Name_____

2024

Triple Science

Foundation

Biology: Paper 2

PMT

AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

GCSE BIOLOGY

F

Foundation Tier Paper 2F

Friday 7 June 2019 Afternoon 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.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- 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 nervous system allows a person to detect stimuli.

0 1 . 1 Draw **one** line from each stimulus to the sense organ that detects the stimulus.

[2 marks]

Stimulus	Sense organ
Chemicals	Ear
Light	Eye
	Tongue

Moving a hand away from a hot object is an example of a reflex action.

0 1 . 2 What is a reflex action?

[2 marks]

_____

_____

_____

_____

Do not write outside the box

0 1 . 3 A muscle in the arm moves the hand away from the hot object.

How does the arm muscle do this?

[1 mark]

Tick (✓) **one** box.

- The muscle contracts. ☐
- The muscle expands. ☐
- The muscle relaxes. ☐
- The muscle shrinks. ☐

Question 1 continues on the next page

Do not write outside the box

Two students investigated the effect of drinking coffee on reaction time.

This is the method used.

1. Student **A** holds a metre rule just above student **B**'s hand, as shown in **Figure 1**.
2. Student **A** lets go of the metre rule.
3. Student **B** catches the metre rule as quickly as possible.
4. Student **A** writes down the reading from the scale on the metre rule.
5. Students **A** and **B** repeat steps 1–4 another four times.
6. Student **B** then drinks a cup of coffee.
7. After 15 minutes, students **A** and **B** repeat steps 1–5.

Figure 1

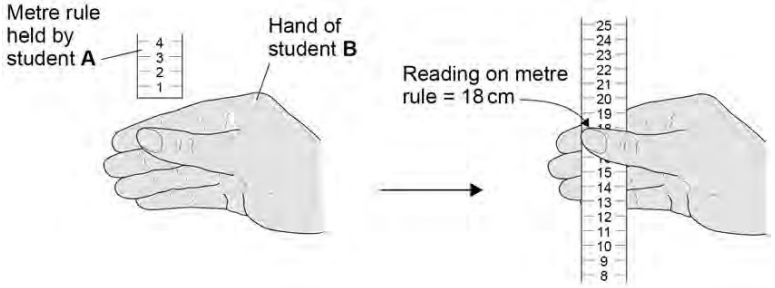


Table 1 shows some of the results.

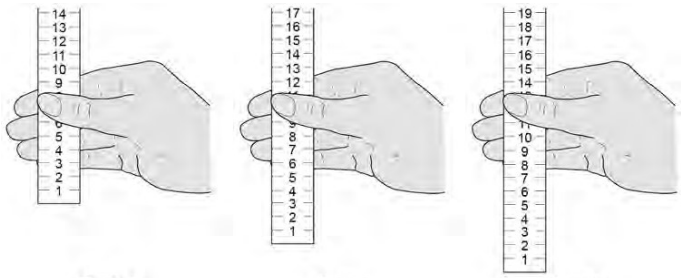
Table 1

Test	Reading from scale on metre rule in cm	
	Before drinking coffee	After drinking coffee
1	18	10
2	21	14
3	15	
4	12	
5	19	

Do not write outside the box

Figure 2 shows the results **after** drinking the coffee for tests **3**, **4** and **5**.

Figure 2



0 1 . 4 Complete **Table 1.**

Use results from **Figure 2.**

[2 marks]

The students made the following conclusion:

'Drinking coffee speeds up reactions.'

0 1 . 5 Give evidence from **Table 1** to support the students' conclusion.

[1 mark]

0 1 . 6 The students' conclusion may **not** be valid.

Suggest **two** improvements the students could make to their method.

[2 marks]

1 _____

_____

2 _____

_____

10

Turn over ►

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There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

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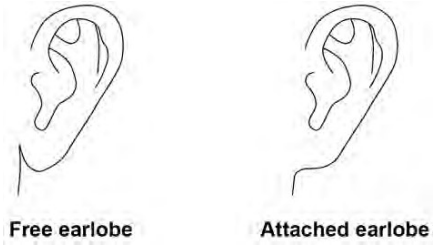
0 2 The shape of a person's earlobes is controlled by a gene.

Figure 3 shows two types of earlobe.

Figure 3



A dominant allele codes for free earlobes.

0 2 . 1 What is a dominant allele?

[1 mark]

Tick (✓) **one** box.

- An allele expressed even if a person only has one copy of the allele ☐
- An allele expressed only if a person has two copies of the allele ☐
- An allele expressed only if a person has no recessive allele ☐
- An allele expressed only if it is inherited from the male parent ☐

Question 2 continues on the next page

Turn over ►

Do not write outside the box

0 2 . 2 A man with free earlobes and a woman with attached earlobes have children together.

Complete **Figure 4** to show the possible genotypes of the children.

Use the symbols:

E = allele for free earlobes
e = allele for attached earlobes

[2 marks]

Figure 4

		Woman	
		e	**e**
Man	**E**	**Ee**	
	e		

0 2 . 3 What is the probability that one of the children would have attached earlobes?

Use **Figure 4**.

[1 mark]

Tick (✓) **one** box.

0.125 ☐ 0.25 ☐ 0.5 ☐ 0.75 ☐

Do not write outside the box

0 2 . 4 **Figure 5** shows the inheritance of the sex chromosomes, **X** and **Y**.

Complete **Figure 5** to show the sex chromosomes in the gametes of the man and the woman.

[2 marks]

Figure 5

		Woman	
Man		**XX**	**XX**
		XY	**XY**

0 2 . 5 Calculate the probability that the man and the woman's next child will be a girl with attached earlobes.

[2 marks]

Use the equation:

probability of a girl with attached earlobes

= probability of attached earlobes × probability of being a girl

Probability of a girl with attached earlobes = _____

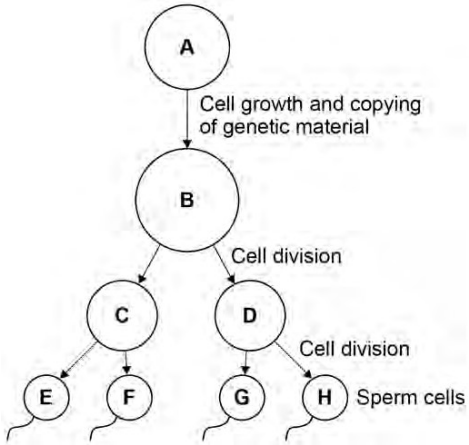
8

Turn over ►

Do not write outside the box

0 3 **Figure 6** shows the production of sperm cells in humans.

Figure 6



0 3 . 1 Cell **A** is a normal body cell.

How many chromosomes are there in cell **A**?

[1 mark]

Tick (✓) **one** box.

23 ☐ 46 ☐ 48 ☐ 92 ☐

0 3 . 2 What is the mass of DNA in cell **E**?

[1 mark]

Tick (✓) **one** box.

A quarter of the mass of the DNA in cell **A** ☐

Half the mass of the DNA in cell **A** ☐

The same mass as the DNA in cell **A** ☐

Twice the mass of the DNA in cell **A** ☐

Do not write outside the box

0 3 . 3 What type of cell division produces sperm cells?

[1 mark]

Tick (✓) **one** box.

- Binary fission ☐
- Differentiation ☐
- Meiosis ☐

0 3 . 4 Sometimes there are errors in copying the genetic material.

What term describes an error in the genetic material?

[1 mark]

Tick (✓) **one** box.

- Absorption ☐
- Fertilisation ☐
- Mitosis ☐
- Mutation ☐

0 3 . 5 A woman has three children, aged 4, 6 and 9 years.

Why are the children **not** genetically identical?

[2 marks]

_____

_____

_____

_____

Turn over ►

Do not write outside the box

In sexual reproduction, a sperm cell fuses with an egg cell to form a new single cell.

An embryo develops from the single cell.

The cell divides three times to produce the embryo.

0 3 . 6 How many cells are there in the embryo after three cell divisions?

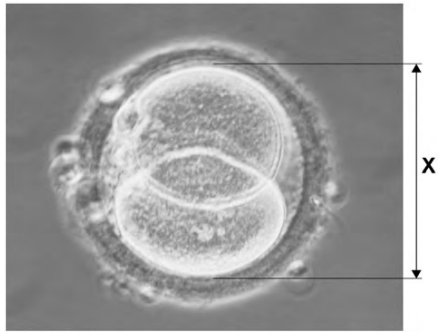
[1 mark]

Tick (✓) **one** box.

3 ☐ 6 ☐ 8 ☐ 9 ☐

Figure 7 shows a different human embryo.

Figure 7



0 3 . 7 Measure image length **X** on **Figure 7**.

[1 mark]

Give your answer in millimetres (mm).

X = _____ mm

Do not write outside the box

0 3 . 8 The image in **Figure 7** has been magnified ×500

Calculate the real length of the embryo.

Use the equation:

$$\text{real length of the embryo} = \frac{\text{image length}}{\text{magnification}}$$

Give your answer in micrometres (μm).

1 mm = 1000 μm

[3 marks]

Real length of the embryo = _____ μm

0 3 . 9 The embryo may **not** implant in the lining of the uterus.

The embryo will then be lost from the woman's body several days later.

Explain why the woman may **not** notice this has happened.

[2 marks]

13

Turn over for the next question

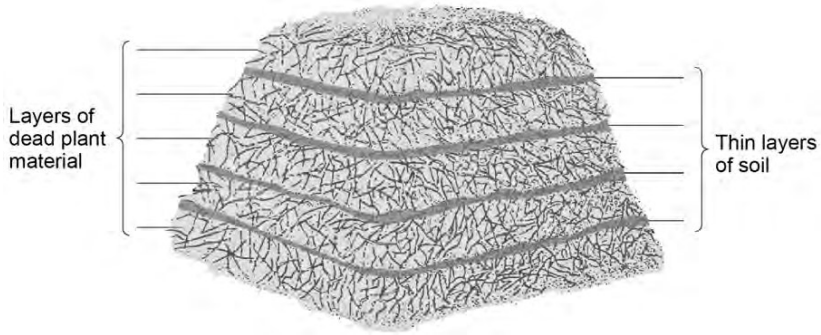
Do not write outside the box

0 4 Gardeners sometimes make compost heaps from dead plant material.

The dead plants decay in the compost heap.

Figure 8 shows a compost heap.

Figure 8



0 4 . 1 The thin layers of soil contain organisms that cause decay.

Which **two** types of organism cause decay?

[2 marks]

Tick (✓) **two** boxes.

- Bacteria ☐
- Fungi ☐
- Grass ☐
- Insects ☐
- Worms ☐

Do not write outside the box

The rate of decay in the compost heap depends on several environmental factors.

0 4 . 2 Explain how the rate of decay would be affected by:

- an increase in oxygen concentration
- a temperature increase from 5 °C to 25 °C

[3 marks]

0 4 . 3 Give **one** environmental factor needed for decay.

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

[1 mark]

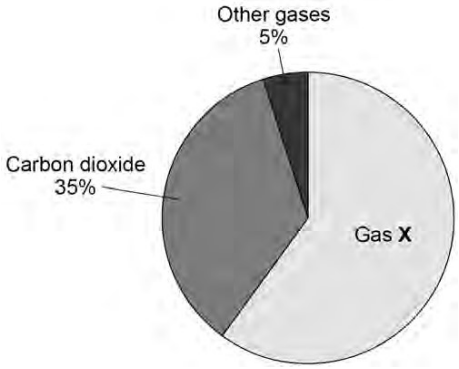
Question 4 continues on the next page

Do not write outside the box

Dead plant material can also be decayed in a biogas generator.

Figure 9 shows the percentages of the gases found in a sample of biogas.

Figure 9



0 4 . 4 Gas **X** is the main fuel gas found in the biogas.

What is gas **X**?

[1 mark]

Tick (✓) **one** box.

Carbon monoxide ☐

Hydrogen ☐

Methane ☐

Nitrogen ☐

Do not write outside the box

0 4 . 5 What is the percentage of gas **X** in the biogas?

[1 mark]

Percentage = _____ %

0 4 . 6 The dead plant material in the compost heap and biogas generator does **not** decay completely.

Explain why a farmer might spread the remaining dead plant material onto his fields.

[2 marks]

10

Turn over for the next question

Do not write outside the box

0 5 **Figure 10** shows a flightless bird called the dodo (*Raphus cucullatus*).

Figure 10

The dodo:

- was 1 m tall
- had a mass of 20 kg
- lived in rainforests on a tropical island
- ate fruits
- made its nest on the ground.

A female dodo laid only one egg each year.

Humans arrived on the island in the year 1507. By 1681 the dodo was extinct.

0 5 . 1 What is the genus of the dodo?

[1 mark]

Tick (✓) **one** box.

Animal ☐

Bird ☐

Raphus ☐

Do not write outside the box

0 5 . 2 Before the arrival of humans, there were no other large animals living on the island.

Suggest **two** reasons why the dodo became extinct soon after the arrival of humans.

[2 marks]

1 _____

_____

2 _____

_____

Today, humans are cutting down large areas of tropical rainforests.

0 5 . 3 Suggest **one** use of the land after the trees have been removed.

[1 mark]

_____

_____

0 5 . 4 Why does the removal of trees cause an increase in carbon dioxide in the atmosphere?

[2 marks]

Tick (✓) **two** boxes.

- There are fewer animals. ☐
- There is less photosynthesis. ☐
- There is less respiration. ☐
- The soil dries out. ☐
- The trees are burned. ☐

Turn over ►

Do not write outside the box

0 5 . 5 What effect would an increase in carbon dioxide in the atmosphere have on global air temperature?

[1 mark]

Tick (✓) **one** box.

- Decrease ☐
- Increase ☐
- Stay the same ☐

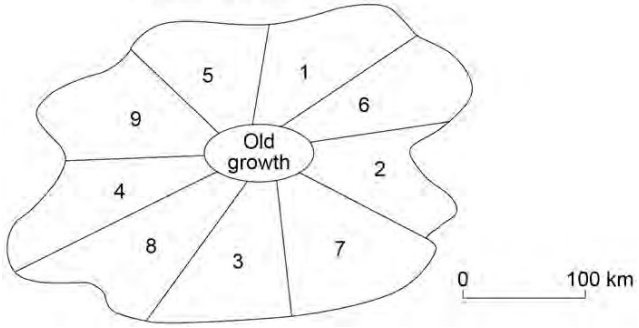
'Sustainable forestry' reduces the harmful effects of cutting down trees on the environment.

Figure 11 shows a method of 'sustainable forestry'.

Numbers 1–9 show different parts of a rainforest.

Figure 11

Map of the rainforest



The trees are cut down in the sequence 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9

- The trees are cut down in only one area at any one time.
- It takes 30 years to cut down the trees in each area.
- The trees in the 'Old growth' area are never cut down.

Do not write outside the box

0 5 . 6 How many years would it take to cut down the trees in all of the numbered areas in **Figure 11**?

[2 marks]

Number of years = _____

0 5 . 7 The rainforest contains:

- 750 species of trees
- 400 species of birds
- 150 species of butterflies
- many other species of plants and animals.

Explain how the pattern of cutting down trees shown in **Figure 11** stops the biodiversity of the rainforest being reduced.

[4 marks]

13

Do not write outside the box

0 6 Two of the substances the body excretes are urea and carbon dioxide.

0 6 . 1 Complete the sentence.

[1 mark]

Choose the answer from the box.

carbohydrate	lipid	protein	salt

A person makes a lot of urea if the person's diet contains a lot of _____.

0 6 . 2 Why must urea be excreted from the body?

[1 mark]

0 6 . 3 A person produces more carbon dioxide during exercise than when resting.

Complete the sentences.

[2 marks]

Choose answers from the box.

breathing	digestion	egestion
osmosis	respiration	

The process that makes carbon dioxide is _____.

During exercise, extra carbon dioxide can be removed from the body by increasing the rate of _____.

Do not write outside the box

0 6 . 4 Excess water must also be removed from the body.

If a person sweats a lot, less water will be excreted in the urine.

A healthy person did the same amount of exercise on each of 3 days.

Table 2 shows information for the 3 days.

Table 2

Day	Air temperature in °C	Volume of water consumed in cm^3	Relative amount of urine produced by the kidneys
1	30	1500	
2	20	1500	
3	15	2000	

Complete **Table 2.**

[2 marks]

Choose answers from the box.

least	medium	most

Question 6 continues on the next page

Turn over ►

Do not write outside the box

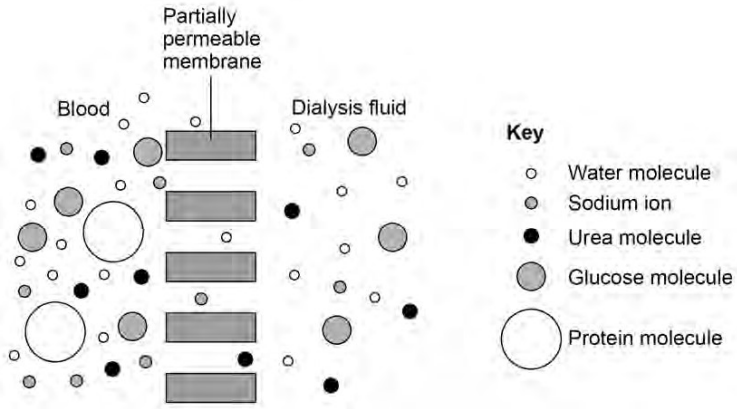
Some people have kidney disease.

Kidney disease may be treated by dialysis or by having a kidney transplant operation.

- During dialysis, a person is connected to a machine that filters the blood.
- Each dialysis session lasts about 6 hours.
- The person has several dialysis sessions each week.

Figure 12 shows how dialysis works.

Figure 12



0 6 . 5 How does urea move out of the blood during dialysis?

[1 mark]

Tick (✓) **one** box.

Diffusion ☐

Digestion ☐

Osmosis ☐

Respiration ☐

Do not write outside the box

0 6 . 6 Which substance in **Figure 12** does **not** pass from the blood into the dialysis fluid?

Give the reason for your answer.

[2 marks]

Substance _____

Reason _____

_____

Question 6 continues on the next page

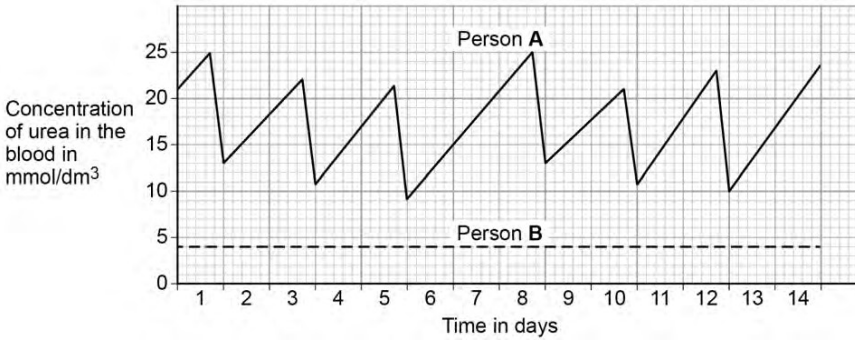
Do not write outside the box

Two people have kidney disease.

- Person **A** is treated by dialysis.
- Person **B** has had a kidney transplant.

Figure 13 shows changes in the urea concentration in the blood of each person over 2 weeks.

Figure 13



0 6 . 7 How many dialysis sessions did person **A** have **each week**?

[1 mark]

_____

0 6 . 8 What happens to the concentration of urea in the blood between dialysis sessions?

[1 mark]

_____

0 6 . 9 Give **two** reasons why a kidney transplant is a better method for treating kidney disease than dialysis.

[2 marks]

1 _____

_____

2 _____

_____

13

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Turn over for the next question

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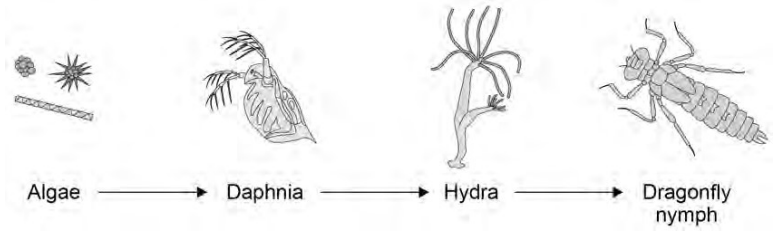
0 7 **Figure 14** shows a food chain in a pond.

Figure 14



0 7 . 1 Which term describes the Daphnia in this food chain?

[1 mark]

Tick (✓) **one** box.

- Apex predator ☐
- Primary consumer ☐
- Producer ☐
- Secondary consumer ☐

Do not write outside the box

0 7 . 2 Draw a pyramid of biomass for the food chain.

Label each trophic level.

[2 marks]

0 7 . 3 Give **one** reason why the total biomass of the Daphnia in the pond is different from the total biomass of the algae.

[1 mark]

Question 7 continues on the next page

Do not write outside the box

Students investigated the size of the population of Daphnia in the pond.

This is the method used.

1. Collect 1 dm^3 of pond water from near the edge of the pond.
2. Pour the water through a fine net.
3. Count the number of Daphnia caught in the net.
4. Repeat steps 1–3 four more times.

Table 3 shows the results.

Table 3

Sample number	Number of Daphnia in 1 dm^3 water
1	5
2	21
3	0
4	16
5	28

0 7 . 4 Calculate the mean number of Daphnia in 1 m^3 of pond water.

1 m^3 = 1000 dm^3

[2 marks]

Mean number of Daphnia in 1 m^3 of pond water = _____

Do not write outside the box

0 7 . 5 The pond was a rectangular shape, measuring:

- length = 2.5 metres
- width = 1.5 metres
- depth = 0.5 metres.

Calculate the estimated number of Daphnia in the pond.

Use your answer from Question **07.4**.

Give your answer in standard form.

[4 marks]

Number of Daphnia in the pond = _____

Question 7 continues on the next page

Do not write outside the box

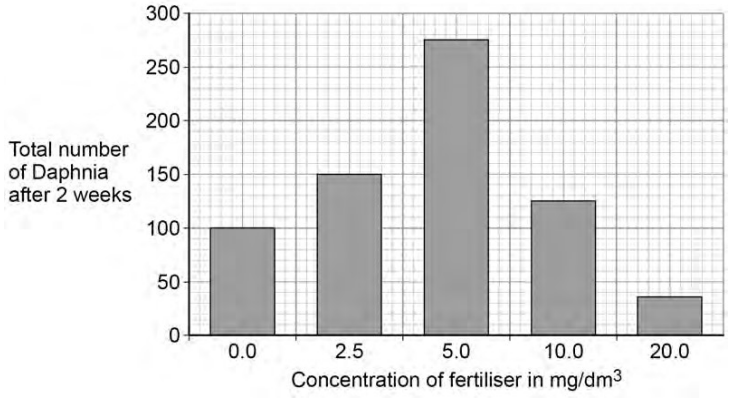
Rainfall can cause fertiliser to be washed from farmland into a pond.

The students investigated the effect of fertiliser on the population of Daphnia in water from the pond.

- The students put 20 Daphnia in each of five different concentrations of fertiliser.
- The students counted the total number of Daphnia in each concentration of fertiliser after 2 weeks.

Figure 15 shows the results.

Figure 15



0 7 . 6 A concentration of 5.0 mg/dm^3 of fertiliser caused a large increase in the population of Daphnia.

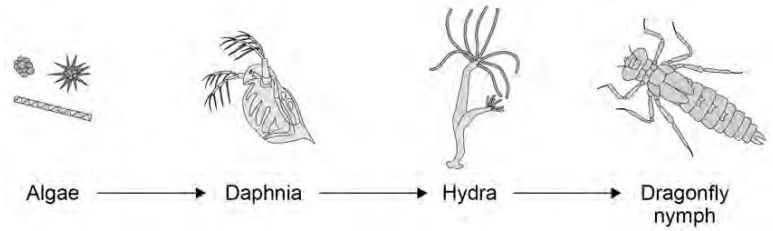
Explain why.

[2 marks]

Do not write outside the box

0 7 . 7 **Figure 14** is repeated below.

Figure 14



The population of **Hydra** will decrease when 20 mg/dm^3 of fertiliser is added to the pond.

Explain why.

[2 marks]

14

Turn over for the next question

Do not write outside the box

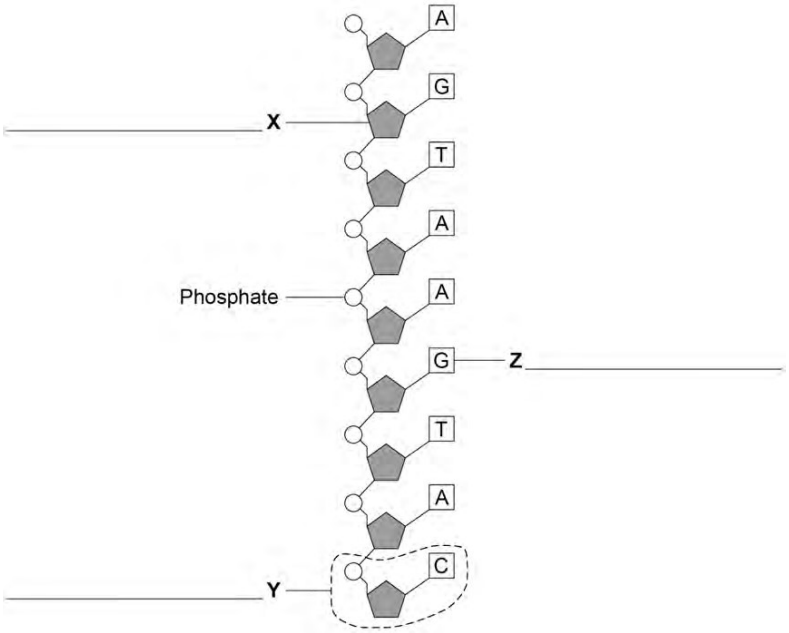
0 8 Genetic material is made of DNA.

0 8 . 1 Which structures in the nucleus of a human cell contain DNA?

[1 mark]

Figure 16 shows part of one strand of a DNA molecule.

Figure 16



0 8 . 2 Label parts **X**, **Y** and **Z** on **Figure 16**.

[3 marks]

Choose answers from the box.

Base	**Fatty acid**	**Nucleotide**	**Sugar**	**Glycerol**

Do not write outside the box

0 8 . 3 A complete DNA molecule is made of two strands twisted around each other.

What scientific term describes this structure?

[1 mark]

_____

0 8 . 4 DNA codes for the production of proteins.

A protein molecule is a long chain of amino acids.

How many amino acids could be coded for by the piece of DNA shown in **Figure 16**?

[1 mark]

Tick (✓) **one** box.

2 ☐ 3 ☐ 9 ☐ 18 ☐

0 8 . 5 Scientists have now studied the whole human genome.

Give **two** benefits of understanding the human genome.

[2 marks]

1 _____

_____

2 _____

_____

8

Turn over for the next question

Do not write outside the box

0 9 Phototropism is a growth response by part of a plant to light.

0 9 . 1 Name **one** other tropism.

Give the stimulus the plant responds to in the tropism you have named.

[2 marks]

Tropism _____

Stimulus _____

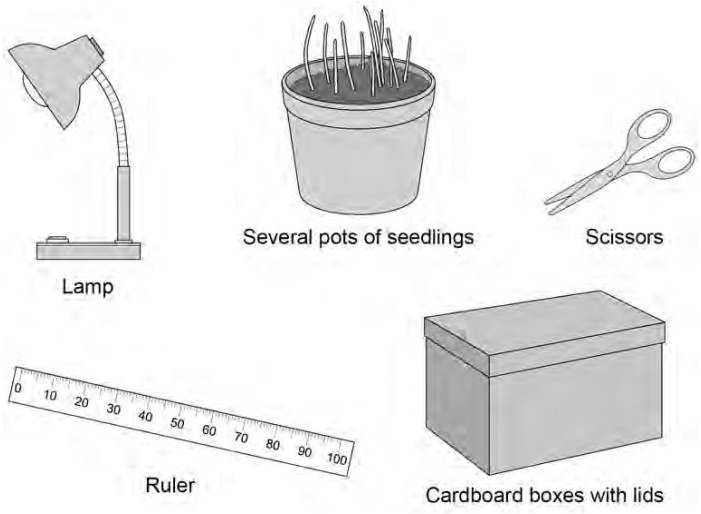
0 9 . 2 Plan an investigation to show the effect of light from one direction on the growth of plant seedlings.

Include details of any controls needed.

You may use some of the equipment shown in **Figure 17** and any other laboratory apparatus.

[6 marks]

Figure 17



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0 9 . 3 Explain how phototropism in a plant shoot helps the plant to survive.

[3 marks]

11

END OF QUESTIONS

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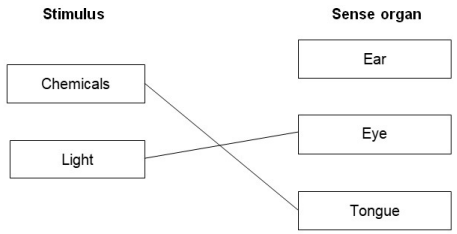
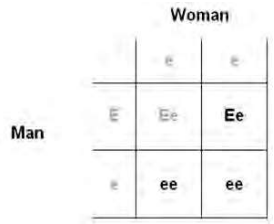
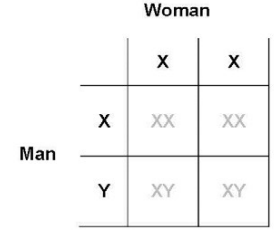
PMT

MARK SCHEME – GCSE BIOLOGY – 8461/2F – JUNE 2019

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1		additional lines from a stimulus negates the mark for that stimulus	1 1	AO1 4.5.2.1
01.2	any **two** from: • fast / rapid • protect (from danger / harm) • a response / a reaction • automatic / involuntary **or** not under conscious control	ignore 'action' allow not coordinated by conscious part of the brain **or** allow does not involve thought / thinking ignore not coordinated by the brain	1 1	AO1 4.5.2.1
01.3	the muscle contracts		1	AO1 4.5.2.1
01.4	(10) (14) 8 11 13	in this order all 3 correct = 2 marks 2 correct = 1 mark 0 or 1 correct = 0 mark	2	AO2 4.5.2.1 8.2.7
01.5	(after drinking coffee) ruler falls less far (before being caught)	allow mean before = 17 **and** mean after = 11(.2) **or** mean after is only 11(.2) allow (ruler is) caught more quickly	1	AO3 4.5.2.1 8.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	any **two** from: • more repeats • test more students • use ruler with more precise scale – eg mm scale • drop from same height (above the hand) • make sure student **B**'s hand is stationary • same distance between finger(s) and thumb	ignore accurate allow alternative method – eg use of computer to measure reaction time	2	AO3 4.5.2.1 8.2.7
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	an allele expressed even if a person only has one copy of the allele		1	AO1 4.6.1.6
02.2		all 3 correct= 2 marks 1 or 2 correct = 1 mark	2	AO2 4.6.1.6
02.3	correct probability from Figure **4**	if no answer in Question **02.2** allow 0.5	1	AO3 4.6.1.6
02.4		gametes = X + X **and** X + Y allow in incorrect positions X, X, X and Y in correct boxes	1 1	AO2 4.6.1.6 4.6.1.8
02.5	 answer from Question **02.3** × 0.5 answer to calculation in mp1	an answer matching the answer from Question **02.3** × 0.5 scores **2** marks if no answer in Question **02.3**, an answer of 0.25 / ¼ / 1 in 4 / 25% scores **2** marks if no answer in Question **02.3** allow 0.5 × 0.5 if no answer in Question **02.3** allow 0.25 / ¼ / 1 in 4 / 25%	 1 1	AO2 4.6.1.6 4.6.1.8
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	46		1	AO1 4.6.1.2 4.6.1.8
03.2	half the mass of the DNA in cell **A**		1	AO2 4.6.1.2
03.3	meiosis		1	AO1 4.6.1.2
03.4	mutation		1	AO1 4.6
03.5	any **two** from: • different egg / sperm each time • genes from two parents • each gamete / egg / sperm has different alleles / genes / DNA / genetic information	 ignore different chromosomes ignore the children have different genes / alleles	2	AO2 4.6 4.6.1.1
03.6	8		1	AO2 4.1.2.2 4.6.1.2
03.7	40	allow in range 39 to 41	1	AO2 4.6.1.2
03.8	 $\frac{40}{500}$ × 1000 80	an answer of 80 scores **3** marks allow ecf from Question **03.7** for **3** marks an answer of 0.08 scores **2** marks allow $\frac{\text{answer to Question 03.7}}{500}$ an answer from mp1 but not × 1000 scores **2** marks	 1 1 1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.9	embryo is (very) small		1	AO2 4.5 4.5.3.4
	(so) embryo not seen / felt **or** lost in normal menstrual flow	ignore not noticed	1	AO3
Total			**13**	

PMT

MARK SCHEME – GCSE BIOLOGY – 8461/2F – JUNE 2019

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	bacteria		1	AO1 4.7.2.3
	fungi		1	
04.2	both increase rate		1	AO1 4.2.2.1
	because oxygen is needed for (aerobic) respiration **or** oxygen is used to release energy	do **not** accept anaerobic ignore energy produced	1	4.4.2.1 4.5.1 4.7.2.3 4.7.4.1
	as increased temperature causes faster reactions	allow named example eg respiration allow increased rate of enzyme action	1	
04.3	water	allow H_2O / H_2O / moisture / rain do **not** accept H^2O / H2O	1	AO1 4.7.2.3
04.4	methane		1	AO1 4.7.2.3
04.5	60	allow sixty	1	AO2 4.7.2.3
04.6	so plants / crops grow faster / better		1	AO1 4.7.2.3
	(decays further and) releases / contains mineral ions / named example	allow releases / contains nutrients ignore nitrogen / food / carbon dioxide allow as a fertiliser allow retains water in soil allow improves drainage allow insulates / keeps warm allow suppresses weed growth allow improves soil structure	1	
Total			**10**	

PMT

MARK SCHEME – GCSE BIOLOGY – 8461/2F – JUNE 2019

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	Raphus		1	AO2 4.6.4
05.2	any **two** from: • humans hunted / killed / ate the dodo **or** dodo easy to catch • humans ate / collected eggs • humans ate the dodo's food • animals brought by humans ate dodo / eggs • diseases introduced by humans **or** by imported animals • humans destroyed dodo's habitat / nests	 allow examples – eg cats / dogs / pigs / rats allow deforestation	2	AO2 4.6.3.6
05.3	any **one** from: • growing crops / biofuels • grazing animals • building houses • quarrying / mining • dumping waste	allow farming / agriculture allow other correct examples – eg building roads	1	AO1 4.7.3.3 4.7.3.4
05.4	there is less photosynthesis the trees are burned		1 1	AO2 4.4.1.1 4.4.1.2 4.7.3.4 4.7.3.5
05.5	increase		1	AO1 4.7.3.5
05.6	 9 × 30 270	an answer of 270 scores **2** marks	 1 1	AO2 4.7.3.4 4.7.3.6

Question	Answers	Mark	AO / Spec. Ref.
05.7	**Level 2:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO3
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • displaced animals can move to adjacent areas • where suitable habitat is found **or** where the trees have not been cut down • seeds return to deforested area • from other (forested) areas • plants / trees begin to grow back • so provide food / shelter / nest sites / suitable habitat for animals • animals return to re-growing area • from other (forested) areas • sufficient time for regeneration • old growth area is a source of recolonising organisms		4.7.3.1 4.7.3.4 4.7.3.6
Total		**13**	

PMT

MARK SCHEME – GCSE BIOLOGY – 8461/2F – JUNE 2019

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	protein		1	AO1 4.4.2.3 4.5.3.3
06.2	urea is a waste (product)	allow toxic / poisonous **or** may damage cells **or** denatures proteins ignore harmful / dangerous	1	AO1 4.5 4.5.3.3
06.3	respiration breathing	in this order	1 1	4.4.2.1 4.4.2.2 4.7.4.3 AO1
06.4	least medium most	in this order 3 correct = **2** marks 1 or 2 correct = **1** mark	2	AO3 4.5.2.4 4.5.3.3
06.5	diffusion		1	AO1 4.1.3.1 4.5.3.3
06.6	protein (molecules too) large	this mark may only be awarded if mp1 is correct or not attempted allow pores in membrane are too small	1 1	AO3 4.5.3.3
06.7	3	allow three	1	AO3 4.5.3.3
06.8	increases	ignore numbers	1	AO3 4.5.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.9	any **two** from: • has a low(er) concentration of urea • constant urea concentration / level • less time attached to machine **or** fewer hospital visits • no / less restriction on travel • not piercing skin repeatedly • less chance of infection / blood clots • cheaper in the long term • no restrictions on diet	allow converse points for person **A** / dialysis allow substance (if named must be correct) ignore cheaper unqualified	2	AO3 4.5.3.3
Total			**13**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	primary consumer		1	AO2 4.7.2.1 4.7.4.1
07.2	correct shape: 4 tiers with largest at bottom and smallest at top correctly labelled: dragonfly / nymph + hydra + daphnia + algae	 in this order **or** allow: 3rd-order **or** tertiary consumer **or** apex / top predator **or** (trophic level) 4 2nd-order **or** secondary consumer **or** (trophic level) 3 1st-order **or** primary consumer **or** herbivore **or** (trophic level) 2 producer **or** (trophic level) 1 allow for **2** marks inverted pyramid if correctly labelled	1 1	AO2 4.7.4.2
07.3	any **one** from: (Daphnia biomass smaller because) • non-digestible parts (of algae) or lost in faeces • not all absorbed • lost in urine / urea • used in respiration **or** lost as carbon dioxide / CO_2 • algae not all eaten **or** eaten by other organisms • some algae decompose	 ignore waste allow excretion allow (to supply energy) for movement / warmth allow used to supply energy	1	AO1 4.7.4.3
07.4	 14 14 000	an answer of 14 000 scores **2** marks allow evidence of an incorrectly calculated mean × 1000 allow 1.4×10^4	 1 1	AO2 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	 (volume of pond =) 1.875 **or** 2.5 × 1.5 × 0.5 14 000 × 1.875 26250 2.625×10^4	an answer of 2.625×10^4 **or** 2.63×10^4 **or** 2.6×10^4 scores **4** marks an answer of 26250 scores **3** marks allow ecf from Question **07.4** an incorrect answer for one step does **not** prevent allocation of marks for subsequent steps allow ecf from Question **07.4** allow 2.63×10^4 **or** 2.6×10^4	 1 1 1 1	AO2 4.7.2.1
07.6	increased (growth / reproduction of) algae (more algae so) more food for Daphnia	 allow fertiliser toxic to Hydra (1) (so) fewer Daphnia eaten (1)	1 1	AO2 4.7.2.1 4.7.3.2 4.7.4.1
07.7	(Hydra have) less food because (graph shows) fewer Daphnia (with more fertiliser)	 allow other valid suggestions, eg fertiliser toxic to Hydra (1) **or** fertiliser causes growth of algae (on surface) which block light and so die and decay **or** eutrophication (1) (decay / eutrophication) uses up oxygen (so lack of oxygen for Hydra) (1)	1 1	AO3 4.7.2.1 4.7.3.2
Total			**14**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	chromosome(s)	allow gene(s) / allele(s)	1	AO1 4.6.1.4 4.1.2.1
08.2	X = sugar Y = nucleotide Z = base		1 1 1	AO1 4.6.1.5
08.3	double helix		1	AO1 4.6.1.4
08.4	3		1	AO2 4.6.1.5
08.5	any **two** from: • diagnosis of inherited / genetic disorder • gene therapy **or** treatment of inherited disorders • understanding (human) evolution **or** understanding ethnic origins (of a person) **or** understanding ancestry • tracing human migration patterns	allow descriptions or named examples allow research / understand genetic disorders allow other examples – eg identification of criminals (1) paternity determination (1)	2	AO1 4.6.1.4
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec.
09.1	named example of tropism – eg geotropism / gravitropism correct corresponding stimulus – eg gravity	allow hydrotropism **or** chemotropism **or** thermotropism allow water **or** chemical **or** 'heat'	1 1	AO1 4.5.4.1
09.2	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		5–6	AO1 AO2 4.5.4.1
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.		3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.		1–2	
	No relevant content		0	
	Indicative content • several seedlings in each batch **or** one pot of seedlings in each batch • measure heights of shoots • leave some in dark with light from one side / direction in box with hole • control(s) with all-round light **or** rotating on clinostat **or** in dark • control variable(s) eg same temperature / water / soil type • after suitable time (at least several hours) • record appearance of seedlings re. light direction • re-measure heights of shoots • detail of how bent shoots were measured – eg use thread or straighten them out • calculate mean height increase for each group • use ruler / protractor to estimate angle of bending for level 3 a reference to comparing the growth of plants with light from one direction with plants either in darkness or in full light along with a control variable is required			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	leaves / plant receive(s) / absorb(s) more light (so) more photosynthesis (so plant) produces more glucose	 allow starch / carbohydrate / sugar / organic material / other named organic substance if no other mark awarded allow **1** mark for any two of the mark points with no reference to 'more'	1 1 1	AO2 4.5.4.1 4.7.2.1 4.4 4.4.1.2 AO1
Total			**11**	

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	

Do not write outside the box

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

Do not write outside the box

0 1 . 2 What is a fossil?

[2 marks]

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. ☐
- The animal was frozen in ice. ☐

0 1 . 4 Dinosaurs are extinct.

Give **two** causes of extinction.

[2 marks]

1

2

Question 1 continues on the next page

Do not write outside the box

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

[2 marks]

Tick (✓) **two** boxes.

- Bacteria can become resistant to an antibiotic. ☐
- Early forms of life lived in the ocean. ☐
- Older fossils are simpler than more recent ones. ☐
- Older layers of rock are closer to the surface. ☐

9

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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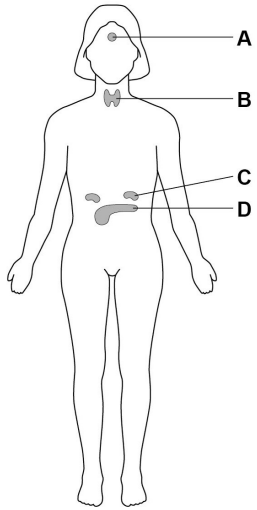
0 2 Many internal processes of the human body are controlled by hormones.

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** ☐

0 2 . 2 Which gland is the pancreas?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

Do not write outside the box

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 ☐

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

Do not write outside the box

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

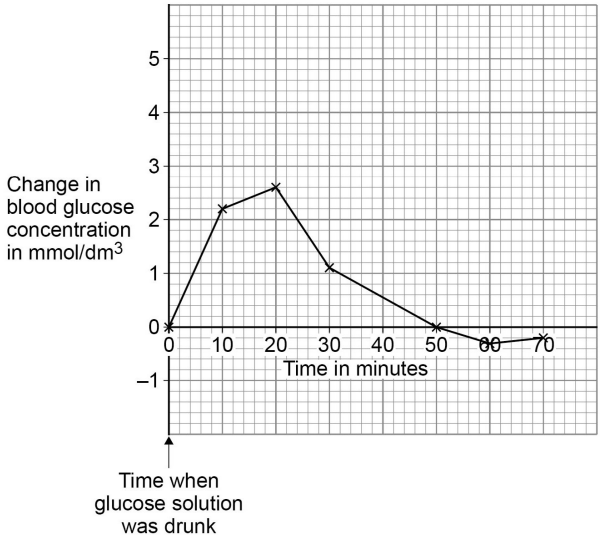


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Figure 3 shows the **change** in blood glucose concentration.

0 2 . 5 At the start of the investigation, the blood glucose concentration was 5 mmol/dm^3.

Calculate the highest blood glucose concentration during the investigation.

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

[2 marks]

Highest blood glucose concentration = _____ mmol/dm^3

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]

Time taken = _____ minutes

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

[1 mark]

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

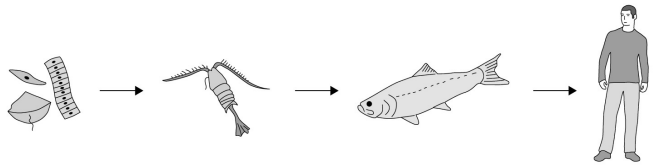
Turn over for the next question

Do not write outside the box

0 3 People eat fish caught in the North Sea.

Figure 4 shows a food chain.

Figure 4



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 ☐

Do not write outside the box

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

[1 mark]

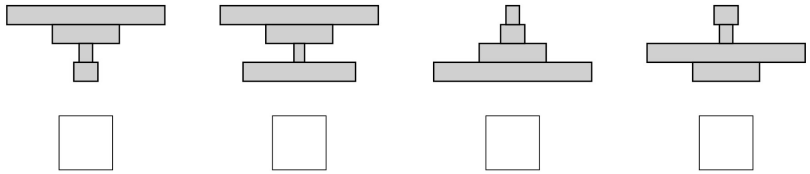
Tick (✓) **one** box.

- 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.



Question 3 continues on the next page

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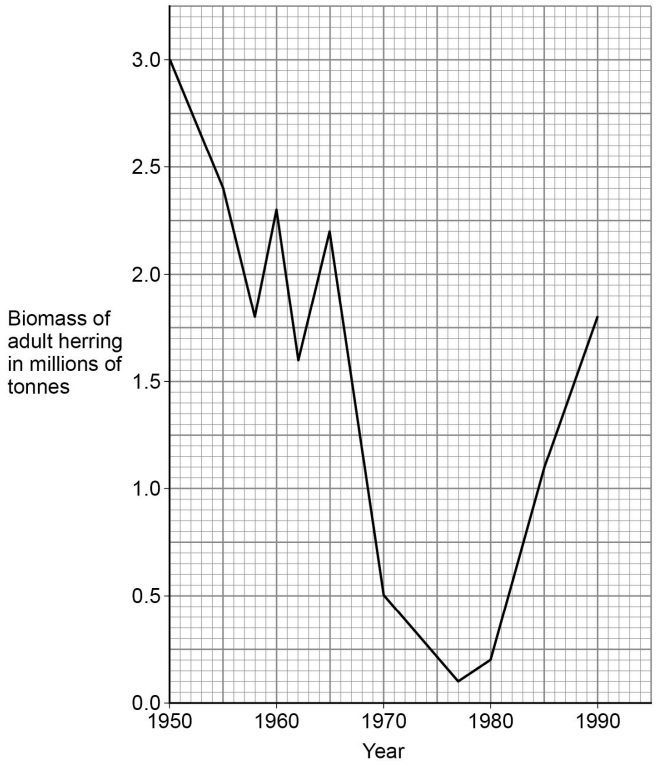
Figure 5 shows the biomass of adult herring in the North Sea between 1950 and 1990.

Figure 5



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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]

Percentage decrease = _____ %

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]

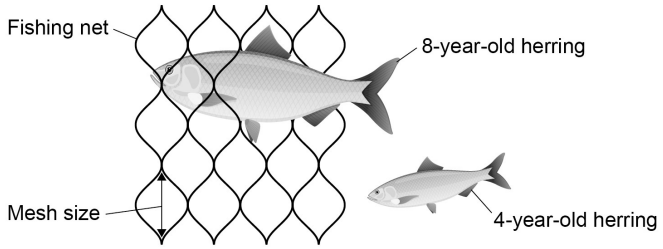
Question 3 continues on the next page

Do not write outside the box

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



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]

12

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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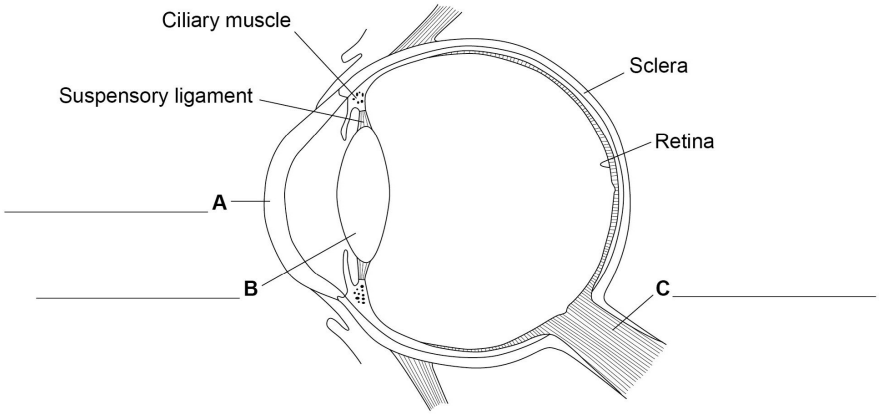
0 4 The human eye can form images of objects that are at different distances away from the eye.

Figure 7 is a diagram of the eye.

Figure 7



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

[3 marks]

Choose answers from the box.

cornea	**eyelid**	**iris**	**lens**	**optic nerve**

Do not write outside the box

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 ☐
- Cornea ☐
- Iris ☐
- Sclera ☐
- Suspensory ligaments ☐

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]

_____

Question 4 continues on the next page

Turn over ►

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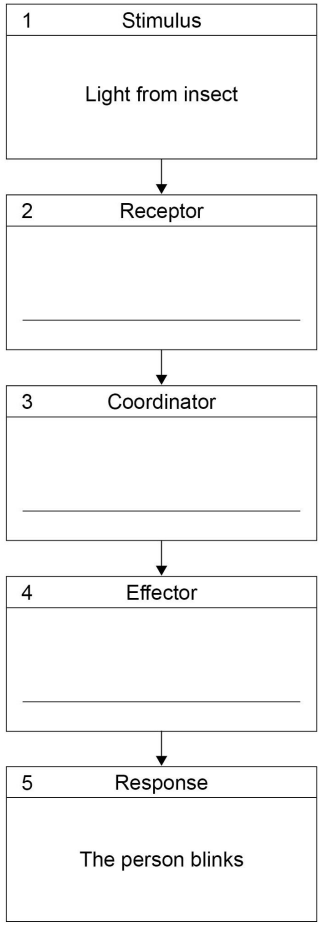
0 4 . 5 An insect flies near a person's eye. The person blinks. This is a reflex action.

Figure 8 shows the coordination system for this reflex action.

Figure 8



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

Do not write outside the box

0 5 Potato blight is a disease of potato plants.

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

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. ☐

The fungus can get water from the potato. ☐

Question 5 continues on the next page

Do not write outside the box

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. ☐

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]

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**.

Do not write outside the box

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

[2 marks]

Figure 9

		Male gametes: R	Male gametes: r
Female gametes	R	RR	
Female gametes	r		

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

[1 mark]

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% ☐

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]

11

Turn over for the next question

Do not write outside the box

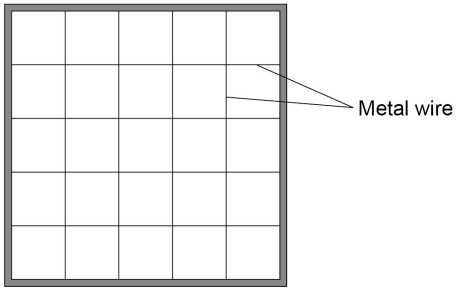
0 6 A student estimated the percentage cover of buttercup plants in a field.

The student used a quadrat.

The quadrat was divided into 25 equal squares.

Figure 10 shows the quadrat.

Figure 10



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.

Do not write outside the box

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. ☐
- 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]

X = _____ %

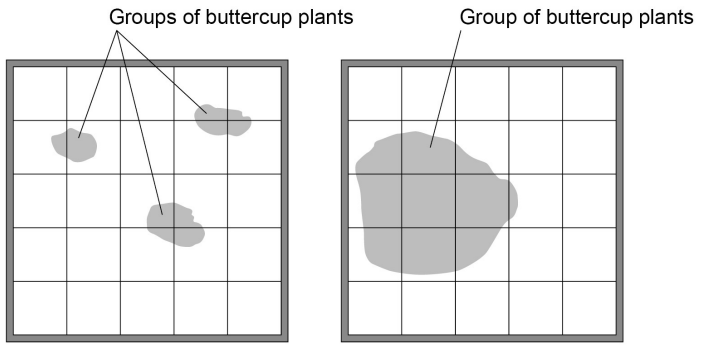
Question 6 continues on the next page

Do not write outside the box

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



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. ☐

Do not write outside the box

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 _____

_____

2 _____

_____

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

[3 marks]

1 _____

2 _____

3 _____

9

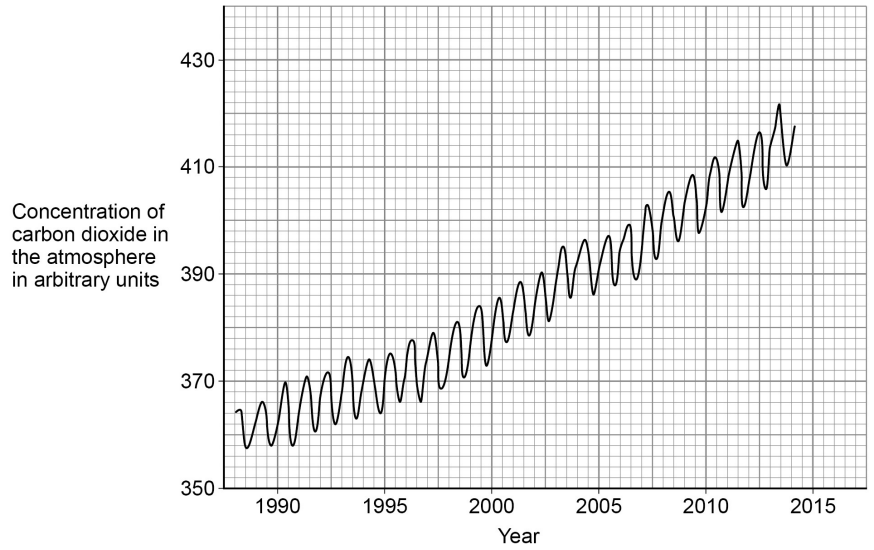
Turn over for the next question

Do not write outside the box

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 _____

_____

_____

_____

2 _____

_____

_____

_____

Do not write outside the box

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

[2 marks]

1 _____

_____

2 _____

_____

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]

_____

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10

Do not write outside the box

0 8 The nucleus of a cell contains DNA.

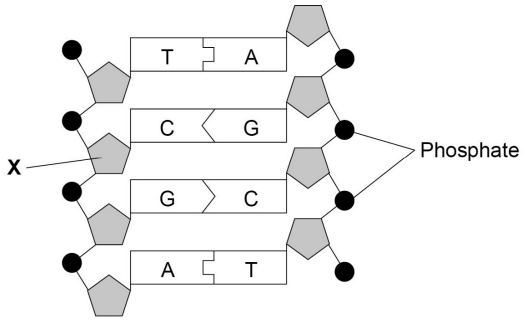
0 8 . 1 Name the structures inside the cell nucleus that contain DNA.

[1 mark]

_____

Figure 13 shows part of a DNA molecule.

Figure 13



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

[1 mark]

_____

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

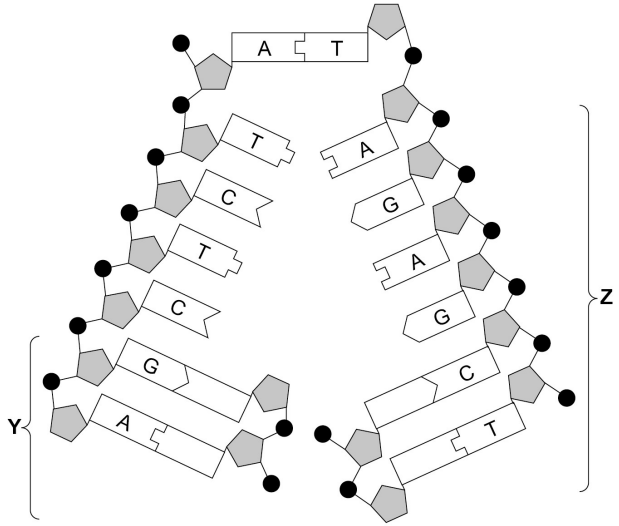
[1 mark]

_____

Do not write outside the box

Figure 14 shows another section of a DNA molecule.

Figure 14



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 ►

Do not write outside the box

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

What type of substance does a gene code for?

[1 mark]

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 ☐

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 ☐
- Mitosis ☐

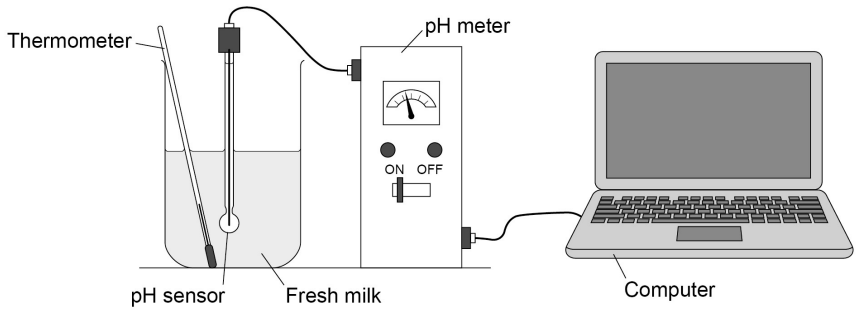
8

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



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]

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

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

[1 mark]

Question 9 continues on the next page

Turn over ►

Do not write outside the box

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

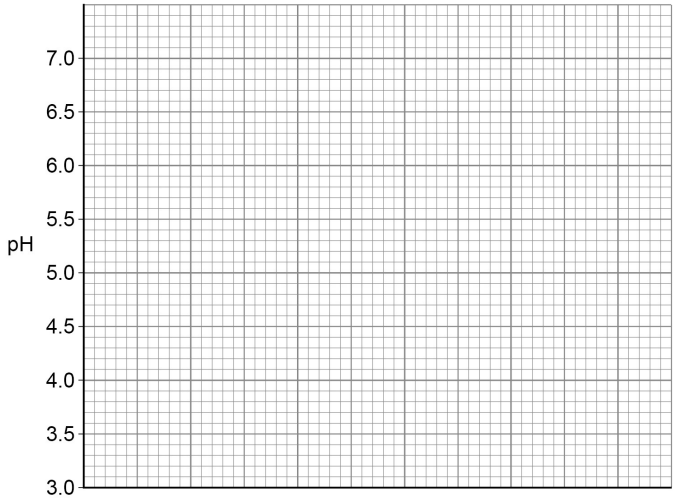
0 9 . 3 Complete **Figure 16.**

[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

Do not write outside the box

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 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.

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

[1 mark]

Question 10 continues on the next page

Do not write outside the box

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

Figure 17

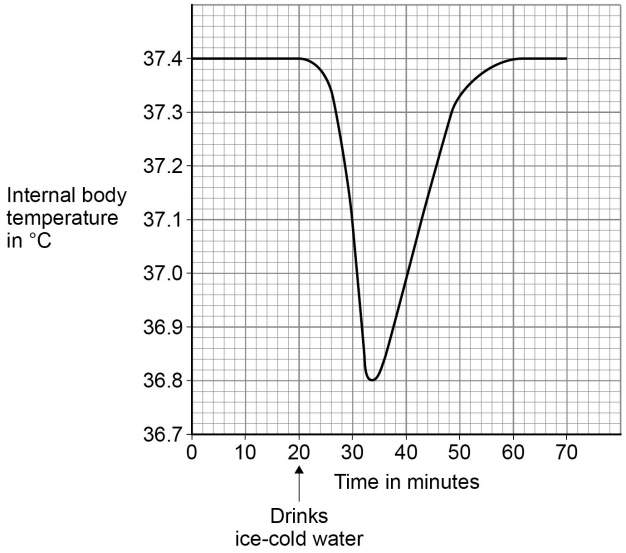
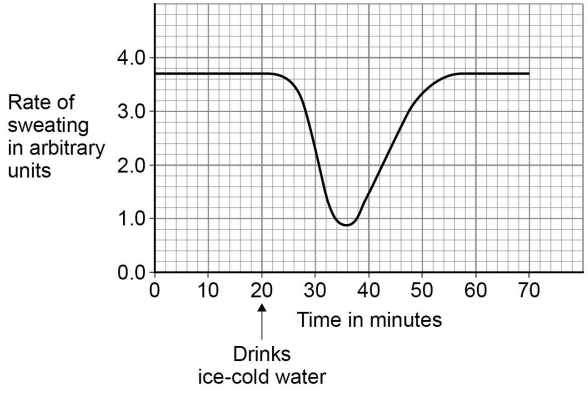


Figure 18



Do not write outside the box

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 ☐

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]

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]

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]

Question 10 continues on the next page

Do not write outside the box

10.6 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

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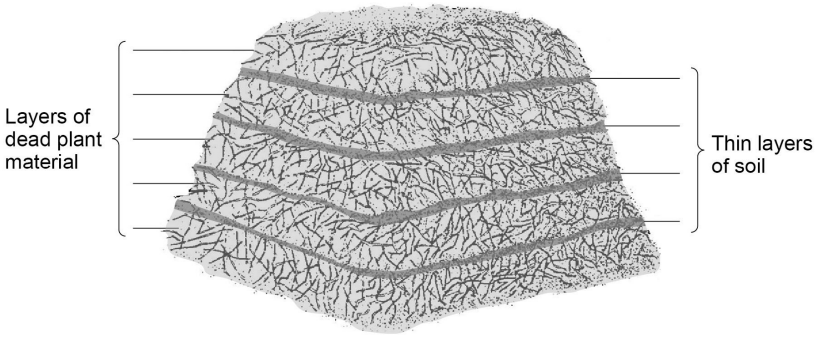
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

1 1 Decay occurs in a compost heap.

Figure 19 shows a compost heap.

Figure 19



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]

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6

END OF QUESTIONS

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

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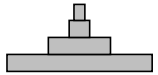
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	Alfred Russel Wallace Charles Darwin		1 1	AO1 4.6.3.1 4.6.3.2
01.2	remains of an organism from a long time ago	allow remains of an animal / plant allow from thousands / millions of years ago	1 1	AO1 4.6.3.5
01.3	the animal walked on mud		1	AO2 4.6.3.5
01.4	any **two** from: • flooding • drought • ice age • global warming • volcanic activity • asteroid collision • (new) predators • (new) disease / pathogen • competition for food • competition for mates • lack of habitat **or** habitat change	 } if none of these, allow climate change for **1** mark ignore weather } if neither of these, allow catastrophic event **or** natural disaster for **1** mark allow hunters / poachers allow named example allow lack of food allow lack of mates ignore competition unqualified ignore environment change ignore isolation ignore pollution	2	AO1 4.6.3.6
01.5	bacteria can become resistant to an antibiotic older fossils are simpler than more recent ones		1 1	AO1 4.6.2.2 4.6.3.4
Total			**9**	

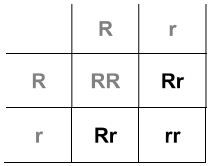
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	A		1	AO1 4.5.3.1
02.2	D		1	AO1 4.5.3.1 4.5.3.2
02.3	liver		1	AO1 4.5.3.2
02.4	glycogen		1	AO1 4.5.3.2
02.5	2.6 7.6 (mmol/dm^3)	allow answers in the range 2.5 to 2.7 allow a correctly calculated value using student's value from graph + 5	1 1	AO2 4.5.3.2
02.6	30 (minutes)	allow ½-hour **or** 0.5 hour	1	AO2 4.5.3.2
02.7	points too far apart **or** no reading between 30 and 50 mins **or** points joined by straight lines **or** values could have fallen to zero change before 50 mins	 allow no reading at 40 mins allow not a curve of best fit	1	AO3 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	higher values of y than given line returning to(wards) zero change later than given line		1 1	AO2 AO3 4.5.3.2
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	carbon dioxide water		1 1	AO1 4.7.2.2 4.4.1.1
03.2	light		1	AO1 4.7.4.3 4.4.1.1
03.3			1	AO3 4.7.4.2
03.4	2.3 **and** 0.5 $\frac{(2.3 - 0.5)}{2.3} \times 100$ **or** $\frac{1.8}{2.3} \times 100$ 78.2(6087....) 78	allow figures in millions allow in range 2.25 to 2.3 for 2.3 allow in range 0.5 to 0.55 for 0.5 allow correct substitution of student's incorrect graph readings allow correct answer from student's substitution of incorrect graph readings ignore incorrect rounding allow correct rounding of calculated value	 1 1 1 1	AO2 4.7.5.3
03.5	increase (in biomass of herring) from 0.1 to 1.8 (million tonnes) **or** change of 1.7 (million tonnes) **or** change of 1700%	 allow a tolerance of ± ½ small square for graph readings	1 1	AO3 AO2 4.7.5.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	smaller / 4-yr-old fish not caught	allow younger fish not caught allow (only) older fish caught	1	AO3 4.7.5.3
	(so) escaping fish can reproduce	allow so younger fish can survive to reproduce	1	
Total			**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	A = cornea B = lens C = optic nerve		1 1 1	AO1 4.5.2.3
04.2	by becoming thicker		1	AO1 4.5.2.3
04.3	ciliary muscles suspensory ligaments		1 1	AO1 4.5.2.3
04.4	retina	allow rods / cones / fovea	1	AO1 4.5.2.3
04.5	retina brain muscles	in this order only 3 correct = **2** marks 1 or 2 correct = **1** mark	2	AO2 4.5.2.1
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	*Phytophthora*		1	AO2 4.6.4 4.7.5.1
05.2	the fungus can get oxygen from the air		1	AO2 4.4.2.1 4.7.5.1
05.3	the variety of species of organisms in the river		1	AO1 4.7.3.1
05.4	pesticide washed into river pesticide kills (some) organisms / plants / animals in river	allow spray drift allow reference to run-off allow carried by rainfall	1 1	AO2 4.7.3.1 4.7.3.2 4.7.3.6 4.7.5.1
05.5		all 3 correct = **2** marks 2 correct = **1** mark 0 or 1 correct = **0** marks	2	AO2 4.6.1.6 4.7.5.1
05.6	ring drawn around **RR** / **rr** in **Figure 9**	allow around both **RR** and **rr**	1	AO2 4.6.1.6 4.7.5.1
05.7	75%	percentage must match student's answer in **Figure 9** allow 75% if no answer to question **05.5**	1	AO3 4.6.1.6 4.7.5.1

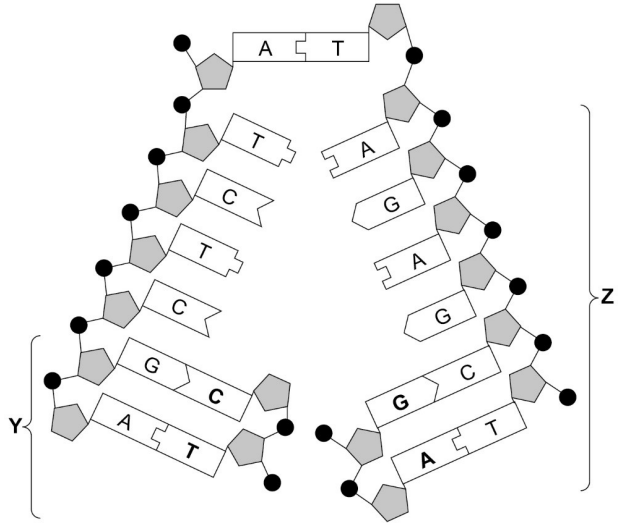
Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.8	no fusion of gametes **or** (asexual reproduction involves) mitosis (so) offspring are genetically identical (to parent plant)	allow no fertilisation allow offspring are a clone allow offspring have same DNA allow no mixing of genes / DNA allow no mixing of genetic material allow all offspring inherit **R**	1 1	AO2 4.6.1.1 4.6.1.3 4.7.5.1
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	place the quadrat using random coordinates		1	AO1 4.7.2.1 RPA9
06.2	$\frac{40 + 52 + 88 + 80 + 40}{5}$ **or** $\frac{300}{5}$ 60		1 1	AO2 4.7.2.1 RPA9
06.3	the area of buttercup plants in quadrat 5 is much larger		1	AO3 4.7.2.1 RPA9
06.4	any **two** from: • place (many) more quadrats • divide quadrats into more / smaller squares • estimate actual percentage cover in quadrat (instead of counting squares) • only count squares with at least 50% cover	 allow repeat allow combine results with results of other students allow use a point quadrat ignore place quadrats randomly	2	AO3 4.7.2.1 8.2.9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	any **three** from: • light • water • minerals / ions / salts • pH • temperature • herbivores • trampling / cultivation • pathogens / disease • use of weedkiller	 allow rain / moisture allow named example such as nitrate / phosphate allow fertiliser allow named example allow wind allow oxygen / air in the soil ignore carbon dioxide ignore weather	3	AO1 4.7.1.1 4.7.1.2 4.7.1.3
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	(overall) increase (in concentration of CO_2)		1	AO2
	(overall increase) by 54 (arbitrary units) **or** from 364 to 418 (arbitrary units)	allow in range 45 to 65 (arbitrary units) allow from 357 to 422 (arbitrary units) allow other correct data	1	AO3
	peaks and troughs	allow description	1	AO3
	each cycle is 1 year **or** variation per cycle is 8 to 16 (arbitrary units)	allow multiples such as 5 cycles every 5 years allow answer in range 8 to 16 (arbitrary units)	1	AO3 4.7.3.5
07.2	combustion	allow a named example such as burning (named) fuels **or** driving cars **or** power stations ignore factories unqualified	1	AO1 4.7.2.4 4.7.3.3 4.7.3.4 4.7.3.5 4.4.1.1
	deforestation	allow a description allow human activities that decrease carbon dioxide concentration such as tree-planting **or** growing crops if no other mark awarded allow respiration for **1** mark	1	

Question	Answers	Mark	AO / Spec. Ref.
07.3	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO3 AO2
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO2 AO1
	No relevant content	0	
	Indicative content • (higher CO_2 concentration causes) global warming • plants photosynthesise faster o due to more CO_2 o due to higher temperature • temperature rise causes changes in rainfall patterns **or** extreme weather conditions such as storms • less rainfall causes desertification o many plant species die out o many animal species lack food and die o other (drought-adapted) plants become more common • more rainfall causes flooding o loss of habitat o may lead to extinction • temperature rise melts (polar) ice caps **or** glaciers o causes flooding o loss of habitat o may lead to extinction • changes in animal / bird migration patterns / times **or** changes in distribution of animals		4.7.2.4 4.7.3.5 4.4.1.1
Total		**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	chromosome(s)	allow chromatid(s) / gene(s) / allele(s)	1	AO1 4.6.1.4
08.2	sugar	allow deoxyribose allow pentose do **not** accept ribose	1	AO1 4.6.1.5
08.3	base(s)	allow nitrogenous base(s) allow adenine **and** cytosine **and** guanine **and** thymine	1	AO1 4.6.1.5
08.4	 all four required for the mark		1	AO3 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	replication		1	AO3 4.6.1.5 4.1.2.2
08.6	protein	allow polypeptide	1	AO1 4.6.1.4
08.7	3×10^{-12} grams		1	AO2 4.6.1.2
08.8	meiosis		1	AO1 4.6.1.2
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	(put beaker in a) water bath	allow (put beaker in an) incubator	1	AO1 4.7.2.3 RPA10
09.2	volume of the milk **or** type of milk	allow amount of milk allow named type of milk, eg cows' or semi-skimmed	1	AO1 4.7.2.3 RPA10
09.3	correct scale and axis labelled all points plotted correctly suitable curved line of best fit	scale must be at least 1 cm for 1 day allow a tolerance of ± ½ small square allow 4 or 5 correct plots for **1** mark ignore line joined point to point with straight lines	1 2 1	AO2 4.7.2.3 RPA10
09.4	similar shaped line drawn to left of 20 °C line on **Figure 4** same start pH	 allow a tolerance of ± ½ small square allow from student's line of best fit or student's plot for 0 days	1 1	AO2 4.7.2.3 RPA10
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	any **one** from: • movement would release (extra) heat • movement would increase body temperature • movement would increase sweating		1	AO2 4.5.1 4.5.2.4
10.2	37.4 °C		1	AO2 4.5.1 4.5.2.4
10.3	<u>blood</u> is cooled at stomach / mouth (cooled) blood flows to the brain		1 1	AO2 4.5.1 4.5.2.4
10.4	via nerve(s) / neurones **or** via (nerve) impulse(s)	ignore type of neurone allow electrical signals allow via the nervous system	1	AO2 4.5.1 4.5.2.4
10.5	less sweating occurs so less heat is lost **or** less cooling	allow less sweat evaporates do **not** accept no sweating allow less heat used for evaporation of sweat / water	1 1	AO3 AO2 4.5.1 4.5.2.4
10.6	dilation of blood vessels in the skin		1	AO2 4.5.1 4.5.2.4
Total			**8**	

Question	Answers	Mark	AO / Spec. Ref.
11	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6	AO1 4.7.2.1 4.7.2.2 4.7.2.3 4.2.2.1 4.2.3.1 4.2.3.2 4.4.1.1 4.4.1.3 4.4.2.1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3	
	No relevant content	0	
	Indicative content *in microorganisms* • digestion **or** large molecules to small molecules • enzymes **or** named example • respiration • production of carbon dioxide • release of mineral ions **or** named example such as nitrate / phosphate / magnesium *in plants* • carbon dioxide (from air) taken in by leaves • by diffusion • via stomata • carbon dioxide used in photosynthesis • making glucose / sugar / starch / cellulose **or** making other correctly named example • (named) ions taken in by roots • by active transport • nitrate ions for making amino acids / proteins / DNA / chlorophyll • phosphate for making DNA For **Level 2** processes in microorganisms and in plants should be considered		
Total		**6**	

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	
TOTAL	

Do not write outside the box

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

0 1 Maple syrup urine disease (MSUD) is a rare inherited human condition.

The allele for MSUD is recessive.

0 1 . 1 What is a recessive allele?

[1 mark]

Tick (✓) **one** box.

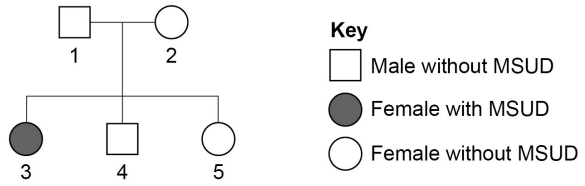
An allele expressed only if a person has two copies of the allele ☐

An allele expressed only if it is inherited from the male parent ☐

An allele expressed when it is found on only one of the chromosomes ☐

Figure 1 shows the inheritance of MSUD in one family.

Figure 1



0 1 . 2 The symbol ■ is **not** in the key for **Figure 1**.

What would this symbol represent?

[1 mark]

_____

Do not write outside the box

Persons **1** and **2** in **Figure 1** have a child with MSUD and some children without MSUD.

0 1 . 3 Complete **Figure 2** to show the possible genotypes of the children.

Use the following symbols:

N = allele for **not** having MSUD
n = allele for MSUD

[2 marks]

Figure 2

Person 2

Person 1	**N**	**n**
N		**Nn**
n		

0 1 . 4 What is the phenotype of a person with the genotype **Nn**?

[1 mark]

0 1 . 5 What percentage of the offspring in **Figure 2** will have MSUD?

[1 mark]

Tick (✓) **one** box.

25% ☐ 50% ☐ 75% ☐ 100% ☐

Question 1 continues on the next page

Do not write outside the box

0 1 . 6 Which scientific term describes the allele **N**?

[1 mark]

Tick (✓) **one** box.

Dominant ☐

Genetic ☐

Heterozygous ☐

0 1 . 7 Alleles are found in the nucleus of a cell.

What chemical substance are alleles made from?

[1 mark]

0 1 . 8 People with MSUD must eat a special diet to reduce their intake of some types of amino acid.

Which component of the diet is made of amino acids?

[1 mark]

Tick (✓) **one** box.

Carbohydrates ☐

Minerals ☐

Proteins ☐

9

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 2 Many human actions are reflexes.

0 2 . 1 Which statement describes a reflex action?

[1 mark]

Tick (✓) **one** box.

A reflex action does not need a sense organ. ☐

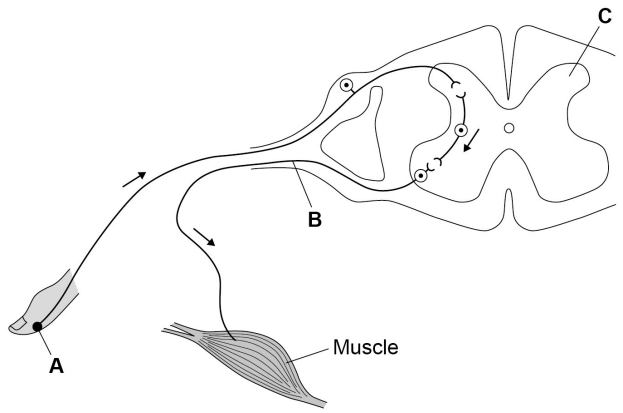
A reflex action is a slow action. ☐

A reflex action is automatic. ☐

Figure 3 shows the nerve pathway for a reflex action.

The arrows show the direction of the nerve impulse.

Figure 3



Do not write outside the box

0 2 . 2 Draw **one** line from each part of the nerve pathway to the name of that part.

Use **Figure 3**.

[3 marks]

Part of nerve pathway	Name of part
A	Motor neurone
B	Receptor
C	Relay neurone
	Spinal cord

0 2 . 3 Which **two** human actions are reflexes?

[2 marks]

Tick (✓) **two** boxes.

- Blinking when an insect flies into the eye ☐
- Catching a ball in a playground game ☐
- Playing a musical instrument ☐
- Removing the hand from a hot object ☐
- Writing a message to a friend ☐

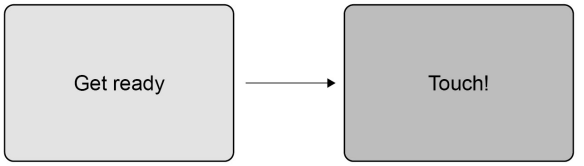
Question 2 continues on the next page

Do not write outside the box

Students investigated their reaction times using a computer program.

Figure 4 shows a sequence of two screens in the computer program.

Figure 4



Red screen **Green screen**

This is the method used.

1. Open the reaction time program.
2. When the screen turns from red to green, touch the screen as quickly as possible.
3. Record the reaction time shown on the screen.
4. Re-set to the red screen.
5. Repeat steps 2 to 4 four more times.
6. Repeat steps 1 to 5 for each student.

Table 1 shows the results.

Table 1

Test	Reaction time in milliseconds			
	Student P	Student Q	Student R	Student S
1	317	310	367	320
2	309	293	352	304
3	290	312	350	315
4	333	307	359	308
5	328	312	635	313
Mean	315	307	357	**X**

Do not write outside the box

0 2 . 4 Calculate mean value **X** in **Table 1.**

[2 marks]

X = _____ milliseconds

0 2 . 5 There is an anomalous result for student **R.**

Draw a ring around the anomalous result in **Table 1.**

[1 mark]

0 2 . 6 Give **two** factors that might affect a person's reaction time.

[2 marks]

1 _____

2 _____

11

Turn over for the next question

Do not write outside the box

0 3 A plant shoot responds to the stimulus of light shining on it from one side.

0 3 . 1 What name is given to the type of response shown by the plant shoot?

[1 mark]

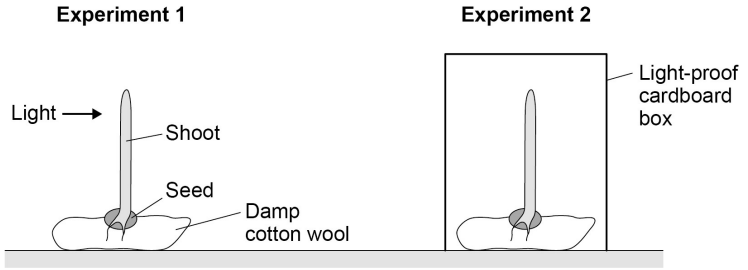
Tick (✓) **one** box.

- Adaptation ☐
- Homeostasis ☐
- Tropism ☐

A student investigated the effect of one-sided light on the growth of plant seedlings.

Figure 5 shows how the student set up the investigation.

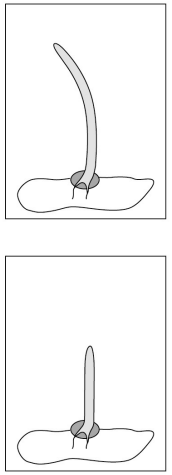
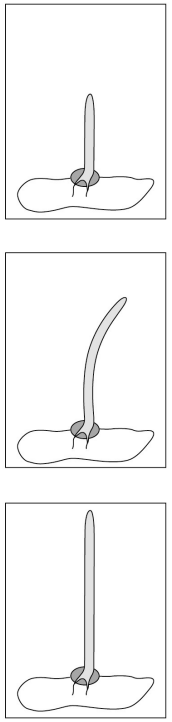
Figure 5



Do not write outside the box

0 3 . 2 Draw **one** line from each experiment to what the seedling would look like after 12 hours.

[2 marks]

Experiment	What the seedling would look like
1	
2	

0 3 . 3 Why did the student set up experiment **2** in this investigation?

[1 mark]

Do not write outside the box

0 3 . 4 The student wanted to make the investigation of the effect of one-sided light more valid.

The student decided to set up a third experiment.

How should the student set up the third experiment?

[1 mark]

Tick (✓) **one** box.

- Give no water to the third seedling. ☐
- Shine light from all sides on the third seedling. ☐
- Turn the third seedling so it is upside-down. ☐

0 3 . 5 What is a suitable control variable for the investigation?

[1 mark]

Tick (✓) **one** box.

- Keep each seedling at the same temperature. ☐
- Keep each seedling the same height above the floor. ☐
- Use the same size cardboard box for each seedling. ☐

0 3 . 6 Give **one** stimulus a plant **root** responds to.

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

[1 mark]

Do not write outside the box

0 3 . 7 Scientists often repeat investigations several times.

Give **two** reasons why.

[2 marks]

1 _____

_____

2 _____

_____

9

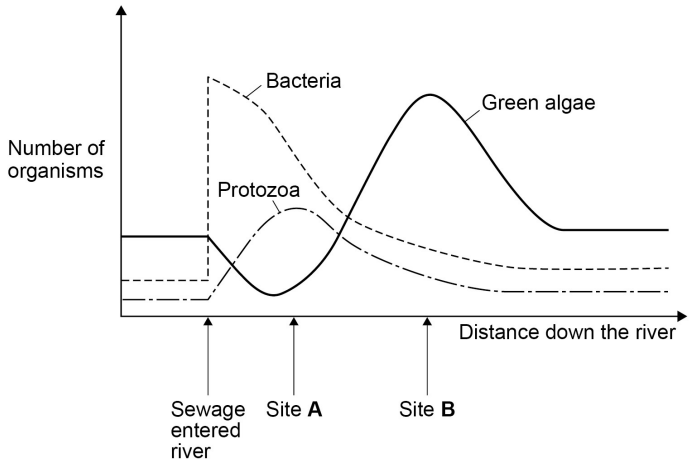
Turn over for the next question

Do not write outside the box

0 4 Rivers are sometimes polluted with untreated sewage.

Figure 6 shows some changes that occurred when untreated sewage entered a river.

Figure 6



0 4 . 1 Which type of organism had the most rapid increase in numbers when sewage entered the river?

[1 mark]

Tick (✓) **one** box.

Bacteria ☐

Green algae ☐

Protozoa ☐

Do not write outside the box

0 4 . 2 Protozoa are single-celled organisms.

Describe **two** ways **Figure 6** shows that the protozoa in the river feed on bacteria.

[2 marks]

1 _____

_____

2 _____

_____

0 4 . 3 When sewage enters a river, the concentration of dissolved oxygen decreases.

The decrease in oxygen concentration is caused by organisms in the water.

What process in living organisms uses oxygen?

[1 mark]

_____

0 4 . 4 As the numbers of green algae in the river increase, the concentration of dissolved oxygen increases.

Explain why the concentration of dissolved oxygen increases.

[2 marks]

_____

_____

_____

_____

Question 4 continues on the next page

Do not write outside the box

Scientists counted the numbers of five different animals in the river at sites **A** and **B**, shown in **Figure 6** on page 14.

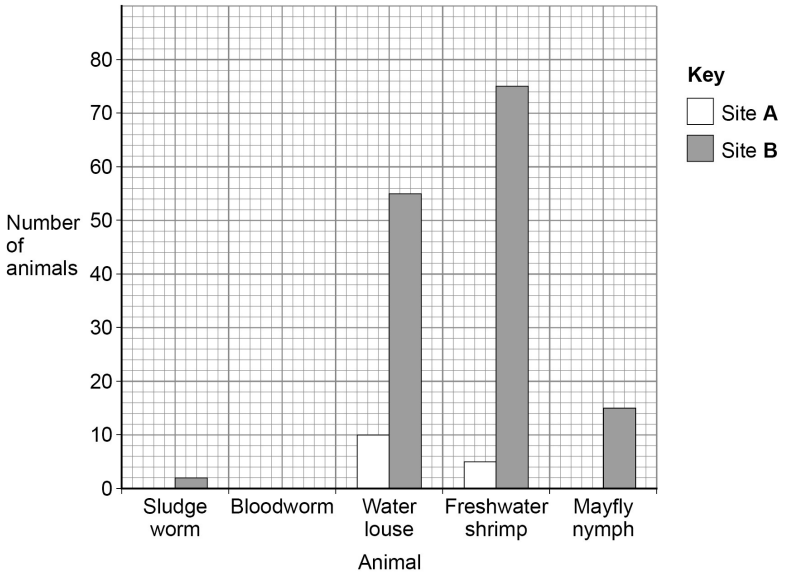
Table 2 shows the results.

Table 2

Animal	Number of animals	
	Site A	Site B
Sludge worm	80	2
Bloodworm	36	8
Water louse	10	55
Freshwater shrimp	5	75
Mayfly nymph	0	15

Figure 7 shows some of the data from **Table 2.**

Figure 7



Do not write outside the box

0 4 . 5 Complete **Figure 7**.

You should use data from **Table 2** for the sludge worm and the bloodworm.

[2 marks]

0 4 . 6 The concentration of oxygen in the water at site **A** is much lower than at site **B**.

- Sludge worms live in places which have a low concentration of oxygen.
- Mayfly nymphs need a high concentration of oxygen.

Give evidence from **Table 2** for the difference in oxygen concentration at sites **A** and **B**.

Refer to sludge worms and to mayfly nymphs in your answer.

[2 marks]

10

Turn over for the next question

Do not write outside the box

0 5 In the human female, an egg is released from one of the ovaries about once every four weeks.

During the four weeks, the lining of the uterus thickens and then breaks down.

This is called the menstrual cycle.

0 5 . 1 Which **two** hormones are female reproductive hormones?

[2 marks]

Tick (✓) **two** boxes.

- Adrenaline ☐
- Oestrogen ☐
- Progesterone ☐
- Testosterone ☐
- Thyroxine ☐

0 5 . 2 Follicle stimulating hormone (FSH) is another female reproductive hormone.

What is the function of FSH in the menstrual cycle?

[1 mark]

Tick (✓) **one** box.

- FSH causes an egg to mature in the ovary. ☐
- FSH causes breast development. ☐
- FSH causes the uterus lining to break down. ☐

Do not write outside the box

0 5 . 3 Sperm cells can survive inside a woman's reproductive organs for five days.

An egg cell can survive for one day after ovulation.

In one woman ovulation occurred on day 14.

Give the range of days on which sexual intercourse could result in fertilisation.

[1 mark]

From day _____ to day _____

0 5 . 4 If a man and a woman have sexual intercourse and do **not** want to produce a baby, they may use contraception.

Explain how different methods of contraception prevent pregnancy.

[6 marks]

10

Do not write outside the box

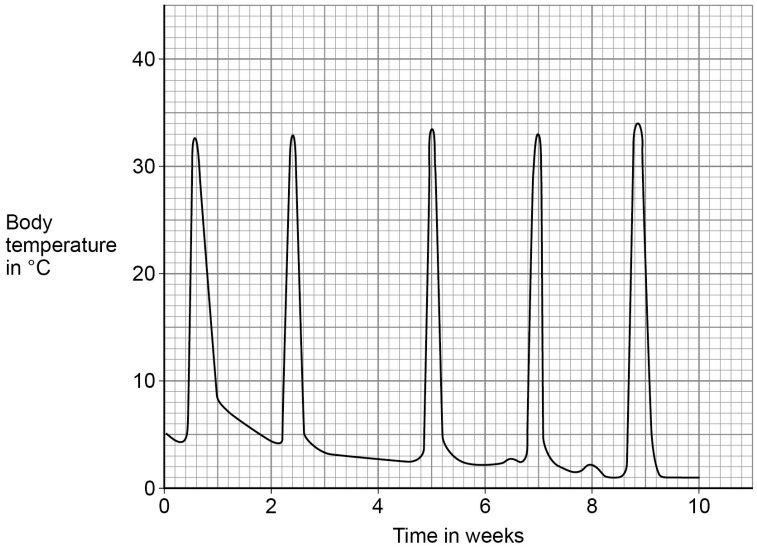
0 6 The echidna is a mammal that lives in Australia.

Figure 8 shows an echidna.

Figure 8

Figure 9 shows how the body temperature of the echidna varies during the cold winter months.

Figure 9



Do not write outside the box

0 6 . 1 Give the lowest and highest body temperatures for the echidna shown in **Figure 9**.

[1 mark]

Lowest temperature = _____ °C

Highest temperature = _____ °C

In the cold winter months, the echidna hibernates.

Figure 9 shows that the echidna woke up from hibernation several times.

The echidna's body temperature increased to over 30 °C each time the echidna woke up.

0 6 . 2 How many times did the echidna wake up?

Use information from **Figure 9**.

[1 mark]

_____

0 6 . 3 Each time the echidna wakes up, it hunts for food.

Suggest why the echidna needs to eat food several times during hibernation.

[1 mark]

_____

_____

Question 6 continues on the next page

Do not write outside the box

0 6 . 4 During hibernation:

- the echidna sleeps
- the echidna's body temperature decreases to below 5 °C
- the echidna uses food stored in its body cells to provide energy.

What process releases energy from stored food?

[1 mark]

Tick (✓) **one** box.

Diffusion ☐

Excretion ☐

Respiration ☐

0 6 . 5 Most mammals use a lot of energy to evaporate sweat.

The echidna does **not** sweat.

Suggest **one** use of energy in the echidna's body.

[1 mark]

_____

Do not write outside the box

The control of body temperature is important in the human body.

An athlete trained in a hot climate.

0 6 . 6 On one day, the athlete lost 3 200 cm^3 of water in sweat.

Evaporation of 1 cm^3 of sweat requires 2.5 kJ of energy.

Calculate the energy the athlete used for evaporation of sweat.

[2 marks]

Energy = _____ kJ

0 6 . 7 On a different day the athlete used 6 000 kJ of energy to evaporate sweat.

The athlete's energy intake was 24 000 kJ.

Calculate the percentage of the athlete's energy intake used for evaporation of sweat.

[2 marks]

Percentage = _____ %

0 6 . 8 Some days the athlete did **not** do any training and rested at home.

What effect would resting have on the volume of sweat produced each day?

[1 mark]

10

Do not write outside the box

0 7 Living organisms can be classified into groups.

Trilobites are animals that lived in the sea 400 to 500 million years ago.

Table 3 gives the classification of two species of trilobite.

Table 3

Classification group	**Trilobite A**	**Trilobite B**
	Animalia	*Animalia*
Phylum	*Arthropoda*	*Arthropoda*
Class	*Trilobita*	*Trilobita*
Order	*Ptychopariida*	*Ptychopariida*
Family	*Alokistocaridae*	*Marjumiidae*
	Elrathia	*Modocia*
Species	*kingii*	*typicalis*

0 7 . 1 Complete **Table 3**.

[2 marks]

Choose answers from the box.

Community	**Genus**	**Kingdom**	**Mammal**	**Population**

Do not write outside the box

0 7 . 2 Which scientist invented the classification system given in **Table 3**?

[1 mark]

Tick (✓) **one** box.

- Darwin ☐
- Lamarck ☐
- Linnaeus ☐
- Mendel ☐

0 7 . 3 What is the binomial name of trilobite **A**?

Use information from **Table 3.**

[1 mark]

Tick (✓) **one** box.

- *Arthropoda kingii* ☐
- *Elrathia kingii* ☐
- *Trilobita kingii* ☐

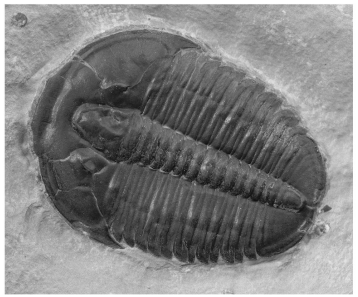
Question 7 continues on the next page

Do not write outside the box

Figure 10 shows fossils of the two species of trilobite.

Figure 10

Trilobite A



Trilobite B

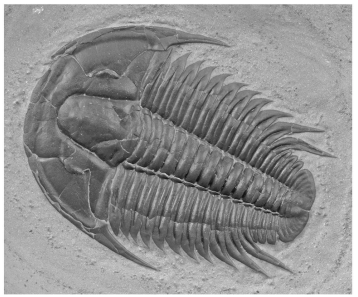
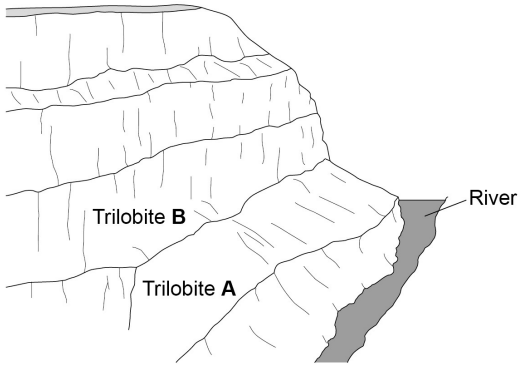


Figure 11 shows:

- layers of rock in a cliff
- where the trilobite fossils were found.

Figure 11



Do not write outside the box

A scientist made the hypothesis:

'Trilobite **B** may have evolved from trilobite **A**.'

0 7 . 4 What **two** pieces of evidence from **Figure 10** and **Figure 11** support the scientist's hypothesis?

[2 marks]

Tick (✓) **two** boxes.

Trilobite **A** and trilobite **B** were in the same type of rock. ☐

Trilobite **A** was found in older rocks than trilobite **B**. ☐

Trilobite **B** has a smaller mass than trilobite **A**. ☐

Trilobite **B** is a different colour from trilobite **A**. ☐

Trilobite **B** is more complex than trilobite **A**. ☐

0 7 . 5 Trilobites are animals that lived in the sea.

Complete the sentences about how the fossils of trilobites **A** and **B** were formed.

Choose answers from the box.

[3 marks]

acids	**bones**	**hard parts**	**minerals**
rocks	**sediments**	**soft parts**	

The animal dies and falls to the sea bed.

The animal is buried in _____.

The _____ of the animal decay.

The remains which do **not** decay are replaced by _____.

Turn over ►

Do not write outside the box

0 7 . 6 Trilobites **A** and **B** are now extinct.

Give **three** possible causes of extinction.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

0 7 . 7 Suggest **one** reason why scientists **cannot** be sure what caused the trilobites to become extinct.

[1 mark]

_____

_____

13

Do not write outside the box

0 8 There are two types of reproduction:

- sexual reproduction
- asexual reproduction.

0 8 . 1 Complete **Table 4** to compare sexual reproduction with asexual reproduction.

Write a tick (✓) in the box if the statement is true.

The first row has been completed for you.

[2 marks]

Table 4

	Sexual reproduction	Asexual reproduction
Cell division occurs	✓	✓
Fertilisation occurs		
Genes are passed on from parent to offspring		
Offspring are genetically identical to each other		

0 8 . 2 Gametes are formed in sexual reproduction.

Name the male gamete formed in flowering plants.

[1 mark]

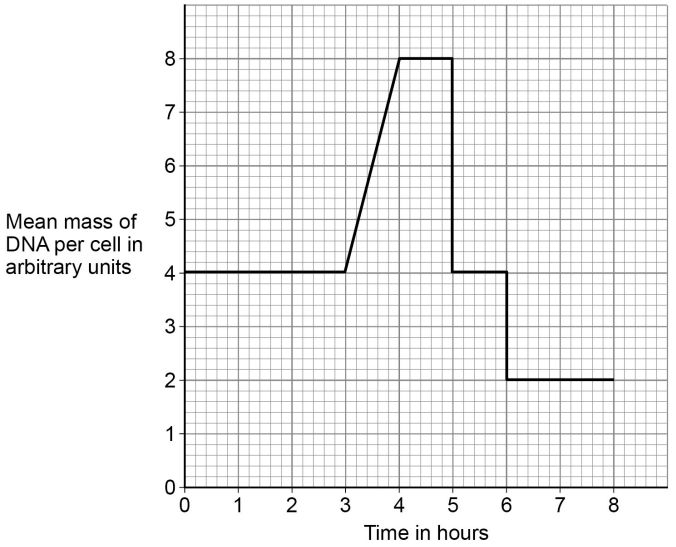
Question 8 continues on the next page

Do not write outside the box

Cell division by meiosis forms gametes.

Figure 12 shows the mean mass of DNA per cell before, during and after meiosis.

Figure 12



Use information from **Figure 12** to answer questions **08.3** to **08.6.**

0 8 . 3 When is the DNA in the chromosomes being copied?

[1 mark]

Tick (✓) **one** box.

Between 0 and 3 hours ☐

Between 3 and 4 hours ☐

Between 4 and 5 hours ☐

Between 5 and 6 hours ☐

Do not write outside the box

0 8 . 4 Cells divide twice during meiosis.

Which **two** times in **Figure 12** show one cell dividing into two cells?

[2 marks]

Tick (✓) **two** boxes.

- 3 hours ☐
- 4 hours ☐
- 5 hours ☐
- 6 hours ☐
- 8 hours ☐

0 8 . 5 What is the mean mass of DNA in arbitrary units in a sperm cell?

[1 mark]

Tick (✓) **one** box.

2 ☐ 4 ☐ 8 ☐ 16 ☐

0 8 . 6 What is the mean mass of DNA in arbitrary units in each cell in an embryo?

[1 mark]

Tick (✓) **one** box.

2 ☐ 4 ☐ 8 ☐ 16 ☐

8

Turn over for the next question

Do not write outside the box

0 9 Earthworms:

- live in soil
- feed on dead and decaying plant matter
- have soft, moist skin
- exchange gases through their skin.

0 9 . 1 Give **two** abiotic factors and **two** biotic factors that could affect the size of an earthworm population.

[4 marks]

Abiotic factors

1 _____

_____

2 _____

_____

Biotic factors

1 _____

_____

2 _____

_____

Do not write outside the box

0 9 . 2 Students investigated the populations of earthworms in the soil in two different areas:

- Area **A**: a grass lawn
- Area **B**: a farmer's field.

Chemical **X** can be mixed with water and poured onto the soil.

The mixture brings earthworms to the surface of the soil but does **not** harm the earthworms.

Plan an investigation using chemical **X** to compare the number of earthworms per m^2 in areas **A** and **B**.

[6 marks]

10

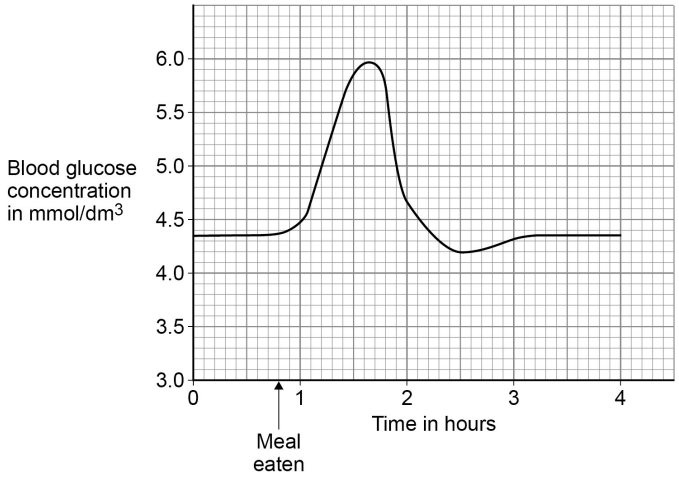
Turn over for the next question

Do not write outside the box

1 0 It is important to control the concentration of glucose in the blood.

Figure 13 shows how the concentration of glucose in the blood of a person changed over 4 hours.

Figure 13



1 0 . 1 Give **one** time when the concentration of **insulin** in the person's blood would be high.

Use **Figure 13**.

[1 mark]

Time = _____ hours

Do not write outside the box

1 0 . 2 Explain the effect a high concentration of insulin has on blood glucose concentration.
[3 marks]

Effect _____

Explanation _____

_____

_____

_____

Question 10 continues on the next page

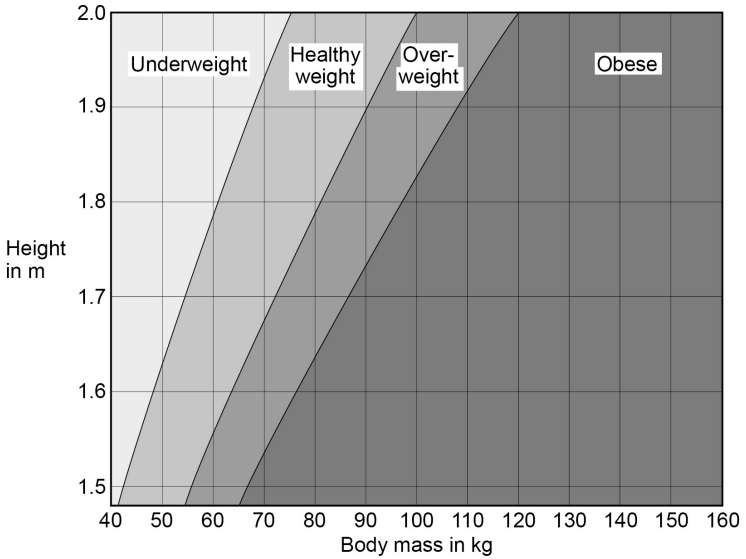
Do not write outside the box

People with diabetes have difficulty controlling the concentration of glucose in their blood.

Type 2 diabetes is linked to obesity.

Figure 14 shows how to find if an adult's body mass is healthy for their height.

Figure 14



Do not write outside the box

10.3 Person **A**:

- is 1.75 m in height
- has a body mass of 52 kg.

What is person **A**'s weight category?

[1 mark]

Tick (✓) **one** box.

Underweight ☐

Healthy weight ☐

Overweight ☐

Obese ☐

10.4 Person **B** is 1.9 m in height.

Give the range of body masses that would put person **B** in the healthy weight category.

[1 mark]

Range from _____ kg to _____ kg

Question 10 continues on the next page

Do not write outside the box

10.5 Person **C** is obese.

A doctor thinks that person **C** has Type 2 diabetes.

The doctor tests a sample of blood from person **C**.

Table 5 shows:

- the results of the blood test
- the mean results for people who do **not** have diabetes.

Table 5

	Concentration in blood	
	Person C	**Mean for people who do not have diabetes**
Cholesterol in mmol/dm^3	6.21	5.20
Glucose in mmol/dm^3	9.56	4.51
Insulin in arbitrary units	24.32	14.83

Type 2 diabetes occurs when body cells have a reduced response to insulin.

Give **two** ways the results of the blood test show that person **C** might have Type 2 diabetes.

[2 marks]

1 _____

_____

2 _____

_____

Do not write outside the box

1 0 . 6 Give **two** ways that a person can reduce the chance of developing Type 2 diabetes.

[2 marks]

1 _____

_____

2 _____

_____

10

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.**

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

Do not write outside the box

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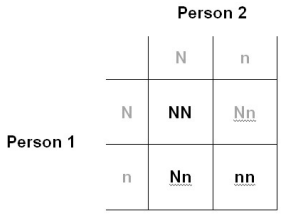
Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	an allele expressed only if a person has two copies of the allele		1	AO1 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	male with MSUD	allow equivalent statements eg affected male **or** MSUD male **or** man with the disease	1	AO3 4.6.1.6 4.6.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3 *mark with 01.4, 01.5*		3 correct = **2** marks 2 or 1 correct = **1** mark	2	AO2 4.6.1.6 4.6.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4 *mark with 01.3, 01.5*	does not have MSUD	allow equivalent statements – eg normal **or** not affected **or** healthy ignore carrier	1	AO2 4.6.1.6 4.6.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5 *mark with 01.3, 01.4*	correct percentage from **Figure 2**	if no answer in question **01.3** allow 25%	1	AO3 4.6.1.6 4.6.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	dominant		1	AO2 4.6.1.6

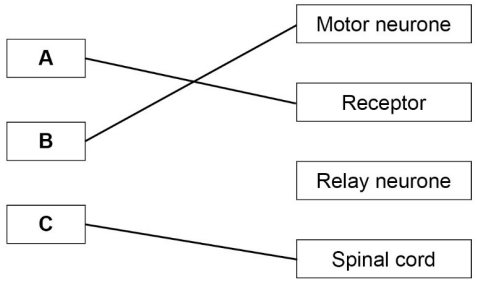
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	DNA	allow deoxyribonucleic acid allow nucleotide(s)	1	AO1 4.6.1.4 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	proteins		1	AO2 4.6.1.4

Total Question 1		**9**

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	a reflex action is automatic		1	AO1 4.5.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	 do **not** accept more than one line from a box on the left		1 1 1	AO1 4.5.1 4.5.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	blinking when an insect flies into the eye removing the hand from a hot object		1 1	AO2 4.5.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4 *View with Table 1* *Mark with 02.5*	$\frac{320 + 304 + 315 + 308 + 313}{5}$ 312	allow $\frac{1560}{5}$ if no other mark awarded allow **1** mark for $\frac{315 + 307 + 357}{3} = 326(.3)$	1 1	AO2 4.5.2.1 RPA7

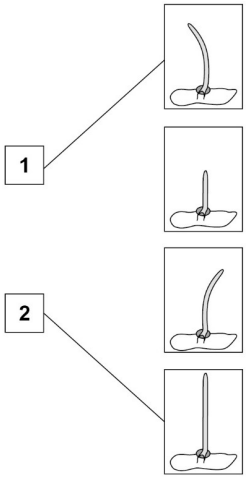
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5 *View with Table 1* *Mark with 02.4*	ring drawn around 635 in Table 1	allow 635 or test 5 (next to question) if no ring drawn on Table 1	1	AO3 4.5.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	any **two** from: • age • drugs • tiredness / sleep • sex	 allow a named example of a drug such as alcohol / caffeine allow gender allow practice at the test **or** playing computer games allow distractions	2	AO1 4.5.2.1 RPA7

Total Question 2		11

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	tropism		1	AO1 4.5.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	 do **not** accept more than one line from a box on the left		1 1	AO3 4.5.4.1 RPA8

MARK SCHEME – GCSE BIOLOGY – 8461/2F – JUNE 2022

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	to show the response in experiment **1** is caused by (1-sided) light **or** as a control	allow to compare with experiment **1** allow to show the difference between (1-sided) light and no light do **not** accept control variable	1	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	shine light from all sides on the third seedling		1	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	keep each seedling at the same temperature		1	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	any **one** from: • gravity • water • chemicals / minerals / ions	allow moisture allow a named chemical such as nitrate ignore nutrients ignore light	1	AO1 4.5.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	because of variation (in results) **or** to identify / eliminate anomalies	allow example such as some may not grow	1	AO2 4.5.4.1
	to calculate a mean **or** a mean value would be more representative / typical	allow to calculate an average ignore to improve accuracy / precision / validity	1	

Total Question 3		**9**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	bacteria		1	AO3 4.7.1.2 4.7.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	any **two** from: • bacteria increase **before** protozoa increase **or** when bacteria are high, protozoa increase • as protozoa increase, bacteria decrease • (after site **A**) as bacteria decrease, protozoa also decrease	 allow protozoa increase **after** bacteria increase allow when bacteria are **l**ow, protozoa are low	2	AO3 4.7.1.1 4.7.1.3 4.7.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(aerobic) respiration	do **not** accept anaerobic respiration	1	AO1 4.7.1.2 4.7.3.2 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	(algae carry out) photosynthesis (which) produces oxygen	 allow algae produce oxygen	1 1	AO2 4.7.3.2 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	bars plotted correctly suitable shading	allow a tolerance of ± ½ a small square ignore column widths	1 1	AO2 4.7.1.2 4.7.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	more sludge worms at **A** (than at **B)** no mayfly nymphs at **A and** mayfly nymphs present at **B**	answers must be comparative allow fewer sludge worms at **B** (than at **A)** allow high number of sludge worms at **A and** low number at **B** allow more mayfly nymphs at **B** (than at **A**)	1 1	AO3 4.7.1.2 4.7.3.2

Total Question 4			**10**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	oestrogen progesterone		1 1	AO1 4.5.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	FSH causes an egg to mature in the ovary		1	AO1 4.5.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	(from day) 9 (to day) 15	do **not** accept (from day) 15 (to day) 9	1	AO2 4.5.3.5

Question	Answers	Mark	AO / Spec. Ref.
05.4	**Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.5.3.4 4.5.3.5
	Level 2: Relevant points (reasons/causes) are identified and there are attempts at logical thinking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical thinking.	1–2	
	No relevant content	0	
	Indicative content • oral contraceptive / the 'pill' ○ (contains hormones / oestrogen / progesterone) to prevent egg / follicle maturing **or** prevents ovulation • injection / implant / skin patch ○ (contains hormones / oestrogen / progesterone) to prevent egg / follicle maturing **or** prevents ovulation • condom / femidom ○ prevents sperm reaching egg or prevents sperm entering woman's body / vagina • diaphragm ○ prevents sperm reaching egg / womb / oviduct • IUD ○ prevents implantation **or** releases hormone / progesterone to prevent ovulation **or** (releases copper ions to) thicken mucus and prevent sperm passage • spermicide ○ kills sperm • sterilisation / vasectomy / tubular ligation ○ prevents passage of sperm / egg • rhythm method ○ no egg available for fertilisation		

Total Question 5		**10**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	(lowest) 1 (ºC) (highest) 34 (ºC)	both correct for **1** mark allow a tolerance of ± 0.2 (ºC) allow a tolerance of ± 0.2 (ºC)	1	AO2 4.5.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	5 / five		1	AO2 4.5.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	so stored food **or** glycogen does not run out **or** to replace stored food **or** glycogen	allow so stored fat does not run out **or** to replace stored fat **or** because stored food **or** glycogen / fat has run out ignore to provide energy	1	AO2 4.5.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	respiration		1	AO1 4.5.2.4 4.4.1.3 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	any **one** from: • movement • muscle contraction • keeping warm • growth / repair • active transport	allow functioning of internal organs – eg heartbeat allow synthesis / described	1	AO1 4.5.2.4 4.1.3.3 4.4.2.1 4.4.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	3200 × 2.5 8000 (kJ)		1 1	AO2 4.5.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	$\frac{6000}{24\,000} \times 100$ 25 (%)	 if no other mark awarded allow for **1** mark 0.25	1 1	AO2 4.5.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.8	reduced	do **not** accept no sweating	1	AO2 4.5.2.4

Total Question 6		**10**

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1 *view with Table 3*	kingdom genus	in this order only	1 1	AO1 4.6.3.5 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	Linnaeus		1	AO1 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	*Elrathia kingii*		1	AO2 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	trilobite **A** was found in older rocks than trilobite **B** trilobite **B** is more complex than trilobite **A**		1 1	AO3 4.6.3.4 4.6.3.5

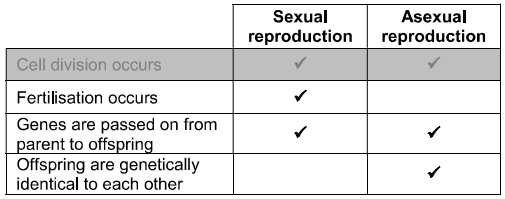
Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	sediments soft parts minerals	in this order only	1 1 1	AO2 4.6.3.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	any **three** from: • drought • ice age • global warming • volcanic activity • asteroid collision • (new) predators • (new) disease / pathogen • competition for food • competition for mates • lack of habitat or habitat change	 } if none of these, allow climate change for **1** mark ignore weather } if neither of these, allow catastrophic event **or** natural disaster for **1** mark allow named example allow hunters allow named example allow lack of food allow lack of mates ignore competition unqualified ignore isolation ignore pollution	3	AO1 4.6.3.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7	no / insufficient evidence **or** cannot perform experiment to find out	allow lack of evidence allow no-one was there to observe	1	AO3 4.6.3.5 4.6.3.6

Total Question 7		**13**

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1			2	AO1 4.6.1.1

	Sexual reproduction	Asexual reproduction
Cell division occurs	✓	✓
Fertilisation occurs	✓	
Genes are passed on from parent to offspring	✓	✓
Offspring are genetically identical to each other		✓

allow **1** mark for 1 or 2 correct rows
ignore 'x' in blank boxes

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	pollen (grain)	allow nucleus in pollen (grain)	1	AO1 4.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	between 3 and 4 hours		1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	5 hours 6 hours		1 1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	2		1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	4		1	AO2 4.6.1.2

Total Question 8		**8**

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	**abiotic** any **two** from: • water	 allow moisture / humidity / rain(fall) allow dryness	2	AO1 4.7.1.1 4.7.1.2 4.7.1.3
	• oxygen / air (in soil) • pH (of soil) • minerals / ions	ignore carbon dioxide allow acidity / alkalinity (of soil) allow salts allow named example of an ion ignore nutrients		
	• temperature • size of soil particles **or** texture / type of soil	allow named example of soil type ignore space / toxins / weather		
	biotic any **two** from: • food	 allow amount of dead / decaying matter (in soil) ignore nutrients	2	
	• predators / consumers / carnivores	allow example – such as birds		
	• disease / pathogens / bacteria / fungi	allow microorganisms / microbes / parasites if **no** other marks awarded allow **2** marks for **four** factors in reverse categories		

Question	Answers	Mark	AO / Spec. Ref.
09.2	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO2
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	AO2
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	AO1
	No relevant content	0	
	Indicative content • same concentration of chemical / **X** applied to the soil • same volume / amount of chemical / **X** applied to the soil • same size of area sampled – eg 1 m^2 or 0.25 m^2 • use of a quadrat • same time between application and collecting worms • same time allowed for collecting worms after application • each sample area selected randomly • method of achieving randomness – eg random coordinates • (collect and) count worms in each of areas **A** and **B** • at least 5 repeats in each of areas **A** and **B** • calculate mean (per unit area) **or** total for each of areas **A** and **B** • compare means / totals for areas **A** and **B**		4.7.2.1 RPA9

Total Question 9		**10**

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	an answer in the range 1.1 to 2(.0) (hours)		1	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	*effect* : lowered *explanation*: glucose taken in **or** glucose converted to glycogen **or** glucose used in respiration by cells / liver / muscles		1 1 1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	underweight		1	AO3 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	(from) 67.5 (kg to) 90 (kg)	allow in the range 67 to 68 (kg) for 67.5 (kg) allow in the range 90 to 90.5(kg) for 90 (kg) allow from 90 (kg to) 67.5 (kg)	1	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5		answers must be comparative		AO3 4.5.3.2
	(person **C** has) higher glucose (than mean)	allow comparison of higher glucose using numbers allow (person **C**'s) glucose is too high	1	
	(person **C** has) higher insulin (than mean)	allow comparison of higher insulin using numbers allow (person **C**'s) insulin is too high do **not** accept (person **C** has) higher cholesterol ignore unprocessed data	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.6	(more) exercise	allow example of (more) exercise	1	AO1 4.5.3.2
	eat less carbohydrate / sugar **or** eat a low carbohydrate diet	allow eat less fat allow eat a carbohydrate controlled diet if no other marks awarded allow **1** mark for lose weight **or** maintain healthy weight **or** eat less **or** eat fewer calories ignore references to healthy / balanced diet **or** diet unqualified	1	

Total Question 10		**10**