

THE OPEN UNIVERSITY OF SRI LANKA
B. Sc / B. Ed DEGREE PROGRAMME
BOTANY – LEVEL 4

BOU2200 / BOE4200/ BTU2201: PLANT PHYSIOLOGY
FINAL EXAMINATION 2011/2012



DURATION: THREE (03) HOURS

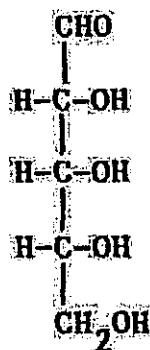
Date: 23rd November 2012

Time: 9.30 am -12.30 pm

There are two (2) parts (part 1 and part 2) in this paper with eight (8) questions. Each part comprises of four (4) questions. You have to answer FIVE (5) questions selecting at least TWO (2) questions from each part.

Part 1

1. This question is based on the following chemical structures of biomolecules.



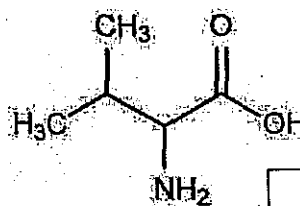
A



B



C



D

- Identify the above biomolecules as far as possible and classify them using a suitable criterion.
- Draw the pyranose and furanose structures of A and B respectively.
- Give the type of bonds formed in polymerization of A and B.

- d. Name the enzymes that hydrolyze each type of polymerized bonds of A and B.
- e. When comparing the functions of A and B, B is involved mostly in 'house keeping' whereas A is involved mostly in 'survival'. Justify this statement.
- f. The derivative of C is a constituent of biological membranes. Draw a sketch of the phospholipid structure of C that forms the biological membrane.
- g. Explain how C is important for the fluidity of cell membrane.
- h. Explain the functions of biological membranes with the aid of fully labeled diagrams.
- i. Draw the dipeptide structure of D and name the organelle in which polymerization of D occurs.
- j. D belongs to a class of biomolecules which serve as the precursor of several plant hormones. Name two plant hormones synthesized from such a precursor and the pathway of synthesis.

2. 'Plants require an external supply of minerals and water to carry on autotrophic nutrition'.

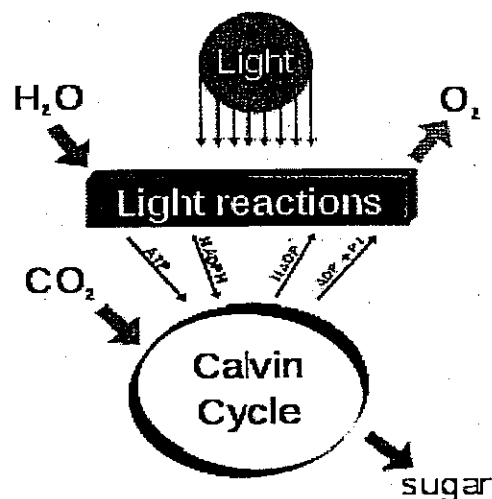
- a. Outline the process of estimating the mineral nutrient requirements of plants.
- b. What are the factors that may affect mineral content of a plant?
- c. What is an essential element to a plant?
- d. Complete the following table for Nitrogen, Sulphur, Potassium, Calcium, Iron, Silica and Magnesium. The first row for carbon has been done for you as an example.

Element	Source & Micro /macro nature	Approximate percentage content in plants	Role
C	Air Macro	45 %	Component of raw material of photosynthesis Major component of biomolecules such as carbohydrates, proteins

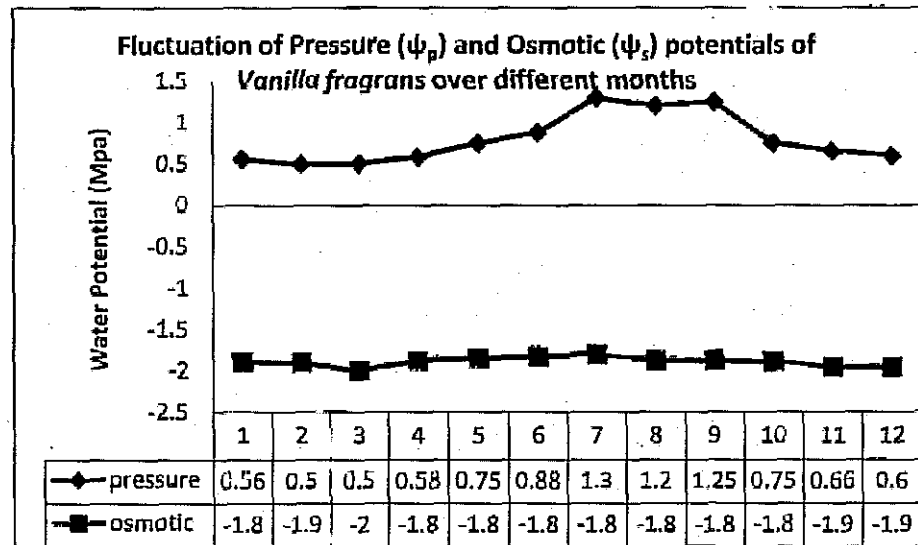
- e. "Although the tea plant (*Camelia sinensis* L.) is Aluminum accumulator, Aluminium is not a contaminant in tea". Justify this statement.
- f. Draw a flow chart to explain the mechanism of Fe (iron) uptake by chelating agents in rice.
- g. Explain the relationship between plant mineral nutrition and cation exchange in soil.

3. Photosynthesis, as shown in the diagram, is the process where solar energy is converted into chemical energy and fixed in the bonds of carbohydrates.

- a. Explain the process of light harvesting in the chloroplast with the aid of a fully labeled diagram.
- b. Higher chloroplast fluorescence is a negative factor that reduces the relative growth rates. Explain briefly.
- c. What is the difference between action spectrum and absorption spectrum of photosynthesis?
- d. How would you prove that oxygen evolved in photosynthesis is from the water molecules?
- e. Explain briefly what photophosphorylation is.
- f. Explain the role of ATP synthase on thylakoid membrane with a fully labeled diagram.
- g. 'Dark reaction is parasitic on the light reaction'. Justify this statement.
- h. Compare cyclic and non-cyclic phosphorylation based on the following
 - i. Pathway of electrons
 - ii. First electron donor
 - iii. Last electron acceptor
 - iv. Products
 - v. Photosystems involved



4. *Vanilla fragrans* L. plant requires to undergo water stressed condition for about two months for flowering to be induced in the subsequent month. Given graph indicates how the Pressure Potential (ψ_p) and Osmotic potential (ψ_s) of leaf tissues of this plant were fluctuated over the months of the previous year.



- Define what water potential is and indicate its relationship to its components.
- What are the four assumptions made during the application of the water potential concept to cells and solutions?
- Distinguish the month in which you think that *Vanilla fragrans* will flower.
- Using the data in the graph calculate the maximum fluctuation in water potential (ψ_w) which is necessary to stimulate flowering in this plant.
- Explain why the osmotic potential of this plant remains relatively unchanged over time.
- Briefly explain the importance of water potential in water uptake and transport in plants.
- Outline the water-stress responsive processes which are being triggered in plants by water stress.
- List three unique properties of water that make it such a good medium for cellular functioning, and explain how each property is useful to the plant.

Part B

5. 'One of the most important determinants of water use efficiency of plants is stomatal dynamics. Movement of stomata depends on several external environmental factors'. Explain how the external environmental factors affect the stomatal dynamics.
6. 'Although hydroponics systems are often recommended for intensive crop cultivation, it has several advantages as well as disadvantages. Proper planning and innovative applications can minimize the disadvantages'. Discuss this statement.
7. 'Plants evolved three types of photosynthesis which avoid photorespiratory losses and facilitate plant to cope with environmental stresses'. Discuss the statement.
8. Discuss the statement that 'knowledge of plant growth regulators enables farmers to manipulate the crop production in a profitable manner'.

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