

GCSE (9-1)

Examiners' report

**GATEWAY SCIENCE
COMBINED
SCIENCE A**

J250

For first teaching in 2016

J250/02 Summer 2022 series

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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. A selection of candidate answers are 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 exam paper and the mark scheme can be downloaded from OCR.

Advance Information for Summer 2022 assessments

To support student revision, advance information was published about the focus of exams for Summer 2022 assessments. Advance information was available for most GCSE, AS and A Level subjects, Core Maths, FSMQ, and Cambridge Nationals Information Technologies. You can find more information on our [website](#).

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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-B6 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 topic CS7. In addition, this paper also contains questions that have elements of synopticity, drawing on material covered by topics B1-3. There are also questions that involve the examination of key mathematical requirements from Appendix 5f of the specification.

Candidates who did well on this paper generally did the following:	Candidates who did less well on this paper generally did the following:
<ul style="list-style-type: none"> • recalled information from the specification including levels of organisation in Question 11 (a), knowledge of the carbon cycle in Question 11 (b) and types of stem cells in Question 14 (c) (i). • expressed data in terms of ratios in Question 13 (b). • gave arguments for and against particular actions such as genetic modification in Question 14 (b) (ii) and whale watching in Question 15 (b). • performed the multi-step calculation to estimate population size in Question 16 (a) (ii). 	<ul style="list-style-type: none"> • confused genotype with phenotype in the multiple-choice Question 9. • could not explain the importance of the carbon cycle to plants in Question 11 (b), confusing photosynthesis with respiration. • were unable to compare trends in data in Question 12 (a) (ii). • showed limited appreciation of the need to increase sample size when trying to produce a more accurate ratio in Question 13 (c). • described benefits or challenges only when provided with information about whale watching in Question 15 (b).

Section A overview

Unlike in some previous series, candidates' achievement was limited on this section compared to their performance on the paper as a whole. Overall, candidates found Questions 1-4 the most accessible, with the majority gaining marks here. Questions 5 and 10 proved to be the most challenging, with Question 10 involving orders of magnitude, yielding very few correct answers. It is important that candidates have experience of all the mathematical skills listed in Appendix 5e of the specification. Again, marks were lost in this section due to some candidates writing 'hybrid' letters that were hard to distinguish.

Question 1

- 1 What is the function of platelets in blood?
- A They destroy pathogens.
 - B They help clot the blood.
 - C They produce antibodies.
 - D They transport oxygen around the body.

Your answer

[1]

This question proved to be a reasonably accessible start to the paper with many candidates correctly choosing the answer B. However, a minority incorrectly thought that platelets are involved in oxygen carriage.

Question 2

- 2 Which **abiotic** factor affects the growth of plants?
- A Food
 - B Nitrogen gas
 - C Predators
 - D Soil pH

Your answer

[1]

Another accessible question, with most candidates giving the correct answer D.

Question 3

3 Plasmodium is a microbe that causes the disease malaria in humans. Humans act as a host for plasmodium.

Which term describes the relationship between plasmodium and humans?

- A Consumer
- B Mutualism
- C Parasitism
- D Predation

Your answer

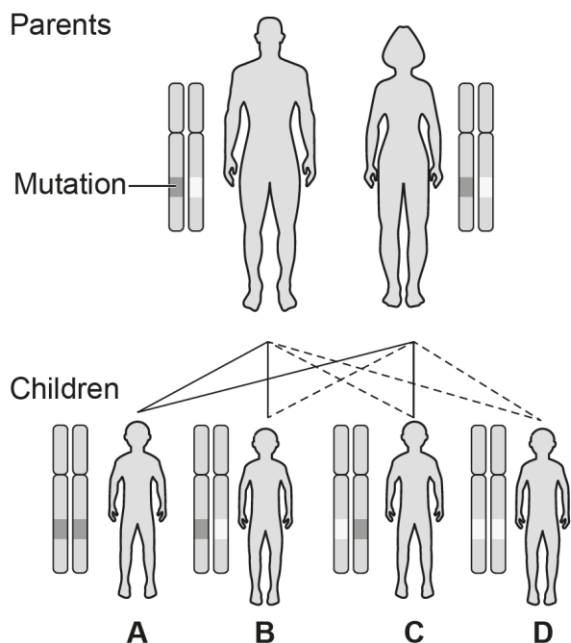
[1]

This was the most accessible question in section A, with the majority of candidates selecting the correct answer. If candidates did answer incorrectly, they tended to choose B.

Question 4

4 The diagram shows how a condition caused by a **recessive** gene mutation is inherited.

Which child, **A**, **B**, **C** or **D**, will inherit and develop the condition?



Your answer

[1]

Generally, well answered but a significant number of candidates did not realise the significance of the mutation being recessive and so incorrectly chose B.

Question 5

5 Which row shows the size of each group from smallest to largest?

- A** class \longrightarrow family \longrightarrow order \longrightarrow phylum
- B** family \longrightarrow order \longrightarrow class \longrightarrow phylum
- C** order \longrightarrow phylum \longrightarrow family \longrightarrow class
- D** phylum \longrightarrow class \longrightarrow order \longrightarrow family

Your answer

[1]

Candidates found this question challenging. It may have been due to the order of groups being from small to large, but few candidates could identify the correct sequence.

Question 8

8 The microorganism that causes Cowpea mosaic disease can pass through a filter that blocks anything larger than 100 nm.

Which type of microorganism causes Cowpea mosaic disease?

	Microorganisms	Smallest size of microorganism
A	bacteria	120 nm
B	fungi	2 μ m
C	protist	8 μ m
D	virus	15 nm

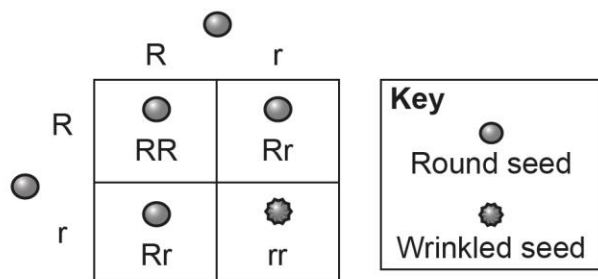
Your answer

[1]

Not many candidates could correctly identify option D. The most common incorrect answer was A, presumably chosen because the units were given in nanometres, even though the question states that the microbe can pass through a filter that blocks 100 nm particles.

Question 9

9 The diagram shows a genetic cross for seed shape in peas.



Which prediction about the offspring is **most** likely?

- A All the offspring will be heterozygous for seed shape.
- B All the offspring will be homozygous for seed shape.
- C The ratio of heterozygous to homozygous offspring will be 1 : 1.
- D The ratio of heterozygous to homozygous offspring will be 3 : 1.

Your answer

[1]

The main error here was for candidates to assume that this was a 3:1 ratio, having learnt that this would be the ratio of phenotypes. Therefore, incorrect answers of D were as common as the correct answer C.

Question 10

10 The diameter of a human ovum is 100 000 nm. The diameter of the HIV pathogen is 100 nm.

How many orders of magnitude larger is the diameter of a human ovum compared to an HIV pathogen?

- A 3
- B 10
- C 99
- D 1000

Your answer

[1]

Very few candidates scored on this question. The almost universal answer was D as the diameters differed by a factor of 1000. The concept of orders of magnitude did not seem to be understood.

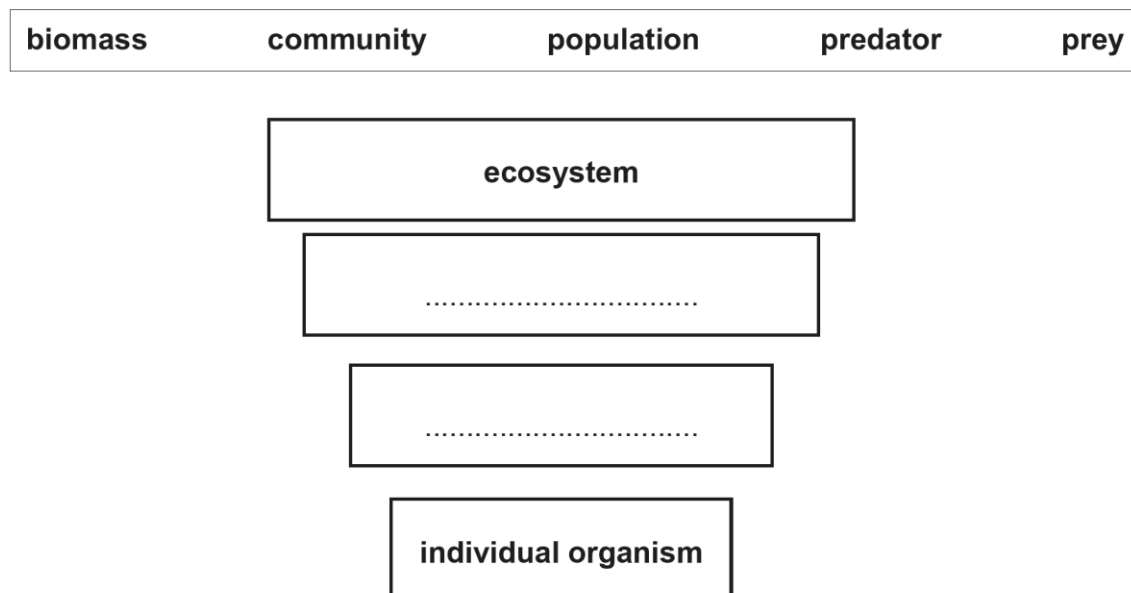
Section B overview

In this section some candidates got off to a good start if they had learnt the specification material covered in Question 11. However, there was confusion between community and population and many needed more knowledge of the carbon cycle. There were also fewer successful responses to questions relating to the defence mechanisms of the lungs involving mucus and cilia. There were more successful responses to the questions that involved analysis of data, with many candidates producing correct ratios in Question 13. Candidates could also use the information provided in the level of demand question about whale watching but often wrote incomplete answers, only covering benefits or challenges. The mathematical skill of calculating the slope of a line in Question 16 (b) (ii) was challenging for many of candidates.

Question 11 (a)

11 (a) The diagram shows some of the levels of organisation within the ecosystem.

Complete the diagram using words in the list.



[2]

Although candidates often chose the correct two terms to put in the boxes, many reversed the two terms and so were not given marks here.

Question 11 (b)

(b) Explain why the carbon cycle is important to plants.

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

There were some good references to carbon dioxide being necessary for the process of photosynthesis and/or food production. However, some candidates confused the processes of photosynthesis and respiration and stated that carbon dioxide was needed for respiration.

Question 11 (c)

(c) Microorganisms have an important role in the carbon cycle.

Complete these sentences about microorganisms.

Microorganisms break down dead organisms releasing nutrients such as nitrogen. This process is called

Microorganisms will also convert the carbon in their food to carbon dioxide in a process called

The reaction to produce carbon dioxide releases energy. This makes it an reaction.

[3]

The second two gaps were often correctly filled in, although there were incorrect references to endothermic. The term decomposition was seen less often.

Question 12 (a) (i)

12 (a) HIV and TB (tuberculosis) are infectious diseases.

HIV is spread between humans during sexual intercourse when body fluids come into contact.

TB is a disease caused by bacteria. It affects the lungs.

(i) Explain how TB is spread between humans.

.....

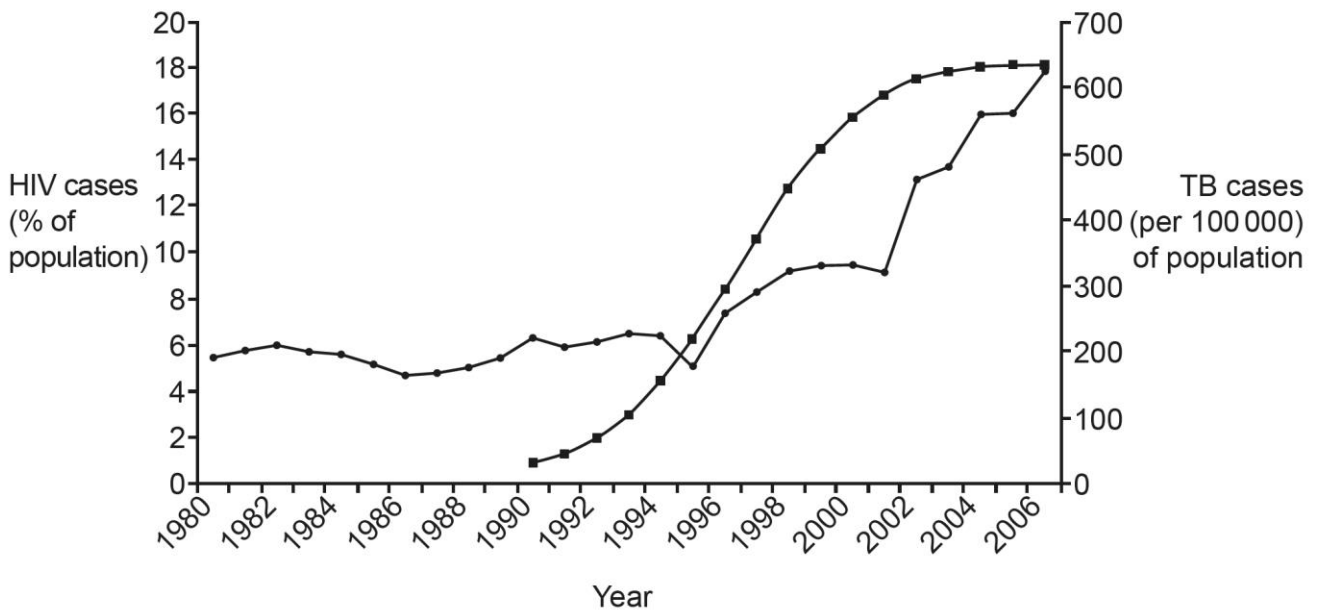
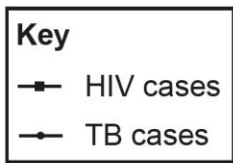
.....

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

Many candidates appreciated that the TB pathogen is released into the air by coughing or sneezing but did not state that the pathogen could then be breathed in. A small number of answers stated that TB was passed on in the same way as HIV.

Question 12 (a) (ii)

(ii) The graph shows how the number of cases for HIV and TB have changed between 1980 and 2006 for one country.



Describe how the graph shows a link between HIV and TB.

.....

.....

..... [2]

Many candidates appreciated that the two diseases both increased in the second half of the time period. Very few also stated that TB cases were fairly stable before the increase of HIV.

Question 12 (a) (iii)

(iii) Describe how the **lungs** defend the body against infection from TB bacteria.

.....

.....

..... [2]

Very few candidates could give answers involving mucus trapping microbes and cilia wafting the mucus. A common misconception was that coughing would remove all the microbes from the lungs.

Question 13 (a)

13 (a) A student models the inheritance of sex using two coins.

- The student puts a **red** sticker on **both** sides of one coin to represent a **female**.
- They then put a **red** sticker on one side and a **white** sticker on the other side of a second coin to represent a **male**.

Which of the two sex chromosomes is represented by each colour?

Red = chromosome

White = chromosome

[1]

The sex chromosomes were correctly stated as X and Y by some candidates but were sometimes linked to the wrong colour. In other cases, XX and XY were given, or female and male.

Question 13 (b) (i)

- (b)** The student tosses the two coins 10 times and records the colour of the sticker showing on each coin.

The table shows their results.

Male coin	Female coin	Offspring Boy (B) or Girl (G)?
red	red	G
red	red	
white	red	
white	red	
white	red	
red	red	
white	red	
white	red	
red	red	
white	red	

The offspring is determined by the colour recorded for each coin.

- (i)** Complete the column for the offspring. One has been done for you. **[1]**

This was well answered with most candidates correctly following the pattern.

Question 13 (b) (ii)

- (ii)** Calculate the ratio of boys to girls in the 10 offspring.

Ratio of boys : girls = **[1]**

The ratio of 6:4 was given in most cases and some did simplify to 3:2. Either was acceptable. If a candidate completed the table incorrectly, marks were given for a correct ratio from their table.

Question 13 (b) (iii)

(iii) The results do **not** match the expected ratio.

What is the expected ratio of offspring for boys : girls?

..... [1]

Question 13 (c)

(c) Explain why the results do **not** match the expected ratio.

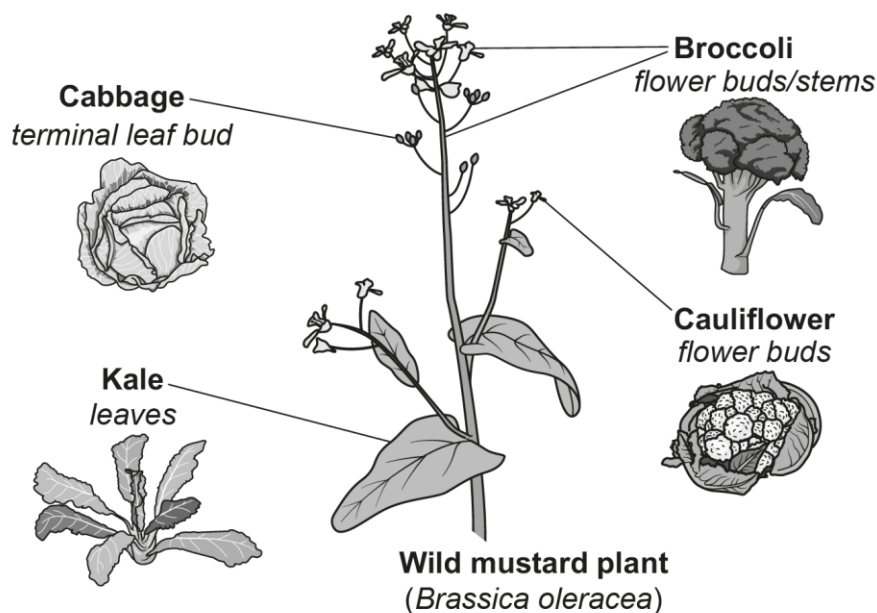
Suggest how the student could develop the experiment to get closer to the expected result.

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

Very few candidates referred to a small sample size or the fact that the coin was only tossed ten times as being an issue in this experiment. However, a number did gain 1 mark for suggesting that more coins should be tossed or the tossing should be repeated.

Question 14 (a)

14 The diagram shows some crops that have been developed from a wild mustard plant.



(a) The cauliflower crops grown today have taken many years to develop.

Name the process used by humans to develop cauliflower plants from wild mustard plants.

Put a tick (✓) next to the correct answer.

Artificial engineering	
Evolution	
Natural selection	
Selective breeding	

[1]

Question 14 (b) (i)

(b) Some bacteria have genes which mean that they can produce a natural insecticide. Scientists have produced cauliflowers that contain these genes. This means the cauliflowers can now make their own natural insecticide.

(i) What is modified inside the cauliflower so that it has the genes?

..... [1]

There were many different parts of the cauliflower suggested here and sometimes the bacteria themselves were stated.

Question 14 (b) (ii)

- (ii) Suggest **one** reason for and **one** reason against producing cauliflowers with these genes.

For:

.....

Against:

.....

[2]

Exemplar 1

For: we can develop different foods and by making cauliflower make their own natural insecticide we have done that
 Against: because it's not how it was made it's not naturally like that so we shouldn't mess with it.

[2]

Reasons for the process either focused on the improved yield of the cauliflowers or the idea that farmers could use less pesticide. However, some candidates simply repeated the information in the question that the cauliflowers would make their own insecticide. Reasons against were sometimes too vague to score a mark, such as references to the process being unnatural. Examples of both these incorrect responses are shown in Exemplar 1.

Question 14 (c) (i)

- (c) Scientists can now treat blood disorders using gene therapy. To do this they need to obtain blood stem cells.

- (i) Scientists can obtain blood stem cells from different sources.

Name the different types of stem cell that could be obtained from these two sources:

Bone marrow

Fertilised egg after 3 to 5 days [2]

Very few candidates correctly named the two types of stem cell.

Question 14 (c) (ii)

- (ii) The blood stem cells are then modified before being placed into the patient.

Complete these sentences to explain the benefits of using modified stem cells.

The stem cells can be modified to stop the blood cells of the immune system detecting the stem cells.

This will reduce the chance of

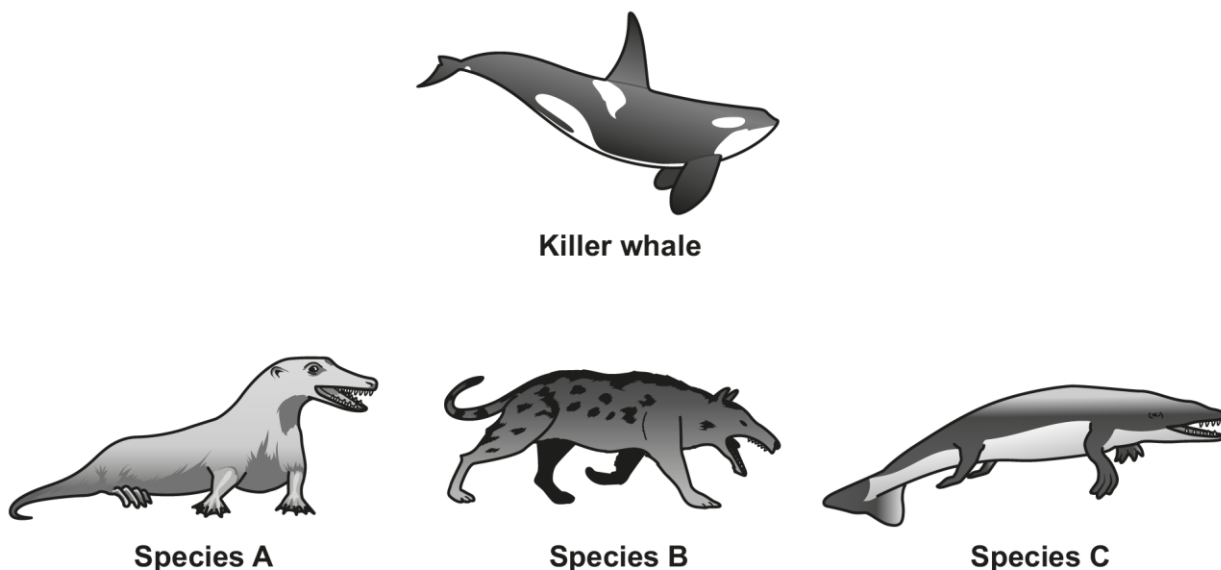
[2]

Misconception

Red was often chosen for the first gap, with candidates thinking that the red cells form part of the immune system. If white cells were correctly chosen then this was often followed by the misconception that modifying the white cells will reduce the chance of infection.

Question 15 (a) (i)

15 (a) The diagram shows a killer whale and three species thought to be ancestors of the killer whale.



(i) Killer whales evolved from ancestors that walked on land and then went back into the sea.

Complete the table to show the time when each species **A**, **B** and **C** existed on this planet.

Species	Time the species existed on this planet
killer whale	present day
.....	41 million years ago
.....	43 million years ago
.....	48 million years ago

[2]

Many candidates interpreted the diagram correctly and gave the correct order.

Question 15 (a) (ii)

(ii) Species **A**, **B** and **C** have **not** existed on this planet for millions of years.

What have scientists used to provide evidence for the evolution of the killer whale?

..... [1]

There were correct answers referring to DNA but most marks were scored by stating fossils. 'Bones' alone did not score a mark unless it was 'fossil bones'.

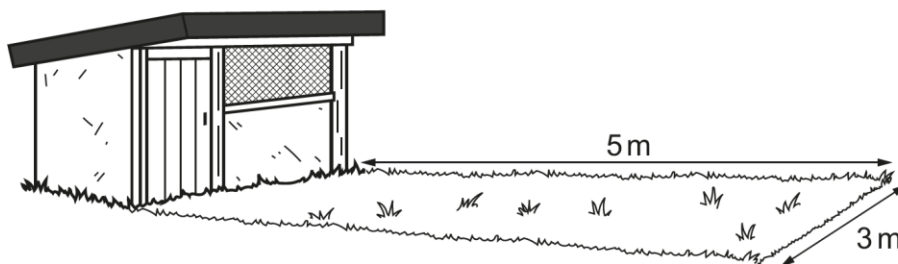
Exemplar 2

The diesel that is coming from these engines will pollute the sea water and can harm the fish in it. Hunting has been banned which is a positive thing because this means not only will the whales have a risk but also all of the other creatures, if hunting was still to occur it would mess up the food chain. The marine biologists will not only educate people but will be able to find out more information to do with the whales and other sea creatures. whale watching isn't a bad thing as long as nobody is harming the animals.

Exemplar 2 shows a response that was placed in Level 3, as the candidate tried to make an overall judgement.

Question 16 (a) (i)

16 Two students investigate the population of daisies in a lawn. The diagram shows the lawn in front of a shed.



(a) (i) Complete these sentences about the method the students use to find the population of daisies.

Use the words in the list.

- | | | | |
|--------|---------|--------|--------|
| pooter | quadrat | random | square |
|--------|---------|--------|--------|

The lawn is sampled using a square frame called a

Drop the square frame over one shoulder to provide a sample.

Count and record the number of daisy plants present in the square grid.

Repeat this process in 10 different areas of the lawn.

[2]

Question 16 (a) (ii)

(ii) Table 16.1 shows their results.

Table 16.1

Square frame	1	2	3	4	5	6	7	8	9	10	Total
Number of daisies counted	14	3	8	10	16	15	11	10	11	12	110

Estimate the population of daisies in the lawn.

- The students used a $0.5\text{ m} \times 0.5\text{ m}$ frame to sample the lawn.
- The lawn size is $5\text{ m} \times 3\text{ m}$.

Estimate of population of daisies in the lawn = [3]

Answers here required finding the area of the quadrat, the area of the lawn and the average number of daisies per quadrat. Some of the candidates could perform these steps and gained marks. However, they could not make the final calculation to estimate the total population.

Question 16 (b) (i)

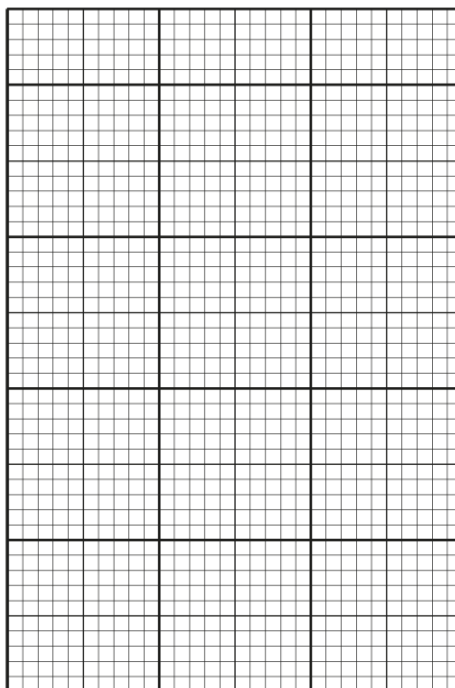
- (b) The students develop their investigation to show how the shed affects where daisies grow in the lawn.

Table 16.2 shows the results.

Table 16.2

Distance from shed (m)	Number of daisies
1.0	0
1.5	2
2.0	4
2.5	6
3.0	8
3.5	10
4.0	12
4.5	14
5.0	16

- (i) Plot a line graph of the results from Table 16.2. Draw a straight line of best fit.



[4]

Graph completion varied greatly. Some candidates plotted the distance on the y axis rather than on the x axis. A common omission was to leave the units off the distance axis.

Question 16 (b) (ii)

(ii) Use the graph to determine the slope of the line.

Slope = [1]

Very few candidates could correctly calculate the slope of the line.

Question 16 (b) (iii)

(iii) Daisy plants require lots of light.

Explain the effect of the shed on the growth of daisies in the lawn.

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

Exemplar 3

• Daisies close to the shed may not receive as much light as daisies at the other side of the lawn as the shed blocks the light.

Many candidates appreciated that the shed would block the sunlight from parts of the lawn so some of the daisies would not receive light. However, this was not always linked to the lack of growth of the daisies in some areas. Exemplar 3 shows an answer that does not make this link and so only scores 1 mark.

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