higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

SOIL SCIENCE
NQF LEVEL 2

(1011002)

15 November 2022 (Y-paper)
13:00–16:00

This question paper consists of 10 pages.

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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 black pen.
6. Write neatly and legibly.

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SECTION A

QUESTION 1

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 Even if the soil on a piece of land appears to be homogenous for vegetable production, a farmer has to take a representative soil sample of that land in order to determine its productivity.

1.2 Nucleons are small particles that occupy orbits of an atom.

1.3 Transpiration is the closing of stomata on leaves in order to keep water within plant leaves.

1.4 By boiling water and allowing it to cool down it removes any dissolved oxygen from the water.

1.5 An older root zone of the root is covered by a root cap.

1.6 Substances in a mixture are chemically bonded together.

1.7 The quantity of air found in the soil depends on the amount of water available in the soil.

1.8 Matter does not exist in three states only.

1.9 Soil mulch helps in slowing down evaporation of moisture from the soil.

1.10 Nitrogen does not dissolve in soil as carbon dioxide and oxygen do.

(10 × 1) **[10]**

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QUESTION 2

Various options are given as possible answers to the following questions. Choose the correct answer and write only the letter (A–D) next to the question number (2.1–2.10) in the ANSWER BOOK.

2.1 This colour of soil is generally warmer as it absorbs more heat:

A dark
B red
C yellow
D light

2.2 Substance made up of only one type of atom:

A compound
B element
C mixture
D molecule

2.3 The boiling point of water is …

A 70°C
B 0°C
C 100°C
D None of the above.

2.4 Once a nutrient is not available in soil and plants lack it, the … symptoms of that particular nutrient will be displayed on the plant.

A simulative
B toxicity
C deficiency
D vegetative

2.5 How many valence electrons are there in a potassium atom?

A 2 electrons
B 3 electrons
C 1 electron
D 4 electrons

2.6 A soil colour that is found in soils during rainy seasons which indicates some water saturation in the soil which is not permanent:

A Yellow
B Red
C Mottled
D Dark

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2.7 An instrument that assists farmers to measure relative humidity in their store rooms.

A Thermometer.
B Bulb thermometer.
C Wet and dry bulb thermometer.
D Humidity guide.

2.8 The temperature at which condensation begins.

A Relative humidity.
B Back diffusion.
C Dew.
D Dew point.

2.9 'Molecular pump' in nutrient absorption by plant roots is related to …

A diffusion.
B active transport.
C osmosis.
D adsorption.

2.10 … is a diatomic molecule.

A CO_2
B H_2O
C CH_4
D O_2

(10 × 1) **[10]**

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QUESTION 3

Choose a term 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	Symbol for atomic number	A	management practices
3.2	Soil colour of badly waterlogged soil	B	calcium
3.3	Readings of wet and dry bulb thermometer	C	capillary water
3.4	One of the factors needed by plants for optimal growth	D	electrons
		E	Z
3.5	Water that is not held strongly by the soil particles	F	A
3.6	Polar molecule	G	^0C
3.7	Its deficiency causes the curling of plant leaves	H	topography
		I	condensation
3.8	Particles that form the outside of an atom with a nearly zero mass	J	free water
3.9	The features of a landscape, such as hills and valleys	K	HCl
		L	grey soil colour
3.10	The process of changing steam into liquid water		

(10 × 1) **[10]**

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QUESTION 4

Give ONE word/term for each of the following descriptions. Write only the word/term next to the question number (4.1–4.10) in the ANSWER BOOK.

4.1 Part of an atom that carries protons and neutrons.

4.2 Movement of plant nutrients from a higher to a lower concentration of nutrients.

4.3 Anything that occupies space and has mass.

4.4 Structures that farmers build around crops to minimize the evaporation and transpiration rate caused by wind.

4.5 Removal of top soil from an area of more use to an area of less use.

4.6 A practice by chemists of determining the concentration of nutrient elements in a leaf.

4.7 Positively charged atom formed after a total transfer of electrons in chemical bonding.

4.8 Colloids that assist in the formation of aggregates where clay content is very low.

4.9 Protective part of the root that covers the root growing point.

4.10 An electrical force of attraction between a positive and a negative charge.

(10 × 1) **[10]**

TOTAL SECTION A: 40

SECTION B

QUESTION 5

5.1 Differentiate between ‘total plant nutrients’ and ‘available plant nutrients’. (4)

5.2 Plants need water for growth. Give FIVE functions of water in plants. (10)

5.3 Give THREE symptoms of a calcium deficiency. (3 × 2) (6)

5.4 Nitrogen stimulates lush vegetative growth. What does 'lush vegetative growth' mean? (2)

[22]

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QUESTION 6

6.1 Soil temperature is how hot or cold the soil is, which depends on the amount of the sun's energy that reaches the earth and heats the soil.

Give FIVE factors that influence soil temperature you have studied. (5)

6.2 Sandy soil is highly leached soil. Briefly describe any methods farmers can use to improve crop growth in sandy soil dealing with a leaching problem. (3)

6.3 Give Hans Jenny's 1941 equation representing the soil formation process. (2)

Sample/ Plot No.	pH (H_2O)	P (Bray 1) mg/kg	K (Am Acet) mg/kg	Ca (Am Acet) mg/kg	Mg (Am Acet) mg/kg	Na (Am Acet) mg/kg	Clay %	Silt %	Sand %	Textural class
No.2A-1	5.77	8.02	67.324	190.432	66.014	49.073	30	4	66	Sandy Clay Loam
No.2A-2	6.22	9.09	65.793	200.491	77.493	19.321	22	6	72	Sandy Clay Loam

6.4 Study the soil analysis results above and answer questions that follow.

NB: The hydrometer method was used to determine soil particle proportions.

6.4.1 Give the soil pH of the soil sample from plot No.2A-1 and plot No.2A-2 respectively. (2)

6.4.2 Which method was used to determine soil particle proportion in this soil analysis results? (1)

6.4.3 Which chemical was used to test the amount of phosphorus in mg/kg of soil? (1)

6.4.4 Give ONE reason for analysing soil from a piece of land for crop production. (2)

6.5 Although the organic component of soil is relatively small, its influence on soil and plant growth is very important. Give FIVE functions of organic matter in soil. (5 × 2) (10)

6.6 List THREE types of soil water. (3)

6.7 Define the following:

6.7.1 Capillarity

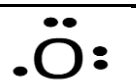
6.7.2 Soil profile

(2 × 2) (4)

[33]

QUESTION 7

7.1 Complete the table of Lewis diagrams for some elements below. Write only the correct answer next to the question number (7.1.1–7.1.3.) in the ANSWER BOOK. Do not redraw the table.

Name of element	Lewis diagram	Valence electrons
Carbon	7.1.1 …	4
7.1.2 …		2
Oxygen		7.1.3 …

(6)

7.2 Define the following terms:

7.2.1 Back diffusion

7.2.2 Transpiration

7.2.3 Covalent bonding

7.2.4 Filtration

(4 × 2) (8)

7.3 Explain the meaning of 'relative humidity of 54%'. (3)

7.4 Represent a water molecule in the form of a Couper diagram showing a bond angle of 105°. Use the free-hand drawing method. (5)

7.5 Decide whether the following molecules and compound are non-polar or polar molecules.

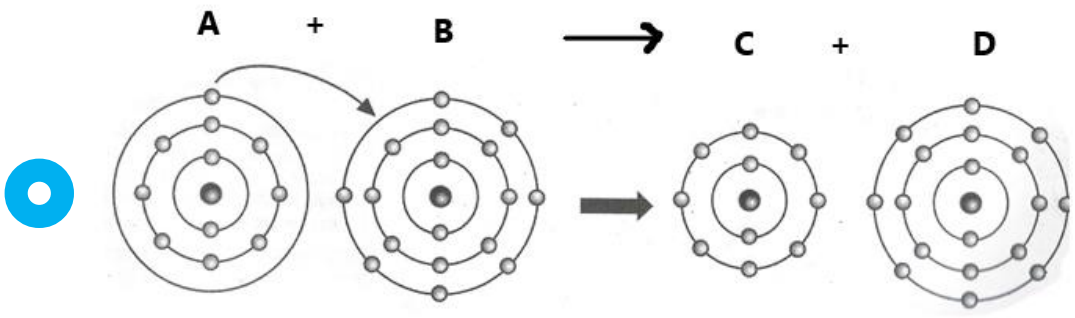
7.5.1 H_2

7.5.2 CH_4

7.5.3 H_2O

(3 × 2) (6)

7.6



(Source: Soil Science L2 (Macmillan) Student's Book by W. Burger)

FIGURE 1

7.6.1 Identify the type of bonding depicted (represented) by FIGURE 1 above. (2)

7.6.2 Give the reason for your answer in 7.6.1. (2)

7.6.3 Indicate A + B ⟶ C + D equation in a simplified version showing the outer shell only using the Lewis Structure format. (4)

7.6.4 Which atoms are represented by the following symbols? Write only the name of the atom next to each symbol (A, B, C and D) as presented. (4 × 2) (8)

7.7 This atom is number 7 on the periodic table. Answer the questions below:

7.7.1 Give the name of this atom.

7.7.2 How many protons does this atom have?

7.7.3 Give the symbol of this atom.

7.7.4 If its mass number is 14, what will the number of neutrons inside the nucleus of this atom be?

(4 × 2) (8)

7.8 Name any THREE types of mulch that farmers use to reduce the evaporation rate on their farms. (3)

[55]

TOTAL SECTION B: 110
GRAND TOTAL: 150

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