



UNIVERSITY OF RUHUNA
FACULTY OF AGRICULTURE

Second Examination in BSc Agricultural Resource Management and Technology / BSc 2023

Agribusiness Management (Part I)

August 2022

SS 2101 Soil Plant Relations and Nutrient Management (Compulsory)

Theory

INSTRUCTIONS

Answer five (05) questions only.

Only non-programmable calculators are permitted.

Mobile phones are NOT permitted.

TIME: 3 (three) Hours

INDEX NUMBER

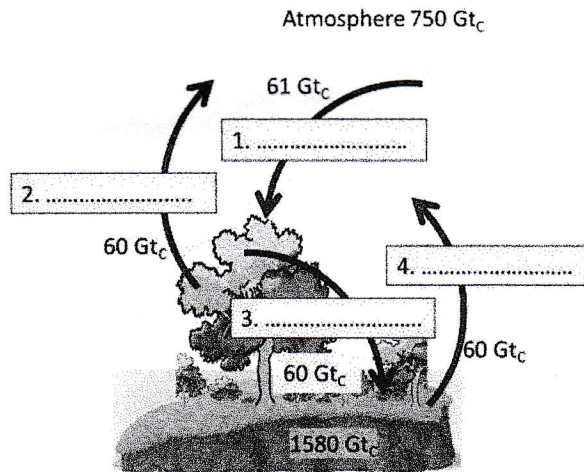
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1. A) (I) List four structure related properties of soil water (10 marks)
- (II) Define following terms considering water in soil. (10 marks)
- a. Cohesion force
 - b. Adhesion force
- (III) What is meant by the following terms? (40 marks)
- a. Field capacity
 - b. Permanent wilting point.
 - c. Plant available water.
 - d. Capillary water.
- B) (I) what is capillarity? (5 marks)
- (II) What will happen to the capillary height with following changes in the system?
(Answer using the terms increase/decrease/no change) (15 marks)
- a. Increase liquid surface tension
 - b. Increase capillary tube radius
 - c. Increase liquid density
 - d. Increase capillary tube height
 - e. Increase liquid pH
- (III) A first year student stated in a lab report that "Capillary rise in soil is identical to the capillary rise in glass tubes." Do you agree with his statement (Yes/No)? Justify your answer. (20 marks)
2. A) (I) What is meant by fertilizer nutrients? (10 marks)
- (II) What are the usable ionic forms in each fertilizer nutrients you named in 2. A) I? (10 marks)
- (III) Categorize following nutrients into primary nutrients, secondary nutrients, micro nutrients and beneficial nutrients. (20 marks)
- Cu, Ca, Zn, Al, N, P, S, Co, Cu, Mo, K, B, Na, Mg, Ni

- B) (I) Define C/N ratio? (05 marks)
 (II) 'Mineralization or immobilization of nitrogen depends on C/N ratio of the decomposing material'. Comment on this statement. (15 marks)
- C) (I) N (nitrogen), P (phosphorus) and K (potassium) are all 'fixed' in the soil. Discuss the fixations processes of these three nutrients separately. (15 marks)
 (II) Indicate the effect of pH on the relative concentrations of the three species of phosphate ions using an appropriate figure (15 marks)
3. A) What is an inorganic fertilizer? (10 marks)
 B) Explain briefly the concept of limiting factor using the law of minimum theory. (25 marks)
 C) Define immobile nutrients and state 5 examples for immobile nutrients. (20 marks)
 D) Assume that you are advised to collect a soil sample for your practical class to conduct a laboratory analysis. State the appropriate procedure you should follow to fulfill this task (ONLY up to sample preparation). (30 marks)
 E) State three (3) disadvantages in observation-based conclusions in soil fertility evaluation. (15 marks)
4. A) (I) What is meant by integrated plant nutrient management? (10 marks)
 (II) State the quantitative methods of soil fertility evaluation? (10 marks)
 (III) Name five (5) visual symptoms of plant nutrient deficiencies. (10 marks)
 B) (I) State 3 examples for inorganic P fertilizers. (5 marks)
 (II) Assume that you add an inorganic P fertilizer to an acidic soil and an alkaline soil separately. In each case, within a few months most of the P has been converted to insoluble forms. State these insoluble forms of P? (15 marks)
 (III) Write the way in which you can enhance the availability of P in these acidic and alkaline soils using microorganisms (10 marks)
 C) (I) Name two minerals that release potassium into soil solution (10 marks)
 (II) What are the four forms of potassium in soils? Indicate their level of availability in soils. (15 marks)
 (III) State three (3) deficiency symptoms of nitrogen (N) in plants. (15 marks)
5. A) (I) State why the humic fraction accounts for nearly 60-80% of the soil organic matter? (15 marks)
 (II) Two plant litter samples collected from Horton Plains were allowed to decompose in Galle and Hambantota areas. In which area you could expect a higher rate of litter weight loss? Explain the reason for your answer. (15 marks)

(III) A farmer complains that his pile of compost takes a long time to decompose even if the moisture content and aeration status were well maintained. What could be the reason for this condition? (15 marks)

B) (I) The figure shows the carbon balance between soil and atmosphere. Write the process that fit inside the cages indicated by the numbers 1, 2, 3, and 4. (15 marks)



(II) Why the Organic Farming campaign of the government failed, leading to a food shortage in the country? (20 marks)

(III) Although the government organic farming campaign failed, the addition of organic matter to the soil is always encouraged to sustain the productivity of the agricultural production systems. Explain how the addition of organic matter helps sustain the productivity of agricultural systems. (20 marks)

6. A) (I) Which soil property is directly connected to the field estimation of the organic matter content in soils? (15 marks)
- (II) If a soil is rich in organic matter, the biological activities of the soil could be high. Explain the reason for that. (15 marks)
- (III) Why the soil manipulation by tillage equipment becomes easier when the organic matter content of a soil increases? (20 marks)
- B) "Capillary rise in soils is responsible for accumulation of salts at surface of soils in dry climates and in potted plants". Explain the statement. (25 marks)
- C) "Soil texture is one of the most important fundamental properties affecting how water moves through soil." Explain the statement considering the water movements through sandy and clayey soils. (25 marks)