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Examiners' report

GATEWAY SCIENCE BIOLOGY A

J247
For first teaching in 2016

J247/02 Summer 2018 series

Version 1

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Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

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Paper J247/02 series overview

J247/02 is the second paper candidates take for foundation tier Gateway GCSE Biology suite. It assesses content from specification topics B4-6 and B7 practical skills. Therefore for candidates to perform well on this paper they will need to have a sound knowledge of the theory covered in B4-6 and be able to apply this to novel situations.

They also need to apply the skills and understanding that they have developed in the practical activities covered in B7. This paper includes synoptic assessment and therefore the paper assumes knowledge of B1-3 in addition to B4-6. There are also questions that involve the assessment of key mathematical requirements from Appendix 5f of the specification.

Candidate performance

Candidates who did well on this paper generally did the following:

- Performed calculations involving percentages and given formula: Q7, Q17(c)(i) calculation of medians and probability: Q10, Q20(c) and other calculations: Q18(b)(ii).
- Demonstrated their knowledge and understanding of continuous and discontinuous variation Q16(a), definition of mutation and/or gene in Q20(a), knowledge and understanding of stem cells Q20(d)(i) and how energy is lost through a food chain Q21(b)(i).
- Applied their knowledge of experimental skills to novel situations Q17(a).
- Analyse data from experimental situations to draw conclusions Q19(b)(i), Q19(b)(ii) Q19(c).
- Analyse information and ideas to draw conclusions Q22(b)(iii) and Q24(b).
- Apply knowledge and understanding of scientific ideas e.g. natural selection Q23(c)(ii).
- Apply knowledge and understanding in generating a graph from given data. Q24(a).

Candidates who did less well on this paper generally did the following:

- Found it difficult to perform calculations such as median Q10, GI index Q17(c)(i) and others Q18(b)(ii).
- Could not recall knowledge and understanding of continuous and discontinuous variations Q16(a) and energy loss through the food chain Q21(b)(i).
- Could not apply their knowledge of experimental skills to novel situations Q17(a) control variables and graphs Q24(a).
- Could not draw conclusions from data or experimental results Q22(b)(ii), Q22(b)(iii) and Q23(b).
- Could not complete the genotypes in a Punnett square and draw a correct probability conclusion Q20(c).

There was no evidence that there were any time constraints that would lead to candidates underperforming. The paper was challenging and discriminated well between candidates. Most candidates made a good attempt at answering the questions in the space available.

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Section A

Question 7

7 A scientist was studying a population of snails.

He caught 60 snails in the first sample. He marked them and released them.

He caught 50 snails in the second sample. 20 of the snails were marked.

Use this equation: estimated population = $\frac{\text{number caught in first sample} \times \text{number caught in second sample}}{\text{number in second sample that are marked}}$

What is the estimated population?

A 150

B 2400

C 3000

D 60 000

Your answer ☐ **[1]**

This question was the most accessible question in the multiple choice section A, with most candidates correctly answering A by correctly applying the equation.

Question 11

11 Strains of bacteria are now becoming resistant to antibiotics.

Which process is causing this resistance?

A Genetic modification

B Natural classification

C Natural selection

D Selective breeding

Your answer ☐ **[1]**

This question proved to be the most challenging question in section A. Many candidates did not recognise this was an example of natural section. The most common incorrect answer was genetic modification, answering A instead of C.

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Section B

Question 16 (a)

16 (a) Characteristics can be examples of continuous or discontinuous variation.

Write the **four** characteristics below in the correct columns of the table.

Sex **Blood group** **Height** **Eye colour**

Continuous variation	Discontinuous variation

[2]

There was some confusion in the answers, mixing up continuous and discontinuous variation. Lower ability candidates did not gain marks here.

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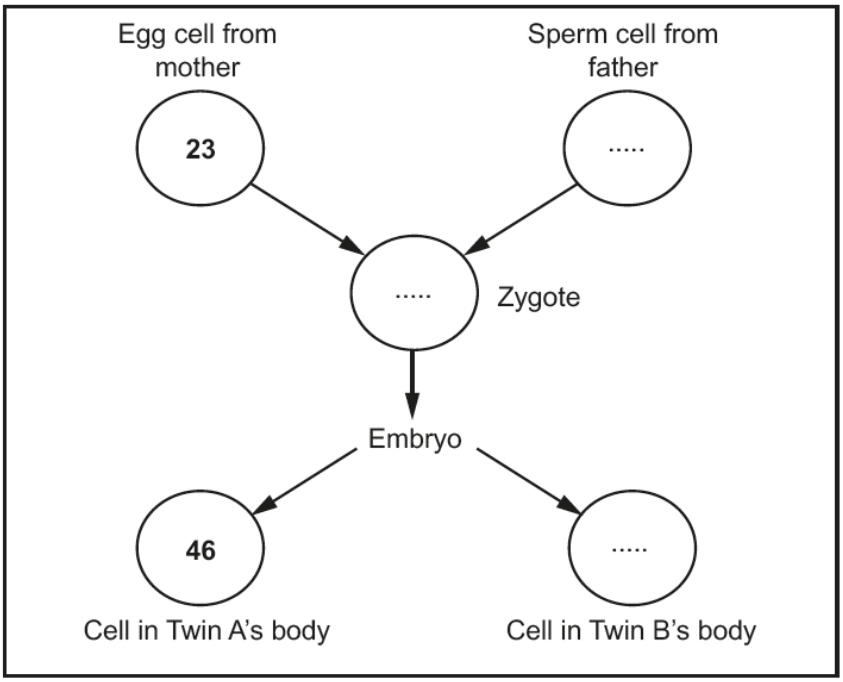
Question 16 (b)

(b) Identical twins occur when an embryo splits into two.

In the diagram below, some of the chromosome numbers in the different cells have been given to you.



Complete the diagram to show the number of chromosomes in:

- The sperm cell
- The zygote
- The cell in Twin B's body.

[3]

The majority of candidates achieved full marks here for correctly identifying the number chromosomes in each of the cell types.

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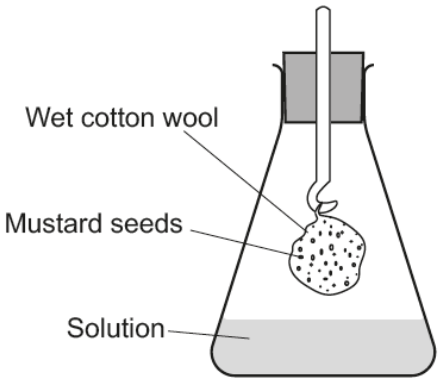
Question 17 (a)

17 A student investigates the effect of acid rain on seed growth.

- She soaks cotton wool in a solution with a pH value of 7.0.
- She puts 20 mustard seeds onto the cotton wool and places it inside a flask.
- She adds the same solution to the flask.
- She then repeats this four times using solutions with different pH values.

One of the flasks is shown in the diagram.



After **8 days** she counts how many of the seeds are growing.

The table shows her results.

pH of solution	Number of the 20 seeds that are growing after 8 days
7.0	17
6.5	18
6.0	16
5.5	6
5.0	2

The student used 20 seeds in each flask.

(a) Write down **one** other factor that the student should have kept the same in this investigation.

..... **[1]**

This question differentiated well, the majority of higher ability candidates correctly gained marks here and lower ability candidates did not. Most correct answers referred to the amount of solution, and most incorrect answers referred to the number of seeds and days left.

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Question 17 (b)

(b) Describe what this investigation shows about the effect of acid rain on seed growth.

.....

.....

..... **[2]**

This question challenged many of the candidates and the majority did not apply the experimental results to the effects of acid rain. Many referred to the effect of pH on seed growth. For the second marking point candidates didn't recognise it was only below pH 6 that affected seed growth, and only stated the general trend. An example of an answer that didn't receive any marks is seen in Exemplar 1.

Exemplar 1

the lower the pH levels the less the seeds will grow

Question 17 (c) (i)

(c) One way to compare the growth of seeds is to use a germination index (**GI**).

Use the formula: $GI = \frac{\text{mean root length} \times \text{number of seeds that are growing}}{\text{number of days}}$

(i) For the seeds at **pH 6.0**, the mean root length was 5 mm.

Calculate the **GI** for these seeds.

Answer = ... **[2]**

This question differentiated well between higher and lower ability candidates. Most common error in the calculation was replacing the number of seeds that are growing with the total number of seeds used. This gave an incorrect answer of 12.5 instead of 10.

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Question 17 (c) (ii)

(ii) Look at the equation for **GI**.

This is a better way of measuring the effect of acid rain on seed growth than just counting the number of seeds growing.

Explain why.

.....

..... **[1]**

Most candidates gave general answers referring to accurate results and difficulty in counting / miscounting of the seeds. This is seen in Exemplar 2 which did not gain marks.

Exemplar 2

this is because the counter can miss some seed growing and it will not be aguate **[1]**

Question 18 (a)

18 (a) The sex chromosomes determine the sex of a baby.

What are the sex chromosomes of a male and of a female?

Male ..... Female ..... **[2]**

The majority of candidates did not recall that males have XY and females have XX sex chromosomes. This question was a good differentiator. Most common errors were linking gametes or chromosome number of gametes to male and female respectively. This is shown in Exemplar 3, which achieved 0 marks.

Exemplar 3

Male 23 Female 23 **[2]**

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Question 18 (b) (i)

(b) The data in the table shows the ratio of males to females in England and Wales.

	Ratio of males to females in England and Wales
At birth	105 males : 100 females
Average over the whole population	98 males : 100 females

(i) What percentage of babies are male at birth?

Answer = ... % **[1]**

This question differentiated well, with the higher ability candidates more likely to correctly calculate the percentage.

Question 18 (b) (ii)

(ii) In a hospital 410 babies are born in a week.

Calculate how many of them are likely to be male.

Answer = ... **[1]**

This answer was correctly calculated by half of the candidates.

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Question 18 (b) (iii)

(iii) On average, men do not live as long as women.

How does the data in the table show this?

.....

.....

.....

..... **[2]**

The most common mark scored was that in the whole population there are more females (than males). Of those candidates that didn't score, the vast majority did not compare males against females and stated the number for males at birth compared to the whole population. Exemplar 4 scored full marks.

Exemplar 4

because at birth there are more males than females but throughout the whole population there is more females than males. **[2]**

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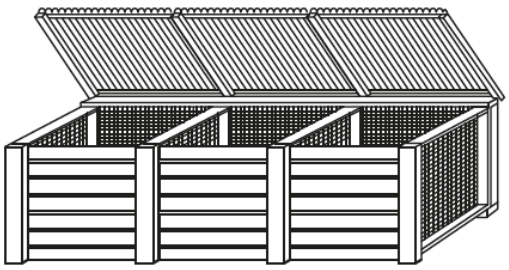
Question 19 (a)

19 A gardener buys a composter to decay plant material as quickly as possible.

The composter has three sections.



Section **A** Section **B** Section **C**

She designs an experiment to see if watering makes the plant material decay faster.

She waters:

- Section **A** once a week
- Section **B** once a month
- Section **C** is not watered.

(a) The gardener wants valid results. Explain **one** factor that the gardener should keep constant.

.....

.....

..... **[2]**

This question was challenging for the candidates. The majority couldn't identify a correct control variable and explain the effect on microbe action. The most common answer was to keep the water the same, which was the independent variable. Exemplar 5 demonstrates an answer which did not gain credit.

Exemplar 5

She should keep the water constant.

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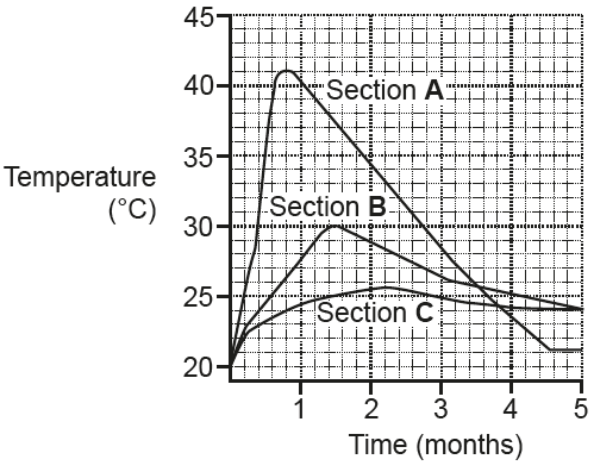
Question 19 (b) (i)

(b) The gardener measures the temperature in each section for five months.

She knows that heat is given off when plant material decays.

The graph shows her results.



(i) Write down **two** differences between the change in temperature in Section **A** and the change in temperature in Section **C**.

1 .....

.....

2 .....

.....

[2]

In this question the most common correct scoring point was that A reaches the highest temperature and increases quicker. Some candidates didn't make it a comparative answer with C, so did not gain credit. A small number of candidates referred to rate of decay instead of temperature or compared section A with section B.

Question 19 (b) (ii)

(ii) The gardener decides that she should water all sections every week.

Explain why she decides this.

.....

..... **[1]**

The majority of lower ability candidates did not score this question and linked watering more often to faster decay. Answer included seeing the effects of water on growth, also references to increases temperature on the plant material.

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Question 19 (c)

(c) Each section of the composter has holes in it to let oxygen in.

Explain why this helps the material to decay.

.....

.....

..... **[2]**

In this question candidates linked oxygen and decay correctly but did not gain credit as couldn't demonstrate their knowledge and understanding of microbes requiring oxygen for respiration.

Question 20 (a)

20 Retinitis pigmentosa is a genetic condition.

It is caused by a mutation to a gene. This mutation produces a recessive allele.

If people have retinitis pigmentosa then the cells in their retina are damaged.

(a) Explain the meaning of these terms.

Mutation .....

.....

Gene .....

.....

[2]

There were some good answers here demonstrating their knowledge and understanding of the meaning of the terms mutation and gene. Mutation was the most common credited answer.

Question 20 (b) (i)

(b) If a person has two alleles for retinitis pigmentosa, they will not be able to see properly.

(i) Why does a person need two affected alleles to have the condition?

.....

..... **[1]**

Candidates need to apply their knowledge and understanding of genetics to achieve this mark. It differentiated well with the higher ability candidates' understanding that the allele is recessive. The majority of candidates referred to the number of eyes, and that they need two to become stronger / dominant, which did not gain credit.

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Question 20 (b) (ii)

(ii) Why does the condition affect the ability to see properly?

.....

..... **[1]**

This was a well differentiated question. The majority of lower ability candidates did not gain the mark as common answers were too generalised such as 'it affects the eyes'.

Question 20 (c)

(c) Two people are heterozygous for retinitis pigmentosa and are expecting a baby.

Complete the genetic diagram to work out the probability that the baby will have the condition.

R is the normal allele and r is the allele for retinitis pigmentosa.

	R	r
R		
r		

Answer = ... **[3]**

The majority of candidates achieved 2 or 3 marks correctly identifying the genotypes in the offspring. Some candidates couldn't work out the probability...

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Question 20 (d) (i)

(d) (i) Scientists want to use stem cells as a treatment for this condition.

Why might stem cells be able to repair the retina?

.....

.....

..... **[2]**

There were some good examples demonstrating their knowledge and understanding of stem cells in this answer. Most common non-credited answers were just repeating the question that they can repair the retina but not describing how. Exemplar 6 gained full marks.

Exemplar 6

Why might stem cells be able to repair the retina?

stem cells are undifferentiated cells, meaning they can be modified to do anything. So scientists are able to modify stem cells to replace the faulty cells in the retina. **[2]**

Question 20 (d) (ii)

(ii) Write down **two** reasons why medical treatments are tested on animals first.

.....

.....

.....

..... **[2]**

The vast majority of candidates scored at least 1 mark here for side effects / make sure it is safe. The least scored marking point was to find the correct dosage.

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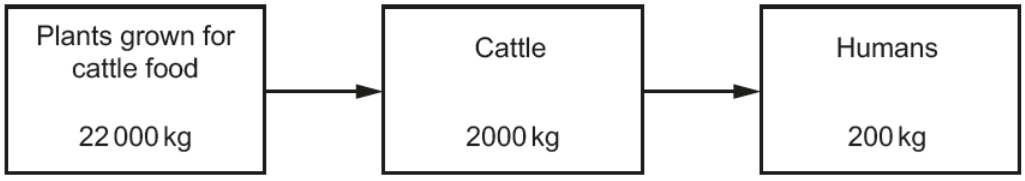
Question 21 (a) (i)

21 The diagram shows the flow of biomass through an agricultural food chain.



(a) (i) Calculate how much biomass is lost between the plants and humans.

Answer = ... kg **[1]**

Over half of the candidates could correctly calculate the amount of biomass lost between plants and humans. The most common incorrect answer was 19800kg.

Question 21 (a) (ii)

(ii) One way biomass is lost from the food chain is by insects eating the leaves of plants.

Write down **one** other way that biomass is lost from the food chain.

..... **[1]**

This again was a good differentiator, with most common credited answer being respiration. A lot of candidates referred incorrectly to the cattle eating them as a cause of biomass loss.

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Question 21 (b) (i)

(b) The plants grown for cattle food often have their leaves eaten by insects.

Scientists have produced genetically modified (GM) plants that make insecticide in their leaves.

(i)* Explain why these GM plants would make more biomass available to humans.

In your answer use the diagram of the agricultural food chain and ideas about photosynthesis.

.....

.....

.....

.....

.....

.....

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.....

.....

.....

.....

..... **[6]**

In this Level of Response question, examiners were looking for a detailed conclusion linking photosynthesis to food chains. This should link both photosynthesis and function of pesticides to agricultural food chains. This differentiated well over the whole ability range of the candidates. Exemplar 7 shows a Level 3 answer which gained 6 marks.

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Exemplar 7

L3

Genetically modified plants that make insecticide are resistant to insects and repell them. This prevents biomass being lost this way and results in more biomass being available for cattle consumption which means more food for them which means more cattle are reared resulting in more food being available for humans in the form of meat or dairy. If less leaves are eaten by insects then there are more leaves available for photosynthesis as there is more surface area. A greater rate in photosynthesis means that the plants will grow stronger and faster which is more efficient for the farmers which means more food for the cattle at a lower cost.

Question 21 (b) (ii)

(ii) Suggest **two** reasons why some people are against this type of genetic engineering.

1 .....

.....

2 .....

.....

[2]

The most common credited mark was that it was ethically wrong. A lot of responses focused on it not being natural, which was a non-credit worthy answer.

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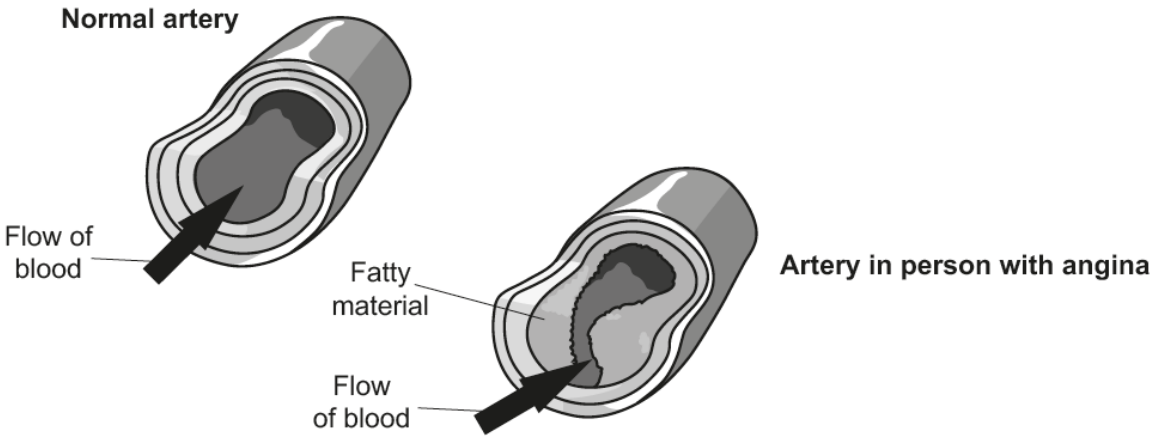
Question 22 (a)

22 Angina is caused by a problem in the arteries that supply the heart muscle.

Fatty material (cholesterol) builds up in these arteries.



(a) In angina the heart muscle starts to carry out anaerobic respiration.

Explain why this happens.

Use the information in the diagram and your biological knowledge.

.....

.....

.....

.....

..... **[3]**

Over half of candidates scored at least one mark here mainly for less blood flow (to the heart muscle). A lot of candidates got confused with the blood flow to the heart muscle with blood flow to the body cells, therefore not gaining credit. Exemplar 8 demonstrates this confusion and is not credited any marks.

Exemplar 8

Use the information in the diagram and your biological knowledge.

The lack of consistent, potent flow of blood through the body causes the body to have to adapt as less blood flow means and causes a far lesser oxygen flow. The body inclines around this by using anaerobic respiring to ensure enough respiration occurs in the body. **[3]**

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Question 22 (b) (i)

(b) Angina is often the first sign of a disease called coronary heart disease (CHD).

The table is used to estimate the risk of getting CHD. The more points a person scores, then the higher the risk of getting CHD.

Risk factor	Number of points		
	1	**2**	**3**
Age in years	<20	21–30	31–40
Blood cholesterol level	Low	Medium	High
Number of cigarettes smoked per day	0	1–10	11–20
Mass	Below average	Average	Above average
Number of parents with coronary heart disease (CHD)	0	1	2

(i) How many points are scored by smoking 20 cigarettes a day?

..... **[1]**

The majority of candidates scored this mark. Those who didn't gain the mark incorrectly identified the age range 31-40 instead of the number of points.

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Question 22 (b) (iii)

(iii) Here is some information about two people.

Person A	**Person B**
25 years old	19 years old
Non-smoker	Smokes 20 cigarettes a day
Low blood cholesterol level	Low blood cholesterol level
Average mass	Below average mass
One parent with CHD	No parents with CHD

Use the table to work out whether Person A or Person B is most likely to develop CHD.

Show how you worked out your answer.

.....

.....

.....

.....

..... **[3]**

Most candidates scored at least one mark here for person A. Higher ability candidates achieving full marks here was common.

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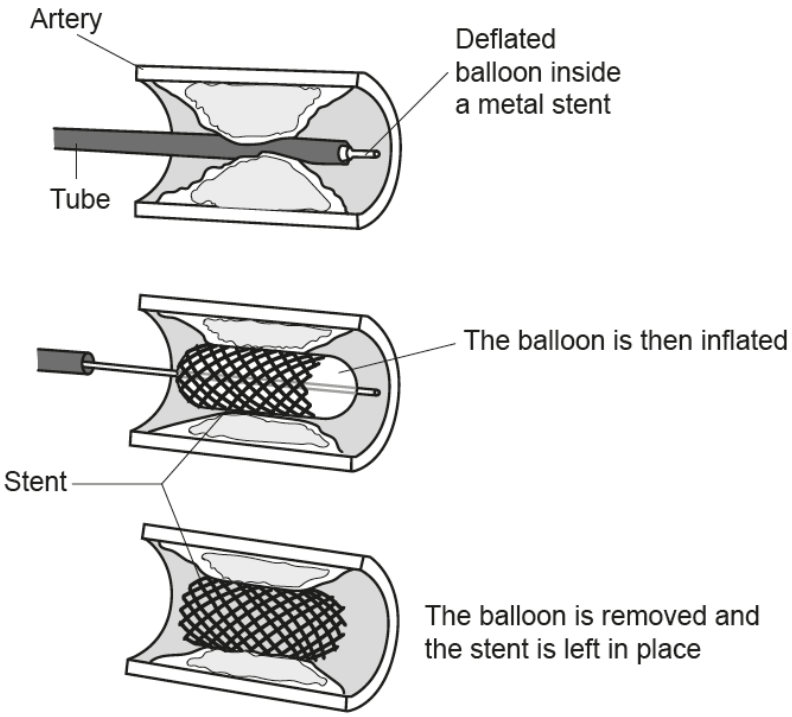
Question 22 (c) (i)

(c) There are several treatments for coronary heart disease (CHD).

One of these is an operation.

In this operation, doctors insert a metal grid called a stent into the artery.



(i) Look at the diagram.

Why does using a stent help treat CHD?

.....

.....

.....

..... **[2]**

Most common credited mark was for the idea the stent widens/opens up the artery. Few candidates stated that more blood/oxygen would be able to reach the heart muscle.

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Question 22 (c) (ii)

(ii) Taking a drug called statins is a treatment for CHD.

The drug is taken every day and lowers the level of cholesterol in a person's blood.

Suggest one **advantage** and one **disadvantage** of taking statins.

Advantage .....

.....

Disadvantage .....

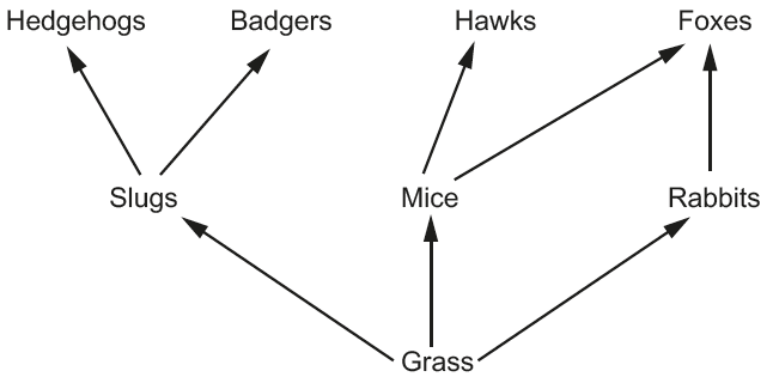
.....

[2]

Most candidates didn't gain the marks for the advantage of taking statins because they just repeated the question and stated it lowers the level of cholesterol in a person's blood. A number of candidates achieved the disadvantage marking point, with the most common answer being that they have to take it on a regular basis. A number of candidates stated that the blood cholesterol would become too low, which wasn't credited.

Question 23 (a)

23 The diagram shows part of a food web from a grassland.



(a) How many secondary consumers are shown in this food web?

..... **[1]**

Over half of candidates achieved this mark and correctly identified the number of secondary consumers.

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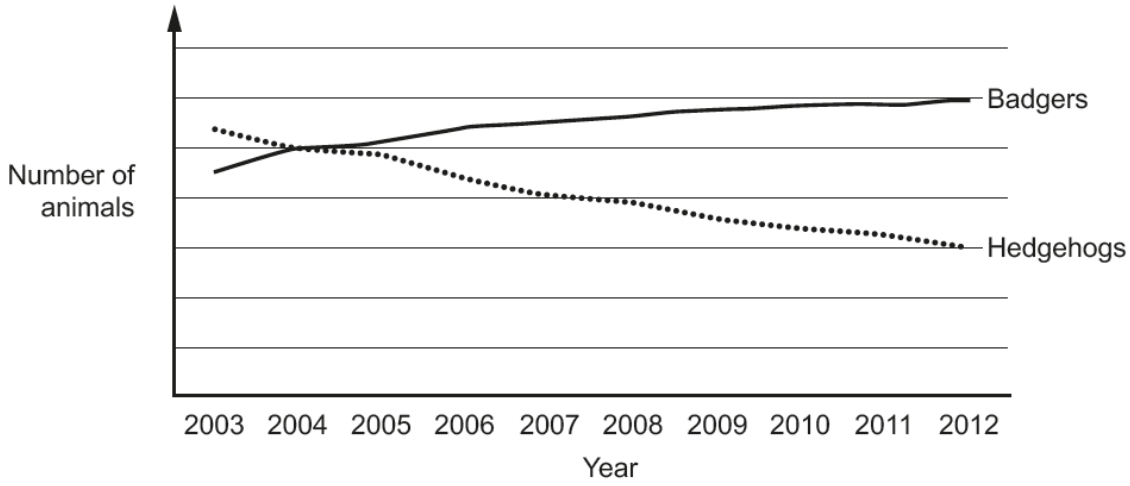
Question 23 (b)

(b) A survey was set up to see if the number of badgers and hedgehogs has changed in the UK.

The number of badgers and hedgehogs were counted in different areas each year from 2003 to 2012.

The graph shows the results.



Use the food web to suggest an explanation for the change in the number of hedgehogs shown in the graph.

.....

.....

..... **[2]**

The majority of candidates could identify there was a lack of slugs to eat for the hedgehogs. The higher ability candidates could link the increase in numbers, as the reason for the lack of food. Candidates that didn't score here just stated that the hedgehogs decrease which wasn't credit worthy, as the question asked for an explanation.

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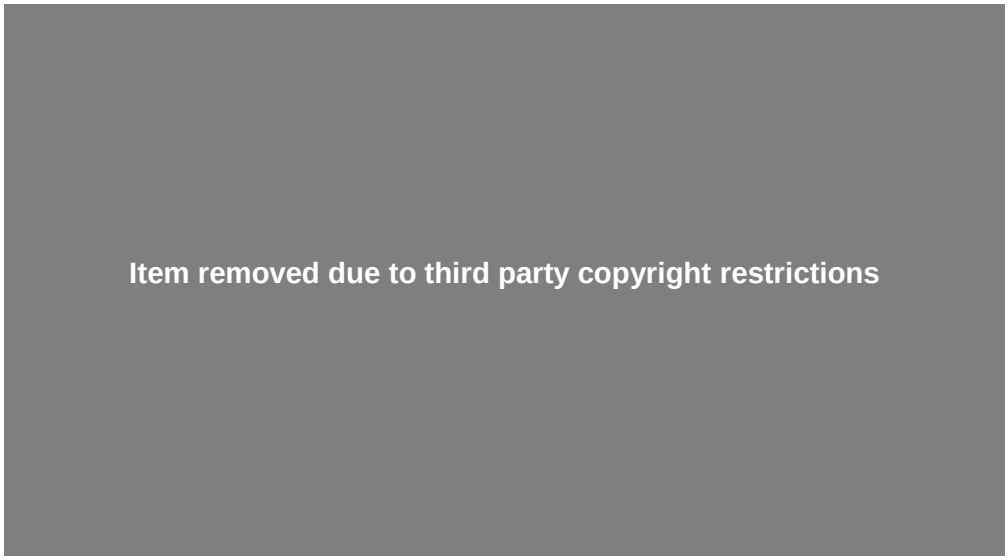
Question 23 (c) (i)

(c) Hedgehogs are covered in small spines.

When they are frightened they often roll up into a ball and keep still.



(i) In country areas, where badgers live, this is an advantage to the hedgehogs.

In cities, where there are many roads, this is a disadvantage.

Explain these two conclusions.

.....

.....

..... **[2]**

More than half of candidates achieved at least one mark here. This question differentiated well between all abilities. Those candidates that didn't score did not link the hedgehogs to each conclusion properly. E.g. advantage/in country/where badges live to correct conclusion. Exemplar 9 was credited 1 mark for the advantage conclusion.

Exemplar 9

In country areas, when badgers come to prey on hedgehogs, the hedgehogs have protection, as badgers are preched if they come to touch the hedgehog. **[2]**

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Question 23 (c) (ii)

(ii) Scientists have noticed that a new type of hedgehog is increasing in numbers in cities.

These hedgehogs do not roll up. They run away when frightened. The scientists think that genes control this behaviour.

Explain how this type of hedgehog may become more common in cities.

Use ideas about natural selection.

.....

.....

.....

.....

.....

.....

..... **[4]**

A number of candidates achieved at least 1 mark, mainly that hedgehogs which run away are more likely to survive. A small number of candidates confused natural selection with genetic engineering. Exemplar 10 shows an answer credited 3 out of 4 marks.

Exemplar 10

because these Hedgehogs don't stay still and run away they can't get ran over as easily and they don't get eaten by predators that can get through the selnes This could be natural selection as only Hedge hogs who have survived are able to pass on these genes to offspring. **[4]**

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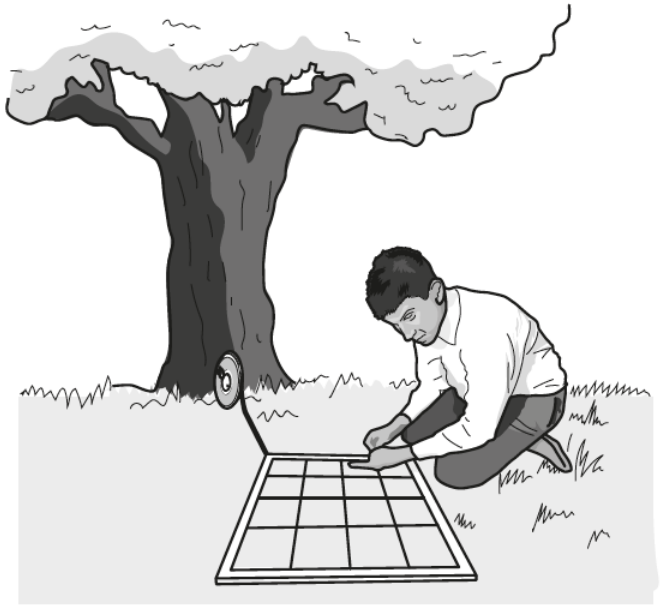
Question 24 (a) (part one)

24 A student investigates plants growing underneath a tree.



He lays out a tape measure on the ground, starting at the tree. He then places a quadrat on the ground.

He measures the percentage of the ground in the quadrat that is covered by plants. He repeats this every metre away from the tree.

The table shows his results.

Distance from the tree (m)	Percentage of ground covered by plants (%)
1	10
2	15
3	18
4	22
5	50
6	58
7	62
8	64

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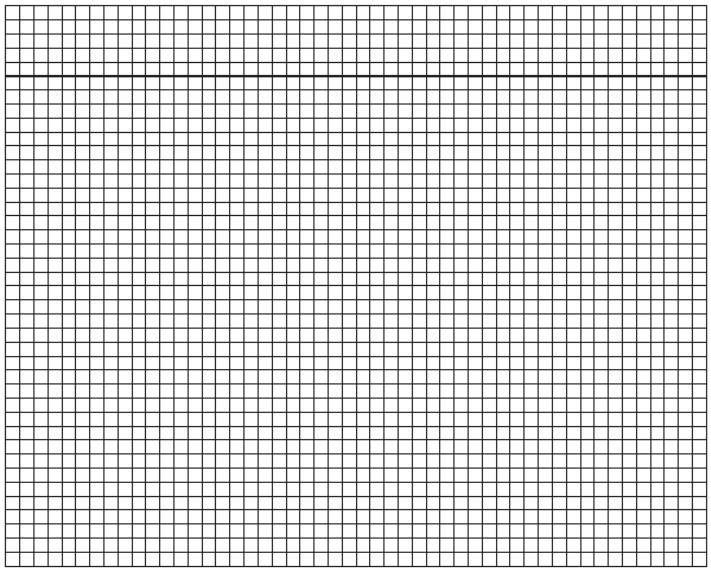
Question 24 (a) (part two)

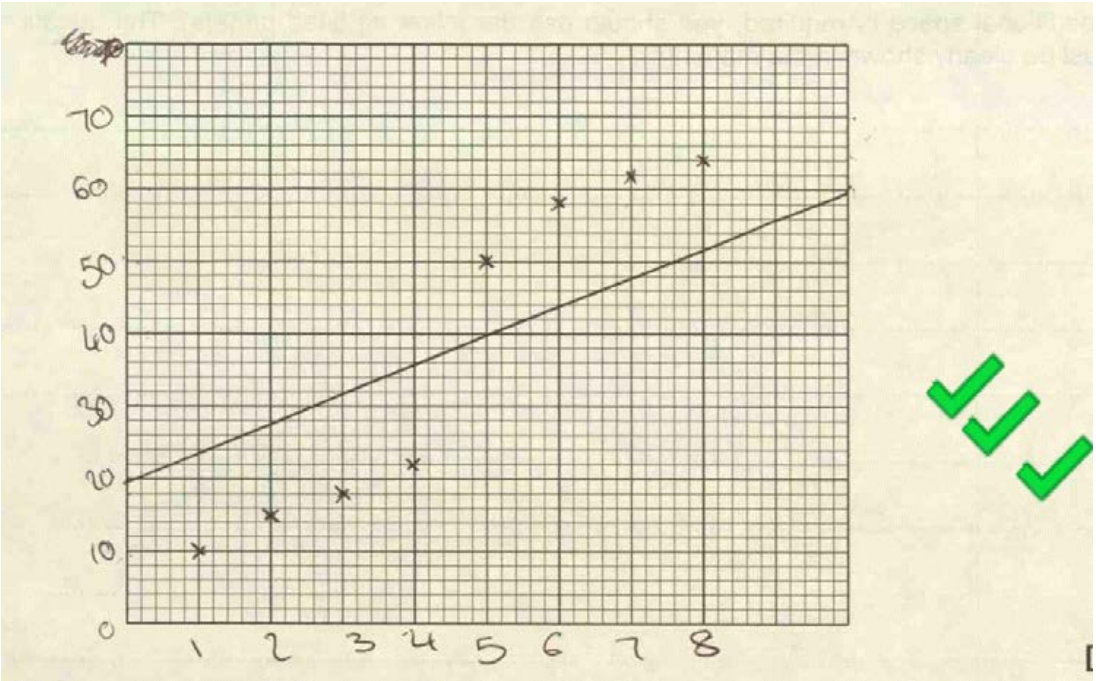
(a) Plot a graph of the student's results and draw a line of best fit.



[5]

The majority of candidates scored 3 or 4 marks for the graph. Most common errors were choosing the wrong axis labelled with units. A number of candidates didn't give a suitable scale on both axes. Points plotted correctly on the graph were where candidates scored most marks. The construction of a line of best fit going through most points seemed very challenging or not attempted. Others just joined the points. Exemplar 11 shows a graph with no axes labelled with units; suitable scale on both axes; all points correctly plotted but no acceptable line of best fit. This graph achieved 3 marks out of a possible5 marks.

Exemplar 11



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Question 24 (b)

(b) The student thinks that shade from the tree is affecting the plants.

Explain how the student's results show this.

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.....

..... **[4]**

A number of candidates achieved 1 mark on this question for the idea of less plants/% cover closer to the tree/shade or the reverse argument. Most candidates didn't link this to less light for photosynthesis. Less food for growth was the least credited marking point.

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