

GCSE (9-1)

Examiners' report

**GATEWAY SCIENCE
COMBINED
SCIENCE A**

J250

For first teaching in 2016

J250/02 Summer 2023 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 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.

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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 assessment of key mathematical requirements from Appendix 5f of the specification.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
<ul style="list-style-type: none"> • recalled genetic definitions from the specification, to include genome (Question 1) and heterozygous (Question 16 (b) (ii)) • calculated means (Question 14 (a) (i)), percentages and rounded numbers correctly (Question 16 (c) (i)) • used information provided in graphical form to give arguments for and against a conclusion (Question 15) • used a knowledge of practical techniques to describe how to carry out a capture-recapture experiment to estimate population size • could modify experimental methods to investigate a different variable (Question 12 (b)). 	<ul style="list-style-type: none"> • could not describe differences between the structures of red and white blood cells (Question 11 (b) (ii)) • were unable to apply an understanding of natural selection to a specific situation (Question 13 (b)) • confused the behaviour of live snails with an experimental set up involving model snails (Question 14 (a) (ii) and (iii)) • could not extract data from a graph to calculate a percentage calculation (Question 16 (c) (i)).

Section A overview

Candidates' performance on the multiple choice questions in this section showed wide variations. Questions 2, 5 and 10 were often answered correctly. Questions 1, 7 and 9 discriminated between students at different grades and were answered correctly by approximately half of the candidates. Questions 6 and 8 were the most challenging questions in this section.

Question 1

1 Which word describes the entire genetic material of an organism?

- A Chromosome
- B Genome
- C Nucleus
- D Phenotype

Your answer

[1]

Although the majority of candidates choose the correct response, many incorrectly gave A, being distracted by the knowledge that chromosomes contain genetic material.

Question 2

2 Which is a **positive** impact of humans on the environment?

- A Building roads and houses on protected land.
- B Cutting down forests to plant crops.
- C Hunting endangered species.
- D Stopping the use of plastic drinking straws.

Your answer

[1]

Question 4

4 Which type of pathogens cause crown gall disease in plants?

- A Bacteria
- B Fungi
- C Protists
- D Viruses

Your answer

[1]

Only a minority of candidates gave the correct response, with candidates often choosing B or D instead.

Question 5

5 Tuberculosis is a disease of the lungs. The number of cases of tuberculosis in the UK between 1914 and 1987 decreased from 99 497 to 5086.

Which could be a reason for this decrease?

- A Development of a vaccine for tuberculosis
- B Development of industrial processes that produce pollution
- C Increase in population between 1914 and 1987
- D Increase in the number of people who smoke

Your answer

[1]

Question 6

6 Which row shows the correct levels of organisation in an ecosystem?

Smallest → Largest

A	community	population	species	ecosystem
B	community	species	population	ecosystem
C	species	population	community	ecosystem
D	species	community	population	ecosystem

Your answer

[1]

Few candidates answered this question correctly. C proved to be the most common incorrect response, with candidates being confused between the meaning of the terms population and community.

Question 7

7 Which is an example of selective breeding?

- A** Bacteria developing antibiotic resistance.
- B** Farmers developing food plants resistant to disease.
- C** Gardeners adding nitrogen to the soil to help plants grow.
- D** Scientists changing the genes of an organism.

Your answer

[1]

The majority of candidates chose the correct response, with the most common incorrect choice being D. This indicates possible confusion between genetic engineering and selective breeding.

Question 8

8 There are interactions between some types of disease.

Which is an example of two diseases that interact?

- A Cervical cancer and HPV
- B Cervical cancer and tuberculosis
- C HIV and HPV
- D HPV and tuberculosis

Your answer

[1]

This question directly tested knowledge of specification area B6.3. Many candidates could recall the involvement of HPV and so C featured as a common incorrect response.

Question 9

9 Which is a **true** statement about artificial classification?

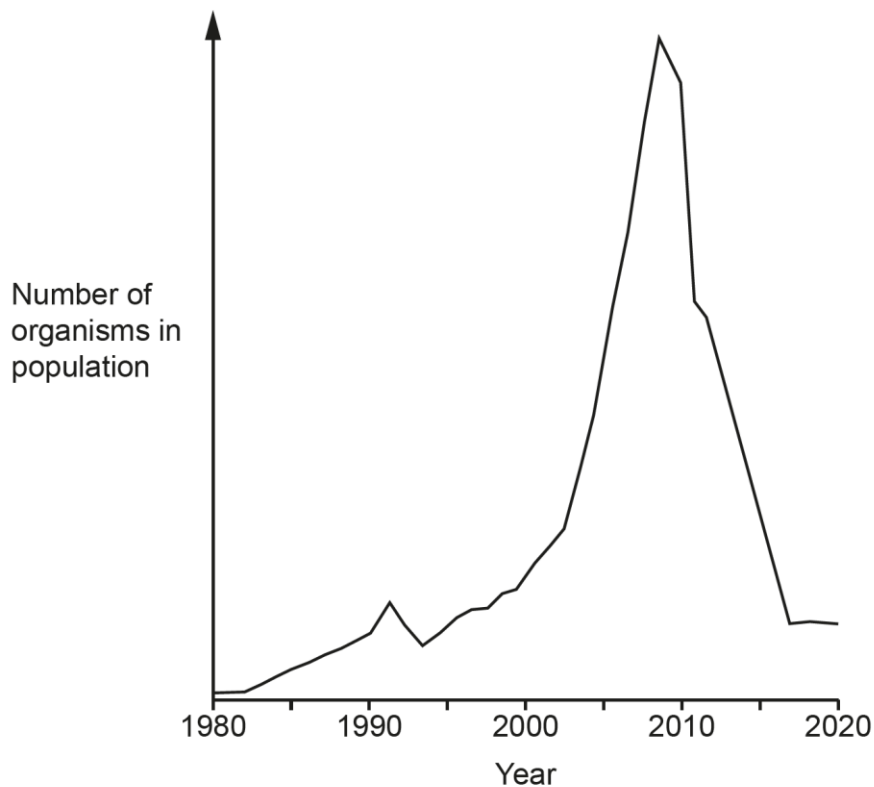
- A It is based on the observation of only one or a few characteristics.
- B It involves the use of DNA sequencing.
- C It relies on the use of phylogenetics.
- D It uses the fossil record to link common ancestors.

Your answer

[1]

Question 10

10 The graph shows the changing population of one species in a habitat.



Predict the years when this species had the **highest** availability of their food source.

- A Between 1980 and 1990
- B Between 1990 and 2000
- C Between 2000 and 2010
- D Between 2010 and 2020

Your answer

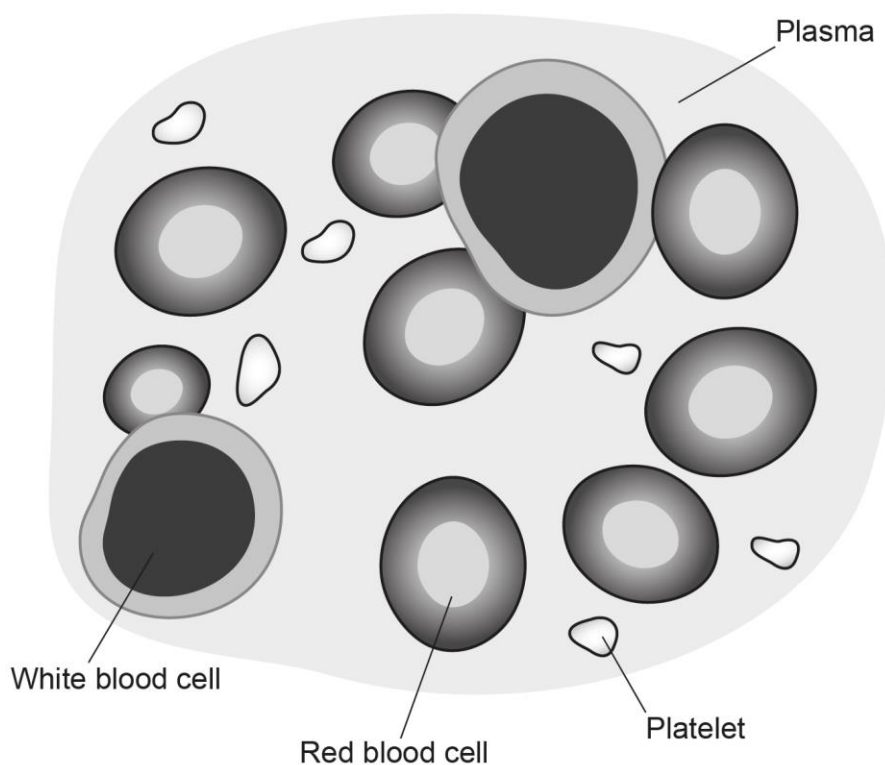
[1]

Section B overview

In this section many candidates did not score marks in Question 11 (a), which was intended to be an accessible start to this section. In the second part of Question 11 and in Question 12 (a) (i) and Question 16 (c) candidates tended to answer well, showing an ability to interpret and manipulate graphical data. Question 16 was the lowest scoring question for most candidates. They found the parts requiring explanations of biological terms such as heterozygous and discontinuous very challenging and struggled to complete the genetic diagram.

Question 11 (a) (i)

11 (a) The diagram shows the main components of the blood.



(i) Complete the table to show which part of the blood is liquid and which helps blood to clot.

Put **one** tick (✓) in each row.

	Part of blood			
	Platelet	Plasma	Red blood cell	White blood cell
Liquid				
Helps blood to clot				

[2]

A number of candidates appreciated that plasma was the liquid part of the blood and so scored 1 mark. However, a significant number of candidates put a tick in each column of the table rather than in each row.

Misconception



It appears that the terms 'row' and 'column' referring to a table were not understood by many candidates. This led to many ticking too many boxes and not being able to be awarded some marks.

Question 11 (a) (ii)

(ii) Describe **two** differences in the **structure** of red blood cells and white blood cells.

1

.....

2

.....

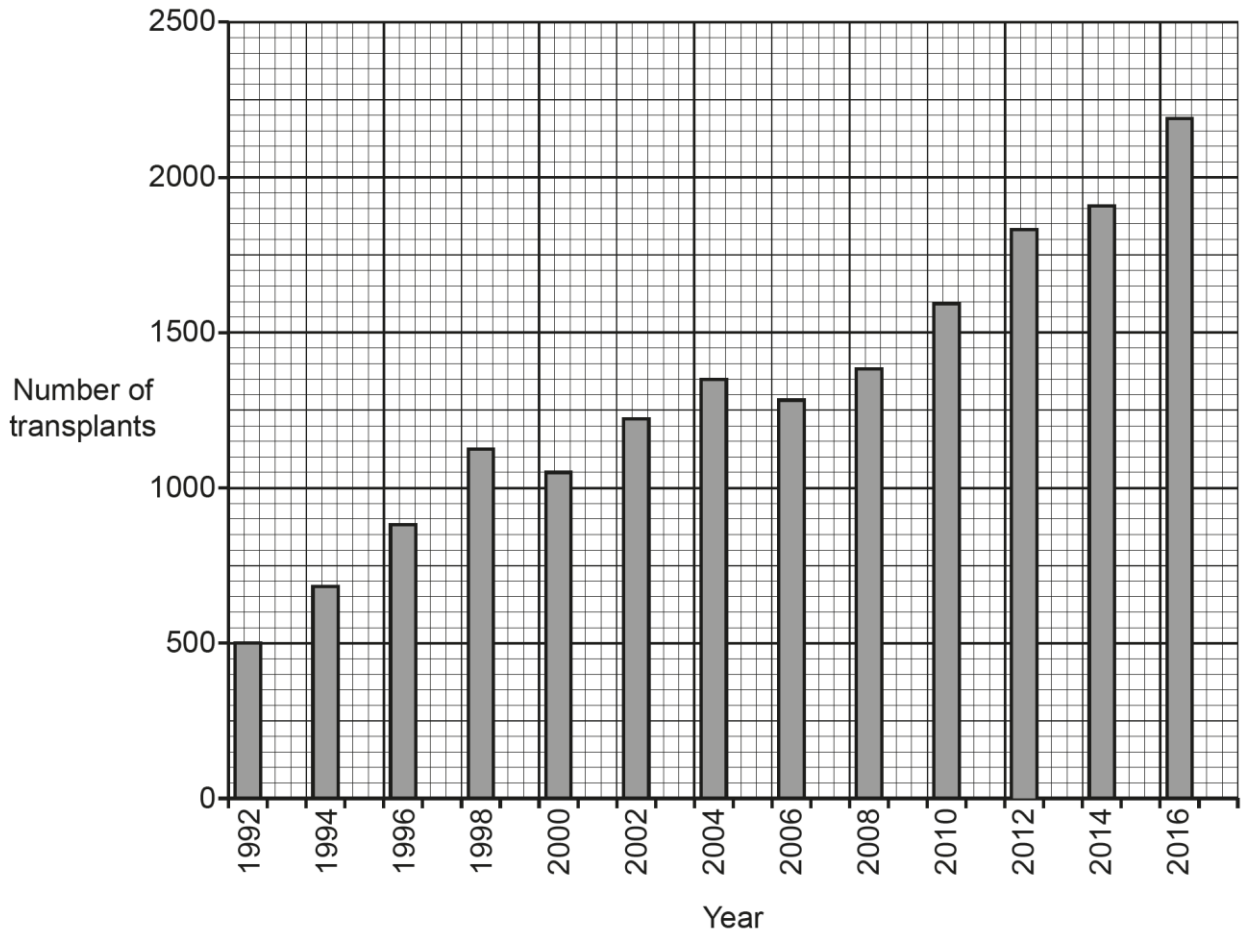
[2]

The most common response to score a mark here was reference to the white blood cells being larger. Common incorrect responses referred to the white blood cells having larger nuclei or thicker cell walls.

Question 11 (b) (i)

(b) Some blood diseases are treated using blood stem cell transplants. Healthy blood stem cells from another person (donor) are injected into the bones of the patients so that the blood stem cells can differentiate into healthy blood cells.

The graph shows the number of blood stem cell transplants for one country.



(i) In which year were there the most number of transplants?

..... [1]

Almost all candidates answered correctly.

Question 11 (b) (ii)

(ii) Describe the overall trend in the number of transplants shown in the graph.

..... [1]

This question was also well answered, although a minority of candidates described the various fluctuations rather than the overall trend.

Question 11 (b) (iii)

(iii) The blood stem cells used in these transplants are adult stem cells from a donor.

Stem cells can also be taken from embryos.

Write down **one** benefit and **one** risk of using adult stem cells from a donor.

Benefit

.....

Risk

.....

[2]

There were correct references in the risk section about the possible transfer of pathogens but very few responses highlighted the ethical benefits of using adult stem cells. This was despite the reference to the use of embryos in the question.

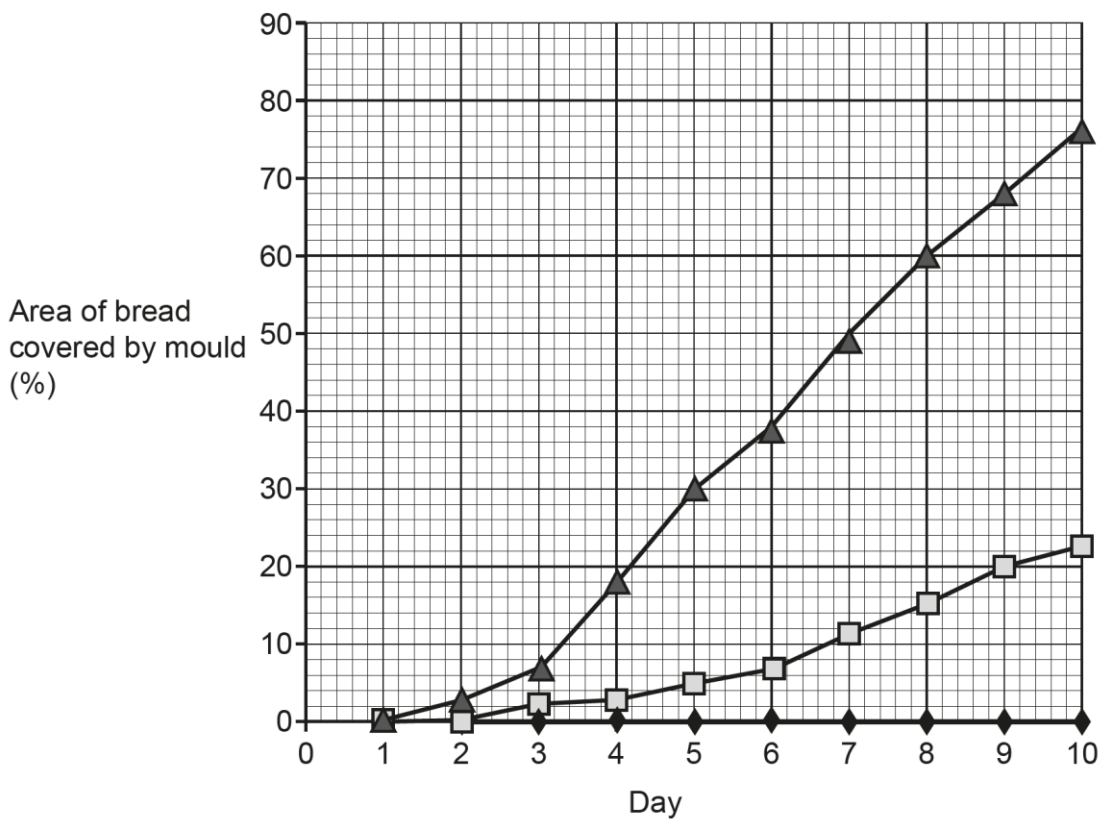
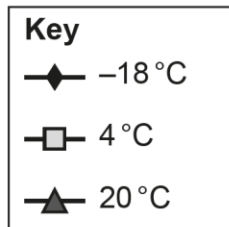
Question 12 (a) (i)

12 Bread mould is a type of fungus that decomposes plant material.

A student investigates the effect of temperature on decomposition.

- They leave slices of bread at three different temperatures.
- Each day the student records the area of each slice of bread covered by mould.

(a) The graph shows their results.



(i) Which is a correct statement about these results?

Tick (✓) **one** box.

Temperatures > 4 °C stop mould decomposing the bread.

Temperatures = to -18 °C stop mould decomposing the bread.

Temperatures > -18 °C stop mould decomposing the bread.

Temperatures = to 4 °C stop mould decomposing the bread.

[1]

Many candidates chose the correct response.

Question 12 (a) (ii)

(ii) Look at the results for 20°C.

Calculate the increase in area covered by mould between **day 5** and **day 10**.

Increase in percentage area covered = % [2]

Most candidates could read the correct values off the correct line for days 5 and 10, therefore scoring at least 1 mark. However, a number then went to perform incorrect calculations rather than just subtracting one value from the other.

Exemplar 1

30 76 ~~76/30~~
 $30 \div 76 \times 100$

Increase in percentage area covered = 39.5 % [2]

Exemplar 1 shows a response where the candidate has read the correct figures of 30 and 76 from the graph. However, instead of calculating the increase in the area covered, they have tried to calculate one figure as a percentage of the other, so were not given both marks.

Question 12 (b)

(b) Suggest how the student could change their method to investigate the effect of **moisture** on decomposition.

.....

 [2]

The examiners were looking for a scientific description of how moisture levels could be varied. Reference to a factor that should be controlled also gained a mark. However, instead of subjecting bread to different levels of moisture, many responses simply said spray the bread with water.

Question 12 (c)

(c) Decomposers release carbon from decaying plant material as part of the carbon cycle.

Complete the table to describe **two** different processes in the carbon cycle.

Process	Description	Takes in carbon from the atmosphere	Releases carbon into the atmosphere
.....	occurs in chloroplasts	✓	✗
combustion	burning of fossil fuels

[2]

The majority of candidates appreciated that combustion released carbon into the atmosphere and many could also state the name of the correct process in the first row.

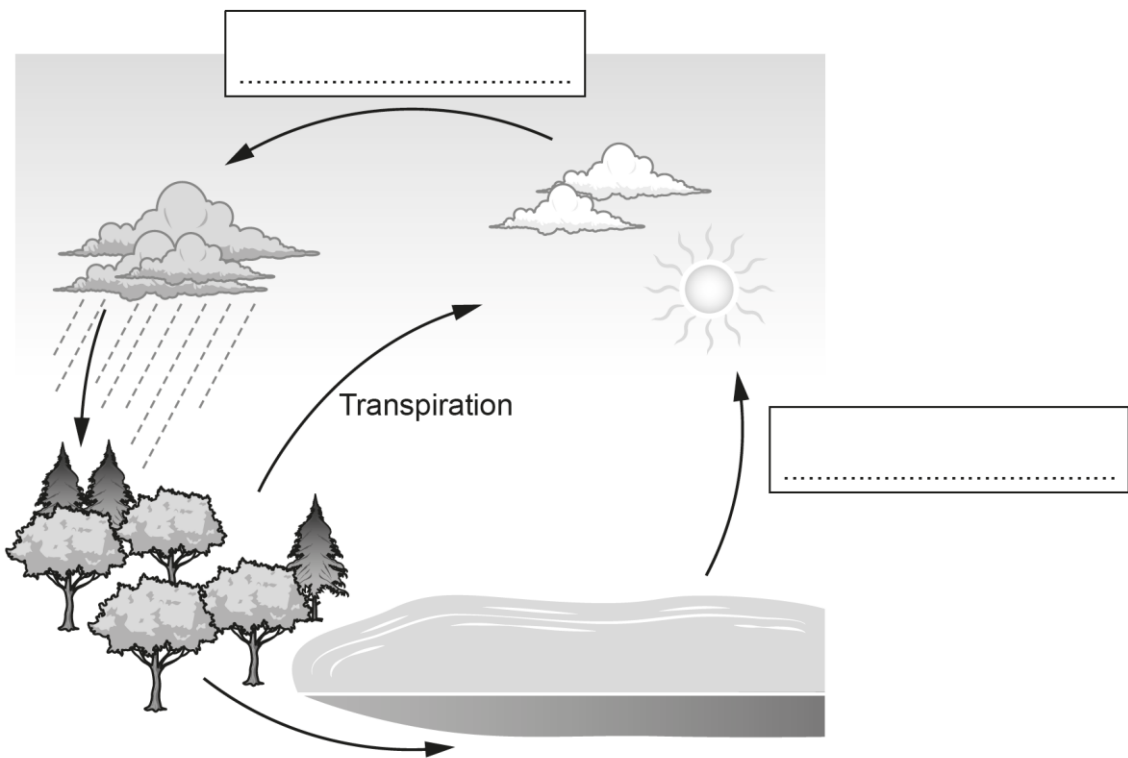
Question 12 (d) (i)

(d) The diagram shows the water cycle.

(i) Complete the diagram.

Use the words from the list.

- | | | | | |
|------------|--------------|-------------|---------------|-------------|
| Collection | Condensation | Evaporation | Precipitation | Respiration |
|------------|--------------|-------------|---------------|-------------|



[2]

This question was well answered by most candidates.

Question 12 (d) (ii)

(ii) Explain why transpiration is important to the plant communities in an ecosystem.

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


Despite the preceding part of the question being about the water cycle, many candidates could not make the link between transpiration, the return of water to the atmosphere and its subsequent uptake and use in plants.

Exemplar 2

Transpiration is important to the plant communities in an ecosystem because it helps them with respiration.....
..... [2]

Exemplar 2 shows an unsuccessful response linking transpiration to respiration. This was a common error with many responses referring to either oxygen or carbon dioxide being released during transpiration.

Assessment for learning



Candidates were often confused between the carbon cycle and the water cycle. Practice at constructing diagrams of these processes might reduce this confusion.

Question 13 (a)

13 The picture is of a sword-billed hummingbird feeding on a flower.



- The hummingbird feeds on nectar from the flower.
- The flower benefits because the hummingbird transfers pollen from one flower to the next.
- This helps the flower to reproduce and develop seeds.

(a) Which word describes the interdependence between the hummingbird and the flower?

Put a **ring** around the correct answer.

competition

mutualism

parasitism

predation

[1]

Most candidates indicated the correct response.

Question 13 (b)

- (b) The long beak of the hummingbird is an adaptation that helps the bird to feed. The bird's ancestors had shorter beaks.

Complete the sentences about the long beak of the sword-billed hummingbird.

The ancestors of the sword-billed hummingbird showed in beak length.

Members of the species with longer beaks fed on more nectar.

This meant they were more likely to

The allele for longer beaks was passed on to the next

Over time, all the hummingbirds evolved to have longer beaks.

This process is called natural






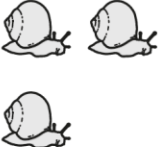

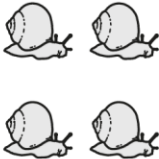







[4]

Many candidates completed the second and the third gap correctly and a reasonable number also completed the term natural selection. However, some did write breeding instead of selection. Few completed the first gap correctly with either variations or mutations.

Question 14 (a) (i)

14 (a) A student draws a grid containing some snails to model a habitat with snails living in it.

They then take a random sample from their grid.

1 	2 	3 	4 	5 
6 	7 	8 	9 	10 
11 	12 	13 	14 	15 

This is the method they follow:

- Write numbers 1 to 15 on pieces of paper.
- Put the pieces of paper in a bag.
- Take one piece of paper out of the bag to select the number of the square.
- Record the number of snails in that square.
- Choose three more squares in the same way.

The table shows their results.

Attempt	Number of square	Number of snails
1	8	4
2	13	2
3	5	3
4	6	3

- (i) Calculate the **mean** number of snails in the four squares listed in the table.

Mean = snails [2]

The majority of candidates could calculate the mean of the four numbers.

Question 14 (a) (ii)

- (ii) The student estimates the total population by multiplying the mean by the number of squares, which is 15.
The actual total population in the 15 squares is 22.

Suggest **two** reasons why the student's estimate is different to the actual total population.

- 1
-
- 2
-

[2]

Some candidates did appreciate that the sample size was small and the number of snails in each square varied significantly, however relatively few correct responses were seen. A number of candidates did not realise that this was a model with paper snails and thought that they were moving around. Other responses just put the deviation down to poor counting.

Question 14 (a) (iii)

- (iii) Suggest **one** way the student could change their method to improve their estimate, without counting all of the snails.

-
- [1]

Some of the responses anticipated the next question and suggested capture-recapture, even though the snails were not moving.

Question 14 (b)

- (b) The method of capture–recapture can be used to estimate the population of snails in their actual habitat.

Describe how the student could use the method of capture–recapture to estimate the snail population.

Include the name of any apparatus the student should use.

.....

.....

.....

.....

.....

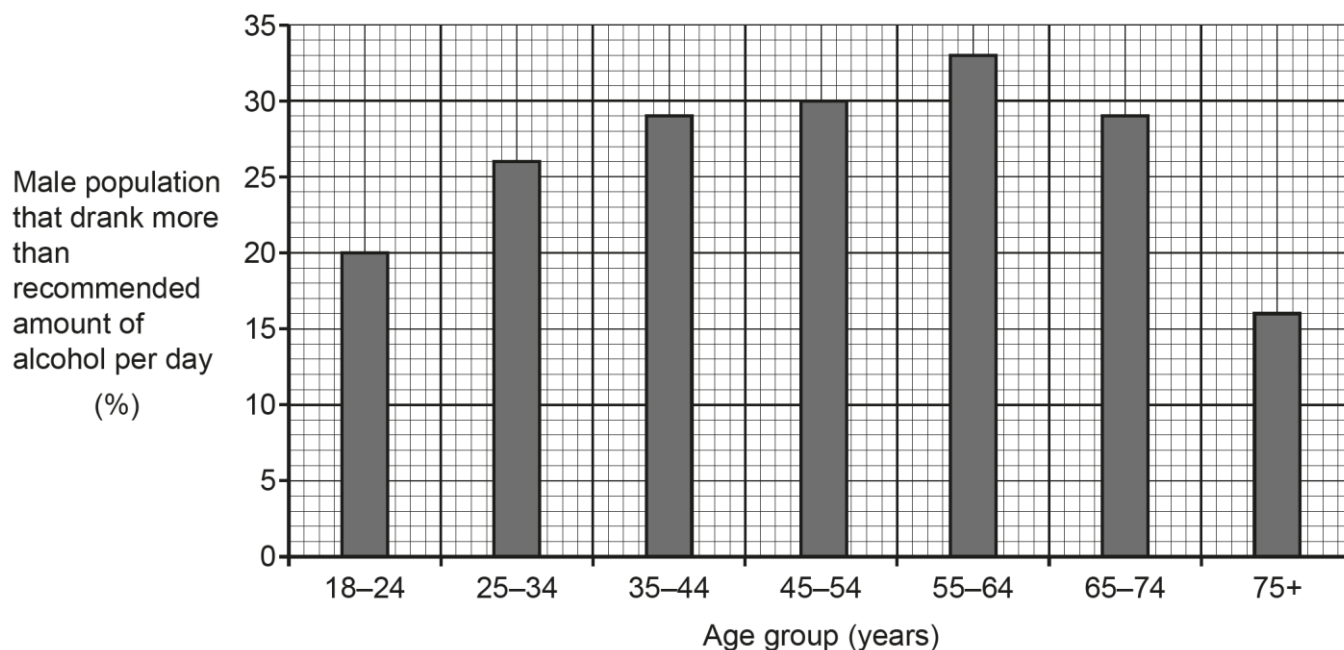
[3]

There were some good descriptions of capturing and marking with non-toxic paint but it did appear that many candidates had little experience of the capture-recapture technique and just answered by using the terms in the title. Regarding the equipment, there were correct references to quadrats for sampling but often responses suggested sucking the snails up using pooters.

Question 15*

- 15* A survey recorded the percentage of the male population that drank more than the recommended amount of alcohol per day.

The bar chart shows the results.



Exemplar 3

As shown in the graph, the most that drink are in the 55-64 year olds. This puts that age group at higher risk for cardiovascular disease, as drinking is a huge factor which can cause, and make the disease worse.

Another lifestyle factor which affects the disease is exercise, people with more exercise are less likely to develop said disease. The evidence from the graph supports my conclusion as it is the 60 year olds who are shown to drink high amounts.

[6]

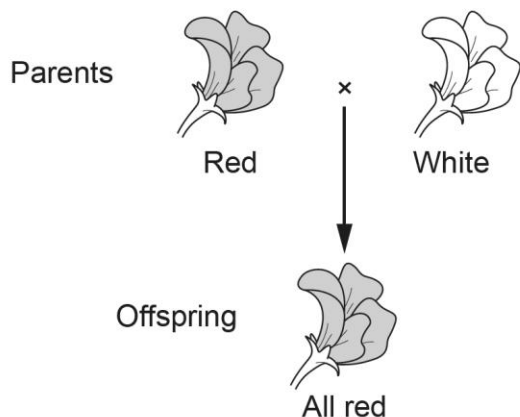
Exemplar 3 shows a response that was given Level 2, 4 marks. The candidate correctly makes the link between the alcohol intake of the 60-year-olds and the risk of cardiovascular disease. They also highlight another lifestyle factor. However, there are no comments regarding the limitations of the data and so the response does not qualify for Level 3.

Question 16 (a) (i)

16 A gardener grows a species of plant that has either red or white flowers. The colour of the flowers is controlled by a single pair of alleles, R and r.

The gardener crosses a plant that is homozygous for red flowers with a plant that is homozygous for white flowers.

The diagram shows the results.



(a) (i) Explain why the offspring in the diagram are **all** red.

.....

.....

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

Although candidates used a range of terms such as plant, flower, gene, or allele, many did comment that red was dominant. However, fewer appreciated that the offspring all had one red allele.

Question 16 (a) (ii)

(ii) The offspring are all heterozygous for flower colour.

What is meant by the term **heterozygous**?

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

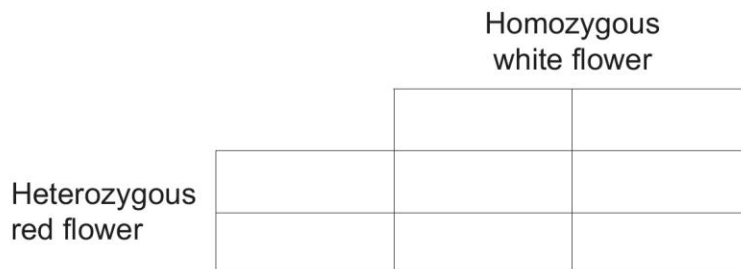
There was often confusion between homozygous and heterozygous in responses and only a minority of candidates scored the mark on this question.

Question 16 (b)

- (b) The gardener crosses one of these offspring plants with a plant that is homozygous for white flowers.

Predict the probability that the next generation of plants will have white flowers.

Complete the genetic diagram to explain your answer.



Probability = [3]

Genetic crosses have often appeared on this paper but the candidates continue to find this type of question difficult. There were a small number of fully correct responses but a variety of mistakes were made. These included the use of letters other than R and r (often R and W), diploid gametes and confusion between homozygous and heterozygous.

OCR support



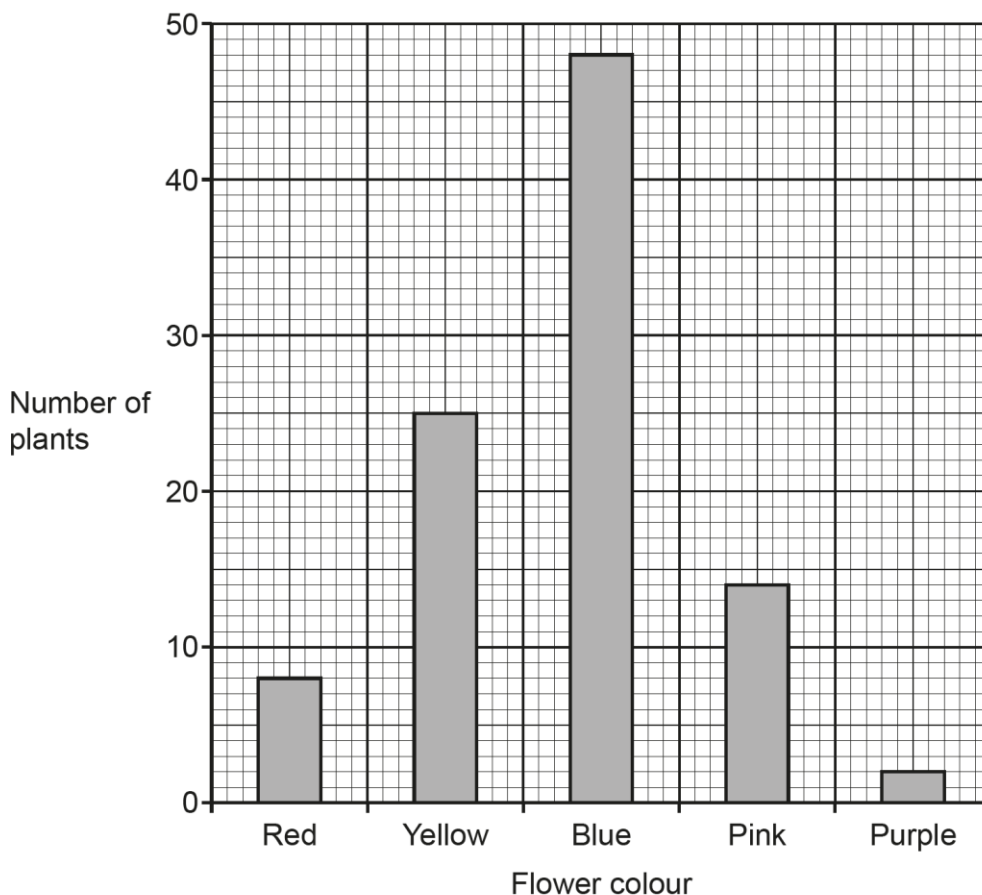
[ExamBuilder](#) is a free bank of all previous questions asked. This can be used to search for previous questions on genetic crosses across both Gateway and 21st Century Science suites to be used as practice with students.

Question 16 (c) (i)

- (c) The gardener grows another species of plant that can produce flowers of five different colours.

The gardener counts the number of plants for each flower colour.

The graph shows their results.



- (i) The gardener counted 97 plants.

Calculate the percentage of these plants that have blue flowers.

Give your answer to the nearest whole number.

Percentage of plants with blue flowers = % [3]

Many candidates answered correctly and scored all 3 marks. A significant number only scored 2 marks, as they either did not give their answer to the nearest whole number or rounded the answer incorrectly. A common mistake involved rounding 49.48 to 50.

Question 16 (c) (ii)

- (ii) What evidence is there in the graph that flower colour is an example of discontinuous variation in this species?

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

This question proved to be the most challenging on the paper. Very few candidates wrote the features of discontinuous variation, with many trying to give evidence in terms of ratios of the offspring.

Question 16 (d)

- (d) The male gametes of a plant are called pollen.

The sentences in the text box are about pollen.
There are two words in the sentences that are **not** correct.

Put **(rings)** around the **two** words that are **not** correct.

Pollen cells are haploid. This means that the pollen cells of a plant have twice the number of chromosomes as the leaf cells of the plant.
Pollen cells are formed by a type of cell division called mitosis.

[2]

Many candidates correctly ringed 'mitosis' with 'twice' being less often identified.

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Question 13, image of sword billed hummingbird feeding, © drferry/iStockphoto

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