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Monday 14 January 2013 – Morning

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

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B73102

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

• Your 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 **20** pages. Any blank pages are indicated.

OCR is an exempt Charity

Turn over

2

Answer **all** the questions.

SECTION A – Module B1

1 Malaria is a disease caused by a protozoan called *Plasmodium*.

Plasmodium is transmitted by mosquitoes.

mosquito

(a) Describe how mosquitoes transmit *Plasmodium* between humans.

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.... **[2]**

(b) One way of preventing the spread of malaria is by draining swamps.

Explain why draining swamps can help.

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.... **[1]**

(c) In the past, some people thought that malaria was caused by harmful gas from swamps.

To protect themselves from malaria, these people put nets around their beds to try to keep out the harmful gas.

Using nets around beds reinforced the **incorrect** idea that malaria is caused by harmful gas.

Explain why.

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.... **[2]**
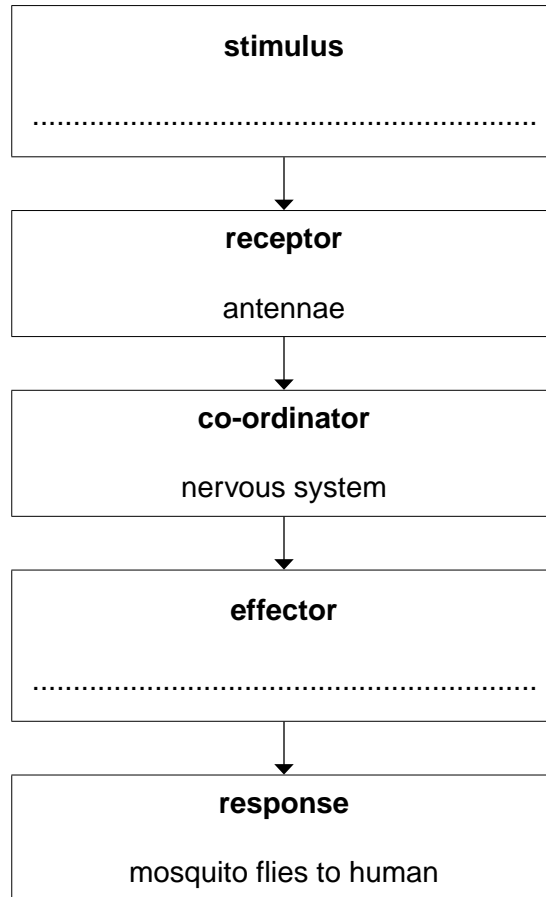
(d) Mosquitoes use their sense of smell to detect humans.

Mosquitoes detect the smell with receptors on their antennae.

Complete the flow chart to show how a mosquito detects, and responds to, the smell of a human.

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┌─────────────────────────────┐
│         stimulus            │
│                             │
│ ........................... │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│         receptor            │
│                             │
│         antennae            │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│        co-ordinator         │
│                             │
│       nervous system        │
└─────────────────────────────┘
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│         effector            │
│                             │
│ ........................... │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│         response            │
│                             │
│   mosquito flies to human   │
└─────────────────────────────┘
```

[2]

(e) One of the symptoms of malaria is a fever.

In a fever, the body temperature may rise to over 40 °C.

(i) How does the body monitor the rise in body temperature?

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.... **[2]**

(ii) One way to cool down is by vasodilation.

Explain how vasodilation cools a body.

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.... **[2]**
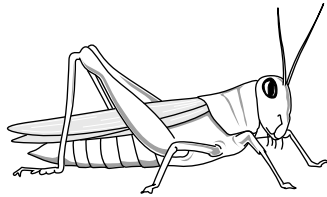
[Total: 11]

Turn over

4

2   Female mammals have two X chromosomes (XX), and males have an X and a Y chromosome (XY).

This is **not** the same in all animals.

grasshopper

In grasshoppers, females have two X chromosomes (XX) but males just have one X chromosome and no Y chromosome.

This is written as XO. (O means no chromosome.)

(a) Complete the genetic diagram to show the genotypes and phenotypes of the offspring of a pair of grasshoppers.

One box has been done for you.

		Male grasshopper	
		X	O
Female grasshopper	X	XX female	....
	X	....	....

[2]

(b) Female grasshoppers have 24 chromosomes in each body cell.

   (i) How many chromosomes are in a **male** grasshopper body cell? .... [1]

   (ii) How many chromosomes are in grasshopper sperm cells? .... [1]

[Total: 4]

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Question 3 begins on page 6

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3 Anya's dad, Bob, has a lot of salt and saturated fat in his diet and is very overweight (obese).

(a) Look at the BMI chart.

Category	BMI
underweight	< 18.5
normal	18.5–24.9
overweight	25.0–30.0
obese	> 30.0

BMI is calculated using the formula:

$$\text{BMI} = \frac{\text{mass in kg}}{(\text{height in m})^2}$$

This can be rearranged to give the formula:

$$\text{mass in kg} = \text{BMI} \times (\text{height in m})^2$$

Bob's height is 1.8 m, his mass is 120.0 kg and his BMI is 37.0.

Calculate the **least** mass he needs to **lose** to fall into the 'normal' category.

Show your working.

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answer ....kg **[4]**

(b) Anya is worried about her dad's health.

She knows that his diet will increase his blood pressure and cause cholesterol to build up.

She wants to explain to her dad why high blood pressure and a build up of cholesterol are dangerous.

What should she say?

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

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.... **[6]**

[Total: 10]

8

SECTION B – Module B2

4   A rare animal called the quoll lives in Australia.

There are four different types of quoll living in Australia.

(a) Scientists want to investigate how closely related the different types of quoll are.

Describe **one** way that they could do this.

....

.... **[1]**

(b) Tasmania is an island off the coast of Australia.

Foxes have recently been introduced to Tasmania.

Scientists are worried that they might compete with the quolls.

(i) Suggest why the different types of quoll are more likely to compete with each other than with foxes.

....

.... **[1]**

(ii) Scientists want to set up a conservation programme to save the quolls.

They want to remove foxes from Tasmania.

Write down **one** reason why scientists want to save endangered species.

....

.... **[1]**

[Total: 3]

5 In wet areas such as marshes, dead plants decompose very slowly.

(a) Explain why dead plants decompose very slowly in marshes.

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.... **[2]**

(b) Over tens of thousands of years the partly decomposed plants form a substance called peat.

Peat builds up in the marsh and makes a habitat called a peat bog.

These bogs contain rare plants.

(i) Peat is often removed from bogs.

It is sold to dig into soil to improve plant growth.

The dead material in the peat is converted to nitrates in the soil.

This involves two different processes.

Describe the processes by which dead material is converted into nitrates.

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.... **[3]**

(ii) Many people think that removing peat from peat bogs should be stopped.

An alternative to peat for gardeners has been developed involving using the outer coating from coconuts.

This is a waste product from coconut-processing factories.

Explain the advantages of this example of sustainable development.
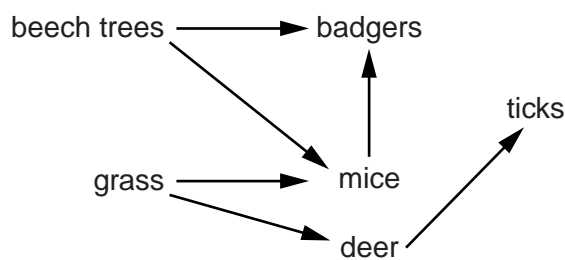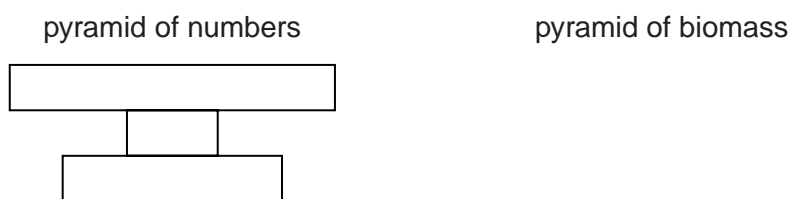
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.... **[2]**

[Total: 7]

6 The diagram shows part of a food web.

beech trees ⟶ badgers

ticks

grass ⟶ mice

deer

(a) (i) The diagram shows the shape of a pyramid of numbers for this food web.

pyramid of numbers   pyramid of biomass

Describe how a pyramid of biomass would look different to this pyramid of numbers.
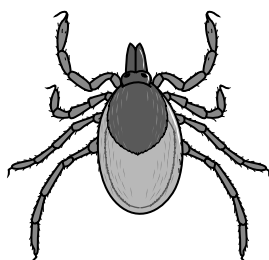
You may draw a diagram in the space above if you wish.

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.... **[1]**

(ii) It is harder to obtain the data to draw a pyramid of biomass than a pyramid of numbers. Explain why.

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.... **[2]**

(b) The food web contains ticks.

This is a drawing of the tick called *Ixodes ricinus.*

Which genus does the tick belong to?

.... **[1]**

(c) Ticks can also feed on the blood of humans if they land on human skin.

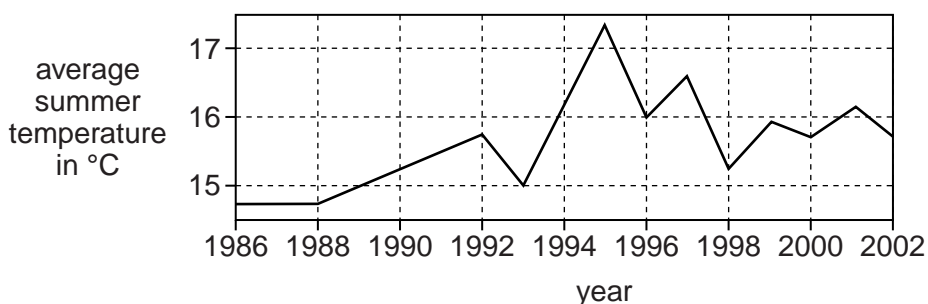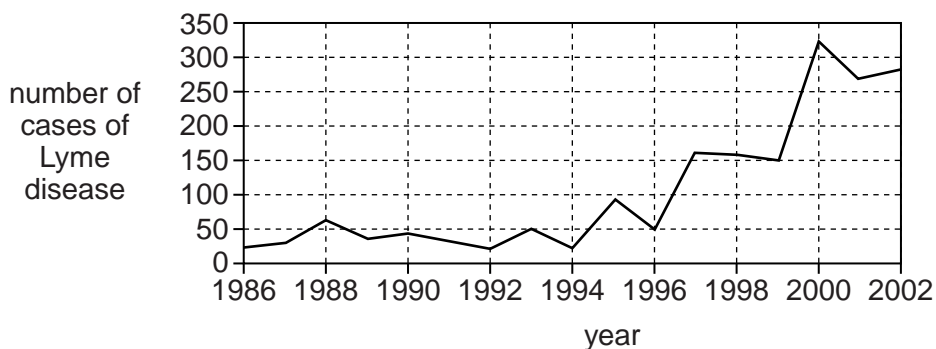People often like to walk in forest areas where deer live.

If people are bitten by ticks they can get a disease called Lyme disease.

The number of people getting Lyme disease seems to be increasing.

Some people think that this is because global warming is making the ticks more active.

One graph shows the number of cases of Lyme disease from 1986 to 2002.

The other graph shows the average summer temperature during those years.

number of cases of Lyme disease

350 300 250 200 150 100 50 0

1986 1988 1990 1992 1994 1996 1998 2000 2002

year

average summer temperature in °C

17 16 15

1986 1988 1990 1992 1994 1996 1998 2000 2002

year

(i) How strong is the evidence in the graphs for a link between global warming and the number of people getting Lyme disease? Explain your answer.
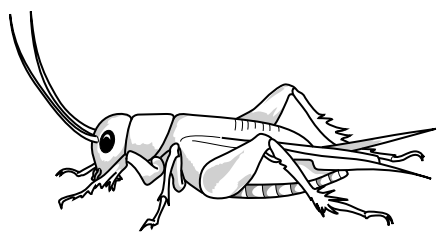
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.... **[2]**

(ii) Suggest **another** explanation for a link between the weather data and the number of people getting Lyme disease.

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.... **[1]**
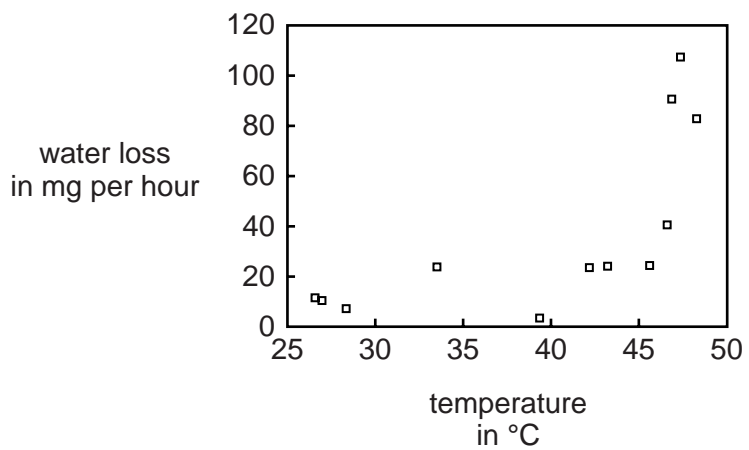
[Total: 7]

Turn over

7 Crickets are small arthropods that look like grasshoppers.

One type of cricket lives on the island of Kauai in Hawaii.

It is adapted to live in hot conditions.

(a) The graph shows the loss of water from crickets at different temperatures.

water loss in mg per hour (y-axis, 0 to 120)
temperature in °C (x-axis, 25 to 50)

Use the graph to explain how crickets survive in hot conditions.

....

.... **[1]**

(b) The crickets make a noise or 'sing' by rubbing their wings together.

This attracts a mate.

Unfortunately, the noise also attracts a type of fly.

The fly lays eggs on the cricket.

The eggs hatch and maggots burrow into the cricket and feed on it, eventually killing it.

(i) What word is used to describe the maggots in this feeding relationship?
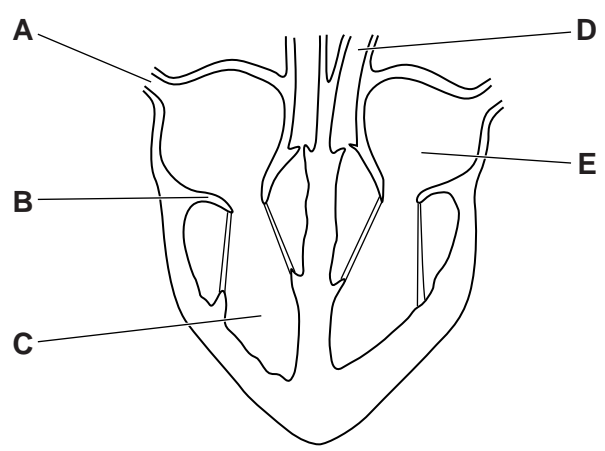
Choose your answer from this list.

competitor   host   parasite   partner   prey

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

13

(ii) Scientists found that some crickets on the island had a gene that made them silent.

The scientists found that after a few years most crickets on the island were silent.

However, there are still a small number of crickets that sing.

Use natural selection to explain why most of the crickets are now silent and why scientists think that this could lead to the formation of a new species.

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

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.... **[6]**

[Total: 8]

Turn over

14

SECTION C – Module B3

8 Look at the diagram of a human heart.

(a) Write the letter **A** to **E** next to the correct name of each part of the heart.

name of part	letter
aorta	
left atrium	
right ventricle	
tricuspid valve	
vena cava	

[2]

(b) Blood contains cells.

One type of cell is a red blood cell.

(i) Red blood cells are adapted for their job by being very small.

Explain why this helps them do their job.

.... **[1]**

(ii) Haemoglobin is found in red blood cells.

Haemoglobin is a protein made in the cytoplasm.

Red blood cells start off life with a nucleus.

The gene for haemoglobin is **only** found in the nucleus.

Explain how it is possible that haemoglobin can be made in the cytoplasm.

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.... **[2]**

(iii) Haemoglobin is important in transporting oxygen.

Describe how haemoglobin transports oxygen from the lungs to the body cells.

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.... **[2]**

(c) Blood also contains white blood cells.

White blood cells and red blood cells are made in the bone marrow.

Why can cells in the bone marrow produce both red and white blood cells?
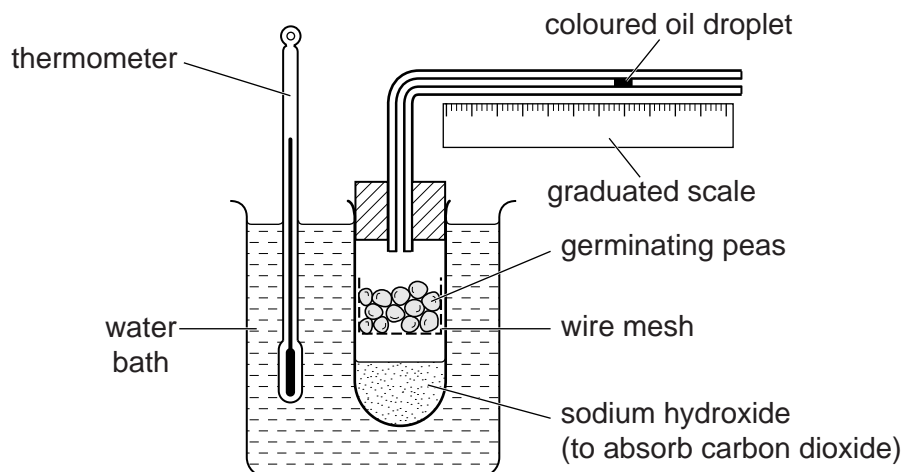
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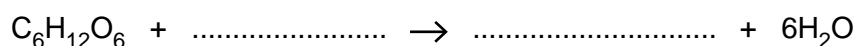
[Total: 9]

Turn over

9 This question is about respiration.

Look at the diagram of a respirometer.

It can be used to investigate the gases involved in aerobic respiration.

 (a) Complete the **balanced symbol** equation for aerobic respiration.

   $C_6H_{12}O_6$ + ... $\rightarrow$ .... + $6H_2O$ **[1]**

 (b) Look at the tables.

   The first table shows the respiratory quotient (RQ) of three food types.

Food type	Respiratory quotient (RQ)
carbohydrate	1.0
fat	0.7
protein	0.9

   The second table shows the results from an experiment investigating aerobic respiration in two types of seed.

Type of seed	Volume of oxygen absorbed in cm³	Volume of carbon dioxide produced in cm³	Respiratory quotient (RQ)
Pea	0.6	0.6	....
Peanut	16.3	13.0	....

Respiratory quotient (RQ) is calculated using the formula:

$$RQ = \frac{\text{volume of carbon dioxide produced}}{\text{volume of oxygen used}}$$

Calculate the RQ for the two types of seed and use your answers to **suggest** how the food type used is different for the two types of seed.

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

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.... **[6]**

 (c) During respiration, food is broken down by enzymes.

The temperature of the water surrounding the seeds is increased from 25 °C to 50 °C.

This stops respiration.

Explain why.

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.... **[2]**
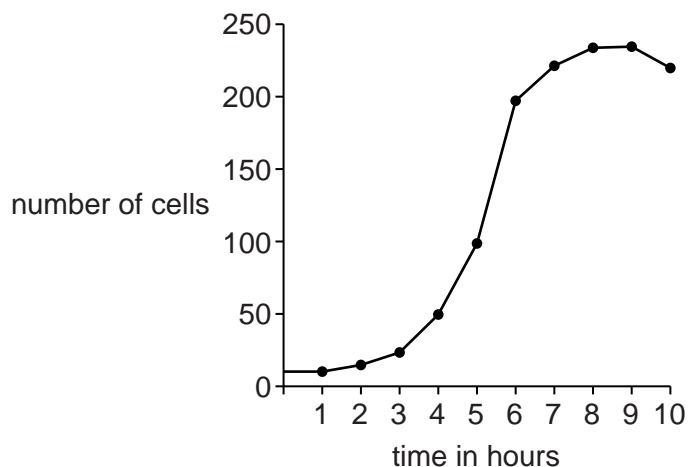
[Total: 9]

10 This question is about genetic engineering.

There is a shortage of human transplant organs.

Researchers are growing genetically engineered pig cells, containing human genes, in the laboratory.

The researchers claim that their work could help save thousands of lives a year.

(a) The graph shows the growth curve of the genetically engineered pig cells.

Use data in the graph to describe how the number of cells changes.

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.... **[2]**

(b) The research team want to genetically engineer pigs so that they produce organs that are **not** rejected by humans.

Describe how they could do this.

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.... **[3]**

(c) Some people are against genetic engineering research.

Other people consider it a medical breakthrough.

Despite the potential benefits, transplants using these genetically engineered organs have been banned.

Do you think the Government should allow these organs to be used in transplants?

Justify your answer.

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.... **[2]**

[Total: 7]

END OF QUESTION PAPER

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