UNIVERSITY OF FORT HARE

PEDOLOGY

AGS 221

NOVEMBER EXAMINATIONS

2016

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TIME : 3 HOURS

SUBJECT : AGS 221

MARKS : 100

This paper consists of 6 pages including the cover page

Internal Examiners

DR A. MANYEVERE

INSTRUCTIONS

1. Answer ALL questions.
2. It is in your best interest to write clearly and legibly.

QUESTION 1 [20]

(a) **Hans Jenny**, an American, developed a model of soil formation processes, which is widely cited today. Briefly describe this model. [4]

(b) Alice and Hogsback are located in arid and humid regions, respectively. Discuss how a combination of **RAINFALL AND TEMPERATURE** is likely to influence soil formation at both sites. Use the following guidelines in your discussion: soil depth, biota, degree of weathering, and erodibility. [8]

(c) Outline how dolerite parent material could influence the following properties: (i) mineral composition of the soil, (ii) texture; (iii) grain size (vi) stability of the soil. [8]

QUESTION 2 [20]

(a) Using examples and equations where possible, differentiate the following soil forming processes: (i) alkalization and solodization (ii) Hydration and hydrolysis (iii) reduction and oxidation. [4 marks each]

(b) Discuss the following processes:

(i) Ferralilitization [4]

(ii) Salinization [4]

QUESTION 3 [20]

With reference to the attached soil profile description and analytical data, answer the following questions:

(i) Indicate the drainage condition of the soil and justify your answer. [2]

(ii) Is the B1 horizon luvic or non-luvic? Explain your answer and show calculation. [3]

(iii) For each of the horizons calculate the S-value and the base saturation. [3]

(iv) Classify the soil as dystrophic, mesotrophic or eutrophic. Show your calculations.[4]

(v) Identify as closely as possible the diagnostic surface and subsurface horizons. Explain your answer. [4]

(vi) Identify the soil form using the SOIL CLASSIFICATION KEY provided. [2]

(vii) Comment on the agricultural potential of the soil. [2]

Question 4 [20]

(a) The USDA Soil Taxonomy recognizes twelve (12) taxa at the highest level of categorization. Identify the **12 soil orders** and give the generalized meaning or connotation of each order name.

[12]

(b) Identify the USDA Soil Taxonomy order and suborder names for each of the following great groups :

(i) torrifluvents (ii) Durixeralfs [4]

(c) Describe briefly what is meant by the following WRB Reference Soil Group:

(iii)

(i) Solonetz
(ii) Glevsols
(iii) Leptosols
(iv) Nitisols

[4]

Question 5[20]

Masakani Food Project would like to develop a piece of land in Qibira village for purposes of irrigated vegetable production. The initial stages of the development will involve carrying out a soil survey and land evaluation exercise for a 100 hectare farm. As a team leader, you are required to put together a team for the exercise.

(a) State with justifications the selection of team members that you will have for this task. [4]

(b) Describe the information you would access in the pre-survey phase. [8]

(c) Describe the field processes that you would undertake when carrying out the soil survey [8]

PROFILE DESCRIPTION

Climate	Subhumid to humid
Landscape (shape)	Convex
Slope (position)	Lowerslope
Slope (%)	6%
Slope (aspect)	South
Land use	Hyparrhenia grassland
Parent material	Dolerite
Mode of accumulation	In-situ weathering
Weathering	Fairly weathered
Effective depth	>120 cm

DESCRIPTION:

0 - 32 cms	Slightly moist: dark brown (7.5YR 3/4): sandy clay loam: weak fine to mediun subangular blocky; friable: many fine roots; moderate permeability: gradual transition to:
32 - 75 cms	Moist: dark reddish brown (5YR Ji4): clay loam; apedal; friable; hard (dry); few fine roots: rapid permeability: gradual transition to:
75 - 135 cms	Moist; red (2.5YR 4/6); clay; apedal; slightly firm; very few fin roots; rapid permeability; gradual transition:
135 – 150+ cms	Moist; red (2.5 YR 4/6); clay; apedal: slightly firm; rapid permeability; gradual transition:

ANALYTICAL DATA

Horizon	Al	B21	B22	B23	B24
Depth (cm)	0 - 32	32 - 75	75 - 110	110 - 135	135 - 150+
Fine earth (%)	97	99	100	100	100
Particle size disrtibutfon (%)					
coarse Sand	6	2		2	2
medium Sand	6	2		2	"
fine Sand	38	32	22	26	26
Silt	24	26	22	20	18
Clay	26	38	52	50	52
Organic C (%)	1.2	0.7	0.4	0.2	0.1
pH (water)	5.0	5.4	5.6	5.8	5.6
Exchangeable cations (cmol(+)/kg					
Na	0.10	0.15	0.15	0.2	0.2
K	0.25	0.10	0.10	0.0	0.0
Ca	0.95	0.60	0.50	0.4	0.6
Mg	0.40	0.45	0.60	1.0	1.2
C.E.C. (cmol(+)/kg soil)	3.93	4.21	4.35	4.5	4.7

KEY TO THE SOIL FORMS

DIAGNOSTIC HORIZONS AND MATERIALS				SOIL FORM	PAGE
TOPSOIL	SUBSOIL				
Organic	unspecified			CHAMPAGNE	48
Humic	yellow-brown apedal B	red apedal B		KRANSKOP	50
Humic	yellow-brown apedal B	unspecified		MAGWA	52
Humic	red apedal B	unspecified		INANDA	54
Humic	pedocutanic B	unspecified		LUSIKI	56
Humic	neocutanic B	unspecified		SWEETWATER	58
Humic	lithocutanic B			NOMANCI	60
Vertic	G horizon			RENSBURG	62
Vertic	unspecified			ARCADIA	64
Melanic	G horizon			WILLOWBROOK	66
Melanic	pedocutanic B	unspecified		BONHEIM	68
Melanic	soft carbonate horizon			STEENDAL	70
Melanic	hardpan carbonate horizon			IMMERPAN	72
Melanic	lithocutanic B			MAYO	74
Melanic	hard rock			MILKWOOD	76
Melanic	unspecified			INHOEK	78
Orthic	G horizon			KATSPRUIT	80
Orthic	E horizon	G horizon		KROONSTAD	82
Orthic	E horizon	soft plinthic B		LONGLANDS	84
Orthic	E horizon	hard plinthic B		WASBANK	86
Orthic	E horizon	yellow-brown apedal B		CONSTANTIA	88
Orthic	E horizon	podzol B + placic pan		TSITSIKAMMA	90
Orthic	yellow-brown apedal B	soft carbonate horizon		MOLOPO	122
Orthic	yellow-brown apedal B	hardpan carbonate horizon		ASKHAM	124
Orthic	yellow-brown apedal B	unspecified		CLOVELLY	126
Orthic	red apedal B	soft plinthic B		BAINSVLEI	128
Orthic	red apedal B	unspecified material with signs of wetness		BLOEMDAL	130
Orthic	red apedal B	soft carbonate horizon		KIMBERLEY	132
Orthic	red apedal B	hardpan carbonate horizon		PLOOYSBURG	134
Orthic	red apedal B	dorbank		GARIES	136
Orthic	red apedal B	unspecified		HUTTON	138
Orthic	red structured B			SHORTLANDS	140
Orthic	podzol B + placic pan			JONKERSBERG	142
Orthic	podzol B	unconsolidated material with signs of wetness		WITFONTEIN	144
Orthic	podzol B	unconsolidated material without signs of wetness		PINEGROVE	146
Orthic	podzol B	saprolite		GROENKOP	148
Orthic	prismacutanic B			STERKSPRUIT	150
Orthic	pedocutanic B	unconsolidated material with signs of wetness		SEPANE	152
Orthic	pedocutanic B	unconsolidated material without signs of wetness		VALSRIVIER	154
Orthic	pedocutanic B	saprolite		SWARTLAND	156
Orthic	neocutanic B	unspecified material with signs of wetness		TUKULU	158
Orthic	neocutanic B	soft carbonate horizon		ETOSHA	160
Orthic	neocutanic B	hardpan carbonate horizon		GAMOEP	162
Orthic	neocutanic B	dorbank		OUDTSHOORN	164
Orthic	neocutanic B	unspecified		OAKLEAF	166
Orthic	neocarbonate B	unspecified material with signs of wetness		MONTAGU	168
Orthic	neocarbonate B	soft carbonate horizon		ADDO	170
Orthic	neocarbonate B	hardpan carbonate horizon		PRIESKA	172
Orthic	neocarbonate B	dorbank		TRAWAL	174
Orthic	neocarbonate B	unspecified		AUGRABIES	176
Orthic	soft carbonate horizon			BRANDVLEI	178
Orthic	hardpan carbonate horizon			CÓEGA	180
Orthic	dorbank			KNERSVLAKTE	182
Orthic	lithocutanic B			GLENROSA	184
Orthic	hard rock			MISPAH	186
Orthic	stratified alluvium			DUNDEE	188
Orthic	regic sand			NAMIB	190
Orthic	man-made soil deposit			WITBANK	192