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

BOU2200 / BOE4200/ BTU2201: PLANT PHYSIOLOGY FINAL EXAMINATION 2012/2013

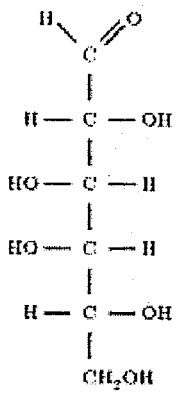
DURATION: THREE (03) HOURS

Date: 6th December 2013 **Time: 9.30 am -12.30 pm**

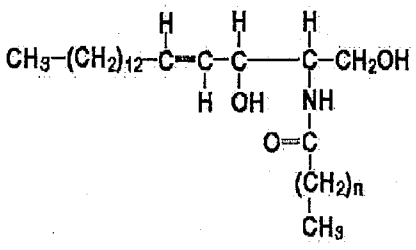
There are two (2) parts (part 1 and part 2) in this paper with eight (8) questions. Each part comprises of four (4) questions. You have to answer FIVE (5) questions selecting at least TWO (2) questions from each part.

Part 1

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



A



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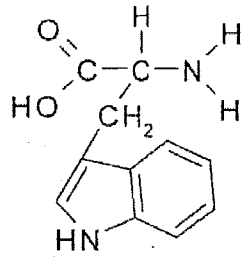
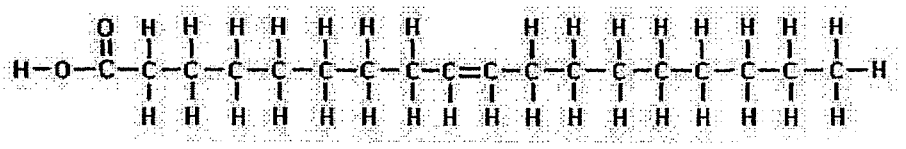


C

a. Identify the above structures as much as possible
b. List three major functions of A, B and C
c. Illustrate the dimers formed by A and dimers formed by C indicating the specific bonds formed in between.
d. Select the molecules which are closely related to A, B and C among the following.



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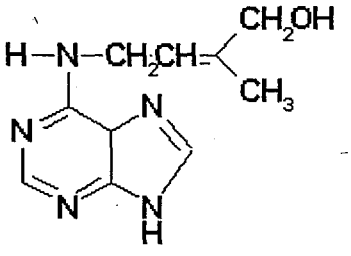

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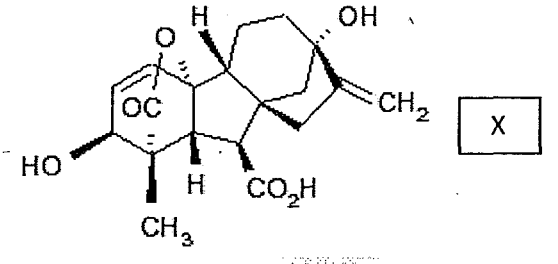

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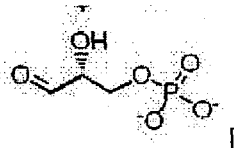

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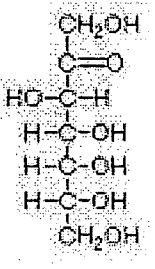


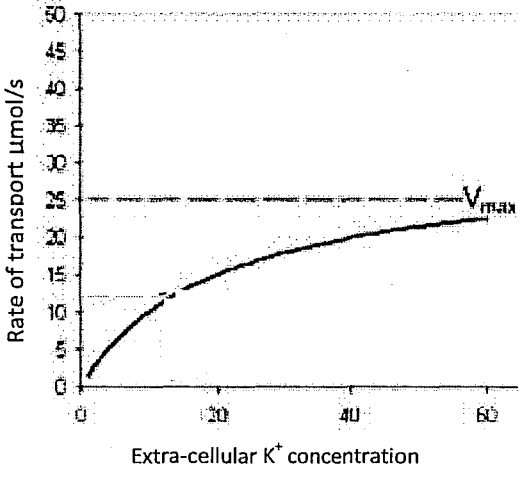
Z

e. Briefly explain the levels of structural organization of polymers formed by C with similar compounds.

f. "Polymeric structures of C play an important role in communication and transport between cells". Explain this statement with suitable drawings.

g. Briefly describe the different types of membrane transporters with illustrations.

h. Following graph was obtained in an experiment to ascertain the rate of transport of K^+ through a monovalent cation transport protein. Calculate the K_m for the activity of the transporter protein.



i. If the K_m value for the rate of transport of Na^+ by the same transporter protein is 15 µmol/s evaluate the specificity of the transporter.

2. ATP is the biological currency of energy and involved in almost all types of energy transformations in living systems".
   a. Illustrate the structure of ATP, highlighting the high energy bonds.
   b. What are the transformations that take place in ATP in metabolic reactions?
   c. Explain how oxidation of glucose molecule into pyruvate generates 4 ATP molecules?
   d. What are the roles of hexokinase and phosphofructokinase in relation to ATP metabolism?
   e. Illustrate the process of generating ATP by chemiosmosis.
   f. What is oxidative phosphorylation?
   g. List three enzyme complexes localized in the respiratory electron transport chain which catalyze oxidative reactions.
   h. What is the terminal donor of electrons to oxygen in the respiratory electron transport chain?
   i. "NADH produced in glycolysis and Kreb's cycle contributes to generate different amounts of ATP molecules". Explain.
   j. Compare types of anaerobic respiration citing examples.

3. Plant responses to stress can be viewed at cellular and biochemical levels. Cellular responses include changes leading to enhanced stress tolerance of cells while the responses at biochemical level alter metabolism in various ways to accommodate environmental stresses
   a. Define what is water deficit?
   b. Explain how the leaf area is reduced in plants facing frequent water deficit conditions.
   c. How does the water deficit affect the root growth?
   d. Compare the hydro-active and hydro-passive closure of stomata in response to water deficit.
   e. What are "compatible solutes" in plants? Give 2 examples.
   f. Illustrate ABA-dependent and ABA-independent gene regulation that occur during osmotic stress.
   g. Briefly explain how fruits lose sweetness under heat stress conditions.
   h. What are the mechanisms adopted by plants to minimize the effects of air pollutants such as SO_2 and NO?

4. Ribulose-5-phosphate is a precursor molecule of an important reactant in the Calvin cycle.
    a. What are the metabolic pathways that synthesize the Ribulose-5-phosphate?
    b. Complete the following reaction by assigning molecules for 'G' and 'H'

Glucose + ATP ----------> Ribulose-5-phosphate + ADP + 2...'G'...+ ...'H'.↑

    c. Name the enzyme/s that mediates the reaction of Ribulose1-5-bisphosphate with oxygen?
    d. Why is the reaction between Ribulose1-5-bisphosphate with oxygen considered as a loss of photosynthate?
    e. Briefly explain the major reactions and organelles involved in the above process mentioned in'd'.
    f. What are the mechanisms evolved in the plants to avoid or minimize the photorespiration?
    g. Compare the physiological differences in the above mechanisms cited in 'f'
    h. Illustrate the anatomical differences of transverse sections of rice and maize leaves.
    i. Briefly discuss the statement that CAM plants can reduce photorespiration under certain conditions.

Part 2

5. "Movement of water along the soil-plant-atmosphere continuum is largely occurs through physical mechanisms which are regulated by biological processes". Discuss this statement.

6. Discuss the following statements
    a. Dormancy is a unique phenomenon in plants and dependent on both genetic and environmental factors.
    b. Senescence is the sudden death of plants or parts of plants.

7. Write an essay on the applications of plant growth regulators in improvement of crop health and quality.

8. Explain the development of symbiotic relationship in biological nitrogen fixation