NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCE
BACHELOR OF SCIENCE HONOURS EXAMINATION
DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY

THEORY: Advanced Biochemistry and Molecular Physiology SBB 4101

3 HOURS (100) Marks

INSTRUCTIONS:
Answer FOUR questions. Each question carries 25 marks. Where a question contains subdivisions the mark value for each subdivision is given in brackets. Illustrate your answer where appropriate with large, clearly labeled diagrams.

Note that most of subdivisions (a) are multiple choice questions and more than one answer may be true. Choose the correct response to each question and briefly justify your answer.

1(a) Muscle cells were broken up and separated into fractions. Samples of each fraction were incubated with: (i) glucose and (ii) pyruvate. Tests were then made for the production of carbon dioxide and lactate in each sample. The results are given in the table below. **Explain the significance of the results obtained with each of the fractions.**

Cell Fraction	Incubated with glucose		Incubated with pyruvate	
	CO_2	Lactate	CO_2	Lactate
Mitochondria	not produced	not produced	produced	not produced
Cytoplasmic residue	not produced	produced	not produced	not produced

(b) Discuss the function of molecular zippers in gene regulation

(15 marks)

(c) Describe the structure of gap junctions and their biological role.

(6 marks)

2(a) Consider the synthetic polynucleotide known as Poly -U (polyuridylic acid).

i) Complete hydrolysis gives uracil, ribose and phosphate

ii) It migrates to the positive electrode on electrophoresis at pH 8.

iii) It forms a double helix by base pairing with itself.

iv) When used as a synthetic messenger for polypeptide synthesis in a ribosomal preparation, only one type of amino acid is incorporated into the peptide.

v) It acts as a transfer-RNA for phenylalanine (3 marks)

2(b) Explain the role of phylloquinone in the synthesis of prothrombin. Give examples of anticoagulants and their mechanism of action. (7 marks)

2(c) Describe the life cycle of the AIDS virus and how it can be stopped. (15 marks)

3(a) Which of the following might apply to a patient with an inadequately controlled insulin-dependent diabetes?

i) An abnormally slow drop in blood glucose concentration following a meal.

ii) An abnormally low concentration of fatty acids in the blood.

iii) A high concentration of ketones in the blood.

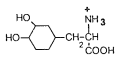
iv) Glycosuria

v) An abnormally high rate of glycogen synthesis. (3 marks)

3(b) Write short notes on the isolation of the lysosomal fraction from liver. (9 marks)

3(c) Give an account of the spontaneous occurrence of transition type of mutation. (13 marks)

4(a) Consider the substance L-3,4 dihydroxyphenylalanine (Dopa):



i) It can be formed from L-tyrosine

ii) It is a major precursor of tyrosine in the body

iii) L~3,4~dihydroxyphenylethylamine is formed by decarboxylation of dopa.

iv) Dopa is an important neurotransmitter.

v) Dopa is an intermediate compound in the biosynthesis of epinephrine

(3 marks)

4(b) Discuss the difference in the catalytic mechanisms of chymotrypisn and carboxypeptidase A

(11 marks)

4(c) Explain the structure and function of the Na, K ATP-ase pump.

(11 marks)

5(a) Which of the following statements are correct and which are false for the amino acid : γ-aminobutyric acid ?

i) It inhibits anticholinesterase activity.

ii) It is an inhibitory neurotransmitter substance.

iii) It is synthesized in the brain from glutamate.

iv) The enzyme glutamate dehydrogenase is directly responsible for its synthesis.

v) It is an essential amino acid.

(3 marks)

5(b) Give an account of power stroke of muscle contraction

(13 marks)

5(c) Describe the biological role of recA protein and explain how recA is involved in the SOS response of the cell.

(9 marks)

6(a) In relation to particular DNAs:

i) *Escherichia coli* contains double-stranded circular DNA.

ii) Smallpox and herpes simplex viruses are examples of DNA viruses.

iii) Influenza A and polioviruses are examples of DNA viruses.

iv) An appropriate DNA polymerase and DNA ligase are required for the in vitro synthesis of some bacteriophages.

v) All oncogenic viruses are DNA viruses.

(3 marks)

6(b) Outline the important differences between eukaryotic and prokaryotic mRNAs

(15 marks)

6(c) How is the coordinated control of the activation of all pancreatic zymogens achieved?

(7 marks)

END OF PAPER.