



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

- COURSE NAME : BIOCHEMISTRY AND BIOMOLECULAR TECHNIQUES
- COURSE CODE : BNN 30104
- PROGRAMME CODE : BNN
- EXAMINATION DATE : JULY 2024
- DURATION : 3 HOURS
- INSTRUCTIONS :
1. ANSWER ALL QUESTIONS
 2. THIS FINAL EXAMINATION IS CONDUCTED VIA
 - Open book
 - Closed book
 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES.

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Q1 Macromolecules are essential molecules in all living organisms that a crucial in various physiological processes.

(a) List **FOUR (4)** types of macromolecules.

(4 marks)

(b) Explain your understanding of the central dogma of molecular biology.

(6 marks)

(c) Determine the complementary DNA sequence for 'TGACCGAAT' and find the corresponding mRNA sequence based on this original DNA sequence.

(4 marks)

(d) Explain the relationship between nucleic acids and nucleotides and outline **THREE (3)** functions for each.

(8 marks)

(e) Name **THREE (3)** products of glycolysis.

(3 marks)

Q2 Metabolism is the set of all chemical reactions that occur within a living organism to maintain life. These reactions are responsible for converting nutrients into energy and building blocks for growth, repairing cellular structures, and regulating bodily functions.

(a) Explain the biochemical pathway that recycles lactate produced by muscle during anaerobic glycolysis.

(9 marks)

(b) Illustrate and explain the connection between the two photosystems in the chloroplast and their role in light-dependent reactions.

(16 marks)

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Q3 Numerous biochemical techniques, such as PCR, chromatography, and electrophoresis, are employed to examine complex mixtures of biomolecules.

(a) Chromatography is the most widely used separation technique in laboratories, where it is used in analysis, isolation and purification. It is commonly used in the chemical or bioprocess industry as a component of small and large-scale production.

(i) Name **THREE (3)** types of liquid chromatography that can be used to separate proteins.

(3 marks)

(ii) In reference to **Table Q3.1**, thoroughly explain the protein purification process with **TWO (2)** appropriate liquid chromatography techniques. Clearly state the sequence of the protein that will be separated; first, second and third.

Table Q3.1

Protein	Molecular weight (kDa)	Net charge on protein with buffer of pH 6
X	284	+
Q	55	+
F	61	-

(7 marks)

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- (b) Thin layer chromatography (TLC) functions on the same principle as all chromatography: a compound will have different affinities for the mobile and stationary phases, affecting the speed at which it migrates. The goal of TLC is to obtain well defined, well separated spots.

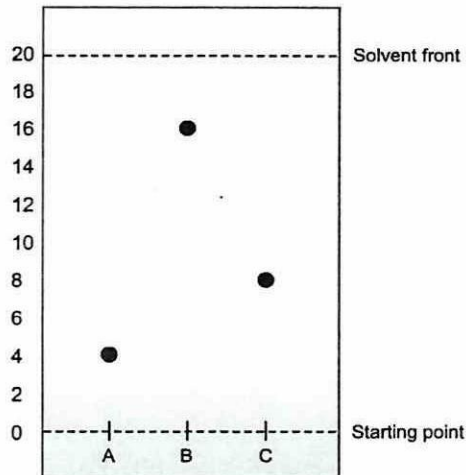


Figure Q3.1

- (i) Based on **Figure Q3.1**, calculate the retention factor (R_f) for compounds A, B and C. (3 marks)
- (ii) Assuming that polar solvent is used in the separation process, conclude on the characteristic of compounds A and B as compared to C. (2 marks)

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- Q4** You are a Master student in Fakulti Teknologi Kejuruteraan, UTHM. Your supervisor has obtained sample X from a private company. The company have asked your supervisor to perform a thorough analysis to determine and analyse the bioactive compound(s) of the sample. Sample X extract have been used in cosmeceutical products, as well as skincare products. The company have positive testimonies on their array of commercial products, but they want to have scientific data to further promote the effectiveness of their products. To keep the sample confidential, the company did not provide any information on sample X, except that it is derived from a natural source, halal-certified and is not toxic. Your supervisor has assigned this project for your Master study.

Propose **FIVE (5)** biochemical experiments to characterize sample X. In your answer, justify your chosen experiment based on the objective of each of the experiment and relate it to the sample application(s). In your answer, you should briefly document the methodology and the instrument that will be required for each experiment for qualitative/quantitative measurement.

(25 marks)

- Q5** In water treatment, membranes are barriers that allow water to pass through but stop unwanted substances from passing through with it. Working much like the cell walls in our bodies, technical membranes filter out salts, impurities, viruses, and other particles from water.

- (a) Name **ONE (1)** largely employed membrane transport process in the wastewater industry and briefly describe the process.

(4 marks)

- (b) Evaluate **TWO (2)** advantages and disadvantages of the process mentioned in **Q5(a)**.

(4 marks)

- (c) Provide recommendations for the disadvantages stated in **Q5(b)**.

(2 marks)

- END OF QUESTIONS -