higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

SOIL SCIENCE
NQF LEVEL 3

(1011003)

14 November 2022 (X-paper)
09:00–12:00

This question paper consists of 10 pages.

289Q1N2214

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TIME: 3 HOURS
MARKS: 150

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Start each section on a new page.
5. Use only a black or blue pen.
6. Write neatly and legibly.

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SECTION A

QUESTION 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 (1.1–1.10) in the ANSWER BOOK.

1.1 Plants need nutrients in order to grow, develop, and …

A germinate.
B function.
C reproduce.
D to be healthy.

1.2 Plants get carbon (C), hydrogen (H), and oxygen (O) from the air and …

A water.
B rocks.
C roots.
D particles.

1.3 After soil analysis, phosphorus was found to be deficient.

Which ONE of the following fertilisers will correct this deficiency?

A 3:4:3 (30)
B 1:0:1 (25)
C Urea
D Potassium sulphate

1.4 ONE of the following is not an organic fertiliser:

A Animal waste
B Limestone
C Green manure
D Maize stubbles

1.5 A shortage of water in plant tissue is called …

A water stress.
B transpiration.
C respiration.
D photosynthesis.

1.6 … matter is living or dead parts of an animal or plant.

A Soil
B Organic
C Fertilisers
D Sand

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1.7 In a situation where both soil macro-pores and micro-pores are occupied by soil water, the soil is said to be …

A aerobic.
B sodic.
C drought prone.
D saturated.

1.8 … is needed for root growth and the formation of reproductive parts of the plant.

A Calcium
B Bicarbonate
C Potassium
D Phosphorus

1.9 The TWO main forces that hold water in soil are …

A pull and push.
B adhesion and cohesion.
C the hydrogen and covalent bond.
D the ionic and polar covalent bond.

1.10 Soil does not reach the extreme pH values of the pH scale, but the most acid soil has a pH of …

A 3,5.
B 10,5.
C 7,0.
D 2,5.

(10 × 1) **[10]**

QUESTION 2

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (2.1–2.5) in the ANSWER BOOK.

2.1 Texture is the portion of soil volume not occupied by solid particles but which is filled with air and water.

2.2 Plant-available water is the water held between field capacity and wilting point.

2.3 Structure is the relative proportion of the different soil particle sizes in a given soil.

2.4 The value 22 on a 50 kg bag of 1:0:1 (22) means that 78% of the 50 kg in the bag is the active ingredient.

2.5 Zero tillage does not disturb the structure of the soil.

(5 × 1) **[5]**

QUESTION 3

Choose an item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–L) next to the question number (3.1–3.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1	Yellowing of the leaf	A	organic fertiliser
3.2	Signs of death in any living tissue	B	suspension
3.3	These are man-made or artificial chemical substances that are manufactured in the form of granules, powders and liquids	C	leachates
		D	necrosis
3.4	Manure that can improve the soil structure	E	photosynthesis
3.5	Wash-out materials that can dissolve in water	F	inorganic fertilisers
		G	compost
3.6	The removal of a land surface by running water, wind, ice or other geological agents including landslides and soil creep	H	gabion
		I	chlorosis
3.7	The upward movement of water through narrow spaces towards the dry soil	J	soil erosion
3.8	A heap of decayed organic material	K	capillarity
3.9	The transport process of very fine particles of silt and clay lifted high into the air and carried kilometres from point of origin	L	sediments
3.10	Wire container filled with earth or rocks		

(10 × 1) **[10]**

QUESTION 4

Complete the following sentences by writing only the missing word or words next to the question number (4.1–4.5) in the ANSWER BOOK.

4.1 … is the element that regulates osmosis and maintain the saltwater balance.

4.2 … is the material that is spread on the soil surface to protect the soil from drying, raindrop impact, and evaporation.

4.3 … is a substance which gives colour to a plant.

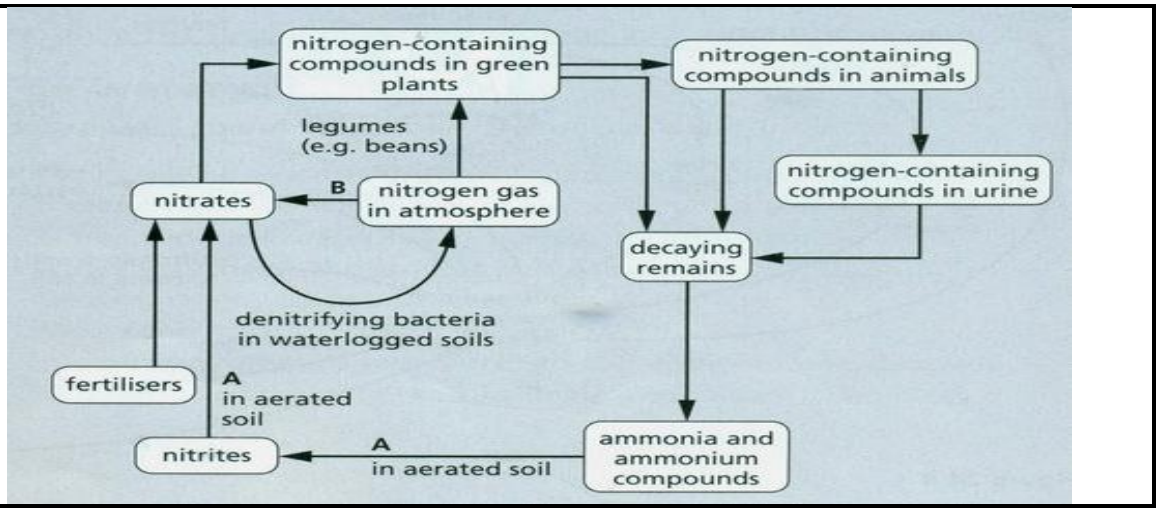
4.4 … is the loss of soil water through evaporation and transpiration.

4.5 Soils high in sand have a … total water-holding capacity.

(5 × 2) **[10]**

QUESTION 5

The FIGURE below shows the nitrogen cycle. Study it and answer the questions that follow:



[Source: *Soil Science NQF Level 3,* J de Fontaine & F Mitchell]

5.1 Explain the difference between the *nitrogen cycle* and *carbon cycle*. (4)

5.2 Mention THREE stages of the nitrogen cycle. (3)

5.3 Give TWO ways the farmer can use to increase the nitrogen content in the soil. (2)

5.4 Give TWO forms of inorganic nitrogen that are found in the soil. (2)
[11]

TOTAL SECTION A: 46

SECTION B

QUESTION 6

Study the scenario below and answer the questions that follow: ☆

A farmer has just planted crops and wants you to help in determining the irrigation requirements for the field of crops. All that the farmer knows is that the soil is at field capacity, and it has an available moisture capacity (AMC) of 20%. You know that the rooting depth of the soil is 700 mm. The farmer tells you that the land planted with crops is 4 hectares and that the evapotranspiration rate is 6 mm per day.

The farmer asks you to:

6.1 Calculate the total available moisture (TAM) of the soil. (3)

6.2 Determine how many days the farmer should wait before the next irrigation. (3)

6.3 ☆ Calculate how much water the farmer will need to apply per hectare during the next irrigation to get the soil back to field capacity. (3)

6.4 Answer the following questions on soil water:

6.4.1 What does the term *anaerobic* mean?

6.4.2 Explain the difference between the effect of *sandy* and *clay* soils on the soil water-holding capacity.

6.4.3 Which type of soil water is found in saturated soil?

6.4.4 Describe TWO ways in which water loss occurs in plants and soil.

6.4.5 Identify TWO conditions that encourage water loss described in question 6.4.4

(5 × 2) (10)

[19]

QUESTION 7

Study the scenario below and answer the questions that follow:

Farmers usually rotate livestock and crops in an effort to protect the land. Rotational grazing is an important function and excellent agricultural conservation practice that protects soil, water, and animal health as well as cutting feed costs for the farmer. A farmer has to maintain the farm by placing the flock on a rotational grazing basis so that the soil on the farm can get proper care and a resting period, and also for the livestock to have enough places for grazing with enough food on it.



[Source*: https:// agric.wa.gov.au/n/2391,* 17 June 2019]

7.1 Explain what is meant by *rotational grazing*? (2)

7.2 Mention FIVE conservation practices or methods the farmer can use on the rangeland. (5)

7.3 Give THREE ways the farmer can use to control erosion on cultivated land. (3)

7.4 Answer the following questions on soil erosion and its prevention:

7.4.1 Give the TWO primary causes of soil erosion. (2)

7.4.2 Explain THREE damaging effects of soil erosion on agriculture. (9)

7.4.3 Mention FIVE factors affecting wind erosion. (5)

7.4.4 Differentiate between *weathering* and *erosion*. (4)

7.4.5 Give FIVE forms of water erosion that are of particular concern to the farmer. (5)

[35]

TOTAL SECTION B: 54

SECTION C

QUESTION 8

Answer the following questions on soil sampling, acidity and alkalinity:

8.1 Give THREE methods for crop inspection that can be used to diagnose nutrient deficiency in plants. (3)

8.2 Give FOUR guidelines that can aid a farmer when deciding which areas require soil sampling on the farm. (8)

8.3 Give THREE methods to determine the acidity and alkalinity of the soil. (3)

8.4 Which ONE of the three methods given in QUESTION 8.3 is the most reliable in determining soil pH? (2)

8.5 Name an agricultural lime that can be used in sandy soil lacking magnesium. (2)

8.6 Acidic and sodic soils are examples of problem soils. Copy and complete the table below in your ANSWER BOOK.

	Acidic soils	**Sodic soils**
Cation responsible		
pH		
Treatment to rectify		

(6)
[24]

QUESTION 9

Answer the following questions on mulching, organic and inorganic fertilisers:

9.1 Define the term *mineral salts*. (2)

9.2 Give TWO main categories into which plant nutrients are divided. (2)

9.3 List any SIX advantages of green manuring. (6)

9.4 Differentiate between *organic* and *inorganic* fertilisers. (4)

9.5 Application of inorganic fertilisers results in a good crop yield. This is not regarded as an environmentally friendly and sustainable farming practice.

Discuss FIVE disadvantages of continuous use of inorganic fertilisers without applying organic matter to the soil. (5)

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9.6 Nitrogen is one of the most commonly used inorganic fertilisers in South Africa.

Name THREE straight nitrogen fertilisers. (3)

9.7 Give FOUR important functions of phosphorus in plants. ☆ (4)
[26]

TOTAL SECTION C: 50
GRAND TOTAL: 150

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