AFRICA UNIVERSITY
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COLLEGE OF HEALTH, AGRICULTURE & NATURAL SCIENCES

NACP 101: INTRODUCTION TO SOIL SCIENCE

END OF FIRST SEMESTER FINAL EXAMINATIONS

NOVEMBER/DECEMBER 2022

LECTURER: MRS. S. MBIZI

DURATION: 3 HOURS

INSTRUCTIONS

1. Read and understand all questions before you answer.
2. Answer all questions from section A and any two from section B.
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.

SECTION A

ANSWER ALL QUESTIONS IN THIS SECTION

1. Describe with the aid of diagrams, the two building blocks which are important in soil formation. (6)
2. Explain the difference between PH dependant and permanent charges and show how these are formed. (6)
3. Draw a simplified diagram of a soil profile and clearly label the following :
   (i) A,B,C,E and R horizons
   (ii) Regolith
   (iii) Solum
   (iv) Saprolite (6)

   (b) What are the characteristics of the B horizon?. (2)

4.

Exchangeable Cation	mmoles charge kg^{-1}
Calcium (Ca)	30
Mgnesium (Mg)	40
Potassium (K)	2
Sodium (Na)	1
Hydrogen (H)	10
Aluminium) (Al)	50

Use the above data to calculate:

(i) The total exchangeable bases (TEB) (2)
(ii) The percentage Base Saturation (% BS) (2)
(iii) What are the characteristics of soils with a high Cation Exchange Capacity (CEC) value?. (4)

5. Explain how temperature and humans contribute to soil formation. (6)
6. Distinguish between Primary and secondary minerals and give one example of each.(4)
7. Sandy soils derived from granite in Zimbabwe are often acidic and of low fertility. Discuss the effect of PH in these soils on the availability of Zinc, Phosphorous and Iron. (4)
8. Define the following terms :
   (a) Cohesion and Adhesion (2)
   (b) Isormophous Substitution (IS) (2)
   (c) Soil water potential (2)

(d) Catena (2)

(e) Sodium Adsorption Ratio (SAR) (2)

9(a) List six causes of soil acidity. (6)

(b) Explain the significance of soil colour (2)

SECTION B

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION 10

An applied soil science student carrying out a study on soil measurements generated out the data below for a soil profile from a field that has been under plough- based cultivation for over a decade.

HORIZON	Depth	Bulk Density (gcm-1)	Field Capacity (FC)	Wilting Point (WP)	Available Water Capacity (AWC) mm/100mm	Cumulative available water capacity (mm/100mm
A1	0-25	1.62	42	11		
A2	25-35	1.75	18	5		
A3	35-45	1.70	16	6		
B1	45-75	1.60	87	45		
B2	75-150	1.55	99	113		

(a) (i) Copy the column for Horizon (AWC) and Cumulative available water capacity and fill in the missing values. (10)

(ii).What may have caused the increase in the bulk density within the A2 and A3 Horizon?

(2)

(b) A wheat crop growing under irrigation in the above field has a root depth of 0,08m.

(i) What is the total Plant Available Water (PAW) in $mm/100mm^{-1}$ in the wheat root zone?. (2)

(ii) If the farmer is using a 60% depletion of the PAW, Calculate the total evaporation reading at which irrigation should commence. (3)

iii. List three factors which affect Bulk Density. (3)

QUESTION 11

Describe the processes involved in soil formation, (20)

QUESTION 12

(a) Describe the Nitrogen gain and loss pathways from agricultural cropping systems. (12)
(b) Discuss on the reclamation of Saline and Sodic soils (8)

END OF EXAMINATIONN PAPER