higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

SOIL SCIENCE
NQF LEVEL 3

14 November 2022

This marking guideline consists of 7 pages.

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SECTION A

QUESTION 1

1.1 C
1.2 A
1.3 A
1.4 B
1.5 A
1.6 B
1.7 D
1.8 D
1.9 B
1.10 A

(10 × 1) **[10]**

QUESTION 2

2.1 False
2.2 True
2.3 False
2.4 False
2.5 True

(5 × 1) **[5]**

QUESTION 3

3.1 I
3.2 D
3.3 F
3.4 A
3.5 C
3.6 J
3.7 K
3.8 G
3.9 B
3.10 H

(10 × 1) **[10]**

QUESTION 4

4.1 Sodium✓✓
4.2 Mulch✓✓
4.3 Pigment✓✓
4.4 Evapotranspiration✓✓
4.5 low✓✓

(5 × 2) **[10]**

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QUESTION 5

5.1
- Nitrogen cycle – process by which the atmospheric nitrogen enters the soil and micro-organisms, and then back into the atmosphere again.✓✓
- The carbon cycle – process by which carbon dioxide is fixed by photosynthesis, forming organic nutrients, and is ultimately restored by respiration, combustion, or protoplasmic decay.✓✓ (4)

5.2
- Nitrification
- Ammonification/Mineralisation
- Denitrification (3)

5.3
- Adding artificial or inorganic nitrogen fertilisers
- Growing leguminous plants and ploughing them back into the soil (green manuring)
- Adding manure
- Adding compost or organic matter (Any 2 × 1) (2)

5.4 Ammonium✓ and nitrate ion✓ (2)
[11]

TOTAL SECTION A: 46

SECTION B

QUESTION 6

6.1 TAM = AMC mm/m × rooting depth
= 200/1000 × 700✓
= 140 mm✓✓ (3)

6.2 The soil has a field capacity of 140 mm, and the rate at which the water is being lost is 6 mm a day; the soil may not get drier than 50% of the TAM.

Thus TAM × 50%
140 mm × 50% = 70 mm✓
Therefore, 70 mm/6 mm = 11,6666 days = 12 days✓✓ (3)

6.3 TAM – 70 mm
140 mm – 70 mm = 70 mm. Every 12 days, 70 mm is required.
Therefore, 1 hectare = irrigation = 10 000 × 70
= 700 000 ℓ ✓
= 700 000 × 4
= 2 800 000 ℓ ✓✓ (3)

6.4 6.4.1 The term anaerobic means in the absence of free oxygen.✓✓

6.4.2 Clay soil holds more water than sandy soil or sandy soil hold less water than clay soil

6.4.3 Free water or gravitational water✓✓

6.4.4 Plants loses water form leaves through the process known as transpiration
The soil loses water through the process known as evaporation

6.4.5 Wind,✓ high temperatures,✓ broad/large leaves, uncovered soil
(Any 2 × 1)
(5 × 2) (10)
[19]

QUESTION 7

7.1 Rotational grazing is the movement of livestock from one grazing area to another, to give the grass or pastures time to recover, which also leaves a portion of the farm to 'rest.'✓✓ (2)

7.2
- Resting pasture
- Restrict animal numbers
- Rotational grazing
- Animal diversity
- No burning of veld without a permit
- Removal of alien invader plants (Any 5 × 1) (5)

7.3
- Mulching
- Conservation tillage
- Crop rotations
- Using contour planting
- Growing cover crops and green manure
- Ridging and terracing
- Stopping and filling in gullies (Any 3 × 1) (3)

7.4 7.4.1 Primary causes of soil erosion
- Water✓ and wind✓ (2)

7.4.2 **Loss of rooting depth**✓
Erosion carries away soil and thins the soil, making it shallow for roots to grow.✓The shallow soil will decrease water-holding capacity of the soil.✓This lead to the reduction of yield

Loss of soil fertility✓
Topsoil provides the best environment for root growth because it provides the most air, water and nutrients✓. Removal of air, water, and nutrients from the topsoil provide bad environment for root growth and microorganisms✓.

Loss of plant production✓
Topsoil contains organic matter and as it is eroded, nitrogen, phosphorus and other nutrients are lost✓. Loss of N, P and other nutrients decreases yield✓. When soil fertility is reduced, inputs of inorganic fertilisers increases, this also increases input costs
(Any 3 × 3) (9)

7.4.3
- Soil erodibility
- Surface roughness
- Climatic conditions
- Length of the field
- Vegetation cover (5)

7.4.4
- Weathering is the decomposition of rock, soil and minerals by direct contact with the atmosphere.✓✓
- Erosion is the displacement of solids by wind, water and ice.✓✓ (4)

7.4.5
- Gully erosion
- Stream bank erosion
- Sheet erosion
- Rill erosion
- Splash erosion (5)

[35]

TOTAL SECTION B: 54

SECTION C

QUESTION 8

8.1
- Visual inspection
- Soil tests
- Plant tissues (leaf analysis) (3)

8.2 Guidelines for soil sampling:
- Only one type of soil to be sampled✓✓
- Divide the area according to cropping, fertiliser and liming history✓✓
- Unusual areas should be avoided. E.g., field edges or area with fertiliser spills✓✓
- Patches in land where plant growth is poor should be sampled when the crops are still on the land✓✓ (8)

8.3
- Electronic pH meter
- Colorimetric method
- Litmus papers (3)

8.4 Electronic pH meter✓✓ (2)

8.5 Dolomitic lime or $CaCO_3$, $MgCO_3$✓✓ (2)

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8.6

	Acidic soils	**Sodic soils**
Cation responsible	Hydrogen ion (H^+)✓	Sodium ion or Na^+✓
pH	3,5✓	Between 8,5 and 10✓
Treatment to rectify	Apply lime (calcitic or dolomitic lime)✓	• Good drainage method✓ • Over-irrigation • Organic matter may be added to improve soil structure (Any ONE)

(6)
[24]

QUESTION 9

9.1 Mineral salts – compounds occurring in rocks or soil and made up of positive and negative ions.✓✓ (2)

9.2
- Essential nutrients
- Non-essential nutrients (2)

9.3
- Improves aeration
- Results in savings on nitrogen fertilisers
- Legume green manure fix nitrogen in the soil
- Prevents weed growth
- Improves soil structure
- Improves drainage
- Improves water-holding capacity
- Increases the percentage of organic matter & microbes (Any 6 × 1) (6)

9.4
- Organic fertilisers – decomposed plant and animal residues.✓✓
- Inorganic fertilisers – ground-up rocks which contain nutrients or are manufactured by industry.✓✓ (4)

9.5 **Disadvantages of inorganic fertilisers:**
A problem with bulk blends is separation of materials which can result in uneven distribution of nutrients✓.
High nutrient loss can occur through leaching especially in sandy soil. If conditions are dry, loss of nitrogen by volatilisation will occur✓.
Most fertiliser are salts. High rate of fertiliser application may result in the build-up of salts causing salinity in the soil✓.
Inorganic fertilisers have little effect on improving soil structure in terms of aggregation compared to the aggregation effects of organic materials✓. They also do not add to nutrient-holding capacity or water-holding capacity of soils.
Continual addition of inorganic fertilisers decreases the number of micro-organisms because they are not food for micro-organisms✓.
Fertilisers that contain ammonia or produce ammonia generate hydrogen ions that may acidify the soil✓. (Any 5 × 1) (5)

9.6
- Ammonium nitrate
- Limestone ammonium nitrate
- Ammonium sulphate
- Urea (Any 3 × 1) (3)

9.7
- For root growth and flower, fruit, and seed formation
- Improves quality of produce
- Required in the making of cell membranes, enzymes and nucleic acid
- Necessary for energy conversion (4)

[26]

TOTAL SECTION C: 50
GRAND TOTAL: 150