UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTER NUMBER						CANDIDATE NUMBER			

1282503609

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.

For Examiner's Use

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 (✓) to 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, *Casuarius casuarius*, 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.

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..... [2]

For Examiner's Use

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

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..... [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*.

For Examiner's Use

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..... [3]

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

1 .....

2 .....

3 ..... [3]

For Examiner's Use

(b) Glucose is absorbed in the small intestine and transported in the blood. The kidneys filter the blood and reabsorb the glucose.

If the blood contains more than 180 mg of glucose per 100 cm^3, 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.

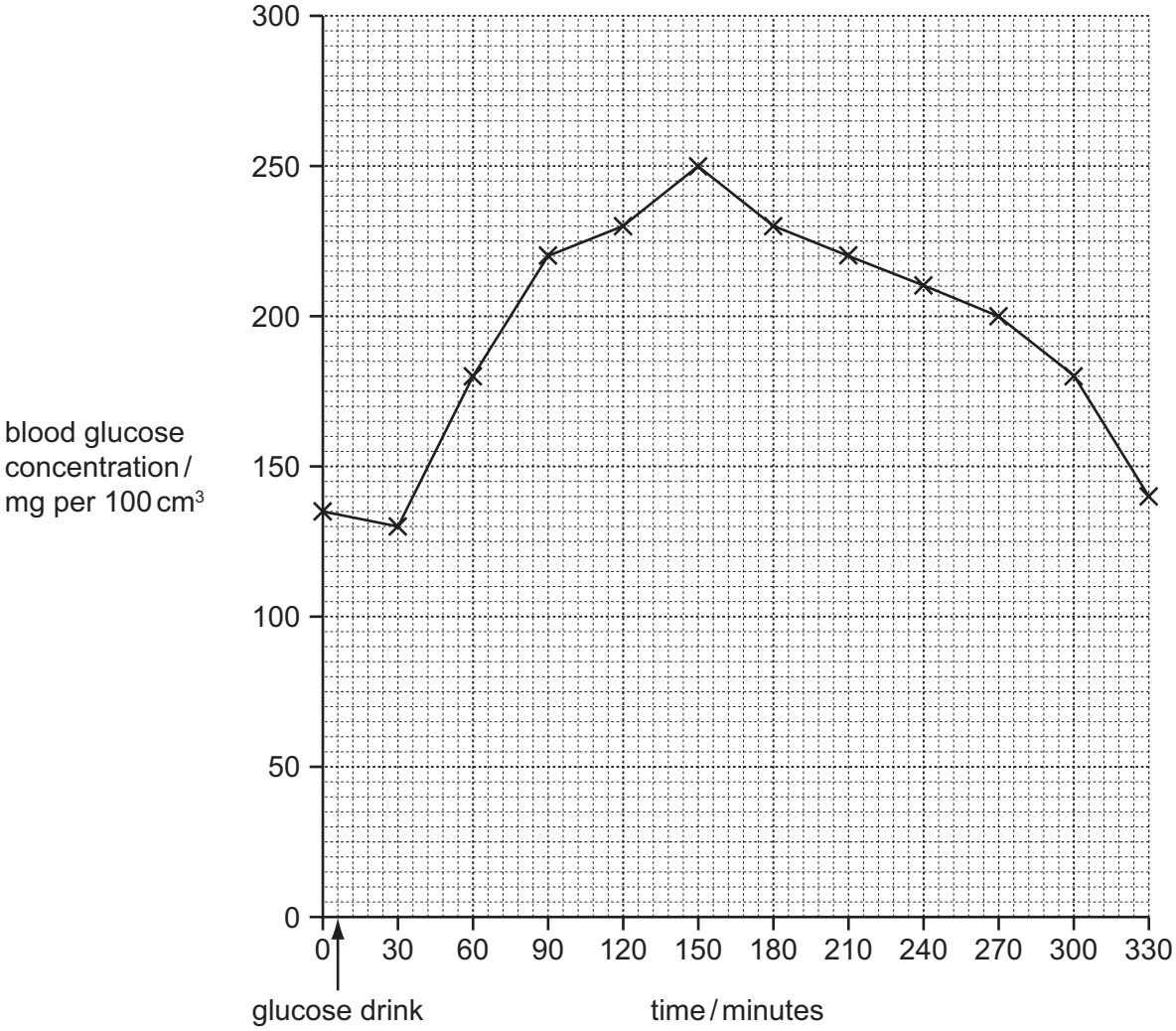

Fig. 2.1

(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]

(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]

(c) People who do not have diabetes maintain their blood glucose concentration below 180 mg per 100 cm^3.

For Examiner's Use

Explain how the body does this.

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..... [3]

[Total: 12]

For Examiner's Use

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.

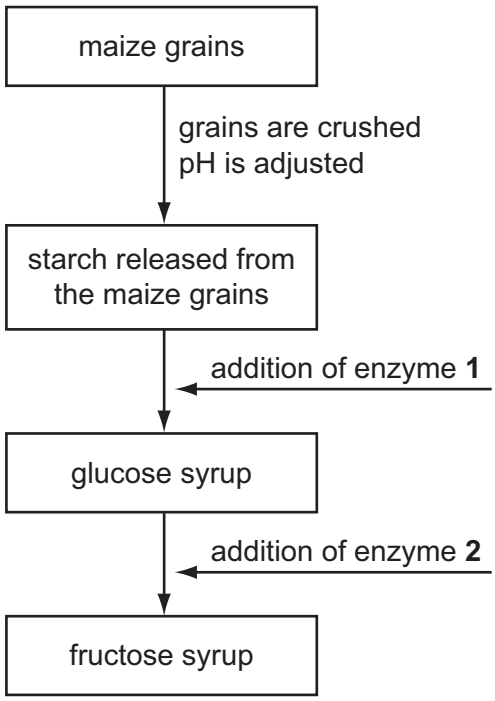

Fig. 3.1

(i) Name enzyme **1**.

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[1]

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

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[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.

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[1]

[Turn over

For Examiner's Use

(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.

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..... [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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..... [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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[Total: 10]

For Examiner's Use

4 **(a)** Sickle cell anemia is a genetic disorder that is found among people in certain parts of the world.

A sample of blood was taken from a person with sickle cell anemia and examined with an electron microscope.

Fig. 4.1 shows some of the red blood cells in the sample.

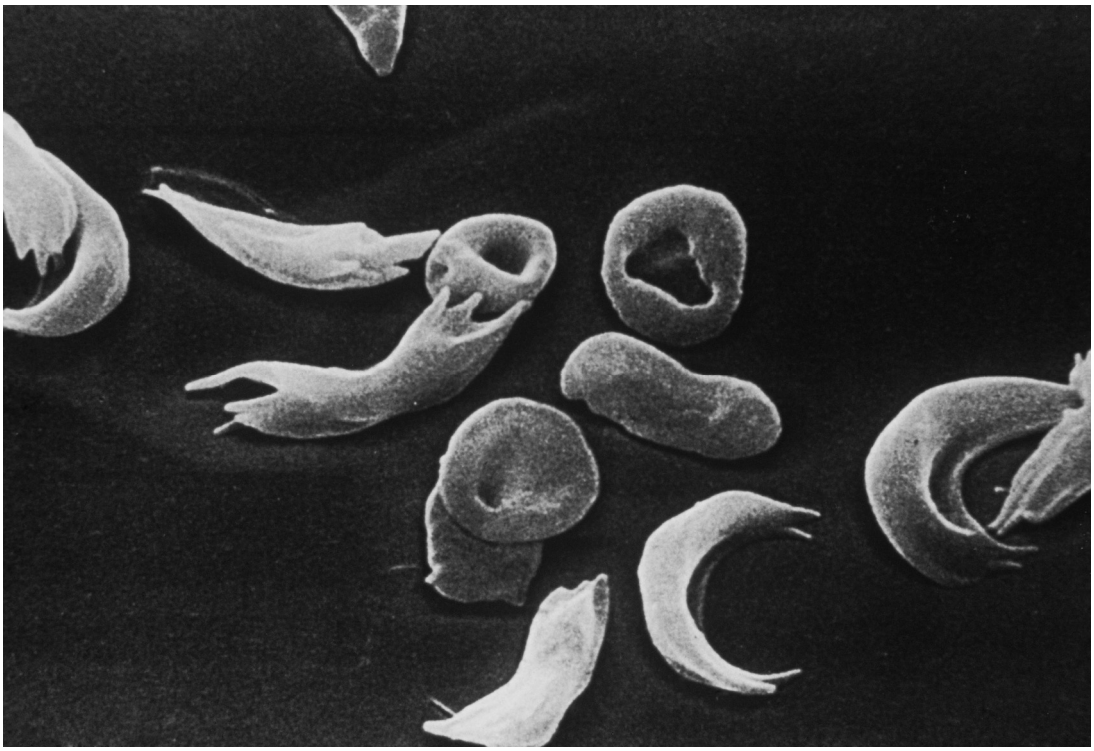

Fig. 4.1

Explain the problems that may occur as these cells circulate in the blood system.

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..... [4]

For Examiner's Use

(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.

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[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.

parental phenotypes	normal	×	normal
parental genotypes	H^AH^S	×	H^AH^S
gametes	◯ ◯	+	◯ ◯

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?

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[1]

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

For Examiner's Use

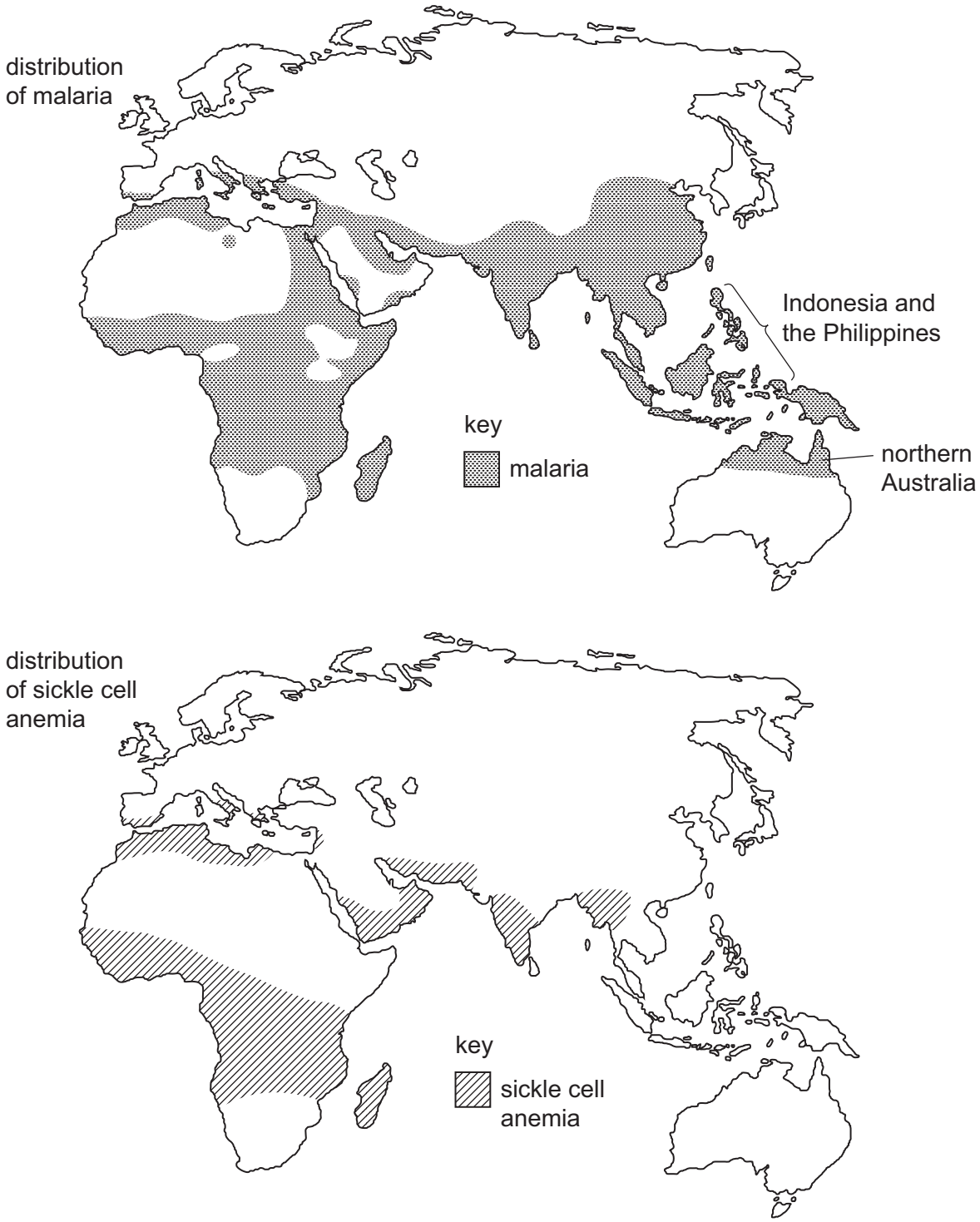

Fig. 4.2

For Examiner's Use

(i) Explain why sickle cell anemia is common in people who live in areas where malaria occurs.

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..... [4]

(ii) Suggest why sickle cell anemia is very rare among people who live in Indonesia and northern Australia.

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[Total: 14]

Question 5 begins on page 14.

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

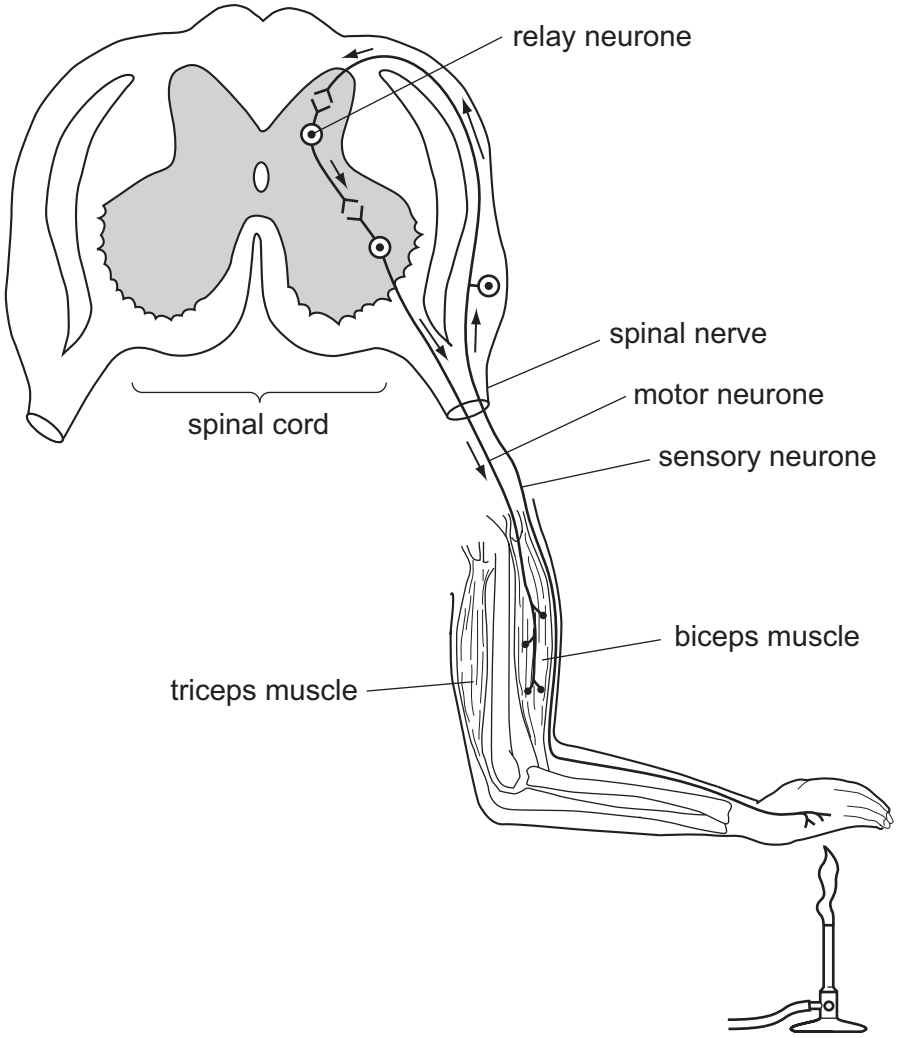

Fig. 5.1

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

For Examiner's Use

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

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(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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[Total: 14]

For Examiner's Use

For Examiner's Use

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.

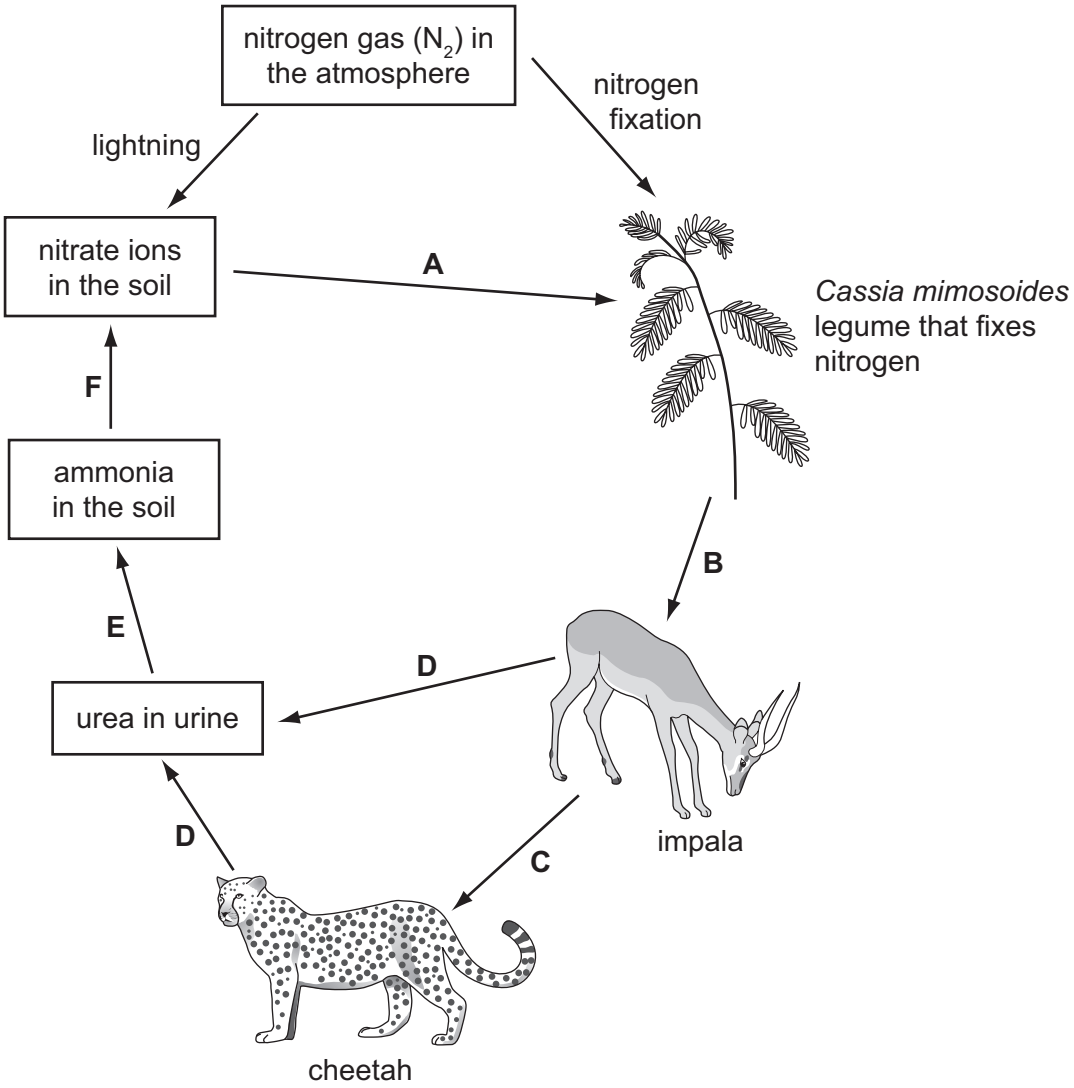

Fig. 6.1

(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]

For Examiner's Use

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

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[1]

(iv) process **F**.

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[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]

(d) Explain why there are far fewer cheetah than impala.

For Examiner's Use

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(e) The cheetah is an endangered species.

It is important to conserve their food supply and all the species that inhabit their ecosystem.

Explain why.

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..... [3]

[Total: 17]

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