

INTI INTERNATIONAL UNIVERSITY
 FOUNDATION IN SCIENCE (CFSI)
 BIO1203: BIOLOGY 1
 FINAL EXAMINATION: JANUARY 2014 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) Fig. 1.1 shows a portion of a plasma membrane.

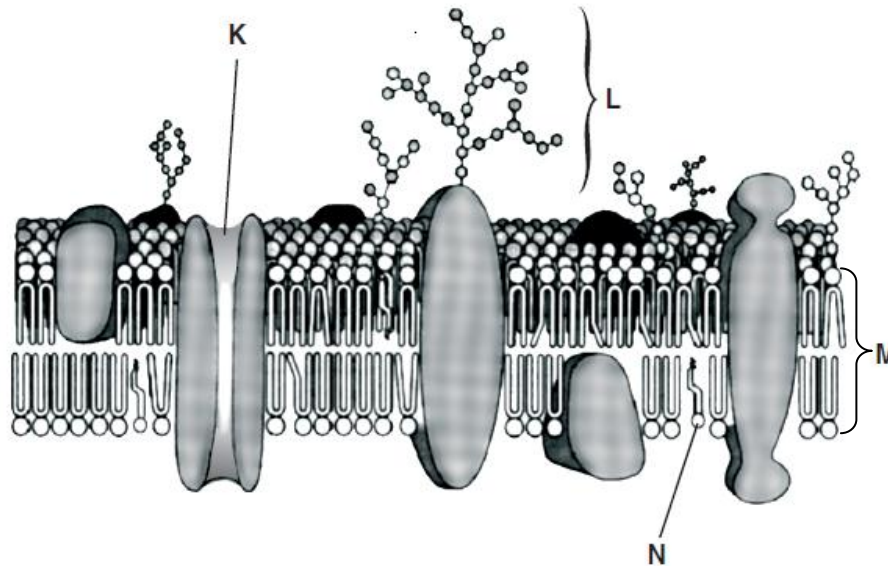


Fig. 1.1

- (i) Identify structures labeled K, L, M and N. (4 marks)

- (ii) Describe **THREE (3)** features which influence the ability of a substance to pass through a cell membrane. (6 marks)

- (iii) Give **TWO (2)** reasons why transport across membrane is vital to a cell. (2 marks)

(b) Fig. 1.2 represents a molecule of a triglyceride.

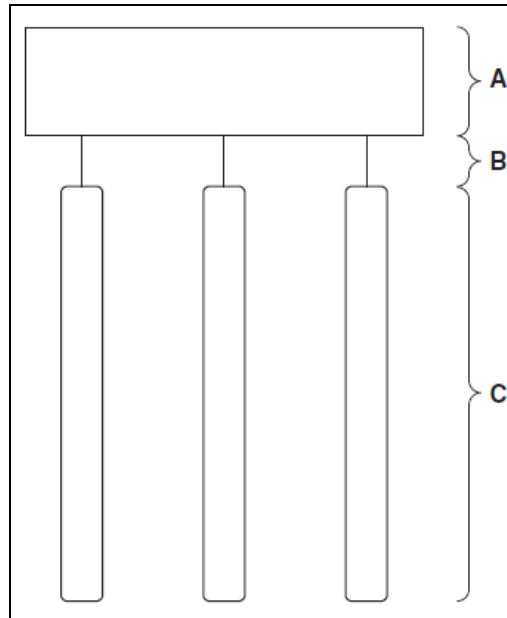


Fig. 1.2

(i) Name the components **A** and **C** and type of bond **B**.

(3 marks)

(ii) How does the structure of a phospholipid differ from a triglyceride?

(2 marks)

- (c) A student carried out an investigation into the digestion of triglycerides using lipase. 10 cm³ of olive oil, adjusted to pH 8.0, was added to a test-tube, which was then put in a water bath at 37 °C for ten minutes. One cm³ of lipase solution was incubated at the same temperature in a separate test-tube before being added to the olive oil. The initial pH of the reaction mixture was measured using a pH meter. The pH was recorded at five minute intervals for 60 minutes.

Fig. 1.3 shows the results of the investigation.

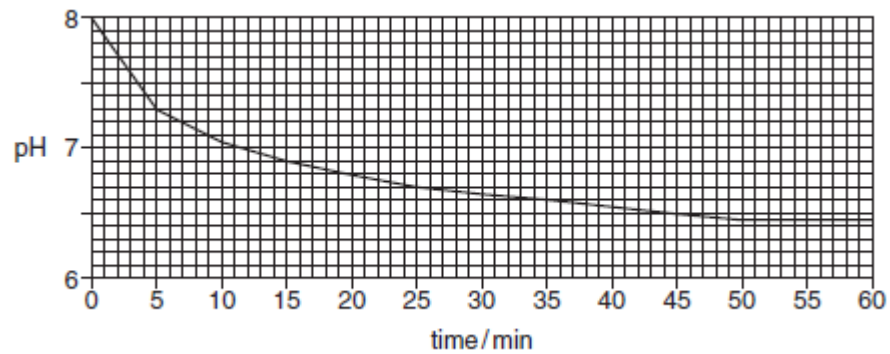


Fig. 1.3

- (i) Suggest why the olive oil was adjusted to pH 8.0 before the lipase was added. (1 mark)
- (ii) Describe the results of the investigation. (3 marks)
- (iii) Explain the results of the investigation. (4 marks)

Question 2

- (a) Explain the evolution of sharp claws and teeth of tigers in terms of natural selection. (3 marks)
- (b) Why does water form hydrogen bonds with reference to its structure? (2 marks)
- (c) 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)

- (d) Starch, glycogen and cellulose are all polysaccharides. They are made from monomers that are joined by covalent bonds. Copy and complete the table below 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.

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) Fig. 2.1 is a drawing made from an electron micrograph of a cell from the ciliated epithelium of the bronchus.

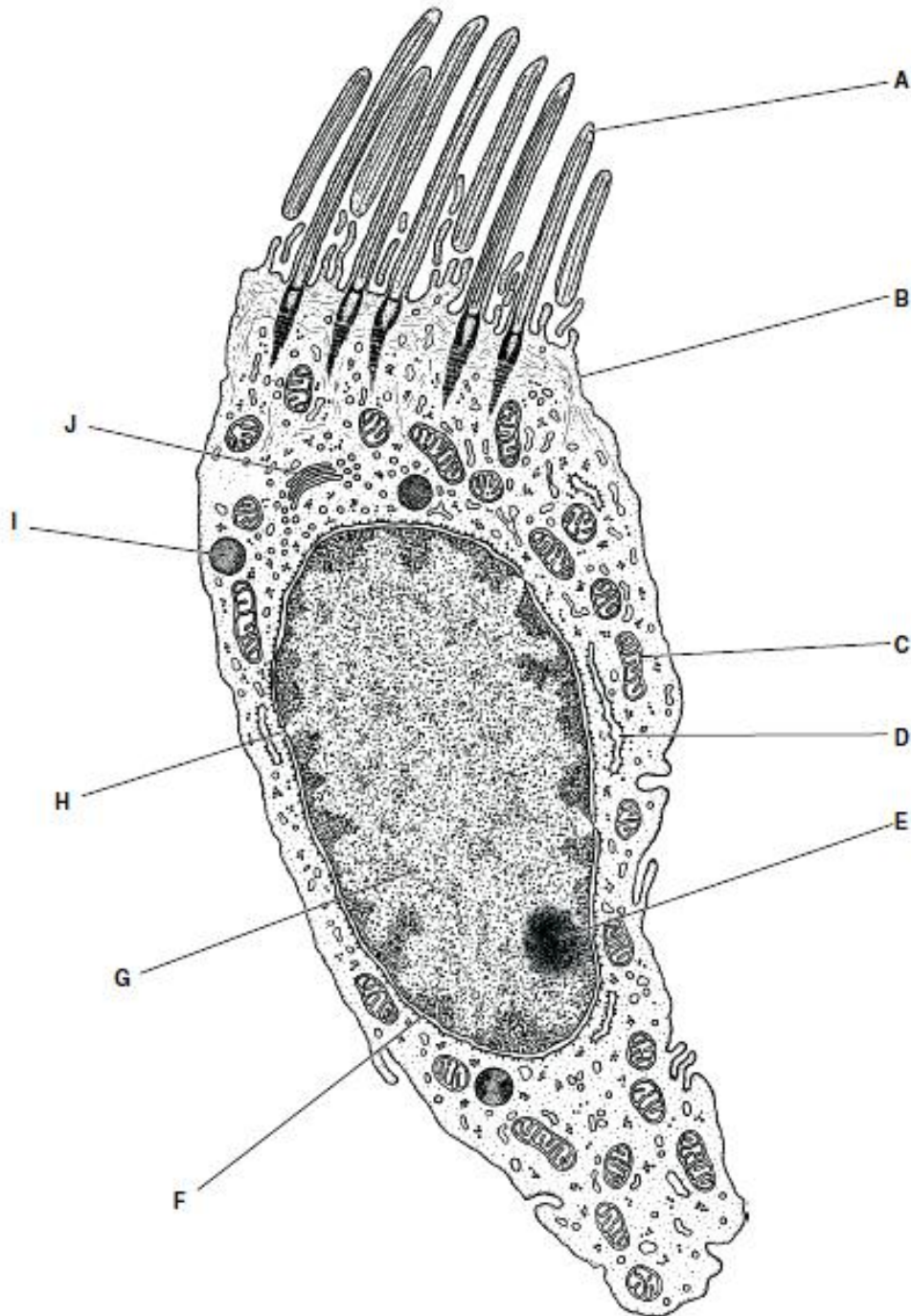


Fig. 2.1

Copy and complete the table below by writing the appropriate letter from Fig. 2.1 to indicate the structure that carries out each of the functions listed. The first one has been completed for you.

function	structure
facilitated diffusion of glucose	B
creates a current to move mucus	
aerobic respiration	
makes ribosomes	
a site of transcription	
packages proteins into lysosomes	

(5 marks)

(f) Fig. 2.2 is a diagram of a bacterium.

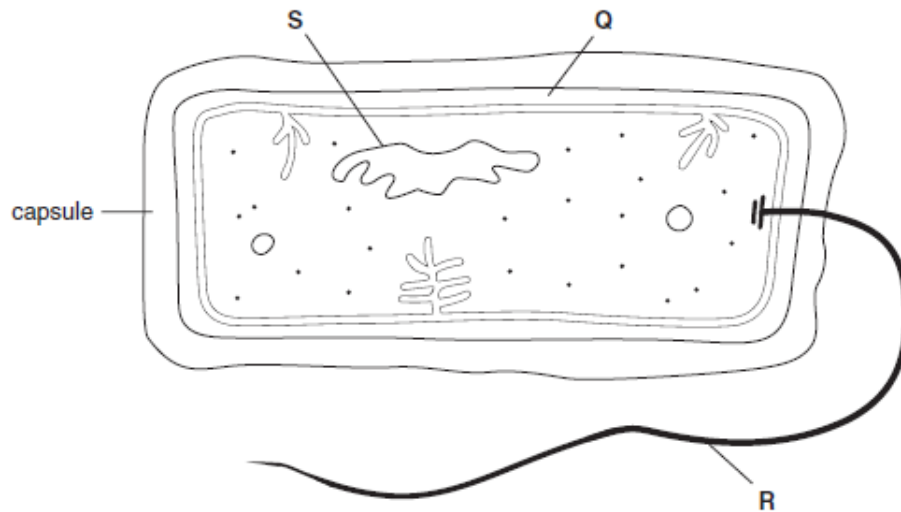


Fig. 2.2

(i) Name the structures labeled Q and S.

(2 marks)

(ii) State **TWO (2)** structures that are present in a phagocyte from a mammal which are **NOT** present in bacteria.

(2 marks)

Question 3

(a) Fig. 3.1 is an electron micrograph of a section through a mitochondrion.

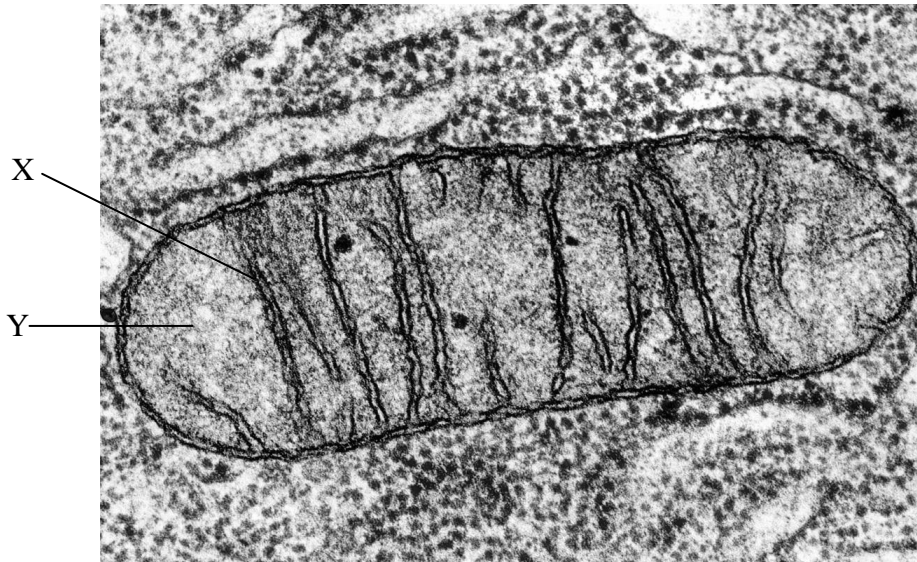


Fig. 3.1

Identify structures labeled X and Y.

(2 marks)

(b) Fig. 3.2 outlines the early stages of respiration.

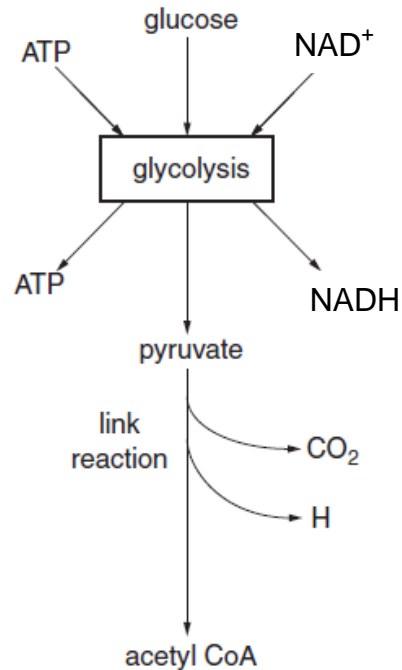


Fig. 3.2

- (i) Why is ATP needed at the start of glycolysis? (1 mark)
- (ii) List **THREE (3)** roles of NAD⁺ in glycolysis. (3 marks)
- (iii) State how many molecules of ATP (net products) are produced from one molecule of glucose during glycolysis. (1 mark)
- (iv) Name the location of the link reaction. (1 mark)
- (v) Describe what happens to the hydrogen released during the link reaction. (3 marks)
- (vi) Describe how the formation of ATP in the Krebs cycle differs from the formation of ATP in oxidative phosphorylation. (3 marks)

- (c) Complete table below by filling the differences between the Calvin cycle and the Krebs cycle as the difference are indicated by (i) to (x).

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

(5 marks)

- (d) Fig. 3.3 shows an outline of the main stages in the Calvin cycle.

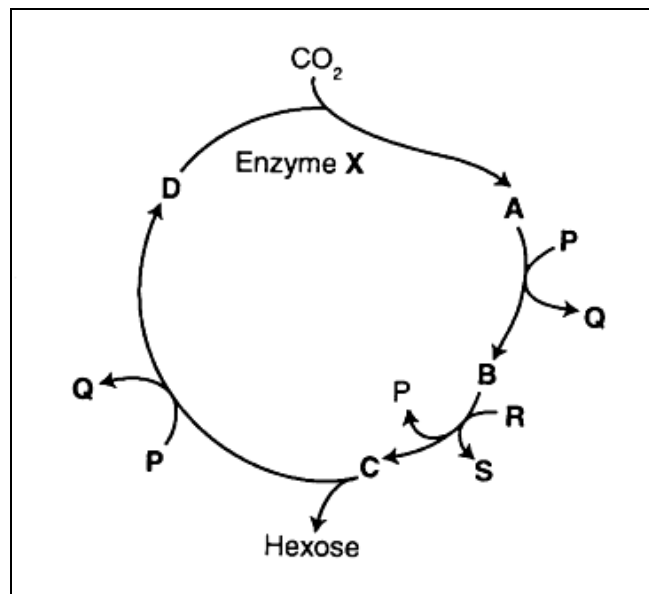


Fig. 3.3

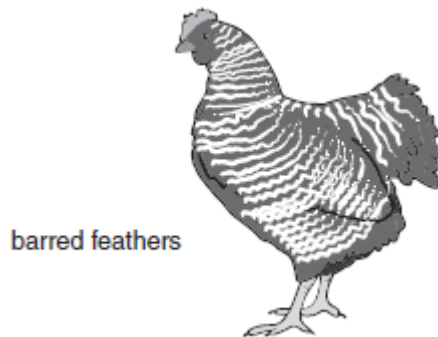
- (i) Identify enzyme **X** and substance **D** in the diagram above. (2 marks)
- (ii) What would happen in C₃ plants when the concentration of CO₂ is low? (4 marks)

Question 4

- (a) A gene for feather colour in chickens is carried on an autosome. This gene has two alleles, black (C^B) and splashed-white (C^W). When a male chicken with black feathers is mated with a female chicken with splashed-white feathers, all the offspring have blue feathers. This also occurs when a male chicken with splashed-white feathers is crossed with a female with black feathers.



Another gene may cause stripes on feathers (barred feathers). This gene is carried on the X chromosome. The allele for barred feathers (X^A) is dominant to the allele for non-barred feathers (X^a). In chickens the male is homogametic and has two X chromosomes while the female is heterogametic and has one X chromosome and one Y chromosome.



A male chicken with black, non-barred feathers was crossed with a female chicken with splashed-white, barred feathers. All the offspring had blue feathers, but the males were barred and the females were non-barred. Using the symbols given above draw a genetic diagram (as below) to show this cross.

parents' phenotype	male, black, non-barred feathers.	female, splashed-white, barred feathers.
genotype
gametes
offspring genotypes
phenotypes	male, blue, barred feathers.	female, blue, non-barred feathers.

(6 marks)

- (b) In mice there are several alleles of the gene that controls the intensity of pigmentation of the fur. The alleles are listed below in order of dominance with **C** as the most dominant.

C = full colour

C^{ch} = chinchilla

C^h = himalayan

C^p = platinum

C^a = albino

The gene for eye colour has two alleles. The allele for black eyes, **B**, is dominant, while the allele for red eyes, **b**, is recessive.

A mouse with full colour and black eyes was crossed with a himalayan mouse with black eyes. One of the offspring was albino with red eyes.

Using the symbols above, draw a Punnett square to show the genotypes and fraction phenotypes of the offspring of this cross.

(9 marks)

- (c) Fig. 4.1 is a diagram drawn from a photomicrograph of a plant cell undergoing meiosis.

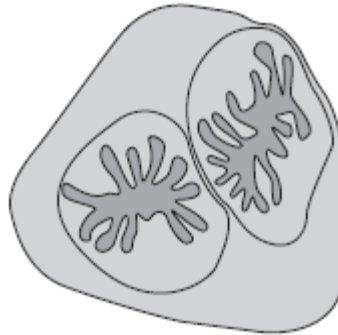


Fig. 4.1

- (i) Identify the stage of meiosis shown in Fig. 4.1. (1 mark)
- (ii) Describe the main events that will occur to complete meiosis from this stage. (3 marks)
- (iii) Explain how meiosis can lead to genetic variation. (4 marks)
- (iv) State **TWO (2)** differences between mitosis and meiosis. (2 marks)

Question 5

(a) Fig. 5.1 shows the gene cloning in a bacterium. Briefly describe the steps of gene cloning.

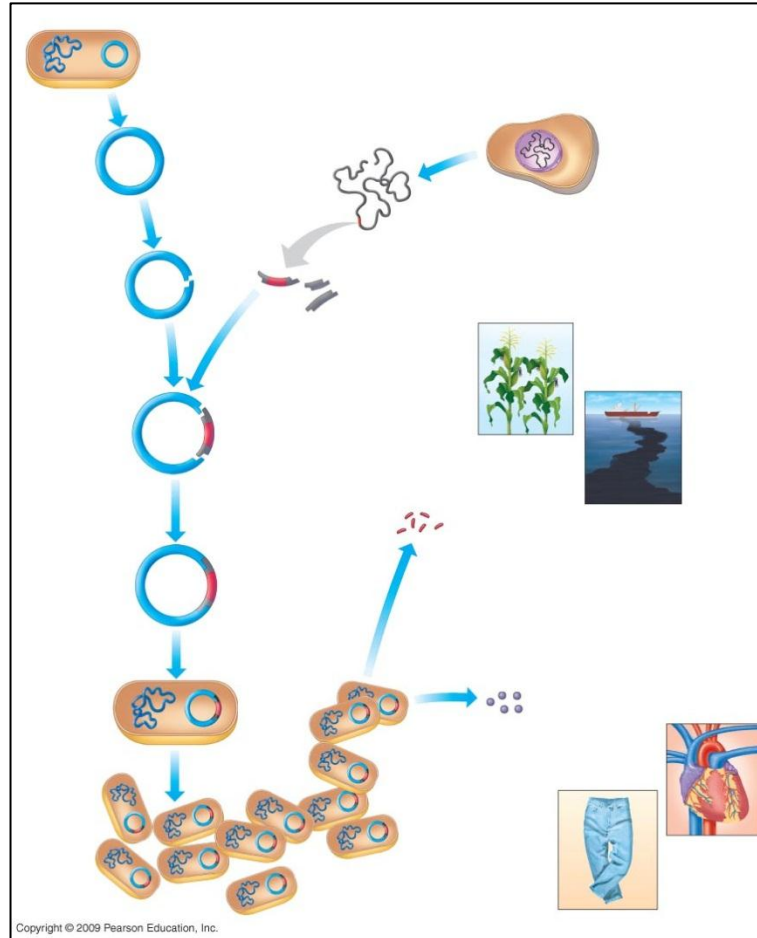


Fig. 5.1

(8 marks)

(b) Explain the regulation of *trp* (tryptophan) operon.

(5 marks)

(c) Fig. 5.2 shows part of a DNA molecule.

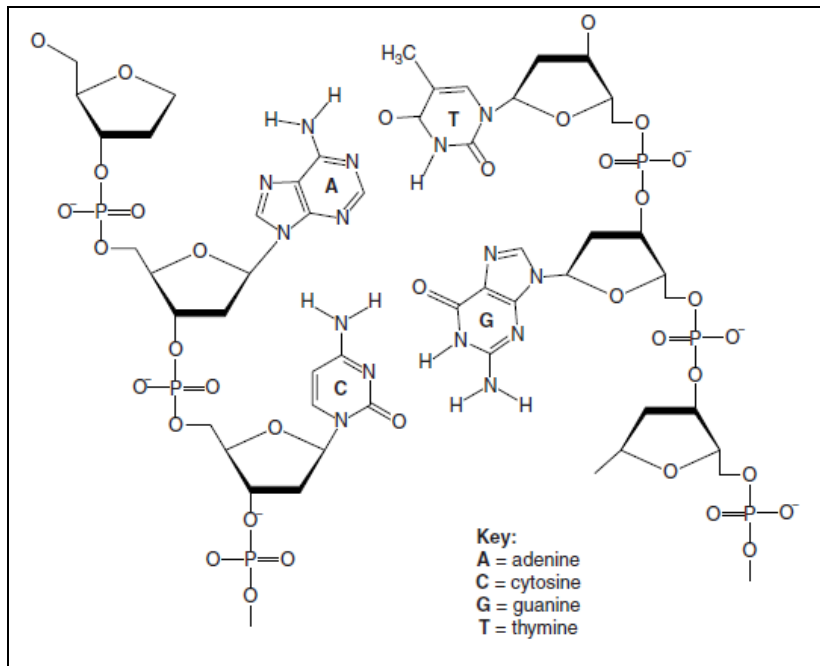


Fig. 5.2

- (i) Name the bonding between two base pairs shown. (1 mark)
- (ii) State **TWO (2)** importance of the bonding mentioned in (i) in DNA structure. (2 marks)
- (d) Switching genes on and off allows proteins to be synthesized only when required. Processes P and Q occur when a gene is switched on, as shown in Fig. 5.3.

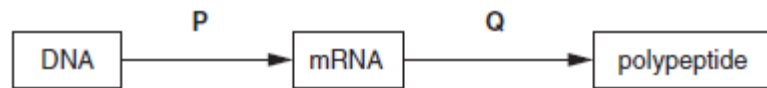


Fig. 5.3

- (i) Name processes P and Q. (2 marks)
- (ii) Name the organelle that required in Q and describe its roles in process Q. (5 marks)

(e) Fig. 5.4 shows a section of mRNA with the sequences of three codons.

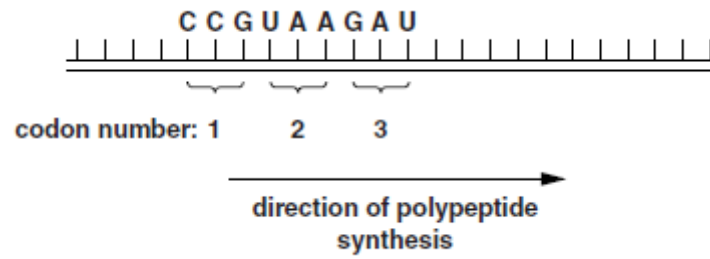


Fig. 5.4

- (i) State the base sequences of the tRNA anticodon complementary to **codon 1**. (1 mark)
- (ii) State the base sequences of the DNA sequence which coded for **codon 3**. (1 mark)

--THE END--

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