GCSE

Combined Science: Trilogy

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

Report on the exam 2023

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Contents

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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 seven 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 6 and 7 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

The questions that were common with the Higher tier proved quite challenging for students on this tier, particularly Question 7, where understanding of how decreasing the rate of antibiotic resistance evolving in bacteria was very limited.

Many students appeared to confuse resistance and immunity. Some students misinterpreted the question and gave descriptions of how antibiotic-resistant bacteria evolve rather than answering the question.

Generally, students found application (AO2) questions that required them to write something, rather than multiple-choice, challenging and many of these questions were not well answered.

Knowledge of the reactants and products of respiration was not well demonstrated.

The questions assessing maths skills in this paper (**01.4**, **05.3** and **05.4**) were generally answered well, with the exception of some graph skills (**02.4**, **03.3**, **03.4**, **03.5** and **05.5**).

The use of poorly phrased sentences and imprecise language lead to a lack of clarity in many responses. For example, reference to just 'healthiness' in **04.6**, **05.9** and **06.5** was insufficient.

Question 1 (Low demand)

01.1 Students were asked to identify why peat is removed from peat bogs. One-third of students were able to do this.

01.2 The most common correct answer for the name of one type of organism that causes decay was bacteria. Frequently seen incorrect responses included insects, or named insects. Either the question was not well read or there was frequent confusion that a gas was an organism, with various gases being named, perhaps as a result of question **01.3**.

01.3 The most common error was to confuse oxygen and carbon dioxide as a product and reactant in respiration, but all combinations of the words in the answer spaces were seen.

01.4 50% of students could identify how the percentage could be calculated.

01.5 Many students could state the reason as climate change or global warming. Incorrect or insufficient answers included 'they are melting', 'because they are decaying' (both of which are simply rephrasing what has been given in the question and not creditworthy), 'people are taking peat' and 'we aren't making them anymore'.

Some students had made the correct connection between the reduction of frozen peat bogs and temperature but were not awarded the mark as they had just said that temperature 'changes' or has 'changed over the years' which was insufficient as the 'change' could be colder temperatures.

01.6 Over 50% of students could identify two activities that decrease the area of land available for other animals and plants.

Question 2 (Low demand)

02.1 20% of students could correctly identify which variable was a control, independent or dependent variable for 3 marks. A further 40% gained 1 mark. The most common correct answer was for the control variable.

02.2 50% of students could correctly identify an improvement to the method.

02.3 Although the context of the investigation was a novel application of the required practical activity, many students had no difficulty applying their knowledge of the effects or practice and familiarity to answer the question. Few students mentioned distractions. References to simply repeating were insufficient (and just repeated part of the question). Being focused / alert / prepared were considered insufficient because these ideas could equally apply the first time the student undertook the test.

02.4 Students were asked to label the *y*-axis. Axes labels should enable anyone viewing the graph to make sense of the results. Therefore, simply labelling the *y*-axis 'y-axis' is insufficient. The label should include the unit. The brackets on the mark scheme indicate what was considered essential for the label, therefore 'Time / ms' was the minimum requirement.

The bars could be in either order. Some students confused the labels on the two bars. Students should be encouraged to use a ruler to draw bar charts. Those who drew the bars freehand were sometimes out of tolerance on the height of the bars.

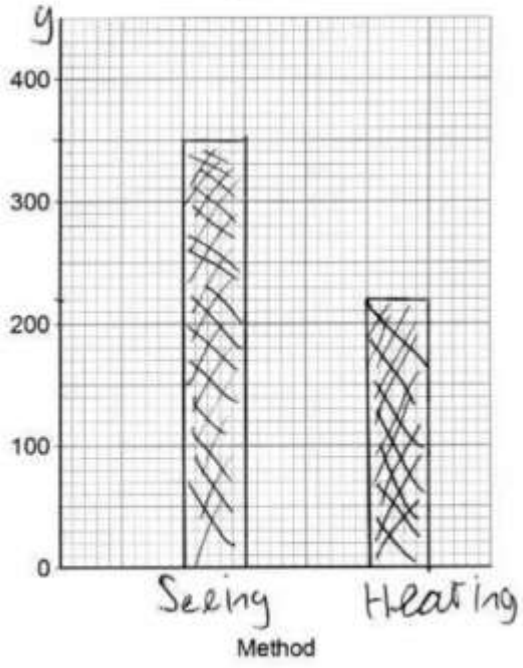
0 2 . 4 Complete **Figure 2**.

You should:

- plot the data from **Table 2** as a bar chart
- label each bar
- label the y-axis.

[2 marks]

Figure 2



The student has simply labelled the axis 'y' therefore marking point 2 cannot be awarded. The labels for the bars and the height of the bars allow marking point 1 to be awarded.

02.5 There are many ways that students could make a correct comparative statement about the two reaction times. Some students incorrectly stated that the reaction time when seeing was faster. This continues to be an issue, with students equating a larger number with 'faster'.

Unless stated otherwise by the student, we assumed the answer referred to reaction time when seeing the stimulus. This is due to the way the question is phrased. Therefore, 'it' was taken as the reaction time when seeing the stimulus, unless otherwise stated.

It is equally valid for students to give the converse argument, but only if clearly relating that argument to hearing. Therefore, 'They heard it quicker than they saw it' was acceptable.

0 2 . 5 Compare the reaction time when seeing the stimulus with the reaction time when hearing the stimulus.

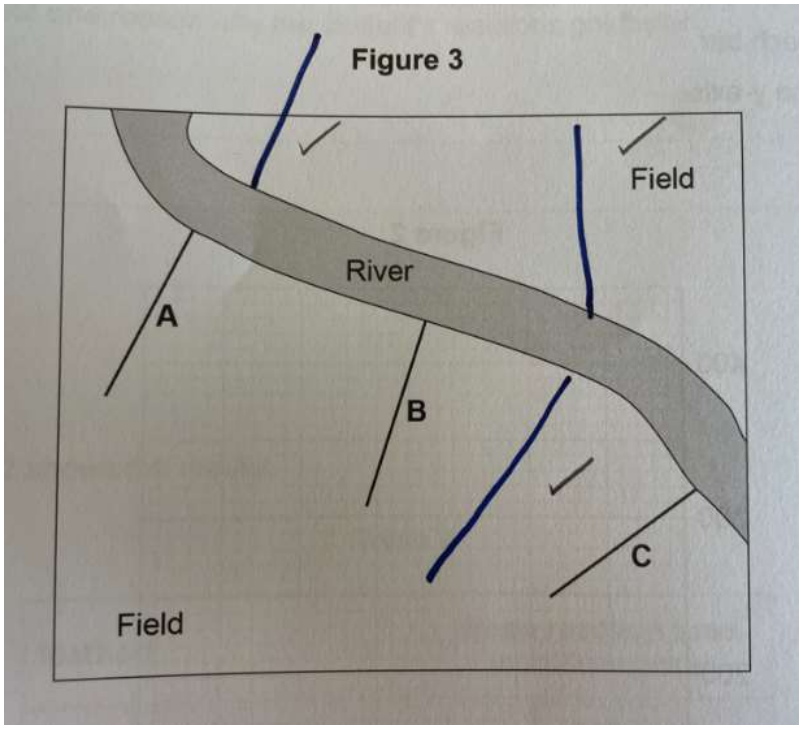
[1 mark]

There is about 130 milliseconds differences between seeing and hearing.

The student has calculated the difference in reaction time, but the mark is not awarded because they have not stated which reaction time is greater / smaller.

Question 3 (Low and Standard demand)

03.1 Many students could identify where to place a fourth transect for this investigation. Students could draw their transect either side of the river. Transects parallel to the river were incorrect. A significant number of students misunderstood the aim of the investigation and instead connected the existing three transects.



The three lines on the image above are examples that were acceptable for 'approximately perpendicular to river'. Note that we have ticked each line to indicate the lines have been drawn. The lines could be drawn by hand or with a ruler and could extend beyond the boundary of the image (as shown in the top left). Lines that extended well into, or across, the river were incorrect.

03.2 The majority of students knew that a quadrat was required.

03.3 Most students could interpret the graph to state the correct mean. Some students attempted to calculate the mean of the mean at each distance, which was incorrect.

03.4 Due to the way the question was phrased, we assumed 'it' referred to the plant species. Many students could state that the mean number of plant species increased further from the river. This was expressed in a variety of ways. 'Wider range / diversity' or 'bigger / higher numbers' or 'bigger / higher mean' all gained the mark. A simpler response such as 'There are more' or 'We see more plants' was also sufficient for the mark.

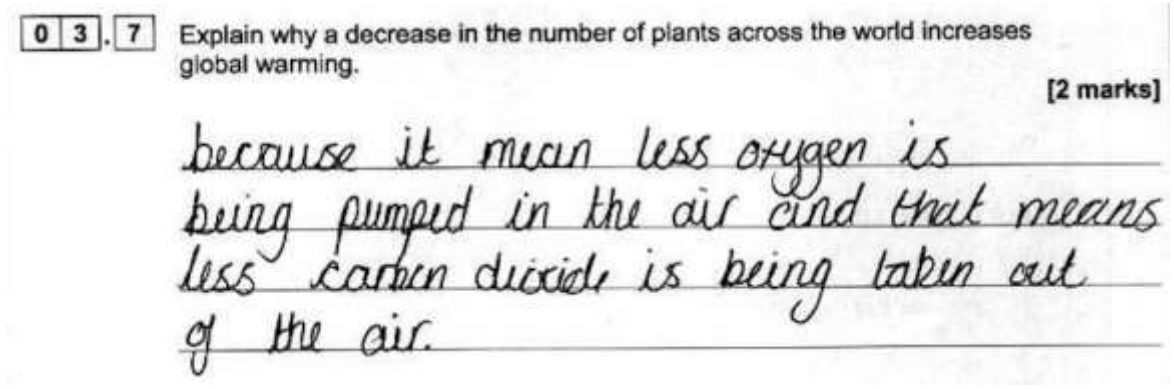
A significant number of students misunderstood the question and attempted to explain rather than describe the effect of moving away from the river.

03.5 40% of students could identify why it is useful to know the range of results.

03.6 50% of students could identify two abiotic factors from the list provided.

03.7 Some students could state that plants use carbon dioxide during photosynthesis. This was awarded 1 mark (in the absence of either marking point) but was insufficient to answer the question fully.

A common misconception was that global warming is linked to the oxygen concentration in the air. Incorrect references to ozone were also frequently seen. There were incorrect references to plants 'breathing' and respiration was sometimes stated as the process involved.



0 3 . 7 Explain why a decrease in the number of plants across the world increases global warming.

[2 marks]

because it mean less oxygen is being pumped in the air and that means less carbon dioxide is being taken out of the air.

Many students made an incorrect link between oxygen and global warming. Marking point 1 was awarded here but with no reference to photosynthesis, decay or burning marking point 2 could not be awarded.

Question 4 (Low and Standard demand)

04.1 The most common correct answer was ‘kingdom’. Many students had a lack of knowledge of the difference between genus and species and hence frequently had these placed incorrectly in reverse position.

04.2 The majority of students could identify the correct food chain.

04.3 Few students knew what the arrows in a food chain represent, with many ticking ‘the predators in the food chain’.

04.4 Most students could identify the next stage in the process of selective breeding.

04.5 70% of students could identify when the process of selective breeding is finished, but a significant number thought it was finished after one generation have produced offspring.

04.6 The most common correct statements were:

- do not have to remove lice
- more likely to be bought
- not off-putting to customers.

Very few students referenced that antibiotics would not be required or that pesticides were not required.

The health or safety of the consumer being compromised was a common theme of many student responses that did not gain credit. Likewise, salmon are 'healthier' was a common statement that was too vague.

04.7 70% of students could identify a disadvantage of selective breeding.

04.8 Answers needed to be comparative to give an advantage of farming GM salmon instead of non-GM salmon. Many students simply copied the information provided, which is never given credit. For example, ‘The GM salmon **cost less to feed**’ was creditworthy, but an answer stating ‘The GM salmon need 25% less food to get to the same size’ would not be creditworthy since that information was given in the question.

Other fish farmers have produced genetically modified (GM) salmon.

GM salmon grow large enough to sell in 18 months.

Non-GM salmon grow large enough to sell in 3 years.

GM salmon need 25% less food than non-GM salmon to get to the same size.

0 4 . 8 Suggest **two** advantages of farming GM salmon instead of farming non-GM salmon.

[2 marks]

1 grow large enough to sell in 18 months

2 25% less food than non-GM salmon to get to same size

0 4 . 8 Suggest **two** advantages of farming GM salmon instead of farming non-GM salmon.

[2 marks]

1 Spending less money on food

2 grow quicker so you can sell them quicker

The first response only repeats the information given in the question, therefore no mark was awarded. The second response gained 2 marks for bullet point 2 and bullet point 3.

04.9 70% of students could identify the risk of GM salmon breeding with wild salmon.

Question 5 (Low and Standard demand)

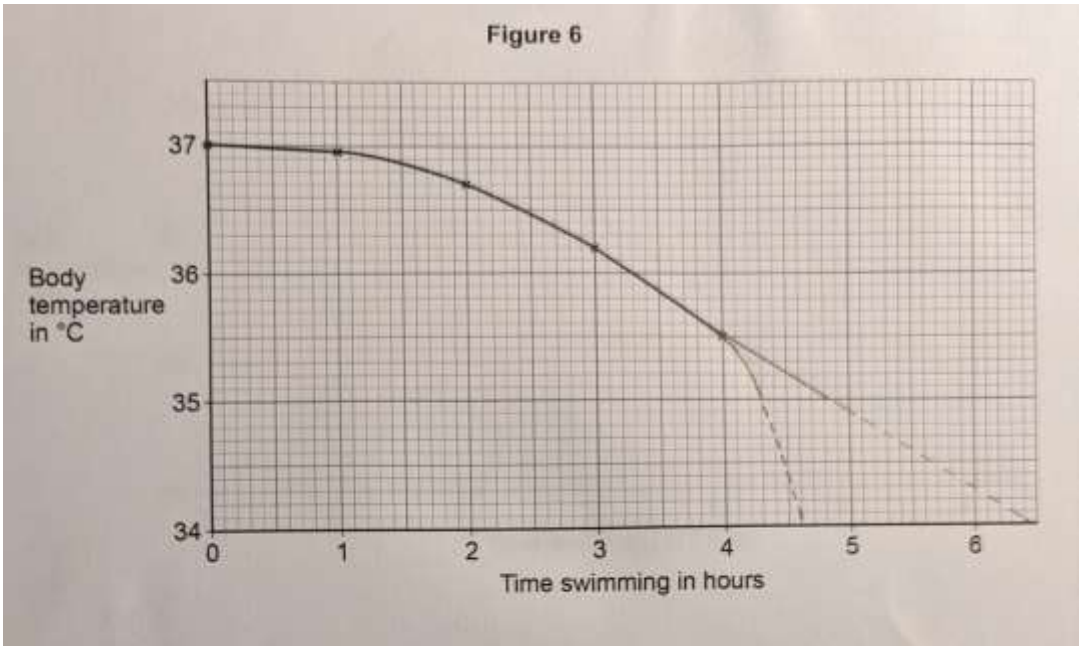
05.1 Most students gained 2 or 3 marks. The most frequent error was to link 'Receptor' with 'Changes air temperature outside the body'.

05.2 40% of students could identify why homeostasis is important.

05.3 Most students could describe the trend as a decrease in temperature. Some students misinterpreted the graph as lower temperature causing longer time.

05.4 Most students could read the relevant values from the graph and subtract the values.

05.5 There was a generous tolerance on extrapolation lines, from appropriately curved to straight.



The illustration above shows the acceptable limits for the extrapolation line, which needed to reach 35 °C. Small imperfections were acceptable, but lines could not be too thick, wobbly or sketchy to allow a reading to be taken. Extrapolation of the line below 35 °C was ignored (as shown by the dashed lines above).

Where extrapolation lines were drawn most were acceptable and gained credit.

The mark scheme for marking point 2 details how this was marked if no extrapolation line was drawn, but in that instance **only** marking point 2 was awarded. Of the large number of students who did not draw a line many still scored a mark for predicting a suitable result, usually 4.5 hours.

Of those who did draw a line about half correctly read their result at 35 °C, and about half gave a different answer of 5 or 6 hours, which did not match to their graph line.

05.6 Most students knew that insulin is produced by the pancreas.

05.7 Very few students knew that the endocrine system is the name of the system involving hormones. Many incorrect answers were seen, such as glands, nervous, reproductive, stomach, capillaries, intestines and brain.

05.8 There was considerable confusion over the function of an increased insulin concentration, with only 55% of students choosing the correct option.

05.9 The most common correct answer was obesity, although the full range of other acceptable responses, as shown in the extra information on the mark scheme, was seen.

Many students misinterpreted the question and believed it was asking for a future risk if a person has Type 2 diabetes. Thus, common responses such as ‘coma’, ‘CHD’ and ‘high blood glucose level’ were frequently seen and did not gain credit.

Those that did read the question correctly generally gave ‘obesity’ to gain the mark. Specific types of eating or diets such as those high in fats or sugar were acceptable, but vague terms such as bad / poor / unhealthy diets or ‘eating junk food’ were not accepted.

Question 6 (Standard demand)

06.1 Phonetic spelling was allowed, and variations of many phonetically correct spellings were seen. Hybrid terms between meiosis and mitosis were not credited. The list principle was applied when students stated both meiosis and mitosis. See page 4 of the mark scheme for an explanation of how lists within responses are marked.

Whilst mitosis was a common error, there were many students who simply put any word that they could relate to sexual reproduction such as fertilisation, ovum, sperm, hormones.

06.2 Few students could give two reasons why sexual reproduction causes variation in the offspring. Marking point 2 was seen more frequently than marking point 1.

Responses that did not gain credit only referred to the offspring having different characteristics, such as eye colour.

For marking point 1 we were looking for the idea of variation in gametes from one parent, or for the variation in gametes more generally, such as ‘the genes from the egg and sperm are different’. The word genetically was bracketed and therefore is not required, but could not be contradicted, such as ‘the egg and sperm look different’. We cannot put every variation of how students could phrase this in the mark scheme. For example, the mark scheme allowed ‘cells produced by meiosis are not identical’, so if a student wrote ‘cells produced by meiosis are different’ that was also worth the mark.

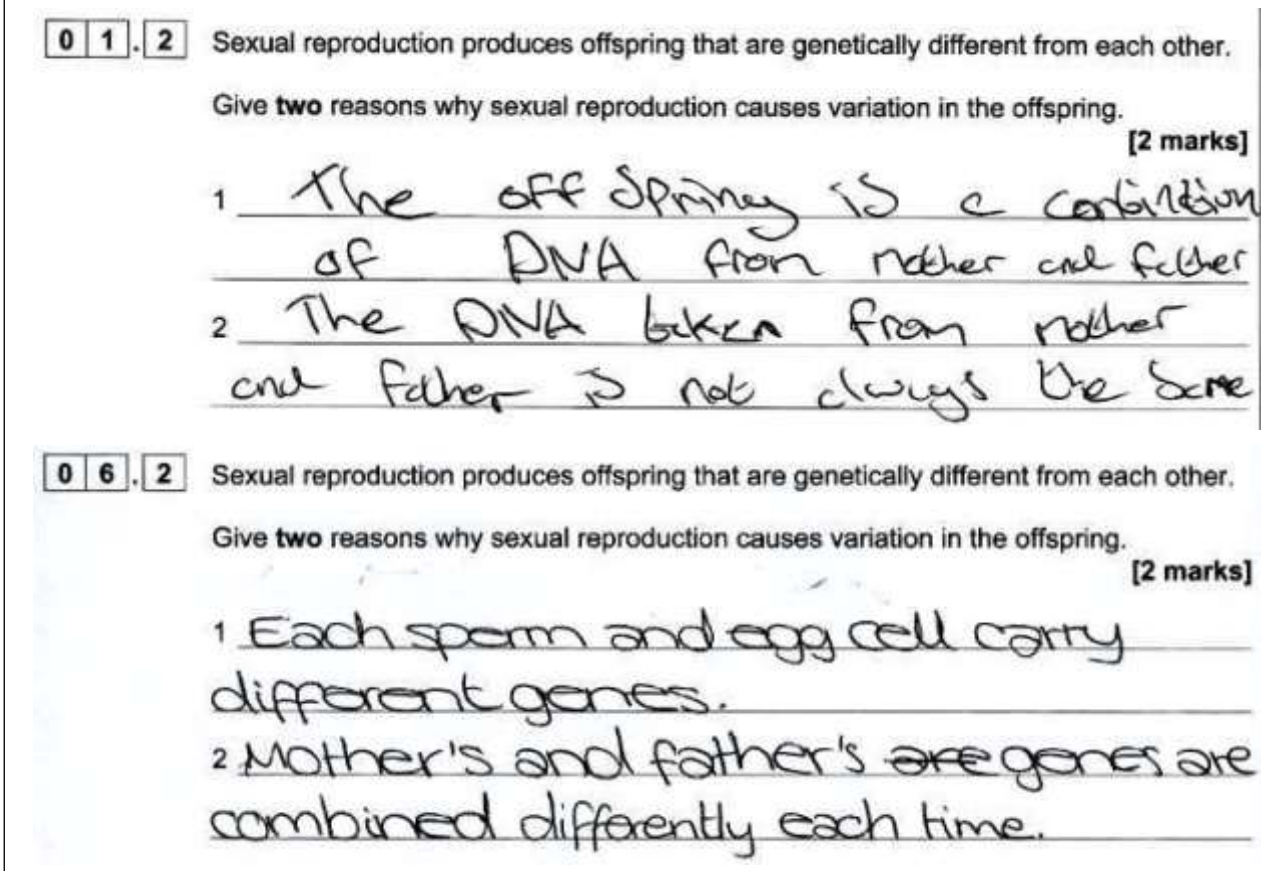
A few students referred to chromosomes crossing over in meiosis. This was a correct response that is beyond the specification and scored marking point 1. There is no expectation for teachers to teach this idea.

We did not credit vague answers that were open to different interpretations such as:

- egg and sperm contain 50% DNA
- half is from mother, half is from father
- genetics is from mother and father
- one gene from each parent.

Errors were seen in some responses that referred to chromosomes. The response needed to be biologically correct to gain the mark. ‘They get chromosomes from each parent’ or ‘Chromosomes mix’ or ‘2 sets of chromosomes mix’ was acceptable. However, ‘2 chromosomes mix’ or ‘pairs of chromosomes come from each parent’ are incorrect. Likewise, ‘2 genes mix’ was incorrect.

There was a fallback mark for ‘mutations’. This mark was awarded only if no other mark was given.



0 1 . 2 Sexual reproduction produces offspring that are genetically different from each other.

Give **two** reasons why sexual reproduction causes variation in the offspring.

[2 marks]

1 The off spring is a combination of DNA from mother and father

2 The DNA taken from mother and father is not always the same

0 6 . 2 Sexual reproduction produces offspring that are genetically different from each other.

Give **two** reasons why sexual reproduction causes variation in the offspring.

[2 marks]

1 Each sperm and egg cell carry different genes.

2 Mother's and father's ~~are~~ genes are combined differently each time.

The first response (from a Higher tier paper) gave marking point 2 twice, therefore only 1 mark was awarded. The second response (from a Foundation tier paper) gave marking point 1 and marking point 2 for 2 marks.

06.3 This was very well answered. Phonetic spelling was allowed. See page 5 of the mark scheme for information on marking phonetic spelling.

06.4 On the Foundation tier, few students achieved all 5 marks, but partial credit was given frequently, such as correct derivation from incorrect gametes.

On the Higher tier, most students could complete the Punnett square and state the probability of the child having polydactyly. However, few students identified which offspring genotype would result in polydactyly. This could be indicated on any or all offspring, with a circle, line, key or label or any other clear method of identification.

06.5 Clear responses most frequently knew that embryo screening enables us to find out whether an embryo has an inherited disorder. Some confusion was seen between the term disorder and the terms diseases or disabilities.

Many responses were vague, such as 'to see if the embryo is healthy'. Some incorrect responses incorrectly implied that embryo screening is ultrasound screening.

Very few students took the marking point 4 approach of the implications to the population over time.

A general misconception was that embryo screening is the same as genetic counselling, so students referred to finding out the likelihood of the embryo having an inherited disorder. The misconception that embryo screening can change DNA or treat inherited disorders was also seen.

Question 7 (Standard demand)

07.1 In this question students were asked to identify why the percentage of species that are extinct is only an estimate. Over 85% of students gave the correct answer.

07.2 Most students could state that fossils or DNA are used as evidence to study species that have become extinct. References to fossil fuels were seen and did not gain credit. A few students misread the question and gave details of the reasons why species become extinct instead.

07.3 This was an 'extended response' style of question. Such questions are marked holistically. There are overall generic descriptions for the three levels of response at the top of the scheme, giving a hierarchy of response. Within each level there are 2 marks.

In this question, students were asked to explain how the evolution of an antibiotic-resistant bacterium could be slowed down. As students were asked to explain how this could be done, it was necessary to link suggested actions with reasons in order to achieve higher level marks.

The question was not asking how antibiotic-resistant bacteria evolve in the first place and neither was it about genetic engineering.

Students achieving Level 1 gave simple unconnected but appropriate suggestions such as 'isolation of infected people' or 'don't use antibiotics when not necessary'. To enter Level 2 there had to be evidence of at least an attempt at linking an idea with the underlying reason(s) behind it together with some limited but additional relevant information. To enter Level 3 students had to make several appropriate points as well as show at least one clear, logical link.

The most frequently seen suggestion was that patients should complete courses of antibiotics. This was often correctly linked with the need to kill all *C. difficile* but fewer answers then went on to say that none would therefore (survive and) mutate to form resistant strains.

Simple rewording of the question did not gain credit. Answers that simply said 'so the bacteria would not be able to evolve and become antibiotic resistant' added nothing else to be credited.

Other points that were commonly made included references to isolation of patients and to hand washing. The question context here was of infection of the digestive system by *C. difficile* and, therefore, suitable qualification of hand washing, such as 'after going to the toilet' or 'before preparing food' was required in order for a strong, reasoned link to be credited. Vague answers relating to 'good hygiene' only were insufficient. Some students thought that diet and exercise would kill the bacteria.

Several students made references to doctors not prescribing antibiotics inappropriately but few students went on to explain why. Similarly, the reason for not using antibiotics for mild infections – 'the body's own immune system can respond effectively' – was rarely seen. Students do seem to appreciate, though, that antibiotics cannot kill viruses and so a mention of this linked to no antibiotics being used in such cases often gained credit.

Some answers suggested that new antibiotics might be developed but the idea that antibiotics can be made 'stronger' is incorrect. As with the point about completing courses of antibiotics, the advantage of a new antibiotic would need to be linked to 'all *C. difficile* being killed' or 'none could survive to mutate' in order to gain credit for a linked statement.

Some students commented on developing a vaccine against *C. difficile* but very few then managed to link this to an explanation.

The indicative content in the mark scheme can never cover all ideas that are worthy of credit, but are there to guide examiners. Other ideas such as 'Treatment with several antibiotics at the same time to kill all of them' was another appropriate method with linked explanation.

Many students referred to 'it' it their answer. Sometimes this meant antibiotics and other times this meant bacteria. We always read for context to make sense of the term 'it'.

'Immune bacteria' was not an acceptable alternative to resistant bacteria. It was assumed that bacteria referred to in a response meant *C. difficile*.

0 7 . 3 A bacterium called *Clostridioides difficile* (*C. difficile*) can infect the human digestive system.

C. difficile can multiply and produce toxins. The toxins cause diarrhoea.

Doctors are concerned that new strains of *C. difficile* may evolve.
Antibiotics may **not** be able to kill these new strains.

Explain how the evolution of antibiotic resistant *C. difficile* can be slowed down.

[6 marks]

the evolution of the antibiotic resistant C. difficile can be slowed down by getting people who have it on the antibiotics instantly and make sure they take the full course correctly. Another way to stop the evolution from happening so quick is by quarantining people who have it or have been near someone who had it to stop it spreading and developing fast. also staying out/away from lots of heat as that lets bacteria multiply faster.

The student (from a Foundation tier paper) has given bullet point 7 and then linked bullet points 14 and 15 from the indicative content. This exceeds the minimum requirement to meet the Level 2 descriptor, but does not meet the Level 3 descriptor, therefore 4 marks were awarded.

0 2 . 3 A bacterium called *Clostridioides difficile* (*C. difficile*) can infect the human digestive system.

C. difficile can multiply and produce toxins. The toxins cause diarrhoea.

Doctors are concerned that new strains of *C. difficile* may evolve. Antibiotics may **not** be able to kill these new strains.

Explain how the evolution of antibiotic resistant *C. difficile* can be slowed down.

[6 marks]

Evolution of antibiotic resistant C. difficile can be slowed down if the overuse of the antibiotics used to treat this bacterial disease, is reduced by taking precautions. These might be ~~that it~~ making the rules for its prescription more strict and actually having the regulations properly in place.
Another way is to encourage people to use full course of their antibiotic treatment even if the symptoms are relieved, because ~~they~~ when it is not used fully, ~~antibiotics~~ bacteria that's left alive can reproduce and develop resistance to the drug which is what might cause it to evolve.
Also for lighter symptoms, if it is not serious, it might be better for the body to overcome the bacteria by itself to not introduce ~~over~~ the drug to the bacteria.

The student (from a Higher tier paper) has given bullet point 1 from the indicative content. They link bullet points 7 and 8. In the final paragraph they link bullet points 3 and 4. This exceeds the minimum required for the Level 3 descriptor, therefore 6 marks were 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