



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

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BIOLOGY (US)

0438/31

Paper 3 Extended

October/November 2013

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Center number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **19** printed pages and **1** blank page.



1 (a) Table 1.1 shows some features of the five groups of vertebrates.

Complete Table 1.1 to compare the five groups of vertebrates using a tick (✓) indicate if the group shows the feature, or a cross (✗) if not.

The first row has been completed for you.

Table 1.1

group of vertebrates	scaly skin	external ear (pinna)	feathers	mammary glands
birds	✓	✗	✓	✗
bony fish				
amphibians				
reptiles				
mammals				

[4]

Fig. 1.1 shows a southern cassowary, *Casuarus casuarus*, which is a large bird that cannot fly. It lives in rainforests in northern Australia and southern New Guinea.

The cassowary feeds on fruits and helps to disperse seeds for many tree species, such as the cassowary plum.



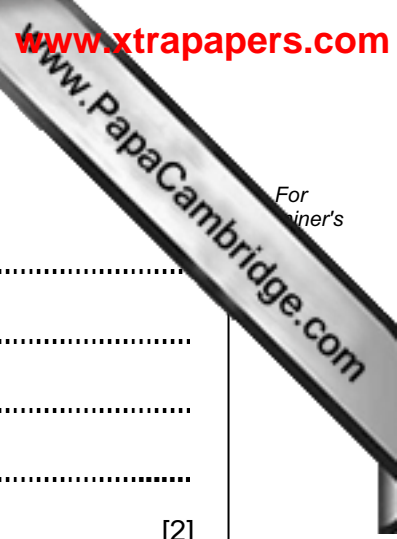
Fig. 1.1

(b) Suggest why the cassowary can digest the **fruit** but not the **seeds** of rainforest trees.

.....

.....

..... [2]



(c) Describe **one** method of seed dispersal that does **not** require animals.

.....
.....
.....
.....
..... [2]

(d) State **two** environmental conditions that seeds require so that they can germinate.

1.
2. [2]

(e) Cassowaries are an endangered species. Many are killed on the roads and development threatens their rainforest habitat.

Cassowaries, as with many other rainforest species, cannot survive in small nature reserves.

Suggest why species, such as cassowaries, cannot survive in small nature reserves.

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..... [3]

[Total: 13]

2 (a) (i) Explain the term *balanced diet*.

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..... [3]

(ii) State **three** factors that influence a person's nutritional needs.

1

2

3 [3]

(b) Glucose is absorbed in the small intestine and transported in the blood. The kidney filters the blood and reabsorbs the glucose.

If the blood contains more than 180 mg of glucose per 100 cm³, the kidney cannot reabsorb it all and some is present in the urine. This figure is called the **renal threshold**.

A doctor suspects that a patient has diabetes because a urine test is positive for glucose.

The patient takes a glucose tolerance test by drinking a solution of glucose. The doctor records the patient's blood glucose concentration at 30 minute intervals for five and a half hours.

The results are plotted on Fig. 2.1.

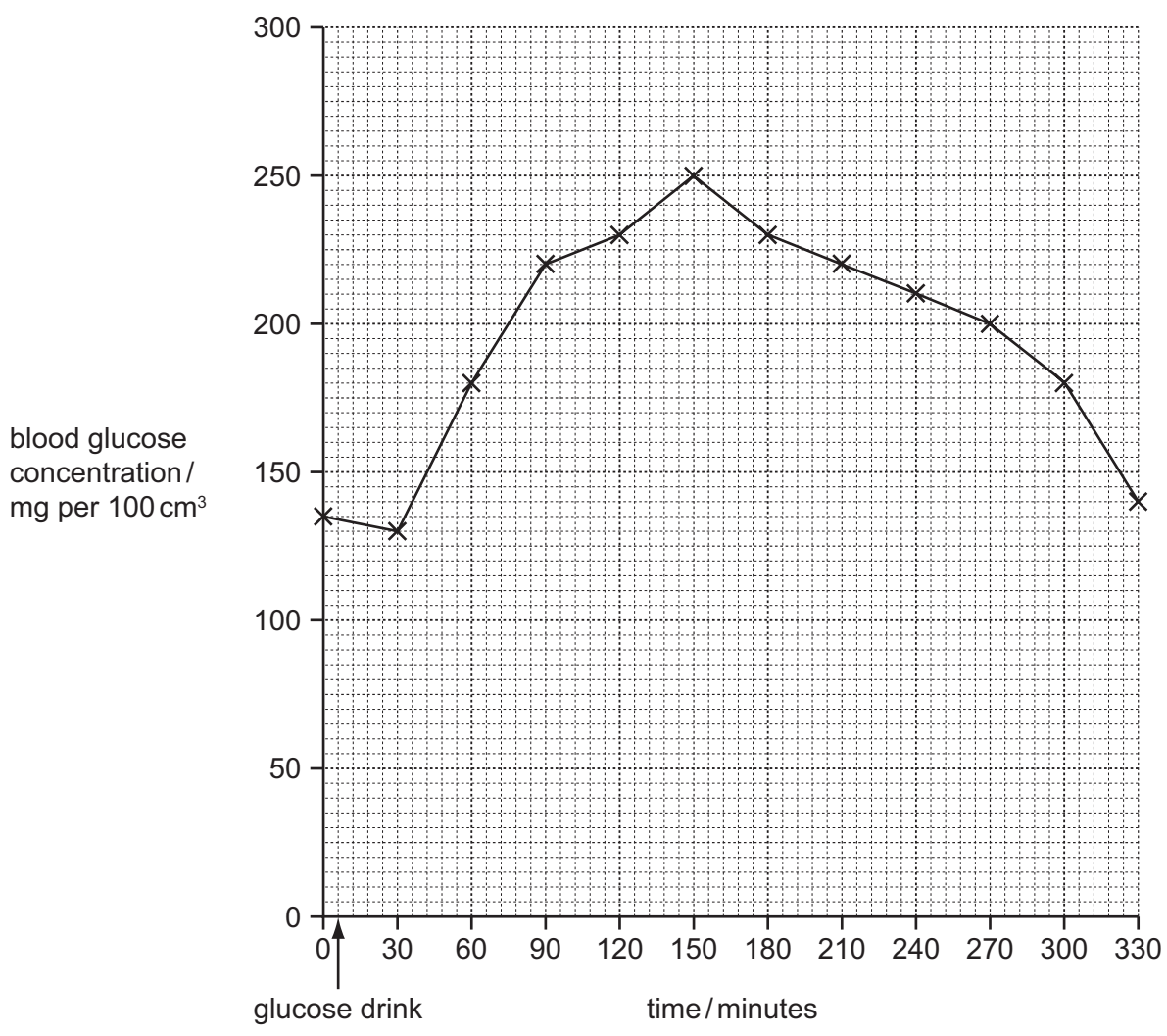


Fig. 2.1

(i) Draw a horizontal line on Fig. 2.1 to show the **renal threshold**. [1]

(ii) State the time period when the kidney will produce urine containing glucose. [1]

..... [1]

(iii) Sketch on Fig. 2.1 the blood glucose concentrations that the doctor might expect if he repeated this test on someone who does **not** have diabetes. [1]

- 3 (a) Starch, glucose and fructose are carbohydrates. Fructose syrup is used as a sweetening agent as an alternative to sucrose.

The flow chart in Fig. 3.1 shows how fructose is prepared from maize starch.

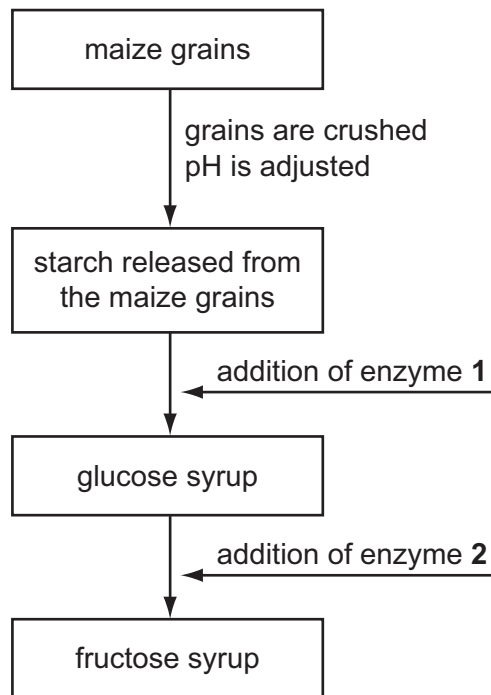


Fig. 3.1

- (i) Name enzyme 1.

..... [1]

- (ii) State why it is necessary to adjust the pH before an enzyme is added to the process.

.....
 [1]

- (b) Maize grains contain protease enzymes. With reference to the processes shown in Fig. 3.1, suggest why it is important that these enzymes do not contaminate the glucose syrup.

.....
 [1]

(c) The formation of fructose syrup from glucose syrup is carried out at a temperature of 60 °C.

Suggest an important property of enzyme **2** that allows it to be used at temperatures as high as 60 °C.

.....
.....
..... [1]

(d) Enzyme **2** is found naturally in many bacteria. Enzymes for use in washing powders are obtained from bacteria.

Describe how bacteria are used to produce enzymes for washing powders.

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.....
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..... [3]

(e) Pectinase is an enzyme that breaks down compounds known as pectins. Cell walls of fruits, such as apples and mangoes, contain pectins.

Explain the **advantages** of using pectinase in fruit juice production.

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..... [3]

[Total: 10]

(b) The gene for hemoglobin exists in two alternative forms:

- H^A codes for the normal form of hemoglobin;
- H^S codes for the abnormal form of hemoglobin.

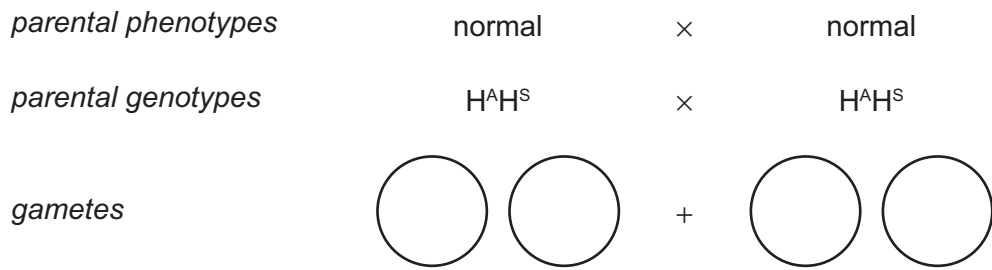
(i) State the name for the alternative forms of a gene.

..... [1]

(ii) A child has sickle cell anemia. The parents do not have this disorder.

Complete the genetic diagram to show how the child inherited the disorder.

Use the symbols H^A and H^S in your answer.



child's genotype

child's phenotype sickle cell anemia

[2]

(iii) The parents are about to have another child.

What is the probability that this child will have sickle cell anemia?

..... [1]

(c) The maps in Fig. 4.2 show the distribution of sickle cell anemia and malaria in different parts of the world.

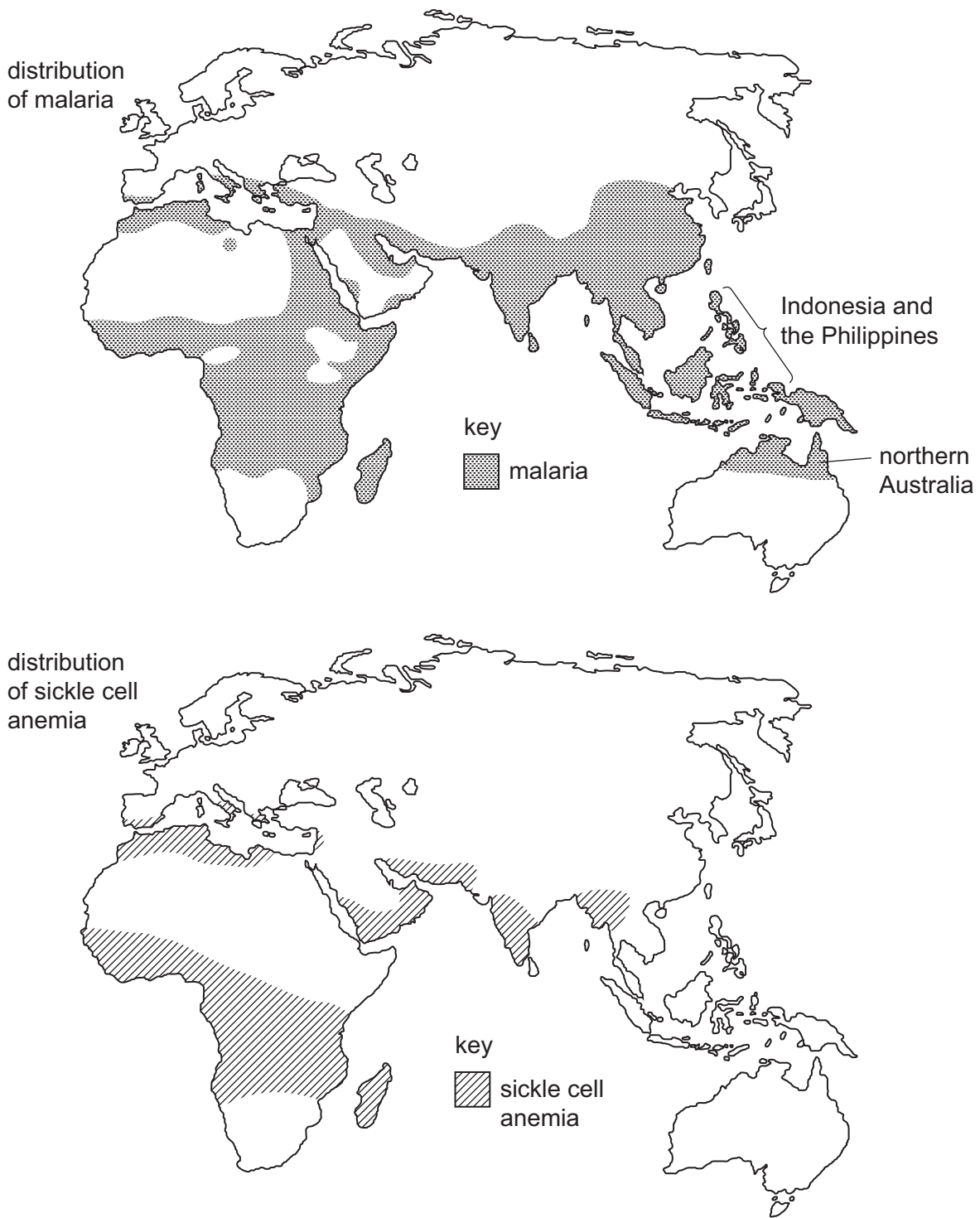


Fig. 4.2

Question 5 begins on page 14.

- 5 (a) Complete Table 5.1 by naming **three** sense organs and the stimulus which detects.

Table 5.1

sense organ	stimulus

[3]

- (b) Reflexes are involuntary actions coordinated by reflex arcs like the one shown in Fig. 5.1.

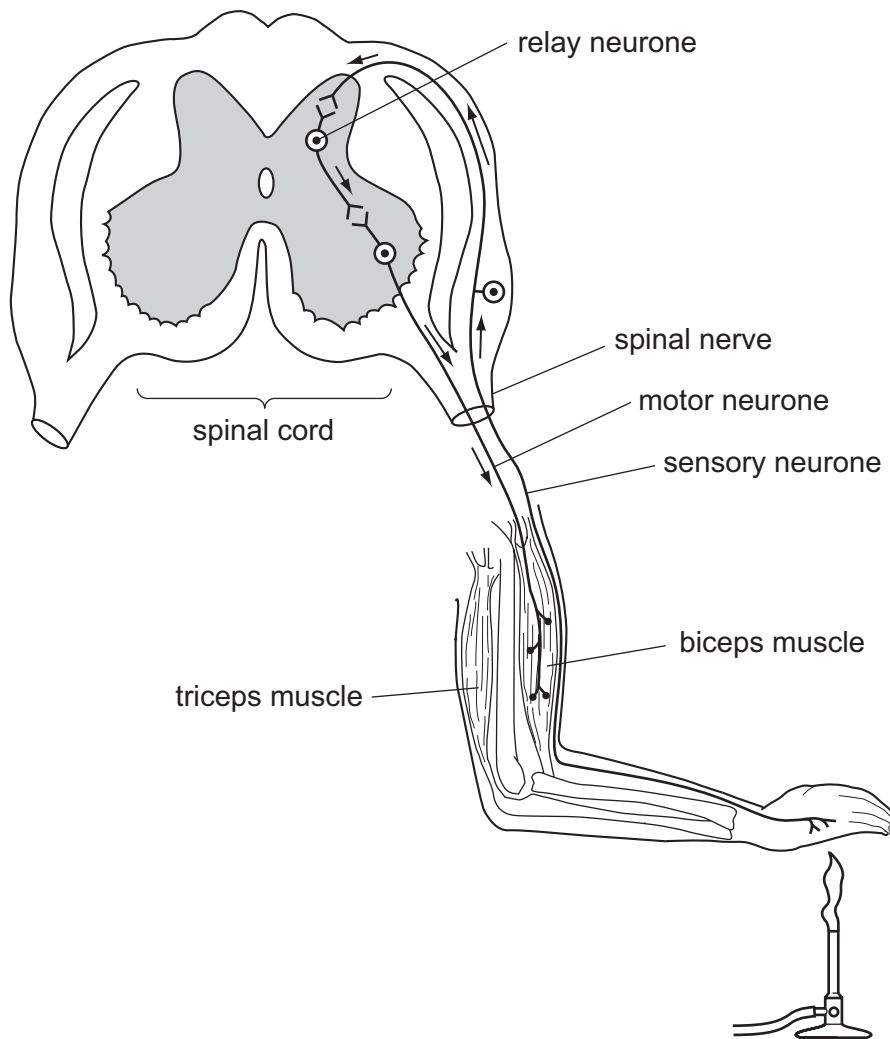


Fig. 5.1

(i) Explain what is meant by the term *involuntary action*.

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.....
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..... [2]

(ii) The arm shown in Fig. 5.1 moves in response to the detection of heat.
Explain how the parts of the reflex arc shown in Fig. 5.1 bring about this response.

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..... [5]

(iii) Describe the advantages of simple reflexes, such as the one shown in Fig. 5.1.

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..... [2]

(c) The organs of the human body are coordinated by the nervous system.

Outline **one** other way in which these organs are coordinated.

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..... [2]

[Total: 14]

6 Nitrogen is one of the most important chemical elements in the biosphere. Nitrogen must be continually recycled if life is to continue on Earth.

Savanna grasslands are an important ecosystem in Africa. Fig. 6.1 shows part of the nitrogen cycle in a grassland ecosystem in southern Africa.

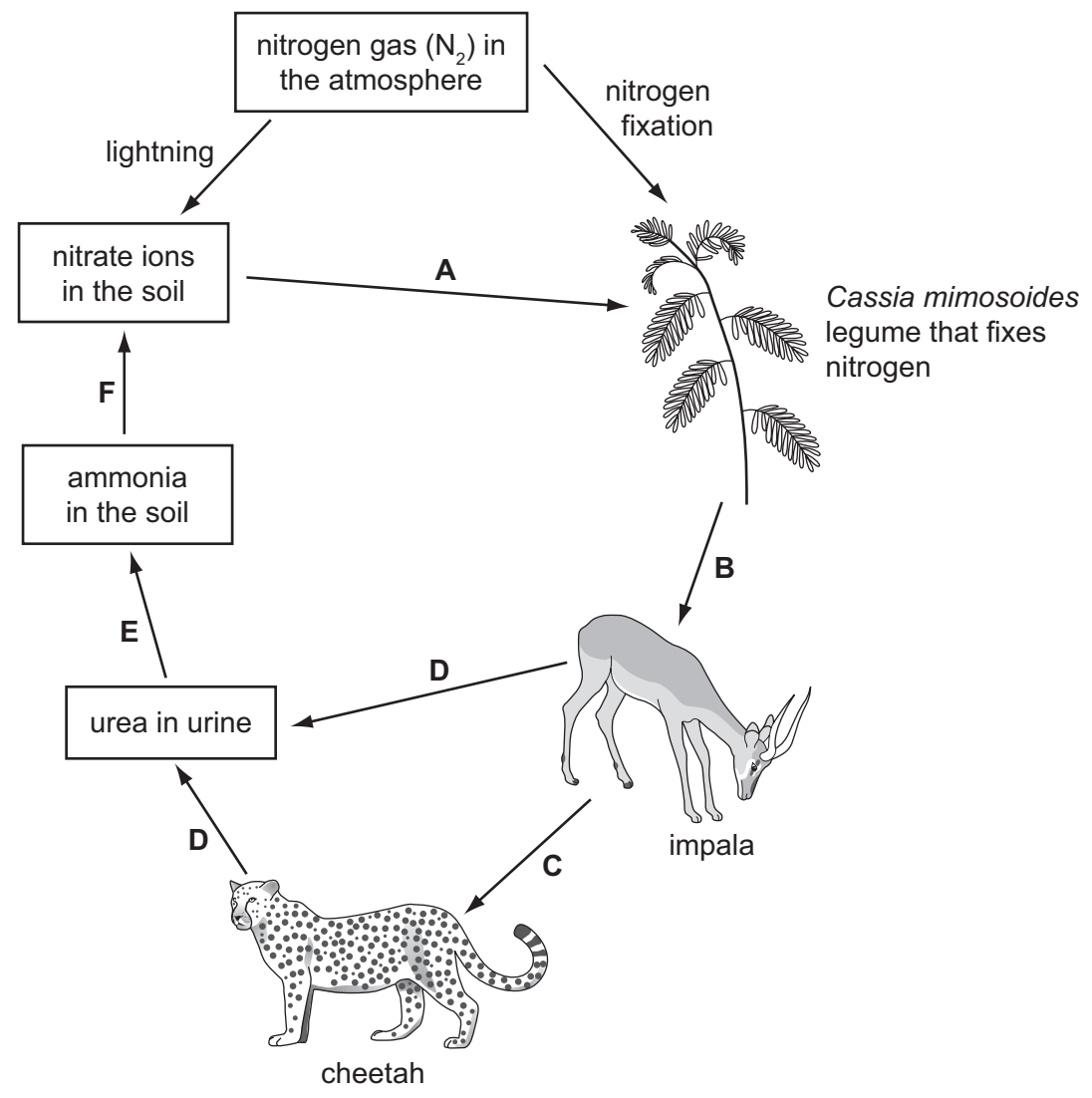


Fig. 6.1

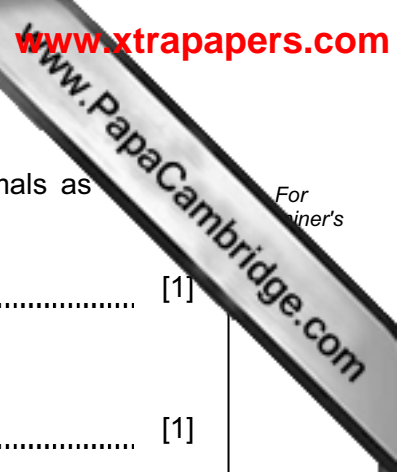
(a) Name:

(i) a type of nitrogen-containing compound that is made by *Cassia mimosoides*, eaten by the impala and by the cheetah;

..... [1]

(ii) the type of consumer as represented by the cheetah;

..... [1]



(iii) the process by which urea is removed from the body of the animals as by **D**;

..... [1]

(iv) process **F**.

..... [1]

(b) Explain the importance of recycling nitrogen in ecosystems, such as the African savanna.

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..... [3]

(c) The most common plants that grow in the African savanna are grasses. There are very few legume plants, such as *C. mimosoides*.

Suggest reasons why *C. mimosoides* is a rare plant in the African savanna.

.....
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.....
.....
..... [3]

Copyright Acknowledgements:

Figure 4.1 © Ref: M108/0009; *Sickle cell disease: variation in cell deformity*; Omikron / Science Photo. Library.

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