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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE

Time 2 hours

Paper reference **4BI1/1B 4SD0/1B**

Biology

UNIT: 4BI1

Science (Double Award) 4SD0

PAPER: 1B

January 2022

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 110.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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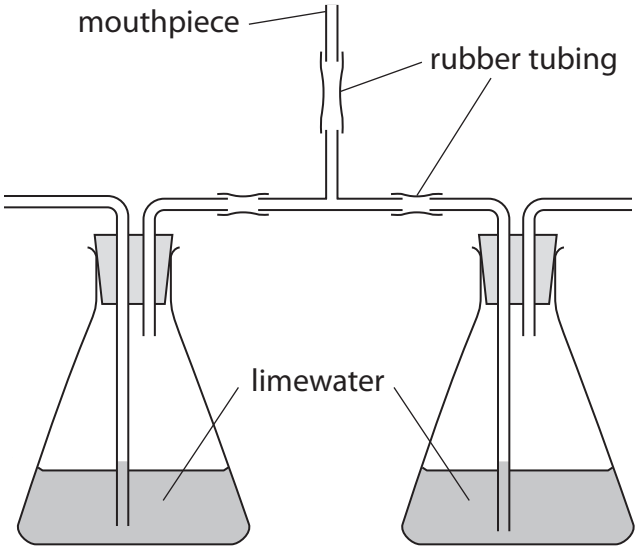
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Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 (a) The diagram shows apparatus a student uses to compare inhaled and exhaled air.



The student breathes into and out of the mouthpiece for one minute.

(i) Explain which flask exhaled air passes through.

(2)

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(ii) Explain the changes that will happen in the limewater in flask A and in flask B.

(2)

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(iii) The student uses limewater to compare the composition of exhaled and inhaled air.

Suggest an alternative substance that they could use.

(1)

(b) Describe the role of the diaphragm and the intercostal muscles in inhalation.

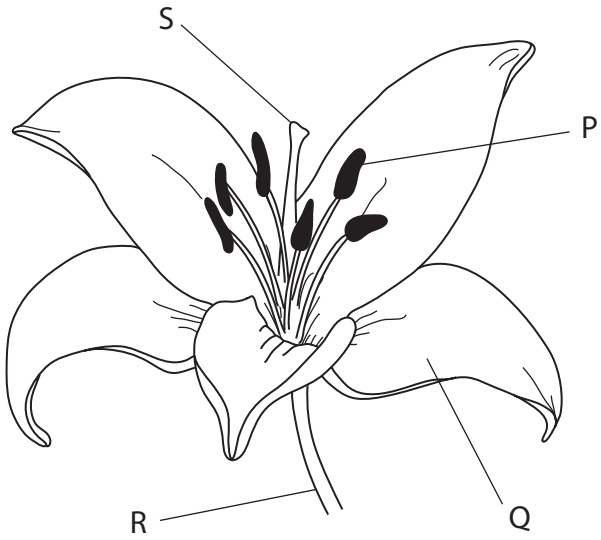
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(Total for Question 1 = 9 marks)

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2 The diagram shows an insect-pollinated flower called a lily.



(a) (i) Which of these is the name of structure P?

(1)

- ☒ **A** anther
- ☒ **B** filament
- ☒ **C** stigma
- ☒ **D** style

(ii) Which of these is the name of structure Q?

(1)

- ☒ **A** leaf
- ☒ **B** petal
- ☒ **C** stem
- ☒ **D** style

(iii) On which structure do pollen grains germinate?

(1)

- ☒ **A** P
- ☒ **B** Q
- ☒ **C** R
- ☒ **D** S

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(b) Describe how the structures of P, Q and S would differ in a wind-pollinated flower.

(3)

(c) Plants can also reproduce by asexual reproduction.

(i) Give one natural method that plants use to reproduce asexually.

(1)

(ii) Give one artificial method that a plant grower may use to reproduce a plant asexually.

(1)

(iii) Suggest why a plant grower may choose to reproduce a plant asexually rather than allowing the plant to reproduce sexually.

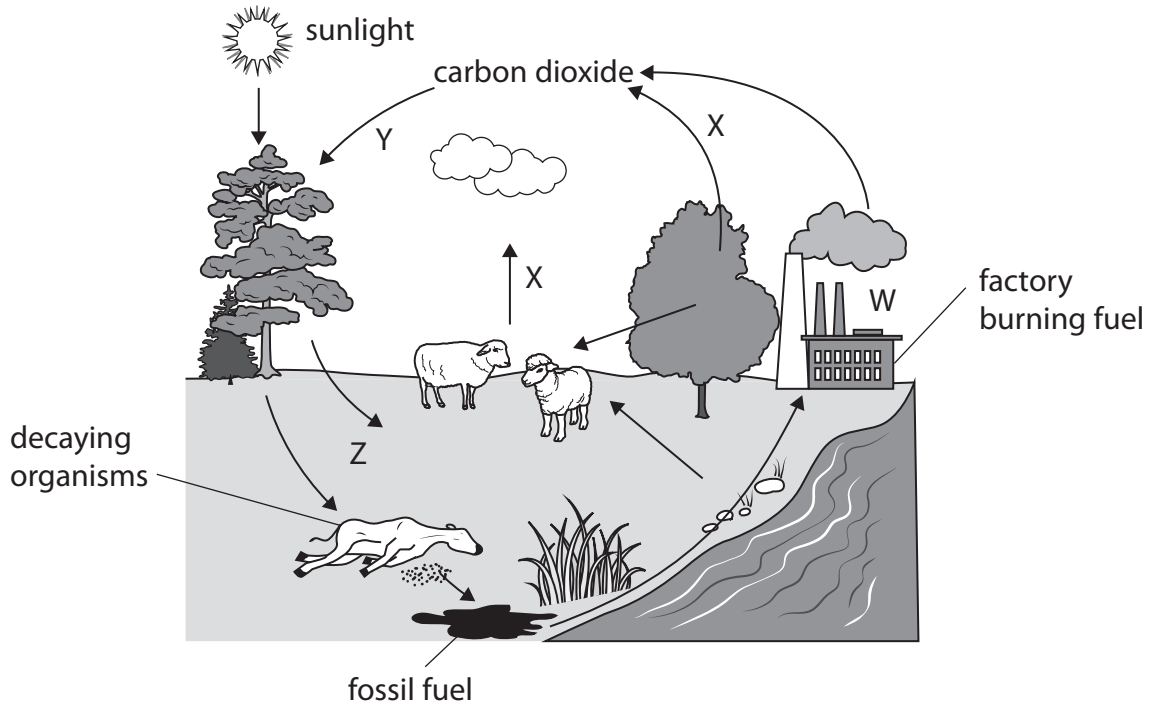
(2)

(Total for Question 2 = 10 marks)

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3 The diagram shows a cycle found in ecosystems.



(a) Give the name of the cycle.

(1)

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(b) (i) Which process is represented by the letter W?

(1)

- ☒ **A** combustion
- ☒ **B** decomposition
- ☒ **C** feeding
- ☒ **D** respiration

(ii) Which process is represented by the letter X?

(1)

- ☒ **A** combustion
- ☒ **B** decomposition
- ☒ **C** feeding
- ☒ **D** respiration

(c) Name a group of organisms that is responsible for decomposition.

(1)

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(d) Carbon dioxide is released into the atmosphere by the decomposition of organic material.

The rate of this decomposition depends on a number of factors.

Design an investigation to find out if changing the pH of organic material affects the rate of decomposition.

Include experimental details in your answer and write in full sentences.

(6)

(Total for Question 3 = 10 marks)

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4 The data in the table was collected in Japan during a seven-year study.

Scientists collected data on the age of mothers and whether they smoked during pregnancy.

They also recorded the percentage of the babies that had a low birth mass.

Age of mother in years	Data for mothers who did not smoke during pregnancy		Data for mothers who did smoke during pregnancy	
	number of mothers	percentage of babies with low birth mass	number of mothers	percentage of babies with low birth mass
19 and under	1331	11.5	356	16.0
20–24	11243	9.8	1677	13.2
25–29	24099	9.0	2211	13.3
30–34	28695	9.2	1847	14.5
35–39	16537	10.5	934	21.1
40 and over	3242	12.3	181	22.1

(a) (i) Calculate the percentage of mothers aged 19 years and under who smoked during pregnancy.

(2)

percentage (%) = ...

(ii) Determine the ratio of non-smokers to smokers used in the study.

Give the ratio as the nearest whole number (n) in the form n:1

(2)

ratio = ... : 1

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(b) A student examines this data and concludes that smoking is the main factor that causes low birth mass.

Use the data and your own biological knowledge to comment on this conclusion.

(6)

(Total for Question 4 = 10 marks)

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5 Scientists carry out an experiment to see if reducing the availability of oxygen affects the production of yoghurt.

They use increasing acidity as a measure of yoghurt production.

They record the acidity of two cultures, one with a reduced oxygen level and one with a normal oxygen level, over 210 minutes.

The table shows their results.

Time in minutes	Acidity (%)	
	reduced oxygen level	normal oxygen level
0	0.20	0.20
30	0.22	0.22
60	0.25	0.24
90	0.40	0.25
120	0.50	0.31
150	0.62	0.41
180	0.70	0.51
210	0.70	0.70

(a) Explain why increasing acidity can be used as a measure of yoghurt production.

(2)

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(b) Give one abiotic variable that the scientists should control in their experiment.

(1)

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(c) (i) Plot a line graph to show how the percentage acidity changes over the period of 210 minutes for the reduced oxygen level and for the normal oxygen level.

Use a ruler to join the points with straight lines.

(5)



(ii) Explain why the changes in percentage acidity are different in the reduced oxygen level and in the normal oxygen level cultures.

(2)

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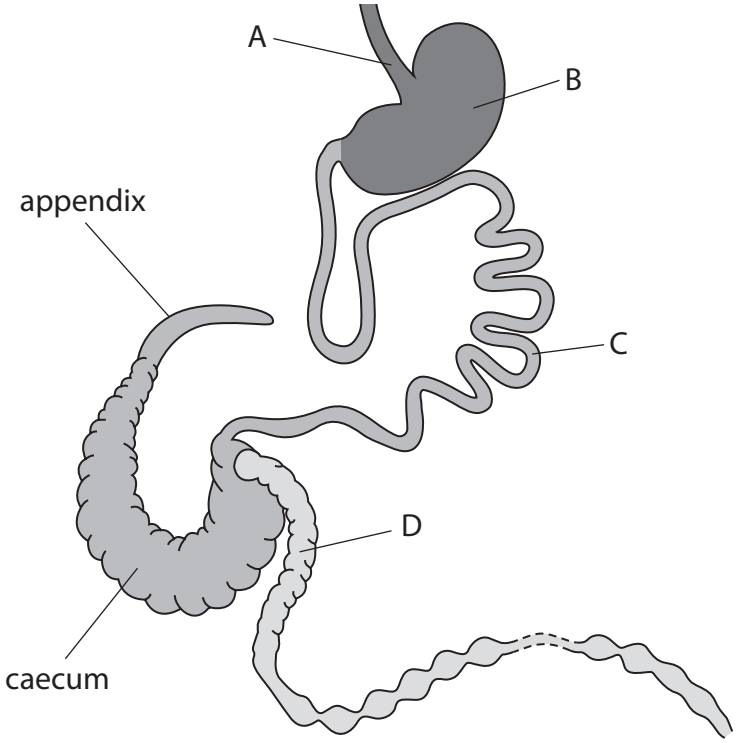
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(Total for Question 5 = 10 marks)

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6 The diagram shows part of the gut of a rabbit.

The rabbit is a primary consumer and eats mainly grass and other vegetable material.



(a) Name the parts labelled A, B, C and D.

(4)

A .....

B .....

C .....

D .....

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(b) The gut of a rabbit has a large caecum and appendix. These contain bacteria that are able to produce the enzyme cellulase.

Explain how these bacteria help the rabbits with their diet of plant material.

(3)

(c) The human gut has a caecum and appendix but they are much smaller than those in the rabbit.

(i) Suggest why the human gut only has a small caecum and appendix.

(1)

(ii) In humans the appendix also acts as a store of useful bacteria. Scientists have discovered that patients who have had their appendix removed are more likely to develop infections of the colon.

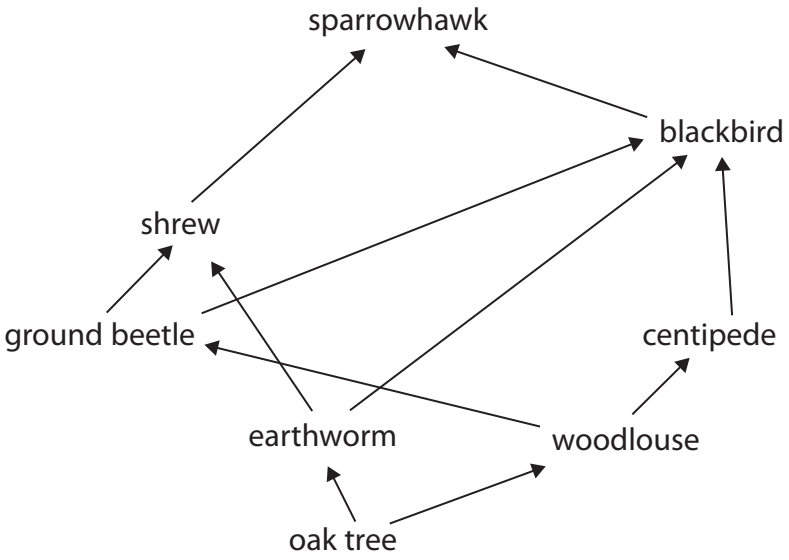
Explain how having no appendix may increase the likelihood of bacterial infections of the colon.

(2)

(Total for Question 6 = 10 marks)

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7 The diagram shows a food web from a woodland ecosystem.



(a) (i) Which organism in the food web is the producer?

(1)

- ☒ **A** blackbird
- ☒ **B** centipede
- ☒ **C** earthworm
- ☒ **D** oak tree

(ii) Which organism acts as both a secondary consumer and a tertiary consumer in the food web?

(1)

- ☒ **A** blackbird
- ☒ **B** earthworm
- ☒ **C** ground beetle
- ☒ **D** sparrowhawk

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(b) The amount of energy transferred changes as you move along a food chain.

The data comes from an ecosystem containing producers, primary consumers and secondary consumers.

Level	Energy in each level in kJ per m^2 per year
producers	8.7×10^5
primary consumers	1.4×10^4
secondary consumers	1.6×10^3

(i) The light energy reaching the producers is 7.1×10^6 kJ per m^2 per year.

Explain why the plants cannot absorb all of this energy.

(2)

(ii) The table shows that energy is transferred between producer and primary consumer and between primary consumer and secondary consumer.

A student states that the energy transfer between producer and primary consumer is the most efficient.

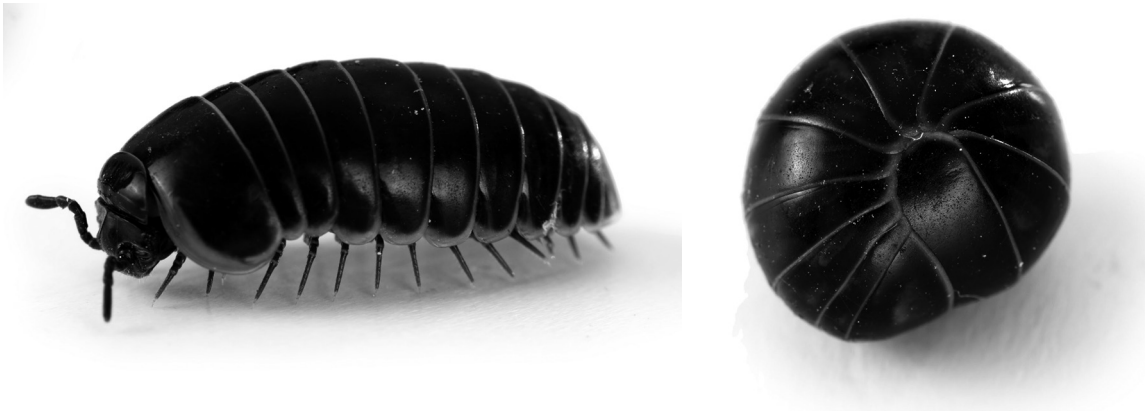
Determine whether the student's statement is correct.

(2)

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(c) Woodlice feed on dead and decaying plant material in the soil.
The photographs show how a woodlouse can curl up into a ball.

This behaviour is an example of a reflex response.



(Source: © StellaNature Alamy Stock Photo)

(i) State what is meant by a reflex response.

(1)

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(ii) Give a reason why this reflex response benefits the woodlouse.

(1)

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(iii) Describe how this reflex response could have evolved by natural selection.

(4)

(Total for Question 7 = 12 marks)

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8 The rate of photosynthesis is affected by different factors. One factor is the concentration of carbon dioxide in the air.

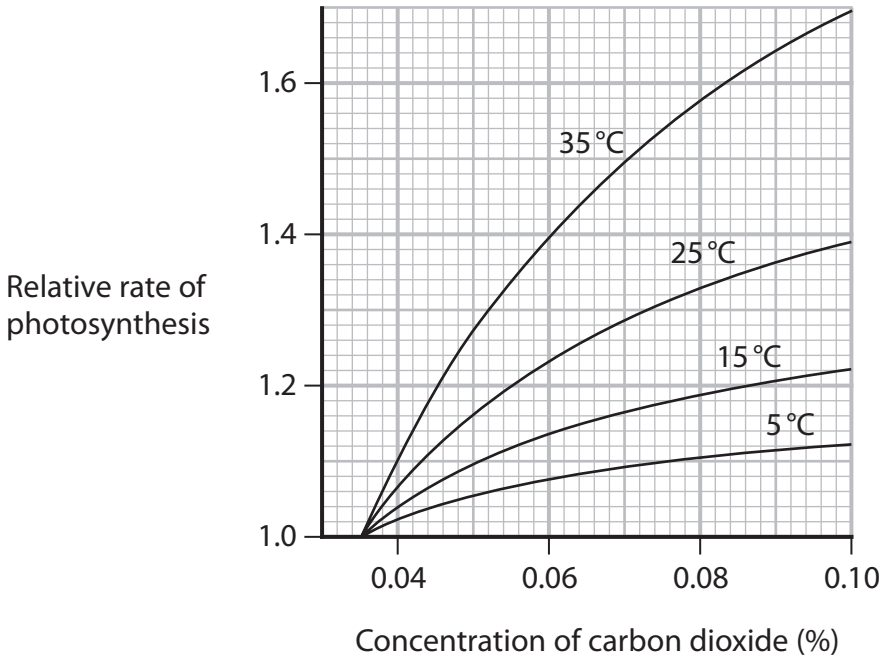
(a) The percentage of oxygen in the air is 21%. This is equivalent to a concentration of 210 000 parts per million.

The percentage of carbon dioxide in the air is 0.04 %. Calculate this concentration in parts per million.

(2)

concentration = ... ppm

(b) The graph shows the effect of increasing the concentration of carbon dioxide in the air on the relative rate of photosynthesis at different temperatures.



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(i) Describe the effect of increasing the concentration of carbon dioxide on the relative rate of photosynthesis at 5 °C.

(2)

(ii) Describe how the effect of increasing the concentration of carbon dioxide on the relative rate of photosynthesis changes when the temperature is increased.

(2)

(iii) Explain the effect of increasing the temperature from 5 °C to 35 °C on the relative rate of photosynthesis.

(3)

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(c) The scientists who carried out this study concluded that the effect of increasing the concentration of carbon dioxide on the rate of growth of a plant is dependent on temperature and also on the minerals that the plants can absorb.

(i) Explain how lacking a named mineral might affect plant growth.

(2)

(ii) Explain how a named factor can affect the rate of photosynthesis, other than carbon dioxide concentration, temperature and minerals absorbed.

(2)

(Total for Question 8 = 13 marks)

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9 Alkaptonuria is an inherited condition caused by the presence of recessive alleles.

(a) State what is meant by a recessive allele.

(1)

.....

.....

(b) Alkaptonuria is first diagnosed in children when it is noticed that they produce very dark urine that turns black when exposed to air.

A woman and a man do not have alkaptonuria. They have a child who has the condition.

The woman and the man are expecting a second child.

(i) Draw a genetic diagram to show the genotypes of the woman and the man, the gametes they produce and the possible phenotypes and genotypes of the second child.

(4)

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(ii) Calculate the probability that the second child is male and does not have the condition.

(1)

probability = ...

(c) Alkaptonuria is caused by the body being unable to break down the amino acids tyrosine and phenylalanine.

This leads to a build-up of a toxin that causes damage to joints and tendons and can also lead to heart valve damage in later life.

A new drug treatment is being tested that can slow the damage to the joints and tendons.

Scientists selected 40 adults who all had alkaptonuria. They placed each patient into one of two groups. One group was given the drug treatment and the other group acted as a control.

The scientists then compared the symptoms of the patients in each group after three years.

(i) Describe what is meant by the control group.

(1)

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(ii) The table compares the control group with the drug treatment group.

It shows the numbers starting and completing the trial and those showing harmful effects.

It also compares improvements in two symptoms of alkaptonuria.

	Control group	Drug group
number of patients starting trial	20	20
number of patients completing trial	17	16
number of patients showing adverse effects	0	2
number of patients that died	0	1
decrease in time taken to stand up and walk 3 m in seconds	0.54	1.33
increase in distance in metres walked in 6 minutes	6.7	51.5

Evaluate whether the new drug should be recommended as an effective treatment for alkaptonuria.

(5)

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(d) Other scientists have suggested that eating fewer proteins that contain tyrosine and phenylalanine would reduce the symptoms of alkaptonuria.

Suggest why eating fewer of these proteins may be difficult.

(2)

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(Total for Question 9 = 14 marks)

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10 Farmers sometimes use biological control to reduce the damage to their crops caused by pests such as insects.

(a) Which of these is an advantage of using biological control over chemical control?

(1)

- ☒ **A** it lasts a short time
- ☒ **B** it leads to bioaccumulation
- ☒ **C** it is specific
- ☒ **D** it is quicker

(b) Aphids are tiny insects that have very sharp mouthparts. They push these mouthparts into the phloem found in stems. They then feed on the phloem contents.



(Source: © Scenics & Science / Alamy Stock Photo)

(i) Name two substances the aphids obtain from the phloem.

(2)

1 .....

2 .....

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(ii) Explain how aphids feeding from the phloem of crop plants can lead to a reduction in yield.

(4)

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(c) Silverflies and hoverflies are two species of insects whose larvae feed on aphids.

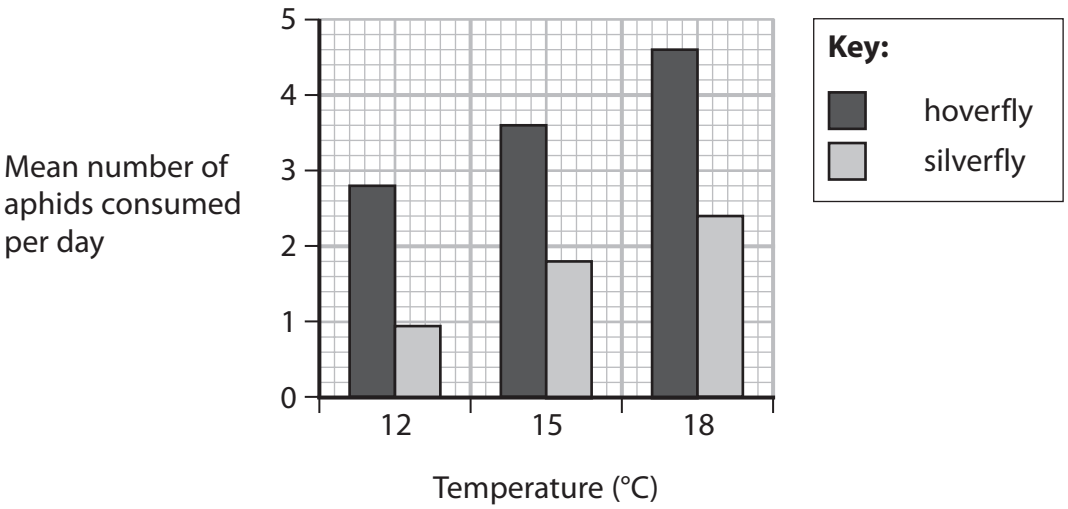
Scientists investigate the feeding behaviour of these species in a laboratory experiment.

This is the scientists' method.

- place a single silverfly in a container
- place a single hoverfly in a separate container
- keep the containers at 12 °C
- put 30 aphids in each container
- count the number of aphids consumed each day for several days
- determine the mean number of aphids consumed per day

The scientists repeat the method at two higher temperatures.

The graph shows the scientists' results.



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The scientists conclude that the hoverfly is the most effective biological control agent for aphids.

Discuss the scientists' conclusion, referring to information in the graph and the scientists' method in your answer.

(5)

(Total for Question 10 = 12 marks)

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