

The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc/ B. Ed Degree Programme



Department	: Botany
Level	: 4
Name of the Examination	: Final Examination (makeup exam)
Course Code and Title	: BYU 4300
Academic Year	: 2020/21
Date	: March 22, 2022
Time	: 9.30 am - 11.30 am
Duration	: Two (2) hours

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **six (6)** questions in **four pages**
3. Answer any **four (4)** questions only. All questions carry equal marks.
4. Answer for each question should commence from a new page.
5. Draw fully labelled diagrams where necessary
5. Relevant log tables are provided where necessary.
6. Having any unauthorized documents/ mobile phones in your possession is a punishable offense
7. Use blue or black ink to answer the questions.
8. Circle the number of the questions you answered in the front cover of your answer script.
9. Clearly state your index number in your answer script

THE OPEN UNIVERSITY OF SRI LANKA
 B. Sc / B. Ed DEGREE PROGRAMME
 BOTANY – LEVEL 4
 BYU4300: PLANT PHYSIOLOGY
 FINAL EXAMINATION 2020/2021



DURATION: TWO (02) HOURS

Date: 22nd March 2022

Time: 9.30 am -11.30 am

There are two (2) parts in this paper with six (6) questions in four (4) pages. Each part comprises of three (3) questions. You have to answer FOUR (4) questions selecting at least TWO (2) questions from each part.

Part 1

1. Questions here are based on the part of abstract extracted from a research publication.

Mobilization of reserves in germinated cereal grains is critical for early seedling vigour, global crop productivity, and hence food security. Gibberellins (GAs) are central to this process. We have developed a spatio-temporal model that describes the multifaceted mechanisms of GA regulation in germinated barley grain. The model was generated using RNA sequencing transcript data from tissues dissected from intact/ungerminated, and germinated grain, which closely match measurements of GA hormones and their metabolites in those tissues. The data show that successful grain germination is underpinned by high concentrations of GA precursors in ungerminated grain, the use of independent metabolic pathways for the synthesis of several bioactive GAs during germination, and a capacity to abort bioactive GA biosynthesis. The most abundant bioactive form is GA1, which is synthesized in the scutellum as a glycosyl conjugate that diffuses to the aleurone, where it stimulates de novo synthesis of a GA3 conjugate and GA4. Synthesis of bioactive GAs in the aleurone provides a mechanism that ensures the hormonal signal is relayed from the scutellum to the distal tip of the grain. (*J Exp Bot.* 2020 Mar 25;71(6):1870-1884).

- A. What are the biochemical factors that promote successful germination of a seed? (15 marks)
- B. Illustrate the pathway of movement of GA1 that induces two other GA types using a fully labeled diagram of a seed. (20 marks)
- C. Name the 1) metabolic pathway 2) precursor and 3) two other hormones synthesized in the same pathway through which GA is synthesized. (15 marks)

D. Discuss briefly on the transport of Gibberellins in plants. (30 marks)

E. What could you say about the relationship between photomorphogenesis and physiological effects of GA? (20 marks)

2. The following questions are based on the graphs shown below. These graphs were extracted from the *Cao et al (2020) Ecotoxicology and Environmental Safety 206 111208*. They indicate the effect of Arsenic accumulation in rice under two different conditions: continuous flooding (CF) and intermittent flooding (IF).

Ecotoxicology and Environmental Safety 206 (2020) 111208

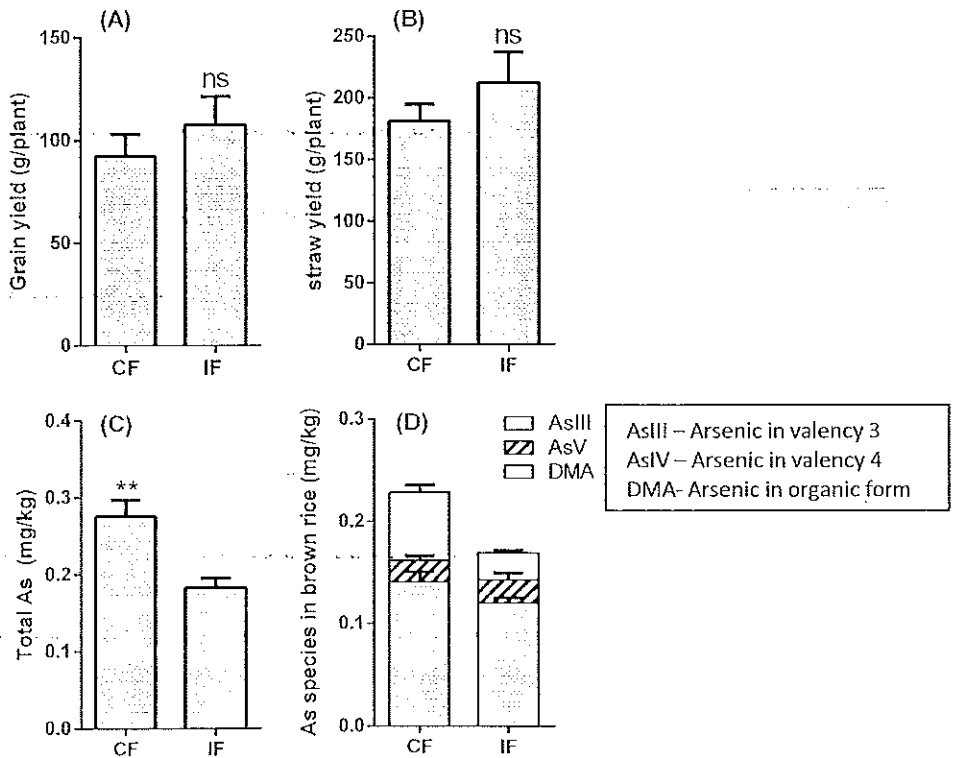


Fig. 1. Rice yields (A, B), the total As (C) and As species (D) in brown rice under different water management treatments. Vertical bars represent standard errors (n = 3). * and ** indicate significant difference at $p < 0.05$ and $p < 0.01$ level between two water management treatments, respectively. ns, non-significant.

PTO...

- A. List the changes in soil environments under CF and IF conditions that may affect the plant metabolism. (20 marks)
- B. What does the hormone that could occur predominantly under CF condition? (10 marks)
- C. List 3 main physiological effects that could be seen in the IF condition due to the hormone you mentioned above. (15 marks)
- D. What are major differences in the As accumulated under CF and IF conditions in rice? (25 marks)
- E. Interpret the results in Fig A, B and C above using your knowledge in physiology? (30 marks)

3. The following questions are based on the excerpt of the abstract from the article published in the *PLOS computational biology*.

Functionally analogous enzymes are those that catalyze similar reactions on similar substrates but do not share common ancestry, providing a window on the different structural strategies nature has used to evolve required catalysts. Identification and use of this information to improve reaction classification and computational annotation of enzymes newly discovered in the genome projects would benefit from systematic determination of reaction similarities.

- A. If you were asked to explain what the analogous enzymes are to a GCE A/L biology student, write your explanation. (20 marks)
- B. What is meant to you by the underlined phrase in the above abstract? (10 marks)
- C. Describe about co-factors and their influence in modulating enzymes catalyzed reactions with examples. (25 marks)
- D. Maximum reaction velocity (V_{max}) of two analogous enzymes at a period of 5 min is given in the table below. Assess if the given data is adequate to calculate the Michaelis-Menton constants of each enzyme (you must cite all the reason/s, if you find it impossible to calculate). (25 marks)

PTO..

Enzyme analogue	Products concentration umol/L	Vmax umol/L/min
X	1.5	1.5
Y	2.5	2.5

- E. Identify the class of enzyme that catalyse the reactions given below. (20 marks)
- I. Glucose - 6 - P \rightarrow Fructose - 6 - P
 - II. phosphoglyceric acid \rightarrow phosphoenol pyruvate + H₂O
 - III. Sucrose + H₂O \rightarrow Glucose + Fructose
 - IV. Glucose + ATP \rightarrow Glucose - 6-P + ADP
 - V. Oxaloacetate \rightarrow malate

Part 2

4. In photosynthesis, solar energy is used by plants to oxidize water and reduce CO₂ into organic compounds. Following three questions are based on the photosynthesis. (100 marks)
- A. Imagine that you are a photon with the wavelength of 420 nm and describe your complete pathway of travelling from atmosphere to induce photosynthesis.
 - B. Explain how the transfer of energy takes place from photon to pigment molecules until the hydrolysis of water takes place.
5. Write an essay on physiology of dormancy in plants (any 20 points 100 marks)
6. Explain the following observations in detail (20 marks per each section)
- a. Rain forest ground may have a seedling stock which may have aged for around 20 years.
 - b. Some rice varieties grown in the paddy fields located close to the express way interchanges did not flower.
 - c. Cuttings of Ixora plants that were soaked in coconut water for 30 min showed fast root growth than those that did not soaked in coconut water.
 - d. It is a challenge to maintain the proper conditions in the hydroponic systems
 - e. Maize plants submerged for more than 10 days show development of adventitious roots in the stem.

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