2019-DSE
BIO (Mock)
PAPER 1B

B

Candidate number	

Form Six Mock Examination 2018-2019

DSE BIOLOGY PAPER 1

SECTION B: Question-Answer Book B

This paper must be answered in English

INSTRUCTIONS FOR SECTION B

(1) Write your name, class and class number in the space provided on this page.

(2) Refer to the general instructions on the cover of the Question Book 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. Answers written in the margins will not be marked.

(5) Supplementary answer sheets will be provided on request. Write your name, class, class number and question number on each sheet, and fasten them with string **INSIDE** this Question-Answer Book.

(6) Present your answers in paragraphs whenever appropriate.

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

Question No.	Marks
1	/ 4
2	/4
3	/ 6
4	/ 8
5	/ 12
6	/ 3
7	/ 7
8	/ 11
9	/5
10	/13
11	/11
Total:	/ 84

SECTION B

Answer **ALL** questions. Put your answers in the spaces provided.

1. For each of the structures listed in Column 1, select from Column 2 one biological process that matches it. Put the appropriate letter in the space provided. (4 marks)

Column 1		*Column 2*
Outer mitochondrial membrane	_____	A. Formation of NADPH
Matrix	_____	B. Formation of lactic acid
Cytoplasm	_____	C. Oxidation of pyruvate
Inner mitochondrial membrane	_____	D. Oxidative phosphorylation
		E. Active uptake of pyruvate

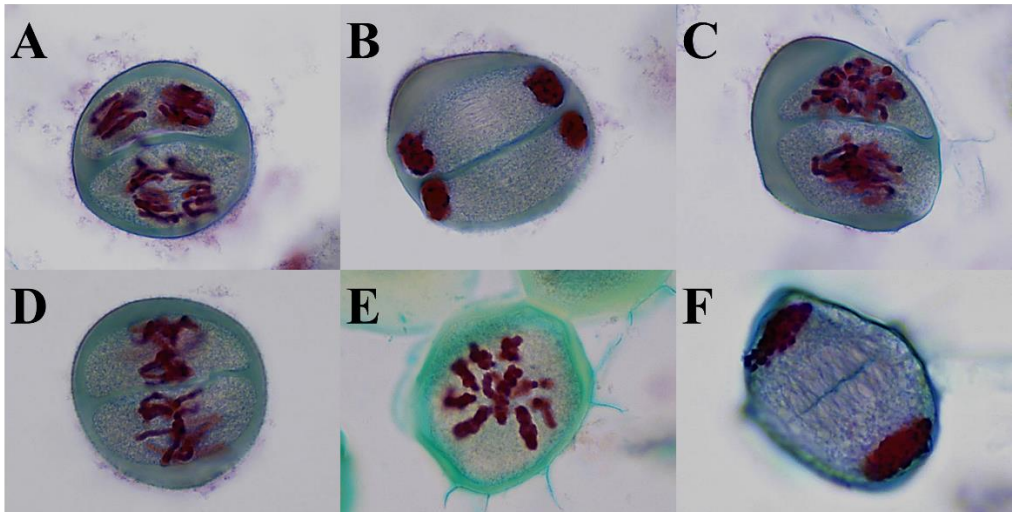
2. People with lactose intolerance failed to produce sufficient lactase in small intestine.

   (a) Use a word equation to show how lactose is broken down in small intestine under normal situation. (1 mark)

   (b) Why will a person with lactose intolerance produce watery faeces if he consumes meals rich in lactose? (3 marks)

Answers written in the margins will not be marked.

3. Each pollen mother cell undergoes meiotic cell division to form pollen grains. The photomicrographs below show some of the stages (A to F) of the division:



(a) Arrange the above stages in the correct order. (1 mark)

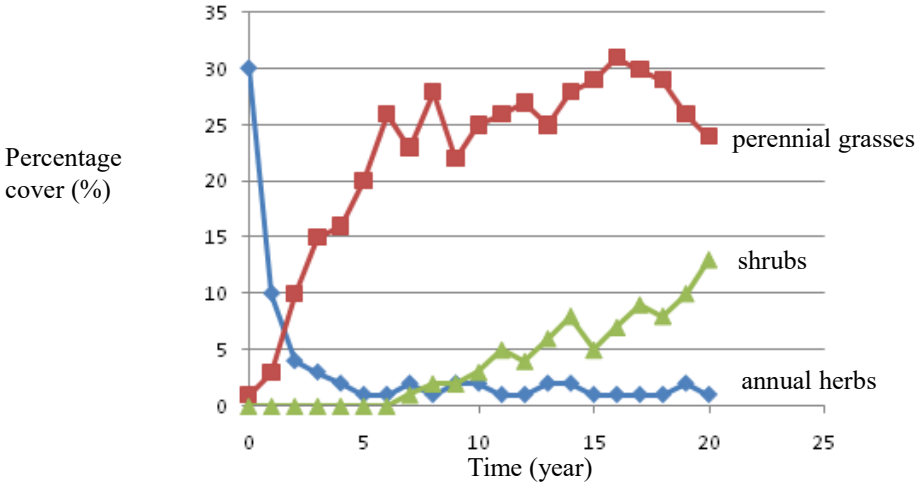
_____ → _____ → _____ → _____ → _____ → _____

(b) Name stage D. Give ***two*** evidences to support your answer. (3 marks)

(c) Are the two daughter cells in stage C genetically identical? Explain your answer. (2 marks)

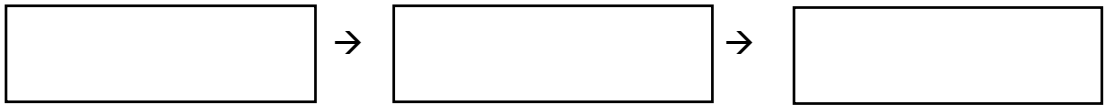
Answers written in the margins will not be marked.

4. A group of scientists have studied the succession of a forest since it was cleared by wildfire twenty years ago. The fire removed all aerial parts of plants. The data they collected are shown in the graph below:



(a) Suggest ***two*** reasons why succession in this case is usually a quicker process than primary succession? (2 marks)

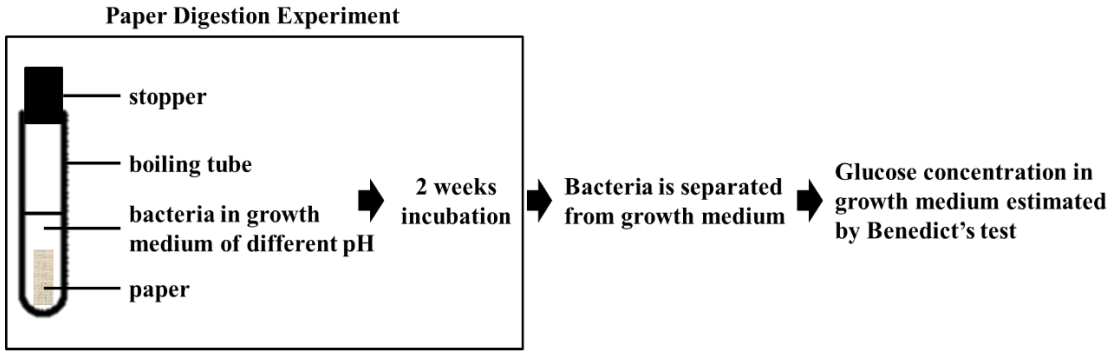
(b) (i) Complete the following flow chart to show the pattern of succession in the burnt area based on the graph. (1 mark)



(ii) Explain the pattern of succession in the burnt area. (3 marks)

(c) The group of scientists estimated that the burnt area will need several decades to reach the climax community which will be more stable than the intermediate community shown above. Explain why a climax community would be a more stable one. (2 marks)

5. Paper is mostly composed of cellulose. Cellulose cannot be digested by most animals as they lack the enzyme cellulase. Some soil bacteria contain the enzyme and play important role in the carbon cycle. A type of cellulose-producing bacteria was isolated and its cellulase activity under different pH was investigated with the procedure shown below:



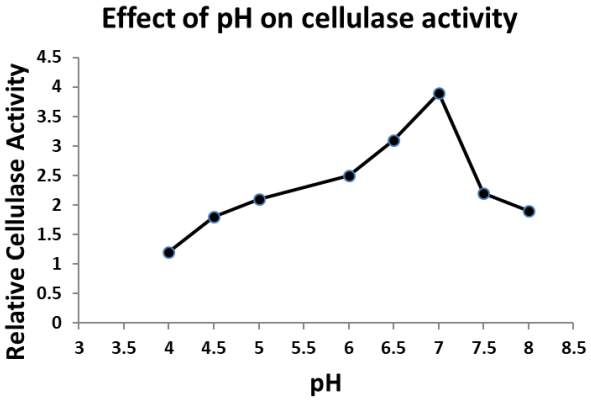
(a) What is the relationship between the glucose concentration in growth medium and cellulase activity? (1 mark)

(b) Suggest ***one*** controlled variable for the paper digestion experiment. (1 mark)

(c) You are provided with glucose solutions of different concentrations, suggest how the glucose concentration in the growth medium can be estimated with the glucose solutions given. (3 marks)

Answers written in the margins will not be marked.

(d) The bacterial cellulase activity was measured and recorded below:



(i) What is the optimal pH of this bacterial cellulase? (1 mark)

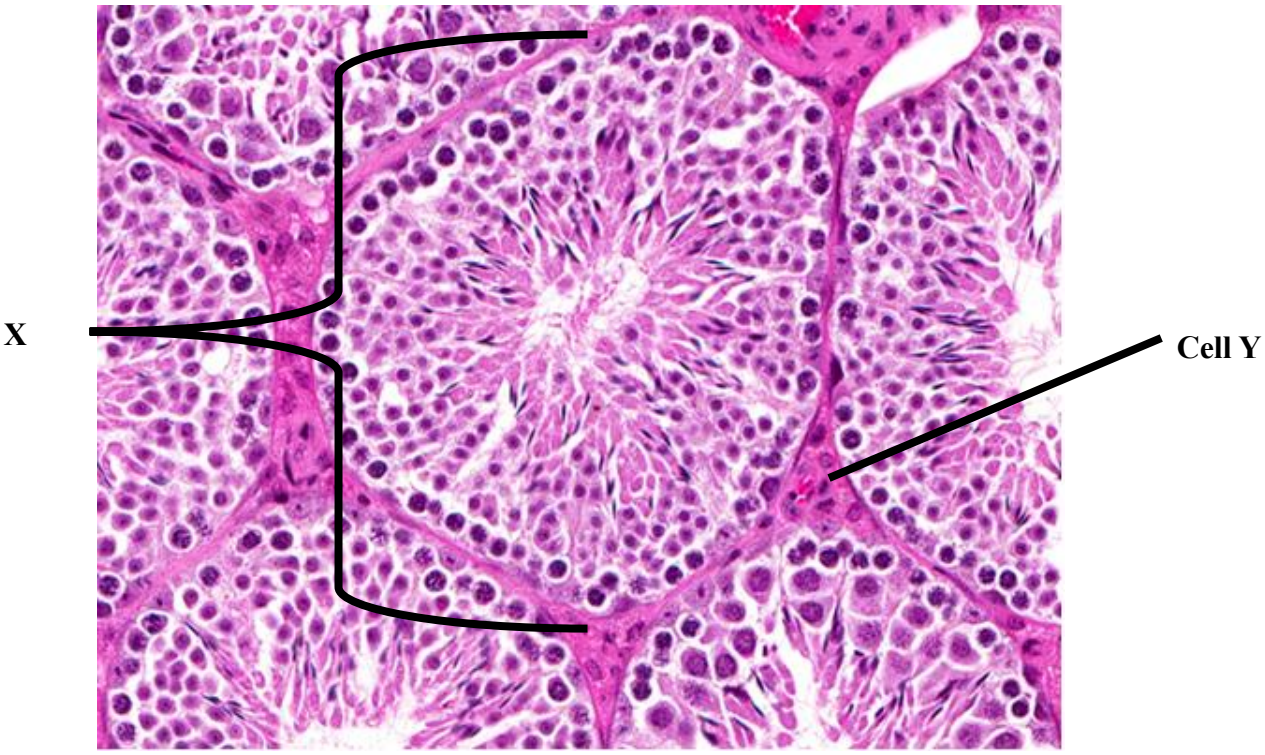
(ii) Explain the effect of pH on cellulase activity when the pH of the growth medium is higher than the optimal pH. (3 marks)

Answers written in the margins will not be marked.

(iii) In paper making industry, degradation of cellulose often involves chemicals such as strong alkali. Based on the experimental result, suggest ***one*** advantage of using cellulase for cellulose degradation over chemicals. (2 marks)

(e) In this investigation, bacteria were cultured in growth medium of different pH. Suggest ***one*** assumption behind this treatment. (1 mark)

6. The following photomicrograph shows a transverse section of human testis.



(a) Name structure X. (1 mark)

(b) Is cell Y a diploid or haploid cell? (1 mark)

(c) Give ***one*** function of cell Y. (1 mark)

Answers written in the margins will not be marked.

7. Rheumatoid arthritis is a disease of the joints in the human body. It is an auto-immune disease where the immune system treats some self antigens as non-self. The symptoms of rheumatoid arthritis include inflammation of the joints, stiffness and loss of function.

(a) What are antigens? (1 mark)

(b) Explain why the inflamed joints show symptoms as redness, swelling and pain. (3 marks)

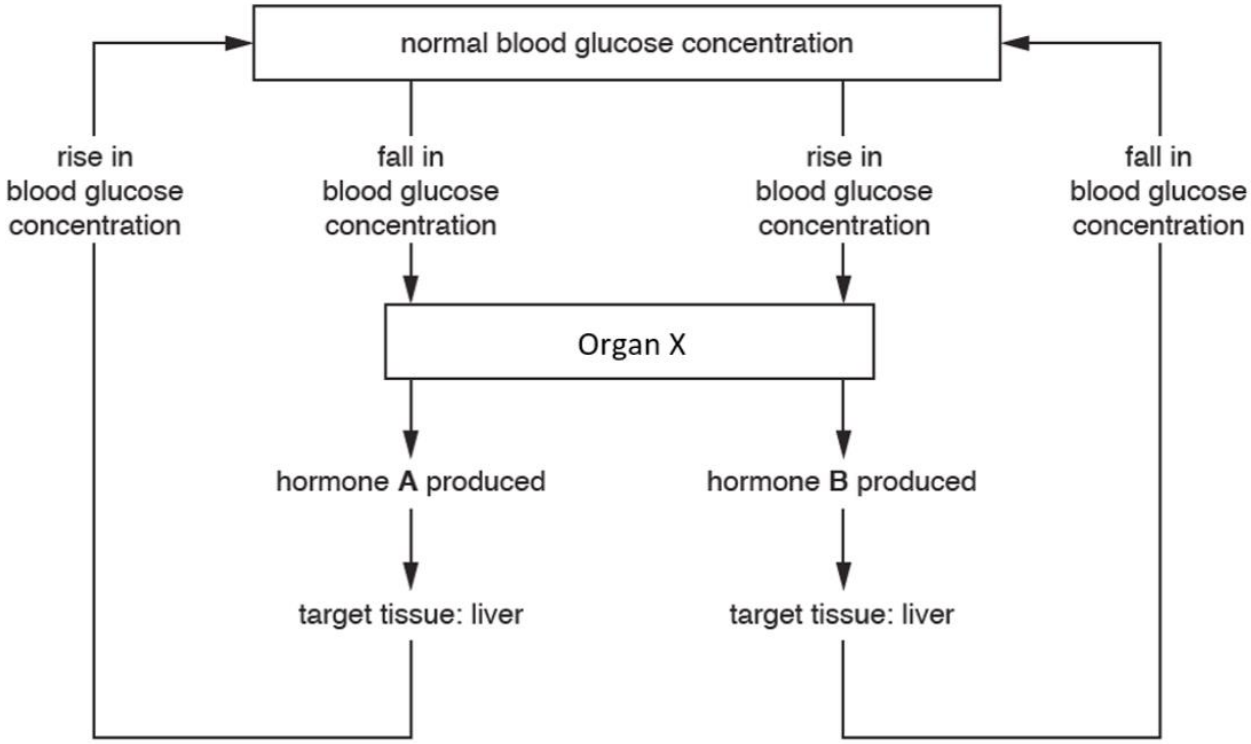
Answers written in the margins will not be marked.

The inflammation is triggered by a chemical known as TNF-α, produced by the patients' own cells. One approach to the treatment of rheumatoid arthritis is by the use of monoclonal antibody against TNF-α.

(c) Name the biomolecule that makes up the antibody. (1 mark)

(d) Suggest the mechanism of how antibodies act against TNF-α to reduce the symptoms of rheumatoid arthritis. (2 marks)

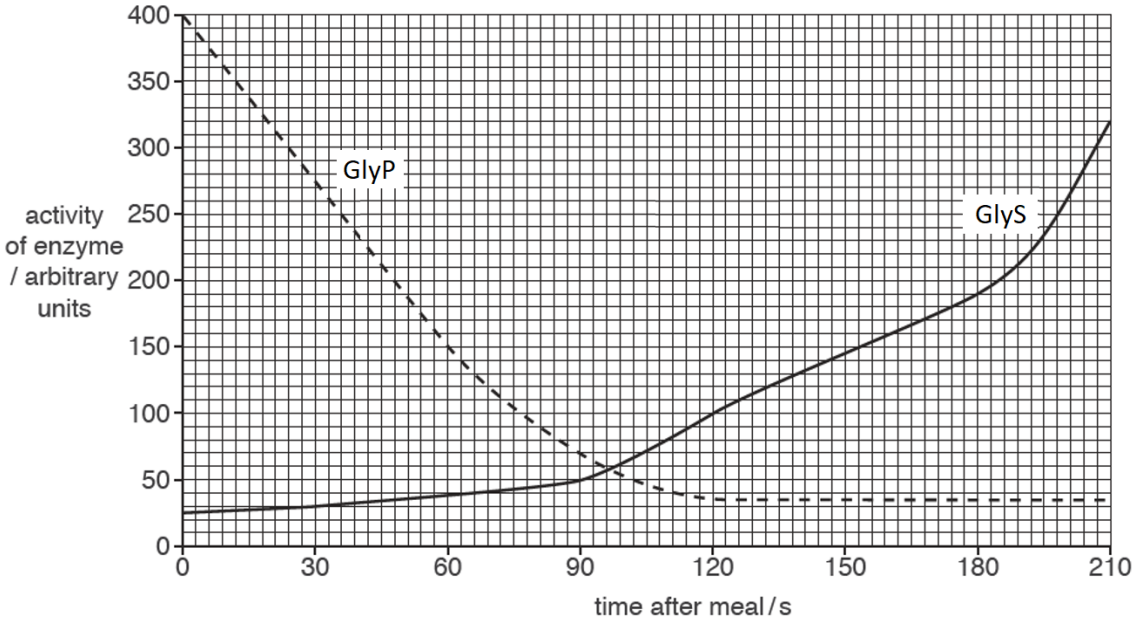
8. The flow chart below outlines how two hormones, A and B, are involved in the regulation of blood glucose concentration.



(a) Name hormone B. (1 mark)

(b) Apart from acting on the liver, suggest how hormone B could help decrease blood glucose level. (1 mark)

Two enzymes in liver cells, GlyP and GlyS, are involved in blood glucose regulation by controlling the glycogen metabolism in liver cells. The graph below shows the activity of these two enzymes after consumption of a glucose meal.



(c) With reference to the flow chart and the graph above, deduce the roles of GlyP and GlyS in glycogen metabolism in liver after the glucose meal. (6 marks)

Answers written in the margins will not be marked.

(d) Other than endocrine gland, organ X also functions as an exocrine gland. Suggest how the exocrine function of organ X would lead to an increase in blood glucose level after a starchy meal.

(3 marks)

Answers written in the margins will not be marked.

9. The Chan family claims that baby Jane, given to them at U hospital, does not belong to them and that baby Sara, who was presented to the Wong family, really belongs to them. They insist that two babies were swapped accidentally. Blood group determinations show the following results:

Mrs Chan, AB and Mr. Chan, O;
Mrs Wong, A and Mr. Wong, O;
Baby Jane, A ; Baby Sara, O.

Suppose you were the genetic counsellor of U hospital, explain to the Chan family who their baby is. (No mark will be awarded for genetic diagram.)

(5 marks)

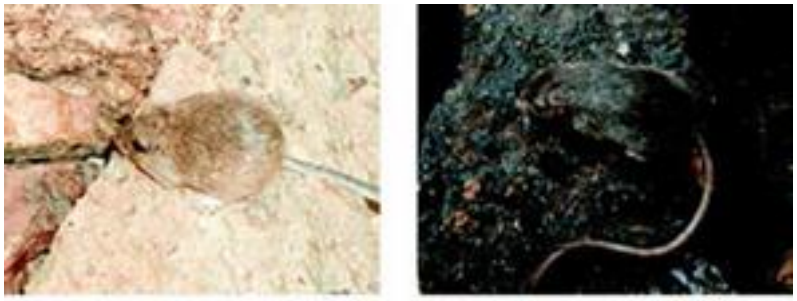
10. The rock pocket mouse is found in rocky outcrops in the Sonoran desert of the southwestern United States. They are nocturnal. They eat mainly plant seeds and make small burrows in soil under rocks to avoid being preyed on by owls.

(a) Based on the above information, construct a possible food chain in the Sonoran desert.

(1 mark)

(b) With reference to ***one*** particular abiotic factor in the desert, state the significance of the nocturnal behavior of rock pocket mice? (1 mark)

Most rock pocket mouse populations have light coloured fur consistent with the colour of the desert rocks on which they live. However, darker coloured rock pocket mice are found living on black rock formations.



Light and dark rock pocket mice on light granite and dark basalt rocks (Photo: Hopi E. Hoekstra)

The dark coat colour of the rock pocket mouse is caused by five mutations occurred in the MC1R gene which codes for a signal protein embedded in the membrane of a cell type specialized for pigment production. The base sequences of DNA segments involved in the mutations are shown below:

The number in italic form shows the order of amino acid on the protein molecule.

Base sequence on the template strand of the wide-type MC1R gene (Light coat-colour phenotype)
015 *022* TTGAGGTGGGCGTGTCCGCAACCA *105* *112* CGGGACCGGTGGGCCCACTGACAC *154* *161* TCATAACACTGTGACGGGGCCCGA *209* *212* GTGTACGAACGT *230* *237* GAACAGGTGGTTCCAAAGGCTGAG

Base sequence on the template strand of the mutant MC1R gene (Dark coat-colour phenotype)
015 *022* TTGAGGTGGACGTGTCCGCAACCA *105* *112* CGGGACCGGTGGACCCACTGACAC *154* *161* TCATAACACTGTGACGGGACCCGA *209* *212* GTGTACGAGCGT *230* *237* GAACAGGTGGTGCCAAAGGCTGAG

Answers written in the margins will not be marked.

(c) There is one mutation in each of the above segments as circled. State the type of point mutation shown in the MC1R gene. (1 mark)

_____

(d) (i) Write down the base sequence on the messenger RNA transcribed from the following segment of DNA. (1 mark)

DNA: TTGAGGTGG

mRNA: _____

(ii) Based on the codon table shown below, find out the 18th amino acid in the protein coded by the wide-type MC1R gene and mutant MC1R gene respectively. (1 mark)

Wide-type:

_____

Mutant:

_____

Codons Found in Messenger RNA

First Base	Second Base U	Second Base C	Second Base A	Second Base G	Third Base
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	Stop	Stop	A
	Leu	Ser	Stop	Trp	G
C	Leu	Pro	His	Arg	U
	Leu	Pro	His	Arg	C
	Leu	Pro	Gln	Arg	A
	Leu	Pro	Gln	Arg	G
A	Ile	Thr	Asn	Ser	U
	Ile	Thr	Asn	Ser	C
	Ile	Thr	Lys	Arg	A
	Met	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	U
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val	Ala	Glu	Gly	G

(iii) Explain why the changes in base sequence of the MC1R gene would affect the structure and function of the membrane signal protein coded. (3 marks)

Answers written in the margins will not be marked.

(e) It is commonly thought that "***all mutations are bad***". Use the example of rock pocket mice to explain why this is ***not true***. (4 marks)

(f) The mutations result in the dark coat colour of rock pocket mouse was discovered by a researcher called Nachman. However before his work, biologists have worked out the genetic and biochemical processes that control coat colour for the common laboratory mouse which is evolutionary closely related to rock pocket mouse.

What does this tell us about the nature of science? (1 mark)

Answers written in the margins will not be marked.

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. In terrestrial flowering plants such as our school's White Jade Lily tree, photosynthesis mainly takes place in the leaf mesophyll cells. Give an account of the processes by which the mesophyll cells obtain the raw materials for photosynthesis. (11 marks)

Answers written in the margins will not be marked.

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End of section B
End of paper

Answers written in the margins will not be marked.