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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023**

COURSE NAME : BIOCHEMISTRY &
BIOMOLECULAR TECHNIQUES

COURSE CODE : BNN 30104

PROGRAMME CODE : BNN

EXAMINATION DATE : JULY/AUGUST 2023

DURATION : 3 HOURS

INSTRUCTION : 1. ANSWER ALL QUESTIONS.

2. THIS FINAL EXAMINATION IS
CONDUCTED VIA **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 **THREE (3)** PAGES

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- Q1** (a) Name **TWO (2)** types of nucleic acid and discuss the structures of the nucleic acids in detail. (5 marks)
- (b) Amino acids are the monomers of a protein and these amino acids undergo a dehydration process to form polypeptides. Draw a tripeptide which consists of glycine, alanine and serine, and name the specific bond that links them together. (5 marks)
- (c) With the aid of a sketch diagram, correlate the role of nucleic acids in protein synthesis. (You are required to state clearly and identify all processes and biomolecules involved) (10 marks)
- Q2** (a) The Calvin Cycle, also known as light-independent reaction, is a process to generate glucose. This process takes place in the stroma of the chloroplasts.
- (i) Identify **TWO (2)** precursors for Calvin Cycle. (2 marks)
- (ii) There are **THREE (3)** phases involved in carbon fixation to produce glucose. Illustrate the process and determine the reactants and products for each phase. (8 marks)
- (b) Fasting is a prevalent approach to weight loss and believed to be a feasible method to reverse some metabolic diseases, such as type 2 diabetes. Debate on this issue by correlating the effects of feeding and fasting on human glucose, protein and lipid metabolisms. (10 marks)
- Q3** (a) A spectrophotometer is commonly used in a biochemical experiments or assays.
- (i) Explain the function of a spectrophotometer. (4 marks)
- (ii) Relate the Beer-lambert Law to the spectrophotometric measurements. (7 marks)
- (b) A biological sample extracted from a plant or an animal source often possesses mixtures of proteins with different molecular weight, charges and affinities. **Table Q3(b)** shows an example of a protein mixture from a biological sample.

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Table Q3(b)

Protein	Molecular Weight (kDa)	Net charge on protein
Lysozyme	14.3	+
Protease peptone	28.0	-
Ovalbumin	45.0	-

- (i) Based on **Table Q3(b)**, choose **TWO (2)** liquid column chromatography techniques that can effectively separate the proteins in correct sequence. (4 marks)
- (ii) Referring to the information from **Table Q3(b)** and your answer for **Q3(i)**, analyze the sequence of proteins that will be eluted off the columns, providing justifications. (5 marks)

Q4 Carbohydrates are considered highly important in biochemistry and food sciences. Analyze **ONE (1)** calorimetric method and **ONE (1)** chromatographic method used to study carbohydrates from biological samples. (20 marks)

Q5 (a) Michaelis-Menten kinetics is a simple model of enzyme kinetics for a one-substrate enzyme-catalysed reaction.

- (i) Indicate the Michaelis-Menten equation for a system where a substrate S binds reversibly to an enzyme E to form an enzyme-substrate complex ES, which then reacts irreversibly to generate a product P and to regenerate the free enzyme E. (3 marks)
- (ii) With the aid of a graph, explain the definition of the term 'Maximum velocity' and 'Michaelis constant'. (5 marks)
- (iii) Sketch Lineweaver-Burk plots to differentiate between *Competitive enzyme inhibition*, *Uncompetitive enzyme inhibition* and *Non-competitive enzyme inhibition*. (6 marks)
- (b) One of useful technology adopted from biochemical processes is reverse osmosis technology, which is commonly found in residential homes through the use of reverse osmosis water purifiers. Analyze how the reverse osmosis process occurs and how it is adapted from osmosis process. (6 marks)

- END OF QUESTIONS -