OCR

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Monday 19 May 2014 – Afternoon

GCSE GATEWAY SCIENCE
BIOLOGY B

B731/02 Biology modules B1, B2, B3 (Higher Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour 15 minutes

* B 7 3 1 0 2 *

* 1 1 6 3 7 8 7 6 9 7 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

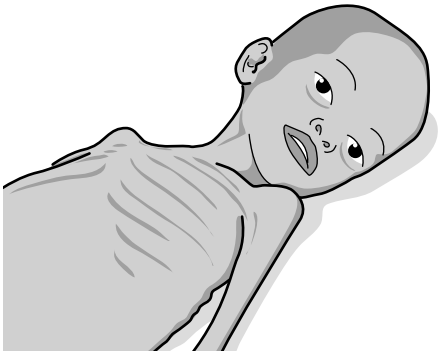
INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **75**.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** the questions.

SECTION A – Module B1

1 Look at the picture of Asad.



He is five years old and lives in Africa.

Asad suffers from marasmus, a disorder caused by starvation.

His muscles have wasted.

This is because his muscle protein is being used as an energy source due to the lack of food.

(a) (i) What molecules are proteins made of?

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

(ii) The estimated average daily requirement (EAR) for protein can be calculated using this formula.

EAR in g = 0.6 × body mass in kg

Asad has a body mass of 12.0 kg.

Use the formula to calculate Asad's EAR for protein.

Asad's EAR = ... g **[1]**

(iii) The usual EAR for protein for a five year old boy is 11 grams a day.

The usual EAR for protein for a fifteen year old boy is 34 grams a day.

Explain why the EARs are **not** the same.

.....

.....

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

(b) Beta thalassaemia is caused by a **recessive** allele.

Asad's sister has beta thalassaemia but Asad does **not**.

His parents do **not** have beta thalassaemia.

Asad's mother is pregnant.

What is the probability of this child having beta thalassaemia?

Draw a genetic diagram to explain your answer.

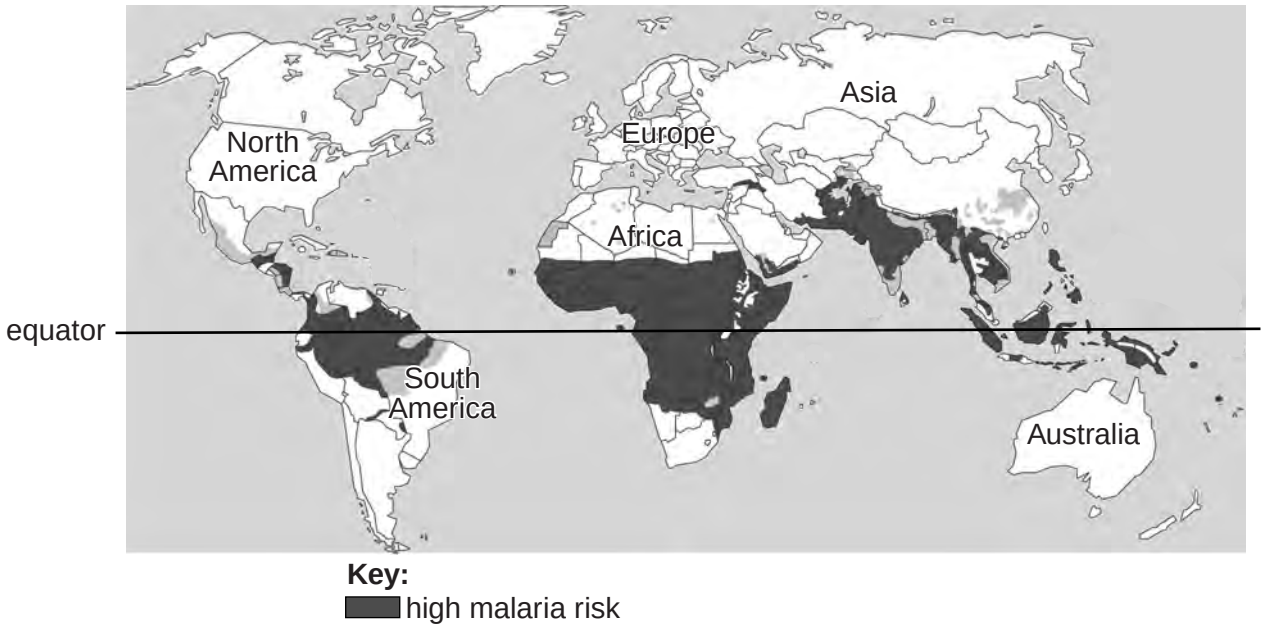
(Use **T** for the dominant allele and **t** for the recessive allele.)

probability of this child having beta thalassaemia ..... **[3]**

[Total: 7]

2 This question is about malaria.

The map shows areas of the world where humans are at high risk from malaria.



(a) (i) Malaria is spread by mosquitoes.

Describe how.

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

(ii) In countries around the equator, pools of water are sprayed with insecticides to reduce the spread of malaria.

Explain how this reduces the spread of malaria.

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

(b) Malaria causes a fever.

The body temperature is very high during a fever and this may cause death.

Describe how high body temperatures can cause death.

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

[Total: 6]

3 This question is about diabetes.

Jessica is an athlete. She has diabetes.

Jessica can help control her blood sugar levels by controlling her diet.

She must **also** inject herself with insulin every day.

(a) Write down which type of diabetes Jessica has.

.....

Explain your answer.

.....

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

(b) Jessica needs to change the amount of insulin she injects during each day.

Jessica plans a training run immediately after breakfast.

Explain how this changes the amount of insulin she would need to inject.

.....

.....

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

[Total: 3]

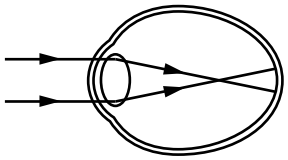
4 Kevin and Jeanette have different eyesight problems.

Look at the diagram.

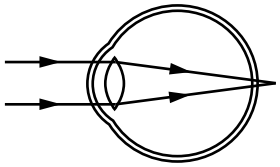
It shows how light is focused in each of their eyes.

how light is focused in eye

Kevin



Jeanette



Kevin and Jeanette both wear glasses.

Jeanette wants to have corneal surgery to correct her eyesight.

Kevin is not sure if he wants corneal surgery.

Explain why Kevin and Jeanette need to wear glasses and suggest reasons for and against having corneal surgery.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

[Total: 6]

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Question 5 begins on page 8

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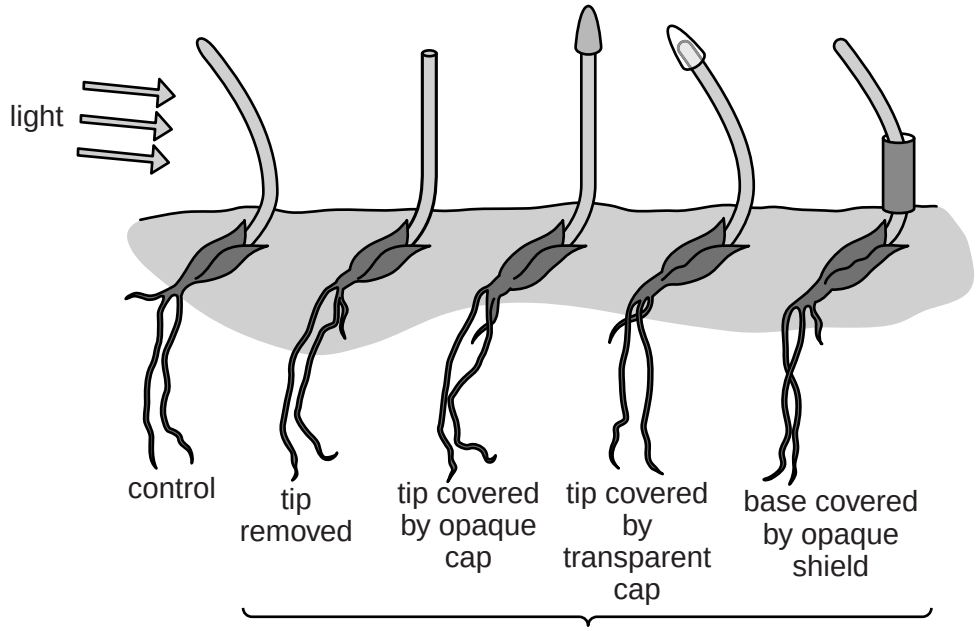
5 This question is about phototropism.

(a) Look at the diagram.

It shows the results obtained by Charles Darwin and his son in 1880.

Their results led to the discovery of a group of plant hormones called auxins and their effect on plant growth.



Darwin and Darwin (1880)

Explain how these results show **where** auxin is made.

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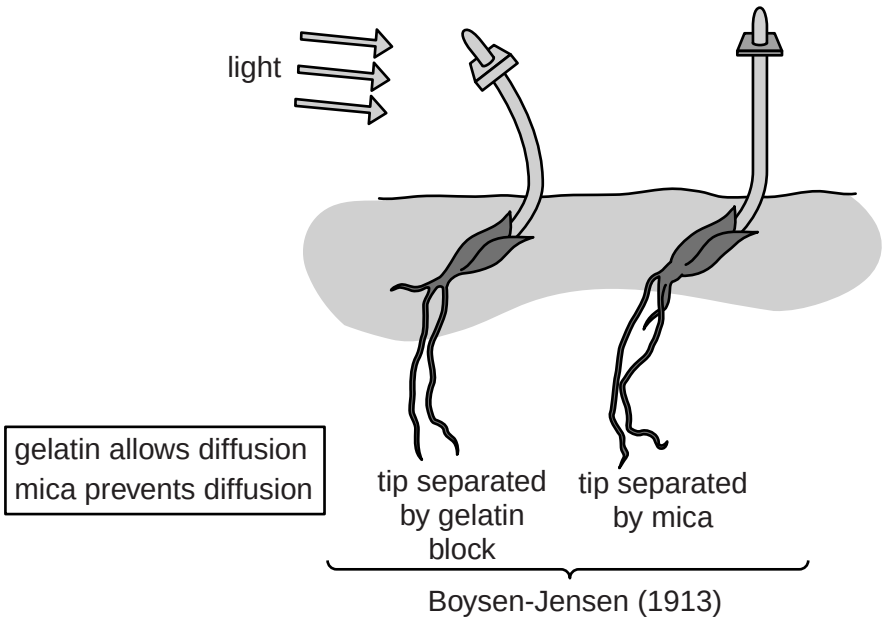
..... **[1]**

(b) In 1913, Boysen-Jensen also investigated phototropism.

The diagram shows his results.



Explain how these results show **how** auxin moves.

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

(c) Explain what both sets of results show about the link between the distribution of auxin and cell elongation.

.....

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

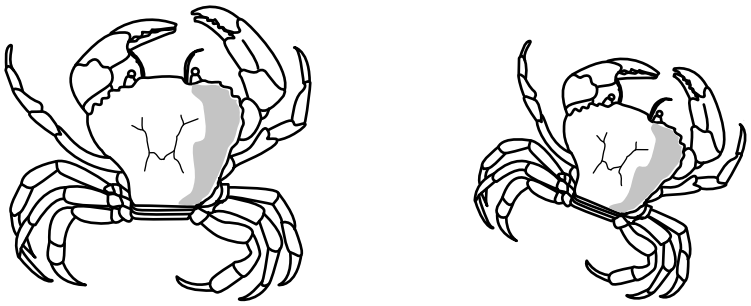
[Total: 3]

SECTION B – Module B2

6 This question is about classification.

(a) Biologists use visible features to classify animals.

Look at the picture of two crabs.



(i) The crabs in the picture are able to breed with each other and produce fertile offspring.

What is the **smallest** group the two crabs could be classified into?

Put a tick (✓) in the box next to the correct answer.

family	☐
genus	☐
kingdom	☐
order	☐
phylum	☐
species	☐

[1]

(ii) Crabs belong to a class of arthropods.

Biologists often find it difficult to place organisms into definite groups just on visible features.

Explain why.

.....

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

(b) Biologists have used two types of classification system.

One is called **natural** and the other is called **artificial**.

Explain the difference between these two systems.

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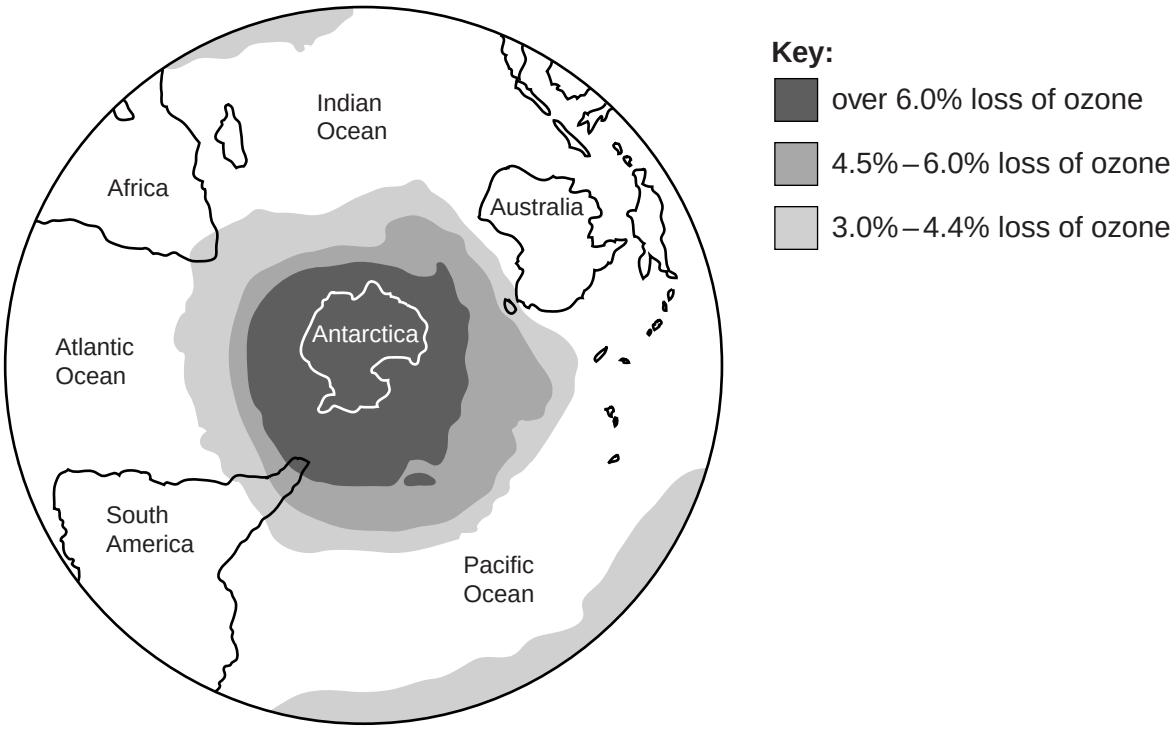
..... **[2]**

[Total: 4]

7 This question is about pollution.

(a) Look at the picture.

It shows the loss of ozone from the Earth's atmosphere.



(i) Write about the reasons why ozone is being lost from the atmosphere.

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

(ii) People live in Africa, South America and Australia.

Parts of each of these continents are affected by the loss of ozone.

People in one of these three continents will be **most** affected by the loss of ozone.

Use the diagram to decide which continent this is **and** explain how the people will be affected.

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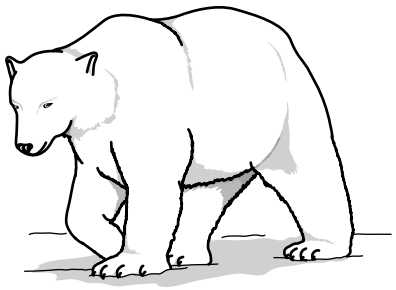
..... **[2]**

(b) Global warming has been linked to the melting of the Arctic ice cap.

Polar bears live in the Arctic regions.



Polar bears and killer whales feed on seals.

Polar bears compete with other polar bears for seals.

They also compete with killer whales for seals.

What is the main difference between these two types of competition and if the ice cap continues to melt, explain which type of competition will be most significant for polar bears.

The quality of written communication will be assessed in your answer to this question.

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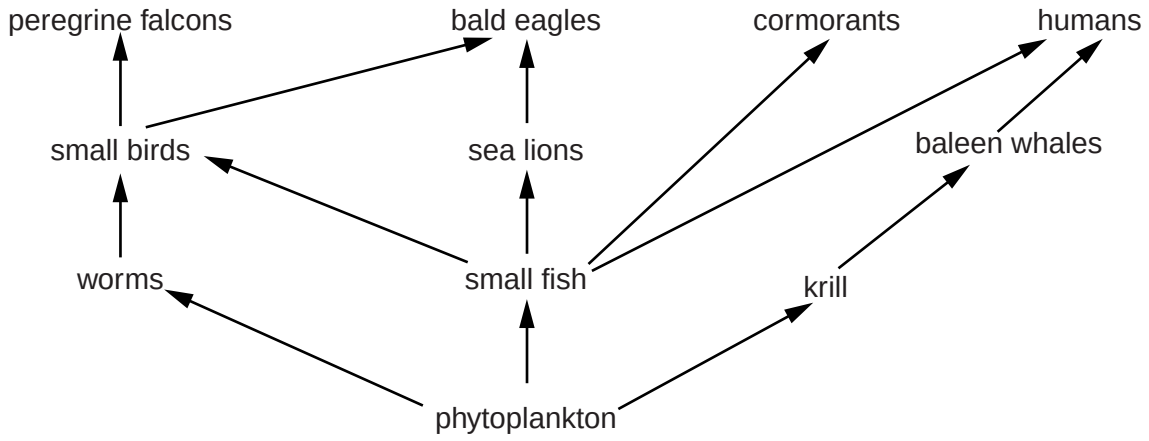
..... **[6]**

[Total: 10]

8 Look at the food web.



(a) (i) This is one of the food chains from the food web.

It shows the relative biomass at each stage.

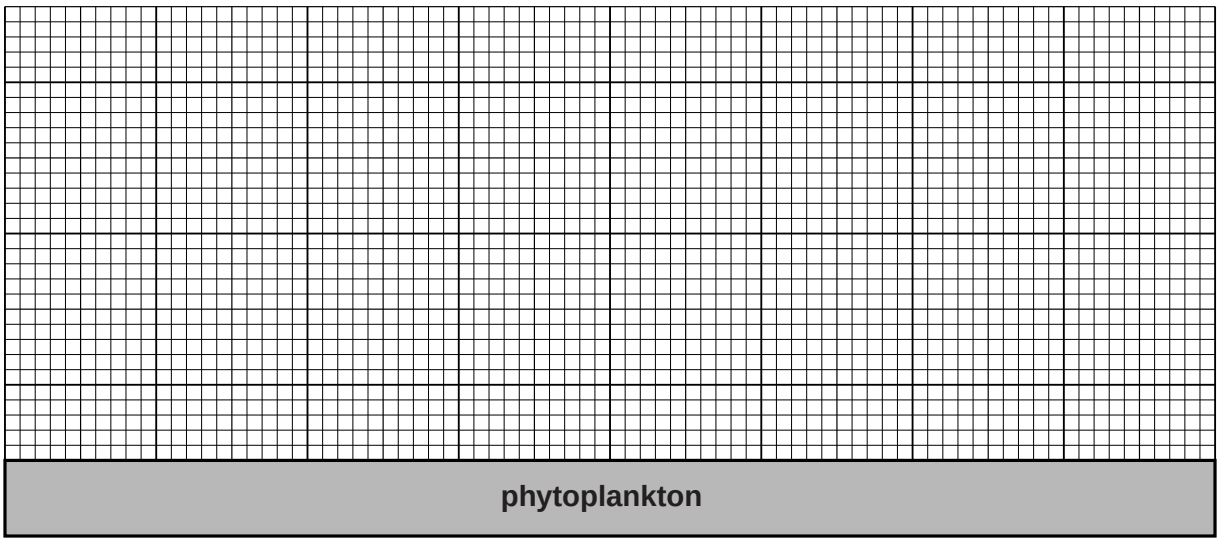
	phytoplankton	→ small fish	→ cormorants
dry biomass	**8000**	**800**	**80**

A pyramid of biomass can be drawn to describe this food chain.

Finish the pyramid of biomass to include the small fish and the cormorants.

Make sure the bars are drawn **to scale** and **labelled**.

The bar for phytoplankton has been drawn for you.



[2]

(ii) Here is another food chain in this food web.

phytoplankton ⟶ krill ⟶ baleen whales ⟶ humans

Biologists would have great difficulty in collecting the data for the pyramid of biomass for **this** food chain.

Explain why.

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

(b) The bald eagle was an endangered bird in the USA.

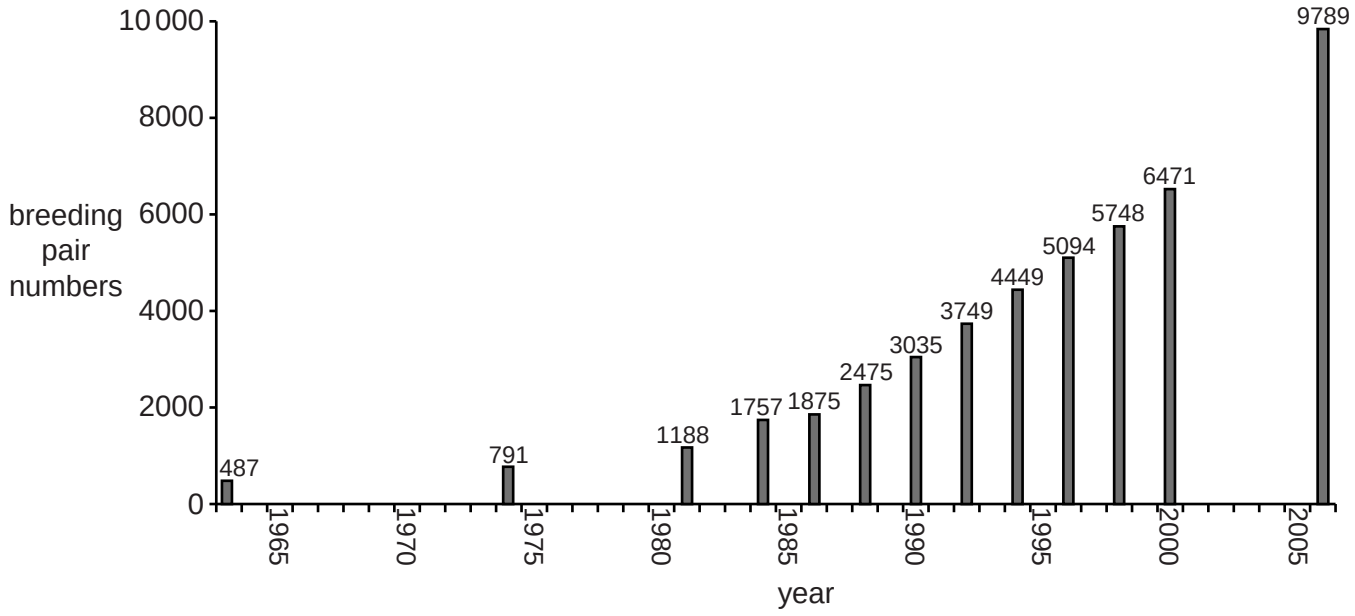
It has had legal protection since 1940.

From 1963 until 2006, surveys of bald eagle breeding pairs were done.

In 2007 the bald eagle was removed from the USA list of endangered species.

Look at the graph.

bald eagle breeding pairs from 1963 to 2006



Use the evidence in the graph to suggest why the bald eagle was at risk of extinction and why it has now been removed from the endangered list.

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

[Total: 7]

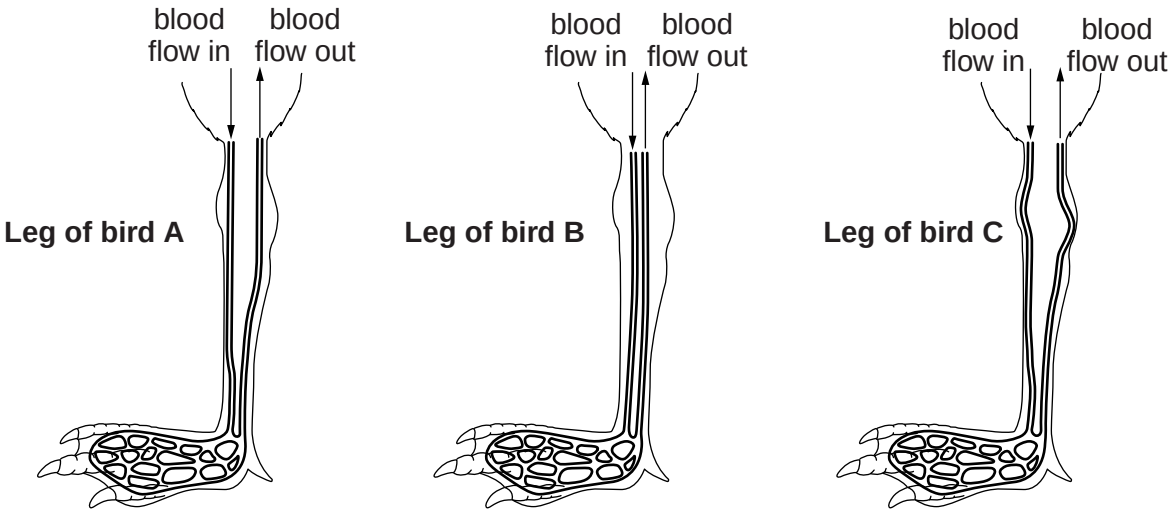
9 Penguins can live in very cold conditions.

(a) Penguin eggs will not freeze until the temperature is well below 0 °C.

Suggest what prevents the eggs from freezing.

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

(b) Look at the diagrams showing blood flow in the legs of three different birds.



Which diagram shows the best blood flow for a penguin?.....

Explain your answer.

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

[Total: 4]

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Question 10 begins on page 18

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SECTION C – Module B3

10 This question is about DNA.

Erwin Chargaff was an Austrian scientist.

His work was important in helping James Watson and Francis Crick work out the structure of DNA.

Chargaff discovered that, in any piece of DNA, the number of **A** bases is always the same as the number of **T** bases.

Also the number of **C** bases is always the same as the number of **G** bases.

(a) In one piece of DNA, 27% of the bases are **A**.

Use Chargaff's discovery to work out the percentages of each of the other bases.

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

(b) Suggest how Chargaff's discovery helped Watson and Crick work out the structure of DNA.

.....

.....

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

(c) In 1962, Watson, Crick and another scientist, Maurice Wilkins, received a Nobel prize for their discovery of the structure of DNA.

Controversially, other scientists whose work had helped Watson and Crick did **not** receive the prize. These included Chargaff.

Some people think that Chargaff should have been included in the group receiving the Nobel prize.

(i) Suggest **one** reason why he should have been included in the group.

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

(ii) Suggest **one** reason why he should **not** have been included in the group.

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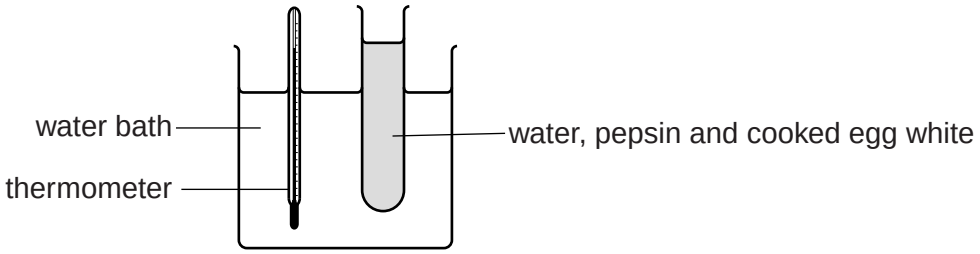
..... **[1]**

[Total: 6]

11 (a) Egg white contains protein.

Natasha is investigating how a protein-digesting enzyme, called pepsin, breaks down cooked egg white.



The pepsin breaks down the cooked egg white.

This makes the mixture in the test tube change from white to colourless.

Natasha times how long it takes for the mixture to go colourless at different temperatures.

She keeps everything else the same.

The table shows her results.

Temperature in °C	**Time for mixture to go colourless in minutes**
20	14
25	9
30	6
35	3
40	3
45	6

(i) Look at the results. What is the optimum temperature for the pepsin?

..... °C **[1]**

(ii) Describe and explain what results you would expect as the temperature increases **above** 45 °C.

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

(b) Proteins have many jobs in the body.

(i) Proteins can be broken down in aerobic respiration.

They have a respiratory quotient (RQ) of 0.9.

$$\text{Respiratory quotient (RQ)} = \frac{\text{volume of carbon dioxide produced}}{\text{volume of oxygen used}}$$

When proteins are used in respiration, how does the volume of carbon dioxide produced compare with the volume of oxygen used?

Put a tick (✓) in the box by the correct answer.

The volume of carbon dioxide is greater than the volume of oxygen. ☐

The volume of carbon dioxide is less than the volume of oxygen. ☐

The volume of carbon dioxide is the same as the volume of oxygen. ☐

[1]

(ii) Apart from being used in respiration, proteins have many other jobs in the body.

Write about **other** jobs of proteins.

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

[Total: 8]

12 The picture shows Dolly the sheep.

Dolly grew from an embryo implanted into a surrogate mother sheep.

(a) As the embryo grew, its cells divided.

Write down the name of this type of cell division.

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

(b) Describe the cloning technique that scientists used to produce the embryo that grew into Dolly.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

[Total: 7]

13 During war time, some emergency transfusions were made using the watery juice from coconuts.

This was done to raise the blood pressure of wounded soldiers who had lost a lot of blood.

Coconut juice was used because it is at the right concentration and is sterile.

(a) Why is it important to raise the blood pressure of patients who have lost a lot of blood?

.....

.....

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

(b) You might expect lactic acid to build up more quickly in patients who have had transfusions with coconut juice than in patients who have had transfusions with blood.

Explain why.

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

[Total: 4]

END OF QUESTION PAPER

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