



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

**SOIL SCIENCE
NQF LEVEL 3**

(1011003)

**8 December 2020 (Y-paper)
13:00–16:00**

This question paper consists of 11 pages.

457Q1N2008

<p>TIME: 3 HOURS MARKS: 150</p>

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 question 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 given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.15) in the ANSWER BOOK.

1.1 The most common macronutrients required for plant growth are:

- A Zn, N, S
- B Ca, Mg
- C Bo, Cu
- D K, N, P



1.2 The most common nutrient deficiency symptom in plants is ...

- A chlorosis
- B stunting
- C abnormal growth
- D necrosis

1.3 Plants absorb nutrients from the soil ...

- A in the form of small rock particles
- B in the form of organic matter
- C in the form of mineral salts
- D only in a gaseous state

1.4 Sandy soils have the following characteristics:

- A High percentage of organic matter
- B Large soil particle size
- C High water-holding capacity
- D Small space for air






1.5 Soil fertility refers to ...

- A the amount of plant nutrients available in the soil
- B the balance between micropores and macropores
- C soil erosive potential
- D soil moisture retention potential


1.6 The pH value of a slightly acid soil solution as on the pH scale is ...

- A 3.5
- B 10.5
- C 6.5
- D 7.0




- 1.7 Fertilising with soluble fertilisers through a sprinkler or drip irrigation system is called ...
- A top-dressing
 - B fertigation
 - C broadcasting
 - D flooding
- 1.8 Dolomitic lime is high in ...
- A phosphorus 
 - B potassium
 - C nitrogen
 - D magnesium
- 1.9 The loss of water from plant leaves in the form of vapour when the atmospheric temperature is too high is called ...
- A transpiration
 - B surface evaporation
 - C guttation
 - D run-off
- 1.10 The two main forces holding water in the soil are ...
- A cohesion force and gravitational force 
 - B cohesion force and adhesion force
 - C root hair pressure and transpiration pull
 - D adhesion force and gravitational force
- 1.11 Slow movement of water down towards the water table off the root zone is called ...
- A the wilting point
 - B leaching
 - C drainage
 - D capillarity
- 1.12 Which one of the following symptoms indicates a lack of phosphorus?
- A Dark, bluish-green or purple leaves 
 - B Light-yellow colouring of leaves
 - C Curling of leaf edges
 - D Leaf drop
- 1.13 Which of the following straight fertilisers contains nitrogen?
- A Superphosphate
 - B Potassium chloride
 - C Potassium sulphate
 - D Ammonium sulphate

1.14 Conservation tillage is an important practice in modern farming.

Which ONE of the following aspects is completely irrelevant concerning conservation farming? 

- A Protecting the soil with living or dead organic cover
- B Ploughing the soil to turn it over so that the subsoil is exposed over the topsoil
- C Ensuring that there is minimum or zero tillage practice
- D Planting the seeds through the debris of the previous crop

1.15 ... is a piece of land that is used for farming, but it is left with no crops for a season to recover its fertility. 

- A Rangeland
- B Arable land
- C Fallow land
- D Duneland

(15 × 1) [15]


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 Urea is a straight fertiliser.

2.2 Cohesion is the attraction of water molecules to other water molecules.

2.3 Soil at field capacity is drier than soil at wilting point.

2.4 Field capacity is reached when air fills the macropores after the soil was saturated. 

2.5 Gullies or dongas are small and more permanent features.

(5 × 1) [5]

QUESTION 3

Choose a description from COLUMN B that matches a term 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	Necrosis	A	negatively charged ion
3.2	Minimum tillage	B	example of organic fertiliser
3.3	Percolation	C	potential ability of rain to cause erosion
3.4	Adsorption	D	term used to describe the signs of death in any living tissue
3.5	Rotational grazing	E	occurs in small streams or channels on a slope
3.6	Erosivity	F	improving an area so that it returns to the previous good condition
3.7	Water	G	portion of soil volume not occupied by solid particles, but which is filled with air and/or water
3.8	Pore space	H	moving stock from one grazing area to another to give the grass time to recover
3.9	Rill erosion	I	has a pH of 7
3.10	Kraal manure	J	attraction of soil water to soil particle
		K	interveinal chlorosis
		L	movement of water through the soil

(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 Micronutrients are required by plants in very ... quantities. 
- 4.2 ... is the loss of soil water through soil surface evaporation and transpiration.
- 4.3 ... is the pressure that holds plant leaves upright and rigid.
- 4.4 Marginal chlorosis refers to the ... of leaf margins. 
- 4.5 Acid soil contains an excessive amount of mainly ... ions.

(5 × 2) [10]

QUESTION 5




Give ONE term for each of the following descriptions by writing only the term next to the question number (5.1–5.10) in the ANSWER BOOK.

- 5.1 Nutrients that plants do not need in order to grow, develop and reproduce, but which are still needed for special functions in the plant.
- 5.2 An agricultural lime that has a mixture of calcium carbonate and magnesium carbonate. 
- 5.3 The term used to describe whether a soil is alkaline or acidic.
- 5.4 Spreading fertiliser on the soil surface before planting and incorporating by tillage.
- 5.5 Macronutrient needed for fruit development.
- 5.6 A soil which is transported and deposited away from its site of origin.
- 5.7 The combination of animal and plant remains, decomposed and treated to provide fertiliser for soils. 
- 5.8 A cover crop that is intercropped between an annual or perennial cash crop.
- 5.9 The removal of soluble material in solution by percolating water.
- 5.10 Method of growing plants without soil.

(10 × 1) [10]

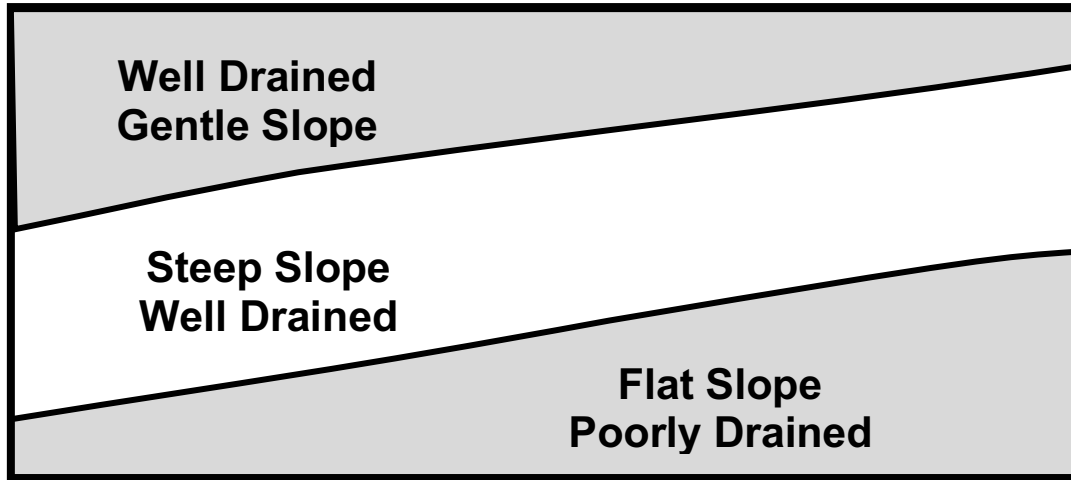
TOTAL SECTION A: 50

SECTION B**QUESTION 6**



- 6.1 Water and wind are important factors of erosion in South Africa, but water erosion is the most common. Answer the following questions referring to water and wind erosion. 
- Define the term *soil erosion*. (2)
- 6.2 Indicate whether the following concepts are related to WIND or WATER erosion. Write only 'Wind' or 'Water' next to the question number in the ANSWER BOOK.
- 6.2.1 Clogging
- 6.2.2 Saltation
- 6.2.3 Suspension (3 × 1) (3)
- 6.3 A rural community that settled on an uneven geographical area experienced heavy rains over two weeks. Afterwards, the area was assessed for damage in the village and on farms. Gullies (dongas) were formed on roads and on cultivated land. 
- 6.3.1 Give any TWO offside effects of erosion on residential areas. (2)
- 6.3.2 Briefly explain any THREE effects of gullies on cultivated land. (3 × 2) (6)
- 6.3.3 Name any TWO measures that the villagers may take to reclaim the cultivated land damaged by gullies. (2)
- 6.4 List FOUR factors affecting the amount of wind erosion. (4)
- 6.5 Briefly describe each of the following soil conservation processes that can be used on rangeland to prevent soil erosion.
- 6.5.1 Rotational grazing 
- 6.5.2 Restriction on animal numbers (2 × 3) (6)
- [25]**

QUESTION 7

7.1 Study the sampling areas below and answer the questions.



[Source: https://www.carnr.msu.edu/resources/farm_soil_sampling]

- 7.1.1 Define the term *soil sample*.  (2)
- 7.1.2 How many composite samples can be taken from the field above? Name the area where they have been taken. (4)
- 7.1.3 Why should field edges be avoided during soil sampling? (2)
- 7.1.4 Briefly explain the purpose of soil sampling and analysis. (2)
- 7.2 Nitrogen is a macronutrient that affects growth and therefore crop yield.
- 7.2.1 In which TWO forms can plants absorb nitrogen? (2)
- 7.2.2 State FOUR functions of nitrogen in plants. (4)
- 7.3 A 50 kg bag of fertiliser mixture is labelled 3:2:1(40).
- 7.3.1 Explain what each of the first THREE numbers indicates. (3)
- 7.3.2 Calculate the amount (in %) of each nutrient in the mixture.  (6)
- [25]**

QUESTION 8

- 8.1 Clay soil has a higher percentage of water retention capacity than loam soil.
Which soil type between the two has the highest percentage of available moisture? Give a reason for your answer. (3)
- 8.2 A specific soil has 130 mm of total available moisture (TAM) at field capacity. The amount of moisture lost per day is 10 mm.
How long is this soil likely to take before it reaches 50% of its TAM? Show your calculations. (4)
- 8.3 Explain how litmus paper is used to estimate soil pH. Provide possible results that may be observed for acidic, neutral and alkaline soil. (5)
- 8.4 Application of inorganic fertilisers results in good crop yield. This is not regarded as an environmentally friendly and sustainable farming practice.
Discuss the disadvantages of continuous use of inorganic fertilisers without applying organic matter to the soil. (5)
- 8.5 Answer the following questions on animal manure:
- 8.5.1 List FIVE factors that determine the nutrient content and the availability of animal manure. (5)
- 8.5.2 Discuss how improper storage affects the nutrient content of animal manure. (3)
- [25]**

QUESTION 9

- 9.1 Answer the following questions on soil water and irrigation.
- 9.1.1 Sprinkler, flood and drip irrigation are three common types of irrigation systems.
Name the most efficient and the least efficient of the three. (2)
- 9.1.2 Briefly explain any TWO advantages of the most efficient irrigation system. (2 × 2) (4)
- 9.1.3 How does over-irrigation reduce yield and productivity in crops? Mention at least THREE effects. (3)
- 9.2 List any FOUR ways in which farmers can recognise poorly drained soil. (4)


- 9.3 Read the following article derived from *The Gardener* and answer the questions.

James Leslie, a progressive farmer, has a passion for healthy soil and the resulting agricultural sustainability. He discovered the needs of living organisms like bacteria and fungi in the soil, and how attending to their needs could improve the health of his flora.



James is also planting as many cover crops as he can after harvesting the main crop, which are then fed back into the soil as green manure, adding valuable organic matter into the cycle. Keeping living roots in the soil also feeds the microbes.

[Source: *The Gardener*, 25 March 2019]

- 9.3.1 Differentiate between *green manure* and *compost*. (4)
- 9.3.2 Give any FOUR factors that are required to create a suitable environment for microbes to perform their functions efficiently. (4)
- 9.3.3 Give any FOUR functions of cover crops in agriculture.  (4)
- [25]**

TOTAL SECTION B: 100
GRAND TOTAL: 150