Mock-DSE
BIO
PAPER 1B

Christian Alliance S C Chan Memorial College
MOCK EXAMIMANTION (2020-2021)

BIOLOGY PAPER 1

SECTION B: Question-Answer Book

Date: 25-Feb-2021
This paper must be answered in English

INSTRUCTIONS

(1) Write your Name, Class and Class number in the spaces provided.

(2) Refer to the general instructions on the cover of the Question Paper for Section A.

(3) Answer ALL questions.

(4) Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answer written in the margins will not be marked.

(5) Graph paper and supplementary answer sheets will be supplied on request. Write your Name, Class and Class number on each sheet.

(6) Present your answers in paragraphs wherever appropriate.

(7) The diagrams in this section are NOT necessarily drawn to scale.

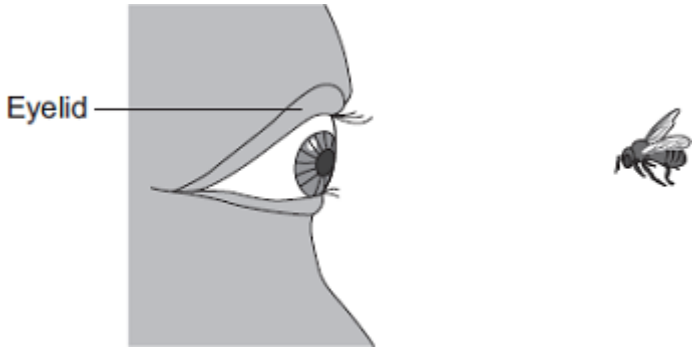
Name	
Class	
Class number	
Block	

Paper 1A	/36
Paper 1B	/84
Paper 1 Total	/120

Section B

Answer ALL questions in this section. Put your answers in the spaces provided.

1. The diagram below shows a bee flying towards a man's eye.



In the *blink reflex*, light from the bee cause the muscles in the eyelid to shut the eye before the bee hits the eye. By means of a flowchart, show the nervous pathway involved.

(3 marks)

2. Physiotherapists need to understand how muscles and bones work together. The figure below shows the bones of the hand and two muscles that help to move the thumb.

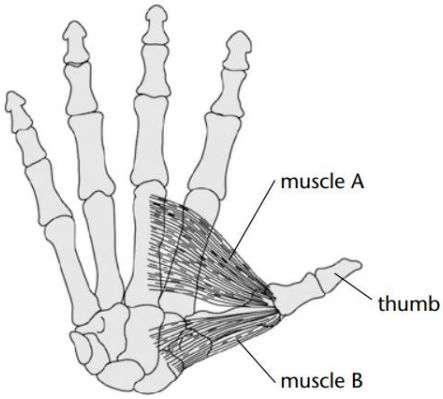


Figure 1

(a) Which muscle, A or B, moves the thumb towards the fingers? (1 mark)

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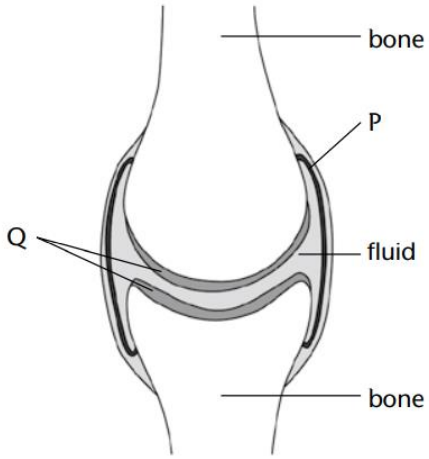
(b) The figure below shows a joint between two bones in a finger.



Structure P makes a fluid. This fluid fills the space between the bones.

(i) Name structure P. (1 mark)

(ii) Describe the function of the fluid made by structure P. (1 mark)

(iii) In a healthy joint, structure Q is smooth. When a person has arthritis, structure Q can become rough and uneven. Explain how arthritis will affect the functioning of the joint. (2 marks)

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3. The appearance of flowers of plant species X is similar to that of female bees. Plant species Y produces flowers that appear like having nectar but actually not. These are examples of strategies of plants for attracting insect pollinators.

Plant species X

Plant species Y

(a) Describe the texture of the pollen grains produced by plant species X and Y. State one advantage of producing pollen grains having the texture you answered. (2 marks)

(b) Suggest one advantage of using flowers that appear like having nectar but actually not to attract insect pollinators. (1 mark)

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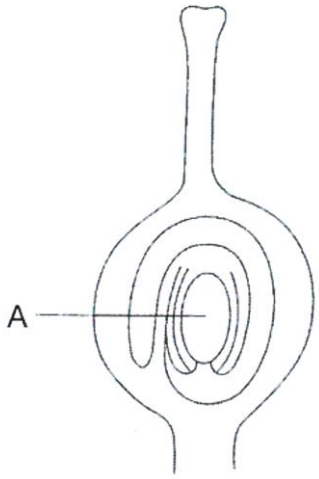
(c) Flowers of plant species X can only attract males of one species of insect pollinators while flowers of plant species Y can attract different species of insect pollinators. Suggest which plant species is more likely to survive in an environment which changes constantly. Explain why. (2 marks)

(d) After pollination, a pollen tube grows through the carpel of the flower. The diagram below shows a longitudinal section through a carpel.



Draw a line on the diagram to show the route of growth of a pollen tube through the carpel to structure A. (1 mark)

(e) Give one advantage of producing offspring by asexual reproduction over sexual reproduction. (2 marks)

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4.(a) Different types of tests are available for coronavirus disease 2019 (COVID-19), including antigen test and antibody test.

Four individuals, P, Q, R and S, took both tests to find out whether they have COVID-19 or not. The results are shown in the table below.

Individual	P	Q	R	S
Antigen test	Positive	Positive	Negative	Negative
Antibody test	Positive	Negative	Negative	Positive

(i) Which individual(s) may have been infected with COVID-19? (1 mark)

(ii) Suggest a reason to explain the difference in the test results of individuals Q and S. (2 marks)

(iii) Vaccines against COVID-19 have been developed by laboratories around the world. Would vaccination against COVID-19 be able to provide immunity against Middle East Respiratory Syndrome (MERS), which is also caused by coronavirus? Explain your answer. (2 marks)

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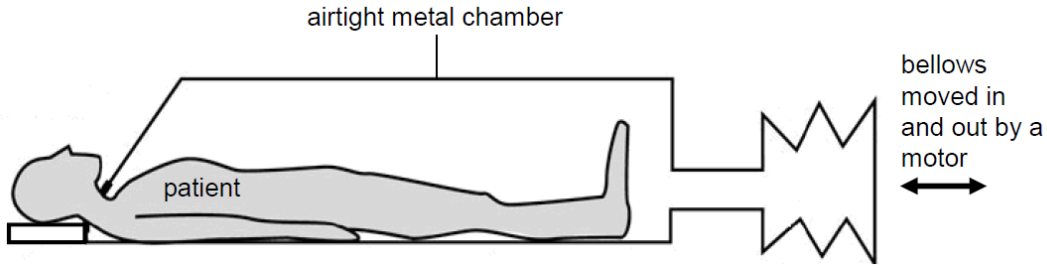
(b) An iron lung can help people who have lost control of their breathing muscles to breathe. The pressure inside the metal chamber is changed by moving the bellows in and out.



When the bellows are moved out, explain whether air moves into or out of the lungs of the patient. (3 marks)

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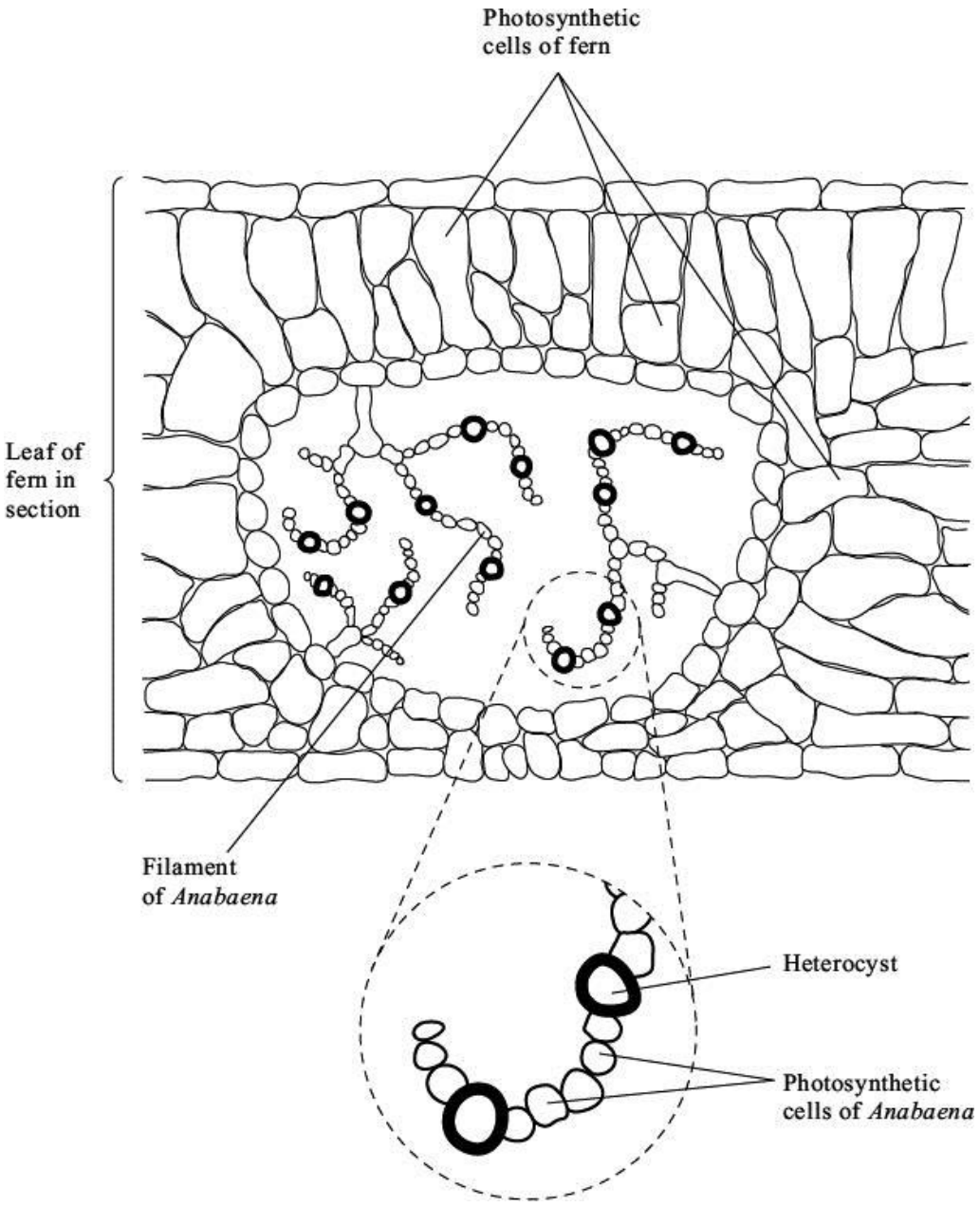
5. Anabaena is a prokaryote found inside the leaves of a small fern. Anabaena can carry out nitrogen fixation only in the anaerobic conditions found in cells called heterocysts. Heterocysts are thick-walled cells that do not contain chlorophyll. The drawing shows the relationship between *Anabaena* and the fern.



(a) Name the biological relationship between Anabaena and fern. (1 mark)

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(b) Suggest how the features of the heterocysts improve the efficiency of the process of nitrogen fixation. (4 marks)

(c) In China, the fern is cultivated and ploughed into fields to act as an organic fertiliser. Explain how ploughing the fern plants into the soil results in an improvement in the growth of the rice crop grown in these fields. (4 marks)

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6. A scientist carried out an investigation about the transport of substances in the vascular tissues in plants. He inserted waxed paper into the stem of two plants to separate the xylem and phloem. He then supplied radioactive potassium ions and carbon dioxide with radioactive carbon to another plant. After a period of time, he detected radioactivity in xylem and phloem at different positions of the plants.

Figure X shows how the waxed paper was inserted into the stem of a plant, and the positions where radioactivity was detected. Figure Y shows where the radioactive potassium ions and carbon dioxide were supplied to the plants.

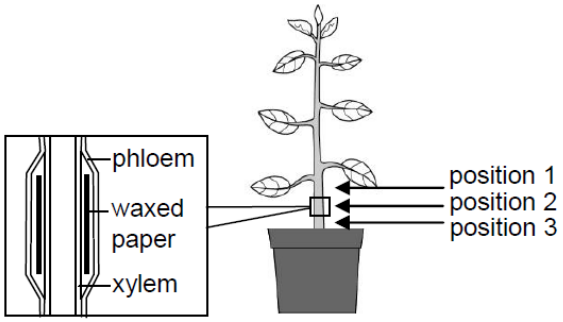

Figure X

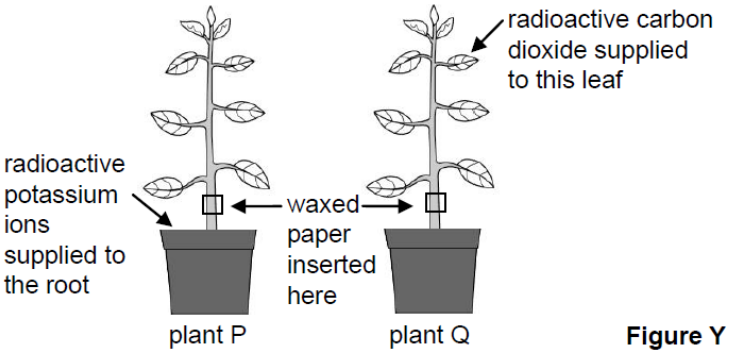

Figure Y

The table below shows the results.

	Radioactivity (arbitrary unit)			
	Plant P		**Plant Q**	
	Xylem	**Phloem**	**Xylem**	**Phloem**
Position 1	55	53	0	4320
Position 2	112	0.4	0	3030
Position 3	59	56	0	2300

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(a) Describe how the carbon dioxide supplied to the leaf became the organic nutrients in the plants. (Details of biochemical pathway is not required) (3 marks)

(b) Explain how the results support the following conclusions of the investigation.

(i) Organic nutrients are transported mainly in the phloem. (1 mark)

(ii) Potassium ions, which is mainly transported in xylem, can move laterally between the xylem and the phloem. (2 marks)

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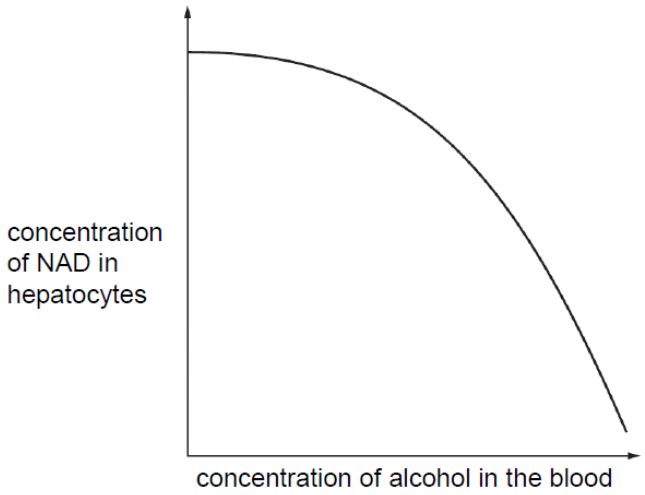
7.(a) Hepatocytes (liver cells) detoxify the blood.

Alcohol can be toxic. To prevent this, hepatocytes oxidize the alcohol into a less toxic substance. This process involves the reduction of NAD.

The relationship between the concentration of NAD in the hepatocytes and the concentration of alcohol in the blood is shown in the diagram below.



(i) Describe the relationship shown in the diagram. (1 mark)

(ii) Using the diagram, suggest *two* respiratory processes that may be affected by an increased concentration of alcohol in the blood. (2 marks)

(b) During a 100-metre race, a sprinter's muscle cells have a high demand for oxygen. The circulatory system is unable to fully meet this demand. In this situation, both anaerobic and aerobic respiration will occur.

Outline the process of anaerobic respiration in muscle cells. (4 marks)

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(c) Both photophosphorylation and oxidative phosphorylation are important biochemical process in living organisms. Describe how the mechanism of photophosphorylation is similar to that of oxidative phosphorylation. (4 marks)

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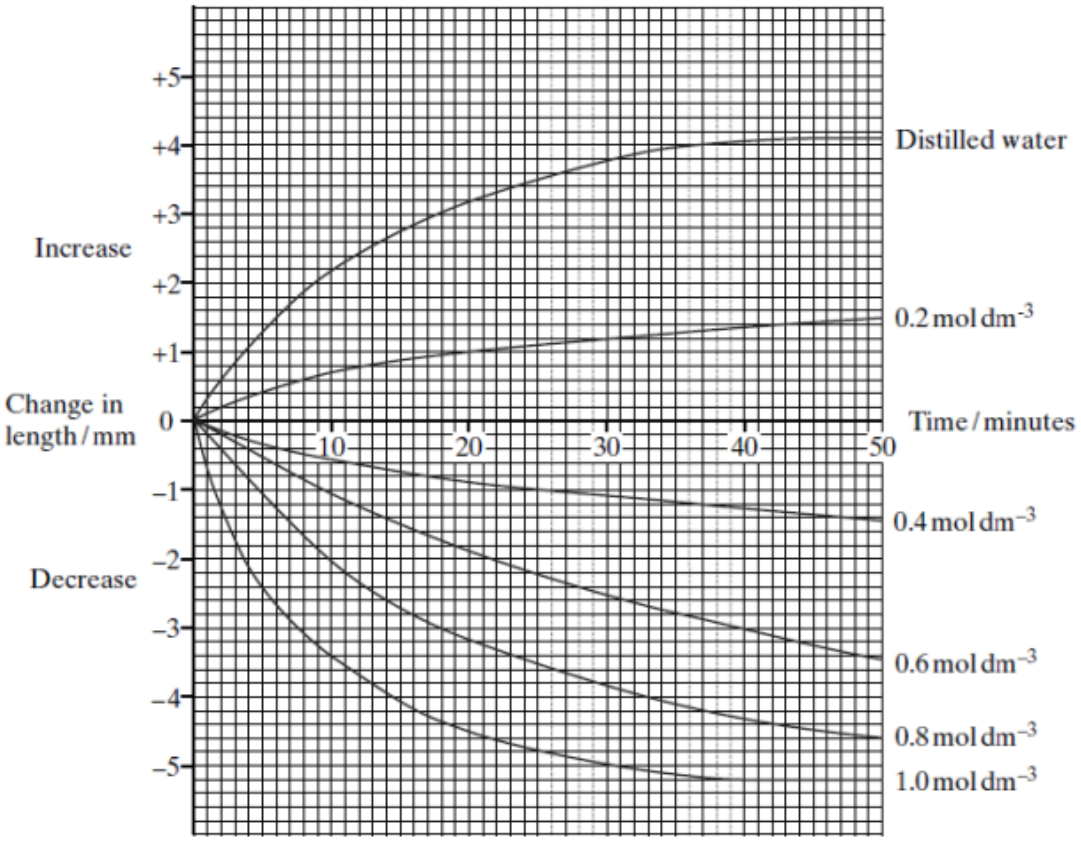
8. Six cylinders of a standard size were cut from a single large potato. One cylinder was placed in distilled water and the others were placed in sucrose solutions of different concentrations. The length of each cylinder was measured every 5 minutes for the next 50 minutes.
The graph shows the changes in length at each sucrose concentration.
(Hint: mol dm^{-3} is a unit of concentration)



(a) What is the independent variable in this experiment? (1 mark)

(b) Explain why

(i) the potato cylinder in distilled water increased in length. (3 marks)

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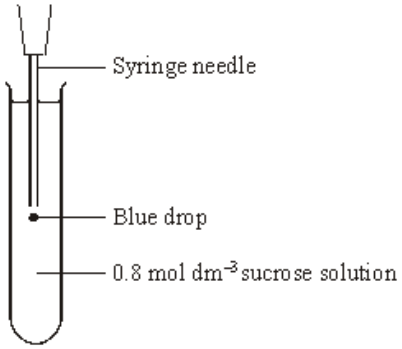
(ii) the potato cylinder in the 1.0 mol dm^{-3} sucrose solution showed no further decrease in length after 40 minutes. (2 marks)

(c) Suggest one modification that can be made to the experiment so that the results can be obtained more quickly. (1 mark)

(d) After 45 minutes, the potato cylinder in the 0.8 mol dm^{-3} solution was removed and blue dye added to this solution. Some of this blue-stained solution was drawn into a syringe. A drop was then released, slowly, halfway down a test tube of pure 0.8 mol dm^{-3} sucrose solution as shown in the diagram. The blue drop quickly moved to the surface of the liquid in the test tube.



(i) The density of a solution depends on its concentration. The more concentrated the solution the greater its density. Explain why the 0.8 mol dm^{-3} blue drop had a lower density and moved up in the pure 0.8 mol dm^{-3} sucrose solution. (2 marks)

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(ii) A sucrose solution of concentration 0.3 mol dm^{-3} has a water potential which is equivalent to that of the potato cells. Describe what would happen to the movement of blue drop from this solution, when released to a pure 0.3 mol dm^{-3} sucrose solution. (1 mark)

9. In 1822, Alexis St Martin survived a gunshot but his body was left with a permanent hole which led to the inside of his stomach. Through this hole, Dr William Beaumont performed a number of experiments to study digestion in the stomach. Below are some of his experiments on St Martin.

Experiment I

Dr Beaumont pushed a piece of cabbage tied to a string into the stomach of St Martin. The cabbage was not digested.

Experiment II

Dr Beaumont pushed a chunk of corned beef tied to a string into the stomach of St Martin. The beef was completely digested in 2 hours.

Experiment III

Dr Beaumont extracted some gastric juice from the stomach of St Martin. He put another chunk of corned beef, which was of the same size as that in experiment II, and the gastric juice into a test tube and incubated it at 37 ℃. The beef was completely digested in 10 hours.

(a) Explain the results of experiment I. (2 marks)

(b) Why did Dr Beaumont incubate the test tube at 37 ℃ in experiment III? (1 mark)

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(c) Explain the difference in the results of experiments II and III. (3 marks)

10.(a)In 1961, two scientists, Jacob and Monod, proposed the concept of messenger RNA (mRNA). They founded this concept on the known fact that protein synthesis takes place in the cytoplasm rather than in the nucleus of eukaryotic cells. They thought that the genes in the nucleus must specify a mobile chemical intermediate for directing the synthesis of proteins in the cytoplasm. They named this intermediate 'the structural messenger'.

(i) State a site in the cytoplasm of a eukaryotic cell where protein synthesis takes place. (1 mark)

(ii) Jacob and Monod guessed that there were 'messengers' of different sizes. Suggest a reason for this guess. (1 mark)

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(b) After scientists had determined that mRNA serves as a copy of each gene's DNA and specifies the sequence of amino acids in proteins, they became interested in studying bow the message in the mRNA (as the sequence of codons) can be translated into the required sequence of amino acids.

(i) At that time, scientists already had the knowledge that there are four different bases in mRNA and that there are 20 different naturally occurring amino acids. They believed that the codons in the mRNA were triplets. Explain the rationale behind this idea.

(2 marks)

(ii) The breakthrough in decoding the triplet genetic codes was brought about by the availability of techniques for making synthetic mRNA strands and analysing the amino acid composition of a polypeptide. The first synthetic mRNA made is shown below. After translation, this gives a polypeptide consisting entirely of the amino acid phenylalanine

…UUUUUUUUUUUUUUUUUUUUUUUU…

Suggest how scientists could use synthetic mRNA strands for finding out the amino acid encoded by each codon. (2 marks)

(iii) It is known that an amino acid can be encoded by more than one codon. What is the significance of this phenomenon? (1 mark)

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For the following question, candidates are required to present their answer in essay form. Criteria for marking will include relevant content, logical presentation and clarity of expression.

11. Gas exchange is an importance process in different stages of human life. Contrast the process of gas exchange in human adult and foetus. State the similarities in the adaptive feature of the corresponding structures. (11 marks)

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