"Investing in Africa's future"

COLLEGE OF HEALTH, AGRICULTURE AND NATURAL SCIENCES

NACP 111 INTRODUCTION TO SOIL SCIENCE

END OF SEMESTER EXAMINATIONS

NOVEMBER/DECEMBER 2021

LECTURER: MRS S MBIZI

DURATION: 5 HOURS

INSTRUCTIONS

1. Read and understand all questions before you answer.
2. Answer any one question from any of the options 1, 2 and 3.
3. All working for numerical answers must be shown.
4. The intended number of marks is given in brackets at the end of each question or part of the question.
5. Begin your answer for each question on a new page.

QUESTIONS

1. (a) Soil forming processes are those that alter the regolith and give it the acquired characteristics that differentiate the soil from its original parent material.
Describe the processes involved in soil formation. (25)
(b) i. What are the main distinctions of Saline and Sodic soils. (5)
ii. Explain any three methods of reclamation of Saline and Sodic soils. (10)
(c) With the aid of a diagram, clearly explain the structure of a typical soil profile showing all Horizons including the:
i. Regolith
ii. Solum
iii. Saprolite (10)

(d) i. Differentiate between Primary and Secondary minerals, citing examples of each. (4)

ii. Discuss how Parent material, Climate and Biosphere influence soil formation. (15)

iii Describe how soil structure and texture can affect availability of water to crops. (6)

(e) I. Explain the term bulk density and give its mathematical notation. (5)

ii. Outline the factors that affect Bulk Density (20)

2. (a) Explain with the aid of Diagrams the two building blocks which are important in soil formation. (6)
(b) Clearly show (with the help of reactions where possible) how the following can influence soil formation.
i. Hydrolysis
ii. Hydration
iii. Carbonation
iv. Human activities (20)

(c) Discuss the four main groups of Aluminosilicate clays. (20)

(d) Distinguish clearly between pH – dependent and permanent charges in clays. (4)

(e) Interpret the following soil analysis results from different farmers who sent soil

samples of top soil (0-300mm) and complete **ALL** the missing values of soils A and B.

(25)

FARMER	**A**	**B**
Sand %	30	64
Clay %	50	27
Silt %	20	9
pH	4.2	8.0
Exch Ca mmolesc kg-1	24.6	50.4
Exch Mg mmolesc kg-1	13,7	21.4
Exch K mmolesc kg-1	3.1	2.7
Exch Na mmolesckg-1	0.2	8.8

Ecxh H mmolesckg-1	10.8	0.2
Bulk Density kgm-3	1250	18.00
Particle Density kgm-3	2600	2650
Exch Na mmolesckg-1	0.2	8.8
Ecxh H mmolesckg-1	10.8	0.2
CEC mmolesckg-1		
Bulk Density kgm-3	1250	18.00
Particle Density	2600	2650
Total Exch Bases (TEB)		
Total Exch Acids (TEA)		
% Base Saturation (% BS)		
ESP value mmolesckg-1		
SAR		
Porosity %		

ii. What detailed advice would you give the farmer A to improve the soil for cropping. (5)

iii Assessing soil pH ESP value and soil Porosity for Farmer B, what problem would you think might arise in terms of cropping the soil. (10)

iv What advice would you give farmer B if He wants to grow a crop first in this soil. (5)

v Describe the reduction process by which the availability of two plant nutrients is likely to decrease in poorly drained soils. (5)

3. (a) Describe any three types of clay minerals that commonly occur in soil. Clearly show the likely advantages and Disadvantages of cropping in each of the clay minerals. (15)

(b) Discuss the factors that influence soil PH under cultivated land. (20)

(c) Discuss the effects of Organic Matter on the Physical, Chemical and Biological properties of soil. (15)

(d) Discuss the Nitrogen loss and gain pathways from the soil. (20)

(e) Describe the transformations involved in the Nitrogen Cycle and the organisms involved . (25)

(f) Differentiate between Organic Matter and Humus. (5)

END OF EXAMINATION