B

Name:	
Class (No.):	F.5_____ ( )

Form FIVE Final Examination 2020-2021

BIOLOGY (F.5A – 5F)
SECTION B: Question-Answer Book

This paper must be answered in English

INSTRUCTIONS

(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) The questions in this Question-Answer Book carry 84 marks. Answer **ALL** questions.

(4) Write your answers to section B 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. Tie them loosely but securely with a string **INSIDE** this Question-Answer Book.

(6) Present your answers in paragraphs whenever appropriate.

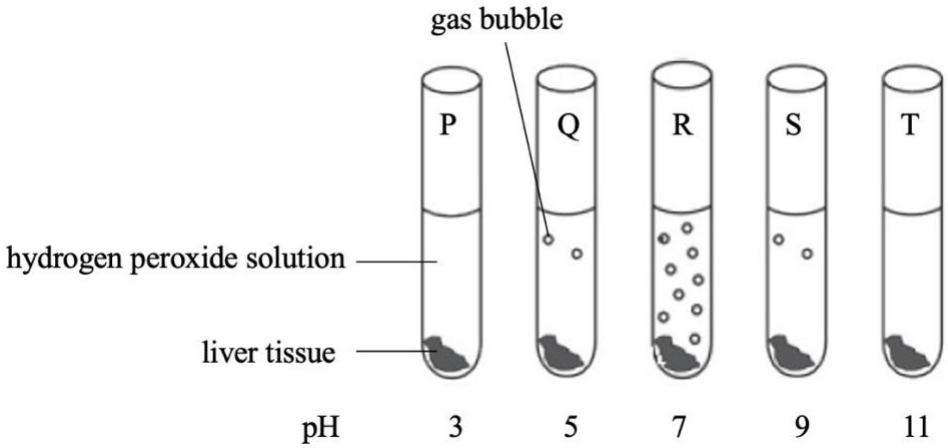
(7) The diagrams in this section are NOT necessarily drawn to scale.

Question No.	Marks
MCQs	/ 36
1	/3
2	/7
3	/6
4	/6
5	/8
6	/8
7	/8
8	/7
9	/9
10	/11
11	/11
Subtotal:	/ 84
Grand Total:	/120

SECTION B

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

1. Lewis carried out an investigation to study the effect of pH on enzyme activity. He placed liver tissues in hydrogen peroxide solutions at different pH. He then calculated the rate at which bubbles were formed in each test tube. The experimental set-up and results are shown in the diagram below:

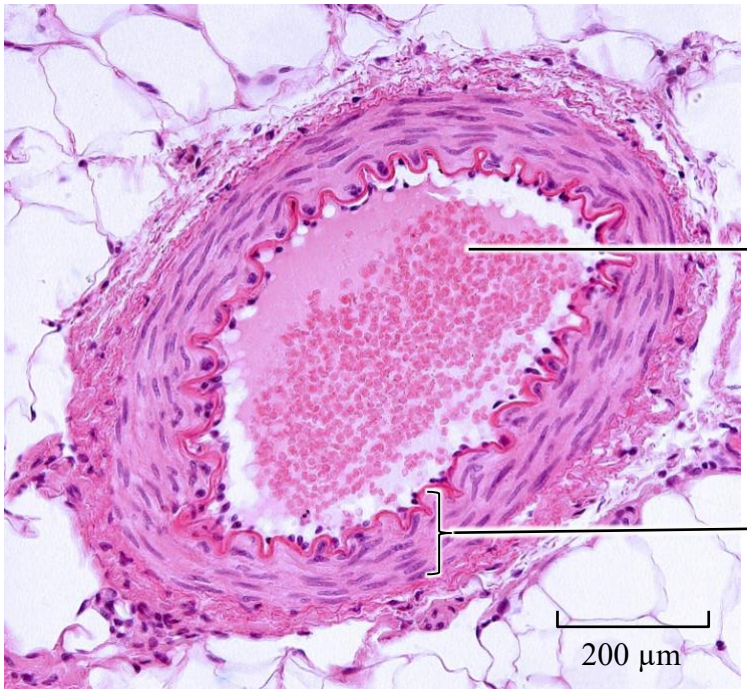


(a) Lewis concluded that the optimum pH of the enzyme in liver tissue is 7. However, his teacher said that his results were not accurate enough. Suggest how Lewis could obtain a more accurate estimation of the optimum pH. (1 mark)

(b) Lewis decided to do a follow-up experiment. He prepared a new test tube that was identical to test tube P. He then added a buffer solution to the test tube such that the pH increased from 3 to 5. However, no gas bubbles were observed. Explain the results of this follow-up experiment. (2 marks)

Total 3 marks

2. The photomicrograph below shows a section through an artery.



(a) Identify

(i) tissue X, and

(ii) tissue Y in the artery wall.

Write their names in the boxes provided. (2 marks)

(b) Using the scale bar, calculate the magnification of the image. Show your working.

(2 marks)

(c) Suggest how the structure of a vein is different from the artery shown in the above photomicrograph. (1 mark)

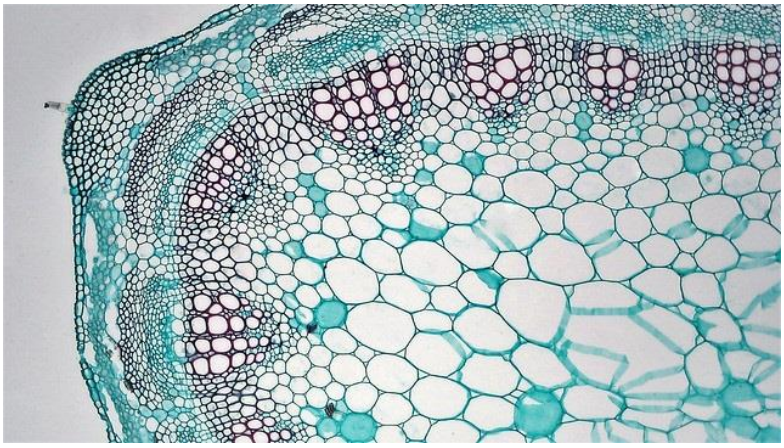
Answers written in the margins will not be marked.

(d) Tissue Y contains elastic fibres. Describe how tissue Y contributes to keeping a continuous blood flow along the artery. (2 marks)

Total 7 marks

Answers written in the margins will not be marked.

3. The following photomicrograph shows part of the transverse section of a dicotyledonous plant organ.



(a) Identify the plant organ shown in the photomicrograph. Explain your answer. (2 marks)

(b) Label the xylem on the above photomicrograph. (1 mark)

(c) What is the main force that draws water up the xylem vessels? (1 mark)

(d) Explain an adaptive feature of xylem vessels for the transportation of water. (2 marks)

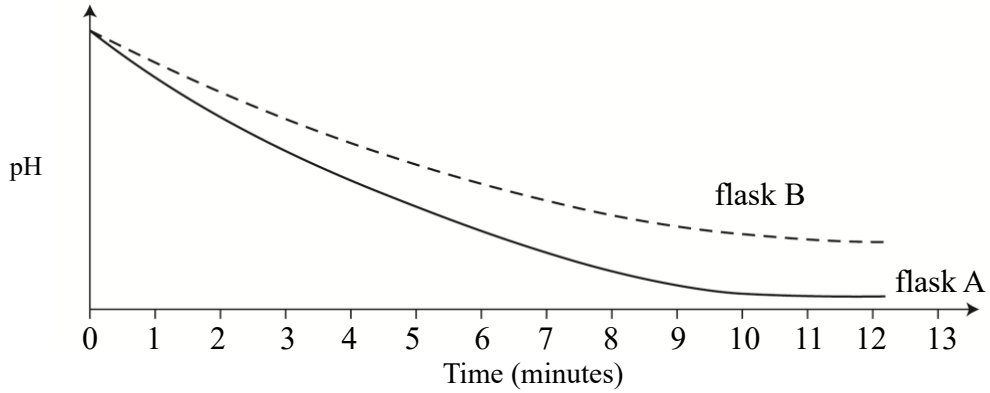
Total 6 marks

Answers written in the margins will not be marked.

4. An investigation was carried out to study the effect of bile salts on the digestion of lipids. Two flasks were set up as shown in the table below:

Contents	**Flask A** (cm^3)	**Flask B** (cm^3)
Milk (full cream)	10	10
Dilute sodium carbonate solution	10	10
Lipase solution	2	2
Bile salt solution	2	0
Water	0	2

The pH of each mixture was recorded using a pH meter connected to a data logger. The results are shown in the graph below:



(a) Write a word equation to demonstrate the action of lipase. Explain why the pH dropped during the experiment. (2 marks)

Answers written in the margins will not be marked.

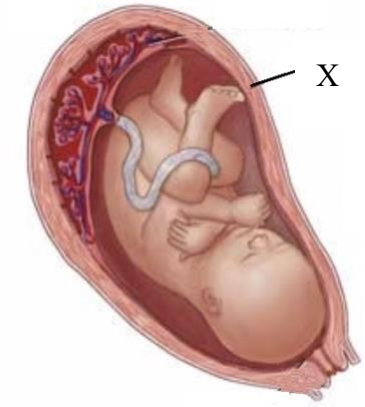
(b) With reference to the graph and your own knowledge, explain whether bile salts help in lipid digestion. (3 marks)

(c) Another student, Candy, forgot to add dilute sodium carbonate solution when preparing flask A. Add a line on the graph above to show the change in pH in the flask prepared by Candy. Label the line as C. (1 mark)

Total 6 marks

Answers written in the margins will not be marked.

5. The following diagram shows a foetus inside the uterus of its mother just before birth.



(a) A foetus depends on its mother for nutrients. Describe how the foetus obtains nutrients from its mother. (3 marks)

(b) Describe and explain ***two*** ways the placenta is adapted for the exchange of materials between the foetal blood and maternal blood. (4 marks)

Answers written in the margins will not be marked.

(c) Describe how structure X is involved in the birth of the baby. (1 mark)

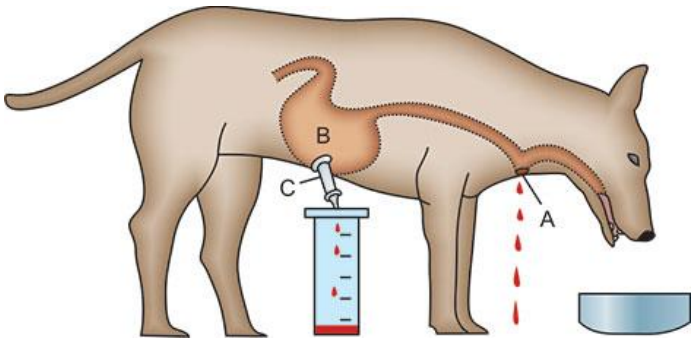
Total 8 marks

Answers written in the margins will not be marked.

6. In the 1900s, scientists conducted investigations to study the secretion of gastric juice in three groups of dogs (I, II and III). All the dogs were treated before the experiment as follows:

(1) An opening (A) was made in the oesophagus. When this opening was opened, food ingested could not reach the stomach. When this opening was closed, food ingested could enter the stomach.

(2) A tube (C) was inserted into the stomach (B) for collecting gastric juice secreted.



The results of the investigations are shown below:

Group I:
- When A was opened, the dogs ingested a piece of meat but the meat could not reach their stomachs, the secretion of gastric juice began within 1 minute.
- However, the secretion of gastric juice soon stopped.

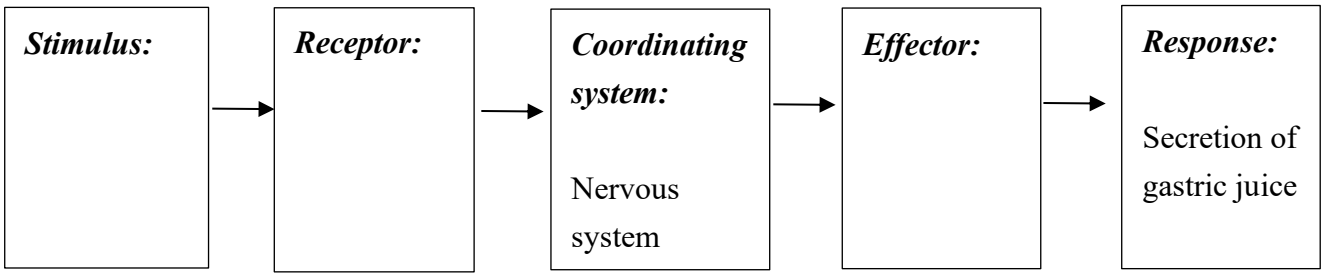
Group II:
- When A was closed, the dogs ingested a piece of meat and the meat had not yet reached their stomachs, the secretion of gastric juice began within 1 minute.
- The secretion of gastric juice continued for 4 hours after the meat entered their stomachs.

Group III:
- The nerves from the brain to the stomach were cut.
- When A was closed, the dogs ingested a piece of meat and the meat had not yet reached their stomachs, no gastric juice was secreted.
- When the meat entered the stomachs, the secretion of gastric juice started and continued for 4 hours.

Answers written in the margins will not be marked.

(a) Based on the results of Group I,

(i) complete the following flow chart to show the coordination pathway resulting in the secretion of gastric juice. (3 marks)



(ii) explain why the response observed in the dogs is a reflex action. (2 marks)

(b) What is the purpose of cutting the nerve connecting the brain and the stomach in Group III dogs? (1 mark)

(c) Based on the results shown in Groups II and III, explain why a hormone may be involved in the control of gastric juice secretion after the food reached the stomach. (2 marks)

Total 8 marks

Answers written in the margins will not be marked.

7. (a) In 1928, Fritz Went discovered that the phototropic responses in plants is controlled by plant hormones which were subsequently named "auxins".

It was postulated that "***auxins can induce loosening of the bonds between the cellulose microfibrils (tiny fibres) in cell walls"***. Using this information, explain how auxins promote cell elongation. (1 mark)

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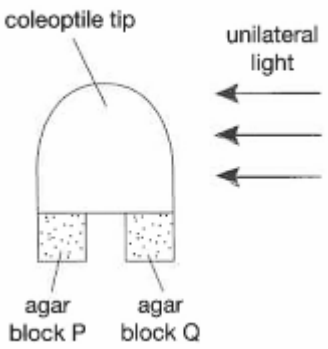
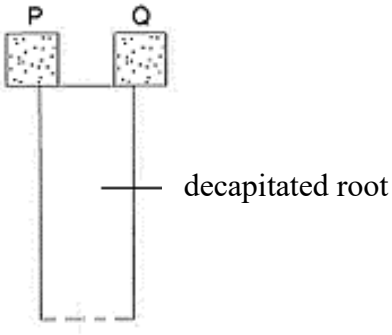
(b) Based on Fritz Went's experiments, Wendy designed the following experiment to investigate the effect of unilateral light on the growth of roots.

A coleoptile tip was placed on two agar blocks, P and Q, as shown in set-up I. The coleoptile tip was illuminated with unilateral light for 24 hours. The two agar blocks were then placed on top of a decapitated root (root with the tip removed) as shown in set-up II.

Set-up I



Set-up II



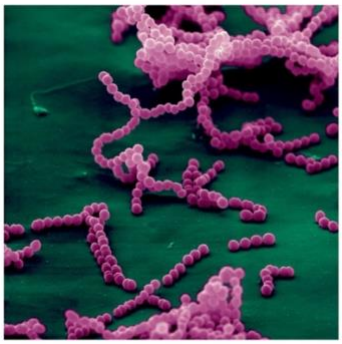
(c) The decapitated root grew and bent towards the left hand side. Explain the result with reference to plant hormones. (5 marks)

(d) Describe how should Wendy set a control set-up for the above experiment. Explain your answer. (2 marks)

Total 8 marks

Answers written in the margins will not be marked.

8. The images below show two organisms, X and Y:



Organism X

Organism Y

(a) Complete the following table regarding the classification of organisms X and Y. (3 marks)

Group	Organism X	Organism Y
	Bacteria	Archaea
Kingdom		

(b) List ***one*** structural similarity and ***one*** structural difference between organisms X and Y. (2 marks)

Similarity:

Difference:

Answers written in the margins will not be marked.

(c) Organisms X and Y were originally classified in the same group due to similarities in their structures. However, nowadays, scientists rely on a new approach in classifying organisms, leading to organisms X and Y being classified separately.

(i) What is the new ***approach*** scientists use to classify organisms? (1 mark)

(ii) State ***one*** aspect of the nature of science that is reflected in the development of a new approach to classifying organisms. (1 mark)

Total 7 marks

Answers written in the margins will not be marked.

9. A hedgehog (fig.1) is a small carnivorous mammal native to Northern Europe. In 1974, they were introduced to South Uist, an island on the west coast of Scotland (fig. 2), to control slugs and snails in a domestic garden.

fig. 1

fig. 2

However, some of the hedgehogs escaped and their population in the wild increased dramatically. Fig. 3 below shows the distribution of hedgehogs in the year 2000. The star indicates the approximate location where hedgehogs were introduced in 1974.

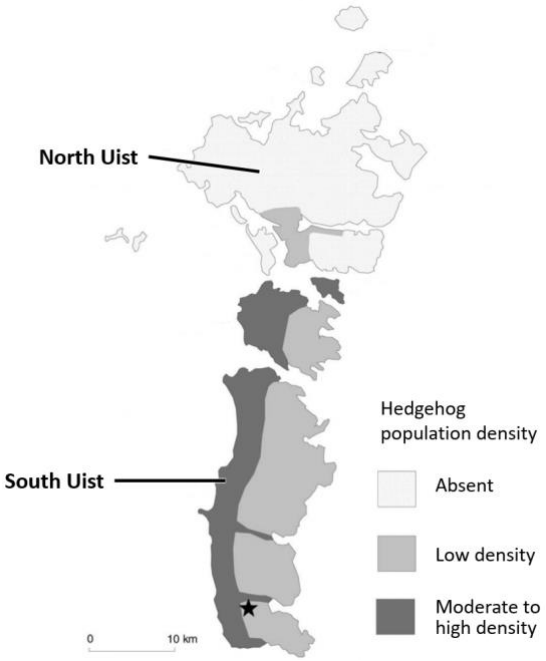


fig. 3

On South Uist, hedgehogs have no natural predators and their diet consists mainly of bird eggs. The table below shows the changes in the populations of two shorebird species in South Uist from 1983 to 2000.

	Population in 1983	**Population in 2000**	**% change in population**
shorebird A	907	1403	+55
shorebird B	1869	1287	

(a) Complete the table by calculating the percentage change in population of shorebird B. (1 mark)

(b) Suggest an explanation for the increase in shorebird A population on South Uist despite the increase in the hedgehog population. (2 marks)

Answers written in the margins will not be marked.

(c) Explain why the population of hedgehogs on South Uist may eventually become a different species from those on mainland Scotland. (5 marks)

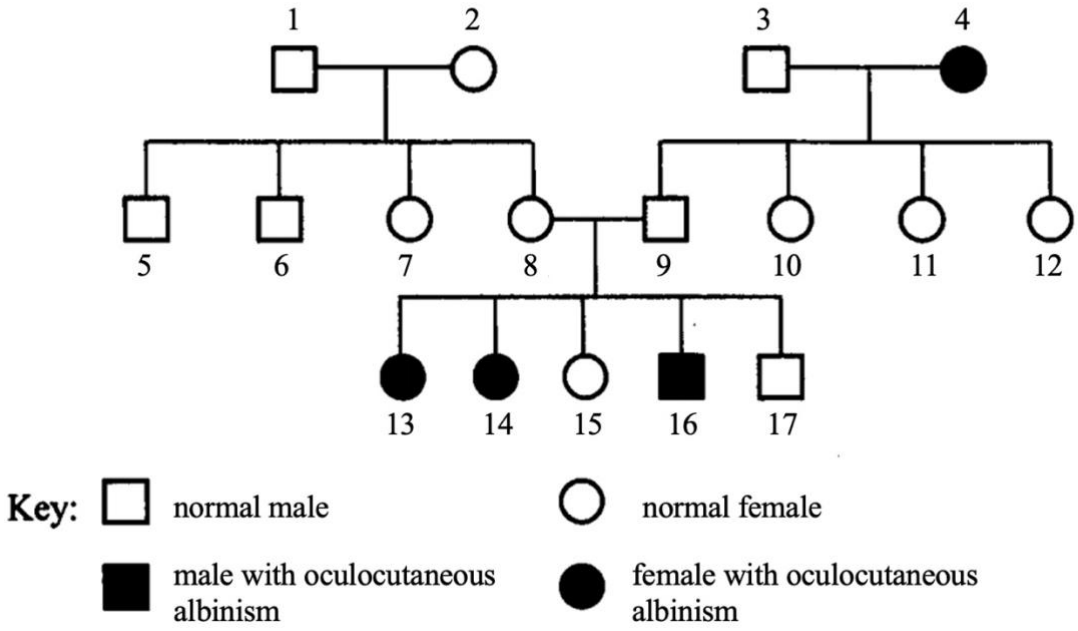
(d) In order to save the local shorebird populations, some people suggest controlling the population of hedgehogs by introducing their natural predators to South Uist. From an ecological point of view, suggest why this should ***not*** be done. (1 mark)

Total 9 marks

Answers written in the margins will not be marked.

10. Pedigree I shows the inheritance of oculocutaneous albinism in a family. Albinism is a condition characterised by the lack of a dark brown pigment in the body. The inheritance of oculocutaneous albinism is controlled by a pair of alleles.

Pedigree I: Inheritance of oculocutaneous albinism



(a) Based on pedigree I, deduce whether the allele for the condition is dominant or recessive. (Note: Marks will not be awarded for genetic diagrams.) (4 marks)

Answers written in the margins will not be marked.

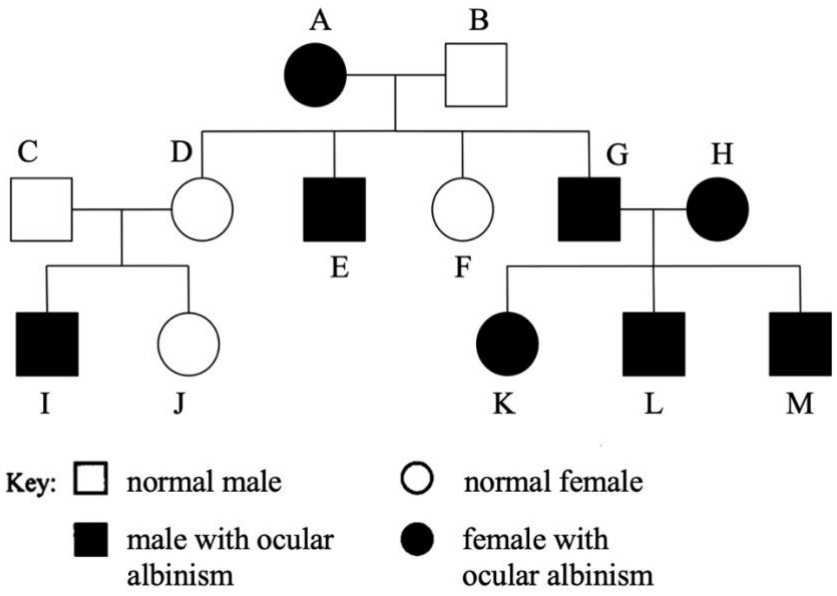
(b) Individuals 8 and 9 are going to have another child. Given that the dominant allele is represented by "A" while the recessive allele is represented by "a", determine all the possible genotypes and phenotypes of the new child of individuals 8 and 9 using a genetic diagram. (3 marks)

(Note: Punnett square is not accepted.)

Answers written in the margins will not be marked.

(c) Another form of albinism is called ocular albinism, which primarily affects the eyes. Pedigree II shows the inheritance of ocular albinism in a family:

Pedigree II: Inheritance of ocular albinism



(i) State whether the allele for ocular albinism is dominant or recessive. (1 mark)

(ii) Given that either oculocutaneous albinism or ocular albinism is X-linked, put a "✓" in the appropriate box below to show which of them is X-linked. (1 mark)

Condition	X-linked (✓)
oculocutaneous albinism	
ocular albinism	

(iii) Using evidence from either pedigree I or II, explain why the condition you did ***not*** choose in (c)(ii) is ***not*** X-linked. (2 marks)

Total 11 marks

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 an ecosystem, nitrogen is cycled between organisms and the environment. Describe the events that occur when nitrogen in the atmosphere passes into grass, then along the food chain to a cow and eventually returns to the environment. (11 marks)

Answers written in the margins will not be marked.

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END OF PAPER