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Examiners' report

GATEWAY SCIENCE COMBINED SCIENCE A

J250

For first teaching in 2016

J250/02 Summer 2024 series

Version 1

ocr.org.uk/science

Contents

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. A selection of candidate answers is also provided. 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 and the mark scheme can be downloaded from OCR.

Paper 2 series overview

J250/02 is the second Biology Foundation Tier paper in the Gateway GCSE Combined Science suite. This paper assesses content from specification topics B4-B6 and CS7. To perform well on this paper, candidates need to have a sound knowledge of the theory covered in topics B4-B7. They also need to apply the skills and understanding that they have developed in the practical activities covered in topic CS7. In addition, this paper also contains questions that have elements of synopticity, drawing on material covered by topics B1-B3. There are also questions that involve the assessment of key mathematical requirements from Appendix 5f of the specification.

The candidates taking this paper have in previous years found some of the practical based questions very challenging. There was some improvement in this series with both knowledge of techniques (Questions 2 and 16 (b) (i)) and also in making fair comparisons and valid conclusions (Questions 14 (a) (ii) and (iii)). Responses to questions testing the mathematical requirements varied. Graph plotting was generally good but dealing with significant figures and decimal places was less secure.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• could plot the bar chart, including labelled axes and a key (Question 16 (a) (i)) • made sound attempts at applying their knowledge to novel situations (Questions 12 (c) and 13 (a)) • appreciated the differences between the processes of mitosis and meiosis (Question 10) • could explain the implications of a dry soil for transpiration rates (Question 14 (b)).	• plotted the bar chart but often omitted the axis label (Question 16 (a) (i)) • found it challenging to convert answers to the stated number of significant figures or decimal places (Questions 16 (b) (ii) and 14 (a) (i)) • could not recall the meaning of certain biological terms such as ecosystem (Question 4), abiotic (Question 14 (c)) or heterozygous (Question 11 (c) (i)) • completed a genetic diagram but could not go on to use this to calculate a probability (Question 11 (c) (ii)).

Section A overview

Section A contains 10 multiple-choice questions targeting Assessment Objectives 1 and 2 (AO1 and AO2). Although many candidates could correctly answer at least half of these questions, there were a number of questions that proved challenging. Questions 5, 9 and 10 were answered correctly by less than half of the candidates. In some cases, it is still proving difficult to interpret candidates' responses when they use a mixture of lower case 'b' and upper case 'D' and also when candidates try to change one letter to another. Encourage candidates to cross out the letter and write their new response next to the box, making it clear that is their answer.

Question 1

1 What traps harmful microorganisms in human lungs?

A Acid

B Hairs

C Mucus

D Plasma

Your answer ☐ **[1]**

Just over half of candidates answered correctly. B was the most common incorrect response, presumably due to candidates thinking that the hairs are small enough to filter out microorganisms.

Question 2

2 A student investigates the number of plant species growing in one area.

Which piece of scientific equipment will they use?

A Balance

B pH probe

C Pooter

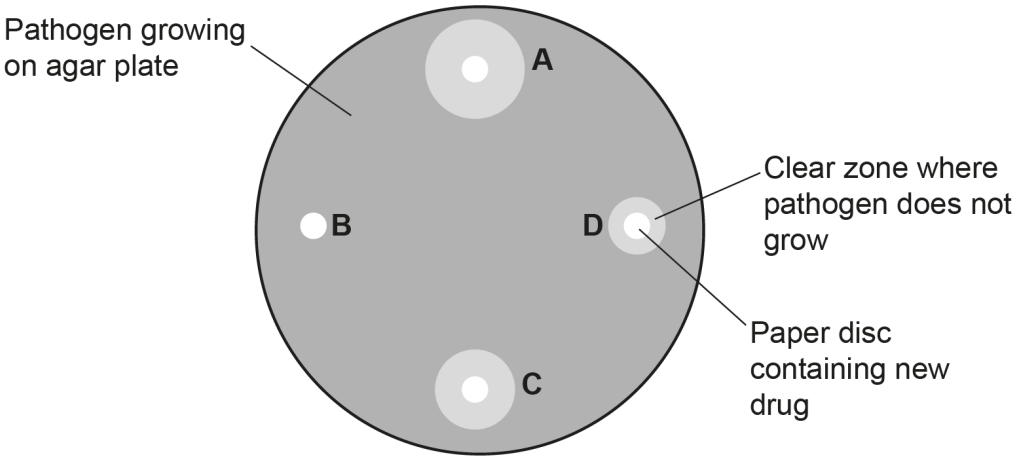
D Quadrat

Your answer ☐ **[1]**

This was the most accessible multiple-choice question, with most candidates selecting the correct piece of equipment.

Question 3

3 Scientists test the effect of new drugs on the growth of a pathogen.



Which new drug has **no** effect on the growth of the pathogen?

Your answer ☐ **[1]**

Again, this question was correctly answered by most candidates. Some incorrectly chose D, possibly as this was where the labels were positioned.

Question 4

4 Which word describes all the physical features and living organisms in an area?

A Community

B Ecosystem

C Habitat

D Interdependence

Your answer ☐ **[1]**

Differentiating between the different levels of organisms in an ecosystem assesses learning outcome B4.1 and has appeared on several previous papers. Just over half of candidates answered correctly. Option A was the most common incorrect response with some candidates seemingly not taking into account the term 'physical features' part of the question.

Question 5

5 Eye colour, height and weight in humans all show variation.

Which of these are examples of **continuous** variation?

A Eye colour and height

B Eye colour, height and weight

C Height and weight

D Height only

Your answer ☐ **[1]**

Question 6

6 Which process is required to recycle both carbon and nitrogen?

A Condensation

B Decomposition

C Photosynthesis

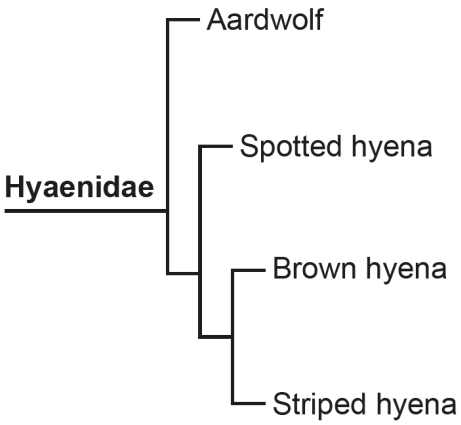
D Precipitation

Your answer ☐ **[1]**

The majority of candidates responded correctly, identifying decomposition as the process. The remaining candidates tended to choose either condensation or photosynthesis.

Question 8

8 The diagram shows a phylogenetic tree for a group of related animals.



Which two animals are most closely related?

A Aardwolf and spotted hyena

B Aardwolf and striped hyena

C Brown hyena and spotted hyena

D Brown hyena and striped hyena

Your answer ☐ **[1]**

Many candidates interpreted the tree correctly but a minority gave the incorrect option C, presumably attracted to the similarity of the names.

Question 9

9 Gardeners are changing the way they care for their gardens.

Which change would **increase** biodiversity?

A Adding chemical fertilisers to a grass lawn

B Cutting a grass lawn more often than usual

C Removing a grass lawn area and putting down paving stones

D Replacing a grass lawn area with a wild flower meadow

Your answer ☐ **[1]**

This proved to be a challenging question, with a significant number of candidates thinking that adding chemical fertilisers would increase biodiversity.

Question 10

10 Which row is a correct comparison of meiosis and mitosis?

	Involves cell division	**Halves the number of chromosomes**	**Requires DNA replication**
A	both	meiosis only	both
B	both	both	both
C	meiosis only	both	mitosis only
D	mitosis only	meiosis only	mitosis only

Your answer ☐ **[1]**

This was the most challenging multiple-choice question with a minority of the candidates responding correctly. The most common incorrect response was C.

Section B overview

Section B of this paper contains a mixture of short answer questions, questions requiring longer responses and one 6-mark Level of Response question (Question 15). The questions between them cover all three Assessment Objectives, AO1, AO2 and AO3.

In this section many candidates scored marks in Question 11 which was intended to be an accessible start to this section. The exception was in part (c) (ii), where many candidates could not determine the probability. Questions 12 (c) and 13 (a) proved to be two of the most challenging questions on the paper, requiring candidates to apply their knowledge of selective breeding and enzyme action respectively. Question 16 was a common question with the Higher Tier paper. Candidates on this tier often scored marks on the graph plotting and the calculation in this question but found making conclusions in part (a) (ii) more challenging.

Question 11 (a)

11 Inheritance is passing genetic material from one generation to the next.

(a) Draw lines to connect each **term** used in inheritance with its correct **definition**.

Term	Definition
	a change in the structure of DNA
Chromosomes	different versions of the same gene
Mutation	nucleus containing two different genes
	strands of DNA containing genes

[2]

This question was well answered with most candidates being able to link either one or both terms to their correct definitions. Some candidates did not score as they drew multiple lines from each term.

Question 11 (b)

(b) Which terms describe sex cells in humans?

Tick (✓) **two** boxes.

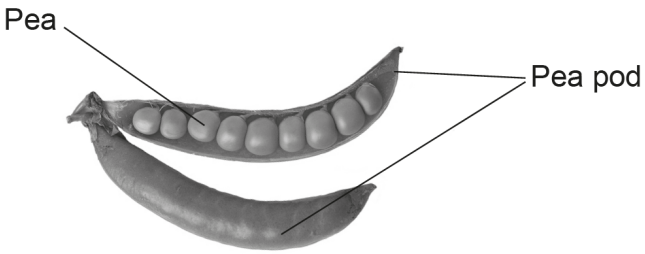
- Diploid ☐
- Double helix ☐
- Gamete ☐
- Genome ☐
- Specialised ☐
- Undifferentiated ☐

[2]

Candidates also scored well on this question, with diploid and genome being the most common incorrect answers. Some candidates only ticked one box, despite the specific instruction.

Question 11 (c) (i)

(c) Peas develop inside pods.



Pea pods can be green or yellow.

(i) A pea plant with green pods is crossed with a pea plant with yellow pods.
All the pods on the new plant are green.

Complete the sentences about the pea pods.

Use words from the list.

dominant	**haploid**	**heterozygous**
homozygous	**recessive**	

The results of this cross show that the allele for green is ..... and the allele for yellow is ..... .

The genotype of the new plant is **Gg**. This means it is ..... for pod colour.

[3]

The terms dominant and recessive were often chosen correctly but a number of candidates confused heterozygous with homozygous in the last gap.

Question 11 (c) (ii)

(ii) The new plants with green pods are then crossed.

What is the probability that a plant from this cross will have **yellow** pods?

Complete the genetic diagram to explain your answer.

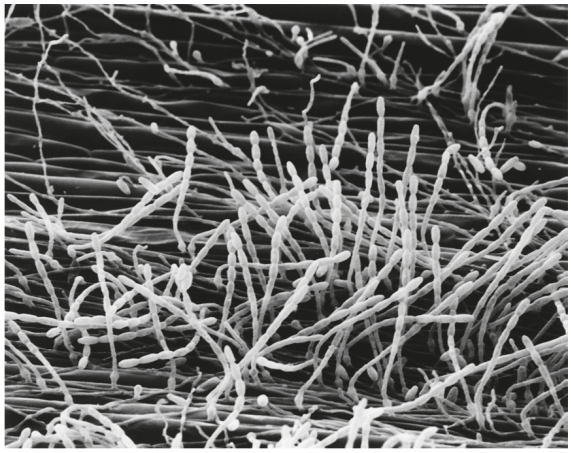
		green pods	
		G	**g**
green pods	**G**		
	g		

Probability = ... **[2]**

Most candidates could correctly complete the diagram and give the genotypes of the offspring. However, only the higher scoring overall candidates could then interpret this and give a correct probability.

Question 12 (a)

12 The picture shows the plant pathogen that causes powdery mildew.



(a) Complete the sentences about powdery mildew.
Use words from the list.

bacterium	**chlorophyll**	**decrease**	**fungus**
increase	**threat**	**virus**	**wind**

Powdery mildew is caused by a pathogen that is a ..... .

The disease is spread by spores which travel to new plants by ..... .

The powdery mildew covers the leaves which could result in less light being absorbed by

..... .

Visual identification of disease is one way to ..... the spread of the

disease.

[4]

There were a good number of full mark responses to this question. If candidates did not gain full marks, it tended to be due to attributing powdery mildew to a bacterium rather than a fungus.

Question 12 (b)

(b) Why is powdery mildew called a **communicable disease**?

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

'Because it can be spread between plants' was the most common correct answer given here.

Question 12 (c)

(c) Describe how selective breeding is used to make plants resistant to powdery mildew.

.....

.....

.....

.....

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

Some candidates understood the principles of selective breeding and could apply them to this particular situation. However, others gave a more generic description of the process. Of the remaining responses, a number confused this process with genetic engineering and described the transfer of genes.

Question 13 (a)

13 New medicines are developed all the time.

(a) Insulin is a protein used to treat diabetes. The human stomach contains an enzyme that is specific to proteins like insulin.

Suggest why it is difficult to develop an insulin medicine that is swallowed.

.....

.....

.....

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

Despite the information given in the question, few candidates seemed to appreciate that insulin would be digested in the stomach. Many thought that insulin would reach the bloodstream but would just take longer to do so.

Exemplar 1

It is difficult to develop an insulin medicine that is swallowed because it doesn't go directly into your blood stream so it will take longer for your body to absorb it. **[2]**

This candidate appreciated that insulin needs to get into the bloodstream but the emphasis of the response is on the time it takes to get there rather than the fact that it will not enter the bloodstream at all as it will be digested. Therefore, no marks were scored for this response.

Question 13 (c)

(c) Some diseases are treated by changes to lifestyle.

Complete these sentences about cardiovascular disease.

The risk of cardiovascular disease is reduced by a ..... low in saturated fat.

This reduces the risk of blocked arteries therefore allowing more oxygen to be transported to the ..... muscle in the ventricle wall.

[2]

A number of candidates correctly inserted 'diet' in the first gap but 'cardiovascular' was often seen in the second gap.

Question 14 (a) (i)

14 The moisture content in soil affects the growth of plants.

A student investigates the moisture content of different soils.

This is the method they use:

- Measure the mass of each soil sample.
- Place the soil samples in a warm oven to dry for 4 hours.
- Measure the mass of each soil sample again.

The table shows their results.

Soil sample	Mass of soil sample at start (g)	Mass of soil sample after drying (g)	Change in mass of soil sample (g)
A	120.1	97.3	.....
B	154.2	125.5	.....
C	126.3	121.3	.....

(a)
(i) Calculate the change in mass for each soil sample.

Write your answers in the table.
Give **all** answers to the **same** number of decimal places.

[2]

Most candidates could perform the subtractions correctly but many did not give their answers to the same number of decimal places. Answers of 22.8, 28.7 and 5 were the most common answers and scored 1 mark out of 2.

OCR support

The Mathematical Skills Handbook can be used to support the teaching of skills such as using decimal places. It can also be shared with students to support their own learning and revision.

Question 14 (a) (ii)

(ii) The student uses the changes in mass to conclude that soil sample **B** had the highest percentage moisture content.

Suggest why the student **cannot** make a fair comparison between the samples.

.....

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

Some candidates correctly stated that the starting masses were different, whereas others focused on other aspects of the method. The use of the term 'amount' rather than 'mass' was not given credit.

Question 14 (a) (iii)

(iii) Describe **two** ways the student could improve their investigation to get a valid conclusion.

1 .....

.....

2 .....

.....

[2]

Repeating the experiment was the most common correct suggestion here and starting with the same mass in each sample was also correct. Some candidates referred to placing the samples in the oven for the same time, even though this was stated in the method.

OCR support

The Language of Measurement in Context: Biology resource can be used to support students with understanding language of measurement terminology used, including how to ensure validity.

Question 14 (b)

(b) Explain how **low** moisture content in soil affects transpiration in plants.

.....

.....

.....

.....

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

Many candidates simply repeated the question by saying that less water in the soil will alter transpiration rates, without saying how they will be altered or why.

Question 14 (c)

(c) Moisture content is one abiotic factor that affects plants.

State **two** other abiotic factors that affect plant growth.

1 .....

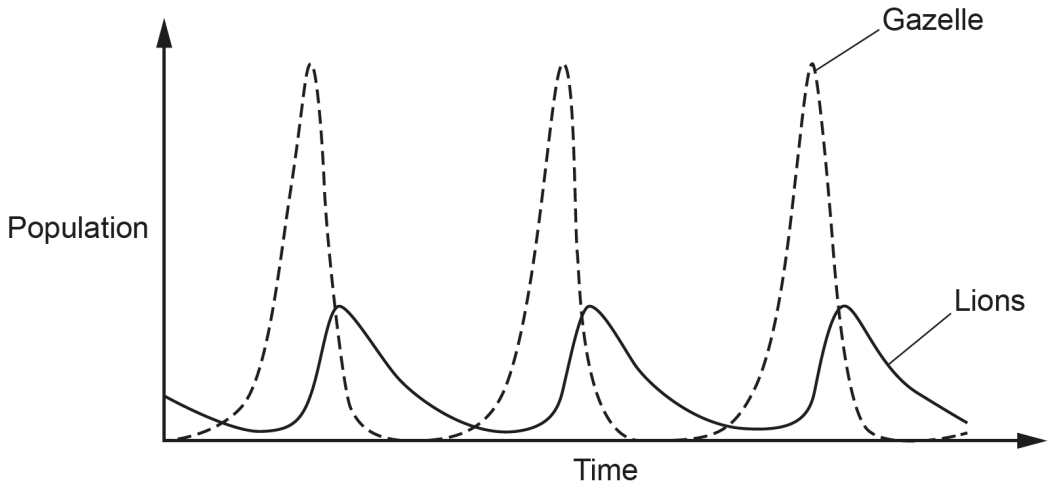
2 .....

[2]

Temperature, sunlight and mineral availability were the most common correct responses. Other candidates gave biotic factors, such as predation or gave water/rain, although this was covered by moisture.

Question 15*

15* The graph shows the changes in population of a predator and its prey.



Describe **and** explain the trends in the graph.
Identify the predator and the prey using evidence from the graph to support your choice.

.....

.....

.....

.....

.....

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

To obtain Level 3, candidates needed to give an explanation that linked a pattern seen in the two lines. They also needed to identify the lion as the predator and the gazelle as the prey with a reason for their choice. There were some good descriptions of the patterns shown by the populations of the two animals, often linking this to hunting and being hunted. This would score Level 2. The identification of predator and prey was often missed.

Question 16 (a) (i)

16 Scientists are concerned that increased pollution in a forest is affecting the population of insects living in the forest.

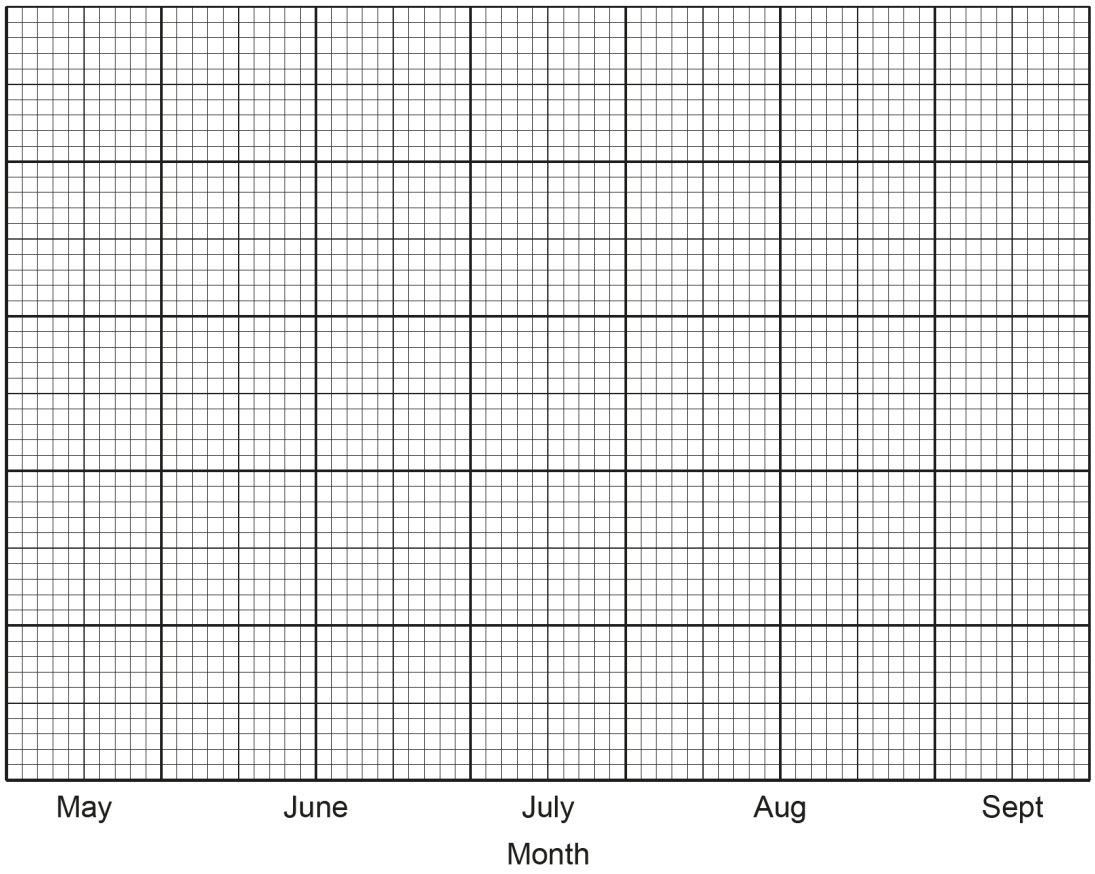
(a) In an investigation, scientists estimated the population of **flying** insects in a forest.

- They trap the insects using nets.
- The mass of insects collected each month is then recorded. The data is collected in two different years, 1995 and 2015.

The table shows their results.

Month	Mass of insects trapped (g)	
	1995	2015
May	450	50
June	520	120
July	920	160
August	420	110
September	100	20

(i) Complete the bar chart to show the mass of insects collected each year.
Both years should be included on the same grid.
Include a Key to identify which year the bars represent.



[4]

Most candidates could produce a suitable scale for the bar chart and plot the bars correctly. By far the most common error was to omit any label at all from the *y* axis or to omit the units. A small number of candidates plotted a line graph despite the instruction in the question. They could still score 3 marks if the line graph was completed correctly.

Assessment for learning

Although candidates were generally good at plotting points, they need to appreciate that:

- a suitable scale should mean that the graph covers more than half of the grid provided
- both axes on a graph should have labels and include units if appropriate.

It is also good practice to draw graphs in pencil so that any errors can be easily corrected.

Question 16 (a) (ii)

(ii) What **two** conclusions can be made about the mass of flying insects in 1995 compared to 2015?

1 .....

.....

2 .....

.....

[2]

The question specifically asked for conclusions regarding the mass of insects but responses often concentrated on the population size. Other candidates made conclusions that could not be made from the data, such as pollution levels or predation.

Question 16 (b) (i)

(b) In a separate investigation, scientists estimated the population of insects that live on the forest **ground**.

The scientists trap insects using a pitfall trap.
This is a hole in the ground that the insects fall into when they crawl along the ground.

For each estimate they use this method:

- Place pitfall traps in different areas of the forest.
- Count the total number of insects caught in the pitfall traps.
- Mark the insects.
- Release the insects where they are collected from.

A week later they trap a second sample of insects.

(i) The scientists used an ink that is not easily washed off to mark the insects for identification.

State **one** other precaution that they should take when deciding how to mark the insects.

.....

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

Many candidates correctly made reference to avoiding harm to the insects or making sure that they were not made more visible to predators.

Question 16 (b) (ii)

(ii) They complete their investigation during July 1995 and July 2015. This table shows the results of this investigation.

Year	Number of insects in first sample	Total number of insects in second sample	Number of marked insects in second sample
1995	114	60	8
2015	146	63	6

The scientists use this formula to estimate the population of insects living on the forest ground:

$$\text{Estimated population size} = \frac{\text{number in first sample} \times \text{total number in second sample}}{\text{number of marked insects in second sample}}$$

The population of insects in 1995 is estimated to be 855.

Use the formula to estimate the population size of insects in **2015**.
Give your answer to **3 significant figures**.

Estimated population of insects = ... **[2]**

The majority of candidates could substitute into the equation the correct figures and produce an estimate. By far the most common error was not converting the answer to 3 significant figures. Often answers were left at 1533, or converted to 3 significant figures by simply deleting the last digit.

Exemplar 2

$\frac{146 \times 63}{6} = 1533$

$= 153 (3 \text{ s.f})$

Estimated population of insects = ... 153 ..... **[2]**

This exemplar shows one of the most common errors when trying to convert to 3 significant figures. The calculation is performed correctly to obtain the answer 1533 and this is given 1 mark but then the conversion is incorrect.

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Question 12 (a): Powdery mildew, © DR. TONY BRAIN/SCIENCE PHOTO LIBRARY.

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