UNIVERSITY OF FORT HARE

AGS 423

DEGREE EXAMINATIONS

SUPPLEMENTARY PAPER

JANUARY 2019

Time: 3 hours Marks: 100

Subject: Chemical Analysis of Soils, Plants and Waters

THIS PAPER CONSISTS OF 2 PAGES

INTERNAL EXAMINER

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EXTERNAL EXAMINER

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INSTRUCTIONS

ANSWER ALL QUESTIONS

QUESTION ONE (20 MARKS)

(a) Explain the role of soil analysis in any sound crop production programme (5 marks)

(b) Briefly describe the basic steps involved in an analytical process. (10 marks)

(c) You are asked to prepare one litre each of the following solutions:

(i) 0.01 M KCl from KCl

(ii) 1M $CaCl_2$ from $CaCl_2.2H_2O$

How many grams of the respective salts will you weigh? (5 Marks)

(K=39; Cl =35.5; O=16; H=1; and Ca=40)

QUESTION TWO (30 MARKS)

(a) Show your understanding of the different variations that are likely to be encountered in soils and their significance to soil sampling (10 marks)

(b) Discuss the importance of quality control in analytical work. What measures ought to be taken in order to maintain reasonable standards in a Soil Science laboratory? (10 marks)

(c) In the determination of soil organic matter (OM) by the Walkley-Black method, 1g Soil (on oven dry weight basis) was treated with 10 cm^{-3} of 0.167 mol dm^{-3} $K_2Cr_2O_7$ solution. After completing the necessary procedural steps in the determination, the excess $K_2Cr_2O_7$ was titrated with $Fe(NH_4)_2(SO_4)_2$. Ten (10) cm^{-3} of the $Fe(NH_4)_2(SO_4)_2$ were required to reach the end point while a blank which was similarly treated required 20 cm^{-3}. Calculate the organic matter content of the soil from the given information. (10 marks).

QUESTION THREE (25 MARKS)

(a) What do you understand by the following terms (10 Marks):

(i) standard solution (ii) guide sample (iii) Determinate errors (iv) Indeterminate errors (v) matrix interference

(b) A solution contains the following: Ca^{+2} = 1000 ppm; Mg^{+2} = 480 ppm; K^+ = 400 ppm; Na^+ = 460 ppm. Calculate the M (mole/liter) for each nutrient (5 marks)

(c) (i) Distinguish between accuracy and precision (4 marks).

(ii) Describe a simple statistical test that you can use for rejecting outliers in analytical work (6 marks)

QUESTION FOUR (25 MARKS)

(a) Discuss the methods of extracting mineral elements from plant tissues. Indicate the reasons for preferring one method over the other. (10 marks)

(b) Using a schematic diagram describe the main components of an Induced Coupled Plasma – Optical Emission Spectrophotometer (ICP-OES) and explain how it works (15 marks).

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