



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2019/2020**

COURSE NAME : BIOCHEMISTRY &  
BIOMOLECULAR TECHNIQUES

COURSE CODE : BNN 30104

PROGRAMME : BNN

DATE : DECEMBER 2019 / JANUARY  
2020

DURATION : 3 HOURS

INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

- Q1** (a) List **TWO (2)** similarities and **TWO (2)** differences between prokaryotes and eukaryotes cells. (4 marks)
- (b) Discuss **THREE (3)** types of RNA. (6 marks)
- (c) List and interpret **THREE (3)** types of metabolic classification of amino acid. (6 marks)
- (d) 'DNA reproduces itself when a cell divides'
- (i) Identify the process involved for statement **Q1(d)**. (1 mark)
- (ii) Illustrate and interpret the process mentioned in **Q1(d)(i)**. (8 marks)
- Q2** Bioenergetics is the study of energy in living systems and the organisms that utilize them.
- (a) Define kinetic energy and potential energy, and give **ONE (1)** example for both energies. (4 marks)
- (b) Sketch and interpret the graphs that show the differentiation between endergonic reaction and exergonic reaction (Gibbs free energy vs time). (8 marks)
- (c) Explain what is the first law of thermodynamics and second law of thermodynamics. (2 marks)
- (d) Draw and interpret how sodium and potassium can be pumping across the membranes powered by ATP. (9 marks)
- (e) Identify **TWO (2)** models of how enzymes work. (2 marks)
- Q3** (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 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)

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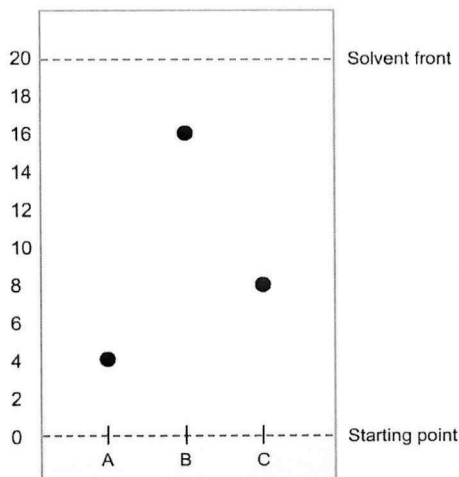
- (ii) In reference to **Table Q3(a)(ii)**, thoroughly explain on protein purification process with **TWO (2)** appropriate liquid chromatography techniques. Clearly state the sequence of protein that will be separated; first, second and third.

**Table Q3(a)(ii)**

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

(7 marks)

- (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, and this affects the speed at which it migrates. The goal of TLC is to obtain well defined, well separated spots.



**Figure Q3(b)**

- (i) Based on **Figure Q3(b)**, calculate the retention factor ( $R_f$ ) for compound A, B and C. (3 marks)
- (ii) Assuming that polar solvent is used in the separation process, conclude on the characteristic of compound A and B as compared to C. (2 marks)
- (c) Polymerase Chain reaction (PCR) generates millions of copies of a target DNA sequence in order to facilitate the downstream analysis of mutational events in cancer tissues.
- (i) Identify **FOUR (4)** important materials to start a PCR. (4 marks)

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(ii) Sketch PCR steps in amplification of DNA. (3 marks)

(iii) Explain why different temperatures are being applied at different stages throughout the cycle. (3 marks)

**Q4** (a) Enzymes are essential components of animals, plants and microorganisms, due to the fact that they catalyse and co-ordinate the complex reactions of cellular metabolism. Up until the 1970s, most of the commercial application of enzymes involved animal and plant sources. However, as demand grew, microbial enzymes were recognized and became more widely used. Debate on the uses of microbial enzymes against animal and plant enzymes in food industry. (5 marks)

(b) 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.

(i) Name **ONE (1)** largely employed membrane transport process in wastewater industry and briefly describe the process. (3 marks)

(ii) Evaluate **TWO (2)** advantages and disadvantages of the process mentioned in **Q4(b)(i)**. (4 marks)

(iii) Provide recommendations to the disadvantages stated in **Q4(b)(ii)**. (2 marks)

(c) Photosynthetic devices and photocatalysts rely on the conversion of photons into charge carriers and their reaction with redox species at the solid-liquid or solid-gas interface.

(i) State **ONE (1)** industry that uses photocatalyst. (1 mark)

(ii) Sketch photocatalysis mechanism in industry **Q4(c)(i)** and extensively explain. (8 marks)

(iii) Provide **TWO (2)** criteria to distinguish photocatalysis and photosynthesis. (2 marks)

END OF QUESTIONS

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