



**higher education  
& training**

Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL CERTIFICATE (VOCATIONAL)**

**SOIL SCIENCE  
NQF LEVEL 2**

(1011002)

**8 December 2020 (X-paper)  
09:00–12:00**

**This question paper consists of 10 pages.**

455Q1N2008

<p><b>TIME: 3 HOURS</b> <b>MARKS: 150</b></p>
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## **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 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 Atom particles with negligible mass are:
- A Protons
  - B Neutrons 
  - C Electrons
  - D Nucleus
- 1.2 Soil type with high water-retaining capacity that makes it cooler:
- A Loamy
  - B Sandy
  - C Mottled
  - D Clay
- 1.3 Two or more atoms of a molecule are joined together by a ...
- A strong reaction.
  - B moderate reaction.
  - C mechanical bond.
  - D chemical bond.
- 1.4 The appropriate time to take leaf samples of an apple plant for analysis is between January and ... 
- A August.
  - B March.
  - C February.
  - D June.
- 1.5 The steam that comes out of the spout of a boiling kettle is caused by ...
- A vaporisation.
  - B evaporation.
  - C condensation.
  - D precipitation.
- 1.6 Many plant nutrients occur as ... in the soil solution.
- A cations
  - B minerals
  - C molecules 
  - D salts

1.7 An upside-down V-shaped green pattern on leaf bases shows a deficiency of ...

- A N
- B Ca
- C Mg
- D P



1.8 Plants can reduce their transpiration rate if they have ...

- A small leaves.
- B short stems.
- C small taproots.
- D polished stems.

1.9 A brown chemical compound formed after iron metal reacted with water or air:

- A Rust
- B Compost
- C Iron chloride
- D Iron compound

1.10 The level in the ground below where rocks are saturated with water:

- A R-horizon
- B B-horizon
- C A-horizon
- D Water table



1.11 Bipolar molecule:

- A  $\text{CO}_2$
- B  $\text{H}_2\text{O}$
- C  $\text{HCl}$
- D  $\text{NaCl}$

1.12 The ... of an atom comes from the space that the electrons occupy.

- A mass
- B volume
- C size
- D reality

1.13 When particles float in the middle of a liquid they are ...

- A colliding.
- B pulled.
- C suspended.
- D pushed.



1.14 Plant nutrient not in the group of macronutrients:

- A Molybdenum
- B Phosphorus
- C Nitrogen
- D Silicon



1.15 A big difference between wet-bulb and dry-bulb thermometer readings indicates ... air.

- A wet
- B saturated
- C slightly moist
- D dry

(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 Nucleons are the neutral particles of an atom.

2.2 Macro-organisms can be seen with the naked eye.

2.3 Root hairs also increase the absorption surface of roots.



2.4 A blowing fan next to an opened beaker full of water can increase the evaporation rate of the water from the same beaker.

2.5 In good agricultural soil the percentage of pore spaces varies between 30% and 70%.

(5 × 2) [10]

**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	Very fine microscopic soil particles less than 0,002 mm	A	anion
		B	root cap
3.2	Minimises loss of water through evaporation	C	distillation
3.3	Electrons occupying the last energy level	D	clay
3.4	Preparing land for planting	E	condensation
3.5	Protects root tips against damage as the root grows	F	till
3.6	Atom that gained an electron	G	valence electrons
3.7	Stimulates flower formation	H	temperature changes
3.8	Physical process to separate mixtures	I	mulching
3.9	Physical weathering agent	J	rusting
3.10	Process of changing steam into liquid water	K	phosphorus
		L	pairing electrons

(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 A wet-bulb thermometer is cooled by ...
- 4.2 ... is build-up caused by adding things.
- 4.3 Protons + neutrons = ...
- 4.4 When transpiration takes place and water evaporates through the stomata of a leaf ... is created.
- 4.5 ... is moisture on grass in the morning.


(5 × 1)

**[5]****TOTAL SECTION A: 40**

**SECTION B****QUESTION 5**

- 5.1 Explain the term *reserve nutrients*. (2)
- 5.2 What does the abbreviation DNA stand for?  (2)
- 5.3 Differentiate between *diffusion* and *osmosis*. (2 + 2) (4)
- 5.4 Where do plants obtain each of the following macro-elements?
- 5.4.1 Hydrogen
- 5.4.2 Carbon  (2 × 1) (2)
- 5.5 Which elements should farmers apply to solve each of the following problems?
- 5.5.1 Very small leaves
- 5.5.2 Poor flower development
- 5.5.3 Curled leaves
- 5.5.4 Plant leaves with unnaturally dark green colour (4 × 2) (8)
- 5.6 Briefly explain *cation exchange* as an important process that takes place in soil.  (4)
- 5.7 Give FOUR functions of water in nutrients and water uptake by plants. (4 × 2) (8)
- [30]**

**QUESTION 6**

- 6.1 Define each of the following terms relating to soil science:
- 6.1.1 Aspect
- 6.1.2 Soil profile
- 6.1.3 Illuviation  (3 × 2) (6)

- 6.2 The Soil Science L2 class wants to test the presence of air in soil. The class has a measuring cylinder, some dry soil and water. ✂

Explain how the class will test for the presence of air in soil and what they will observe. (3)

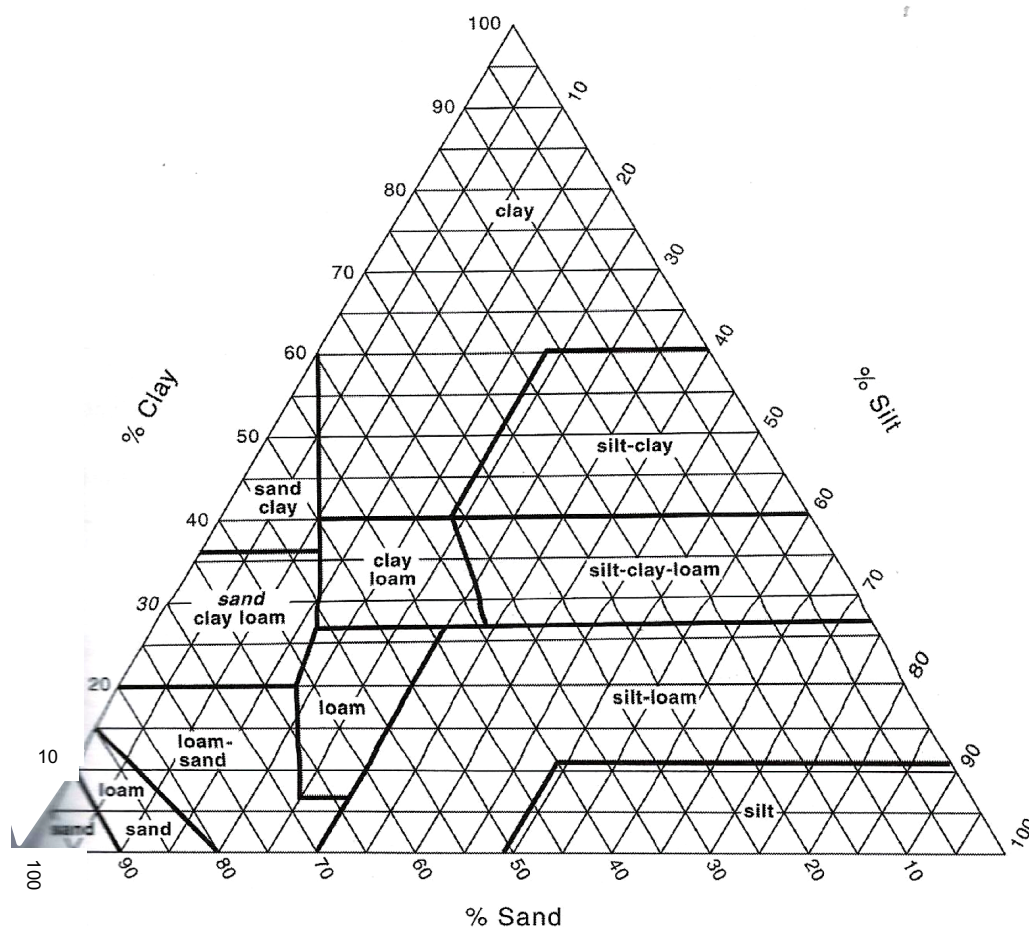
- 6.3 Name THREE groups of organic matter. (3)

- 6.4 Answer the following questions on soil structure

- 6.4.1 Name FOUR main soil structures (4 × 1) (4)

- 6.4.2 ✂ Describe the arrangement of soil particles in each of the soil structure named in question 6.4.1 above. (4 × 1) (4)

- 6.5 A farmer wants to check the soil texture of one of his fields to see if it will be suitable for growing sweet potatoes. Sweet potatoes do well in sandy soils, but not in clay soils. The farmer took soil samples to the laboratory for texture analysis and received the following results:  
Sand = 80%, silt = 12%, clay = 8%  
Study the diagram below and answer the questions.



[Source: Macmillan Soil Science L2 Student Book]

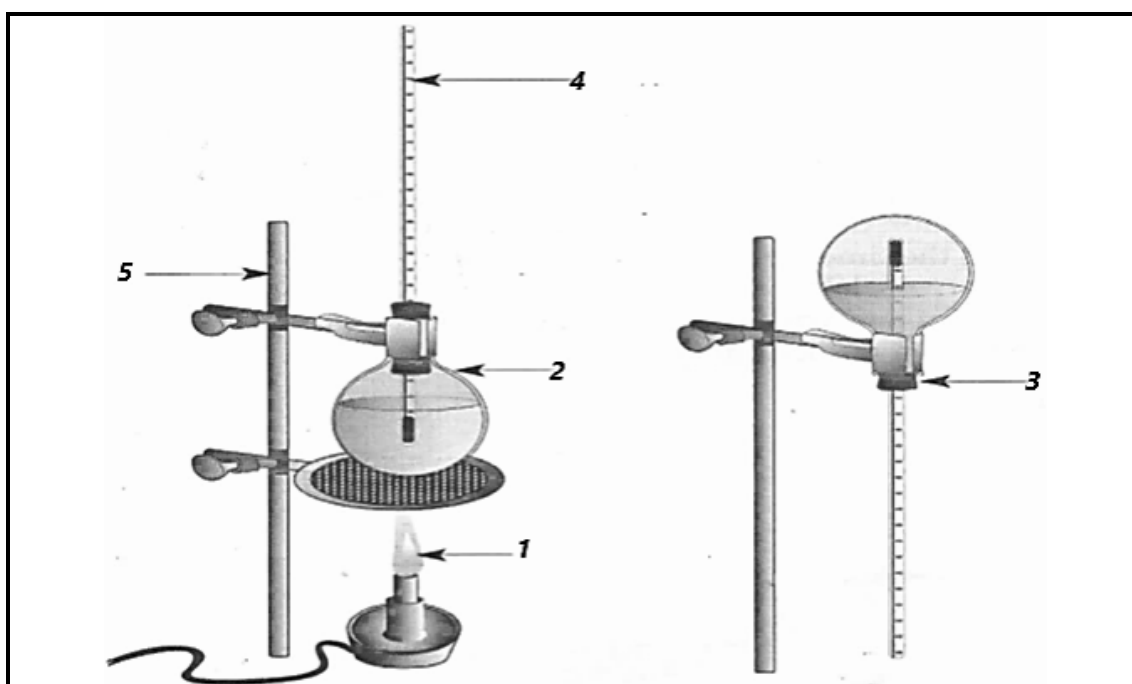
FIGURE 1



- 6.5.1 Use the texture triangle to determine the texture of the soil. (2)
- 6.5.2 Is the soil suitable for growing sweet potatoes? (1)
- 6.5.3 Explain the answer in question 6.5.2 above. ✂ (2)
- 6.5.4 Determine the textural class of a soil sample with the following composition: (25% silt, 55% sand and 20% clay) (2)
- [27]**

## QUESTION 7

- 7.1 Study the diagram below and answer the questions.



[Source: Macmillan Soil Science L2 Student Book]

**FIGURE 2**

- 7.1.1 Label the diagram by writing only the answer next to the number (1–5) in the ANSWER BOOK. ✂ (5 × 1) (5)
- 7.1.2 Name the process represented by FIGURE 2. (2)
- 7.1.3 Define the process named in QUESTION 7.1.2 above. (2)
- 7.2 Use the formula  $\text{H}_2\text{CO}_3$  to answer the following questions:
- 7.2.1 What is the name of this compound? (2)
- 7.2.2 Name the elements of this compound ✂ (3 × 1) (3)
- 7.2.3 Give the number of atoms each element in question 7.2.2 above contains. (3 × 1) (3)

7.3 Draw a diagram to show the chemical reaction of water-molecule formation. (5)

7.4 Briefly explain how many electrons a magnesium atom must lose to become a magnesium ion. (3)  
[25]



## QUESTION 8

8.1 Answer the following questions based on relative humidity.

8.1.1 Define *relative humidity*. (2)

8.1.2 Name TWO instruments used when measuring relative humidity. (2)

8.1.3 Indicate the difference between instruments named in question 8.1.2 above. (2)

8.1.4 Why is high humidity in a storeroom on a farm dangerous? (2)



8.1.5 Where else on a farm (except in a storeroom) is it necessary to measure relative humidity? (2)

8.2 Explain THREE methods that farmers may use to reduce evaporation and transpiration in their fields. (3 × 2) (6)

8.3 Draw a diagram to show the ionisation of sodium chloride when it dissolves in water. (6)

8.4 Define each of the following terms:

8.4.1 Atom

8.4.2 Mixture



8.4.3 Lewis structure

(3 × 2) (6)  
[28]

**TOTAL SECTION B: 110**  
**GRAND TOTAL: 150**