

**Friday 17 June 2016 – Morning**

**GCSE GATEWAY SCIENCE  
BIOLOGY B**

**B732/02** Biology modules B4, B5, B6 (Higher Tier)

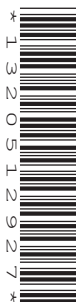
Candidates answer on the Question Paper.  
A calculator may be used for this paper.

**OCR supplied materials:**  
None

**Other materials required:**

- Pencil
- Ruler (cm/mm)

**Duration:** 1 hour 30 minutes



|                       |  |                      |  |
|-----------------------|--|----------------------|--|
| Candidate<br>forename |  | Candidate<br>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. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- 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 **85**.
- This document consists of **32** pages. Any blank pages are indicated.

Answer **all** the questions.

### SECTION A – Module B4

- 1 Jo buys an apple tree and plants it in her garden.

However, she forgets to water it for the first month.

The first picture shows the tree when she first plants it.

The second picture shows the tree a month later.



apple tree when first planted

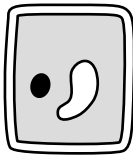


apple tree one month later

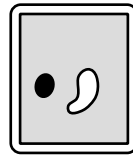
- (a) Look at the pictures of four leaf cells.



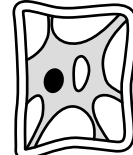
A



B



C



D

- (i) What will the leaf cells from the apple tree look like after a month without watering?

Choose from **A**, **B**, **C** or **D**.

..... [1]

- (ii) What word describes the cells from the apple tree after a month without watering?

..... [1]

- (b) Jo waters the tree and then gives it some fertiliser.

The tree roots absorb the minerals in the fertiliser by **active transport**.

Explain what active transport is.

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..... [2]

[Total: 4]

A stylized illustration of a large, leafy tree with a thick trunk and a smaller branch on the right side. The tree is rendered in a simple, graphic style with a thick, textured trunk and a dense, rounded canopy of leaves. A smaller, thinner branch extends from the main trunk towards the right side of the frame. The background is plain white, and the tree is positioned on a simple horizontal line representing the ground.

**(a)** Bristlecone pine trees live high up in the mountains.

This is because these conditions affect both transpiration and photosynthesis.



..... [6]

- (b) When bristlecone pine trees die the wood does **not** rot.

The wood is full of thick sap called resin.

This means the wood does **not** easily absorb oxygen or water.

Use this information to help explain why the wood does **not** rot.

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..... [2]

- (c) As a bristlecone pine tree gets older, much of its wood dies.

In old trees only a narrow strip of functioning tissue transports substances between the roots and the leaves.

What types of cells will be in this tissue?

Write down the names of these types of cells and what substances each type of cell transports.

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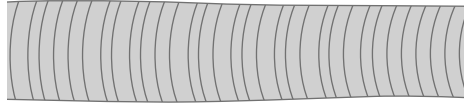
..... [4]

(d) Scientists worked out Methuselah's age.

They drilled a narrow core from the trunk and then counted the rings.

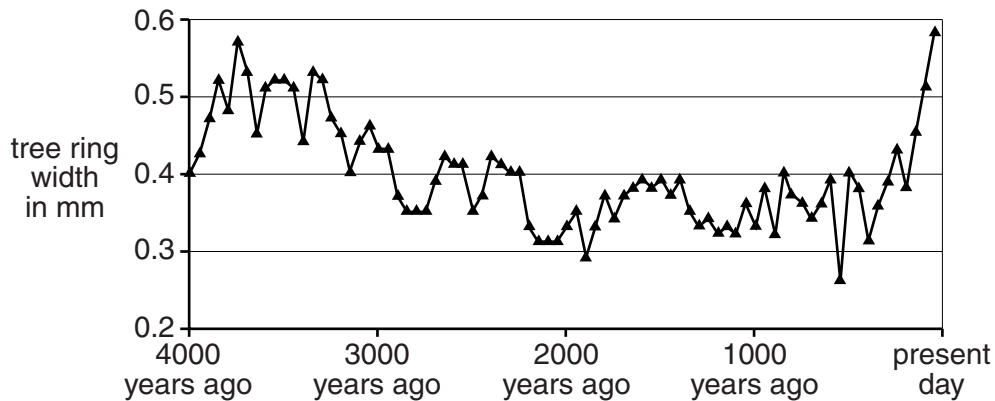
Each ring shows one year's growth.

The wider a ring, the more growth in that year.



**core showing tree rings**

The graph shows the average tree ring widths from a sample of bristlecone pine trees in California.



(i) A scientist concludes that the graph shows an increase in tree ring width.

Look at the graph.

How well does the data support the scientist's conclusion?

Explain your answer.

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..... [2]

- (ii) Many factors affect the width of the tree rings.

One of these factors is temperature. Higher temperatures mean wider rings.

The scientist says, "The data from this sample **proves** global warming has happened".

Do you agree?

Explain your answer.

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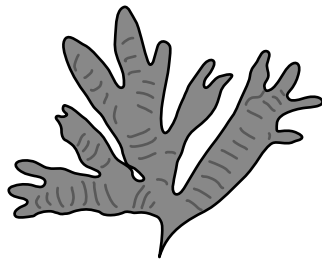
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[Total: 16]

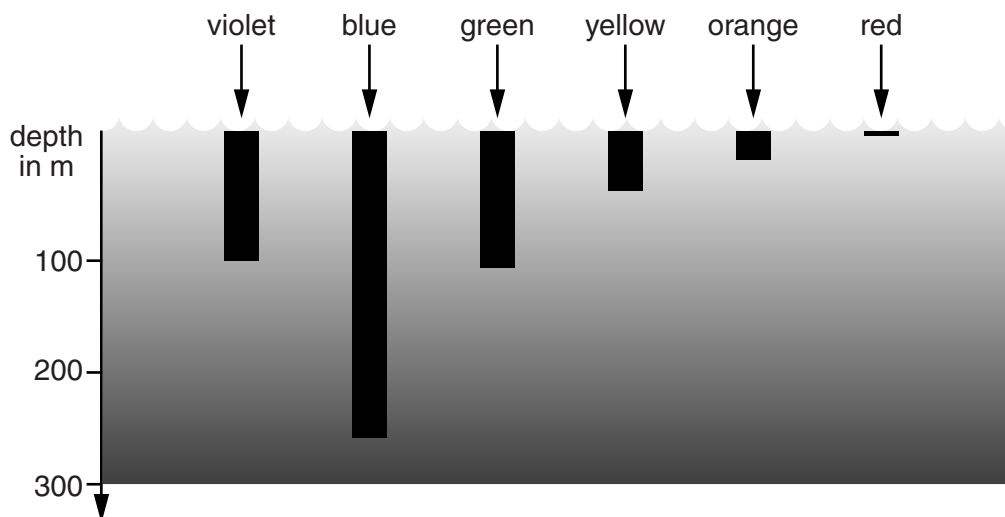
- 3** There are three main types of seaweed, called red, green and brown seaweed. They are different colours because they contain different pigments. The picture shows some red seaweed.



- (a)** White light from the sun is made of light of different colours.

Look at the diagram.

It shows how deep light of different colours can go in sea water.



The colour of the pigments in seaweed is the colour of the light they reflect, **not** the colour of the light they absorb.

Red seaweed can live at greater depths than green or brown seaweeds.

Use the diagram to explain why red seaweed can live at greater depths.

[3]

(b) The pigment in red seaweed is called phycoerythrin.

Phycoerythrin is a protein.

Write down **four** elements that **all** proteins contain.

1 .....

2 .....

3 .....

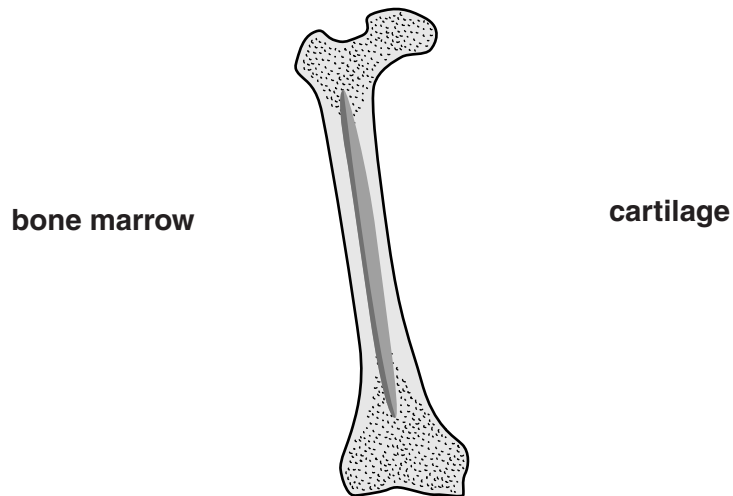
4 .....

[2]

[Total: 5]

## SECTION B – Module B5

- 4 (a) The diagram shows a section through the femur bone of the human leg.



Add lines from the labels to show:

- (i) one position where **cartilage** is found
- (ii) one position where **bone marrow** is found.

[2]

- (b) Each end of the femur has a different type of joint.

Explain how the range of movement is different in these two joints.

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..... [2]

- (c) Over the age of 45 the chance of fracturing a bone in a fall increases with age.

The table shows the risk of this type of damage occurring.

|                    |       | body mass in kg |       |               |       |       |          |       |       |
|--------------------|-------|-----------------|-------|---------------|-------|-------|----------|-------|-------|
|                    |       | 40–44           | 45–49 | 50–54         | 55–59 | 60–64 | 65–69    | 70–74 | 75–79 |
| age<br>in<br>years | 45–49 |                 |       |               |       |       |          |       |       |
|                    | 50–54 |                 |       |               |       |       | low risk |       |       |
|                    | 55–59 |                 |       |               |       |       |          |       |       |
|                    | 60–64 |                 |       |               |       |       |          |       |       |
|                    | 65–69 |                 |       | moderate risk |       |       |          |       |       |
|                    | 70–74 |                 |       |               |       |       |          |       |       |
|                    | 75–79 | high risk       |       |               |       |       |          |       |       |
|                    | 80–84 |                 |       |               |       |       |          |       |       |
|                    | 85–89 |                 |       |               |       |       |          |       |       |

- (i) Victoria is concerned that a fall may cause her femur to fracture.

Victoria is 72 years old and has a body mass of 67 kg.

By how much does Victoria's body mass need to increase for her to be at low risk?

..... [1]

- (ii) Over the age of 45, as you get older, a fall is more likely to cause a fracture.

Explain why.

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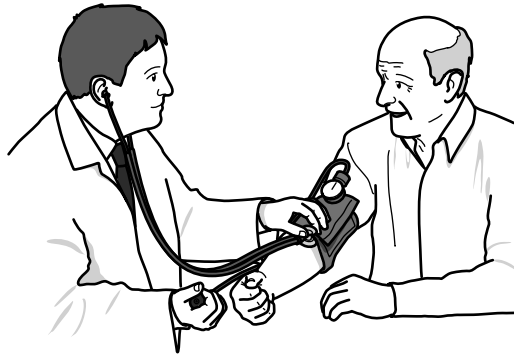
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..... [2]

[Total: 7]

5 Tim is seeing a doctor about his heart.



(a) The doctor says that Tim's heart muscle is not getting enough blood.

This is because he has a blockage in one of his coronary arteries.

The doctor tells Tim that he needs an operation.

Put a tick (✓) next to the type of surgery that can treat this problem.

a by-pass operation

☐

a valve replacement

☐

inserting a pacemaker

☐

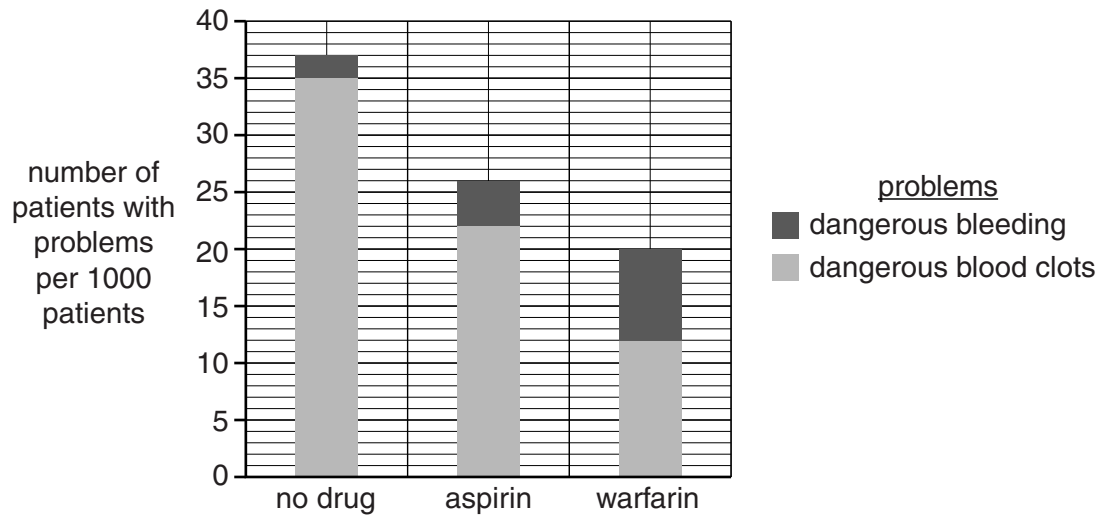
inserting a 'heart assist' device

☐

[1]

**(b)** After his operation Tim will regularly need to take a drug like aspirin or warfarin.

His doctor shows him this graph.



Warfarin reduces the rate at which fibrin is made.

Aspirin stops platelets gathering together in blood vessels.

Explain why aspirin and warfarin have the effects shown in the graph and how the graph convinces Tim that he should take one of these drugs.



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

..... [6]

- (c) Tim may need a blood transfusion during his operation.

He knows that he has **blood group O**.

- (i) Put a tick (✓) in **one** box in this table to show both the antigens and antibodies present in Tim's blood.

|                  |              | Antibodies present |        |                   |                        |
|------------------|--------------|--------------------|--------|-------------------|------------------------|
|                  |              | anti-A             | anti-B | anti-A and anti-B | no anti-A<br>no anti-B |
| Antigens present | A            |                    |        |                   |                        |
|                  | B            |                    |        |                   |                        |
|                  | A and B      |                    |        |                   |                        |
|                  | no A<br>no B |                    |        |                   |                        |

[2]

- (ii) Explain what would happen in Tim's blood if he was transfused with group A blood.

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..... [2]

[Total: 11]

**15**  
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**PLEASE DO NOT WRITE ON THIS PAGE**

**6** The skin is an organ of excretion.

It excretes water from the body in sweat.

Two athletes run in a long race.

They measure their body mass before and after the race.



**Leroy**



**Sanchez**

body mass before race (in kg)

90

64

body mass after race (in kg)

88

60

If a person loses too much water it can make them dehydrated.

The level of dehydration can be worked out using this table.

| Percentage change in body mass | Level of dehydration  | Symptoms                      |
|--------------------------------|-----------------------|-------------------------------|
| +1.0 to -1.0                   | no dehydration        | —                             |
| -1.1 to -3.0                   | slightly dehydrated   | dry lips, thirsty             |
| -3.1 to -5.0                   | moderately dehydrated | muscles work less efficiently |
| -5.1 to -8.0                   | very dehydrated       | muscle spasms and cramps      |

**(a)** Leroy works out that his percentage change in body mass was **-2.2%**.

Work out Sanchez's percentage change.

Use the table to explain which person was most likely to have finished the race.

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

- (b) After the race the two athletes need to replace the liquid that they have lost.

Leroy drinks enough water to replace the water lost.

Sanchez also drinks enough liquid but he drinks an isotonic sports drink.

This contains glucose and is at the same concentration as his blood.

- (i) The glucose is absorbed into Sanchez's blood stream in the small intestine.

Describe how the small intestine is adapted for rapid absorption.

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..... [2]

- (ii) The two athletes drink the liquids at the same time.

During the next few hours Leroy produces more urine than Sanchez.

Explain why.

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..... [3]

[Total: 7]

## SECTION C – Module B6

- 7 The enzyme invertase (sucrase) breaks down sucrose sugar into glucose and fructose sugars.

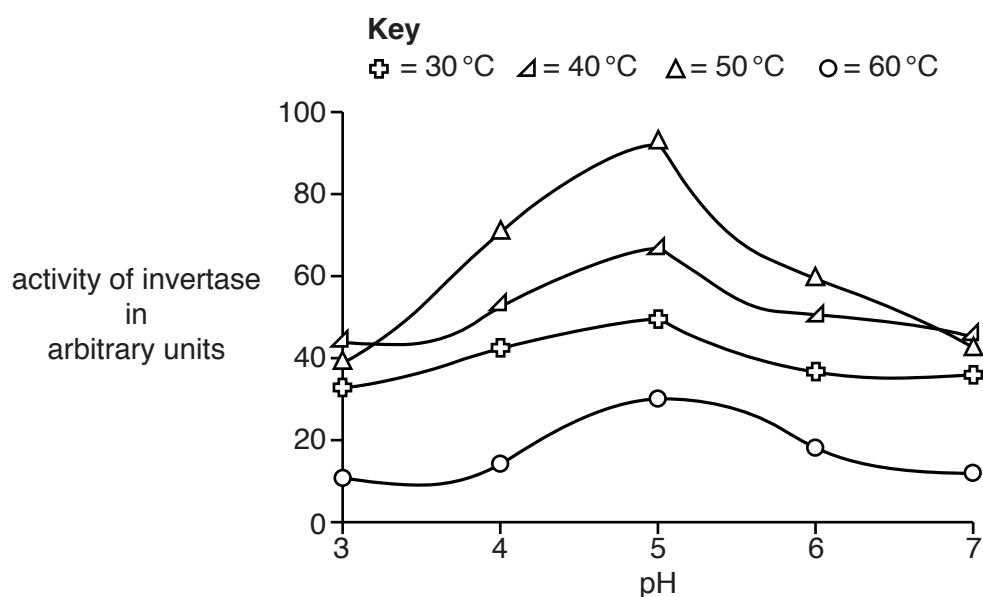
Glucose and fructose taste sweeter than sucrose and are used in the food industry.

Scientists have investigated what the best conditions are for using invertase in a food factory.

They tested invertase that had been **immobilised**, as well as invertase that was **free** (not immobilised).

- (a) Look at **Graph 1**.

It shows the activity of **immobilised** invertase at different pHs and temperatures.

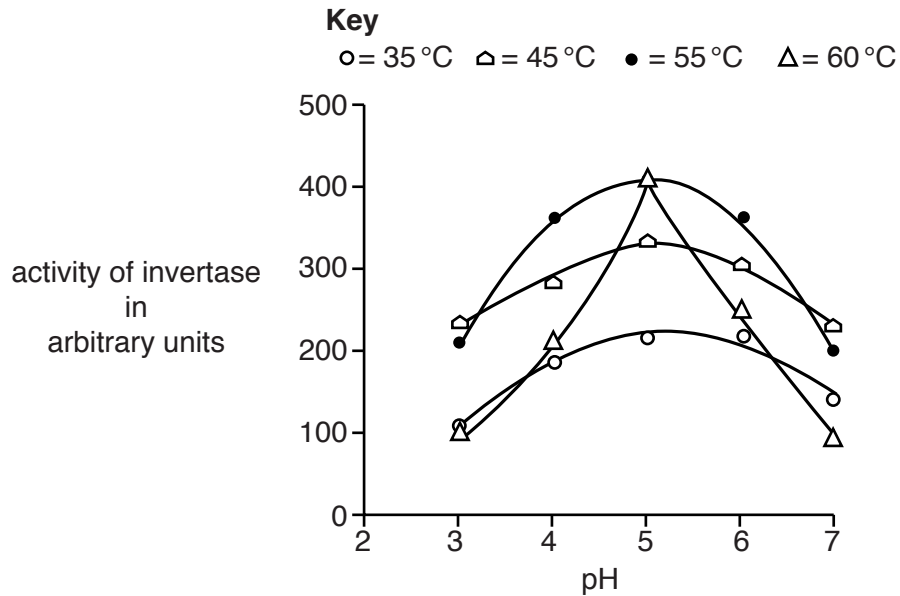


What are the best conditions for immobilised invertase to work?

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

(b) Look at **Graph 2**.

It shows the activity of **free** invertase at different pHs and temperatures.



**Graph 2** shows that free invertase at 55 °C at pH5 and free invertase at 60 °C at pH5 both have the same high activity.

The scientists recommend 55 °C and pH5 as the best conditions for free invertase to work at.

Suggest reasons why the scientists recommend 55 °C rather than 60 °C.

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..... [2]

(c) The scientists have to decide whether to use immobilised enzymes or free enzymes in the factory.

Explain an advantage of each type of enzyme.

Use data from **Graph 1** and **Graph 2**, as well as your own biological knowledge.

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..... [2]

- (d) Glucose and fructose taste sweeter than sucrose.

Explain the advantage of using glucose and fructose in the food industry, rather than sucrose.

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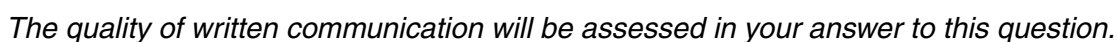
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[Total: 7]

### Graph A – Arctic



..... [6

. [6]

**[Total: 6]**

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- 9 Landfill rubbish dumps produce biogas called landfill gas.

Landfill gas is produced by anaerobic bacteria as they break down waste.

The gas can be released into the air or burned off to provide heat.

Landfill gas contains approximately 50% methane.

Landfill gas can be upgraded by removing carbon dioxide and other gases to produce a gas called biomethane.

Biomethane is very similar to natural gas.

- (a) Look at the table.

|                     | <b>Methane<br/>%</b> | <b>Carbon dioxide<br/>%</b> | <b>Other gases<br/>%</b> | <b>Energy<br/>in MJ/kg</b> |
|---------------------|----------------------|-----------------------------|--------------------------|----------------------------|
| <b>Landfill gas</b> | 50                   | 40                          | 10                       | 12                         |
| <b>Biomethane</b>   | 97                   | 3                           | trace                    | 48                         |
| <b>Natural gas</b>  | 97                   | 3                           | trace                    | 48                         |

Suggest **two** advantages and **one** disadvantage of using biomethane compared with landfill gas and natural gas.

Use information from the table as well as your own biological knowledge in your answer.

Advantage 1 .....

.....

Advantage 2 .....

.....

Disadvantage .....

.....

[3]

- (b) After heavy rain, a rubbish dump can become water-logged.

The production of landfill gas will increase over the following few weeks.

Suggest why.

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[2]

- (c) The production of landfill gas is also affected by temperature.

The rate of gas production is greatest between 35 °C and 50 °C.

Explain why landfill gas production is reduced above and below these temperatures.

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..... [2]

- (d) Landfill gas stops being collected approximately 20 years after a rubbish dump has stopped accepting new waste.

This is because of a decrease in the amount of methane being produced.

However, it is still important to monitor the landfill gas that is being produced.

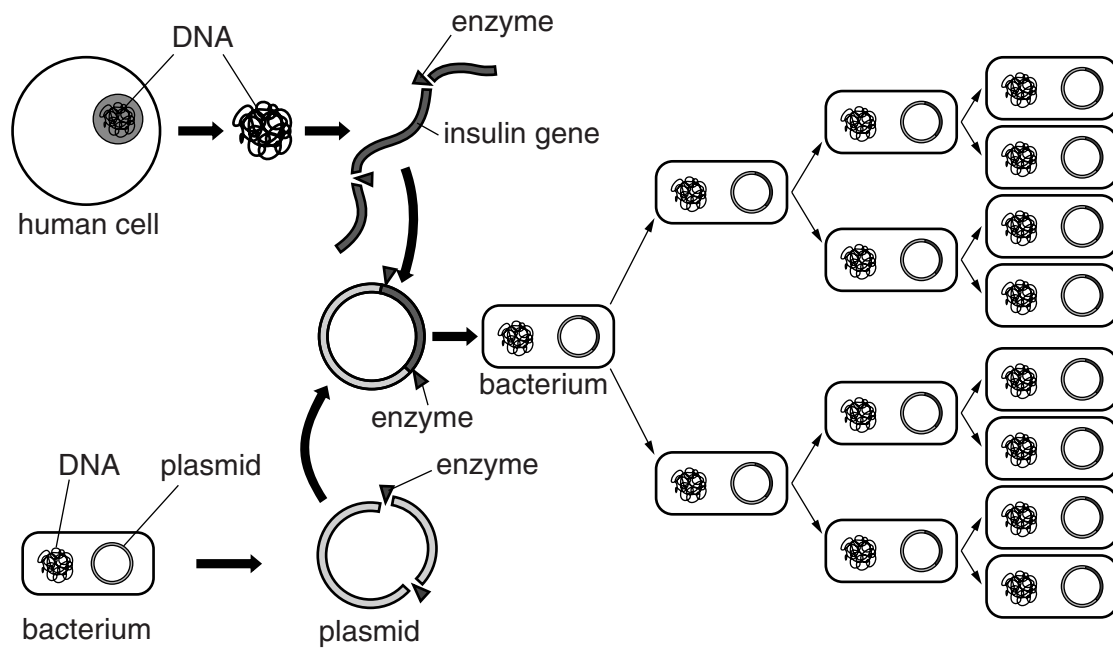
Suggest why this monitoring is important.

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..... [1]

[Total: 8]

- 10 The diagram shows some of the stages in genetically engineering bacteria to produce human insulin.



- (a) (i) What **type** of enzyme cuts open DNA?

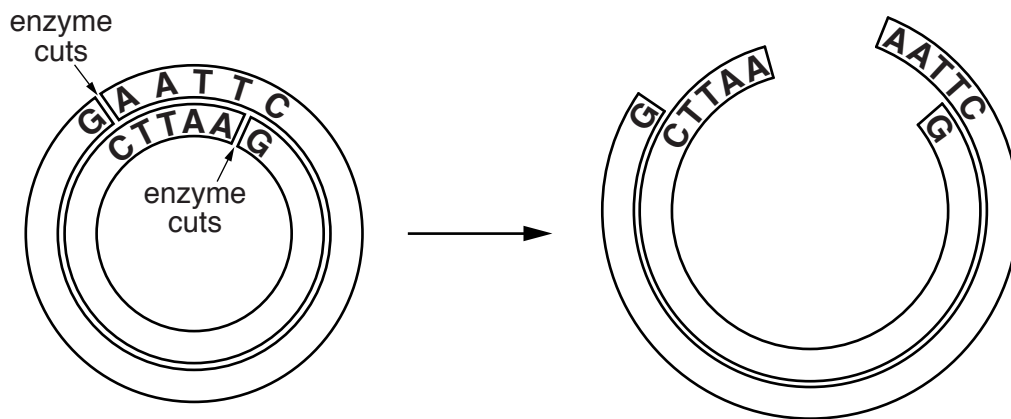
..... [1]

- (ii) What **type** of enzyme joins pieces of DNA?

..... [1]

(b) When an enzyme cuts DNA, it leaves 'sticky ends'.

The diagram shows the 'sticky ends' produced when an enzyme called EcoR1 cuts DNA.



Different enzymes cut at different sequences.

EcoR1 cuts at the sequence:

```

G | A A T T C
C | T T A A | G
  
```

Another enzyme called BamH1 cuts at the sequence:

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G | G A T C C
C | C T A G | G
  
```

When genetically engineering bacteria to produce human insulin it is important that the same enzymes are used to cut both the human DNA and the bacterial plasmid.

Explain why they have to be the **same** enzymes.

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..... [2]

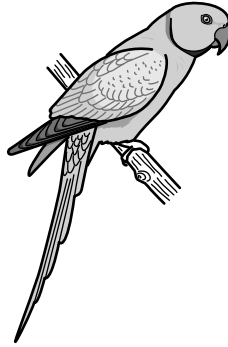
[Total: 4]

## SECTION D

- 11 (a) The ring-necked parakeet is originally from Africa and Asia.

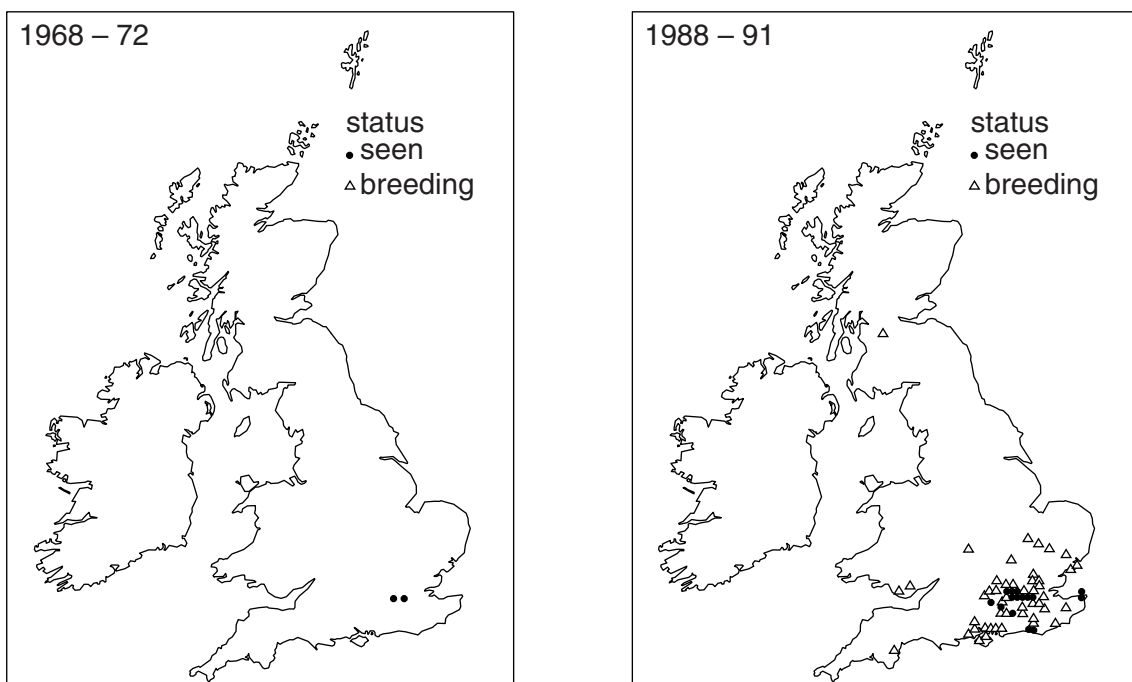
It is often kept as a pet in the UK.

Some of these pet birds escaped in 1969 and started breeding in the wild.



The maps show the results of surveys made by many birdwatchers.

They show the places where ring-necked parakeets were just seen and where they were breeding.



- (i) Do the two surveys provide enough evidence to show any trends?

Explain your answer.

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..... [2]

- (ii) Sam says, "The surveys show that ring-necked parakeets prefer the south because it is warmer".

Do you agree with Sam? Explain your answer.

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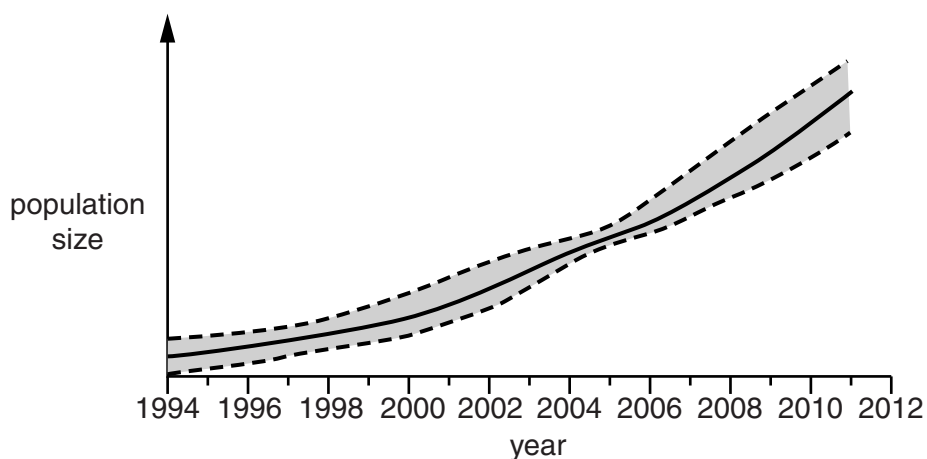
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..... [2]

- (b) The graph shows how the population of ring-necked parakeets in the UK changed between 1994 and 2011.

**Population size of ring-necked parakeets in the UK between 1994 and 2011**



The dotted lines show the upper and lower 95% confidence limits.

This means that you can be 95% certain that the true value for the population size lies between these two lines.

- (i) In which year was there most certainty about the population size?

..... [1]

- (ii) Suggest why there was more certainty in some years than others.

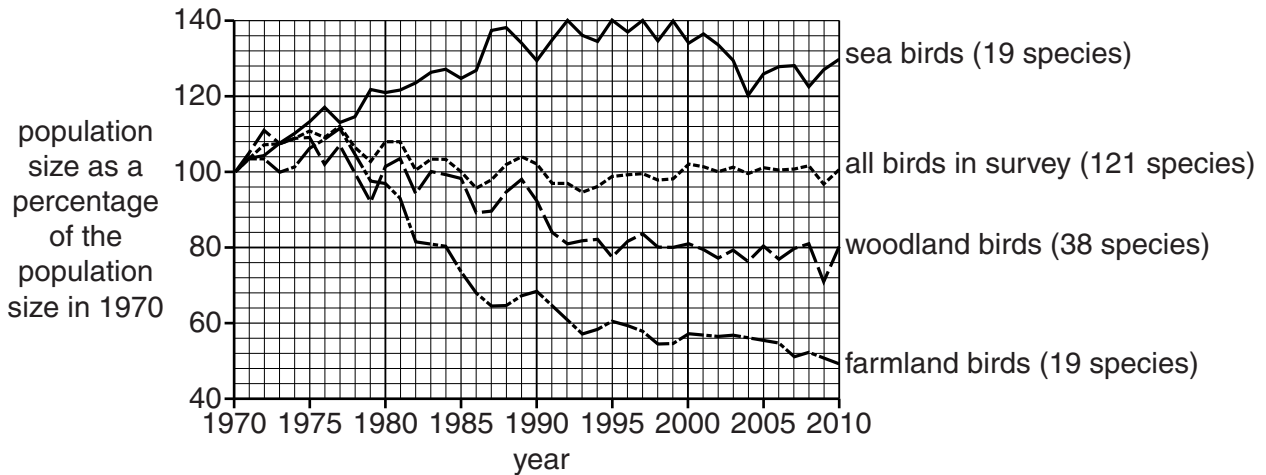
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..... [1]

- (c) The graph shows how the population sizes of some groups of birds in the UK have changed.

The population sizes have been recorded as a percentage of their size in 1970.

The numbers in brackets show the number of species in each group.



- (i) Sam says, "The graph shows that from 1970 to 2010 more bird populations decreased in size than increased".

Discuss whether or not Sam is correct. Explain your answer.

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..... [2]

- (ii) The graphs do **not** show the actual number of birds in each population.

They show each population size as a percentage of its size when the survey started.

Suggest why.

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..... [2]

[Total: 10]

END OF QUESTION PAPER

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