



FACULTY OF AGRICULTURE

First Examination in BSc Agricultural Resource Management and Technology/ BSc

Agribusiness Management / BSc Green Technology (Part II)

August 2023

SS 12301 Fundamentals of Soil Science (Compulsory)

Practical

INSTRUCTIONS

Answer **ALL** the questions.  
Only non-programmable calculators are permitted.  
Mobile phones are **NOT** permitted.  
Each question carries a total mark of 100.  
Attach the question paper to the end of the answer booklet.

TIME: 2 (two) Hours

INDEX NUMBER

1. A farmer owns two lands of 2 ha (Land A) and 3 ha (Land B) in extent. These two lands being used for agriculture for 5 years and have the same soil type. He needs to assess some properties of the topsoil of the lands. A soil analyst has taken topsoil samples from land A and B.

Soil samples were taken from the topsoil of the two lands using core samplers with a **diameter** of **6 cm** and a **height** of **7 cm**. The soil samples were placed in crucibles and then heated in an oven at 105°C for 24 hours. The readings of the analysis are given in Table 01.

Table 01. Sample data

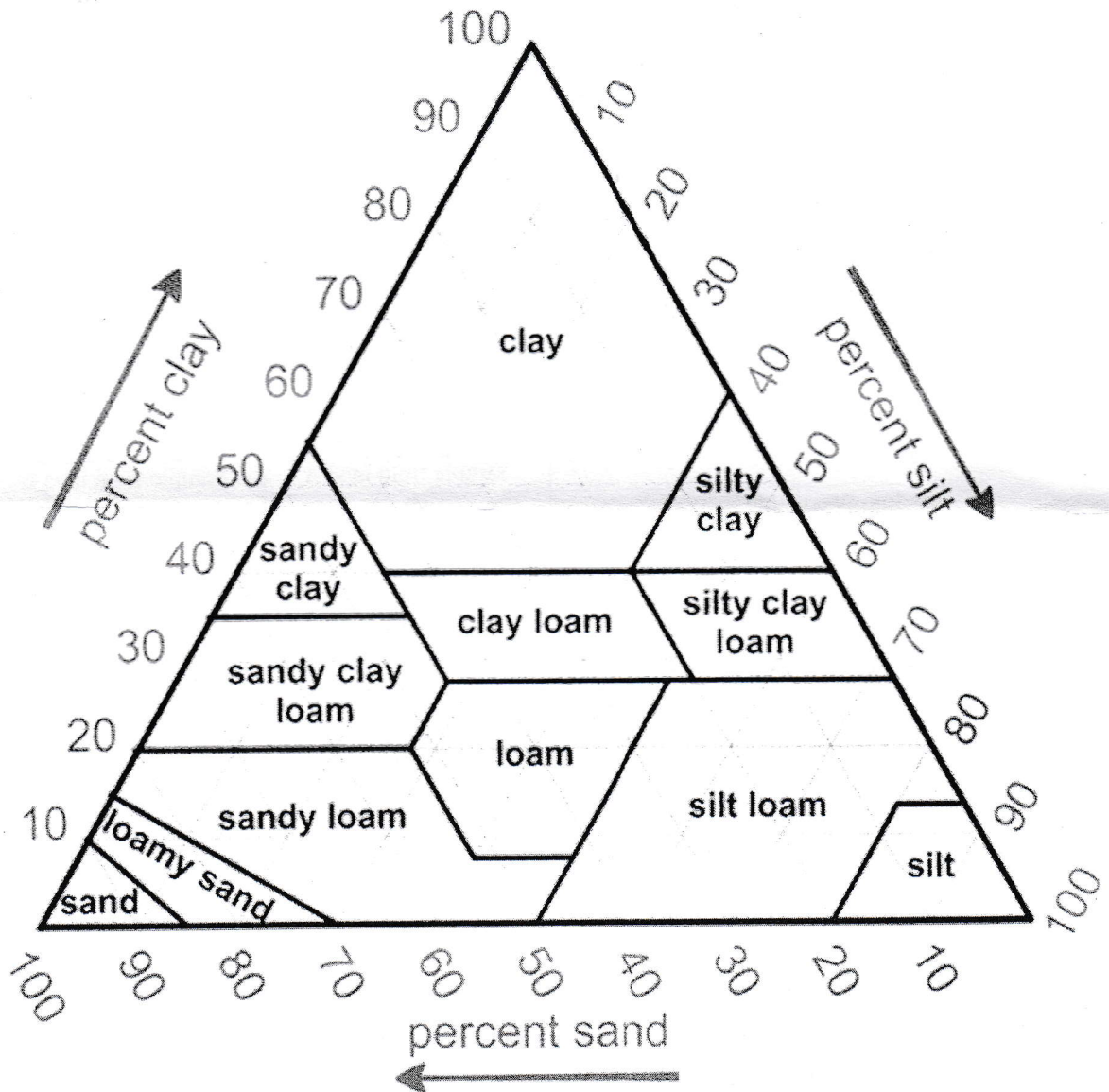
	Measured values	
	Sample from land A	Sample from land B
Empty crucible	50 g	62 g
Moist soil + crucible	325 g	340 g
Oven dried soil + crucible	300 g	380 g
Calculated particle density	2.62 g cm <sup>-3</sup>	2.61 g cm <sup>-3</sup>

Using the information given in the above;

- Calculate the volume of a core used for sampling. (10 marks)
  - Calculate the bulk density of the soil in land A. (15 marks)
  - Calculate the bulk density of the soil in land B. (15 marks)
  - Calculate the total porosity of the soil in land A. (10 marks)
  - Calculate the total porosity of the soil in land B. (10 marks)
  - Calculate the gravimetric water content (%) of the soil in land A. (15 marks)
  - Calculate the gravimetric water content (%) of the soil in land B. (15 marks)
  - In your opinion, what could be the reasons for soils in land A and B to have different bulk densities and porosities? (10 marks)
2. A group of students in your batch were asked to find the texture of a soil sample using the pipette method. They used 20 g of sieved air-dried soil for the analysis. Another 10 g from the same soil sample (a sub-sample) was kept in a drying oven to determine its moisture content. The following readings and measurements were taken during their experiment.
- Oven-dry weight of the sub-sample = 8.5 g
  - After evaporating water,  
the oven-dry weight of the first 25 ml aliquot (3 min & 42 seconds) = 0.34 g

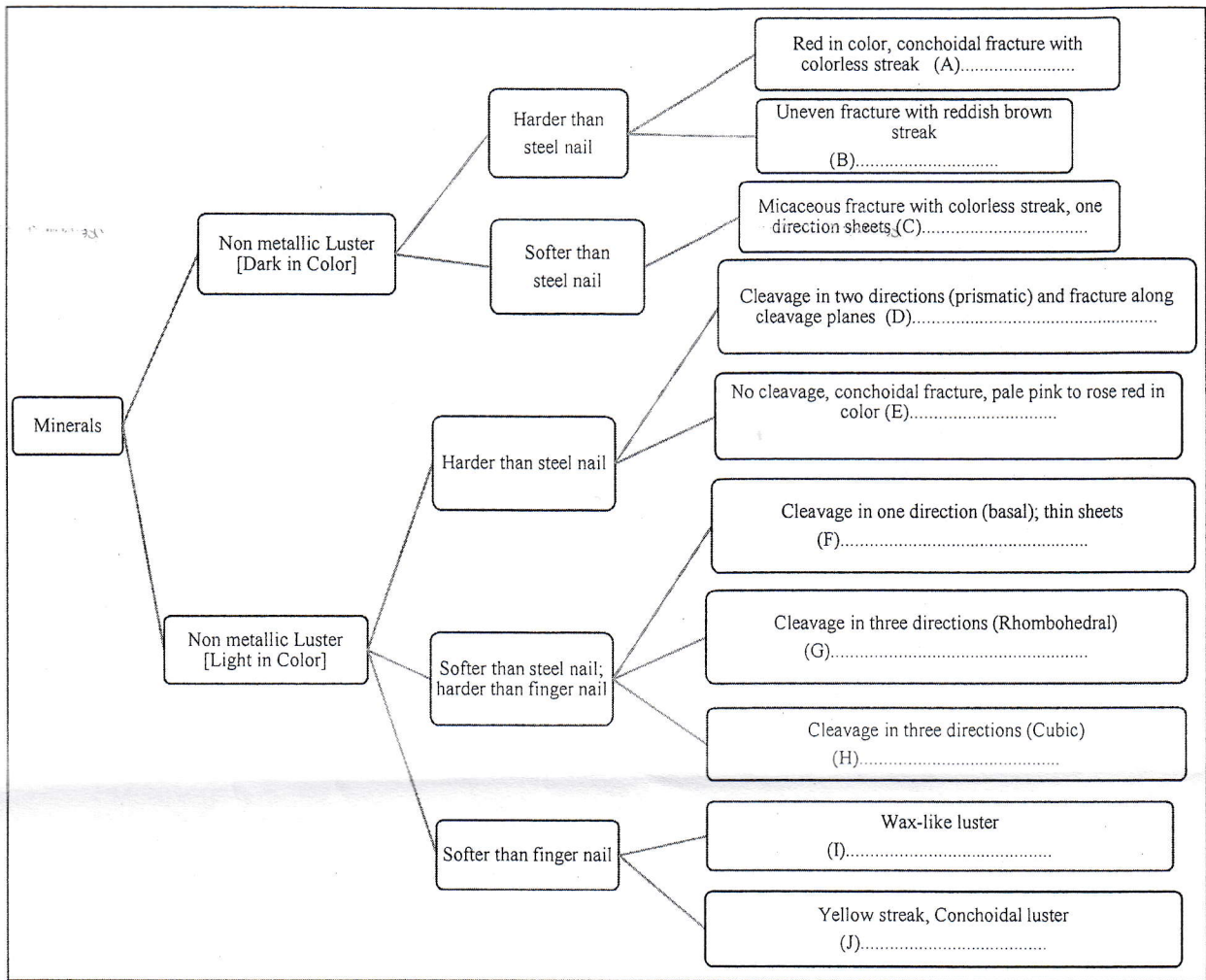
the oven-dry weight of the second 25 ml aliquot (6 hrs. 10 min. & 42 sec.) = 0.085 g

- Total volume of the mixture = 1000 ml
- Calculate the amount of moisture-free soil used for the texture determination. (15 marks)
  - Calculate the clay percentage of the given soil sample. (20 marks)
  - Calculate the silt percentage of the given soil sample. (25 marks)
  - Calculate the sand percentage of the given soil sample. (15 marks)
  - Find the textural class of the given soil sample. (15 marks)
  - State a possible error that could reduce the accuracy of this texture determination procedure. (10 marks)



3. Fill in the blanks (A-J) using given minerals. **Write your answer in the answering book only.** (100 marks)

- |           |                        |                |            |              |
|-----------|------------------------|----------------|------------|--------------|
| 1. Sulfur | 2. Feldspar            | 3. Rose quartz | 4. Calcite | 5. Muscovite |
| 6. Mica   | 7. Biotite mica halite | 8. Talc        | 9. Garnet  | 10. Hematite |



4. Following readings were obtained for the practical conducted to determine the specific gravity of a mineral.

- Weight of beaker (M1) = 175 g
- Weight of beaker + Mineral (M2) = 460 g
- Weight of beaker + Water (After removing the minerals) (M3) = 645 g
- Weight of beaker + Water (Filled up to 500 ml) (M4) = 750 g

- A) Calculate the specific gravity of the mineral. (80 marks)
- B) What are the two steps that you should do carefully when you conduct this practical? (20 marks)