INTI INTERNATIONAL UNIVERSITY

FOUNDATION IN SCIENCE (CFSI)
BIO1203: BIOLOGY 1
FINAL EXAMINATION: MAY 2016 SESSION

Instructions: This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) State the **FOUR (4)** kingdoms of the Eukarya domain and give **ONE (1)** example of each kingdom.

(4 marks)

(b) List **FIVE (5)** characteristics of living things.

(5 marks)

(c) (i) Sodium chloride is a familiar type of salt which often exist as crystal in nature. Explain how does sodium chloride dissolves in water.

(4 marks)

(ii) How does water moderate temperature?

(4 marks)

(d) Starch, glycogen and cellulose are all polysaccharides. They are made from monomers that are joined by covalent bonds. Copy and complete Table 1.1 to show which of the statements apply to each of the polysaccharides.
Fill in each box using a tick (✓) to show that the statement applies and a cross (X) if it does not.

Table 1.1

statement	starch	glycogen	cellulose
glycosidic bonds between monomers			
monomer is β glucose			
stored within chloroplasts			
stored in muscle cells			
exists in two forms – branched and unbranched chains			

(5 marks)

(e) Table 1.2 shows the observations in an experiment to identify the unknown substances. Identify the compound in solution A, B and C.

Table 1.2

Solution	**Benedict's test**	**Iodine test**	**Biuret test**
Distilled water	Blue	Brown	Blue
A	Brick red	Brown	Blue
B	Blue	Dark blue	Blue
C	Blue	Brown	Violet

(3 marks)

Question 2

(a) Fig. 2.1 shows the structure of **TWO (2)** cells.

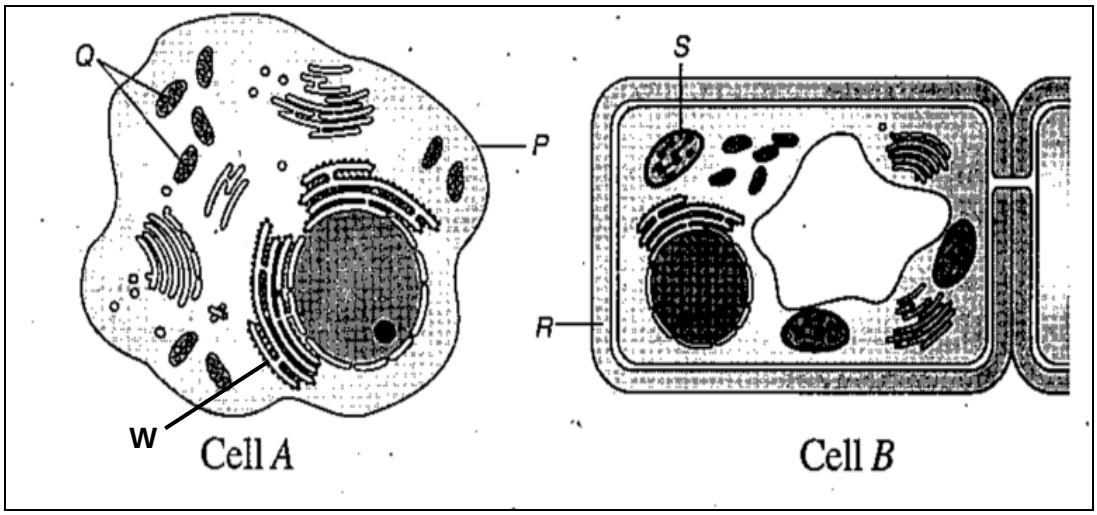

Fig. 2.1

(i) Identify structures labeled P, Q, R, S and W. State **ONE (1)** function of Q, S and W.

(8 marks)

(ii) List **THREE (3)** ways in which the structures of cell A differs from that of cell B.

(3 marks)

(b) When a person is suffering from prolonged exposure to low temperatures, their core body temperature drops. This in turn slows down the metabolic processes in the cell. Death may result from this. Explain this scenario in terms of the action of enzymes in cell.

(3 marks)

(c) Fig. 2.2 shows a diagram of a plasma membrane. Identify structures labeled K, L, M and N and outline their functions respectively.

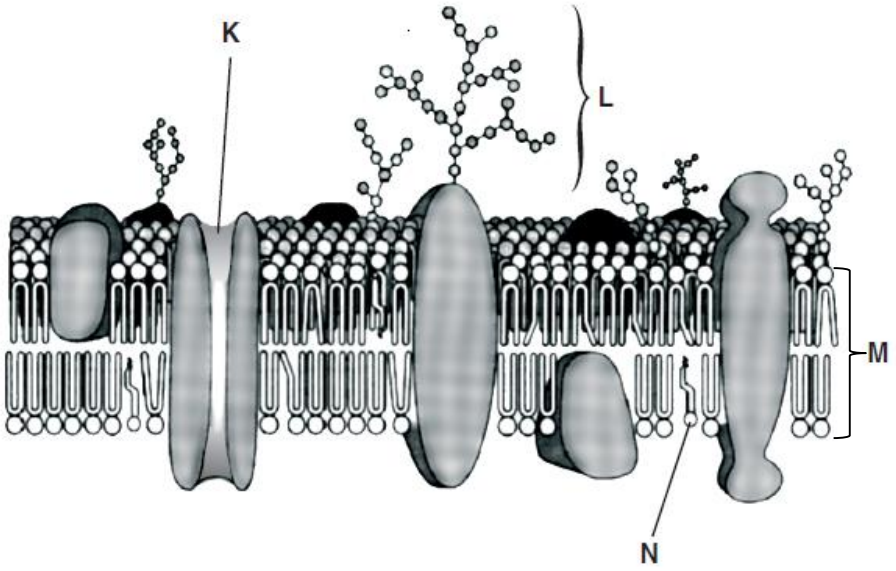

Fig. 2.2

(8 marks)

(d) Briefly suggest how each of the following materials may be transported across a cell membrane:

(i) Water going from the soil into a plant root

(ii) A white blood cell engulfing a bacterium

(iii) Oxygen gas going from the lungs into your bloods

(3 marks)

Question 3

(a) Fig. 3.1 shows the cross section of a mitochondrion.

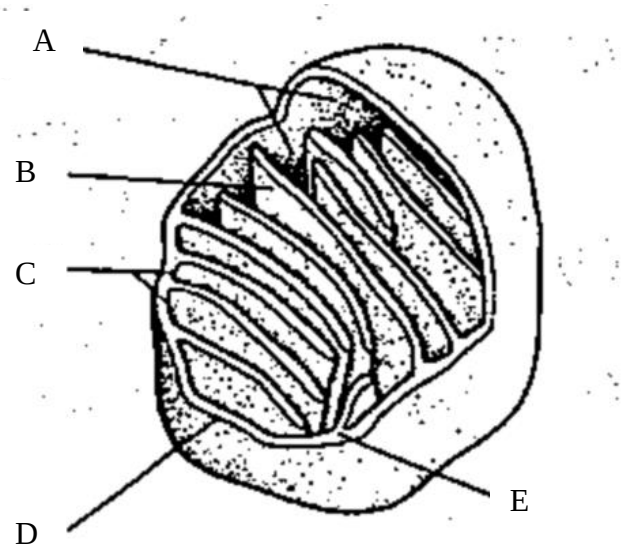

Fig. 3.1

(i) Name the parts labeled A, B, C and D.

(4 marks)

(ii) Where do Krebs cycle and oxidative phosphorylation occur in mitochondria?

(2 marks)

(iii) Only substrate-level phosphorylation is possible in the absence of oxygen. Explain why oxidative phosphorylation is not possible in the absence of oxygen.

(5 marks)

(b) Fig. 3.2 shows the Krebs cycle.

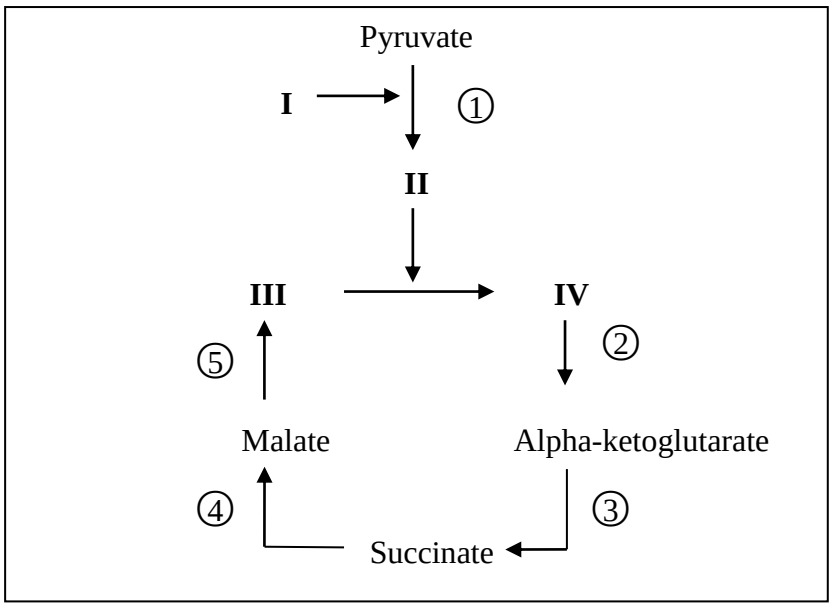

Fig. 3.2

(i) Identify the compounds labeled **I**, **II**, **III** and **IV**.

(4 marks)

(ii) How many NADH and $FADH_2$ are produced from one molecule of glucose in the Krebs cycle?

(2 marks)

(c) Complete Table 3.1 below by filling the differences between the Calvin cycle and the Krebs cycle. The differences are indicated by (i) to (x).

Table 3.1

Criteria	Calvin cycle	Krebs cycle
Site	**(i)**	**(ii)**
ATP (consumed or released)	**(iii)**	**(iv)**
Carbon dioxide (consumed or released)	**(v)**	**(vi)**
Electron or hydrogen carrier	**(vii)**	**(viii)**
Main products	**(ix)**	**(x)**

(5 marks)

(d) Fig. 3.3 showing a structure in a plant cell.

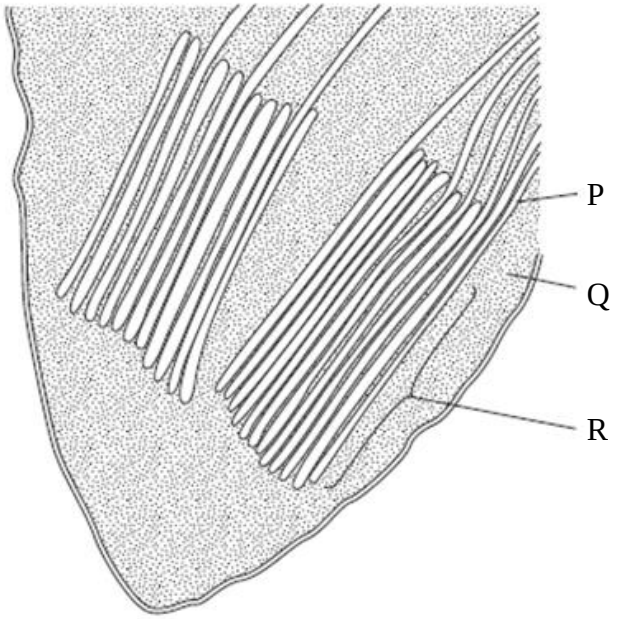

Fig. 3.3

(i) Identify P and Q.

(1 mark)

(ii) Describe **TWO (2)** roles of structure labeled P in photosynthesis.

(2 marks)

Question 4

(a) A student cut thin sections of a root tip of *Allium cepa* and stained them to show chromosomes. A photomicrograph of part of one of these sections is shown in Fig. 4.1.

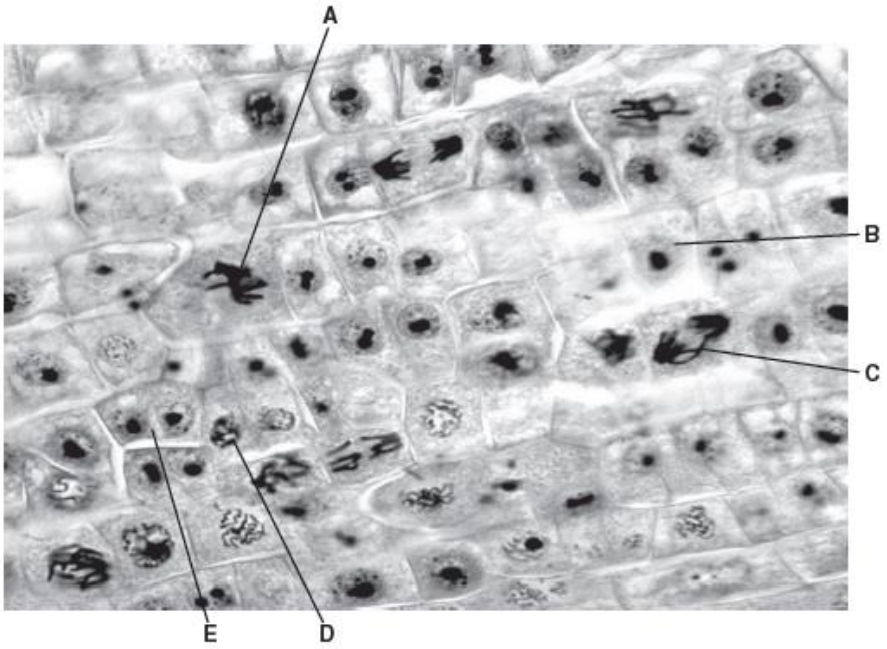

Fig. 4.1

(i) Table 4.1 shows the behaviour of chromosomes and the changes that occur to the nuclear envelope during a mitotic cell cycle in the root tip of *A. cepa*.
Copy and complete Table 4.1.

Table 4.1

Name of stage	Cell in Fig. 4.1	Behavior of chromosomes	Nuclear envelope
Interphase	B	Chromosomes uncoiled, may be replicating	Intact
			Intact, but then break down
Metaphase			Not present
		chromosomes / chromatids, moving to opposite poles	
Telophase		chromosomes uncoiling	

(10 marks)

(ii) Describe the role of mitosis in a growing plant root tip.

(3 marks)

(iii) State **FOUR (4)** differences between mitosis and meiosis.

(4 marks)

(b) In humans, hemophilia is an X-linked recessive disease. Determine the genotypes of children from a marriage between:

(i) A normal man and a carrier woman
(ii) A hemophilic man and a normal woman

(4 marks)

(c) Incomplete dominance is observed in the inheritance of hypercholesterolemia. Mack and Toni are both heterozygous for this characteristic and both have elevated levels of cholesterol. Their daughter Zoe has a cholesterol level six times higher than normal; she is apparently homozygous, **hh**. What fraction of Mack and Toni's children are likely to have elevated but not extreme levels of cholesterol, like their parents? If Mack and Toni have one more child, what is the probability that the child will suffer from the more serious form of hypercholesterolemia seen in Zoe?

(4 marks)

Question 5

(a) Fig. 5.1 shows the gene regulation and expression of a *lac* operon when lactose is present.

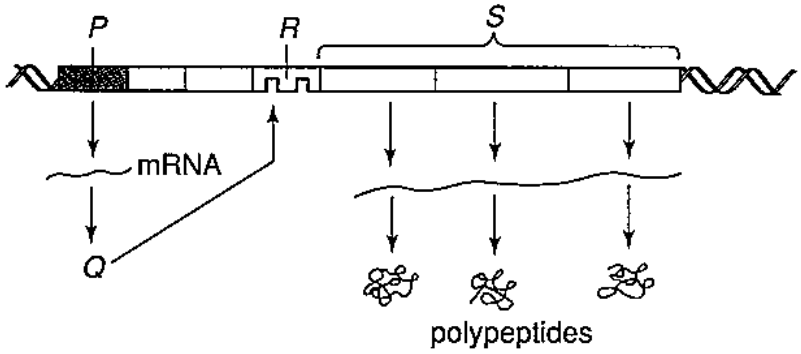

Fig. 5.1

(i) Name the substances labeled with P, Q, R and S.

(4 marks)

(ii) What is *lac* operon and where is it found?

(1 mark)

(iii) State **ONE (1)** function of each substance P and R.

(2 marks)

(b) Fig. 5.2 shows details of DNA replication.

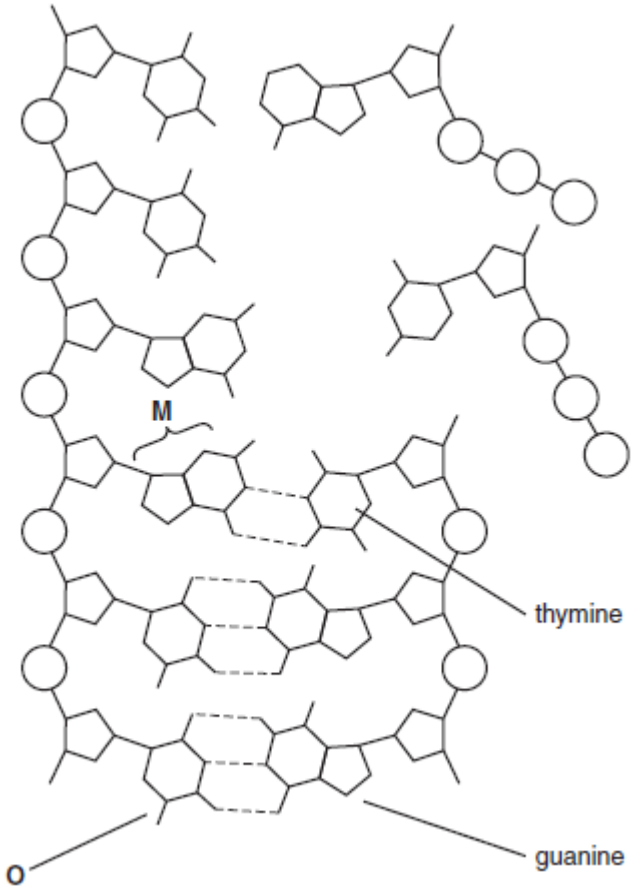

Fig. 5.2

(i) Name the stage during the mitotic cell cycle when replication of DNA occurs.

(1 mark)

(ii) Name the bonds shown by the dashed lines on Fig. 5.2.

(1 mark)

(iii) Name the nitrogenous bases, M and O.

(2 marks)

(iv) Explain why DNA replication is described as semi-conservative.

(2 marks)

(c) Fig. 5.3 shows some of the steps involved in the production of bacteria capable of synthesising human insulin.

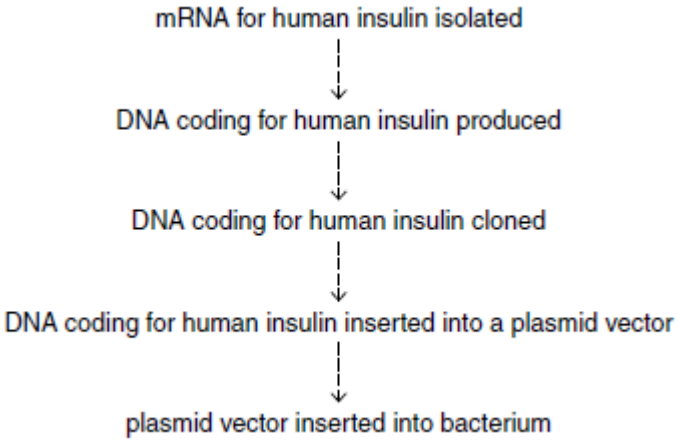

Fig. 5.3

State the role of each of the following enzymes in the production of bacteria capable of synthesising human insulin,

(i) reverse transcriptase
(ii) DNA polymerase
(iii) restriction enzymes
(iv) DNA ligase

(4 marks)

(d) Fig. 5.4 shows protein synthesis in a eukaryotic cell.

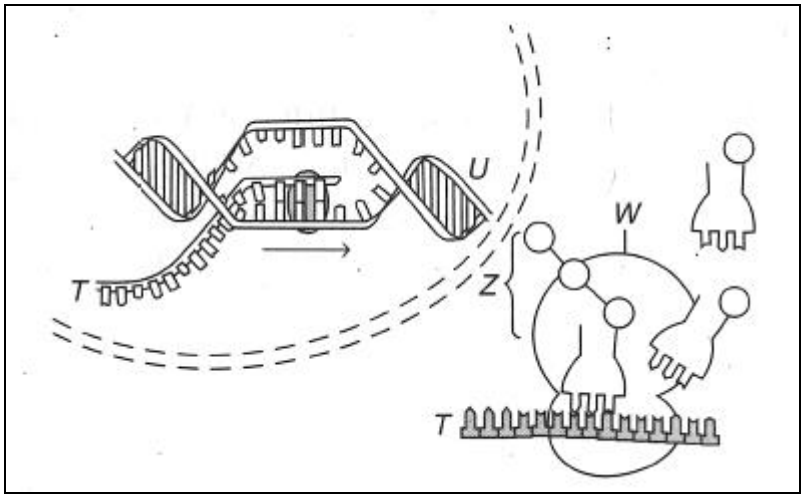

Fig. 5.4

(i) Name the structures labeled **U**, **T**, **W**, and **Z**.

(2 marks)

(ii) Name the process which produces **T** and **Z**, respectively.

(2 marks)

(iii) Table 5.2 shows two messenger RNA (mRNA) codons. Identify E and F.

Table 5.2

mRNA codons	GCG	ACA
complementary tRNA anticodons	**E**	**F**

(2 marks)

(iv) Calculate the minimum number of DNA nucleotides necessary to code for a polypeptide with 310 amino acids. Show your working.

(2 marks)

-THE END-

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