Qualification Accredited

Oxford Cambridge and RSA

GCSE (9-1)

Examiners' report

TWENTY FIRST CENTURY SCIENCE BIOLOGY B

J257

For first teaching in 2016

J257/02 Summer 2023 series

Version 1

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

There are four examination components for GCSE (9-1) Twenty First Century Science Biology B. Papers 2 and 4 (Depth in Biology) provide candidates with the opportunity to demonstrate the depth of their knowledge and understanding in biology. These papers differ from Papers 1 and 3 (Breadth in Biology) in a number of ways, including that in the Depth papers:

- a higher proportion of the questions require written answers (rather than asking candidates to choose the correct answer from provided options);
- more of the questions are worth 2-5 marks;
- each paper includes two 6-mark, extended-writing questions marked using Level of Response mark schemes;
- there is a greater emphasis on assessing candidates' ability to apply their knowledge and understanding in novel contexts (Assessment Objective 2) and analyse information to interpret, evaluate, draw conclusions, and develop or improve experimental procedures (Assessment Objective 3);
- more marks are awarded for knowledge and understanding of practical work.

Paper 2 assesses knowledge from across the specification, including some synoptic questions. Therefore, to do well on Paper 2, candidates need to demonstrate their understanding of ideas from across the whole specification, including Ideas about Science.

On the whole, candidates rose to the challenges of this Foundation Tier examination well, and candidates are to be commended for attempting most questions. The question omission rate was low for most questions, except for the following where between a quarter and a third of the candidates did not attempt the question:

- Question 2 (b) (ii) – in which candidates were required to recall what the body makes from amino acids and how the genome is involved in this;
- Question 3 (f) – in which candidates were required to recall the name of the plant hormone that causes phototropism;
- Question 5 (b) – in which candidates were required to recall examples of evidence that helped Darwin and Wallace to develop their explanation of evolution by natural selection;
- Question 5 (d) – in which candidates were required to apply their knowledge of genetic mutation to suggest what could have changed in a bacterium to enable it to make a new enzyme.

Candidates had been well prepared for most questions. The following questions were answered particularly well:

- Question 1 (a) – in which candidates were required to recall that a sensory neuron enables us to sense the things we touch;
- Question 2 (a) – in which candidates were required to recall the names and roles of some the organs and organ systems involved in the transport of water and maintenance of water balance in the human body;
- Question 2 (b) (iii) – in which candidates were required to recall where the genome is stored in cells;
- Question 4 (a) (i) – in which candidates were required to draw conclusions about a patient's blood pressure by reading off a chart;
- Question 4 (c) (i) – in which candidates were required to apply their knowledge of risk factors for communicable diseases to suggest lifestyle changes that a patient could make to lower their risk of cardiovascular disease;

- Question 4 (c) (iii) – in which candidates were required to apply their knowledge of the use of medicines to treat disease to suggest potential risks of taking a medicine;
- Question 5 (a) (ii) – in which candidates were required to apply their knowledge of factors that affect communities within ecosystems to suggest causes for a decrease in the size of a population of birds;
- Question 5 (c) – in which candidates were required to recall two impacts of Darwin and Wallace's explanation of evolution by natural selection;
- Question 6 (b) (i) – in which candidates were required to recall the correct order of steps to look at a slide using a light microscope.

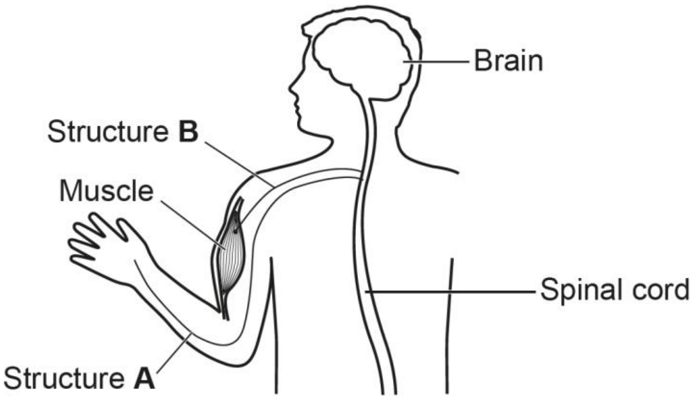
The whole of Questions 6 and 7 were common with the Higher Tier examination (J257/04).

Candidates who did well on this paper generally:	**Candidates who did less well on this paper generally:**
• attempted every question, even when they were unsure about the answer • looked for ways to use their knowledge and understanding to answer questions asked in unfamiliar contexts • drew upon their experiences of practical work in their responses to the practical questions • showed their working for calculations, which often allowed marks to be given for correct working even when the final answer was incorrect.	• did not attempt to answer questions where they seemed to be put off by an unfamiliar context • used up time and answer lines by copying out or re-writing the question before beginning their answer • relied upon everyday vocabulary (such as 'normal' or 'healthy') rather than specific scientific vocabulary and concepts • did not read charts and graphs carefully enough (see, for example, specific comments about Questions 4 (a) (i), 4 (a) (ii) and 4 (b) (i) in this report).

Question 1 (a), (b) and (c)

1 **Fig. 1.1** shows parts of the human nervous system.

Fig. 1.1



(a) Structure **A** allows us to sense the things we touch.

What is the name of structure **A**?

Put a ring around the correct option.

CNS **Effector** **Motor neuron** **Sensory neuron** **[1]**

(b) The muscle contracts to move the arm when it receives a nerve impulse from the brain.

What type of structure is the muscle?

Put a ring around the correct option.

CNS **Effector** **Motor neuron** **Sensory neuron** **[1]**

(c) Structure **B** carries nerve impulses from the brain to the muscle.

What is the name of structure **B**?

Put a ring around the correct option.

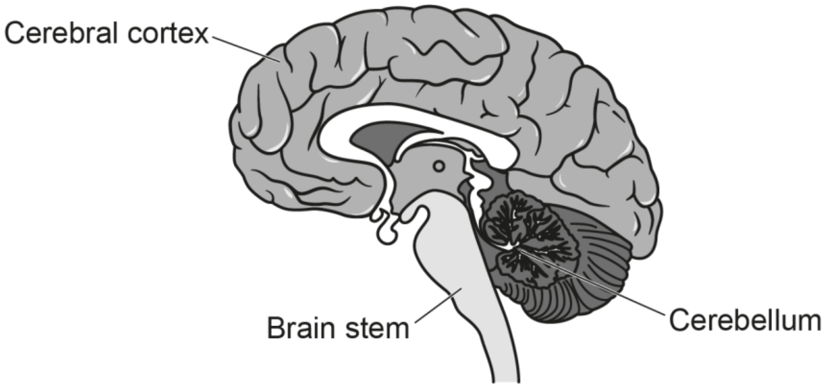
Motor neuron **Reflex arc** **Sensory neuron** **Synapse** **[1]**

Almost no candidates did not answer Questions 1 (a) to 1 (c), making for a strong start to the paper for many and indicating that they were well prepared to have a go at these questions requiring them to put a ring around the correct answer or draw lines to join boxes. Questions 1 (a), 1 (b) and 1 (c) assessed recall of terms associated with the nervous system. The majority of candidates circled 'sensory neuron' as the correct answer for part (a), with many picking up on the use of the word 'sense' in the question stem. Far fewer correctly identified the other neuron as being a motor neuron in part (c), while in part (b) a minority knew that the muscle is an effector.

Question 1 (d)

(d) **Fig. 1.2** shows a diagram of the human brain.

Fig. 1.2



Draw lines to connect each **part** of the brain with the **function** it controls.

Part	**Function**
Brain stem	Conscious movement
Cerebellum	Heart rate and breathing rate
Cerebral cortex	Intelligence and memory

[2]

As with parts (a), (b) and (c), the omission rate was very low for part (d), suggesting candidates were well prepared to have a go at this question requiring them to draw lines to join the correct boxes. Well over a third of candidates scored 1 mark for this question, though no particular combination of boxes seemed to be more or less well known than the others. A minority of candidates scored both marks.

Question 2 (a)

2 The things we eat and drink are processed by our body.

(a) Complete the sentences to describe what happens in our body when we drink water.

Use words from the list.

active transport	**circulatory**	**digestive**	**excretory**	**heart**	
kidney	**osmosis**	**oxygen**	**pancreas**	**water**	**urea**

Water is absorbed into the blood from the .... system.

Some of the water moves into and out of cells by ....

The blood is filtered by an organ called the ....

This organ filters water and .... out of the blood.

This organ then reabsorbs as much .... as the body needs to stay healthy.

[5]

Candidates are to be commended for not being intimidated by this question with its string of gaps to fill and large selection of words to choose from. Almost all candidates attempted this question and most scored 2, 3 or 4 marks. The most commonly correct answers were the first ('digestive') and last ('water').

Question 2 (b) (i)

(b) A student says, "I think cutting all the sugar and fatty acids out of my diet will be good for me."

(i) The student is **wrong**.

Explain how the student's body cells use sugar **and** fatty acids.

....

....

....

....

....

.... **[3]**

Almost all candidates attempted this question, which assessed recall of specification statement B3.3.1 on the use of sugars and fatty acids in the synthesis of carbohydrates and lipids. Candidates appeared to find this question challenging, with many making general references to keeping healthy, having a balanced diet or providing energy, without identifying specific uses of the substances.

Question 2 (b) (ii)

(ii) The student's body cells also need amino acids.

Explain what the student's body cells make using amino acids **and** how their genome is involved.

....

....

....

.... **[2]**

As with part (i), part (ii) assessed recall of candidates' knowledge of the use of small molecules to make bigger ones – in this case the use of amino acids to make proteins according to instructions in the genome (B1.1.6). Almost a third of candidates omitted this question, perhaps put off by the need to explain how the genome is involved. Those who did score a mark tended to get it for recalling that proteins were made.

Question 2 (b) (iv)

(iv) The genome is made of DNA.

Complete the sentence to describe the structure of DNA.

Put a ring around each correct option.

DNA is a polymer made from **two** / **four** different nucleotides in a **single** / **double** helix.
[1]

In this question, candidates were required to circle both parts correctly to get the mark. Most candidates who attempted this question correctly recalled that DNA is a double helix.

Assessment for learning

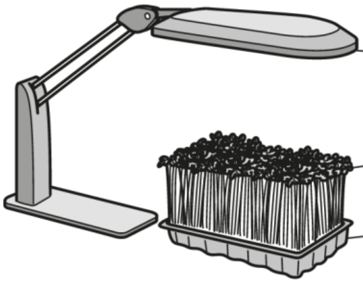
Many candidates circled 'two' instead of 'four' for the number of nucleotides, suggesting that they were thinking of the number of DNA *strands* (not *nucleotides*) in the double helix. The large number of new, abstract technical terms in the topic of DNA and inheritance (compared to KS3 terms) can be challenging for many candidates, especially at Foundation Tier.

Question 3 (a)

3 Zayn investigates if cress plants grow towards the light.

Zayn puts 200 cress seeds in a tray of damp soil and places the tray directly underneath a bright lamp. The tray is labelled **Tray 1**.

The diagram shows the cress in **Tray 1** after 7 days under the lamp.



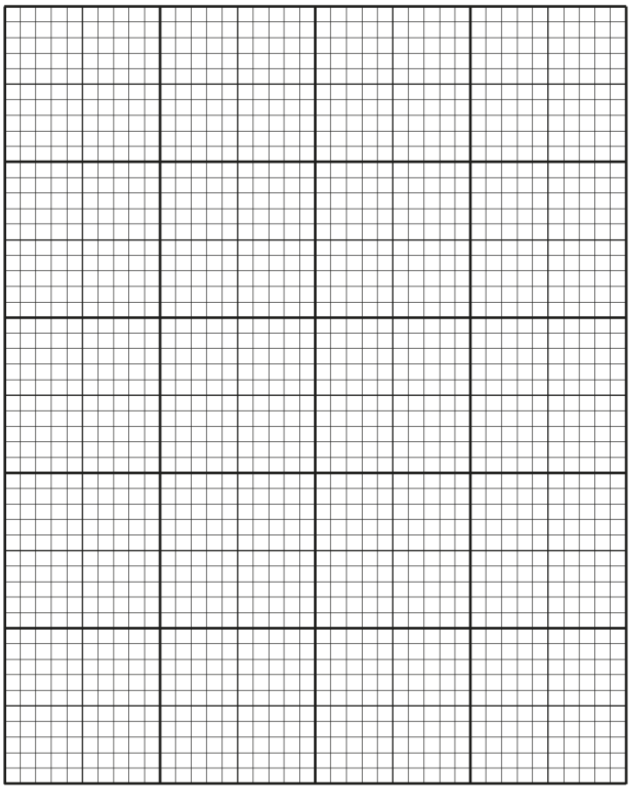
(a) Zayn calculates the percentage of cress seedlings in **Tray 1** that grew straight up and that grew curved towards the side.

The percentages are shown in **Table 3.1**.

Table 3.1

	Percentage of seedlings in Tray 1 (%)
Grew straight up	92
Grew curved towards the side	8

Plot the percentages from **Table 3.1** as a bar chart.



[3]

Candidates demonstrated good plotting skills, with many correctly plotting the bars at 92% and 8%. Most candidates correctly labelled the x-axis of their bar chart with the two category names. Many only wrote numbers on their y-axis without adding a label to describe the variable ('Percentage of seedlings in Tray 1') or identify the unit (%).

Question 3 (b)

(b) Zayn puts 200 cress seeds in another tray of damp soil and places the tray next to the **window**. This is **Tray 2**.

After 7 days:

- 40 of the 200 seedlings in **Tray 2** grew straight up
- 10 of the 200 seedlings in **Tray 2** grew curved **away** from the window

Complete **Table 3.2** by calculating the percentage of seedlings in **Tray 2** that grew straight up.

Table 3.2

	Percentage of seedlings in Tray 2 (%)
Grew straight up	....
Grew curved towards the window	75

[2]

Most candidates who identified the correct information from the first bullet point above the table calculated the correct answer of 20%. The most common incorrect answer was 25, perhaps because some candidates assumed that the two rows of the table should add up to 100% and simply subtracted 75% from 100% to calculate their answer.

Question 3 (c)

(c) At the start of the investigation, Zayn wrote a prediction.

Prediction: The cress seedlings will grow towards bright light.

Explain how the results from both **Tray 1** and **Tray 2** support Zayn's prediction.

Use information from **Table 3.1** and **Table 3.2**.

....

....

....

....

....

.... **[4]**

Candidates are to be commended for their responses to this question assessing their data interpretation and analysis skills (Assessment Objective 3). Most were able to identify multiple pieces of supporting evidence from the two data tables that supported the prediction.

Question 3 (d) (i) and (ii)

(d) **Tray 1** and **Tray 2** were both left in the light for 7 days.

(i) Describe **two** things that could have caused the amount of light received by the seedlings in **Tray 2** to change over the 7 days.

1 ....

....

2 ....

.... **[2]**

(ii) Describe **one** way Zayn could have controlled the amount of light received by the seedlings in **Tray 2**.

....

....

....

.... **[2]**

Disruption caused by the pandemic over recent years will have made it challenging for this cohort of candidates to engage in hands-on practical work, and in general candidates tend to favour questions set in human or animal contexts rather than plant contexts. So it is commendable that the vast majority of candidates attempted parts (d) (i) and (ii) of this question set in a plant practical context. Part (i) was well answered on the whole, with well over half of candidates identifying at least one correct factor that could have caused the light level to vary. Suggesting ways in which these factors could have been controlled (IaS 1.4) proved more challenging in part (ii), with many candidates suggesting steps that would not control the light level (such as placing the tray outside) and would be impractical (such as repeatedly moving the tray throughout the day).

Question 3 (e)

(e) Which process caused the seedlings in **Tray 2** to curve towards the window?

Tick (✓) **one** box.

Gravitropism	☐
Photosynthesis	☐
Phototropism	☐

[1]

This question assessed recall of a tricky piece of vocabulary. In the quartile of candidates that scored highest on the paper overall, a large majority of the candidates correctly recalled phototropism as the name of the process. In the other three quartiles, only around a third of candidates correctly ticked phototropism, with photosynthesis being the most commonly seen incorrect answer.

Question 3 (f)

(f) State the name of the plant **hormone** that caused the seedlings in **Tray 2** to curve towards the window.

.... **[1]**

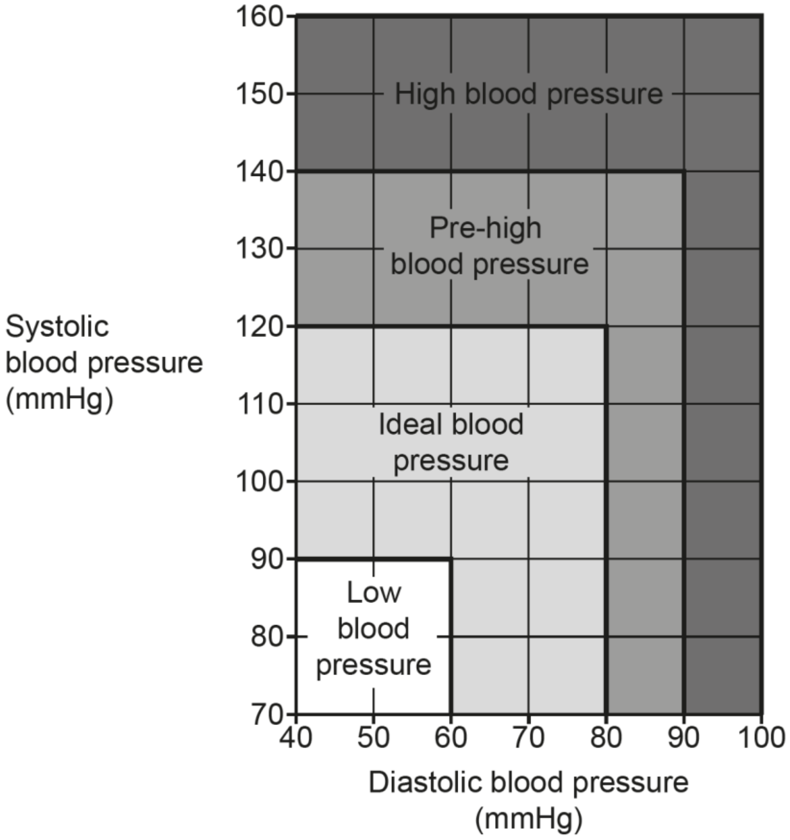
As with part (e) before it, part (f) assessed recall of a tricky piece of vocabulary in a plant context. Part (f) had one of the highest omit rates on the paper, and of those candidates who attempted it a small minority correctly recalled auxin(s). 'Photosynthesis' was commonly seen as an incorrect answer.

Question 4 (a) (i), (ii) and (b) (i)

4 Leo is a 52-year-old man. He is having a health check-up.

(a) Leo has his blood pressure measured.
The doctor uses **Fig. 4.1** to decide which blood pressure category Leo is in.

Fig. 4.1



Leo's diastolic blood pressure is 76 mmHg.
Leo's systolic blood pressure is 141 mmHg.

(i) What can you conclude about Leo's blood pressure from **Fig. 4.1**?

....

....

....

.... **[2]**

(ii) Leo's diastolic pressure remains at 76 mmHg.

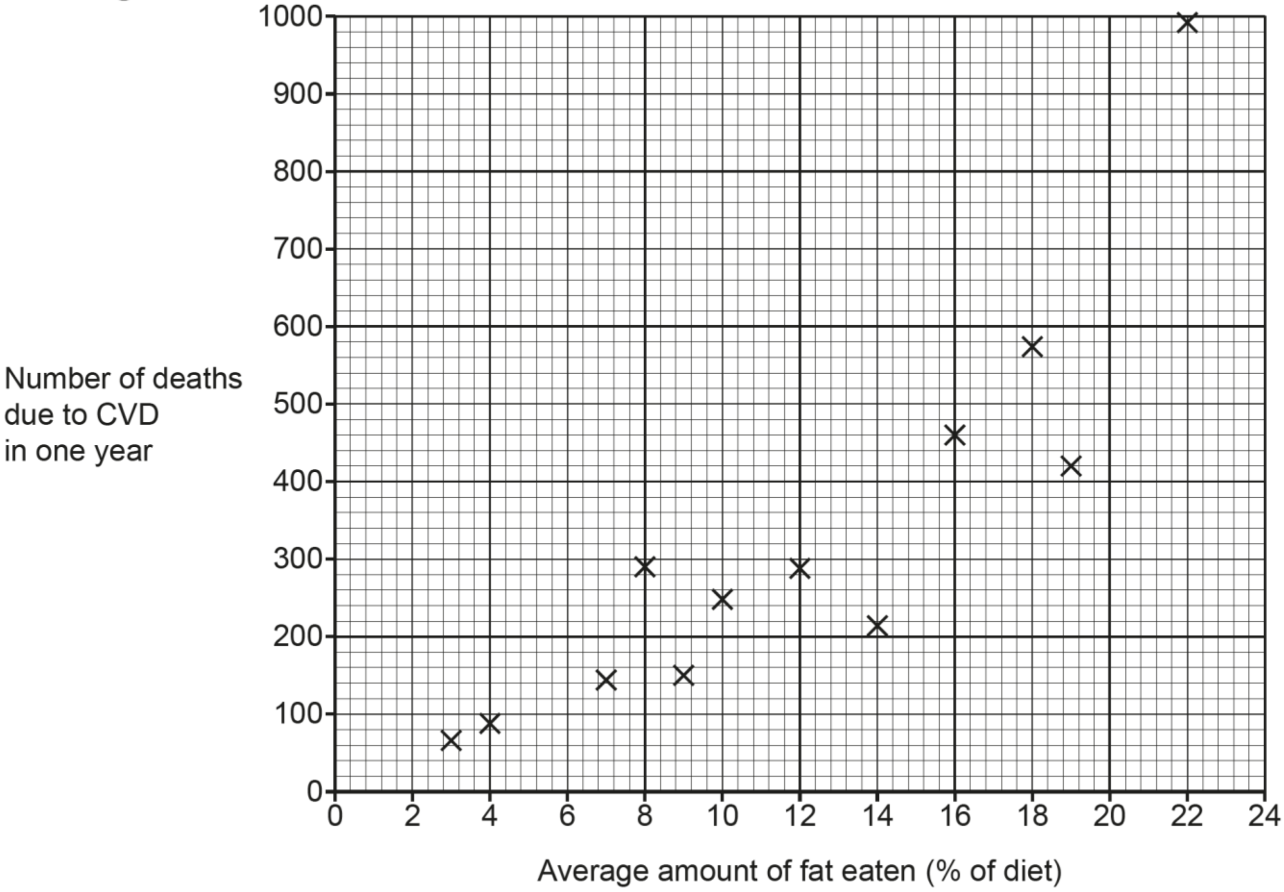
What range of systolic blood pressure would be ideal blood pressure for Leo?

Ideal systolic blood pressure range = ... to .... mmHg **[2]**

(b) High blood pressure is one factor that increases the risk of cardiovascular disease (CVD). Other factors also increase this risk.

Fig. 4.2 shows data on the average amount of fat eaten and the number of deaths due to CVD in one year in a sample of 100 000 people from the UK.

Fig. 4.2



(i) Describe the trend in the data, using **Fig. 4.2**.

....

....

.... **[2]**

On the whole, parts (a) (i), (a) (ii) and (b) (i) of Question 4 were answered well. There was evidence that some candidates had not read the chart and graph carefully enough and had missed key information on them. For example:

- In part (a) (i), some candidates used everyday terms such as 'normal' or 'unhealthy' to describe Leo's blood pressure, rather than using the blood pressure category names presented on the chart.
- In part (a) (ii), many candidates appeared to have only looked at the y-axis when determining the bottom and top of the 'ideal' range, as they wrote 90 and 120; for Leo, whose diastolic blood pressure is 76 mmHg, the 'ideal' range is in fact 70 to 120.
- In part (b) (i), some candidates referred to number of deaths increasing as the year went on, which suggested that they had incorrectly assumed the x-axis represented time rather than the variable identified in the x-axis label.

Assessment for learning

Everyday vocabulary such as 'normal' and 'healthy' is often not specific enough, or not correct, in scientific contexts. For example, what is normal or healthy for one person may not be normal or healthy for another. Candidates should be encouraged to use scientific vocabulary, such as the blood pressure category names presented on the blood pressure chart in Question 4 (a).

Question 4 (b) (ii)

(ii) Explain how the amount of fat eaten could have an effect on the number of deaths due to CVD.

Use ideas about changes in the body caused by eating fat.

....

....

....

....

....

.... **[3]**

This question was well answered, with candidates obviously having been well prepared on the topic of cardiovascular disease. The majority of candidates scored 1, 2 or 3 marks, and all the marking points in the mark scheme were commonly seen.

Question 4 (b) (iii)

(iii) **Fig. 4.2** shows data from a sample of 100 000 people.

What groups of people would you expect to be included in the sample to make it **representative** of the whole population of the UK?

....

....

....

....

....

.... **[3]**

The concept of a representative sample can be tricky at Foundation Tier, yet this was another very well answered question. Most candidates were able to suggest one, two or three groups of people that could be included in a representative sample of the population of the UK. There was, again, evidence of some candidates relying upon everyday language rather than using scientific vocabulary, such as referring to people of different 'size' or 'shape' rather than to people with different body mass or BMI.

Question 4 (b) (iv)

(iv) In this sample of 100 000 people, 3934 people died of CVD in one year.

Calculate how many people you would expect to die in the UK population from CVD in one year.

The UK population is 60 000 000.

Number of people = ... **[2]**

Candidates are to be commended for their willingness to have a go at this tricky calculation (the vast majority of candidates attempted it), and for how many were able to calculate the correct answer (just over half).

Exemplar 1

The UK population is 60 000 000.

60000000 ÷ 100000
= 60

3934 x 60
= 236040

Number of people = 236040 **[2]**

A commonly seen mistake was to miss the final zero off the end of the answer, as shown in this response. This seems to have occurred where candidates thought that 60 000 000 divided by 100 000 was 60 (instead of 600), so the final answer was out by a factor of 10. In this exemplar response, the candidate was awarded the first marking point because they showed their working which included some correct steps.

Question 4 (c) (ii)

(ii) Leo is worried about taking medicine to treat his CVD.

Complete the table by describing how the medicine was tested.

	Medicine tested on	**Medicine tested for**
Pre-clinical testing	....	Safety and effectiveness
Clinical testing	Healthy human volunteers	....

[2]

The most common score here was 1 mark, and this was more commonly awarded for the left-hand side of the table than the right-hand side. On the right-hand side, many candidates wrote 'side effects', which was credited for 'safety'; many also wrote 'effectiveness', which was not credited (as this would involve testing how well the medicine treats the disease, which cannot be done using healthy human volunteers).

Question 4 (c) (iv)

(iv) Without medicine and lifestyle changes, Leo may need heart surgery.

Evaluate the use of lifestyle changes to treat Leo compared with the use of surgery.

...

...

...

... **[2]**

Over half of candidates were able to score 1 or 2 marks on this question that assessed specification statement B2.6.3. Some did not score because they listed lifestyle changes Leo could make, such as getting more exercise or reducing the amount of fat in his diet, which had already been assessed in Question 4 (c) (i).

Exemplar 2

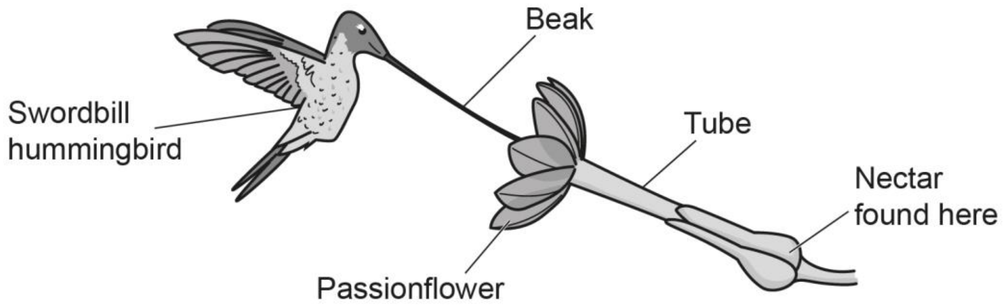
Having a different daily rotine, or eating a whole new diet and having a diffferent amount of sleep. **[2]**

This candidate has missed the point of the question, simply listing lifestyle changes that Leo could make rather than evaluating the relative benefits of these versus having surgery.

Question 5 (a) (i)*

5 Species evolve over time. This evolution can be explained using ideas about the process of natural selection.

(a) Read the article.



One species of hummingbird called a swordbill is the only bird that has a beak longer than its body. It is the most common species of hummingbird in one region of South America.

This region is the only place where a species of plant called a passionflower grows. The passionflower has a long tube with nectar at the bottom. Swordbills feed on the nectar.

(i)* Explain why the swordbill has become the most common species of hummingbird in the region where this passionflower grows.

Use ideas about natural selection in your answer.

....

....

....

....

....

.... **[6]**

Candidates responded well to this 6-mark question that required them to apply their knowledge and understanding of natural selection to the unfamiliar context of hummingbirds and passionflowers. The vast majority of candidates attempted the question, and a large number of those scored marks in Level 1 by recognising that hummingbirds with longer beaks would be better able to reach the nectar (their food source) and therefore more likely to survive than birds with shorter beaks. A smaller number went on to score marks in Level 2 by recognising that these hummingbirds would be more likely to reproduce, and a minority scored marks in Level 3 by explaining that the long beak trait would be passed on to the next generation, and/or by using appropriate scientific vocabulary such as 'adapted' or 'advantage'.

Exemplar 3

The birds with the longer beaks survive by having plenty to eat being able to get their food (nectar) from the flower using their beak. They are more likely to survive compared to other birds who dont have this feature. They breed and produce offspring who also have this adaptation. Due to other birds not surviving as successfully ~~these~~ this species takes over and dominates the region. The offspring breed and have offspring who also have this feature and this keeps happening until a large amount of the birds have **[6]** the feature.

This response scored Level 3, 6 marks. The candidate has explained that the longer beak means the hummingbirds are more likely to get more food, survive, and reproduce, and has gone on to explain that the feature would be passed on to offspring. They have also used appropriate scientific terminology by referring to the long beak as an adaptation.

Question 5 (a) (ii)

(ii) Humans are chopping down trees in which the swordbill hummingbird lives.
This could cause a large decrease in the size of the swordbill population.

Explain how **two other** factors could cause a decrease in the size of the swordbill population.

1 ....

....

2 ....

....

[2]

Candidates engaged well with this question, which required them to apply their knowledge of factors that affect communities within ecosystems to suggest causes for a decrease in the size of a population of birds. Many were able to score 2 marks. Some referred to the trees being chopped down, which was not credited as it is stated in the question stem and candidates were asked for two *other* factors.

Question 5 (a) (iii)

(iii) When swordbill hummingbirds feed on the nectar, they transfer pollen between passionflowers. The pollen contains the male gametes of the passionflowers.

Explain why chopping down the trees in which the hummingbirds live could put the passionflowers in danger of extinction.

....

....

....

....

....

.... **[3]**

This question proved challenging for the majority of candidates, though many were able to score 1 or 2 marks for recognising that the hummingbirds were essential for the passionflowers' reproduction.

Question 5 (b)

(b) Darwin and Wallace suggested that natural selection could be an explanation for the evolution of species.

Describe **two** pieces of evidence that helped them to develop their explanation.

1 ....

....

....

....

2 ....

....

....

....

[4]

This question assessing specification statement B6.1.8 was another one that proved tricky for the majority of candidates. The teaching and learning narrative for part B6.1 of the specification lists three major pieces of evidence that contributed to the development of the theory of evolution by natural selection; these are: the production of new varieties of plants and animals by selective breeding; fossils with similarities and differences to living species; and the different characteristics shown by isolated populations of the same species living in different ecosystems. Most candidates appeared to find it challenging to recall these ideas or express them clearly enough. Some had clearly been well prepared on the story of Darwin and Wallace's work, describing examples such as the different features of populations of Galápagos tortoises and finches, or the evolution of humans from fossil evidence.

Assessment for learning

Very few candidates suggested that selective breeding provided evidence for the development of the theory of evolution by natural selection. Darwin describes selective breeding (which he called 'artificial selection') in the first chapter of *On the Origin of Species*, noting that the 'principle of selection' was 'potent in the hands of man' at driving change in the characteristics of species. He then argued that an analogous process of 'natural selection' could be equally potent in nature – and this became the basis of his explanation for evolution.

Question 5 (d)

(d) A type of bacteria uses an enzyme to digest nylon.
Nylon was invented in 1935.

Scientists think this new enzyme only appeared in bacteria after 1935.

Describe the changes in the bacteria that allowed them to make the new enzyme.

....

....

....

....

....

.... **[3]**

This was the final Foundation-only question on the paper before the 'overlap' Questions 6 and 7, which were common with the Higher Tier. Question 5 (d) had one of the highest omission rates on the paper, with a third of candidates not attempting it, and it proved challenging for those that did. The question was synoptic, requiring candidates to draw together their understanding that genetic mutations can affect phenotype (specification statement B6.1.2) and that the genome provides instructions for making proteins such as enzymes (B1.1.6). Most candidates who scored a mark got it for the idea that a mutation had occurred in the bacterium. A few wrote very good responses, including ideas such as that a mutation has changed the shape of the active site of an existing enzyme.

Question 6 (b) (ii)

(ii) Suggest **two** ways the scientist can work safely when using the microscope.

1 ....

....

2 ....

....

[2]

Many candidates did not answer this question in specific enough detail to score marks, instead making generic suggestions such as 'wear safety glasses' and 'wear gloves'. As noted earlier, disruption caused by the pandemic over recent years will have made it challenging for this cohort of candidates to engage in hands-on practical work, and it is possible that many of them may not have used a light microscope themselves.

Assessment for learning

Generic suggestions such as 'wear safety glasses', 'wear gloves' and 'tie hair back' are often seen when candidates are asked to suggest ways of working safely in practical contexts, but they may not be credited if they are not specific to, or appropriate for, the practical activity described in the question.

Question 6 (c) (i)

(c) **Fig. 6.3** shows part of the slice of stem. One of the cells is dividing by mitosis.

Fig. 6.3

Item removed due to third party copyright restrictions

(i) The chromosomes in the labelled dividing cell are clearly visible and appear dark.

Describe what the scientist added to the slide to make the chromosomes clearly visible.

.... **[1]**

Many candidates made correct references to 'stain' or – more commonly but less ideally – 'dye'. Others struggled to recall the correct scientific vocabulary, referring incorrectly to things such as 'ink' and 'indicator'.

Question 6 (c) (ii)

(ii) To get the image in **Fig. 6.3** the scientist used an eyepiece lens with a magnification of ×10, and an objective lens with a magnification of ×40.

Describe how to calculate the total magnification.

....

.... **[1]**

Well over a third of candidates correctly answered this question. Common mistakes were adding the two magnifications together to get a total of 50, and thinking that the actual size of the image should be included in the multiplication.

Question 6 (d) (i) and (ii)

(d) One of the dividing cells in **Fig. 6.3** has a width of 10 μm.

(i) What is 10 μm to the nearest order of magnitude?

Put a ring around the correct option.

10^0 μm **10^1** μm **10^2** μm **10^3** μm **[1]**

(ii) In the dividing cell, a single chromosome has a width of 0.01 μm.

How many orders of magnitude **larger** is the cell than the single chromosome?

Put a ring around the correct option.

3 **30** **100** **1000** **[1]**

Although mathematical skill 2h ('Make order of magnitude calculations') is assessable at Foundation Tier, Questions 6 (d) (i) and (ii) proved challenging for candidates. While well over a third of candidates selected the correct answer for part (i), which is commendable, far fewer candidates selected the correct answer for part (ii). The most commonly seen incorrect answer in part (ii) was 100, which proved to be a strong distracter as multiplying the width of the chromosome (0.01 μm) by 100 does give the width of the cell (10 μm).

Question 7 (b)

(b) The process of cellular respiration takes place continuously in plant cells.

Explain why it has to take place continuously.

....

.... **[1]**

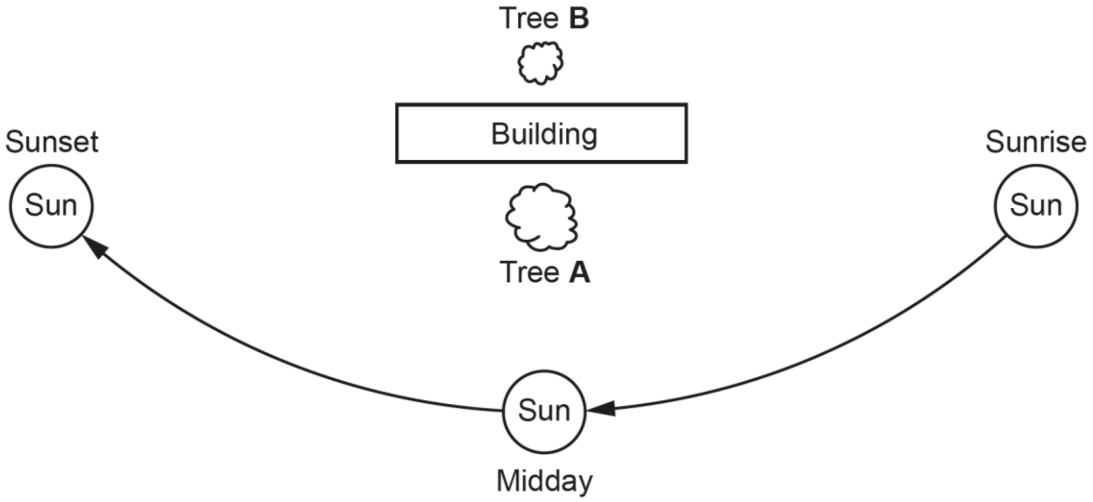
Most candidates attempted this question, which assessed their understanding of specification statement B4.1.2. Few suggested that respiration was required to provide energy or ATP. Many suggested that it was required to 'keep the plant alive', which was not specific enough for the mark.

Question 7 (c)*

(c)* There are two trees growing next to a building.

- Tree **A** is growing on the sunny side of the building.
- Tree **B** is growing on the shadier side of the building.
- Tree **A** has grown larger than tree **B**.

The map shows the positions of the trees and the building. It also shows the movement of the Sun from sunrise to sunset each day.



The two trees are the same species and were planted as seeds at the same time.

Explain why tree **A** has grown larger than tree **B**.

....

....

....

....

....

.... **[6]**

Candidates responded well to this 6-mark question that required them to apply their knowledge and understanding of photosynthesis. Most were able to score marks in Level 1 (for explaining the different in the amount of light received by the two trees) and Level 2 (for explaining how this would affect the amount of photosynthesis and therefore growth in the two trees). A minority of Foundation Tier candidates achieved Level 3 (by linking the amount of photosynthesis to the amount of cellular respiration that could take place in the two trees), following on from the ideas about cellular respiration in the previous two parts of Question 7.

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