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

F

Foundation Tier   Paper 2F

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	
10	
11	
TOTAL	

8461/2F

Maths Made Easy

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

0 1 The theory of evolution states that organisms alive today evolved by natural selection from other species that are now extinct.

0 1 . 1 Which **two** scientists proposed the theory of evolution by natural selection?

[2 marks]

Tick (✓) **two** boxes.

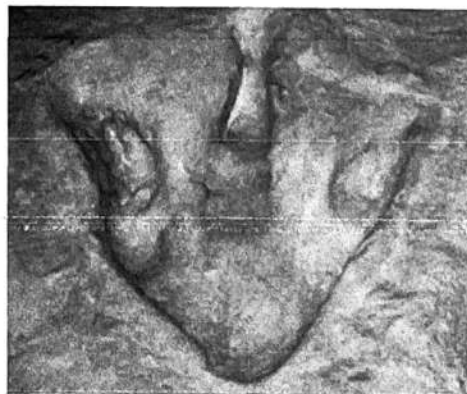Alexander Fleming   ☐

Alfred Russel Wallace   ☑

Carl Linnaeus   ☐

Carl Woese   ☐

Charles Darwin   ☑

Fossils provide evidence for evolution.

Figure 1 shows a fossil footprint of a dinosaur.

Figure 1

0 1 . 2 What is a fossil?

[2 marks]

The remains of an organism from a long time ago that has been preserved in some sense over time.

0 1 . 3 How was the fossil in **Figure 1** formed?

[1 mark]

Tick (✓) **one** box.

Body parts were replaced by minerals. ☐

The animal walked on mud. ☑ footprint had to be pressed into something.

The animal was frozen in ice. ☐

0 1 . 4 Dinosaurs are extinct.

Give **two** causes of extinction.

[2 marks]

1 A catastrophic event like asteroid collision helped to wipe them out.

2 Change in their habitat like cooling due to ice age and they were unable to adapt fast enough.

Question 1 continues on the next page

Turn over ▶

| 0 | 1 | . | 5 | Which **two** of the following provide evidence for evolution?

Tick (✓) **two** boxes.

[2 marks]

Bacteria can become resistant to an antibiotic. ✓

Early forms of life lived in the ocean. ☐

Older fossils are simpler than more recent ones. ✓ *Shows evolution of more complex life forms*

Older layers of rock are closer to the surface. ☐
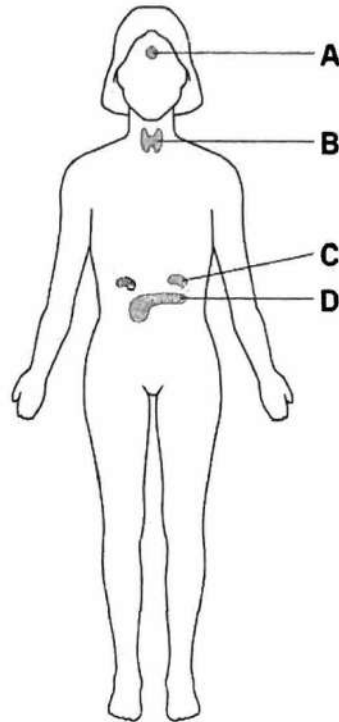
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9

Maths Made Easy

0 2 Many internal processes of the human body are controlled by hormones.

Hormones are produced by glands.

Figure 2 shows glands in a woman's body.

Figure 2

0 2 . 1 Which gland is the pituitary gland?

[1 mark]

Tick (✓) **one** box.

A ✓   B ☐   C ☐   D ☐

Found in the brain

0 2 . 2 Which gland is the pancreas?

[1 mark]

Tick (✓) **one** box.

A ☐   B ☐   C ☐   D ✓   Abdomenal area

The hormone insulin helps to decrease the blood glucose concentration.

Insulin causes its target organs to take in glucose from the blood.

0 2 . 3 Which of the following is a target organ for insulin?

[1 mark]

Tick (✓) **one** box.

Bladder ☐

Heart ☐

Liver ✓ *Where a lot of the glycogen is stored.*

0 2 . 4 The glucose is stored as an insoluble substance.

What is the insoluble storage substance that is formed from glucose?

[1 mark]

Tick (✓) **one** box.

Glycogen ✓

Protein ☐

Urea ☐

Question 2 continues on the next page

Turn over ▶

Scientists investigated the effect of a glucose drink on the concentration of glucose in a person's blood.

This is the method used.

1. Take a small sample of blood from the person.

2. Measure the concentration of glucose in the person's blood.

3. Give the person a drink containing 50 grams of glucose.

4. Measure the concentration of glucose in the person's blood at intervals.

5. Calculate the **change** in blood glucose concentration from the starting value.

Figure 3 shows the results.

Figure 3

Change in blood glucose concentration in mmol/dm^3

Time in minutes

Time when glucose solution was drunk
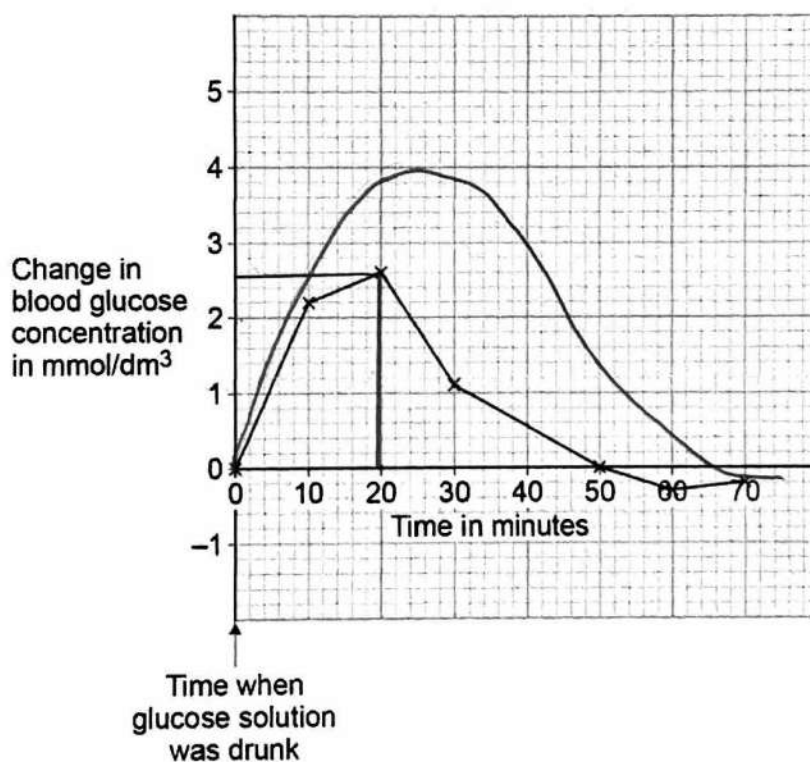
Figure 3 shows the **change** in blood glucose concentration.

0 2 . 5 At the start of the investigation, the blood glucose concentration was 5 mmol/dm³.

Calculate the highest blood glucose concentration during the investigation.

Use information from **Figure 3** in your answer.

[2 marks]

Peak at 20min = 2.6 change in mmol/dm³

5 mmol/dm³ + 2.6 mmol/dm³ = 7.6 mmol/dm³

Start + increase by = total

Highest blood glucose concentration = _____7.6_____ mmol/dm³

0 2 . 6 What is the time taken for the blood glucose concentration to decrease from its highest value back to the starting value?

Use data from **Figure 3** in your answer.

[1 mark]

Highest at 20, normal again at 50 ⟹ 50-20 = 30 min

Time taken = _____30_____ minutes

0 2 . 7 Why can you **not** be certain that your answer to Question 02.6 is accurate?

[1 mark]

Two measurements are to for away, being 20minutes appart. Could be any time inbetween.

0 2 . 8 **Figure 3** shows the results for a person who does **not have** Type 2 diabetes.

Sketch a line on **Figure 3** to show the results you would expect for a person who **has** Type 2 diabetes.
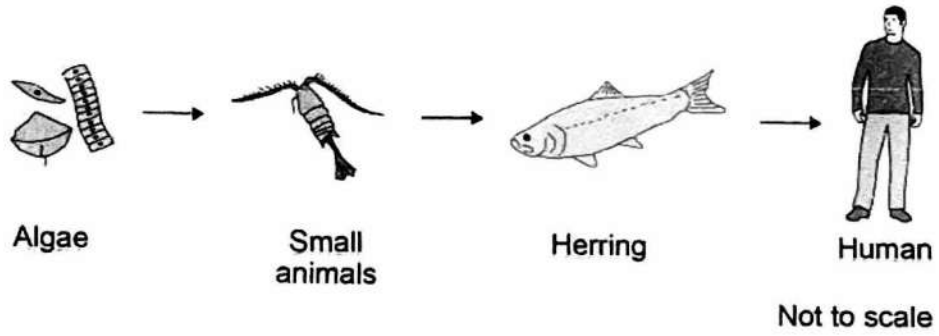
[2 marks]

10

Turn over for the next question

0 3   People eat fish caught in the North Sea.

Figure 4 shows a food chain.

Figure 4

Algae → Small animals → Herring → Human

Not to scale

0 3 . 1   The algae make glucose by photosynthesis.

Which **two** substances do the algae need for photosynthesis?

[2 marks]

Tick (✓) **two** boxes.

Carbon dioxide   ✓

Nitrogen   ☐

Oxygen   ☐

Starch   ☐

Water   ✓

0 3 . 2 What is the source of energy for photosynthesis?

[1 mark]

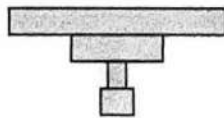Tick (✓) **one** box.

Light ✓

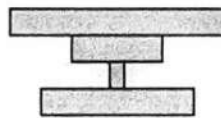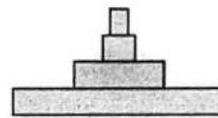Mineral ions ☐

Protein ☐

Water ☐

0 3 . 3 Which pyramid of biomass is correct for the food chain shown in **Figure 4**?
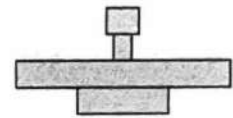
[1 mark]

Tick (✓) **one** box.

☐   ☐   ✓   ☐

each level many of lower level to eat which adds up to larger biomass on lower levels
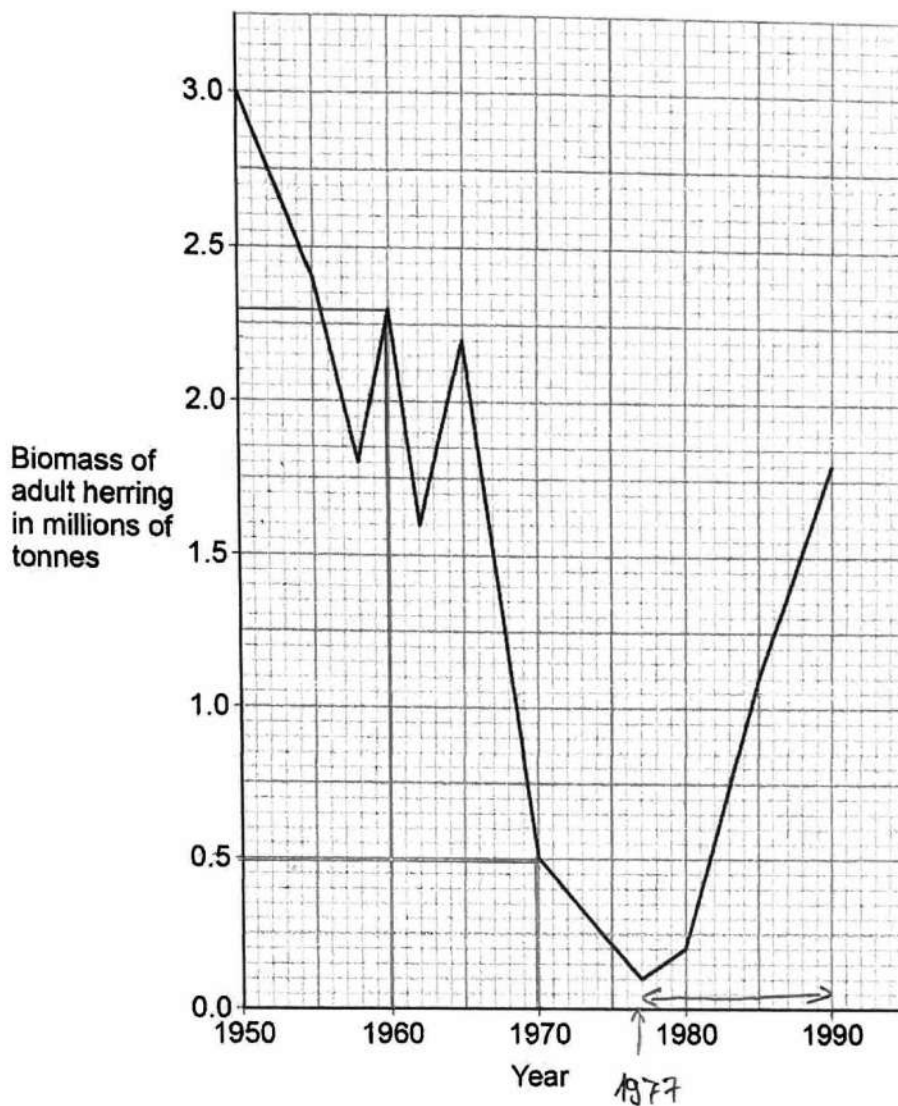
Question 3 continues on the next page

Turn over ▶

Maths Made Easy

Figure 5 shows the biomass of adult herring in the North Sea between 1950 and 1990.

Figure 5

0 3 . 4 Too many herring were caught in the 1960s.

Calculate the percentage decrease in the biomass of adult herring between 1960 and 1970.

Use the equation:

$$\text{percentage decrease} = \frac{(\text{biomass in 1960} - \text{biomass in 1970})}{\text{biomass in 1960}} \times 100$$

Give your answer to the nearest whole number.

[4 marks]

biomass in 1970 = 0.5 millions of tonnes

biomass in 1960 = 2.3 million of tonnes

percentage decrese = $\frac{2.3 - 0.5}{2.3} \times 100 = 78.2608 69.$

=> 78%

Percentage decrease = _____78_____ %

From 1977, laws were introduced to help conserve herring.

0 3 . 5 Describe the change in biomass of adult herring from 1977 to 1990.

Use data from **Figure 5** in your answer.

[2 marks]

It has started to increase, first steadily then more rapidly. It has increased from 0.1 to 1.8 million tonnes, thats 1.7 million tonnes difference.
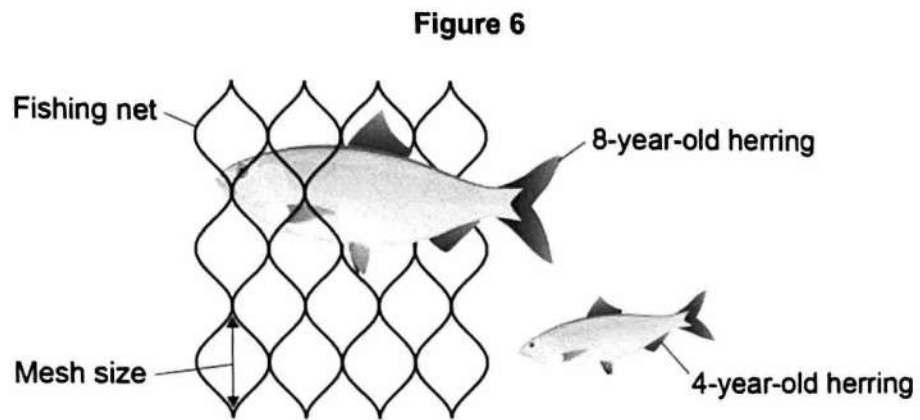
Question 3 continues on the next page

| 0 | 3 | . | 6 |

One of the laws was to control mesh size of fishing nets.

Figure 6 shows a fishing net with a legal mesh size.

Figure 6

Fishing net

8-year-old herring

Mesh size

4-year-old herring

Herring can live for up to 12 years.

Herring start to reproduce when they are 3 to 4 years old.

Explain how the control of mesh size of fishing nets has helped to conserve stocks of herring.

[2 marks]

Mesh has holes large enough for 4 year old and maybe even a bit older herring can escape. These individuals can reproduce to replenish population with new young fish.

12

0 4 The human eye can form images of objects that are at different distances away from the eye.

Figure 7 is a diagram of the eye.

Figure 7

Ciliary muscle

Suspensory ligament

Sclera

Retina

Cornea   A

Lens   B

C Optical nerve
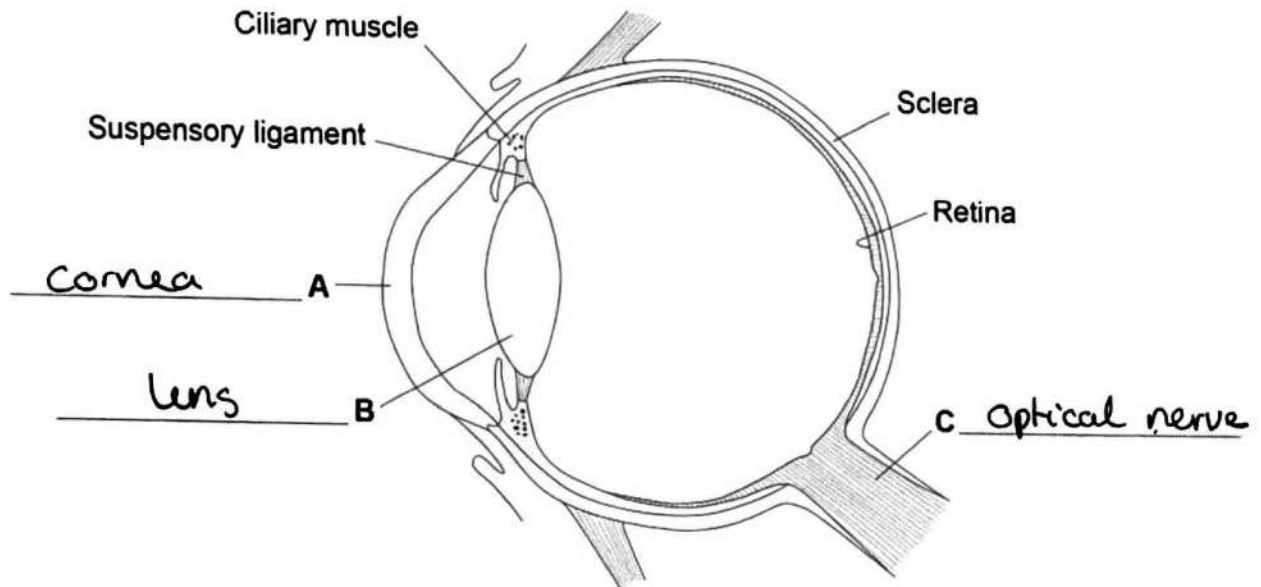
0 4 . 1 Label structures **A**, **B** and **C** on **Figure 7**.

Choose answers from the box.

[3 marks]

cornea	eyelid	iris	lens	optic nerve

The eye in **Figure 7** is focused on a distant object.

If the eye then focuses on the words in a book, changes would occur in the eye.

The light rays would be refracted more by the lens.

| 0 4 . 2 | How does the lens refract the light more?

[1 mark]

Tick (✓) **one** box.

By becoming longer ☐

By becoming thicker ✓

By becoming transparent ☐

| 0 4 . 3 | Which **two** structures control the shape of the lens?

[2 marks]

Tick (✓) **two** boxes.

Ciliary muscles ✓ *muscles cause movement*

Cornea ☐

Iris ☐

Sclera ☐

Suspensory ligaments ✓ *ligaments hold it in place so it can be streched.*

| 0 4 . 4 | To form a clear image, the light rays entering the eye must focus on one structure in the eye.

Name the structure.

[1 mark]

The retina (contains cones and rods as light receptors)
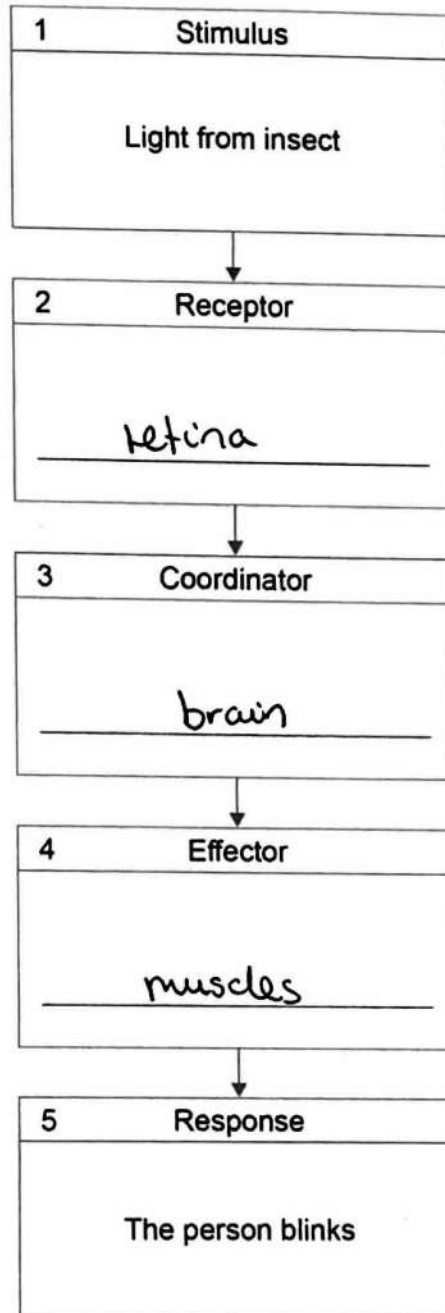
Question 4 continues on the next page

Turn over ▶

Maths Made Easy

0 4 . 5   An insect flies near a person's eye. The person blinks.
This is a reflex action.

Figure 8 shows the coordination system for this reflex action.

Figure 8

1	Stimulus

Light from insect

2	Receptor

retina

3	Coordinator

brain

4	Effector

muscles

5	Response

The person blinks

Complete **Figure 8**.

[2 marks]

Choose answers from the box below.

Write **one** word in each of boxes **2**, **3** and **4** of **Figure 8**.

brain	cornea	iris	muscles	retina

9

0 5 Potato blight is a disease of potato plants.

Potato blight is caused by the fungus *Phytophthora infestans.*

genus *species*

0 5 . 1 What is the genus of the fungus that causes potato blight?

[1 mark]

Tick (✓) **one** box.

infestans ☐

Phytophthora ☑

Phytophthora infestans ☐

0 5 . 2 The fungus grows near the surface of the potato.

How does growing near the surface help the fungus to respire?

[1 mark]

Tick (✓) **one** box.

The fungus can get nitrogen from the soil. ☐

The fungus can get oxygen from the air. ☑ *oxygen is necessary for respiration*

The fungus can get water from the potato. ☐

Question 5 continues on the next page

Turn over ▶

A farmer sprays his potato plants with a pesticide.

The pesticide kills the fungus that causes potato blight.

Spraying the crop with a pesticide could decrease biodiversity in a river flowing through his farm.

0 5 . 3 What does 'biodiversity in a river' mean?

[1 mark]

Tick (✓) **one** box.

The variety of species of animals in the river. ☐

The variety of species of organisms in the river. ✓ *biodiversity accounts for all species: animals and plants.*

The variety of species of plants in the river. ☐

0 5 . 4 The farmer sprayed pesticide on his potato plants. The next day it rained heavily.

Explain why the biodiversity in the river decreased.

[2 marks]

Pesticide washed off plants by the rain and it travelled to the river in the ground water. Once in the river it kills organisms in the river as pesticides kill a range of organisms.

Another method of preventing potato blight is to breed potatoes that are resistant to blight.

Resistance to potato blight is controlled by two alleles:

R = a dominant allele for having resistance to blight.

r = a recessive allele for **not** having resistance to blight.

A scientist crosses two potato plants. Each plant has the genotype **Rr**.

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| 0 5 . 5 | Complete **Figure 9** to show the possible genotypes of the offspring produced. |

[2 marks]

Figure 9

Male gametes

	R	r
R	RR	Rr
r	Rr	rr

Female gametes

| 0 5 . 6 | Draw a ring around **one** of the homozygous genotypes in **Figure 9**. |

[1 mark]

RR or rr

| 0 5 . 7 | What percentage of the offspring in **Figure 9** will be resistant to potato blight? |

[1 mark]

Tick (✓) **one** box.

25% ☐   50% ☐   75% ✓   100% ☐

All RR and Rr offspring.

| 0 5 . 8 | Potatoes can also reproduce asexually. |

Potatoes from one plant can be planted in the ground to produce new potato plants.

All the new plants from a parent plant that is resistant to blight will also be resistant to blight.

Explain why.

[2 marks]

New plants are clones of the mother plant, with being genetically identical to it. Offspring is produced through mitosis not meiosis.

11

Turn over for the next question

Turn over ▶
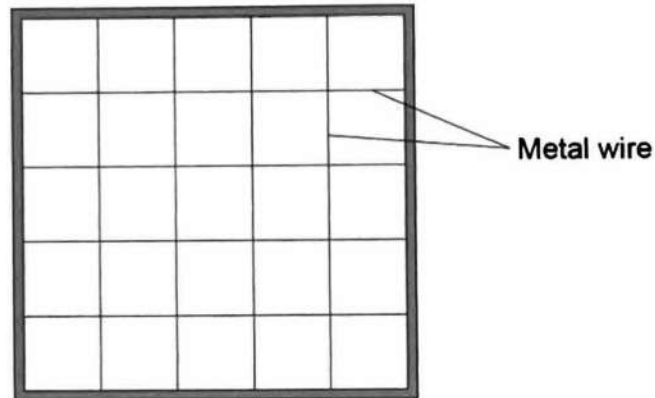
Maths Made Easy

0 6   A student estimated the percentage cover of buttercup plants in a field.

The student used a quadrat.

The quadrat was divided into 25 equal squares.

Figure 10 shows the quadrat.

Figure 10

Metal wire

This is the method used.

1. Place the quadrat on the ground.

2. Record how many squares in the quadrat contain buttercup plants.

3. Place the quadrat in a new position in the field.

4. Record how many squares in the quadrat contain buttercup plants.

5. Repeat steps 3 and 4 another three times.

0 6 . 1 What method should the student have used for placing the quadrat?

[1 mark]

Tick (✓) **one** box.

Place the quadrat where there are many buttercup plants. ☐

Place the quadrat only where there are no trees. ☐

Place the quadrat using random coordinates. ✓ sampling has to be random so no biases

Use the same person to place all the quadrats. ☐

The student calculated the percentage cover of buttercup plants for each quadrat.

Table 1 shows the student's results.

Table 1

Quadrat number	Number of squares containing buttercup plants	Percentage cover of buttercup plants
1	10	40
2	13	52
3	22	88
4	20	80
5	10	40
	Mean	**X**

0 6 . 2 Calculate mean value **X** in **Table 1**.

[2 marks]

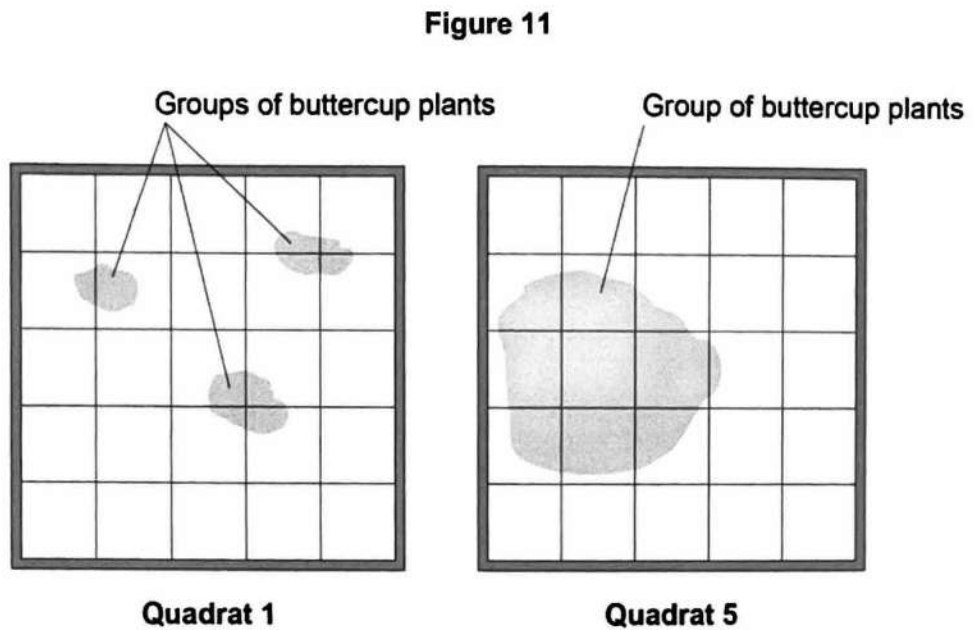$$\frac{40 + 52 + 88 + 80 + 40}{5} = \frac{300}{5} = 60$$

X = _____60_____ %

Question 6 continues on the next page

Turn over ▶

Table 1 shows that quadrat 1 and quadrat 5 each had 40% cover of buttercup plants.

Figure 11 shows the results for quadrat 1 and quadrat 5.

Figure 11

Groups of buttercup plants

Group of buttercup plants

Quadrat 1

Quadrat 5

| 0 | 6 |.| 3 | The student's method of estimating the percentage cover of buttercup plants is **not** accurate.

How does **Figure 11** show this?

[1 mark]

Tick (✓) **one** box.

Quadrat 1 has more groups of buttercup plants. ☐

The area of buttercup plants in quadrat 5 is much larger. ✓

The buttercup plants are in ten squares in both quadrats. ☐

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0 6 . 4 The student wanted to get a more valid estimate of the percentage cover of buttercup plants in the field.

Suggest **two** improvements to the method to make the results more valid.

[2 marks]

1 Carry out more repeats by placing more random quadrats, sampling a larger proportion of the field.

2 Estimate the percentage cover in each quadrat, rather then recording presence or absence only.

0 6 . 5 Give **three** environmental factors that would affect the growth of buttercup plants in a field.

[3 marks]

1 Water

2 Light

3 mineral availability of the soil

9
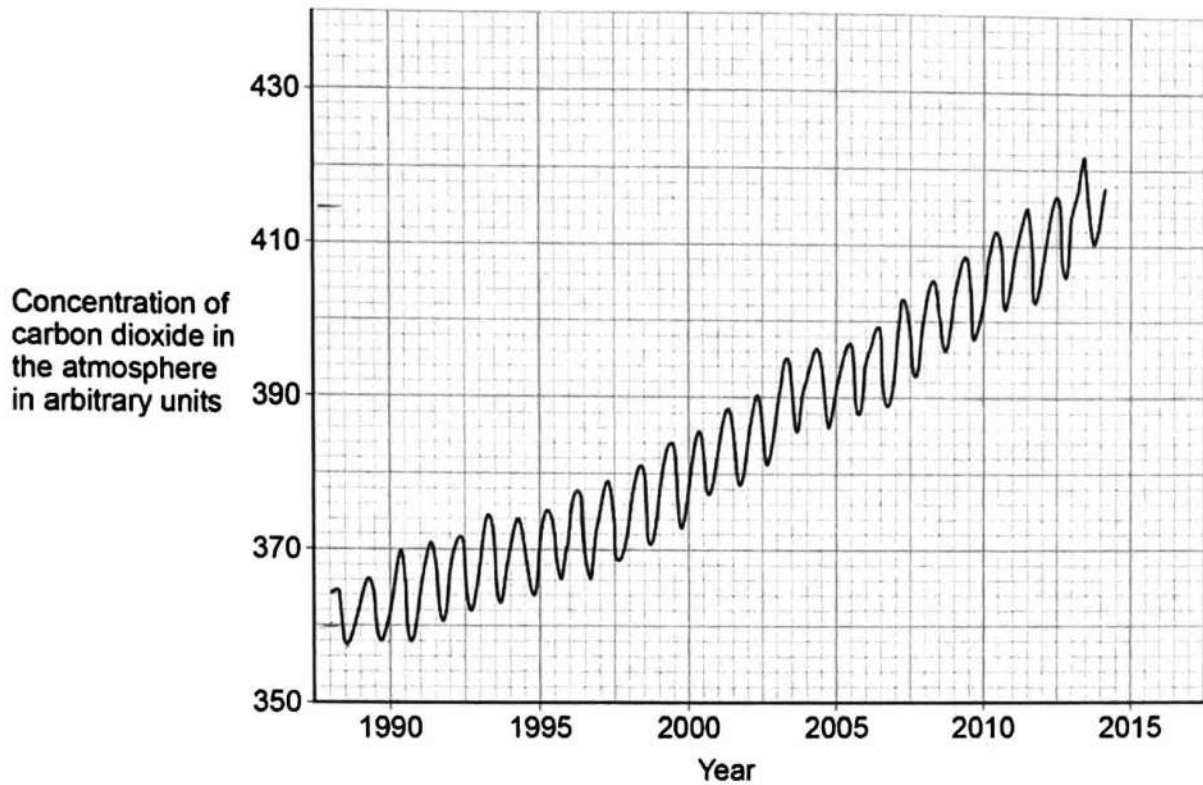
Turn over for the next question

Turn over ▶

0 7

Scientists are very concerned about the changes in concentration of carbon dioxide in the Earth's atmosphere.

Figure 12 shows the concentration of carbon dioxide in the atmosphere between 1988 and 2014.

Figure 12

0 7 . 1 Describe **two** patterns shown in **Figure 12**.

Use data from **Figure 12** in your answer.

[4 marks]

1 *Overall CO$_2$ concentration increases between 1988 and 2014 by 54 arbitary units. From 364 to 418.*

2 *There is a yearly cycle, shown by a series of peaks and troughs.*

0 7 . 2 Give **two** human activities that affect the concentration of carbon dioxide in the atmosphere.

[2 marks]

1 Deforestation, decreases the number of trees that fix CO_2 from the atmosphere.

2 Combustion of fuels release CO_2 into the atmosphere.

0 7 . 3 The trend shown in **Figure 12** may continue for many years.

Explain what effect the changing concentration of carbon dioxide in the atmosphere could have on living organisms.

[4 marks]

Carbon dioxide is a greenhouse gas, so by higher concentration it increases global warming.

Global warming can cause increase in the frequency of extreme weather patterns: too droughts, floods, storms. This will have a knock on effect on habitats for many species. Some too species may not be able to keep up and go extinct, potentially having a knock on effect on the survival of other species.

With the increased temperatures the ice caps and glaciers will melt, releasing large amounts of water into the oceans, leading to sea levels to rise. This causes further habitat loss and flooding.

However, some plant may come to benfit from it. As, increased temperatures and CO_2 concentration provides ideal conditions for photosynthesis, so they can grow faster.

10

Turn over ▶

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0 8 The nucleus of a cell contains DNA.
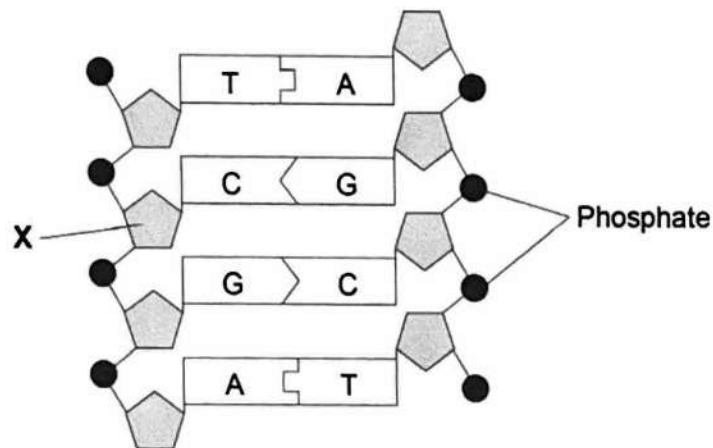
0 8 . 1 Name the structures inside the cell nucleus that contain DNA.

[1 mark]

Chromosome (DNA is organised into chromosomes)

Figure 13 shows part of a DNA molecule.

Figure 13

0 8 . 2 Name the part of the DNA molecule labelled **X**.

[1 mark]

Sugar (deoxyribose sugar)

0 8 . 3 What type of substances are labelled **A**, **C**, **G** and **T** in **Figure 13**?

[1 mark]
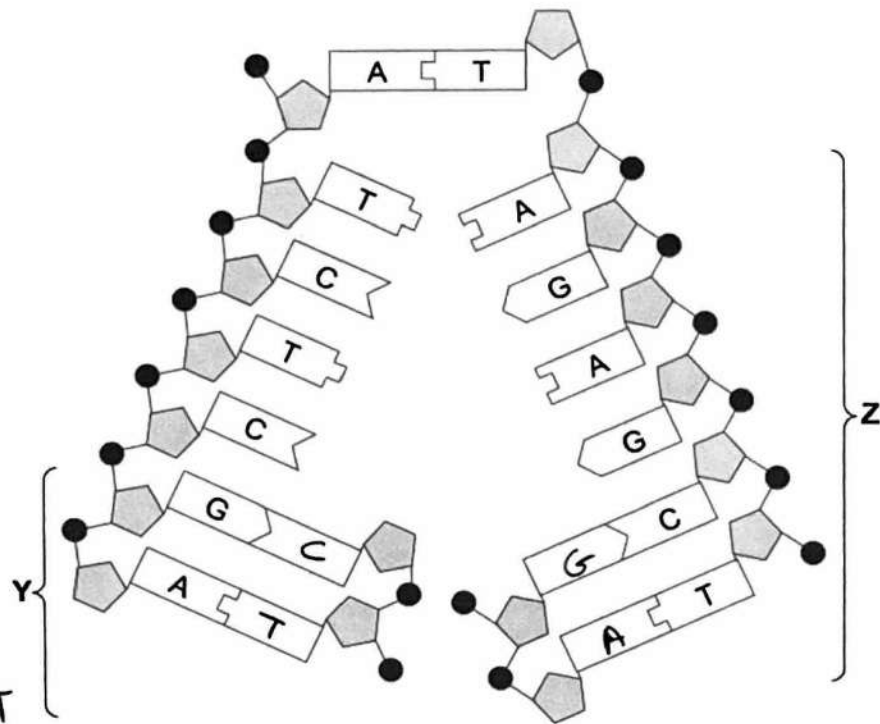
base (nitrogen rich) (adenine, cytosine, guanine, thymine)

Figure 14 shows another section of a DNA molecule.

Figure 14

A pairs with T
C pairs with G

0 8 . 4   Four of the substances you named in Question **08.3** are **not** labelled in part **Y**
of **Figure 14**.

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

Use information from other parts of **Figure 14** to help you.

[1 mark]

0 8 . 5   What is happening to the DNA in part **Z** of **Figure 14**?

[1 mark]

Tick (✓) **one** box.

Differentiation   ☐

Evolution   ☐

Fertilisation   ☐

Replication   ☑

Turn over ▶

0 8 . 6 A gene is a length of DNA.

What type of substance does a gene code for?

[1 mark]

protein (codes for an amino acid sequence, that is folded into a protein)

0 8 . 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 ✓   exactly half of 6×10^{-12} g as sperm cells are haploid containing half of the genetic material of a normal cell.

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

[1 mark]

Tick (✓) **one** box.

Binary fission ☐

Differentiation ☐
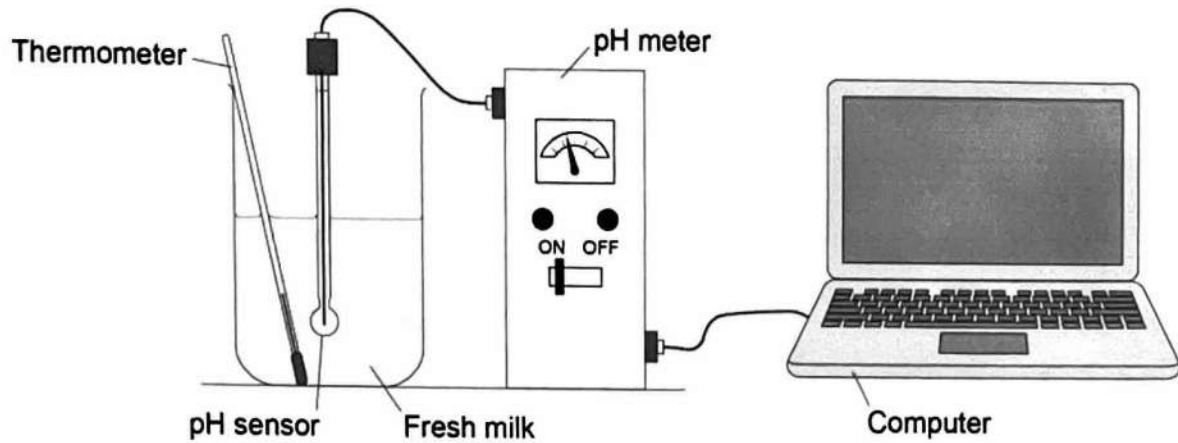
Meiosis ✓   sex cells are produced through meiosis

Mitosis ☐

8

Do not write outside the box

0 9   A student investigated the effect of temperature on the decay of milk.

Figure 15 shows the apparatus the student used.

Figure 15

Thermometer — pH meter — pH sensor — Fresh milk — ON OFF — Computer

This is the method used.

1. Set up the apparatus as shown in **Figure 15** 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 9 . 1   How could the student keep the milk at a constant temperature for 5 days?

[1 mark]

Keep in a constant temperature water bath

0 9 . 2   Give **one** variable the student should keep constant.

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

[1 mark]

The type of milk used
(eg.: goat /cow) or (eg.: skimmed /semi skimmed)

Question 9 continues on the next page

Turn over ▶

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Table 2 shows the student's results for the milk at 20 °C.

Table 2

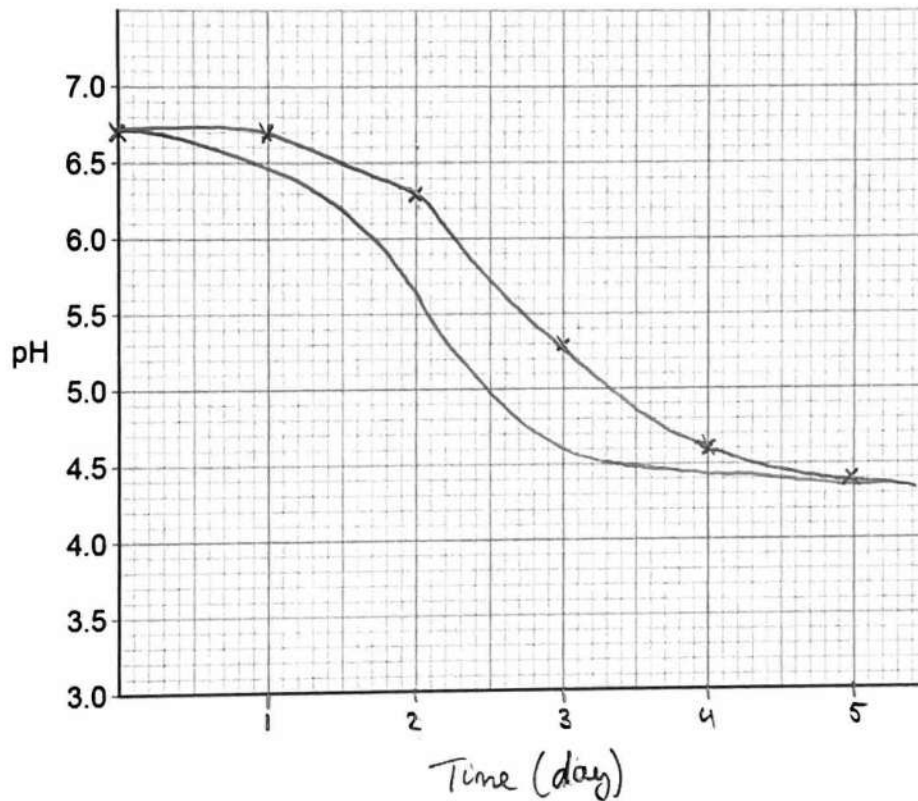| Time in days	0	1	2	3	4	5
pH	6.7	6.7	6.3	5.3	4.6	4.4

0 9 . 3 Complete **Figure 16**.

[4 marks]

You should:

- label the x-axis
- use a suitable scale for the x-axis
- plot the data from **Table 2**
- draw a line of best fit.

Figure 16

0 9 . 4 The data you plotted in Question **09.3** were obtained at 20 °C.

Sketch a line on **Figure 16** to show the results you would expect at 25 °C.

Label this line '25 °C'.

[2 marks]

8

1 0   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 cm³ of ice-cold water to drink.

5. Continue to measure the person's internal body temperature and sweating rate for a further 50 minutes.

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

[1 mark]

Movement would generate more heat so increase the body temperature than Rexpected.

Question 10 continues on the next page

Maths Made Easy

Figure 17 and **Figure 18** show the scientists' results.
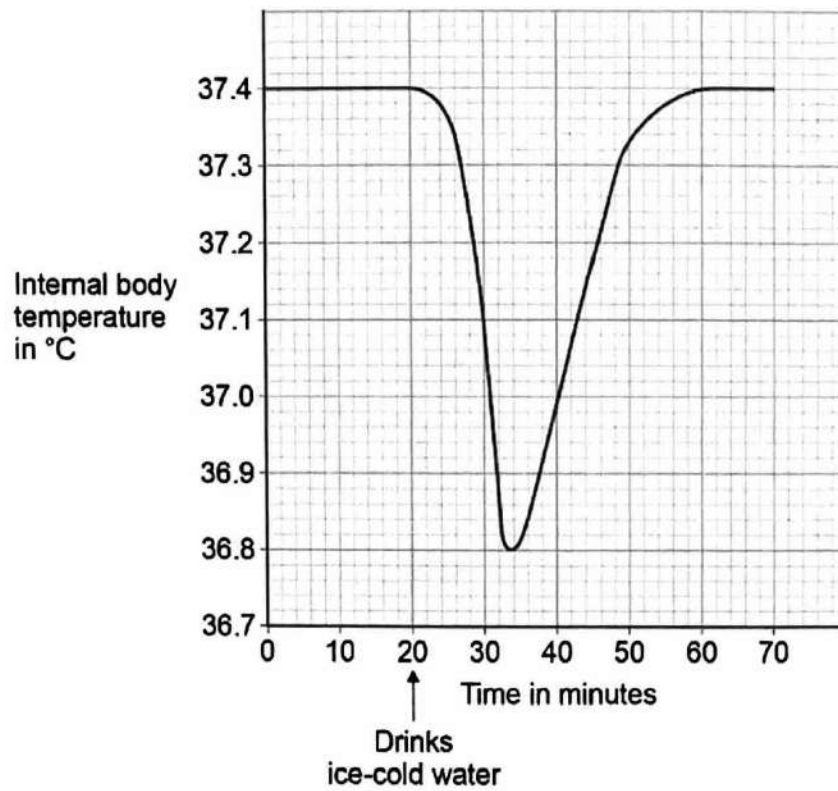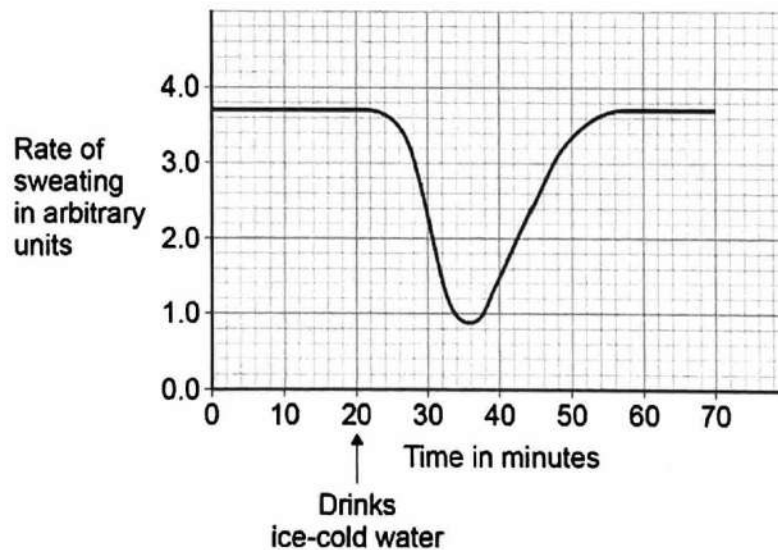

Figure 17

Figure 18

10.2 What is this person's normal internal body temperature?

[1 mark]

Tick (✓) **one** box.

36.8 °C ☐   37.0 °C ☐   37.4 °C ✓

this is what its stabel as before the drink

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

10.3 Explain why the temperature near the brain decreased.

[2 marks]

As the person drinks cold water it cools surfaces where it touches, like the mouth or stomach. As blood travel through these parts it is cooled. ~~and~~ When this cooled blood flows to the brain it decreases the body temperature there as well.

10.4 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]

Through the nervous system that contains neurones. Impulses are sent along them, with a message.

10.5 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]

The rate of sweating decreases. Sweating ~~cooler~~ cools the body, as sweat evaporates from the skin, the heat is lost by the body. By reducing sweating less heat is lost, so body returns faster to the higher temperature.

Question 10 continues on the next page

Maths Made Easy

| 1 | 0 | . | 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

Dilation - expansion of the lumen of the vessles
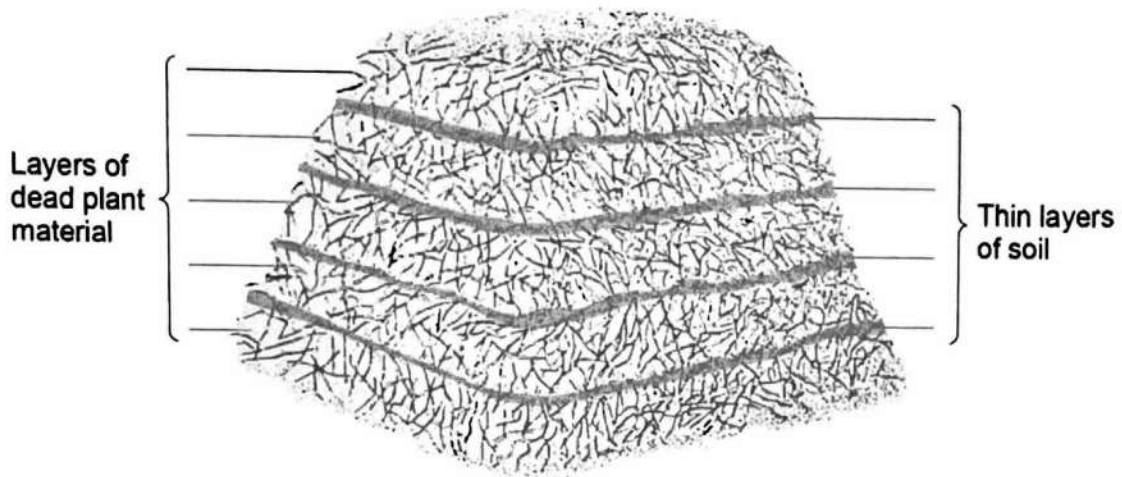
Turn over for the next question

1	1

Decay occurs in a compost heap.

Figure 19 shows a compost heap.

Figure 19

Layers of
dead plant
material

Thin layers
of soil

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]

Dead plant contain all kinds of useful molecules, but these are fixed up in large complex molecules. The function of microorgasms as decomposers is to break down these large molecules into smaller ones. They use enzymes to 'cleave' of smaller molecules that they can then metabolise in respiration. Organic molecules get converted to carbon dioxide that is released into the atmosphere. Other ~~smaller~~ mineral ions also get released into the compost, such as nitrates and phosphates for example.

Do not write outside the box

These ions can be taken up from the compost later by plant roots through active transport. The plant uses nitrates to produce amino acids that make up proteins. They also use phosphates in the sugar - phosphate backbone of DNA. Furthermore, they can take up the Carbon dioxide from the atmosphere through their stomata by diffusion and use it in photosynthesis. This produces sugars for the plant to use for growth and repair and reproduction.

6

END OF QUESTIONS