	21	12
14:00	27	16
16:00	24	18
18:00	19	16

- 3.4.1 Deduce the factor influencing soil temperature from the table above. (1)

- 3.4.2 Draw a bar graph showing soil temperature readings at different depths during different times of the day. (6)
- 3.4.3 Explain the trend of temperature in the soil at 5 cm deep. (2)
- 3.5 An 80 cm^3 soil sample was collected and dried after which a mass of 680 g was recorded.
- 3.5.1 Calculate the bulk density of the sample above. (3)
- 3.5.2 Comment with a reason on the suitability of the soil for deep rooted crops based on its bulk density (2)

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QUESTION 4: SOIL SCIENCE

Start this question on a NEW page.

4.1 The table below shows soil profiles with different combinations of soil horizons:

SOIL PROFILE A	SOIL PROFILE B	SOIL PROFILE C	SOIL PROFILE D
<u>A</u> C	<u>A</u> <u>E</u> B	<u>A</u> <u>G</u> C	<u>B</u> C

4.1.1 Identify the soil profile (**A**, **B**, **C** or **D**) that best suits each of the descriptions below:

- (a) Needs to be drained before cultivation of crops (1)
- (b) Shows sign of erosion (1)
- (c) Indicates the degree of leaching (1)

4.1.2 Name the horizon that is associated with each of the following statements:

- (a) Receives eluviated material (1)
- (b) Mixture of inorganic matter and fully decomposed organic matter (1)
- (c) Soil is directly formed through physical weathering (1)

4.1.3 Indicate TWO possible diagnostic horizons that may occur in soil profile **C**. (2)

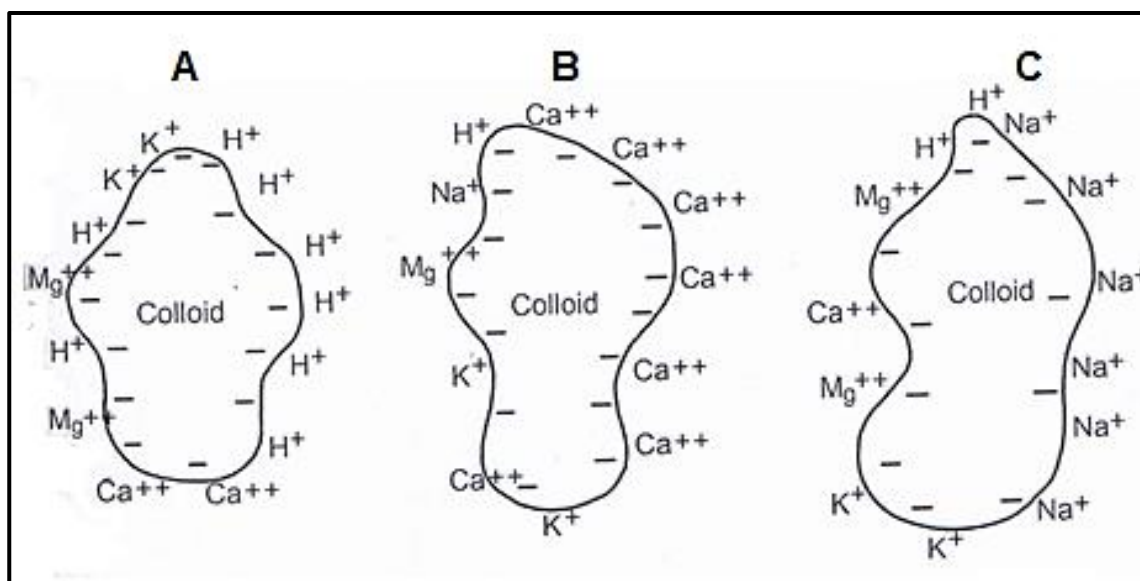
4.2 Soil classification is a systematic way of grouping soil into classes according to certain characteristics. Procedure is followed when classification is done.

4.2.1 Re-arrange the steps below in the correct sequence which are followed when classifying soil:

- Establish soil form
- Determine soil series
- Series characteristics are identified
- Identify diagnostic horizons
- Demarcate master horizons (5)

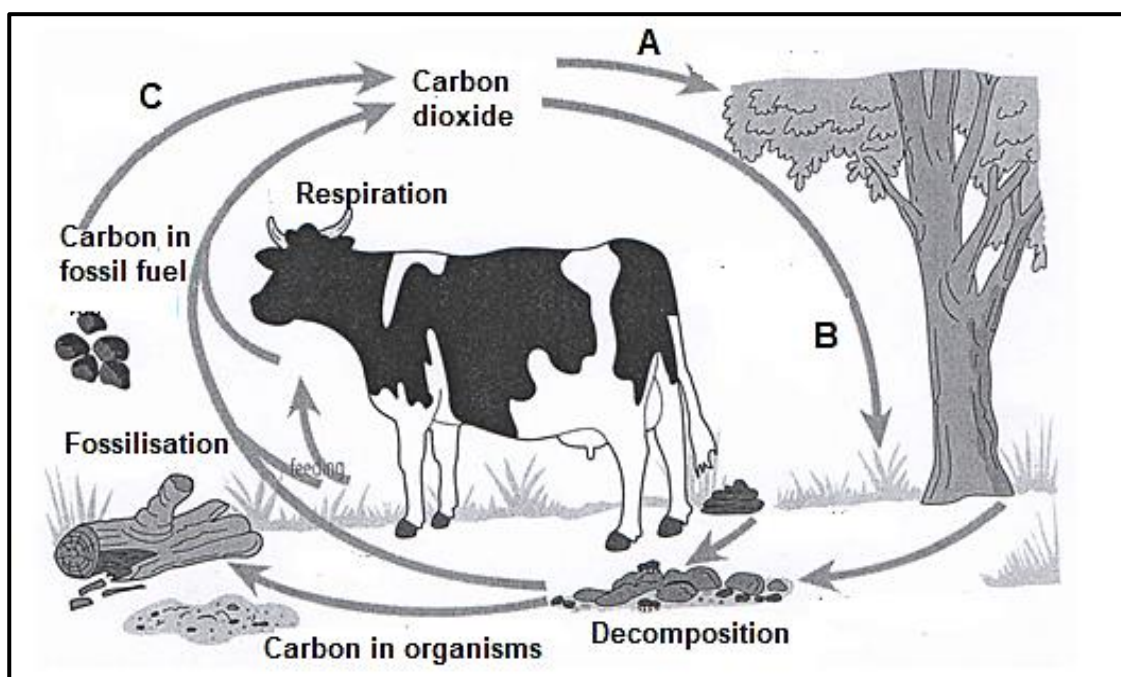
4.2.2 State TWO levels of classes used in South Africa to classify the soil. (2)

- 4.3 The schematic representation below illustrates the cation adsorption on the surface of the colloids.



- 4.3.1 Identify the type of colloid represented in the schematic representation above. (1)
- 4.3.2 Differentiate between the colloid mentioned in QUESTION 4.3.1 and the other colloid with regard to the shape. (2)
- 4.3.3 Indicate the condition of the colloid labelled **A** and **B** based on the cation adsorbed. (2)
- 4.3.4 Name TWO factors that may be the cause of the colloidal condition mentioned in QUESTION 4.3.3 for the colloid labelled **A**. (2)
- 4.3.5 State the detrimental effect of the cation that is dominant on the colloid labelled **C** on the soil structure. (1)
- 4.3.6 Suggest TWO ways to correct the colloidal condition labelled **C** physically. (2)

4.4 The picture below shows nutrient cycling.



4.4.1 Identify the letter that shows the processes in which a carbon compound is incorporated into living organisms. (1)

4.4.2 Name TWO processes visible in the diagram showing the return of carbon dioxide into the atmosphere. (2)

4.4.3 Decomposition process in the pictures above is done by micro-organisms which need certain conditions to survive. Justify this statement by mentioning THREE of these conditions. (3)

4.5 A symbiotic relationship occurs between certain plants and micro-organism for the benefit of both.

4.5.1 Give the name of a micro-organism involved in the following relationships:

(a) Fix nitrogen for the legume crops (1)

(b) Assist plant roots to absorb phosphorus from the soil (1)

4.5.2 Explain the symbiotic relationship between legume crops and the micro-organism mentioned in QUESTION 4.5.1(a). (2)

[35]

TOTAL SECTION B: 105
GRAND TOTAL: 150