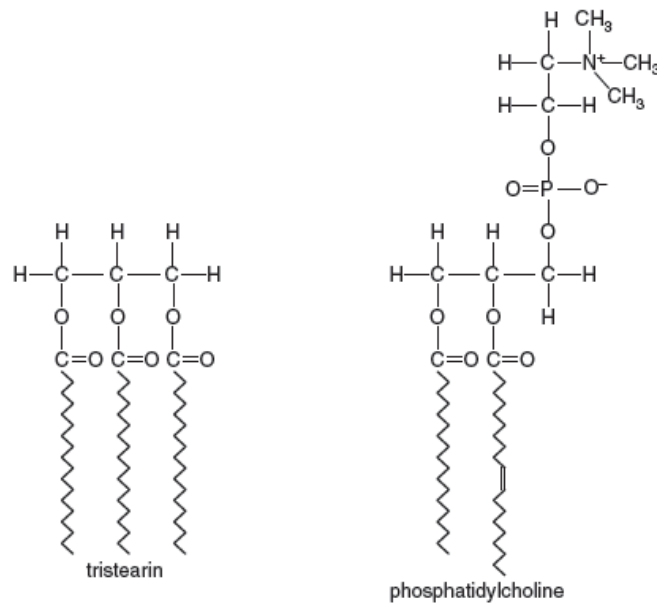


INTI INTERNATIONAL UNIVERSITY  
 FOUNDATION IN SCIENCE (CFSI)  
 BIO1203: BIOLOGY 1  
 FINAL EXAMINATION: AUGUST 2015 SESSION

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) Explain the evolution of sharp claws and teeth of tigers in terms of natural selection. (3 marks)
- (b) Water is an essential component of organisms. Some properties of water are resulted from hydrogen bonding. Explain **THREE (3)** of these properties by giving the appropriate example. (6 marks)
- (c) Fig. 1.1 shows a diagram of the molecular structures of tristearin (a triglyceride) and phosphatidylcholine (a phospholipid).



**Fig. 1.1**

Table 1.1 shows a structural difference between the two molecules shown in Fig. 1.1.

- (i) Copy and complete Table 1.1. Provide **TWO (2)** further structural differences other than in numbers of different types of atoms.

**Table 1.1**

structural feature	tristearin	phosphatidylcholine
length of fatty acid chains	all the same length	different lengths
phosphate (group) / contains phosphorus		
nitrogen		

(4 marks)

- (ii) Carbohydrates and lipids are both used as respiratory substrates. Table 1.2 shows the energy values of carbohydrates and lipids.

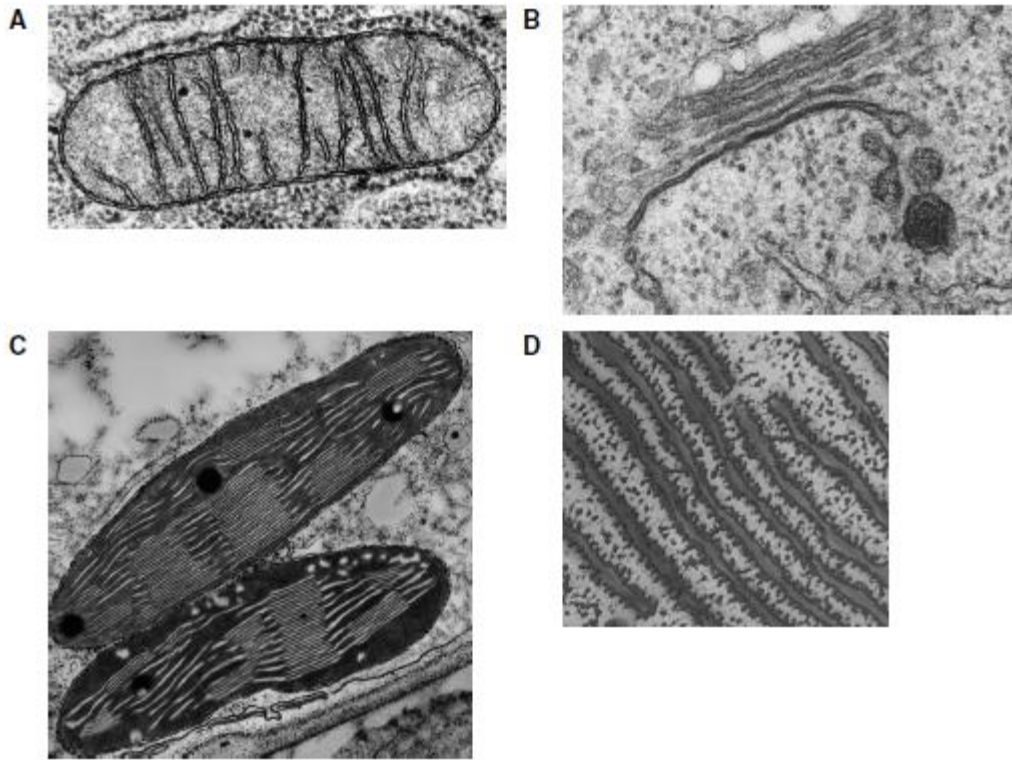
**Table 1.2**

respiratory	substrate energy value / $\text{kJ g}^{-1}$
carbohydrate	15.8
lipid	39.4

Explain why lipids have a higher energy value than carbohydrates.

(2 marks)

(d) Fig. 1.2 shows electron micrographs of some eukaryotic cell organelles.



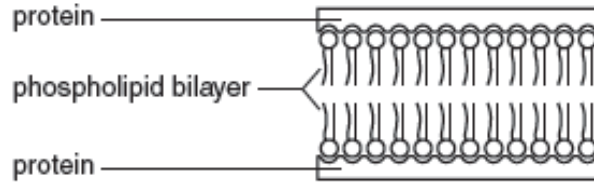
**Fig. 1.2**

- (i) For each of the organelles A, B, C and D, shown in Fig. 1.2, state the name and its function. (8 marks)
- (ii) Explain why an electron micrograph is able to provide more detail than a light micrograph. (2 marks)

**Question 2**

- (a) The cell membrane has a fluid mosaic structure.
- (i) Describe what is meant by the term fluid mosaic. (2 marks)

- (ii) In 1934, the biologists Davson and Danielli published their suggestion for the structure of the cell membrane, as shown in Fig. 2.1. They suggested that the membrane was a phospholipid bilayer with a layer of hydrophilic protein on both surfaces.



**Fig. 2.1**

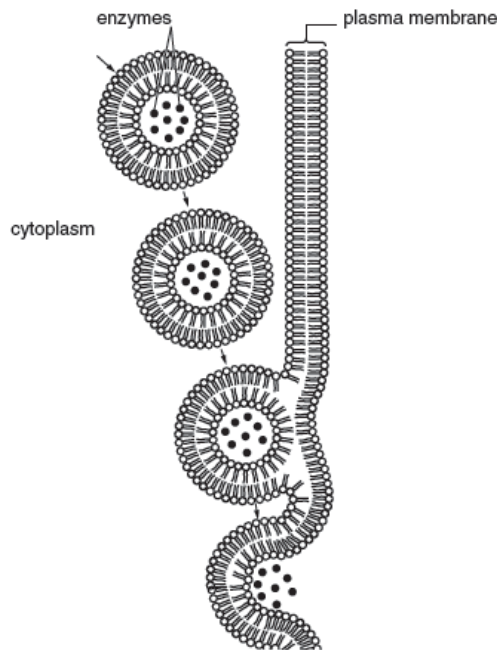
State **ONE (1)** way in which the Davson-Danielli structure is **similar** to the fluid mosaic structure and **ONE (1)** way in which it **differs** from the fluid mosaic model.

(3 marks)

- (b) One way in which substances can cross cell membranes is by active transport. Describe the mechanism of active transport.

(3 marks)

- (c) Cells in the pancreas secrete enzymes, such as amylase and trypsin, into a duct. The enzymes are packaged in vesicles so that they can be exported from these cells as shown in Fig. 2.2

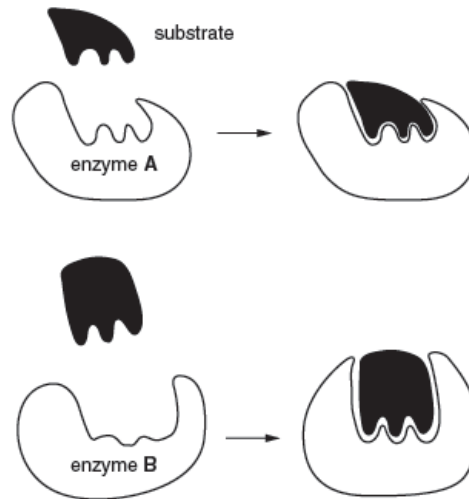


**Fig. 2.2**

With reference to Fig. 2.2, explain how enzymes that are secreted by cells in the pancreas are packaged into vesicles and exported.

(6 marks)

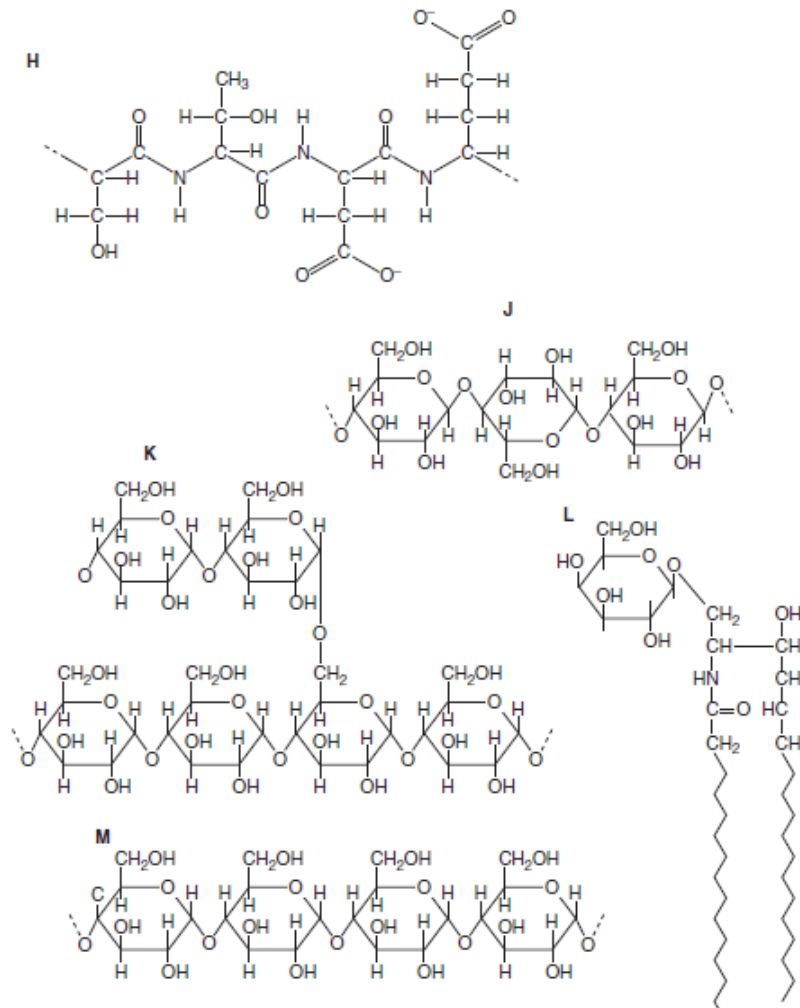
- (d) Fig. 2.3 shows two ways in which enzymes interact with their substrates. Explain the difference between the two ways in which enzymes interact with their substrates as shown in Fig. 2.3.



**Fig. 2.3**

(4 marks)

(e) Fig. 2.4 shows **FIVE (5)** different biological molecules labeled H, J, K, L and M.



**Fig. 2.4**

Refer to Fig. 2.4 and complete Table 2.1 by indicating which molecule matches each statement. **You may use each letter H, J, K, L and M once, more than once or not at all.** You should write only **ONE (1)** letter in each box.

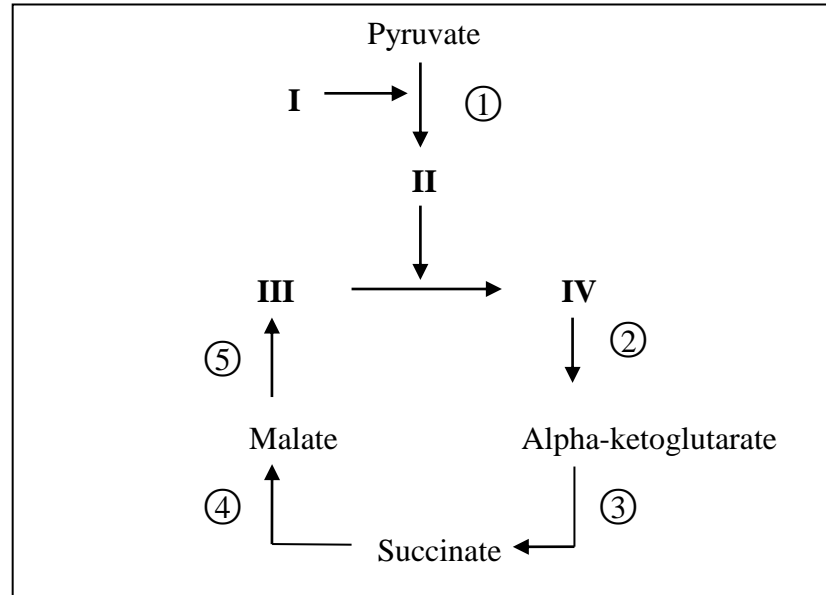
**Table 2.1**

No.	Statement	Letter
1	contains peptide bonds	
2	part of the molecule forms the hydrophobic part of cell membranes	
3	contains 1-4 and 1-6 glycosidic bonds	
4	forms the primary structure of a protein	
5	used for energy storage in plants	
6	forms a helical structure	
7	the sub-unit molecule is β-glucose	

(7 marks)

**Question 3**

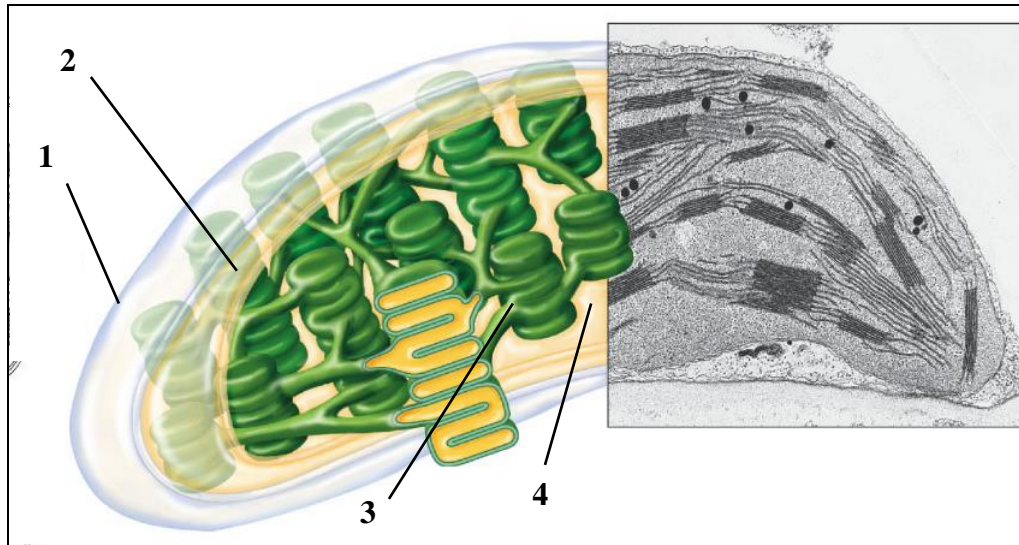
(a) Fig. 3.1 shows the Krebs cycle.



**Fig. 3.1**

- (i) Identify the compounds labeled **I**, **II**, **III** and **IV**. (2 marks)
- (ii) How many NADH and FADH<sub>2</sub> are produced from one molecule of glucose in the Krebs cycle? (1 mark)
- (iii) What can happen to the NADH that is produced during the Krebs cycle? (2 marks)
- (iv) State the precise location in the cell where Krebs cycle occurs. (1 mark)
- (v) What would happen to pyruvate if oxygen is absent? (2 marks)
- (vi) How many ATP molecules are produced by oxidative phosphorylation in the Krebs cycle (include link reaction) for **ONE (1)** molecule of pyruvate? Show your working. (3 marks)

(b) Fig. 3.2 shows an organelle in the plant cell.



**Fig. 3.2**

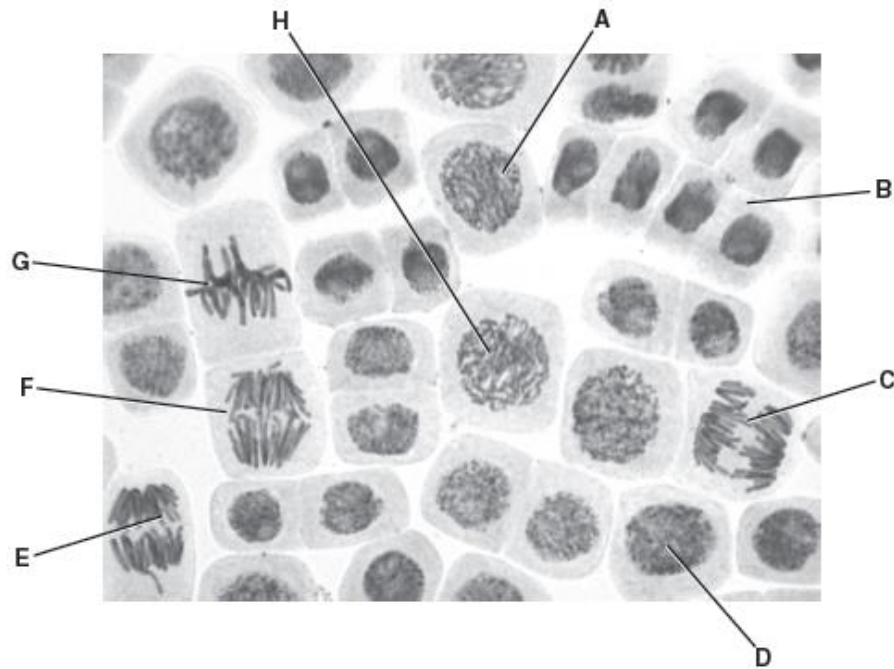
- (i) Name this organelle. (1 mark)
  - (ii) Name the structures numbered 1, 2, 3 and 4. (2 marks)
  - (iii) Which of the numbered structure carries out the light-dependent stage of photosynthesis? (1 mark)
  - (iv) Name the **THREE (3)** products of the light-dependent stage of photosynthesis. (3 marks)
  - (v) What is the final electron acceptor in the electron transport chain? (1 mark)
- (c) Copy and complete Table 3.1 to show differences between C<sub>3</sub> plant and C<sub>4</sub> plant. (6 marks)

**Table 3.1**

Features	C <sub>3</sub>	C <sub>4</sub>
First product of Calvin cycle	(i)	(ii)
Enzyme used to fix carbon dioxide	(iii)	(iv)
Location of Calvin cycle to occur	(v)	(vi)

**Question 4**

- (a) A student investigated growth in the roots of broad bean, *Vicia faba*. The student cut sections of the root tip of this plant and viewed them with a light microscope. Fig. 4.1 is a photomicrograph of one of the sections. The cell labeled D is in interphase.



**Fig. 4.1**

- (i) Copy and complete the table below by:
- naming the stages of mitosis in the correct sequence following interphase
  - identifying one example from the cells labelled A to H that is in each stage of mitosis that you have named.

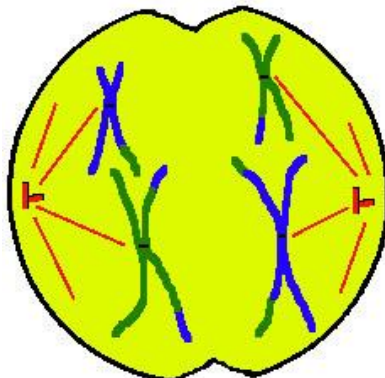
Stage of mitosis	Label from Fig. 4.1

(4 marks)

- (ii) In animal cells, centrioles are responsible for assembling microtubules to make the spindle at the beginning of mitosis. Describe the role of the spindle during mitosis. (3 marks)

- (iii) Apart from growth, state **TWO (2)** roles of mitosis in plants and animals. (2 marks)

(b) Fig. 4.2 shows a cell undergoing cell division.



**Fig. 4.2**

(i) Identify the type and stage of cell division shown. Give **TWO (2)** evidences from Fig. 4.2 to support your answer. (4 marks)

(ii) Briefly describe how crossing over occurs during cell division. (2 marks)

(c) In a family with **FOUR (4)** children, each child has different blood group. Their mother is group A and their father is group B. Copy and complete the genetic diagram below to show how this is possible.

Parents	Father	Mother
Genotypes	.....	.....
Gametes	.....	.....
Offspring genotypes	.....	.....
Offspring phenotypes	.....	.....

(4 marks)

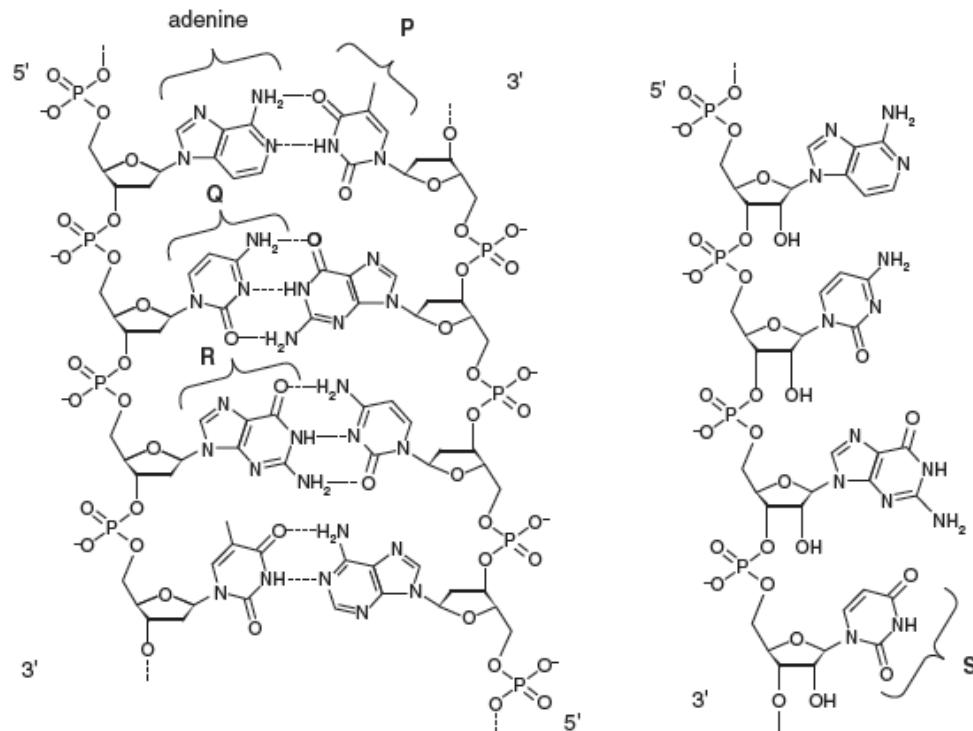
(d) In human, hemophilia is an X-linked recessive disease. Copy and complete the genetic diagram below to show the possible phenotypes and genotypes of the children of marriage between a normal man and carrier woman.

Parents	Father	Mother
Genotypes	.....	.....
Gametes	.....	.....
Offspring genotypes	.....	.....
Offspring phenotypes	.....	.....

(6 marks)

**Question 5**

- (a) Red blood cells are formed from cells called reticulocytes. Stem cells in the bone marrow produce reticulocytes which differentiate into red blood cells. During differentiation haemoglobin is produced. Fig. 5.1 shows the structure of small sections of DNA and messenger RNA (mRNA) in the nucleus of a reticulocyte during transcription.



**Fig. 5.1**

- (i) Name the bases labeled P, Q, R and S. (4 marks)
- (ii) Describe the role of the mRNA molecule shown in Fig. 5.1. (6 marks)
- (b) The diagram below shows the base sequence of an mRNA.

5' AUG GCU UAU UCG UUA CGU 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) Identify the polypeptide chain produced by the mRNA in (b). Refer to the table below.

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

(1 mark)

- (iii) State **TWO (2)** differences between transcription and translation.

(2 marks)

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

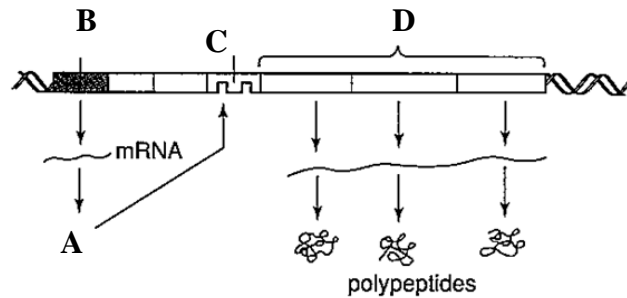


Fig. 5.2

- (i) Identify the substances labeled A, B, C and D. (4 marks)
- (ii) Explain how *lac* operon works when lactose is absent. (3 marks)
- (d) What is polymerase chain reaction (PCR)? Explain its process. (4 marks)

**-THE END-**