INTI INTERNATIONAL UNIVERSITY

FOUNDATION IN SCIENCE (CFSI)
BIO1203: BIOLOGY 1
FINAL EXAMINATION: JUNE 2015 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) Water is the only common substance found naturally in all three common states of matter and it is essential for all life on Earth. The unique properties of water and its abundance make possible for life to thrive on Earth.

(i) Water is polar molecule. Briefly explain this statement.

(2 marks)

(ii) How does water moderate temperature?

(4 marks)

(d) Fig. 1.1 shows part of a molecule of deoxyribonucleic acid (DNA).

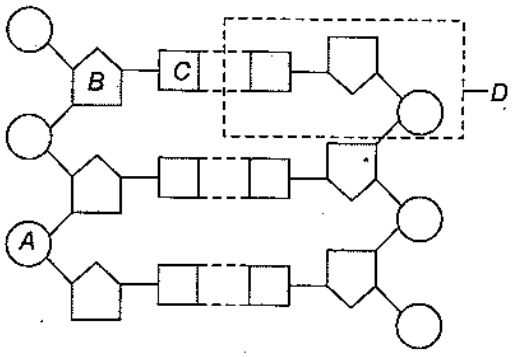

Fig. 1.1

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

(2 marks)

(ii) Name the bond that links the two strands of polynucleotides.

(1 mark)

(iii) An analysis of a molecule of DNA showed that thymine accounted for 8 % of the content of the nitrogenous bases. Calculate the percentage of cytosine in the molecule. Show your working.

(2 marks)

(e) There are many types of amino acids, but only twenty that are polymerised to make polypeptides and proteins in animals.

(i) Name the type of chemical reaction that occurs when two amino acids form a dipeptide.

(1 mark)

(ii) Fig. 1.2 shows two amino acids, glycine and valine. Make a drawing to show what happens when these two molecules join together to form a dipeptide.

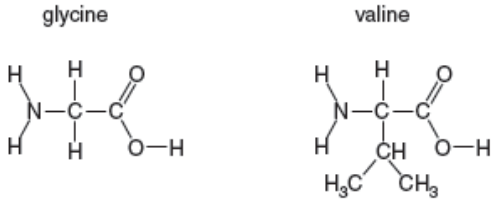

Fig. 1.2

(4 marks)

Question 2

(a) Fig. 2.1 shows some organelles inside a cell.

(i) Name the structures labeled A, B, C, D, E, F, G and H.

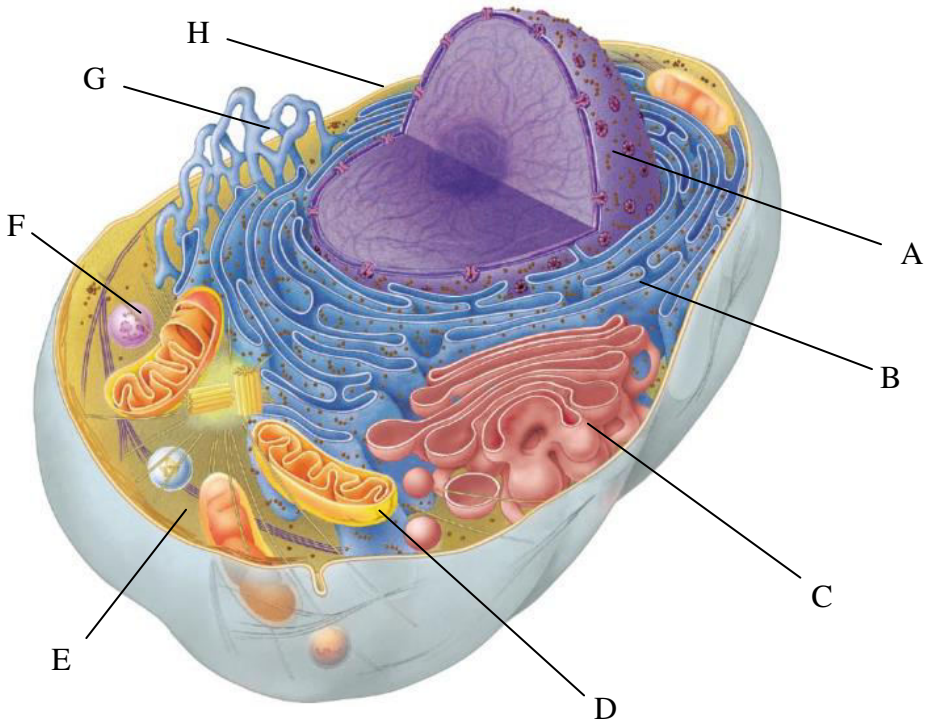

Fig. 2.1

(4 marks)

(ii) Give one function for each of the structures labeled A, B, C, D, G and H.

(6 marks)

(b) Fig. 2.2 shows a diagram of part of a cell surface membrane.

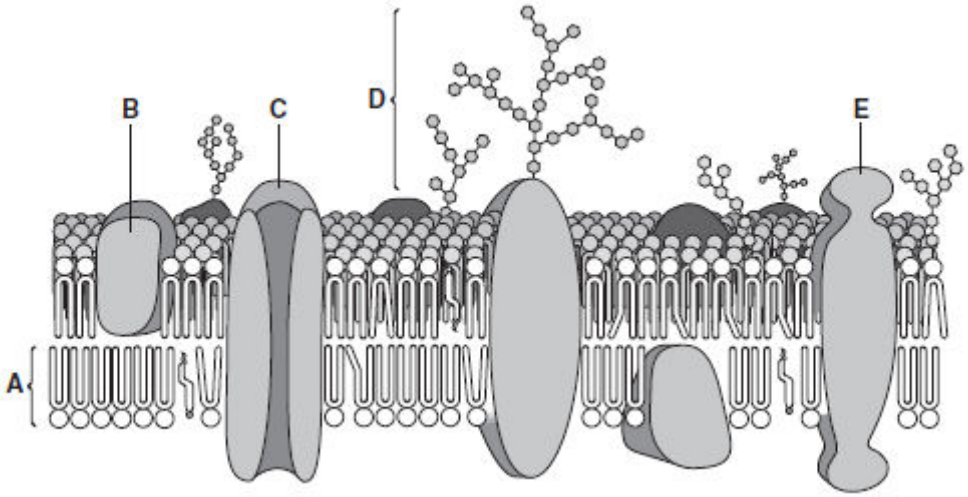

Fig. 2.2

(i) Name molecules A and B

(2 marks)

(ii) Explain how the features of molecules of A cause them to form a layer in the membrane as seen in Fig. 2.2.

(2 marks)

(iii) State the functions of C and D.

(2 marks)

(iv) Structure E is a protein composed of 788 amino acids.
Calculate the minimum number of nucleotide base pairs required in the gene coding for this protein. Show your working.

(2 marks)

(c) Fig. 2.3 shows an inhibition of an enzyme.

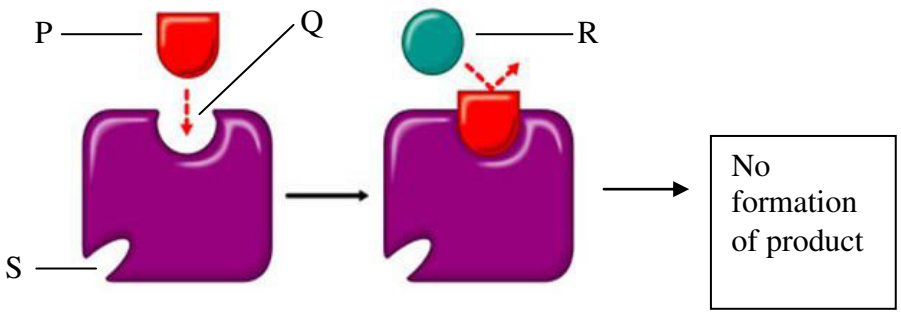

Fig. 2.3

(i) Identify the structures labeled P, Q, R and S.

(4 marks)

(ii) Which type of inhibition is shown in Fig. 2.3? Briefly explain your answer.

(3 marks)

Question 3

(a) All living organisms require a continuous supply of energy.

(i) Outline the need for energy in living organisms.

(3 marks)

(ii) Fig. 3.1 shows the structure of ATP.

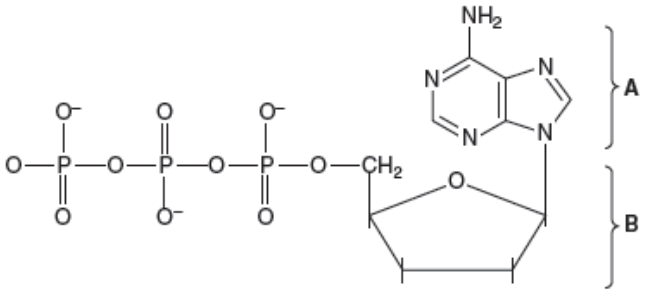

Fig. 3.1

(I) Identify A and B.

(2 marks)

(II) Describe how the structure of ATP is related to its role as energy currency.

(2 marks)

(b) Fig. 3.2 represents the main stages of aerobic respiration.

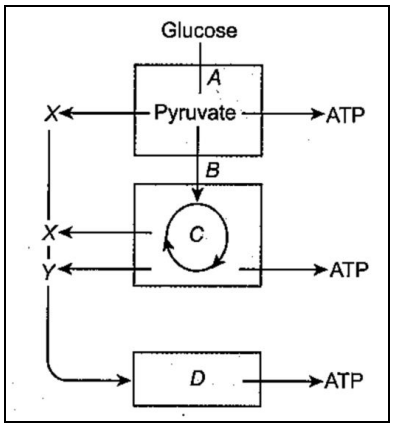

Fig. 3.2

(i) What are the stages A, B, C, and D?

(4 marks)

(ii) Where do the stages C and D occur in the cell?

(2 marks)

(iii) What are the substances X and Y?

(2 marks)

(iv) Complete the table (i-x) below to show differences between the Calvin cycle and stage C as shown in Fig. 3.2.

	Calvin cycle	Stage C
Site	(i)	(ii)
ATP	(iii)	(iv)
Carbon dioxide	(v)	(vi)
Electron or hydrogen carrier	(vii)	(viii)
Main products	(ix)	(x)

(5 marks)

(c) Fig. 3.3 shows the stages of Calvin cycle.

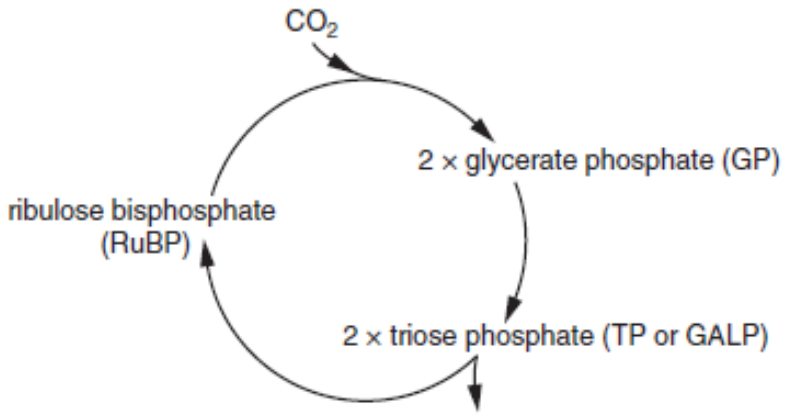

Fig. 3.3

(i) State the name of the five carbon molecule in the cycle.

(1 mark)

(ii) State the name of the enzyme that fixes carbon dioxide.

(1 mark)

(iii) State where in the chloroplast the Calvin cycle occurs.

(1 mark)

(iv) State **TWO (2)** compounds which produced in the light-dependent stage of photosynthesis that is used in the Calvin cycle.

(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.

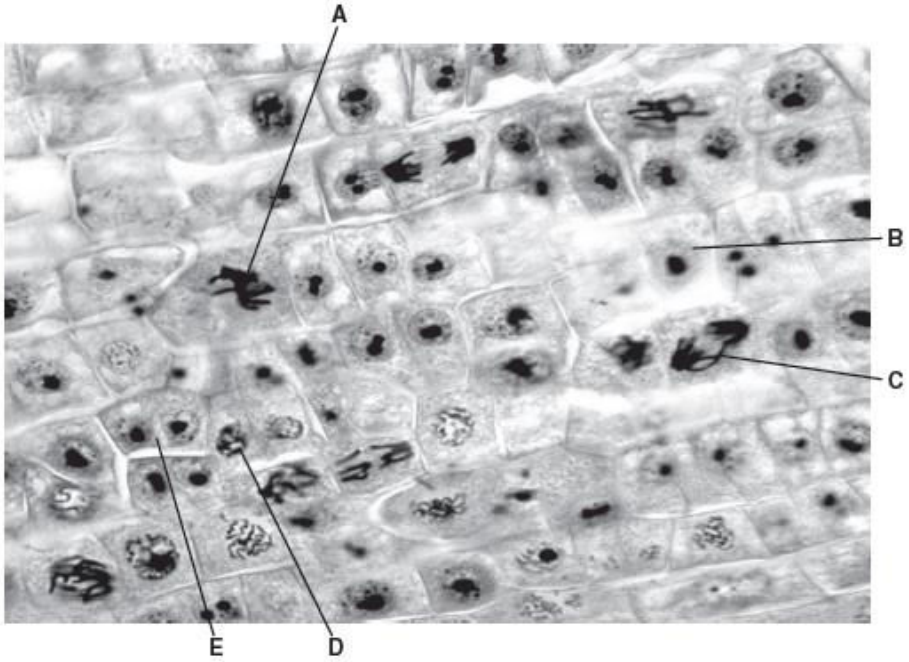

Fig. 4.1

(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 replicatin	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)

(b) The summer squash plant produces fruits that are either white or yellow in colour and are either shaped like a disc or a sphere. The dominant phenotypes are white and disc shaped fruits. Using the symbols **A** for white, **a** for yellow, **B** for disc and **b** for sphere, draw a Punnett square to show the genotypes and phenotypes of **all** offspring if a white and disc-shaped fruit plant, heterozygous for both genes, is self-fertilised. Include fraction of each phenotype.

(8 marks)

(c) Incomplete dominance is observed in the inheritance of hypercholesterolemia. Jane and Steven are both heterozygous for this characteristic and both have elevated levels of cholesterol. Their daughter Susan has a cholesterol level six times higher than normal; she is apparently homozygous, **hh**. If Jane and Steven have one more child, what is the probability that the child will suffer from the more serious form of hypercholesterolemia seen in Susan?

(4 marks)

Question 5

(a) Fig. 5.1 outlines how a gene coding for human insulin is produced by genetic engineering techniques.

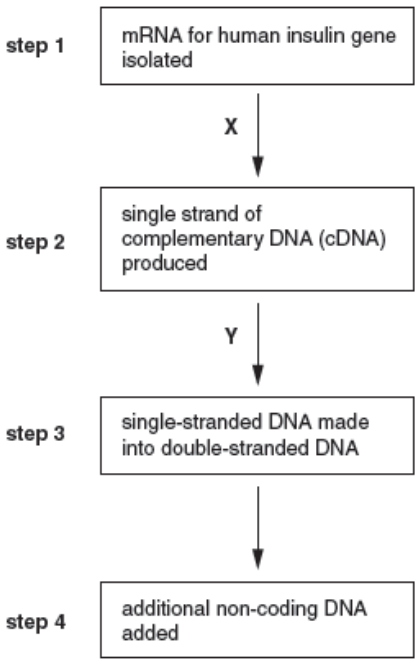

Fig. 5.1

(i) Name the enzymes X and Y.

(2 marks)

(ii) Explain why the starting point in this procedure is mRNA.

(3 marks)

(iii) State **THREE (3)** advantages of using human insulin produced by genetic engineering.

(3 marks)

(b) Fig. 5.2 shows the gene regulation and expression of a *lac* operon when lactose is present.

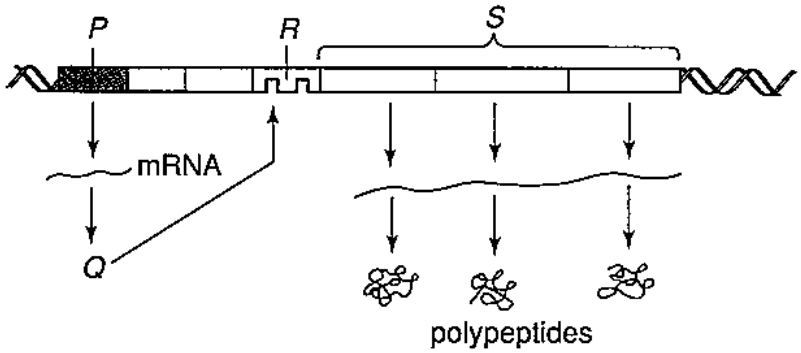

Fig. 5.2

(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)

(c) Catalase is an enzyme with a molecular structure composed of four identical sub-units. Fig. 5.3 is a diagram that shows how catalase is produced in cells.

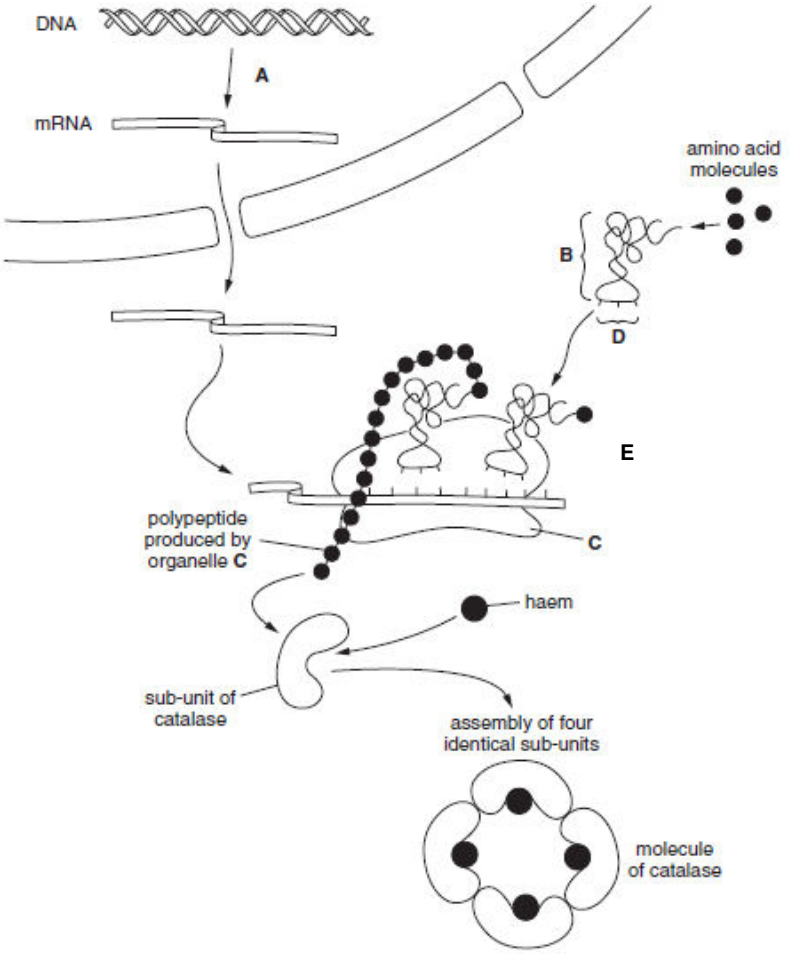

Fig. 5.3

(i) Identify process A, molecule B, structure C and sequence of bases D.

(4 marks)

(ii) State **THREE (3)** differences between process A and E.

(3 marks)

(d) The diagram below shows the base sequence of an mRNA.

5'-AUG AAA UAU UCG UUA UAU UAC GUC-3'

If AUG on the mRNA is the first codon produced through transcription ,

(i) Draw the base sequence on the corresponding DNA strand where this mRNA is produced by process A. Include the **5'** and **3'** on the strand.

(1 mark)

(ii) A tRNA molecule has the anticodon AUA. Which amino acid does the tRNA molecule carry? (refer to the table in (iii))

(1 mark)

(iii) Identify the polypeptide chain produced by the mRNA in (d). Refer to the table below.

FIRST BASE	SECOND BASE U	SECOND BASE C	SECOND BASE A	SECOND BASE G	THIRD BASE
U	UUU Phe	UCU Ser	UAU Tyr	UGU Cys	U
	UUC Phe	UCC Ser	UAC Tyr	UGC Cys	C
	UUA Leu	UCA Ser	UAA Stop	UGA Stop	A
	UUG Leu	UCG Ser	UAG Stop	UGG Trp	G
C	CUU Leu	CCU Pro	CAU His	CGU Arg	U
	CUC Leu	CCC Pro	CAC His	CGC Arg	C
	CUA Leu	CCA Pro	CAA Gln	CGA Arg	A
	CUG Leu	CCG Pro	CAG Gln	CGG Arg	G
A	AUU Ile	ACU Thr	AAU Asn	AGU Ser	U
	AUC Ile	ACC Thr	AAC Asn	AGC Ser	C
	AUA Ile	ACA Thr	AAA Lys	AGA Arg	A
	AUG Met or start	ACG Thr	AAG Lys	AGG Arg	G
G	GUU Val	GCU Ala	GAU Asp	GGU Gly	U
	GUC Val	GCC Ala	GAC Asp	GGC Gly	C
	GUA Val	GCA Ala	GAA Glu	GGA Gly	A
	GUG Val	GCG Ala	GAG Glu	GGG Gly	G

(1 mark)

-THE END-

BIO1203(F)/JUNE2015/LEONGWAICHING