



GCSE

Combined Science: Trilogy

8464/B/2F Combined Science: Trilogy Biology Paper 2F

Report on the exam

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Overview

This paper is one of the six examined components for Combined Science: Trilogy. All of these papers follow a similar structure and test the same assessment objectives.

This paper has 70 marks available to students and is made up of six questions.

- Approximately 40% of marks assess AO1; 40% of marks assess AO2; and 20% of marks assess AO3.
- Approximately 60% of marks target Low demand and 40% of marks target Standard demand.

Questions 5 and 6 on this paper and questions 1 and 2 on the Higher Tier paper are common. These questions are identical and are targeted at standard demand.

Questions are set at two levels of demand for this paper:

- **Low demand** questions are designed to broadly target grades 1–3.
- **Standard demand** questions are designed to broadly target grades 4–5.

A student's final grade is based on their attainment across all six papers.

Summary of overall performance

There were significant gaps in knowledge and understanding evident on the Foundation tier. Skills such as describing the trends in a graph and use of the Punnett squares appeared to be areas of strength.

Students occasionally used the word 'it' in their responses in ways that were not clear enough to award marks. See the guidance on page 4 of the mark scheme.

The questions that were common with the Higher tier proved quite challenging for students on this paper, particularly question 06.5, worth 6 marks. Many students demonstrated confusion between genetic modification and selective breeding. In this question, and other questions requiring prose, it was common for students to repeat the information given in the question and not add anything extra.

For mathematical skills, conversion between units (centimetres and metres) and how to calculate area were common errors. Many students demonstrated confusion between mean, mode and median.

Question 1 (low demand)

- 01.1** The vast majority of students could identify that the cell membrane controls the movement of substances into and out of cells.
- 01.2** More than half of the students could identify that the allele would be dominant.
- 01.3** More than half of the students correctly selected 'heterozygous' as the term that describes the genotype Bb.
- 01.4** Most students could interpret the question and use the Punnett square. The Punnett square had been partially completed to reduce the demand of this question. Where students made an error in their choice of gamete for Parent 1, they could still gain the 2 derivation marks using their incorrect gamete. The derivation marks could only be given if the derivation matched the gamete given by the student.
- 01.5** Students were told that cystic fibrosis is caused by a recessive allele, so the question tested their application of this fact to their Punnett square. The percentage had to match the derivations given in question 01.4. If no derivations were attempted in question 01.4, then an answer of 25% was awarded the mark.

01.4

Two people plan to have a child.

Both people have the genotype **Bb**.

Complete **Figure 1** to show the possible genotypes of the child.

[3 marks]

Figure 1

	Parent 1	
	B	b
Parent 2	B	BB
	b	bb

01.5

What is the chance that a child of these parents will have cystic fibrosis?

Use **Figure 1**.

[1 mark]

Tick (✓) **one** box.

0% 25% 50% 75%

This student gave the correct Parent 1 gamete, but did not correctly derive any offspring genotypes, therefore 1 mark was awarded for question 01.4.

In question 01.5, the student gave a correct percentage from their Punnett square, therefore the mark was awarded.

- 01.6** Most students knew that screening was being described.
- 01.7** Nearly all students knew that mutation is the name of a change in DNA.
- 01.8** The mark scheme required a cause of environmental variation or the result of the cause. Where a student gave a result of the cause as their response, this was only given credit if it is from an environmental cause. For example, a tattoo would be the result of an environmental cause. However, weight, freckles, skin colour and hair colour are all also affected by genetic causes, so a student needed to qualify these to gain credit. Correct examples commonly seen were 'weight because you eat too much' and 'freckles/skin colour from being out in the sunlight'. Despite the prompt in the question *not* to refer to inheritance or to changes in DNA, these were frequently seen.

Question 2 (low & standard demand)

- 02.1** Students found it particularly difficult to label the pituitary gland and adrenal gland. Thyroid gland was commonly incorrectly given for either of these labels. A significant proportion of students could not label the ovary.
- 02.2** Over 50% of students could select 'receptor cells' as the correct response.
- 02.3** Most students knew that insulin is transported around the body in the blood, or correctly named a blood vessel. Some students incorrectly stated that the insulin is transported by red blood cells.
- 02.4** Fewer than 50% of students knew that the liver is the target organ of insulin.
- 02.5** Most students knew that glycogen is a store of glucose in human cells.
- 02.6** The majority of students could read the two values from the graph and calculate the increase. The most common incorrect answer was 11, where students had not appreciated the question asked for the change in blood glucose concentration. The word 'change' was emboldened on the question paper to try to avoid this error from occurring.
- 02.7** There were many ways to describe the trend between blood glucose concentration other than the words used on the mark scheme. For example, 'up, then back to normal', or 'up then down' or 'up and down' each gained 2 marks.

Credit was given whether the student was referring to all three people or to just one person.

Reference to 'a peak' was taken as equivalent to increase and awarded the first mark. Therefore, 'after a peak it decreases' was worth 2 marks.

Some students found it difficult to describe the decrease. 'After 60 minutes it decreases' is the correct idea so was given the mark. Simply stating as part of their answer, 'then it drops' was also equivalent to 'then decreases'. However, 'then it relaxes', 'then it releases' or 'it decreases' unqualified was insufficient.

02.8 The mark points were independent. More students gained the first mark than the second. Despite the prompt in the question, many students made no reference to insulin.

Some students used the word 'it', such as 'it goes high'. Given the way the question was phrased, 'it' was taken to mean insulin, unless qualified. Note the guidance on page 4 of the mark scheme.

Many students have the misconception that insulin is broken down to produce glucose. Other students appear to have misinterpreted the graph as showing concentration of insulin.

0 2 . 8 A student concluded:

'Person A has diabetes'.

Explain how **Figure 3** supports the student's conclusion.

You should refer to insulin in your answer.

[2 marks]

person A's blood glucose concentration is much higher than person B and C due to having more insulin than the other two

Marking point 1 was awarded, but the reference to insulin is incorrect, so the second mark cannot be given.

02.9 Most students knew that more exercise is an appropriate lifestyle change for a person with Type 2 diabetes.

References to diets were often too vague, such as 'go on a diet' or 'eat healthy food'. The specification should be used to guide the level of detail required.

Many students incorrectly stated that the person should inject insulin or have an insulin pump. These are not lifestyle changes.

Question 3 (low & standard demand)

03.1 Most students could suggest why fast reactions are important for car drivers.

Responses that restated the question, such as 'fast reactions are important', or 'to be alert' were not sufficient. Some students misinterpreted the question and explained how they could get to where they were going faster by driving quickly, which was incorrect.

03.2 The most common error was to confuse the independent and dependent variable.

03.3 Most students could identify that it was a problem that the student may catch the card between scores.

03.4 Most students could plot the point correctly.

03.5 Many students could give the mode. Some students attempted calculations in the answer space, which were not needed to answer the question. In most cases, these students were attempting to calculate the mean or median.

03.6 Approximately half of the students selected the correct response that reaction time stayed the same.

03.7 Many students gave the idea of repeats, or using a wider range of different sleep times.

In most cases, incorrect responses were suggesting other independent variables that could be changed, such as drinking different caffeine drinks before the test. Other students incorrectly stated that all the students should sleep for the same length of time or that a stopwatch should be used.

03.8 Few students could state an adaptation of the motor neurone cell. The most common correct answers were 'long' or 'attached to muscle cells'. Explanations of the adaptation were very rare.

A frequently seen misconception was that the muscle contracts and then a signal is passed to the motor neurone. Few students referred correctly to an impulse.

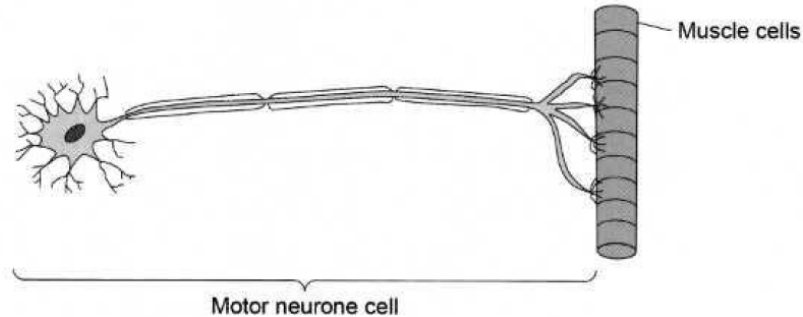
Misconceptions that were frequently seen included:

- neurones transport energy
- the motor neurone tells muscle/brain what to do
- the motor neurone sends messages
- the cell can move
- the cell has a large surface area
- the cell pulls the muscle
- the cell has a tail/arm/leg/stem.

0 3 . 8 Motor neurones are involved in reactions.

Figure 7 shows a motor neurone.

Figure 7



Explain **one** way the motor neurone cell is adapted for its function.

[3 marks]

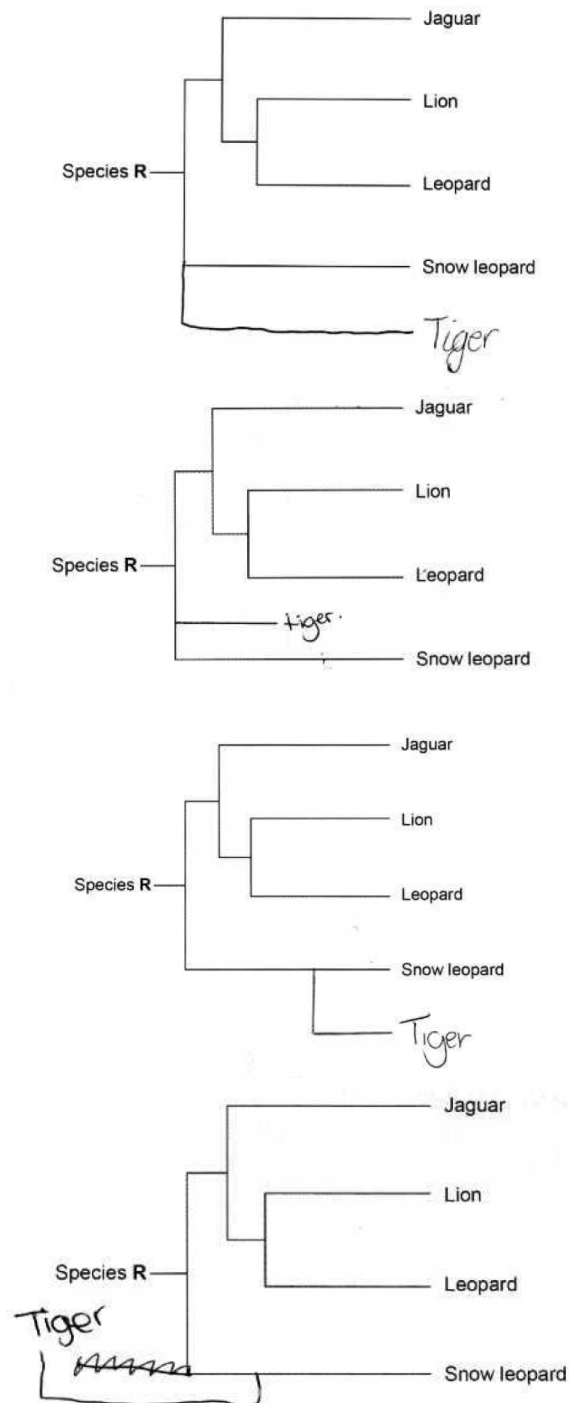
Motor neurone cells are long in length so that messages being sent around the body can happen quickly and efficiently. Their length means they can travel longer distances so messages to the CNS can happen as fast as possible.

The student gained 1 mark for 'long'. The misconception here, that the motor neurone is sending impulses, was frequently seen. In this instance, the student also refers to 'impulses' as 'messages', which is insufficient. The misconception that the impulse is travelling from the muscle, as demonstrated here, was also common.

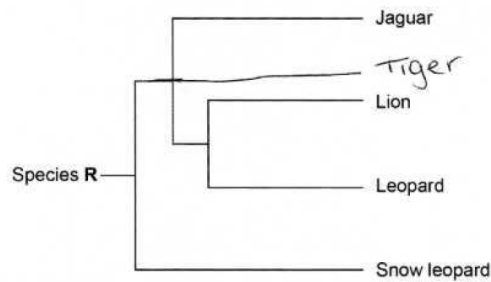
Question 4 (low & standard demand)

04.1 Most students could interpret the evolutionary tree correctly.

04.2 Most students could add the line and label to the Figure. Students who did not score the mark did not label their line or labelled it incorrectly, 'lion' being frequently used. Other incorrect responses linked their line with other lines on the diagram.



The above examples were correct, even the fourth example despite reading right to left.



This response is incorrect.

- 04.3** The majority of students could identify what ‘species R’ represented.
- 04.4** Most students knew that evolution occurs by the process of natural selection.
- 04.5** Many students could give two possible causes of extinction. The most common correct responses described predators or lack of food or loss of habitat.
- 04.6** Most students expressed their answers in line with marking point 1 or marking point 4, with the majority saying to compare old species with those of today or seeing what they used to look like. Alternatively, for the first marking point students responded ‘to see what animals there used to be before they became extinct’.

There was confusion evident in answers, with many students referring to what fossils are or references to history, what life was like in the past or how big/old the fossils were. Some students referred to fossils showing the skeletal structure but didn't compare it to the structure of the species today or discuss any change that could be seen between different fossils.

There were also many responses that referred to fossils being hundreds or thousands of years old or giving us knowledge of species that existed thousands of years ago, which is a misconception regarding geological time.

- 04.7** Rarely did students score 3 marks for this question, indicating that the process of evolution was not clearly understood. Students frequently linked:
- A to E or E to C
 - B to A was less frequently linked.

Some students also included D in their responses even though D had already been given as the first stage.

- 04.8** More than 50% of students gained both marks here. A significant number of students only ticked one box, or ticked more than two boxes.

Question 5 (standard demand)

05.1 Many students could give the food chain in the correct order with appropriate arrows showing the flow of energy. Responses that used commas or hyphens, rather than arrows, did not gain the mark. Some students tried to give extra information, such as identifying the producer and primary consumer, but this was not required.

05.2 Students demonstrated problems converting from centimetres to metres. Responses often stated that $50 \text{ cm} = 5 \text{ m}$.

Calculation of area was sometimes a challenge, with frequently seen responses such as $50 + 50 + 50 + 50 = 200$, indicating confusion between area and perimeter.

Students were most frequently awarded just the first mark, for $(50 \times 50 =) 2500$. Most then divided 2500 by 100 or 1000 to give an incorrect answer.

05.3 Marks were often awarded for allowing error carried forward from the previous question.

Many students only calculated 2% of the area of the shore and then stopped. Therefore, only the first mark was awarded.

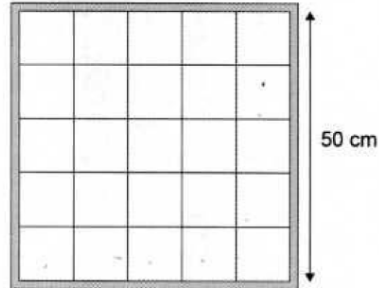
Some students who did not gain marks had attempted to calculate 2% of their answer to the previous question, indicating they had not understood the context.

Students estimated the population of limpets on a sea shore.

The students were given a square quadrat.

Figure 10 shows the quadrat.

Figure 10



0 5 . 2 Calculate the area of the quadrat in m^2 .

[2 marks]

$$50 \times 50 \text{ cm}$$

$$\text{Area of quadrat} = 2500 \text{ m}^2$$

0 5 . 3 The total area of the sea shore was 1800 m^2 .

The students sampled 2% of the total area of the sea shore.

Calculate the number of times the students needed to use the quadrat for the 2% sample.

Use your answer from Question 05.2

[2 marks]

$$2\% \text{ of } 2500 = 500$$

$$1/1 = 250$$

$$\text{Number of times} = 50$$

For question 05.2, marking point 1 was awarded.

For question 05.3, the student has attempted to calculate 2% of the quadrat area, which is not a logical approach, therefore no marks can be given.

- 05.4** Most students could give a reason for not throwing the quadrat and gain the first mark. Usually, students stated throwing could be biased. Very few could explain why this was a problem. References to the effect it would have on the population estimate were rare.

Some students demonstrated the misconception that throwing quadrats is an appropriate sampling method. Others stated that the issue is that the quadrat could sample the same area twice, which was not correct, because that could also occur with a random method.

- 05.5** Some students had knowledge of using a random number generator on their calculator or phone and could describe the use of coordinates on the shore.

Many students incorrectly referred to throwing in random directions or being blindfolded. These are never appropriate methods for sampling. Others demonstrated the misconception that choosing locations with the most limpets would be appropriate. Some confusion between quadrats and transects was seen.

- 05.6** On the Foundation tier, many students gave a risk, such as drowning, rather than a hazard. Common incorrect answers referred to the quadrat being washed away, or gave descriptions of ways to reduce risk, such as 'wear sensible shoes'.

- 05.7** Most students could name one type of pollution that may affect the population of limpets. The most frequently seen answers were plastic and sewage. Common responses that were not awarded the mark were chemicals, crabs and waste.

Question 6 (standard demand)

- 06.1** 30% of students could select that the classification group 'Eukaryota' is a domain.
- 06.2** 50% of students knew that asexual reproduction produces genetically identical offspring.
- 06.3** Just over 50% of students knew that a gamete contains half the number of chromosomes compared to the other cells in a potato plant.
- 06.4** Most students could describe how a new plant species could be identified as being in the same genus as potatoes. DNA analysis or similar characteristics were the most common correct answers.

Misconceptions were seen, such as the idea that the species would have identical DNA. On the Foundation tier, some answers were much too vague, such as 'by testing'.

06.5 Few students appeared to follow the direction of the question, beyond stating that GM crops can be made to grow even if the climate changes. Some students were aware of food insecurity as a result of climate change, and this could be given credit for the idea that current crops will not be able to grow/survive.

Few students made links between climate change and the possible benefits of GM crops. Lists of possible benefits of GM with no link to climate were limited to Level 1. Some students made very good attempts at this question and a few recognised some of the effects of climate change and were able to link these to the idea that current crops would struggle to grow in these conditions. This was an attempt at a logical link and achieved a Level 2 mark.

Some students further developed this idea, and clearly had a grasp of the question being asked, as they then went on to describe how GM would enable crops (or potatoes) to survive the conditions that climate change brings. They could further strengthen their account with suggestions that more crops could be grown or crops could be grown faster. These responses were detailed and logically linked accounts and were therefore Level 3 responses.

Some students wrongly gave explanations of causes of climate change.

06.5

Scientists have collected and stored seeds from species in the same genus as potatoes.

In the future, these seeds may be used for genetic modification of potato plants.

Genetically modified potato plants could help supply food to the human population as the climate changes.

Explain why genetic modification of crop plants may be important for the human population to survive climate change.

[6 marks]

• the genetically modified plants can photosynthesise ~~more~~ better leading to more oxygen in the ~~plant~~ planet as the plants are reducing the carbon dioxide amount

• Genetically Modified plants can grow faster, so providing more food to the population

• Genetically Modified plants can thrive better without the needs that any other plant need.

In the second paragraph, this student has given the idea that GM crops may grow faster and therefore provide more yield. This is indicated on the mark scheme as one idea for a benefit of GM crops in this context. There is no attempt to link this idea with effects of climate change, therefore the response is within Level 1 and 1 mark was awarded.

Contact us

Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

Tel: 01483 477756

Email: gcsescience@aqa.org.uk

aqa.org.uk