CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF MASTER OF SCIENCE IN SOIL SCIENCE

SOIL 834: SOIL CHEMISTRY

STREAMS: MSC IN SOIL SCIENCE Y1S1   **TIME: 3 HOURS**

**DAY/DATE: TUESDAY 04/12/2018**   **2.30 P.M. – 5.30 P.M.**

INSTRUCTIONS:
- **Answer ALL questions in section A and any two in section B**

SECTION A: Answer all questions

QUESTION ONE

(a)   Isomorphic substitution is one of the most important ways of creating permanent charges in the soil. Calculate the net charge in Montmorrilonite where Mg^{2+} replaces Al^{3+} and explain the type of charge formed   (4 marks)

$$Al_{1.7}Mg_{0.2}[Si_{3.9}Al_{0.1}]O_{10}(OH)_2$$
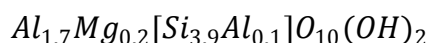
(b)   Explain the general reaction that explains the interaction of a liming material with water in soils.   (4 marks)

QUESTION TWO

(a)   Describe the mineralogical organization of silicate clays and explain the main differences between smectites and vermiculites.   (6 marks)

(b)   Explain any three (3) sources of acidity in soils.   (6 marks)

SECTION B
QUESTION THREE

(a)   Discuss the properties of soil colloids   (8 marks)

(b) Explain the aluminum and iron oxide clays in soils stating their agronomic significance.
(12 marks)

QUESTION FOUR

(a) Discuss the sources of charges on soil colloids. (8 marks)

(b) Discuss the principles governing cation exchange reactions in soils and explain the importance of caution exchange in agricultural production. (12 marks)

QUESTION FIVE

(a) Explain percentage base saturation as applied in soil chemistry and mineralogy and calculate the following. (12 marks)
The following ion quantities were found in the ammonium acetate extract from the leaching of 30 g of soil whose CEC was 20 me/100g soil.

(a) Ca=0.03g
(b) Mg=0.0053g
(c) Na =0.0125g
(d) K=0.0295g

Calculate the me of the ions present in the soil given that: Ca=40, Na-23, K=39 and Mg=24.

(b) Explain the simple rules for assigning oxidation states for inorganic redox couples.
(8 marks)