FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI
SCHOOL OF AGRICULTURE AND AGRICULTURAL TECHNOLOGY
DEPARTMENT OF SOIL SCIENCE AND TECHNOLOGY

2007/2008 Rain Semester M.Sc Examinations
SST 202: Principles of Soil Science

Answer 5 Questions with at Least 2 Questions
drawn from each of Sections A and B

Time Allowed: 3 hrs

SECTION A

Q.1 (i) Define the term leaching

(ii) Name 3 materials commonly leached in soils.

(iii) Which of the leached materials brings about the formation of argillic horizons in soil profiles?

(iv) What is the most significant effect of leaching in tropical soils?

Q.2 (a) Define the term cation exchange capacity and state 3 factors that affect CEC in soils

(b) The following data were obtained from the laboratory analysis of a soil sample: -

Exchangeable	Ca	:	2.75meq/100gsoil
"	Mg	:	2.43 " "
"	K	:	2.35 " "
"	Na	:	1.72 " "
"	H^+		0.84 " "
"	acidity		1.50 " "

Calculate (i) the ECEC of this soil
(ii) the % Aluminium saturation of the soil
(iii) the % base saturation of the soil

(c) From the answer to (ii) above, do we need to apply lime to this soil (yes or No)?
Give appropriate reason for your answer.

Q.3 (a) Define the term soil profile.

(b) A soil profile, after being dug, was found to have the following types of horizons: -
A_{OO}, A_O, A_P, A_{1g}, A_2, A_3, B_{1g}, B_{2t}, C_{Ca}.

Answer the following questions regarding this soil profile: -
(i) Which of the horizons is likely to be a hardened, impermeable layer?

(ii) In which of the horizons do we expect the phenomenon of gleying to occur?

(iii) Which horizon will have a red colour?

(iv) Which of them will display marked accumulation of clay?

(v) Which of them is a cultivated horizon?

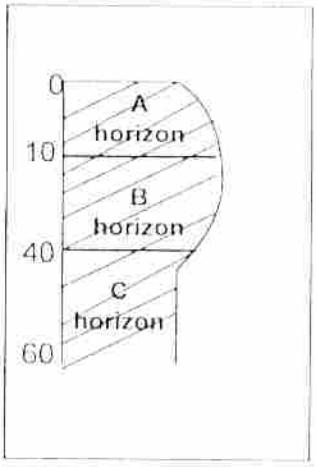
(vi) Which of them has an accumulation of raw above-ground parts of the standing vegetation?

(viii) Which of them is a layer of maximum elluviation?

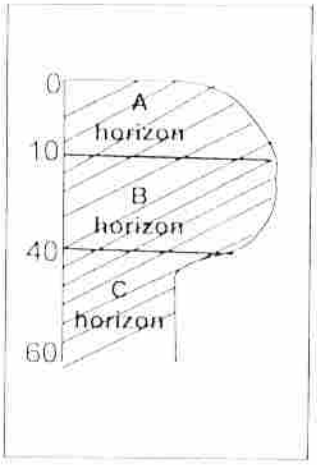
Q.4 (a) A soil is known to be formed through weathering of parent rocks into smaller fragments, followed by the operation of series of pedogenic processes. One of these pedogenic processes is broadly grouped: Additions to the soil system. Name 3 other broad groups of pedogenic processes known to you and list at least 2 items associated with each of the 3 groups of pedogenic processes.

(b) The following 3 diagrams illustrate the relationship between Time as a factor of soil formation on the one hand and degree of soil development which is closely related to amount of clay distribution along the profile. Study the diagrams carefully and answer the questions that follow (Note: A, B, C represent the respective horizons of each profile).

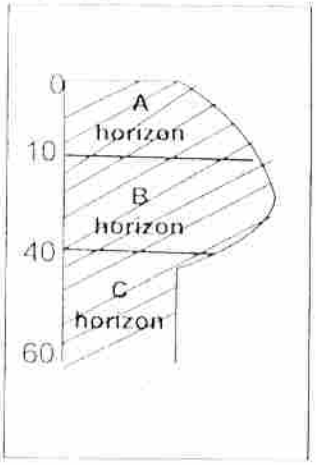
Profile 1



Profile 2



Profile 3



Which of the 3 profiles represents

(a) a young soil
(b) a mature soil
(c) an old soil

(Attempt to give reasons for yours answer)

SECTION B

Q.5 (a) How can you justify the statement that 'Soil texture is the basic unit of a soil'.

(b) A 30g soil sample is made up of 28% sand and 3.4g silt. What is the percentage clay?

(c) How can you distinguish clay from sandy soil?

Q.6 (a) The total and volume fraction of the solid matrix of a 40g soil particle are 38.3cm^3 and 10.6cm^3 respectively. Determine the bulk density, particle density, % pore space and volume of pores of the soil.

(b) Explain the relevance of (i) cohesive and adhesive forces (b) surface tension and (c) hydrogen bonding in soil water movement

Q.7 (a) What is soil structure? How does the following terms relate to soil structure: (i) Grade (ii) Type (iii) class and (d) size

(b) The coefficient of linear expansion of an expansive clay of length 13.58 cm is 52.8%. What is the final length of the soil after moisture absorption?

(c) What is the difference between shrinkage and liquid limits?

Q.8 (a) Write short notes on any **two** of the following (i) flocculation (ii) soil consistency (iii) soil plasticity and (d) soil colour.

(b)Calculate the velocity and time of settlement of sand (0.2mm) and clay (0.002mm) from a water column of height 1m if $K = \frac{9 \times 10^{5}}{Sm}$