AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE BIOLOGY

H

Higher Tier Paper 2H

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- a ruler
- a scientific calculator.

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- 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.
- In all calculations, show clearly how you work out your answer.

Information
- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

Do not write outside the box

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

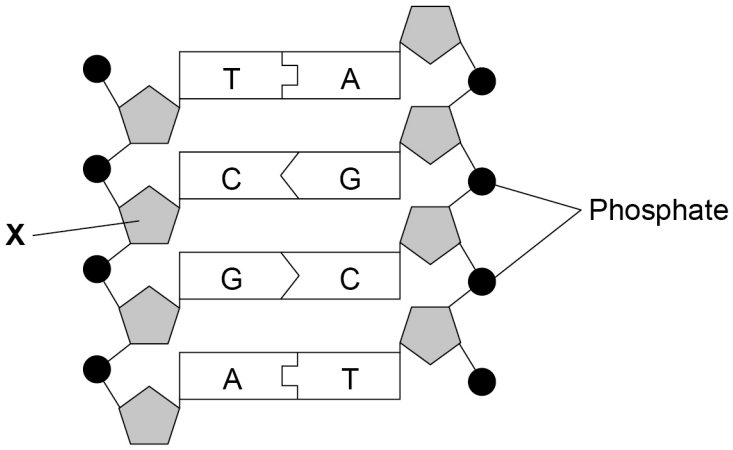
0 1 The nucleus of a cell contains DNA.

0 1 . 1 Name the structures inside the cell nucleus that contain DNA.

[1 mark]

Figure 1 shows part of a DNA molecule.

Figure 1



0 1 . 2 Name the part of the DNA molecule labelled **X**.

[1 mark]

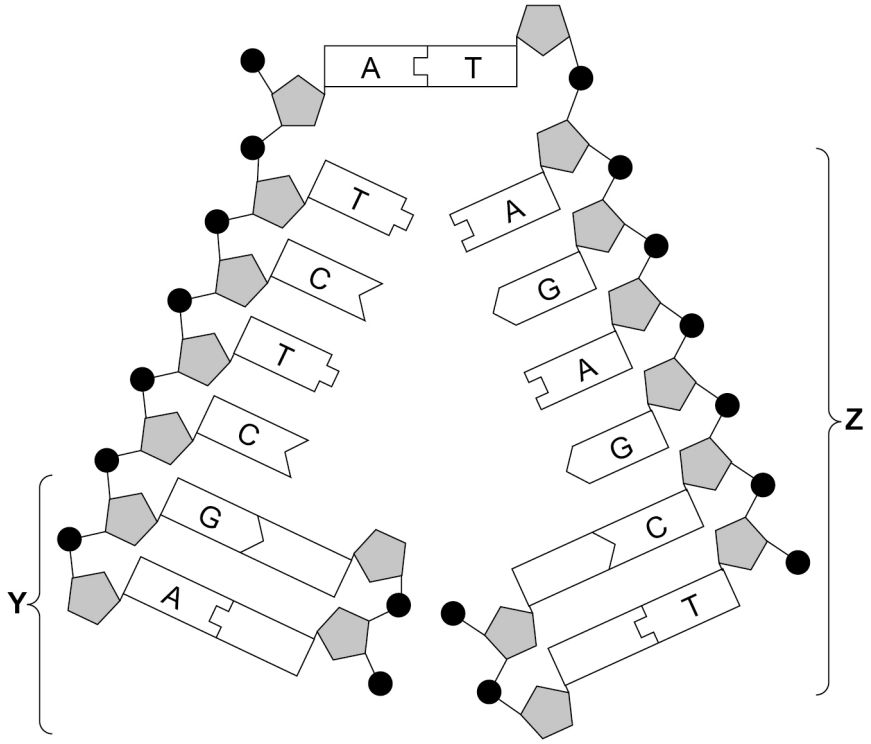
0 1 . 3 What type of substances are labelled **A**, **C**, **G** and **T** in **Figure 1**?

[1 mark]

Do not write outside the box

Figure 2 shows another section of a DNA molecule.

Figure 2



0 1 . 4 Four of the substances you named in Question **01.3** are **not** labelled in part **Y** of **Figure 2**.

Label each of these substances with the correct letter, **A**, **C**, **G** or **T**.

Use information from other parts of **Figure 2** to help you.

[1 mark]

0 1 . 5 What is happening to the DNA in part **Z** of **Figure 2**?

[1 mark]

Tick (✓) **one** box.

Differentiation ☐

Evolution ☐

Fertilisation ☐

Replication ☐

Turn over ►

Do not write outside the box

0 1 . 6 A gene is a length of DNA.

What type of substance does a gene code for?

[1 mark]

---

0 1 . 7 Most human body cells contain 6×10^{-12} grams of DNA.

What mass of DNA will a human sperm cell contain?

[1 mark]

Tick (✓) **one** box.

6×10^{-6} grams ☐

6×10^{-12} grams ☐

3×10^{-6} grams ☐

3×10^{-12} grams ☐

0 1 . 8 What is the name of the type of cell division that produces sperm cells?

[1 mark]

Tick (✓) **one** box.

Binary fission ☐

Differentiation ☐

Meiosis ☐

Mitosis ☐

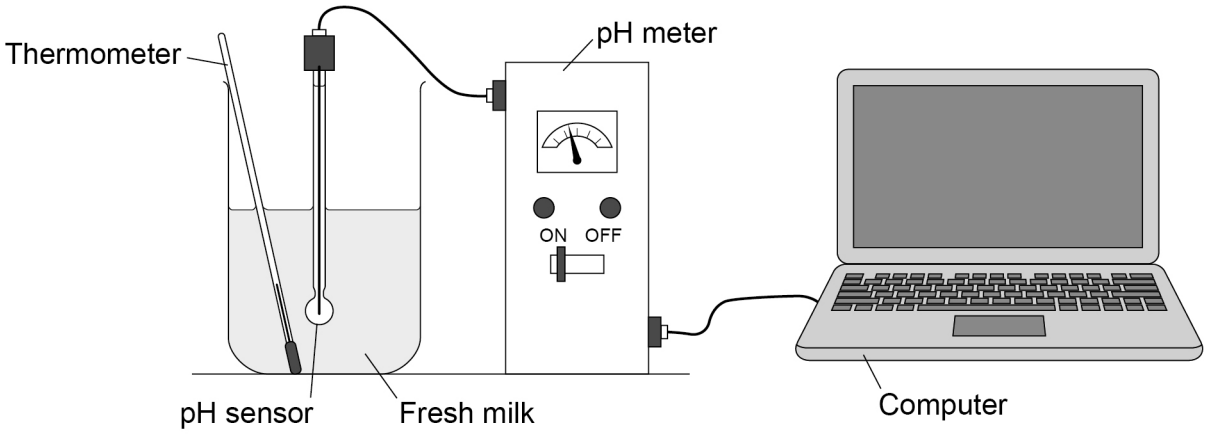
8

Do not write outside the box

0 2 A student investigated the effect of temperature on the decay of milk.

Figure 3 shows the apparatus the student used.

Figure 3



This is the method used.

1. Set up the apparatus as shown in **Figure 3** with the milk at 20 °C.
2. Record the pH over 5 days using the computer.
3. Repeat with another batch of fresh milk at 25 °C.

0 2 . 1 How could the student keep the milk at a constant temperature for 5 days?

[1 mark]

0 2 . 2 Give **one** variable the student should keep constant.

Do **not** refer to temperature in your answer.

[1 mark]

Question 2 continues on the next page

Do not write outside the box

Table 1 shows the student's results for the milk at 20 °C.

Table 1

Time in days	0	1	2	3	4	5
pH	6.7	6.7	6.3	5.3	4.6	4.4

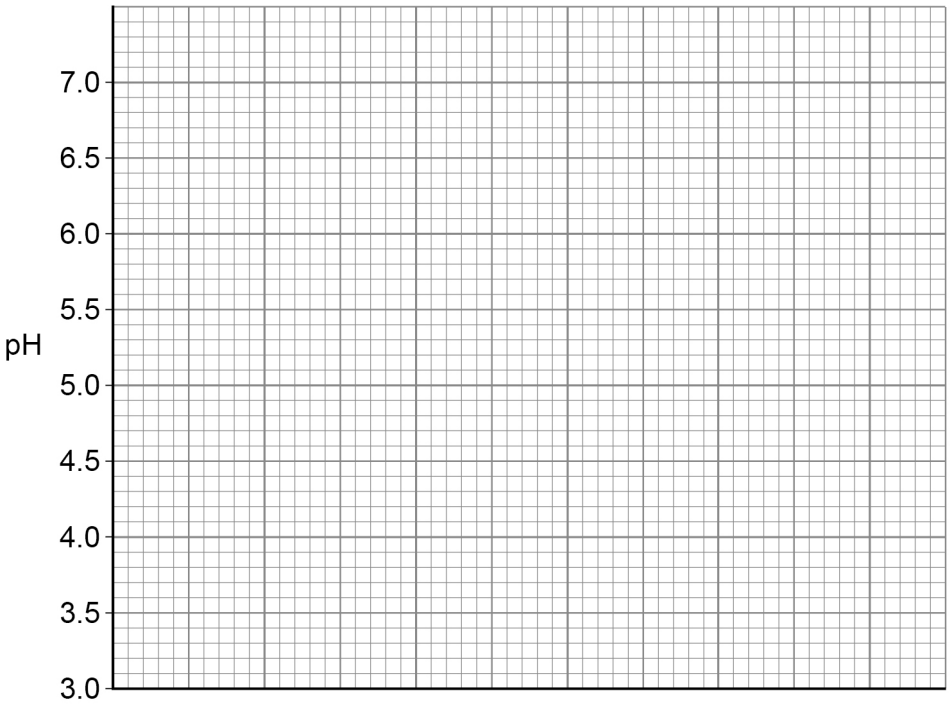
0 2 . 3 Complete **Figure 4**.

[4 marks]

You should:

- label the x-axis
- use a suitable scale for the x-axis
- plot the data from **Table 1**
- draw a line of best fit.

Figure 4



0 2 . 4 The data you plotted in Question **02.3** were obtained at 20 °C.

Sketch a line on **Figure 4** to show the results you would expect at 25 °C.

Label this line '25 °C'.

[2 marks]

8

Do not write outside the box

0 3 Human body temperature is controlled within very narrow limits.

Scientists investigated the effect of drinking ice-cold water on:

- internal body temperature
- the rate of sweating.

This is the method used.

1. Sit a person inside a room kept at a constant temperature of 25 °C.
2. Measure the person's internal body temperature near the brain.
3. Measure the person's rate of sweating.
4. After 20 minutes, give the person 500 cm^3 of ice-cold water to drink.
5. Continue to measure the person's internal body temperature and sweating rate for a further 50 minutes.

0 3 . 1 Give the reason why the person should **not** move during the investigation.

[1 mark]

Question 3 continues on the next page

Do not write outside the box

Figure 5 and **Figure 6** show the scientists' results.

Figure 5

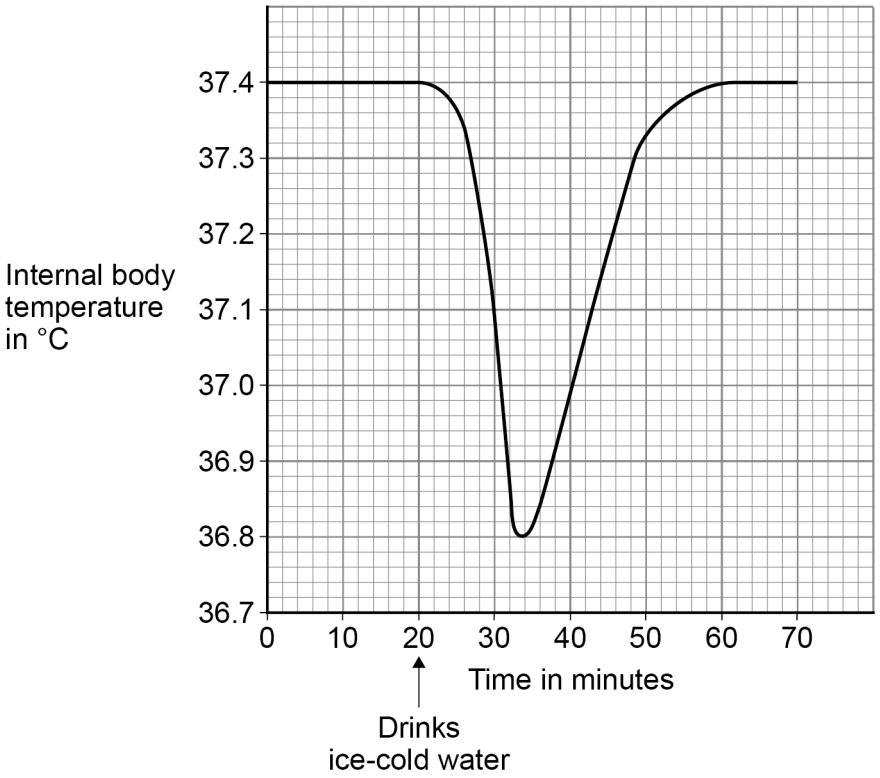
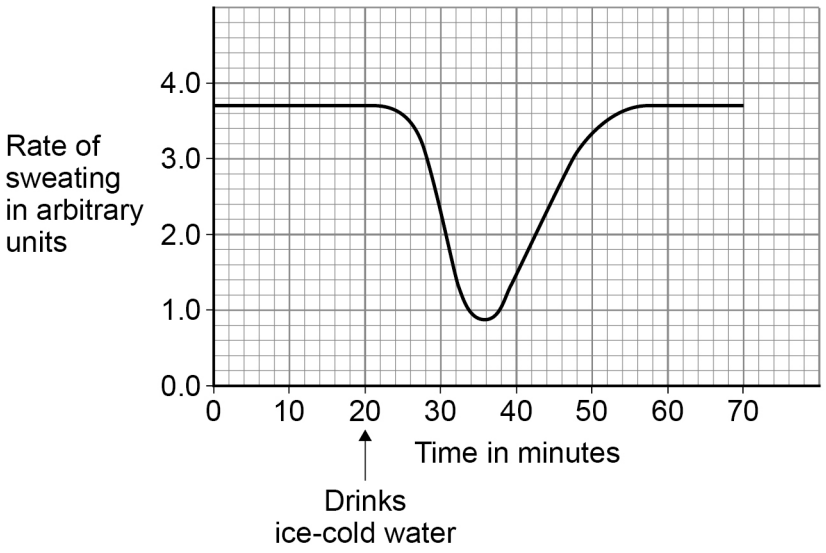


Figure 6



Do not write outside the box

0 3 . 2 What is this person's normal internal body temperature?

[1 mark]

Tick (✓) **one** box.

36.8 °C ☐ 37.0 °C ☐ 37.4 °C ☐

The results show that when the ice-cold water was drunk, the temperature near the brain decreased.

0 3 . 3 Explain why the temperature near the brain decreased.

[2 marks]

0 3 . 4 The thermoregulatory centre in the brain responds to the decrease in temperature.

How does the thermoregulatory centre send information to sweat glands in the skin?

[1 mark]

0 3 . 5 The rate of sweating changes between 24 minutes and 36 minutes.

Explain how this change helps to maintain the person's normal body temperature.

[2 marks]

Question 3 continues on the next page

Do not write outside the box

0 3 . 6 During exercise, the skin appears red.

What causes the skin to appear red?

[1 mark]

Tick (✓) **one** box.

- Blood vessels moving closer to the skin surface ☐
- Constriction of blood vessels in the skin ☐
- Decrease in heart rate ☐
- Dilation of blood vessels in the skin ☐

8

Turn over for the next question

Do not write outside the box

Turn over for the next question

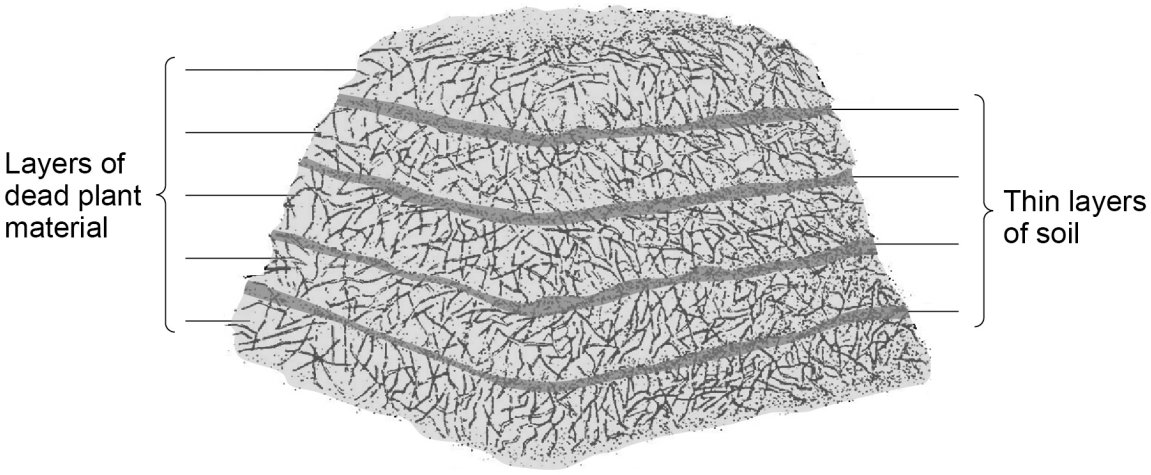
DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 4 Decay occurs in a compost heap.

Figure 7 shows a compost heap.

Figure 7



Describe:

- how microorganisms in the layers of soil help to recycle chemicals in the dead plants
- how the chemicals are used again by living plants.

[6 marks]

Do not write outside the box

6

Turn over for the next question

Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 5 The growth of daisy plants on a lawn is affected by biotic factors and by abiotic factors.

0 5 . 1 **Table 2** shows six factors.

Tick (✓) **one** box in each row to show whether the factor is biotic or abiotic.

[3 marks]

Table 2

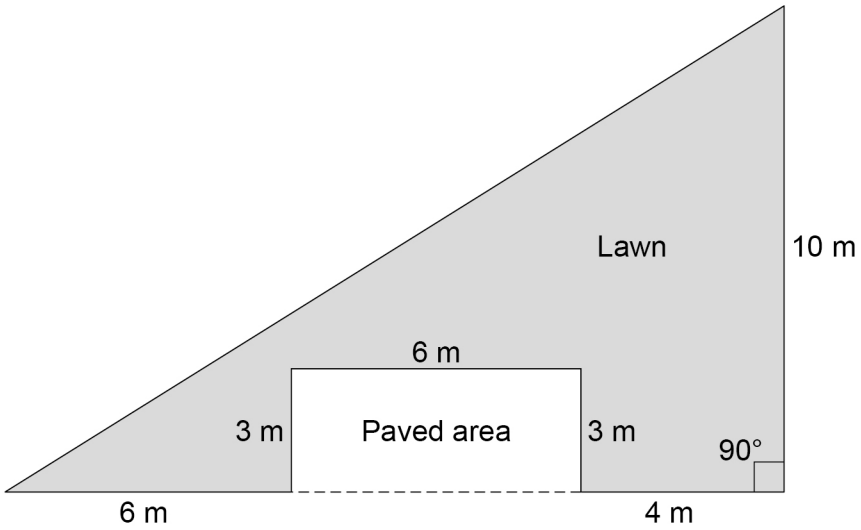
Factor	Biotic	Abiotic
Nitrates in the soil		
Rabbits eating the plants		
Shading by a building		
Soil pH		
Temperature		
Trampling by people		

Question 5 continues on the next page

Do not write outside the box

Figure 8 shows a plan of a garden.

Figure 8



A student estimates the number of daisy plants growing on the lawn.

The student places a quadrat at 10 different positions on the lawn.

The quadrat measures 50 cm × 50 cm.

The student counts the number of daisy plants in each quadrat.

0 5 . 2 How should the student decide where to place the quadrat?

Give the reason for your answer.

[2 marks]

Do not write outside the box

0 5 . 3 The mean number of daisy plants in each quadrat is 6.

Calculate the number of daisy plants on the lawn.

Give your answer to 3 significant figures.

[6 marks]

Number of daisy plants on the lawn = _____

0 5 . 4 Using the mean from this investigation to calculate the number of daisy plants on the lawn may **not** be accurate.

Give **two** reasons why.

[2 marks]

1 _____

2 _____

13

Turn over for the next question

Do not write outside the box

0 6 Reflex actions are coordinated by the nervous system.

0 6 . 1 What is meant by the term 'reflex action'?

[2 marks]

0 6 . 2 A woman's hand accidentally touches a hot object.

The woman moves her hand away rapidly.

Describe how the woman's nervous system coordinates the reflex action.

[6 marks]

Do not write outside the box

0 6 . 3 The endocrine system coordinates many internal functions of the body.

Give **three** ways coordination by the endocrine system is different from coordination by the nervous system.

[3 marks]

1 _____

2 _____

3 _____

0 6 . 4 Describe how hormones control the menstrual cycle.

[5 marks]

16

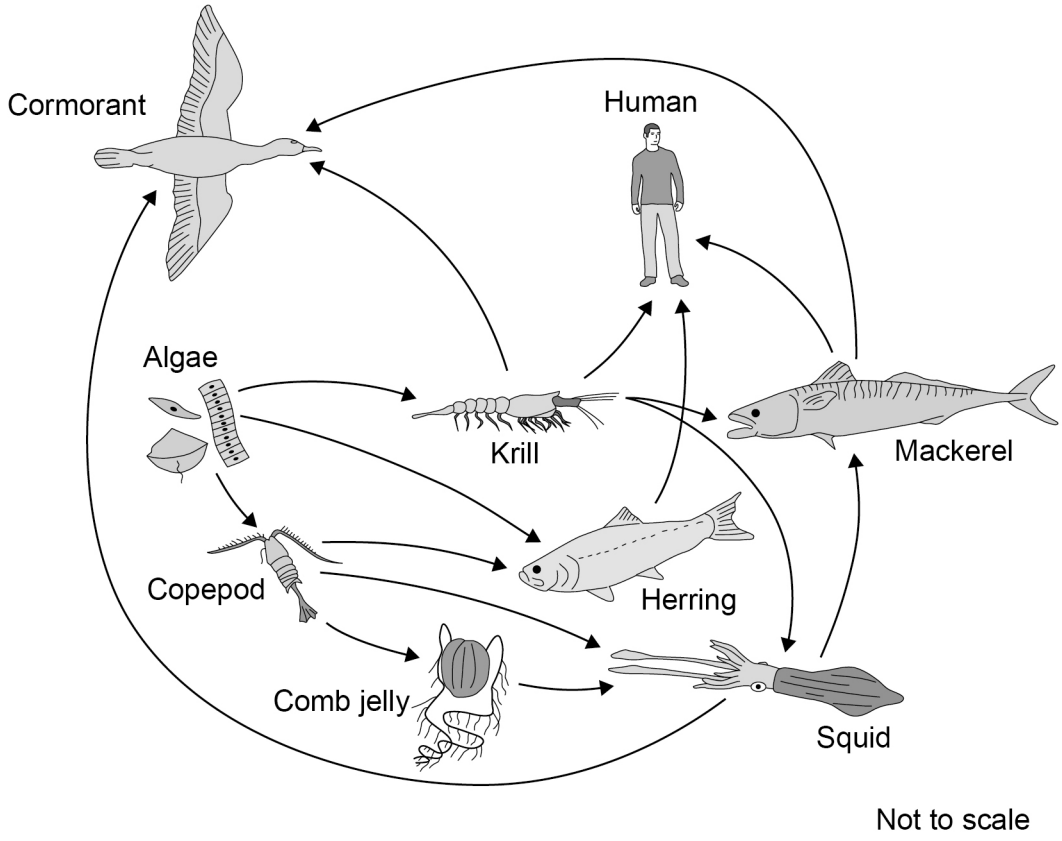
Turn over for the next question

Do not write outside the box

0 7 A food web contains several food chains.

Figure 9 shows a food web.

Figure 9



0 7 . 1 The animals in **Figure 9** get their energy by eating other organisms.

Describe how the algae get energy.

[2 marks]

0 7 . 2 Name **one** primary consumer in **Figure 9**.

[1 mark]

Do not write outside the box

0 7 . 3 Name **one** producer in **Figure 9**.

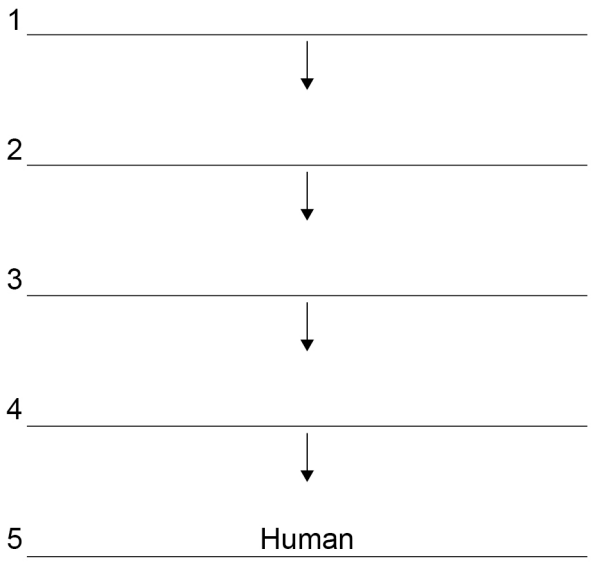
[1 mark]

0 7 . 4 The different food chains in **Figure 9** have different numbers of organisms.

Complete **Figure 10** to show a food chain in **Figure 9** with **five** organisms, including the human.

[1 mark]

Figure 10



0 7 . 5 **Figure 9** shows that mackerel eat krill and squid.

The biomass of mackerel is much less than the combined biomass of krill and squid.

One reason for this is that the mackerel cannot digest all parts of the krill and squid.

Give **two** other reasons.

[2 marks]

1 _____

_____

2 _____

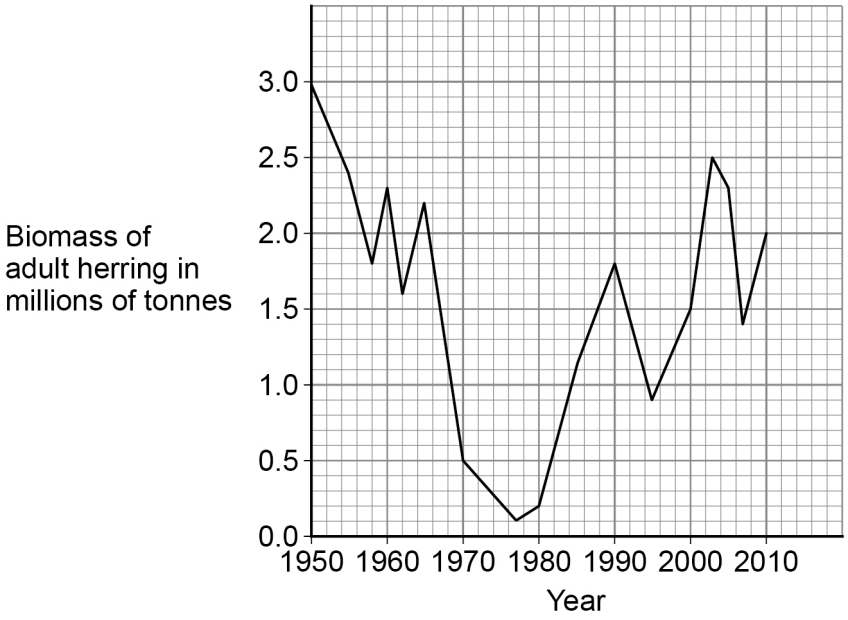
_____

Turn over ►

Do not write outside the box

Figure 11 shows how the biomass of adult herring in the North Sea has changed between 1950 and 2010.

Figure 11



0 7 . 6 Calculate the percentage decrease in the biomass of herring between 1960 and 1977.

Give your answer to the nearest whole number.

[4 marks]

Percentage decrease = _____ %

Do not write outside the box

Question 7 continues on the next page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 7 . 7 Too many herring were caught by fishermen between 1960 and 1977.

Herring can live for up to 12 years and begin to reproduce when 3 to 4 years old.

Laws have been introduced to help conserve herring:

- 1977 to 1981 – herring fishing was banned in the North Sea
- 1984 to present day – control of mesh size of fishing nets
- 1997 to present day – fishing quotas were introduced
- 1998 to present day – herring fishing was banned in breeding grounds during the breeding season.

Figure 12 shows how a minimum mesh size helps to conserve herring.

Figure 12

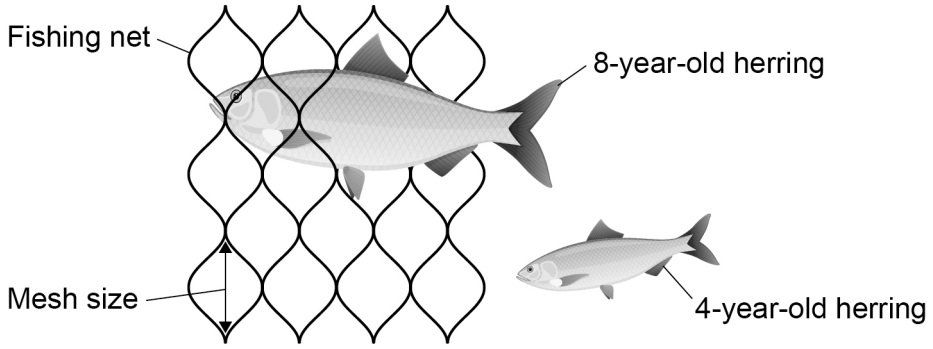
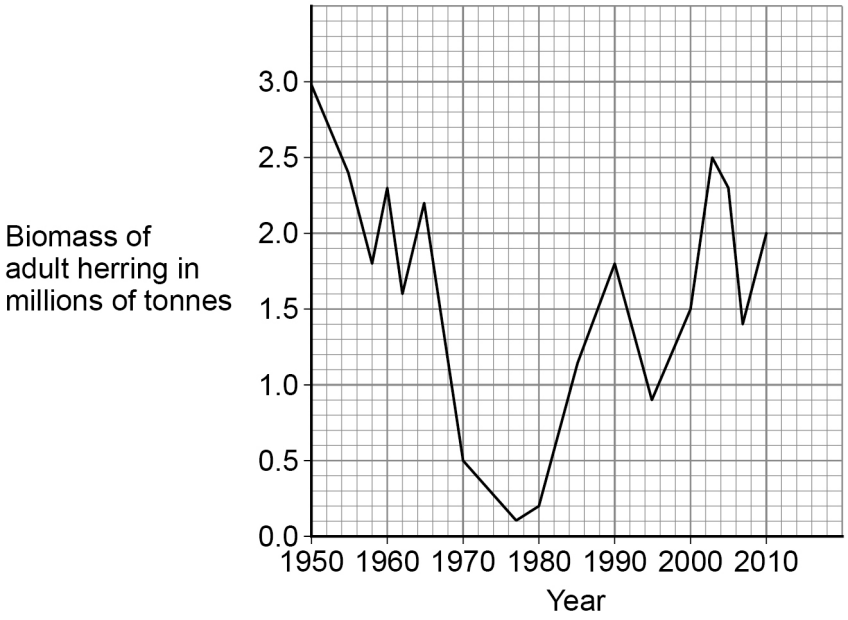


Figure 11 is repeated below.

Figure 11



Do not write outside the box

Evaluate the effect of these laws on the conservation of herring stocks.

Use data from **Figure 11** and information from **Figure 12** in your answer.

[6 marks]

17

Turn over for the next question

Do not write outside the box

0 8 Sickle cell anaemia is an inherited condition that affects red blood cells.

Sickle cell anaemia is caused by a mutation in the gene for haemoglobin. Haemoglobin is the red pigment found in red blood cells.

A person who is homozygous for the normal haemoglobin allele ($\mathbf{H^A}$) produces normal red blood cells.

A person who is homozygous for the mutated allele ($\mathbf{H^S}$):

- produces red blood cells with abnormal haemoglobin
- has red blood cells that can form an altered shape
- has sickle cell anaemia and becomes ill.

A person who is heterozygous:

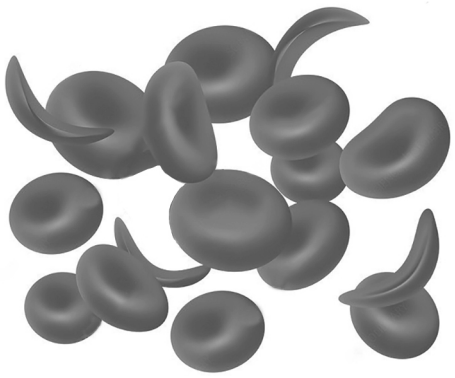
- has both normal and abnormal haemoglobin in the red blood cells
- has sickle cell trait
- is generally healthy but can become ill in certain circumstances.

0 8 . 1 Give the reason why a mutation in the gene coding for haemoglobin could be harmful.
[1 mark]

Do not write outside the box

0 8 . 2 **Figure 13** shows some red blood cells from the blood of a person with sickle cell trait.

Figure 13



Calculate the proportion of cells in **Figure 13** that have an altered shape.

[2 marks]

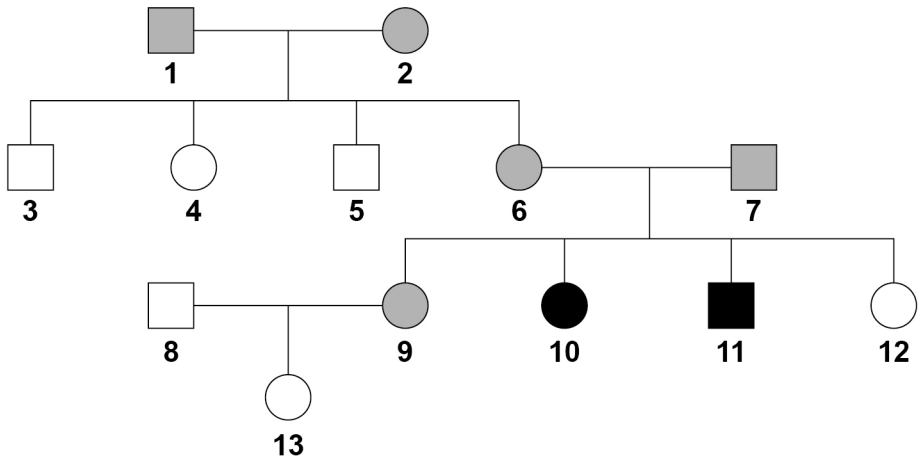
Proportion = _____

Question 8 continues on the next page

Do not write outside the box

Figure 14 shows the inheritance of sickle cell anaemia in one family.

Figure 14



Key

- Unaffected male
- Unaffected female
- Male with sickle cell anaemia
- Female with sickle cell anaemia
- Male with sickle cell trait
- Female with sickle cell trait

Do not write outside the box

0 8 . 3 Persons **8** and **9** in **Figure 14** are expecting a second child.

Determine the probability that the child will be a girl with sickle cell trait.

You should:

- draw a Punnett square diagram
- identify the phenotype of each offspring genotype
- use the symbols:

  $\mathbf{H^A}$ = normal haemoglobin allele

  $\mathbf{H^S}$ = mutated haemoglobin allele.

[5 marks]

Probability of a girl with sickle cell trait = _____

Question 8 continues on the next page

Do not write outside the box

0 8 . 4 Without medical treatment, people with sickle cell anaemia are frequently ill and have a reduced life expectancy.

The malarial parasite cannot live in the red blood cells of a person who has the $\mathbf{H^S}$ allele.

A scientist stated:

'It is an advantage for people to have the $\mathbf{H^S}$ allele in countries where malaria occurs.'

Evaluate the scientist's statement.

[3 marks]

11

Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 9 The Galapagos Islands are located in the Pacific Ocean.

Several species of birds called finches live on the Galapagos Islands.

These finches are very similar to each other.

Figure 15 shows two modern species of Galapagos finch and their classification.

Figure 15

Medium ground finch



Small ground finch



Classification group	**Medium ground finch**	**Small ground finch**
Kingdom	*Animalia*	*Animalia*
	Chordata	*Chordata*
Class	*Aves*	*Aves*
	Passeriformes	*Passeriformes*
	Thraupidae	*Thraupidae*
Genus	*Geospiza*	*Geospiza*
	fortis	*fuliginosa*

Do not write outside the box

0 9 . 1 Complete **Figure 15** to give the names of the missing classification groups.

[2 marks]

0 9 . 2 Give the binomial name of the medium ground finch.

Use information from **Figure 15**.

[1 mark]

Question 9 continues on the next page

Do not write outside the box

In each species of finch, there is a variation in beak depth.

Figure 16 shows how beak depth is measured.

Figure 16

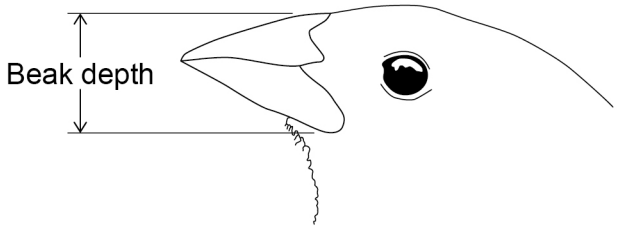
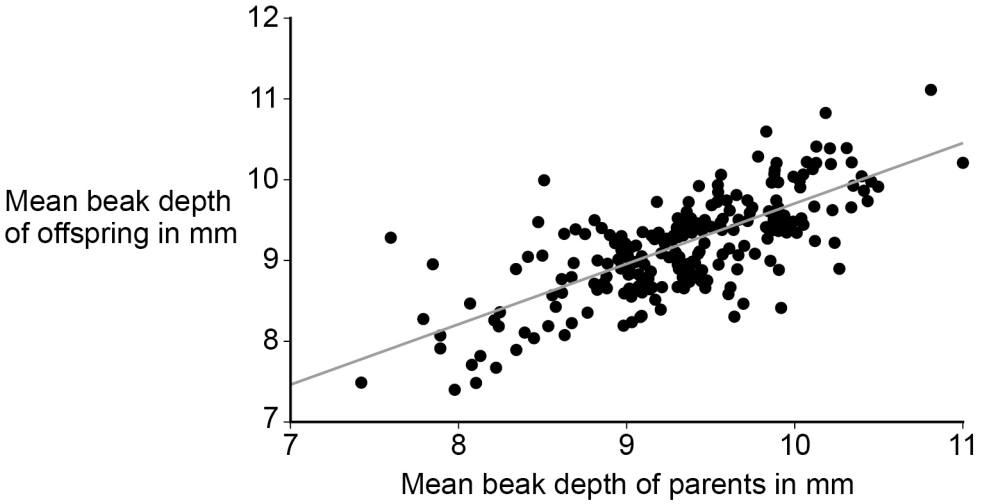


Figure 17 shows the relationship between the beak depth of parent birds and the beak depth of their offspring.

Figure 17



0 9 . 3 Give evidence from **Figure 17** that beak depth is an inherited characteristic.

[1 mark]

Do not write outside the box

0 9 . 4 Scientists suggested that more than one gene controls beak depth.

Give evidence from **Figure 17** to support the scientists' suggestion.

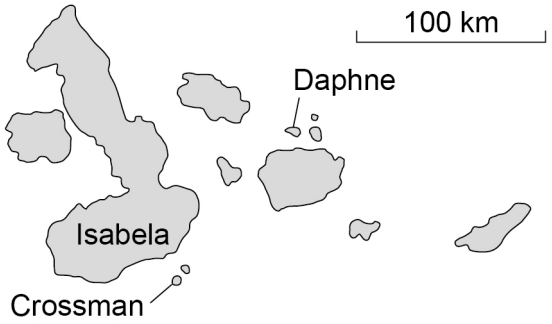
[1 mark]

Question 9 continues on the next page

Do not write outside the box

Figure 18 is a map of the Galapagos Islands.

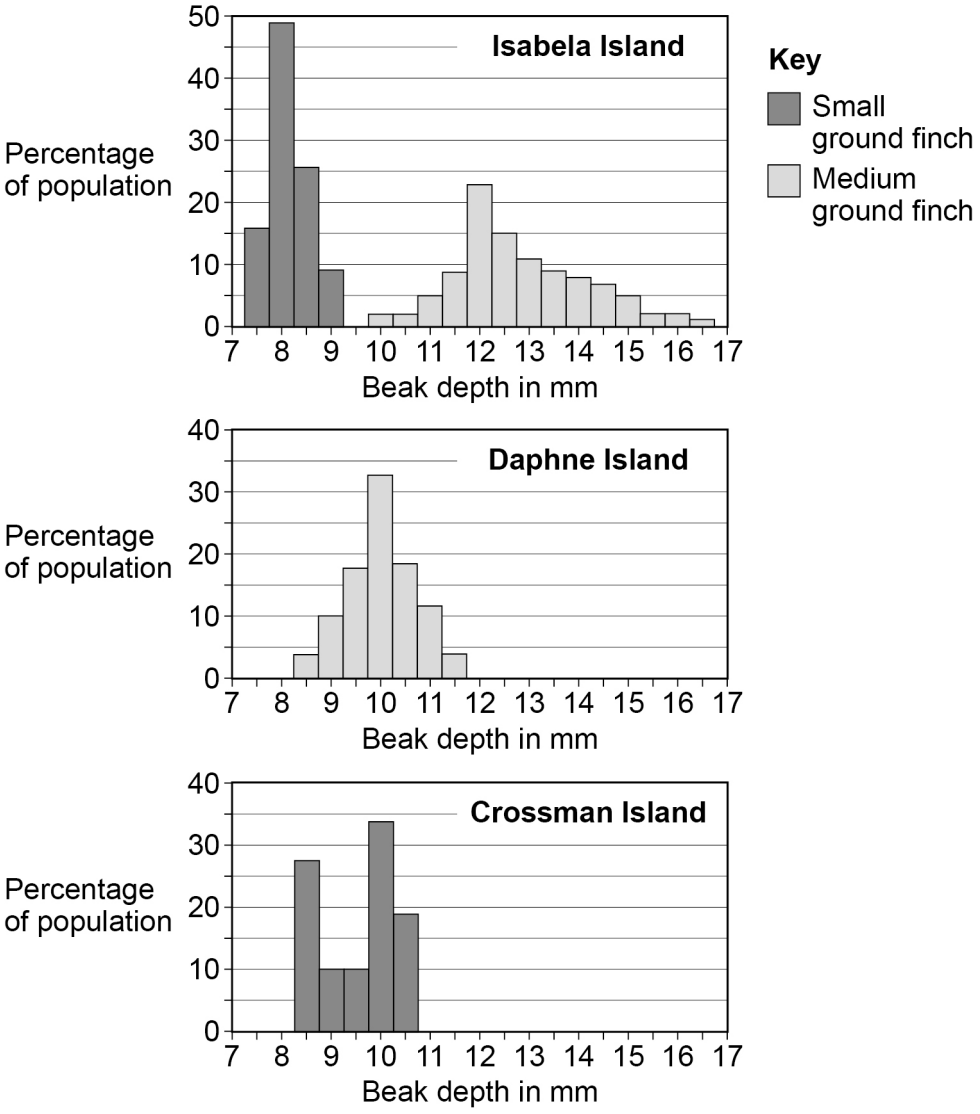
Figure 18



On Isabela Island, the medium ground finch **and** the small ground finch are found.
On Daphne Island, only the medium ground finch is found.
On Crossman Island, only the small ground finch is found.

Figure 19 shows how the beak depth of each species varies on each island.

Figure 19



Do not write outside the box

The medium ground finch and the small ground finch both feed on seeds.

The size of seeds eaten by each bird depends on the depth of the bird's beak.

0 9 . 5 The range of beak depth of **medium ground finches** on Isabela Island is different from the range on Daphne Island.

Explain what might have caused this difference.

[6 marks]

Question 9 continues on the next page

Do not write outside the box

0 9 . 6 **Figure 19** shows:

- the **two** species of finch live on Isabela Island
- only **one** of the species lives on Daphne Island
- only **one** of the species lives on Crossman Island.

Suggest why both species of finch are able to live on Isabela Island.

[2 marks]

13

END OF QUESTIONS

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Copyright information

For confidentiality purposes, all acknowledgements of third-party copyright material are published in a separate booklet. This booklet is published after each live examination series and is available for free download from www.aqa.org.uk.

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements. If you have any queries please contact the Copyright Team.

Copyright © 2021 AQA and its licensors. All rights reserved.