



1ST SEMESTER 2017/2018

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UNIVERSITY OF SWAZILAND

MAIN EXAMINATION

**PROGRAMME: BACHELOR OF SCIENCE IN
AGRONOMY, YEAR 2**

COURSE CODE: CPR 205

**TITLE OF PAPER: INTRODUCTION TO SOIL
SCIENCE**

TIME ALLOWED: 2 HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS

**DO NOT OPEN THIS QUESTION UNTIL PERMISSION HAS BEEN
GRANTED BY THE INVIGILATOR**

SECTION A

This section has 25 multiple choice questions (25 Marks). There may be more than one answer per question.

1. A' horizon of the soils also designated as:
A. Eluviated horizon B. Illuviated horizon
C. Both (a) & (b) D. None of these
2. Hue' is the term, which is used for the determination of:
A. Relative thickness or whiteness B. Purity of the colour
C. Dominant spectral or rainbow D. All of the above
3. A man made epipedon in many characters except P_2O_5 content (more than 250 ppm) is:
A. Histitic epipedon B. Ochric epipedon
C. Anthropic epipedon D. Umbric epipedon
4. A sub-surface horizon in which the accumulation of organic matter and clay occurs just below the plough:
A. A horizon B. B horizon
C. C horizon D. None of these
5. A vertical section of soil body, which shows different layer, is known as:
A. Soil horizons B. Soil profile
C. Regolith D. Parent material
6. A vertical section of the soil through all its horizons are extending into the parent material is known as:
A. Soil horizons B. Solum
C. Profile D. None of the above
7. A pH value of 6.0 indicates that the soil reaction is:
A. Acidic B. Alkaline
C. Neutral D. Highly alkaline
8. Adsorbed hydrogen and aluminium are largely responsible for:
A. Soil acidity B. Soil alkalinity
C. Neutrality D. None of the above
9. Adsorbed Ca^{++} , Mg^{++} or Al^{++} may encourage soil aggregate formation starting with a process called:
A. Flocculation B. Exfoliation
C. Soil solrization D. None of above
10. Aridisols soils re found in the region of:
A. Humid B. Arid
C. Submerged D. None of these

11. Arrangement of soil particles is referred to as:
A. Soil structure B. Soil texture
C. Soil organization D. None of the above
12. Black soils _____ in organic matter and high in bases:
A. Poor B. Medium
C. High D. None of these
13. Bulk density is denoted by:
A. Weight of the given soil sample volume of the same soil sample (g/c.c.)
B. Volume of the soil sample/Weight of the soil sample (g/c.c.)
C. Weight of the soil sample x 100/Volume of the soil sample (g/c.c.)
D. None of these
14. The Zn, Fe, Cu, B, Mn and Mo are called micronutrients, because they are:
A. Nutrients of microscopic significance B. Nutrients, which produce microscopic effects
C. Nutrients that is required in minute qualities D. Nutrients required by micro-organisms
15. Cation exchange capacity is expressed as:
A. Mole/litre B. cmol/kg
C. Meq/lit D. Per cent
16. Cation exchange capacity is highest in:
A. Kaolinite B. Montmorillonite
C. Illite D. Humus
17. Chemical weathering governs mostly by the process:
A. Solution B. Hydration
C. Hydrolysis D. All of these
18. Different soil separate may be determined with the help of:
A. International pipette method B. Yet's chart
C. Munsell chart D. None of the above
19. Which one of the following refers to the nutrient-holding ability of the soil?
A. Alkalinity
B. Cation Exchange Capacity
C. Available Water Capacity
D. Nutrient Loading
20. Leaching of bases out of a soil causes the soil to become
A. Alkaline
B. Acid
C. Acid-Alkaline
D. None of the above

21. Which of the following is NOT a plant nutrient?
- A. Nitrogen
 - B. Copper
 - C. Aluminum
 - D. Potassium
22. Nutrients needed in large quantities by plants are called
- A. Meganutrients
 - B. Micronutrients
 - C. Macronutrients
 - D. High end nutrients
23. Which one of the following plant nutrients comes from the air?
- A. Carbon
 - B. Potassium
 - C. Hydrogen
 - D. Copper
24. Which of the following affects nutrient availability? (circle all correct responses)
- A. pH
 - B. Soil organic matter content
 - C. Texture
 - D. Soil moisture
25. An ion with a positive charge is called a(n)
- A. Cation
 - B. Anion
 - C. Onion
 - D. Positron

SECTION B (30 marks)

QUESTION 1

Table 1: In the table below is the morphological properties of the soils at the Crop Production Department that has been described using morphological properties.

- Itemize five factors that can influence the formation of the soil above. (5 marks).
- Five horizons can be identified (Table 1), state the Hue in these horizons (5 marks);
- Briefly itemize the soil structure in these five horizons (5 marks)
- In which Soil Order can the soil be placed? (5 marks)
- Briefly, state how you will collect soil samples from these horizons for laboratory analyzes (10 marks)

Table 1: Morphological properties of soils, CP building, Luyengo, UNISWA Campus.

Classification	: fine-loamy, mixed, thermic, Calcic Palearudult
Location	: 200 m north-west of the Crop Production Complex, Luyengo, University of Swaziland, Swaziland.
Vegetation	Grasses
Landscape position : alluvial plain	Upper slope
Slope	: 1-4% concave position
Parent material	: Alluvium derived from gabbro
Elevation	: 580 m above sea level (a.s.l).
Colour	: on moist basis
Depth (cm)	Morphological Properties
0-15	Reddish brown 5R $\frac{4}{6}$, silty clay loam, moderate medium; granular and strong medium subangular blocky structure, slightly hard; friable, sticky, plastic; common medium roots; strongly effervescent; gradual boundary
15-45	Yellowish red 5YR, silty clay loam, strong coarse angular blocky structure; very hard, firm, sticky, plastic; few fine roots; strongly effervescent; clear boundary
45-85	Yellowish red 5YR $\frac{4}{6}$, silty clay loam, strong coarse angular blocky structure; very hard, firm, sticky, plastic; very few fine roots; stage I calcium carbonate filaments, strongly effervescent; gradual boundary
85-90	Strong brown 7.5YR 4/6, silty clay loam, strong coarse angular blocky structure that breaks to strong medium subangular blocky; very hard, firm, very plastic, sticky; stage II calcium carbonate nodules; common thick clay films; no roots; violently effervescent; clear boundary
90-120	Reddish brown 5YR $\frac{4}{6}$, silty clay loam, moderate medium subangular blocky structure; slightly hard, firm, slightly sticky, slightly plastic; stage II calcium carbonate; many thick clay films; violently effervescent; gradual boundary

SECTION C (45 Marks)

QUESTION 1

- Calculate the Clay contents (%) (9 marks)
- Use the Textural Triangle (Fig 1) to estimate the soil texture shown in Table 2 (9 marks)
- Estimate the Soil organic matter contents (%) (9 marks)
- Calculate the porosity (%) given that the particle size density is 2.65 g/cm^3 (9 marks)
- Calculate effective cation exchange capacity (ECEC) (cmol/kg) (9 marks)

Table 2. A data is given on the selected soil physical and chemical properties of the pedons in Luyengo, Swaziland

Pit	Depth	Horizon	Sand	Silt	Org. C	BD	pHw	pHk	Av-P	Na ⁺	Mg ²⁺	Ca ²⁺	K ⁺
			----- % -----			g/cm^3			mg/kg	----- cmol/kg -----			
1	0-20	Ap	57.3	30.72	1.25	1.52	4.97	4.25	2.16	0.16	0.70	0.18	0.20
1	20-50	Bt	59.3	26.72	0.23	1.5	4.88	4.23	2.734	0.15	0.98	0.18	0.47
1	50-95	B2	69.3	20.72	3.9	1.57	5.25	4.52	4.15	0.36	1.54	0.26	0.21
1	95-120	3C	63.3	22.72	2.0	1.5	5.14	4.53	1.32	0.78	0.90	0.26	0.21
2	10-30	A	59.3	34.72	1	1.62	4.83	4.26	2.02	0.57	0.72	0.71	0.17
2	30-65	Bt1	61.3	26.72	05	1.52	4.83	4.3	1.64	0.37	0.72	0.36	0.18
2	65-90	Bt2	74.7	15.28	1.05	1.58	5.4	4.41	1.38	0.42	0.73	0.95	0.11
2	90-105	C1	67.3	22.72	2.0	1.59	4.97	4.52	3.28	0.30	0.68	0.78	0.47
2	105+	C2	68	20	1.12	1.54	4.8	4.35	2.03	0.18	1.74	0.85	0.21

Note: BD= Bulk density; pHw= pH water; pHk = pH in KCl; Av-P = Available Phosphorus ; Org. C = organic carbon

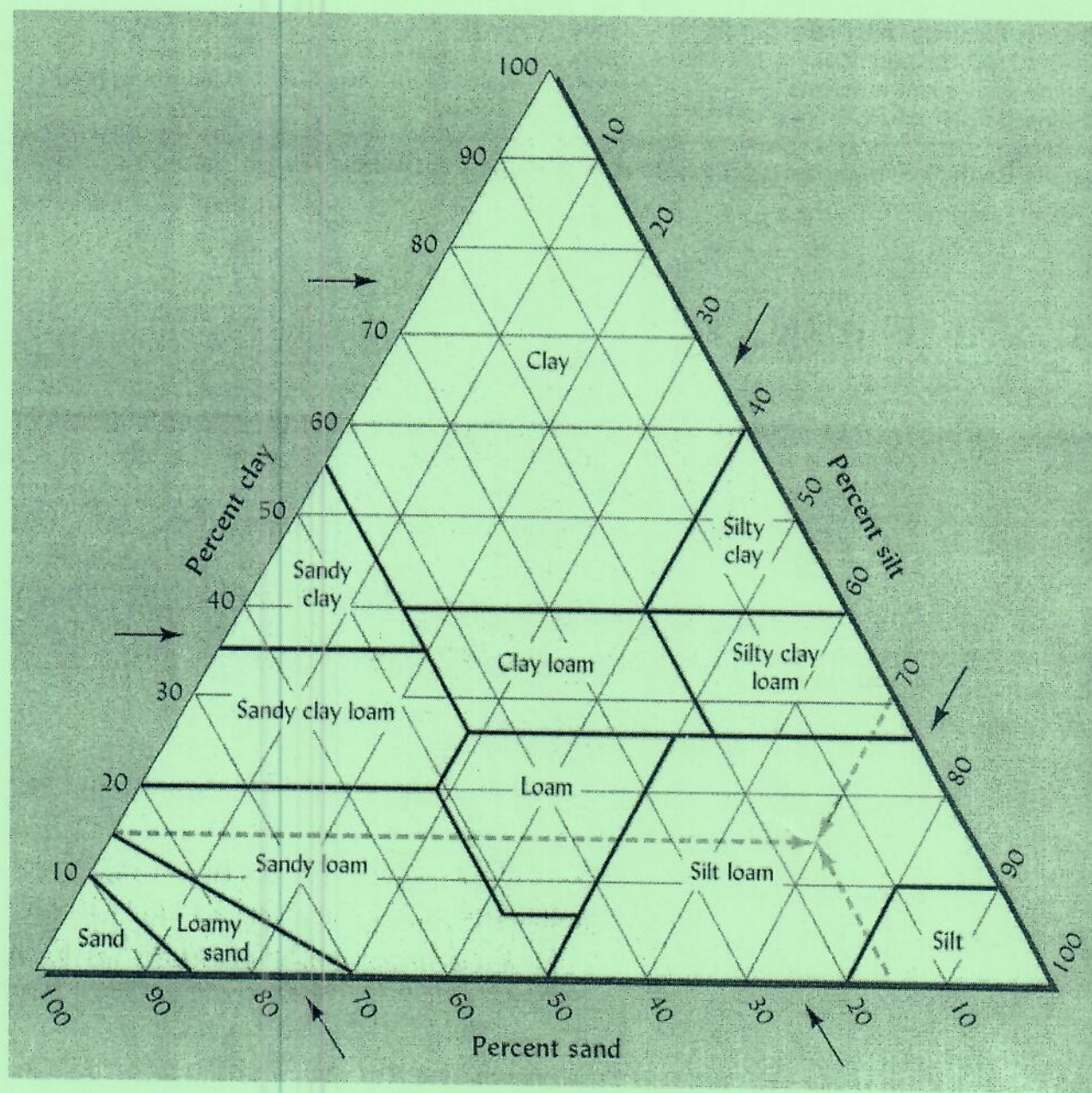


Fig 1: Textural Triangle