higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

SOIL SCIENCE
NQF LEVEL 3

(1011003)

6 March 2020 (X-paper)
09:00–12:00

This question paper consists of 11 pages.

295Q1S2006

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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 blue or a black 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 Water moves from areas of … concentration to areas of low concentration in response to an energy gradient.

A low
B moderate
C high
D dry

1.2 Which ONE of the following fertiliser does not contain the nutrient nitrogen?

A Potassium sulphate
B Limestone ammonium nitrate
C Ammonium sulphate
D Urea

1.3 Soils that are neutral to alkaline are usually developed from parent materials like …

A granite.
B limestone.
C sandstone.
D shale.

1.4 Sodic soils are high in … but low in soluble salts and the pH is between 8,5 and 10.

A sodium
B sodium chloride
C calcium carbonate
D calcium oxide

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

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

1.6 Which ONE of the following would be classified as a macronutrient?

A Calcium
B Iron
C Zinc
D Copper

1.7 Frequent veld fires in the same area may have a detrimental effect on the soil and agricultural production.

Which ONE of the following is not an effect of frequent veld fires?

A Creation of dongas
B Reduced organic matter in the soil
C Increased surface erosion
D Destruction of soil texture

1.8 Plants need … to grow, develop and reproduce.

A essential nutrients
B micro-organisms
C herbicides
D nonessential nutrients

1.9 Which ONE of the following quantities of phosphorus makes a crop grow and develop at its best?

A Deficient
B Sufficient
C Toxic
D None of the above

1.10 …is the absorption of nitrogen from the air by micro-organisms.

A Immobilisation
B Mineralisation
C Nitrogen fixation
D Denitrification

1.11 Which ONE of the following straight fertiliser contains phosphorus?

A Superphosphate
B Potassium chloride
C Potassium sulphate
D Ammonium sulphate

1.12 Which ONE of the following is not an organic fertiliser?

A Animal waste
B Limestone
C Green manure
D Maize stubbles

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1.13 … is the application of fertiliser in strips on one or both sides of a row of plants.

A Drilling
B Top dressing
C Band placing
D Broadcasting

1.14 Which ONE of the following C:N ratios indicates slow mineralisation if there is no alternative source of nitrogen in the soil?

A 84:1
B 10:1
C 22:1
D 25:1

1.15 Which ONE of the following is not a condition that affects limiting factors?

A Seasonality
B Soil texture
C Type of crop
D Growth stage of crop

(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 Photosynthesis is the process by which plants lose water through the leaves.

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

2.3 Effective rooting depth is the depth in which 85–90% of roots occur.

2.4 Base saturation is the number of exchange sites filled with acid-forming cations.

2.5 A composite sample is made up of samples taken from the same place in a field.

(5 × 1) **[5]**

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QUESTION 3

Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–I) next to the question number (3.1–3.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1	Community of plants and animals in a particular environment	A	infiltration
3.2	Process of water entering the soil, generally through the soil surface and vertically downward	B	drainage
3.3	Percentage of water remaining in the soil after free drainage has stopped	C	auger
3.4	Upward movement of water through narrow spaces towards dry soil	D	ecosystem
3.5	Looking like large corkscrew boring into the ground, commonly used for taking soil samples	E	water potential
		F	spade
		G	field capacity
		H	wilting point
		I	capillarity

(5 × 2) **[10]**

QUESTION 4

Complete the following sentences by writing only the missing word or words next to the question number (4.1–4.10) in the ANSWER BOOK.

4.1 Soil erosion is caused primarily by the action of water or … on the soil.

4.2 ... is the removal of soluble materials in a solution by percolating water.

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

4.4 In terms of water requirements the … stage is the most critical growth stage of the crop.

4.5 … is when the top layer of soil becomes hard and impermeable to roots and water.

4.6 … erosion means that human activities are speeding up the rate of erosion compared to its natural occurrence.

4.7 … is the amount of water vapour contained in the air.

4.8 The main source of phosphorus in the soil is in the form of … ions.

4.9 … are crops planted to reduce nutrient leaching.

4.10 … is the loss of water from the soil surface in a gaseous form.

(10 × 1) **[10]**

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QUESTION 5

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

5.1 Condition in the soil where plants quickly use the small amount of water available to them

5.2 Agricultural lime having a mixture of calcium carbonate and magnesium carbonate

5.3 Chemical that can be added to soil solution to cause hydrogen ions to leave the particle surface and enter the soil solution

5.4 Soils with high pH and high concentration of exchangeable sodium

5.5 Combination of animal and plant remains, decomposed and treated to provide fertiliser for crops

5.6 Process where ammonia is oxidised by bacteria to produce nitrite and nitrate

5.7 Application of fertiliser to irrigation system like sprinklers used for field crops

5.8 Cover crop that is intercropped between an annual or perennial cash crop.

5.9 Change of immobilised nutrients through microbial decomposition into inorganic form

5.10 Fertiliser containing only ONE nutrient like nitrogen or phosphorus or potassium

(10 × 1) **[10]**

TOTAL SECTION A: 50

SECTION B

QUESTION 6

6.1 Name the THREE parts of a leaf that may show chlorosis. (3)

6.2 Explain each of the following forms of fertilisers:

6.2.1 Liquid fertiliser

6.2.2 Organic fertiliser

(2 × 2) (4)

6.3 Give THREE conditions that affect the limiting factors in a field at a certain time and place. (3)

6.4 A small-scale subsistence farmer wants information before buying a 50-kg bag of 2:3:4 (30) fertiliser. Answer the following questions to help him:

6.4.1 Define *active ingredient.* (2)

6.4.2 Calculate how much active ingredients are in a 50-kg bag of fertiliser. (4)

6.4.3 Calculate how much nitrogen, phosphorus and potassium (in kg) are in a 50-kg bag of fertiliser (9)

[25]

QUESTION 7

7.1 In South African soils the activities of micro-organisms continue right through the year, although more slower in winter than in summer when decay is more rapid. For this reason, green manuring can be used as one of the practices to conserve organic matter. Green manuring crops need to be sown into a standing crop or into the fallow land after harvesting.

7.1.1 Define *green manuring.* (2)

7.1.2 Give THREE examples of species suitable for green manuring. (3)

7.1.3 Differentiate between *dead mulch* and *living mulch.* (4)

7.1.4 State FIVE benefits of green manuring. (5)

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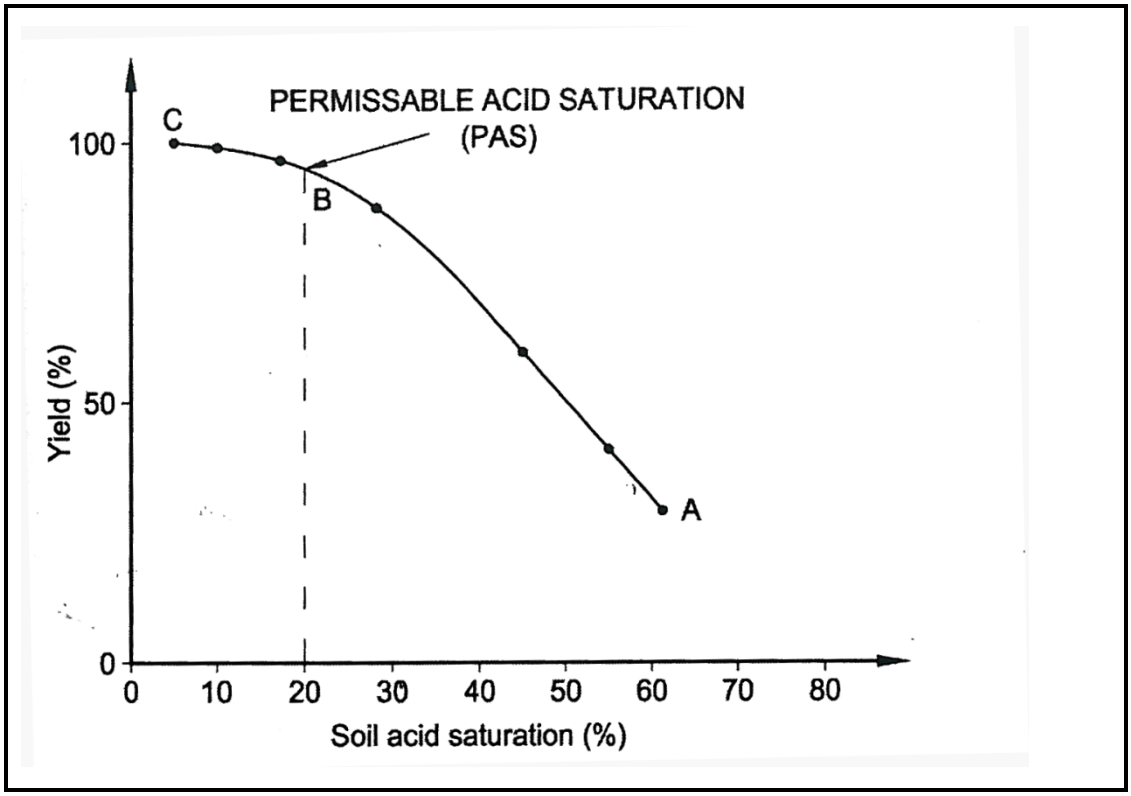
7.2 A range of lime treatment was applied to different plots to obtain different soil acid saturations. The effect of these treatments on maize yield is shown in the graph below.

Study the graph below and answer the questions.



[Source: *Soil Science NQF level 3,* J de Fontaine and F Mitchell]

7.2.1 Name the TWO types of agricultural lime commonly used by farmers in South Africa. (2)

7.2.2 Explain the relationship between *quantity of soil acid saturation* and *maize yield* in A and B. (2)

7.2.3 Explain the relationship between the *quantity of soil acid saturation* and *maize yield* in B and C. (2)

7.2.4 What is the maximum yield of maize at point B (permissible acid saturation)? (2)

7.2.5 Why is it unnecessary to reduce acid saturation to values below permissible acid saturation? (3)

[25]

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QUESTION 8

8.1 Soil water plays a major role in farming.

8.1.1 Name TWO main forces which work against force gravity to hold water in the soil for crop use. (2)

8.1.2 Identify THREE types of soil water and explain each type, referring to their availability to crop. (3 × 2) (6)

8.1.3 Explain FIVE functions of water in plants which is fundamental for growth and good yields. (5)

8.2 Briefly explain the difference between *sprinkler* and *drip irrigation* systems in terms of each of the following:

8.2.1 For plants or crops used where they are grown (2)

8.2.2 Efficiency (4)

8.3 Which irrigation system is better: sprinkler or drip irrigation? (1)

8.4 Why does over-irrigation reduce yield and productivity in crops? (5)
[25]

QUESTION 9

9.1 Give the main agent of soil erosion in South Africa. (1)

9.2 Explain each of THREE mechanical stages of soil erosion below.

9.2.1 Detachment

9.2.2 Transport

9.2.3 Deposition

(3 × 2) (6)

9.3 Explain the difference between *rill* and *gully* erosion (4)

9.4 Study the picture below and answer the questions.



The picture above shows the practice of conservation farming with the main aim of saving money while yield is maintained. The soil programme is built on three fundamentals: crop rotation, maintenance layer of mulch on soil surface and no-till crop production which does not disturb the soil and its natural processes. This type of farming reduces input costs while increasing yields. In conventional farming the land is worked several times to prepare the seedbed.

[Adapted from: *www.facebook.com/farmersWeeklySA*]

9.4.1 Differentiate between the following:

(a) Conservation and conventional tillage

(b) Crop rotation and monocropping

(4 × 2) (8)

9.4.2 Explain THREE advantages of mulching. (3)

9.4.3 Which method of farming is the best to reduce costs for the farmer? Substantiate your answer. (3)

[25]

TOTAL SECTION B: 100
GRAND TOTAL: 150

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