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I declare this is my own work.

INTERNATIONAL GCSE COMBINED SCIENCE

Paper 1 Biology Extension

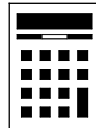
E

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

- a pencil and a ruler
- a scientific calculator.



Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
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6	
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8	
TOTAL	

Information

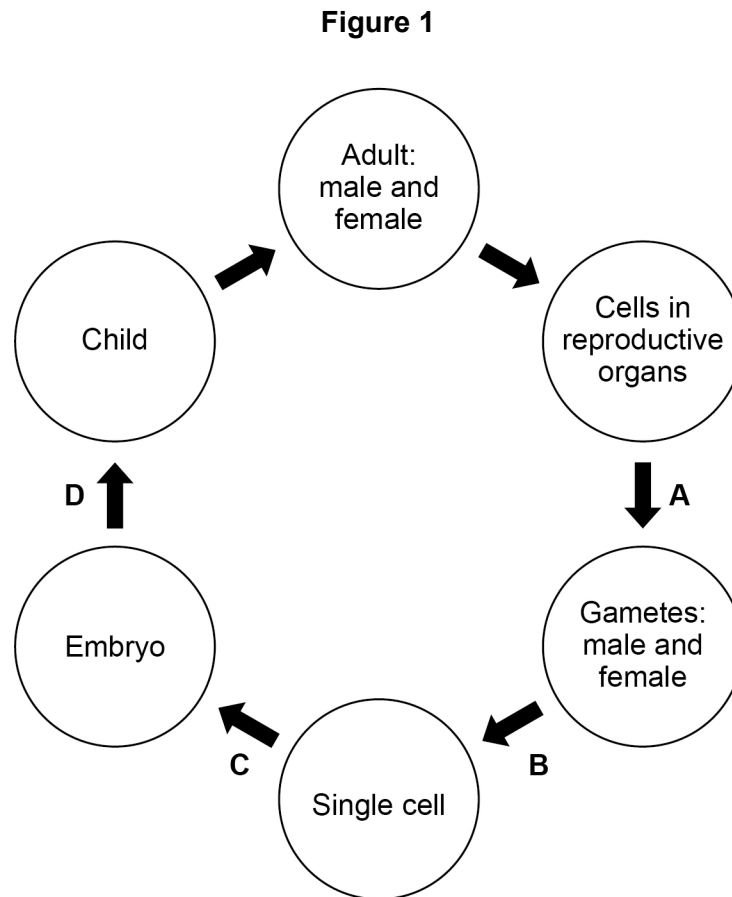
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.
- You are expected to use a scientific calculator where appropriate.



Answer **all** questions in the spaces provided.

0 1

Figure 1 shows some of the stages in the human life cycle.



0 1 . 1

Complete **Table 1** to identify the processes **A**, **B**, **C** and **D**.

[4 marks]

Tick (✓) **one** box in each row.

Table 1

	Fertilisation	Meiosis	Mitosis
A			
B			
C			
D			



0 1 . 2 What are the different forms of a gene called?

[1 mark]

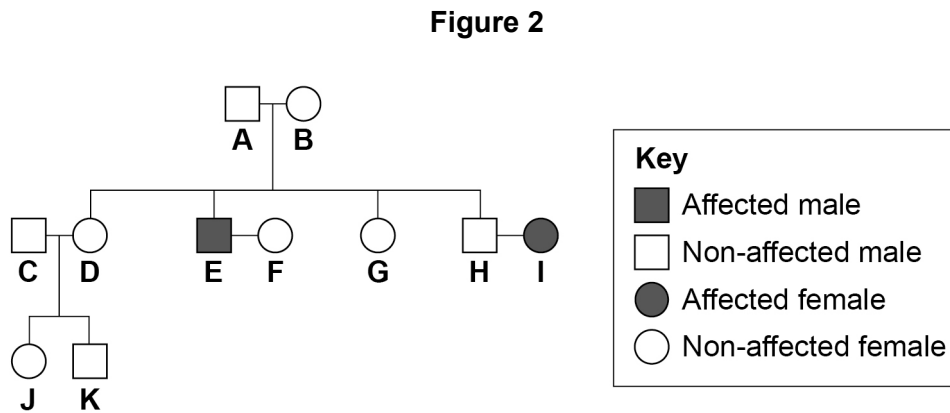
Question 1 continues on the next page

Turn over ►



Phenylketonuria (PKU) is a disorder that can be inherited.

Figure 2 shows the inheritance of PKU in one family.



0 1 . 3 How many children do **A** and **B** have?

[1 mark]

0 1 . 4 PKU is caused by the recessive form of a gene.

Use evidence about **A** and **B** and their children in **Figure 2** to support this statement.

[2 marks]



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0 1 . 5

Some foods contain an amino acid called phenylalanine.

A high concentration of phenylalanine in the blood may cause brain damage.

A person with PKU cannot remove phenylalanine from the blood when they absorb too much.

Explain how a low protein diet will help prevent brain damage in a person with PKU.

[2 marks]

10

Turn over for the next question

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0	2
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Figure 3 shows an athlete ready to run in a race.

Figure 3

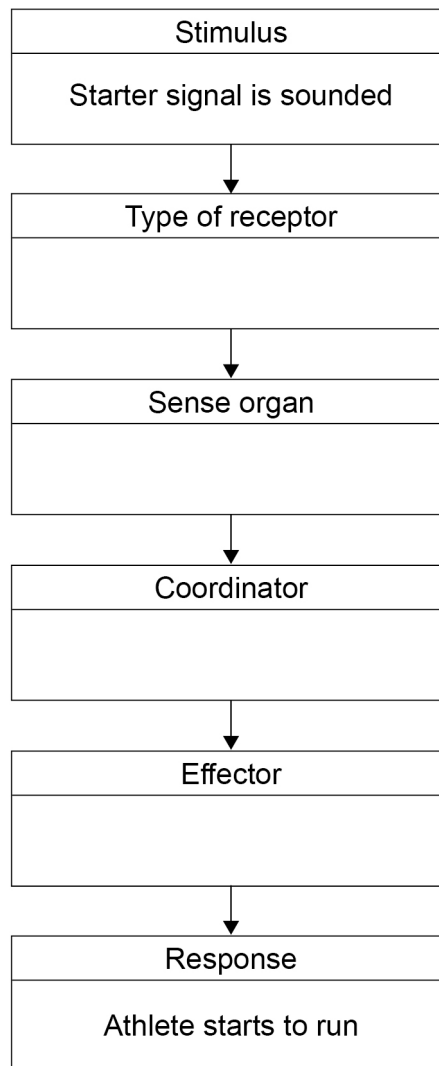


When a starter signal is sounded, the athlete starts to run.



Figure 4 shows how the athlete is able to respond to the stimulus.

Figure 4



0 2 . 1 Complete Figure 4.

[4 marks]

0 2 . 2 Name the type of cell that passes impulses from receptors to coordination centres.

[2 marks]

Question 2 continues on the next page

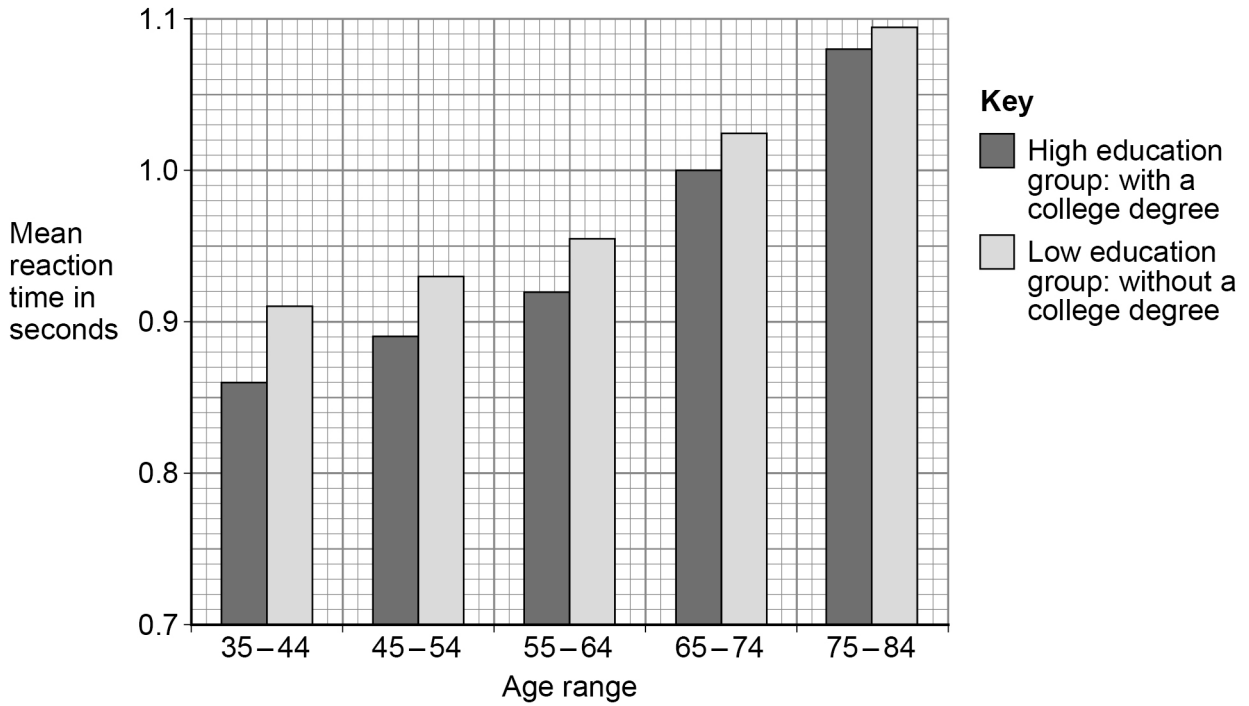
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A scientist investigated the effects of age and education level on human reaction time.

Figure 5 shows some of the results.

Figure 5



0 2 . 3 What was the range of the mean reaction time for the high education group? **[1 mark]**

Range = _____ to _____ s

0 2 . 4 Describe **two** trends in **Figure 5**. **[2 marks]**

- 1 _____
- _____
- 2 _____
- _____



0 2 . 5

The scientist concluded:

'Higher education level has less effect on a person's reaction time as they get older.'

Give evidence from **Figure 5** that supports the scientist's conclusion.**[1 mark]**

10

Turn over for the next question**Turn over ►**

0 3

Bacteria reproduce by dividing into two.

Bacteria can divide every 20 minutes to form a colony.

0 3 . 1

Starting with one cell, the number of bacteria in a colony is calculated using the formula:

$$\text{Number of cells} = 2^n$$

where **n** is the number of cell divisions.

Calculate the number of bacteria in a colony after 2 hours.

[3 marks]

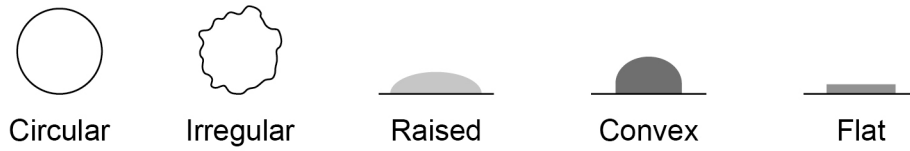
Number of bacteria = _____



Bacteria can be identified by the characteristics of their colony.

Figure 6 shows some bacterial colonies.

Figure 6



0 3 . 2

Suggest **one** characteristic that could be used to identify bacteria on nutrient agar.

[1 mark]

Question 3 continues on the next page

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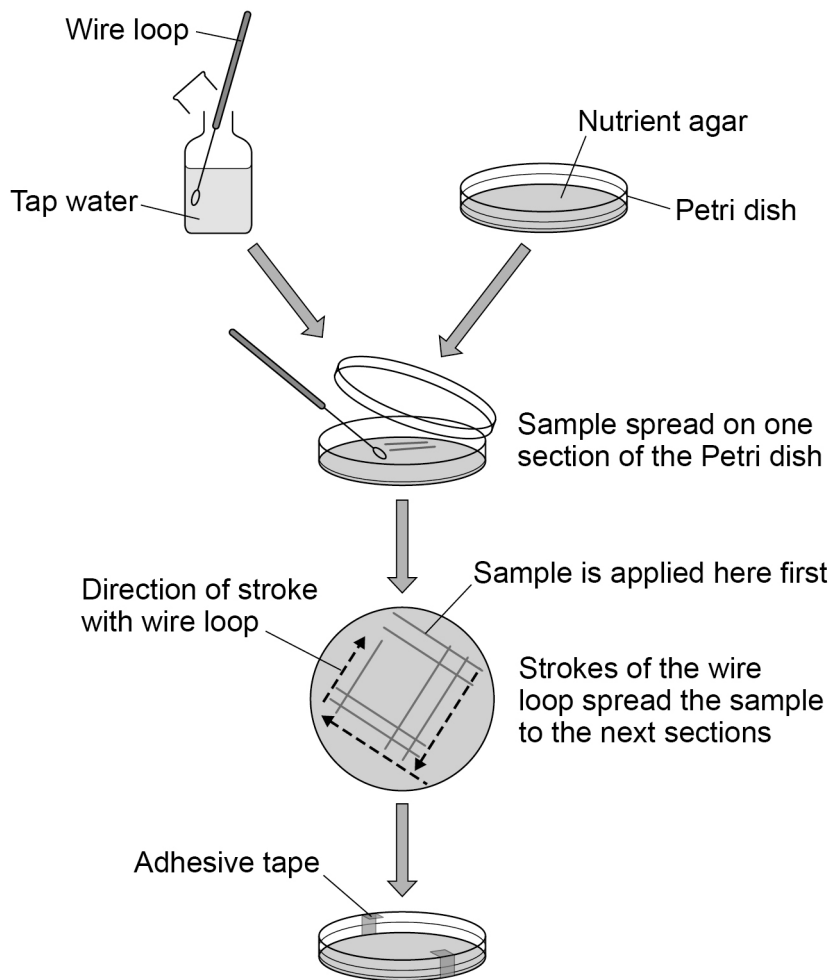


A scientist investigated which bacteria are present in tap water.

The scientist tested two different methods to transfer samples of water onto nutrient agar.

Figure 7 shows method 1.

Figure 7



0	3	.	3
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Give **three** procedures the scientist should use to ensure there are bacteria from **only** the tap water on the nutrient agar.

[3 marks]

1 _____

2 _____

3 _____

Question 3 continues on the next page

Turn over ►



In method **2** the scientist pours a small volume of tap water onto the nutrient agar in a Petri dish.

The Petri dishes from method **1** and method **2** are incubated for two days to allow bacterial colonies to grow.

0 3 4 Suggest a suitable temperature for incubation of the Petri dishes.

Give a reason for your answer.

[2 marks]

Temperature _____

Reason _____



Figure 8 shows bacterial growth on the Petri dishes after two days.

Figure 8



Method 1



Method 2

0 3 . 5

Method 1 should be used to identify the bacteria present in the water sample.

Explain why.

[2 marks]

11

Turn over ►



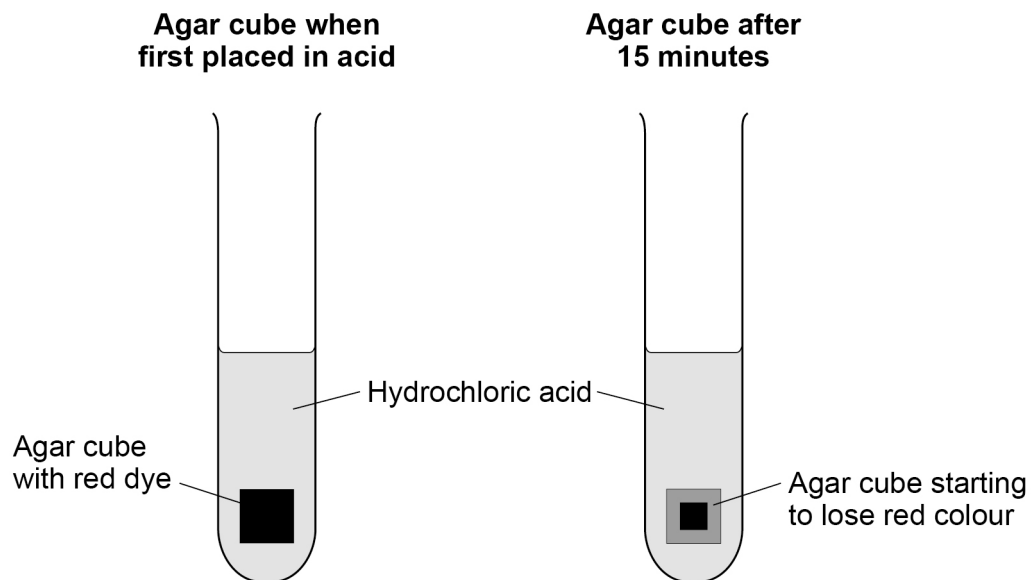
0 4

Agar cubes containing a red dye are used in experiments about diffusion.

Hydrochloric acid diffuses into agar cubes and causes the red dye to become colourless.

Figure 9 shows an agar cube losing its red colour when placed in hydrochloric acid.

Figure 9



A student investigated diffusion using agar cubes that were different sizes.

Table 2 shows the student's results.

Table 2

Length of each side of cube in cm	Time taken to lose red colour in s	Rate of diffusion in cm/s
1.0	97	5.15×10^{-3}
1.5	144	5.21×10^{-3}
2.5	241	
4.0	386	5.18×10^{-3}

0 4 . 2

Calculate the rate of diffusion for the cube with sides that are 2.5 cm in length.

Give your answer in standard form.

[4 marks]

Rate of diffusion = _____ cm/s



0 4 . 3 The student concluded:

'The 4.0 cm cube took the longest time to lose its colour. This is because the rate of diffusion decreases as the size of the cube increases'.

Explain why this is **not** a valid conclusion.

[2 marks]

0 4 . 4 Substances can move into cells by active transport.

Explain the process of active transport.

[3 marks]

15

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0 5

This question is about the circulatory system.

0 5 . 1

Describe the process of blood clotting when a person's skin is cut.

[4 marks]

0 5 . 2

Describe how cells in the blood are adapted to transport oxygen.

[3 marks]

0 5 . 3

The heart pumps blood around the body.

Name the main type of tissue found in the wall of the heart.

[1 mark]

Question 5 continues on the next page

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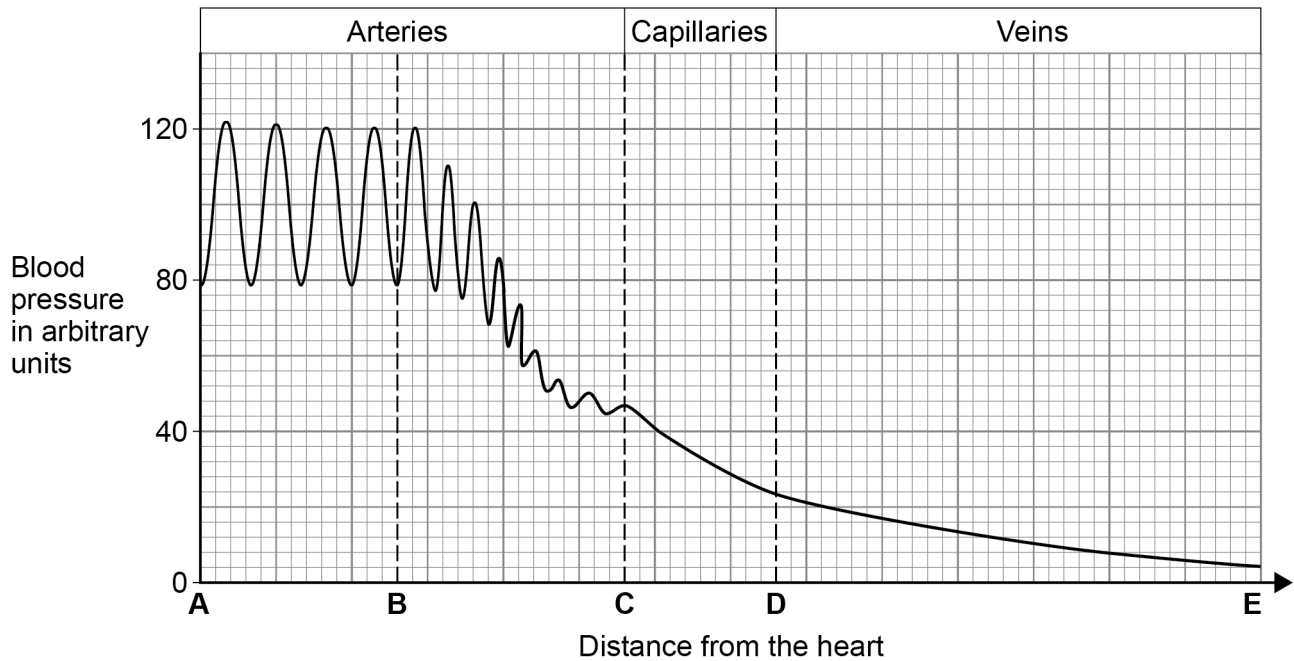


Blood is forced out of the heart into arteries.

The blood is transported around the body in arteries, capillaries and veins.

Figure 10 shows blood pressure in the arteries, capillaries and veins as the blood flows through them.

Figure 10



0 5 . 4

Explain why blood pressure in the arteries rises and falls between **A** and **B** on **Figure 10**.

[2 marks]



0 5 . 5

Explain **one** way that the structure of an artery is related to its function.**[2 marks]**

0 5 . 6

Explain the change in blood pressure in the capillaries between **C** and **D**.**[2 marks]**

0 5 . 7

The speed of blood flow decreases in the capillaries.

Explain how a slower blood flow helps the capillaries carry out their functions.

[2 marks]

16

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0 6

Nematodes are small worms found in soil.

Nematodes infect the roots of banana plants and cause damage.

0 6 . 1

What is the function of plant roots?

[1 mark]

0 6 . 2

Plants infected by nematodes also have a decreased leaf surface area.

Banana plants infected by nematodes produce a lower yield of bananas.

Explain why banana plants infected by nematodes produce a lower yield of bananas.

[2 marks]

Question 6 continues on the next page

Turn over ►

0 6 . 3

Scientists can produce genetically modified (GM) banana plants that are resistant to nematodes.

Describe how genes are transferred from one organism into the cells of a different organism.

[4 marks]



Two genes are used to produce GM banana plants that are resistant to nematodes:

- Gene **C** codes for cystatin.
Cystatin prevents protein digestion in nematodes, which causes the nematodes to die.
- Gene **P** codes for a peptide.
The peptide is secreted into the soil and prevents nematodes infecting the roots.

0 6 . 4 Cystatin inhibits the activity of an enzyme.

Which type of enzyme is inhibited by cystatin?

[1 mark]

Question 6 continues on the next page

Turn over ►



A scientist investigated the effects of gene **C** and gene **P** on banana plants.

The scientist planted three groups of GM banana plants and a control group of non-GM banana plants.

- Group **C** had 16 plants with gene **C**.
- Group **P** had 16 plants with gene **P**.
- Group **CP** had 16 plants with both gene **C and gene P**.
- Control group had 16 non-GM plants.

An even distribution of nematodes was added to the soil.

Table 3 shows some of the results recorded at the end of the investigation.

Table 3

Plant group	Number of nematodes in 100 g of root	Root damage in %	Mass of bananas in kg	Relative yield in %
Control (non-GM)	5100	21.4	205.8	100.0
C	1100	18.7	197.6	96.0
P	400	0.8	381.8	185.5
CP	800	14.9	213.4	103.7

0 6 . 5

Calculate the percentage decrease in the number of nematodes in the group **P** plants compared to the control group plants.

Give your answer to one decimal place.

[3 marks]

Percentage decrease = _____ %



0 7 . 1

What are the **two** causes of **genetic** variation in a population of organisms?**[2 marks]**

1 _____

2 _____

0 7 . 2

Scientists have suggested different theories to explain why organisms change over time.

What is Lamarck's theory?

[1 mark]_____

0 7 . 3

The theory of evolution describes a process which leads to changes in the characteristics of a population over time.

Name this process.

[1 mark]



Many species of finch live on the Galapagos Islands.

Figure 12 shows the heads of four species of finch that live on the same Galapagos Island.

Figure 12



0 7 . 4

Explain how the variation between the four species of finch in **Figure 12** helps them to survive on the same Galapagos Island.

[3 marks]

Question 7 continues on the next page

Turn over ►



0 8

Animals show a variety of behaviours when reproducing and caring for their offspring.

Figure 13 shows some ducklings responding to their mother.

Figure 13



0 8

. 1

What is the name for this type of behaviour?

[1 mark]

0 8

. 2

Give **one** reason why parental care of the young is a successful evolutionary strategy.

[1 mark]

Question 8 continues on the next page

Turn over ►



0 8 . 3

In some mammal populations the males fight for the right to mate with the females.

Suggest **one** advantage and **one** disadvantage to the population if the strongest male mates with all the females.

[2 marks]

Advantage _____

Disadvantage _____

0 8 . 4

Male insects use courtship behaviour to begin mating.

Suggest **one** reason why it is important that each species has its own specific courtship behaviour.

[1 mark]



0 8 . 5 Malaria is a disease that is transmitted to humans by female mosquitos.

Female mosquitos mate only once in their lifetime.

Scientists have developed techniques to produce sterile male mosquitos. Sterile mosquitos are **not** able to produce gametes.

Large numbers of sterile male mosquitos are released into mosquito populations.

Explain how the release of sterile male mosquitos can help in the control of malaria.

[3 marks]

8

END OF QUESTIONS



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