Location Entry Codes

As part of CIE's continual commitment to maintaining best practice in assessment, CIE uses different variants of some question papers for our most popular assessments with large and widespread candidature. The question papers are closely related and the relationships between them have been thoroughly established using our assessment expertise. All versions of the paper give assessment of equal standard.

The content assessed by the examination papers and the type of questions is unchanged.

This change means that for this component there are now two variant Question Papers, Mark Schemes and Principal Examiner's Reports where previously there was only one. For any individual country, it is intended that only one variant is used. This document contains both variants which will give all Centres access to even more past examination material than is usually the case.

The diagram shows the relationship between the Question Papers, Mark Schemes and Principal Examiners' Reports that are available.

Question Paper	**Mark Scheme**	**Principal Examiner's Report**
Introduction	Introduction	Introduction
First variant Question Paper	First variant Mark Scheme	First variant Principal Examiner's Report
Second variant Question Paper	Second variant Mark Scheme	Second variant Principal Examiner's Report

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The titles for the variant items should correspond with the table above, so that at the top of the first page of the relevant part of the document and on the header, it has the words:

- First variant Question Paper / Mark Scheme / Principal Examiner's Report

or

- Second variant Question Paper / Mark Scheme / Principal Examiner's Report

as appropriate.

First Variant Question Paper

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

* 9 9 2 7 1 2 3 1 2 5 *

BIOLOGY **0610/31**

Paper 3 Extended **May/June 2009**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre 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.
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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
Total	

This document consists of **17** printed pages and **3** blank pages.

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UNIVERSITY of CAMBRIDGE International Examinations
[Turn over

Answer **all** the questions.

For Examiner's Use

1 Table 1.1 shows some of the external features of the five classes of vertebrates.

Complete the table by using a tick (✓) to indicate if each class has the feature or a cross (×) if it does not. The first row has been completed for you.

Table 1.1

feature	fish	amphibia	reptiles	birds	mammals
mammary glands	×	×	×	×	✓
fur / hair					
scales / scaly skin					
external ears					
feathers					

[4]

[Total: 4]

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For Examiner's Use

2 Fig. 2.1 shows the blood supply for the liver of a mammal.

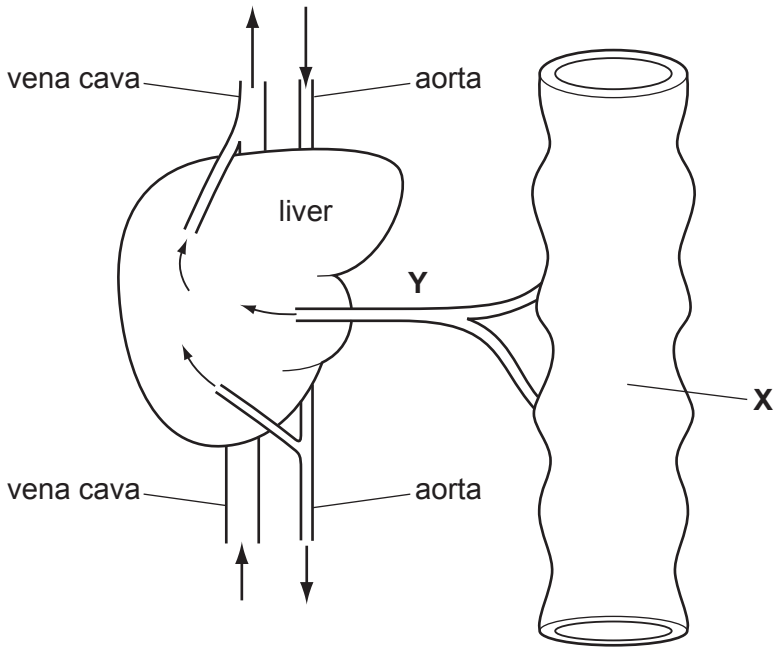

Fig. 2.1

(a) Blood from organ **X** is carried to the liver by blood vessel **Y**.

Name

(i) organ **X**,

..... [1]

(ii) blood vessel **Y**.

..... [1]

For Examiner's Use

Fig. 2.2 shows some liver cells as seen with a light microscope.

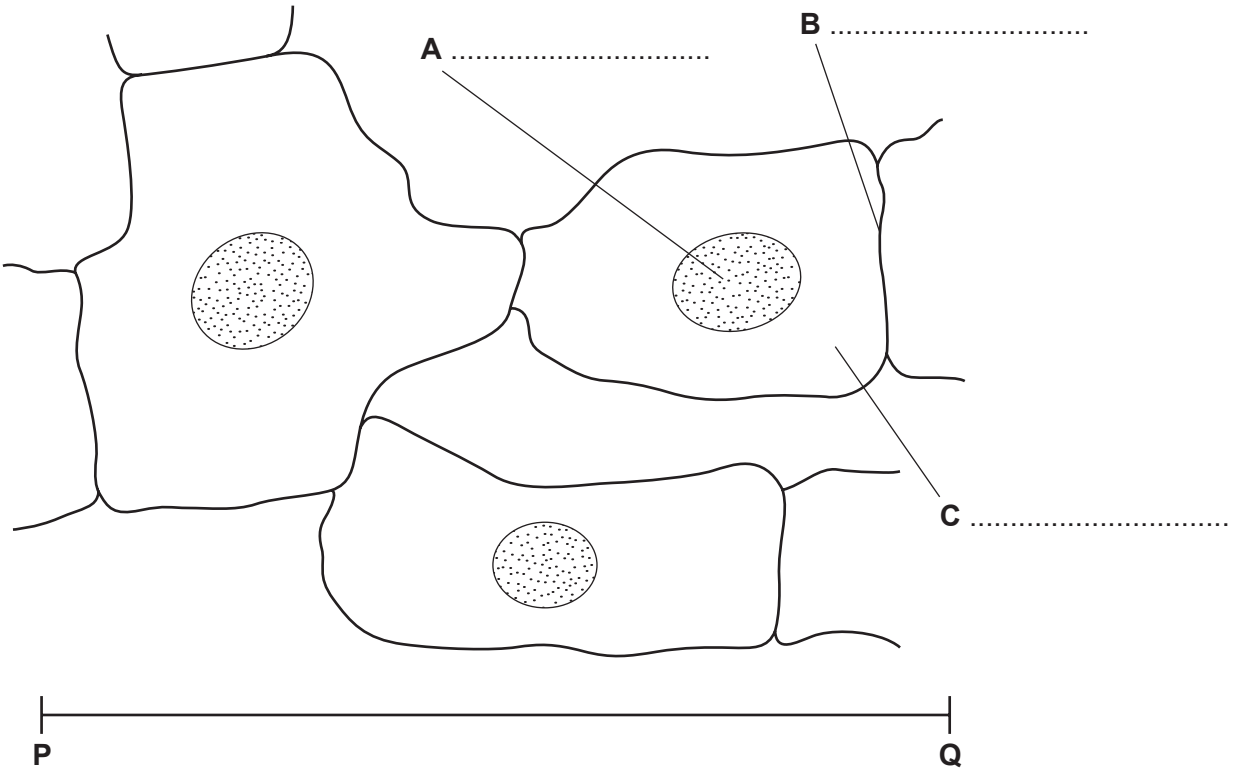

Fig. 2.2

(b) **(i)** Label, on Fig. 2.2, the structures **A**, **B** and **C**.

[3]

(ii) The distance **P-Q** is 0.06 mm.

Calculate the magnification of Fig. 2.2.

Show your working.

Magnification = x ..... [2]

Liver cells absorb glucose and amino acids from the blood and help to regulate the concentrations of these substances in the blood.

For Examiner's Use

(c) Explain how liver cells help to regulate the concentration of glucose in the blood in response to hormones from the pancreas in each of the following situations.

Blood glucose concentration is higher than normal.

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Blood glucose concentration is lower than normal.

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..... [5]

(d) Describe what happens to amino acids inside liver cells.

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[Total: 15]

For Examiner's Use

3 **(a)** Fig. 3.1 shows the activity of an enzyme produced by bacteria that live in very hot water.

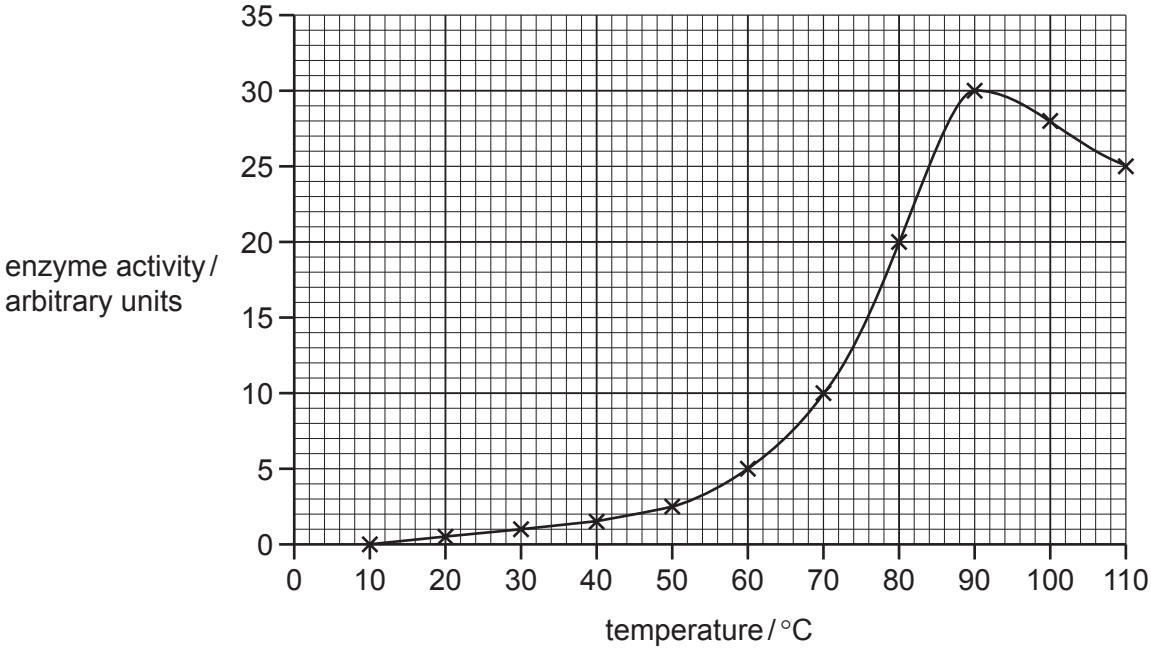

Fig. 3.1

Using the information in Fig. 3.1, describe the effect of increasing temperature on the activity of the enzyme.

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..... [3]

Enzymes extracted from bacteria are used in biological washing powders.

(b) Describe how bacteria are used to produce enzymes for biological washing powders.

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..... [4]

For Examiner's Use

(c) Food and blood stains on clothes may contain proteins and fats.

Explain how enzymes in biological washing powders act to remove food and blood stains from clothes.

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..... [4]

(d) When blood clots, an enzyme is activated to change a protein from one form into another.

Describe the process of blood clotting.

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..... [3]

[Total: 14]

For Examiner's Use

4 Fig. 4.1 is a photograph of a root of radish covered in many root hairs.

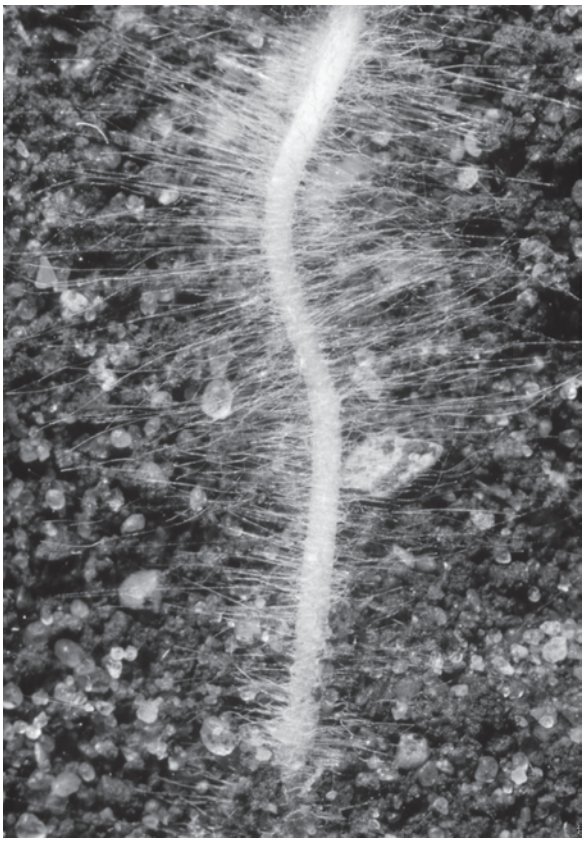

Fig. 4.1

(a) Using the term *water potential*, explain how water is absorbed into root hairs from the soil.

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..... [3]

For Examiner's Use

A potometer is a piece of apparatus that is used to measure water uptake by plants.

Most of the water taken up by plants replaces water lost in transpiration.

A student used a potometer to investigate the effect of wind speed on the rate of water uptake by a leafy shoot. As the shoot absorbs water the air bubble moves upwards.

The student's apparatus is shown in Fig. 4.2.

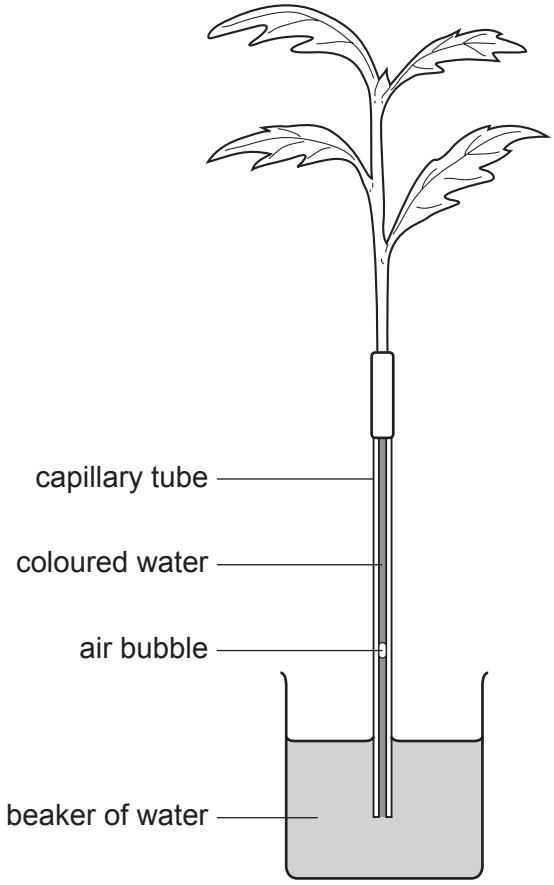

Fig. 4.2

The student used a fan with five different settings and measured the wind speed. The results are shown in Table 4.1.

For Examiner's Use

Table 4.1

wind speed / metres per second	distance travelled by the air bubble / mm	time / minutes	rate of water uptake / mm per minute
0	4	10	0.4
2	12	5	2.4
4	20	5	4.0
6	35	5	7.0
8	40	2	……

(b) Calculate the rate of water uptake at the highest wind speed and write your answer in the table.

[1]

(c) Describe the effect of increasing wind speed on the rate of water uptake. You may use figures from Table 4.1 to support your answer.

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..... [2]

(d) State two environmental factors, **other than wind speed**, that the student should keep constant during the investigation.

1. .....

2. ..... [2]

For Examiner's Use

(e) Some of the water absorbed by the plants is **not** lost in transpiration.

State two **other** ways in which water is used.

1. .....

2. ..... [2]

(f) Water moves through the xylem to the tops of very tall trees, such as giant redwoods of North America. The movement of water in the xylem is caused by transpiration.

Explain how transpiration is responsible for the movement of water in the xylem.

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..... [4]

(g) Plants that live in hot, dry environments show adaptations for survival.

State three **structural** adaptations of these plants.

1. .....

2. .....

3. ..... [3]

[Total: 17]

For Examiner's Use

5 **(a)** Define the term *gene*.

.....

..... [1]

The medical condition sickle cell anaemia is widely distributed in Africa, parts of Asia and the Americas. People with sickle cell anaemia have red blood cells with an abnormal form of haemoglobin.

The gene for haemoglobin exists in two forms:

H^N = allele for normal haemoglobin
H^S = allele for abnormal haemoglobin

(b) Complete the genetic diagram below to show how two people who are heterozygous for this gene may have a child who has sickle cell anaemia.

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

parental phenotypes	normal	x	normal
parental genotypes	……	x	…….
gametes	……	+	…….

child's genotype	……
child's phenotype	sickle cell anaemia

[3]

(c) Describe the effects of sickle cell anaemia on the body.

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For Examiner's Use

(d) Fig. 5.1 is a map that shows the distribution of the allele for the abnormal form of haemoglobin (**H^S**) and malaria in Africa.

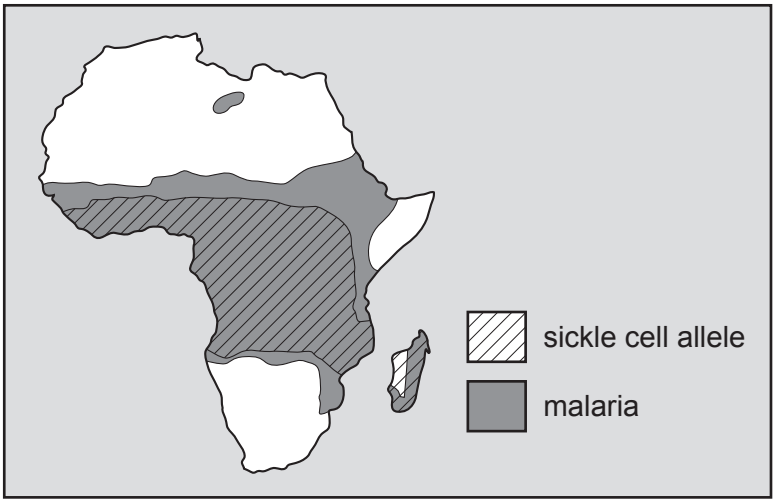

Fig. 5.1

Explain how natural selection is responsible for the distribution of the allele for the abnormal form of haemoglobin (**H^S**).

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(e) Sickle cell anaemia is an example of the variation that exists in the human population. It is a form of discontinuous variation.

Explain why sickle cell anaemia is a form of discontinuous variation.

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..... [3]

[Total: 16]

For Examiner's Use

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QUESTION 6 STARTS ON PAGE 16

For Examiner's Use

6 An agricultural student investigated nutrient cycles on a farm where cattle are kept for milk. The farmer grows grass and clover as food for the cattle. Clover is a plant that has bacteria in nodules in its roots.

Fig. 6.1 shows the flow of nitrogen on the farm as discovered by the student. The figures represent the flow of nitrogen in kg per hectare per year. (A hectare is 10 000 m^2.)

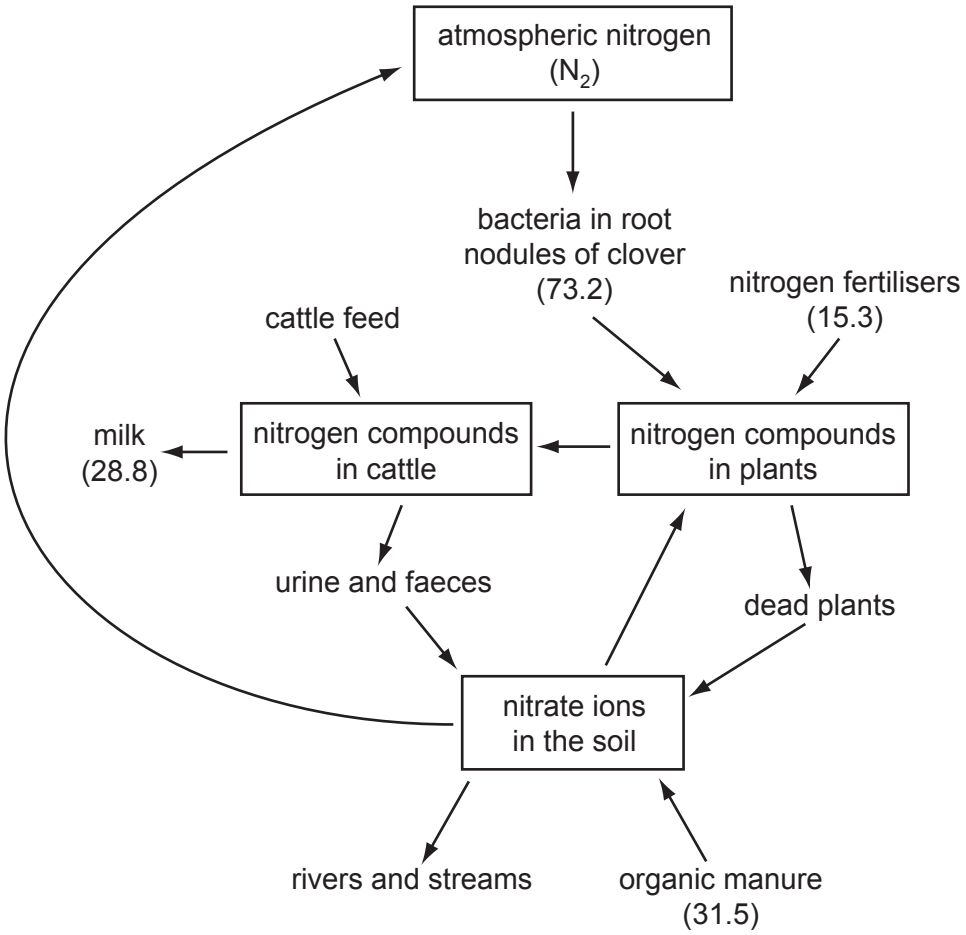

Fig. 6.1

(a) **(i)** Name the process in which bacteria convert atmospheric nitrogen into a form that is available to clover plants.

..... [1]

(ii) Name **two** processes that convert nitrogen compounds in dead plants into nitrate ions that can be absorbed by grass.

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

For Examiner's Use

(b) The total quantity of nitrogen added to the farmer's fields is 120 kg per hectare per year.

Calculate the percentage of this nitrogen that is present in the milk.

Show your working.

Answer = ...% [2]

(c) State two ways in which the nitrogen compounds in the cattle's diet are used by the animals **other than to produce milk**.

1. .....

2. ..... [2]

(d) The student found that a large quantity of the nitrogen compounds made available to the farmer's fields was not present in the milk or in the cattle.

Use the information in Fig. 6.1 to suggest what is likely to happen to the nitrogen compounds that are eaten by the cattle, but are **not** present in compounds in the milk or in their bodies.

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..... [5]

For Examiner's Use

(e) The carbon dioxide concentration in the atmosphere has increased significantly over the past 150 years.

Explain why this has happened.

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..... [2]

[Total: 14]

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Second Variant Question Paper

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

BIOLOGY **0610/32**

Paper 3 Extended **May/June 2009**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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For Examiner's Use	
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Total	

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Answer **all** the questions.

For Examiner's Use

1 Table 1.1 shows some of the external features of the five classes of vertebrates.

Complete the table by using a tick (✓) to indicate if each class has the feature or a cross (×) if it does not. The first row has been completed for you.

Table 1.1

feature	fish	amphibia	reptiles	birds	mammals
mammary glands	×	×	×	×	✓
fur / hair					
scales / scaly skin					
external ears					
feathers					

[4]

[Total: 4]

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For Examiner's Use

2 Fig. 2.1 shows the blood supply for the liver of a mammal.

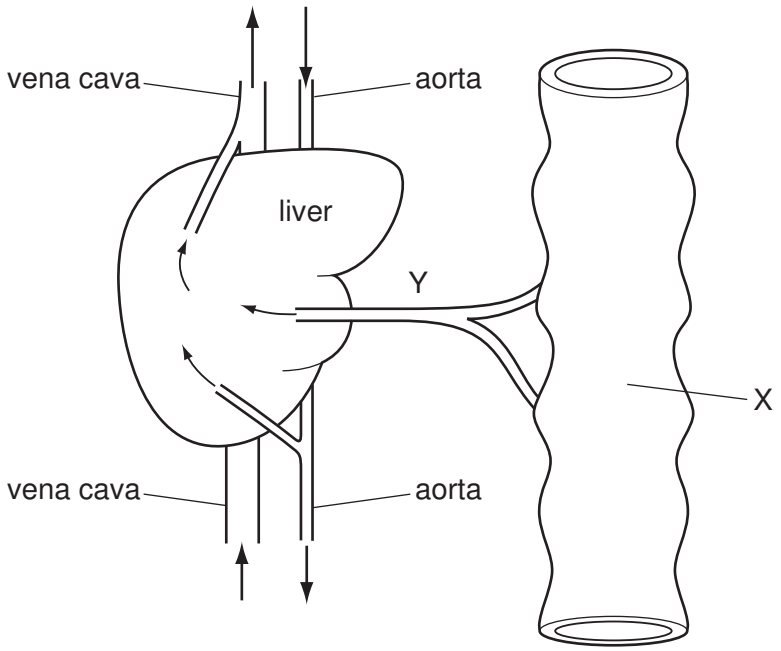

Fig. 2.1

(a) Blood from organ **X** is carried to the liver by blood vessel **Y**.

Name

(i) organ **X**,

..... [1]

(ii) blood vessel **Y**.

..... [1]

For Examiner's Use

Fig. 2.2 shows some liver cells as seen with a light microscope.

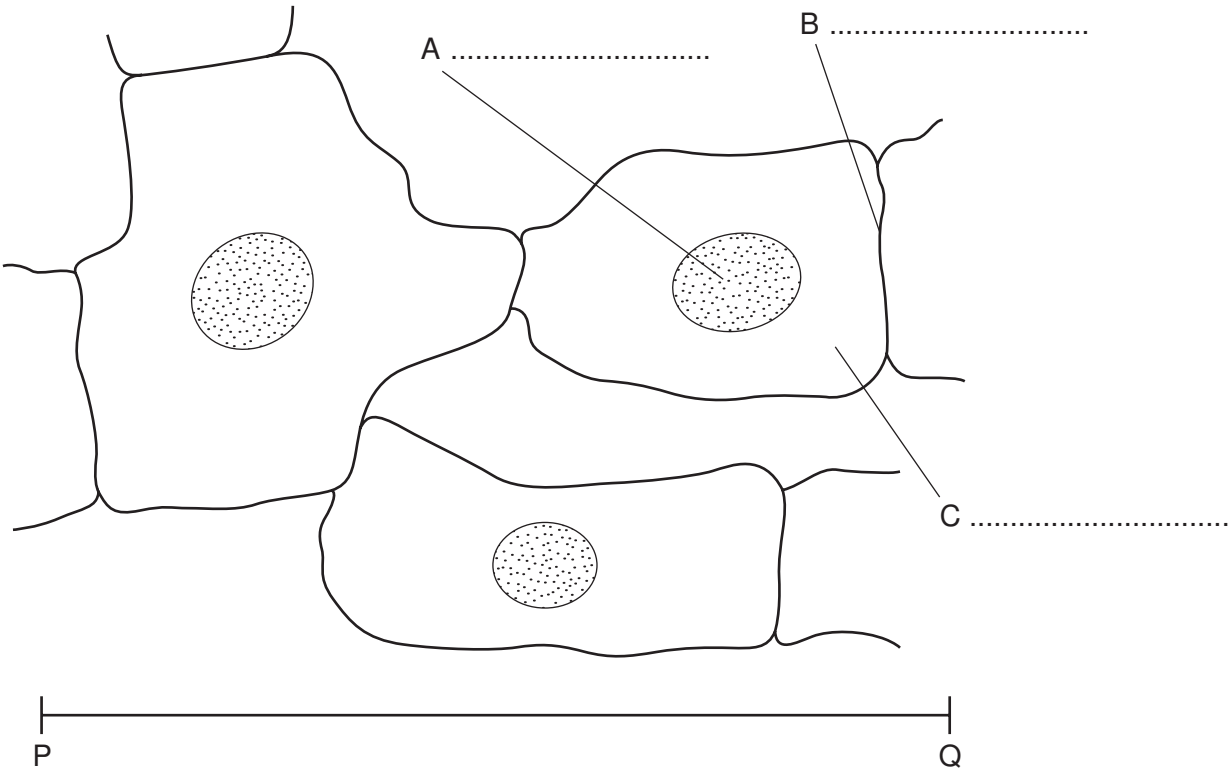

Fig. 2.2

(b) **(i)** Label, on Fig. 2.2, the structures **A**, **B** and **C**.

[3]

(ii) The distance **P-Q** is 0.06 mm.

Calculate the magnification of Fig. 2.2.

Show your working.

Magnification = x ..... [2]

Liver cells absorb glucose and amino acids from the blood and help to regulate the concentrations of these substances in the blood.

For Examiner's Use

(c) Explain how liver cells help to regulate the concentration of glucose in the blood in response to hormones from the pancreas in each of the following situations.

Blood glucose concentration is higher than normal.

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Blood glucose concentration is lower than normal.

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..... [5]

(d) Describe what happens to amino acids inside liver cells.

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..... [3]

[Total: 15]

For Examiner's Use

3 **(a)** Fig. 3.1 shows the activity of an enzyme produced by bacteria that live in very hot water.

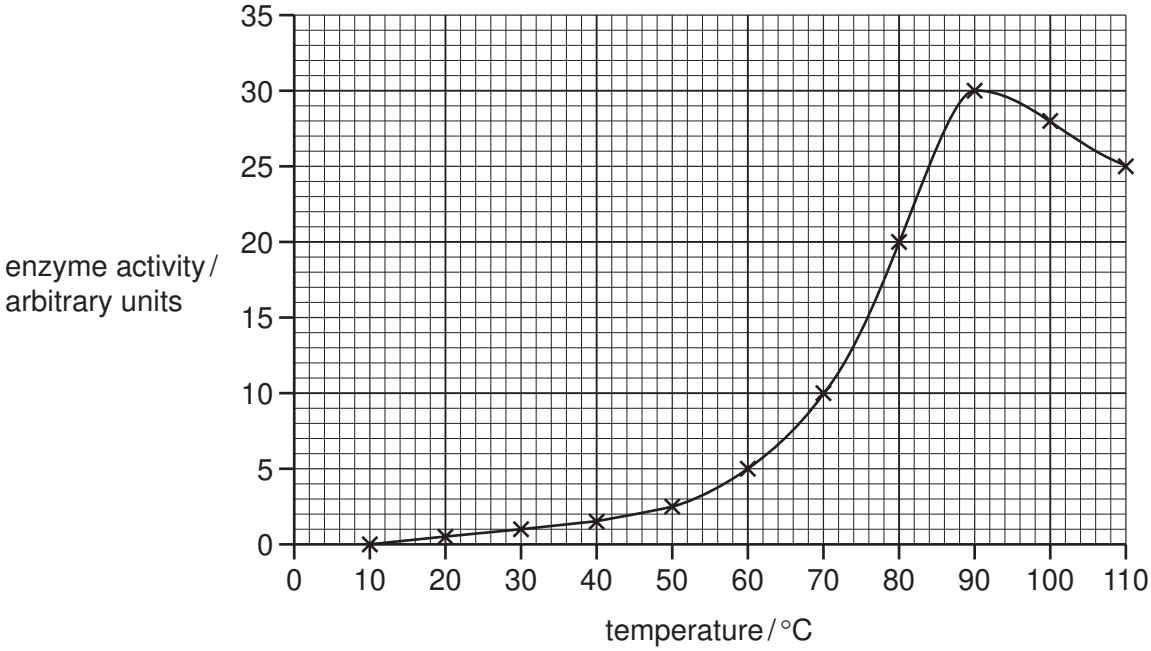

Fig. 3.1

Using the information in Fig. 3.1, describe the effect of increasing temperature on the activity of the enzyme.

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..... [3]

Enzymes extracted from bacteria are used in biological washing powders.

(b) Describe how bacteria are used to produce enzymes for biological washing powders.

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..... [4]

For Examiner's Use

(c) Food and blood stains on clothes may contain proteins and fats.

Explain how enzymes in biological washing powders act to remove food and blood stains from clothes.

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..... [4]

(d) When blood clots, an enzyme is activated to change a protein from one form into another.

Describe the process of blood clotting.

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..... [3]

[Total: 14]

For Examiner's Use

4 Fig. 4.1 is a photograph of a root of radish covered in many root hairs.

Fig. 4.1

(a) Root hairs absorb ions, such as nitrate ions and magnesium ions, from the soil by active transport.

Explain how ions are absorbed by active transport into root hairs.

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..... [3]

Many plants can be cultivated in nutrient solutions rather than in soil. This method of cultivation is called hydroponics. Using this method a student investigated the growth rate of radish plants.

Fig. 4.2 shows the apparatus that the student used.

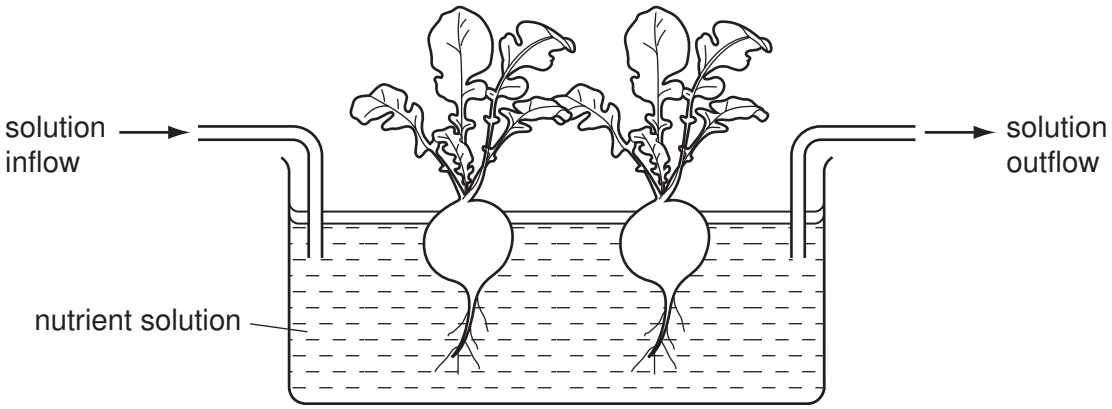

Fig. 4.2

The student determined the dry mass of 10 radish plants over a period of time and calculated the rate of growth of the plants. The results are shown in Table 4.1.

For Examiner's Use

Table 4.1

time / weeks	dry mass of 10 radish plants / grams	rate of growth / grams per week
1	1.3	1.3
2	6.2	4.9
3	17.5	11.3
4	20.4	2.9
5	26.7	……..
6	28.0	1.3

(b) Calculate the rate of growth of the radish plants during week 5 and enter your answer in Table 4.1. [1]

(c) Describe three factors that the student should keep constant during this investigation.

1. .....

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2. .....

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3. .....

..... [3]

(d) Describe how the student would find out the dry mass of the radish plants.

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..... [3]

For Examiner's Use

(e) The student also grew some radish plants in a solution that contained all the mineral ions required by plants **except nitrate**. The radish plants did not grow as well as those given all the mineral ions.

(i) Describe the appearance of plants grown without any nitrate ions.

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..... [2]

(ii) Outline how nitrate ions are used by plants to help their growth.

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..... [2]

(f) Plants also require magnesium ions. If plants are grown where there is very little magnesium available they show deficiency symptoms.

Explain how a deficiency of magnesium ions leads to poor growth in plants.

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..... [3]

[Total: 17]

For Examiner's Use

5 **(a)** Define the term *gene*.

.....

..... [1]

The medical condition sickle cell anaemia is widely distributed in Africa, parts of Asia and the Americas. People with sickle cell anaemia have red blood cells with an abnormal form of haemoglobin.

The gene for haemoglobin exists in two forms:

H^N = allele for normal haemoglobin
H^S = allele for abnormal haemoglobin

(b) Complete the genetic diagram below to show how two people who are heterozygous for this gene may have a child who has sickle cell anaemia.

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

parental phenotypes	normal	x	normal
parental genotypes	……	x	…….
gametes	……	+	…….

child's genotype	……
child's phenotype	sickle cell anaemia

[3]

(c) Describe the effects of sickle cell anaemia on the body.

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..... [4]

For Examiner's Use

(d) Fig. 5.1 is a map that shows the distribution of the allele for the abnormal form of haemoglobin ($\mathbf{H^S}$) and malaria in Africa.

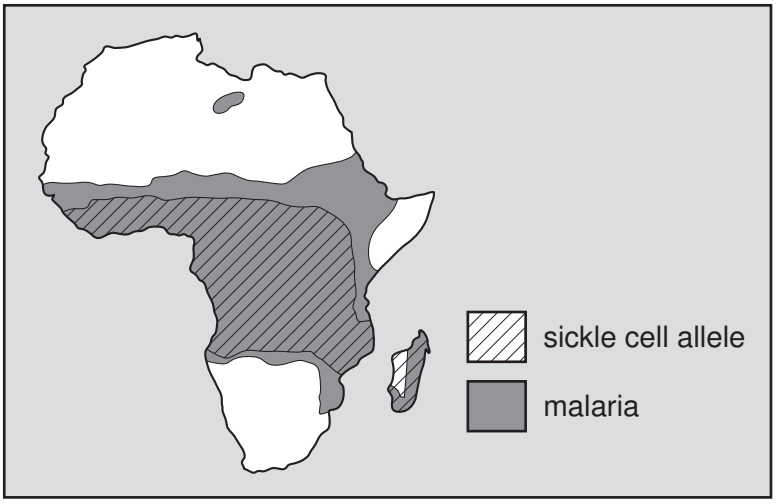

Fig. 5.1

Explain how natural selection is responsible for the distribution of the allele for the abnormal form of haemoglobin ($\mathbf{H^S}$).

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..... [5]

(e) Sickle cell anaemia is an example of the variation that exists in the human population. It is a form of discontinuous variation.

Explain why sickle cell anaemia is a form of discontinuous variation.

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..... [3]

[Total: 16]

For Examiner's Use

For Examiner's Use

6 An agricultural student investigated the flow of biomass and energy on a livestock farm in a country where winters are very cold. The farmer grows wheat to feed to the livestock, which are animals kept in sheds where they are not allowed to move very much. The student investigated the efficiency of this method of producing food for humans.

The student discovered that an area of 250 m^2 of wheat provided 140 kg of animal feed.

Table 6.1 shows the results of the student's investigation.

Table 6.1

area of wheat field / m^2	250
energy from the Sun that is available to the wheat crop / kJ	9×10^7
biomass of animal feed from the wheat crop / kg	140
energy in animal feed / kJ	2 000 000
increase in mass of animals fed 140 kg feed / kg	50
energy in 50 kg meat that is available to humans / kJ	380 000

(a) Table 6.1 shows how much energy the wheat crop receives from the Sun while it is growing in the field.

Suggest three reasons why only a small proportion of that energy is available in the animal feed from the harvested wheat.

1. .....

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2. .....

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3. .....

..... [3]

(b) Calculate the energy in the meat that is available to humans, as a percentage of the energy in the animal feed. Show your working.

Answer = ...% [2]

For Examiner's Use

(c) Using the information in Table 6.1, explain why it is more efficient for humans to gain their food from the first trophic level rather than from the second trophic level.

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(d) The student suggests to the farmer that it is better for the livestock if they are not kept in sheds. The farmer replies that his animals will grow more slowly if kept outside.

Describe two reasons why animals kept in sheds gain weight faster than those kept outside.

1. .....

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2. .....

..... [2]

(e) Explain why acid rain has become an important environmental problem in some parts of the world over the past 100 years.

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..... [2]

[Total: 14]

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