



GCSE

Combined Science: Trilogy

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

Report on the exam

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Contents

The below table is interactive. You can press the control button click on the title of the question to go directly to that page.

Contents	Page
Overview	4
Summary of overall performance	5
Question 1	6
Question 2	7
Question 3	10
Question 4	12
Question 5	15
Question 6	17

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 40% of marks target Standard demand, 40% of marks target Standard/High demand and 20% of marks target High demand.

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

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

- **Standard demand** questions are designed to broadly target grades 4–5.
- **Standard/High demand** questions are designed to broadly target grades 6–7.
- **High demand** questions are designed to broadly target grades 8–9.

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

Summary of overall performance

Generally, students correctly completed the genetic diagram (Punnett square) in question **01.2**. However, students are often still missing one step in the instructions. In this instance, that was to 'identify any offspring that will have white fur', therefore that mark was the least frequently awarded mark.

Understanding a described method for a required practical is a challenge for some students, as seen across question **03**. This suggests limited experience of practical work for some students. In question **03.3**, responses suggesting throwing quadrats were surprisingly common. As has been included in previous examiner reports, throwing quadrats is never an appropriate method.

Questions requiring mathematical skills were generally answered well, with the exception of the area of the quadrats in question **03.4**. In question **03.4**, students frequently gave incorrect units for area, such as 'm' or 'cm', or made errors attempting to convert metres to centimetres as part of their calculation. Some students made errors when attempting to rearrange the equation in question **03.6**. This was a particular problem for students who tried to make an 'equation triangle' before attempting rearrangement.

Credit cannot be given for students repeating information given in the stem of the question. This was particularly problematic for students in question **04.4** and question **04.5** where students tended to repeat or attempted to paraphrase the information provided, rather than answering the question.

Students are still making the same common error when referring to respiration releasing energy (as part of question **06.4**). Note the statement 'do **not** accept less energy produced / made / created' on the mark scheme. If these responses are seen, that marking point cannot be awarded.

Question 1 (Standard demand)

- 01.1** The most common incorrect answer was a gene linked to 'a fur colour that is seen'. Students seemed to have a better understanding of the meaning of the term genome.
- 01.2** 88 % of students on Higher tier gained 4 or 5 marks.
Those students who were able to put the gametes given in the question stem correctly into the Punnet square generally also achieved 2 marks for the correct derivations. Many students failed to identify the offspring that would have white fur and consequently could not be awarded marking point 4. However, the probability mark was often seen and was awarded if it was correct for the student's derivations.
Some students used the Punnet square incorrectly, with gametes given on the outside of the square and more than four derivations.

The most common error was students using both parent genotypes as Bb.
A number of 50/50 answers were seen despite this being highlighted in previous examiner reports as not being an equivalent probability to 0.5 or 50:50. Some students incorrectly gave the probability as 50, rather than 50% and therefore could not be awarded marking point 5.

- 01.3** This proved a challenging question with only 25% of students on Higher tier gaining one or two marks. Commonly, students tried to answer in terms of dominant and recessive alleles or genotypes, described the inheritance of alleles from parents, or described the different roles of sperm cells and body cells. Few made any reference to chromosomes, and even fewer mentioned meiosis.

A frequently seen misconception was that 'sperm contain half a chromosome', illustrating that some students struggle with the abstract concepts relating to this part of the specification. Incorrect use of terminology was frequent, such as 'body cells are heterozygous, but sperm cells are homozygous'. Another occasional misconception was the idea that body cells contain maternal and paternal genes or chromosomes, but that sperm cells only contain paternal chromosomes or genes.

0 1 . 3 A male rabbit is heterozygous for fur colour.

The rabbit's body cells have the genotype **Bb**.

One of the sperm cells from the rabbit has the allele **b**.

Explain why the alleles in the rabbit's body cells and the allele in the sperm cell are different.

[2 marks]

The sperm cell only contains half of the genetic material needed for an offspring. The egg will contain the other half.

This student has given a typical response that did not contain sufficient detail to gain either mark.

- 01.4** Just over 25% of students correctly gave an answer of 44, and very few gave the correct equivalent answer of 22 pairs. The most common incorrect answers were 21, 22 and 42, although those also frequently seen included 1, 2, 11, 23 and 46.
- 01.5** This question asked for evidence from the figure that the rabbit was female. This was answered very well with many students stating that there were 2 X chromosomes. A few students did not gain the mark because they stated '2 X genes' or '2 X alleles'. Some students recognised the absence of the Y chromosome which also gained the mark.

Question 2 (Standard demand)

- 02.1** The most common answer was oestrogen, with many alternative spellings. The usual rule regarding phonetic spelling was applied. See page 5 of the mark scheme for an explanation of how this is applied. Progesterone was less frequently given and testosterone was given by a few students and was also correct.

Incorrect responses included FSH / LH / other varied combination of letters. The reference to something being 'produced in the ovaries' led some students to respond with 'eggs' instead of a hormone. Glucagon, adrenaline and insulin were very occasionally offered as an answer.

- 02.2** Many students gave correct answers to this question, the responses being evenly split between the two points listed in the mark scheme.

Puberty was often named in relation to bullet point 2 and various secondary sexual characteristics were suggested, the most frequent being 'muscle growth'.

Incorrect answers often arose from not reading the question and giving the name of the hormone released from the testes as testosterone.

Credit was not gained for statements that:

- were too vague such as – 'hair growth', 'helps males develop' or 'sperm' without qualification
- named the hormone rather than its function
- referred to functions of sperm cells rather than of the hormone
- suggested adaptations of sperm cells instead.

- 02.3** Students generally gave appropriate answers here, the most commonly seen correct response being 'protection from sexually transmitted infections'. A significant number also identified the lack of side effects or the accessibility of condoms. Credit was not given for responses which focused only on either how condoms acted as a method of contraception or their relative efficacy.

- 02.4** This was a levelled, extended response question based on hormonal methods of contraception. The command word, 'describe', allowed students to feel confident in answering and many gained high marks.

The suggested indicative content covered both the naming of methods and the key details of those methods.

Students achieving a Level 1 mark had to correctly give at least one point from the indicative content. This could be a named hormonal method, or relevant detail as demonstrated by the indicative content. On the Higher tier, for most students, this a very accessible question.

To enter Level 2 it was necessary to give a greater variety of relevant facts and to correctly identify at least one method with some details about the method. Many students were comfortably able to achieve this level. Usually, Level 2 was accessed by students giving detail of two or more methods, but full marks could be achieved even if only one method was referred to if the level of detail was appropriate.

All points from the indicative content were evident in answers and the full variety of different types of pill and of other appropriate methods was seen. The least commonly referred to ideas were about hormones being released into the blood and about possible effects on cervical mucus or on changes to the uterine lining. It is, however, never necessary for all, or even most, suggested points to be covered for the award of the highest marks.

Many responses included demonstration of:

- good basic knowledge of the different types of hormonal contraception
- the ability to marshal ideas effectively and in a sensible sequence
- inclusion of appropriate detail to answer the question.

Frequently seen aspects of answers that did not gain credit included:

- inclusion of non-hormonal methods such as the condom / sterilisation / spermicides (such reference to non-hormonal methods had no impact on the mark awarded)
- consideration of IVF as a method of contraception
- details of the normal roles of hormones and of their interactions without relating to their significance in contraception
- statements that were too vague such as 'it makes the body believe it is pregnant' / 'it has an effect on' (e.g. eggs being released) or 'it controls' (e.g. FSH production) without any specific creditworthy detail
- evaluation of the efficacy rather than a description of methods as was asked for in the question.

There were a few misconceptions with students stating that the hormones killed the sperm or stopped the sperm entering the egg. Others responded that the contraceptive pill makes the body produce oestrogen / progesterone, rather than 'containing' those hormones. Some students also thought the hormones had a 'rebalancing' effect on the body or gave insufficient answers such as 'the body is tricked into thinking it is pregnant'.

0 2 . 4

Describe how **hormones** are used in different methods of contraception.

[6 marks]

- Patch → releases progesterone and ~~ee~~strogen to stop the egg maturing/releasing. Goes on arm
- IUD → plastic, releases progesterone
- Implant → releases progesterone, lasts up to 3 years, stops egg maturing, goes in your arm
- injection → releases progesterone, stops egg maturing
- the pill → progesterone and ~~ee~~strogen → ingested, stops egg maturing and releasing

Extra space

This student has given five hormonal methods and six details and is therefore, Level 2, 6 marks. The repeated references to hormonal methods releasing progesterone are only credited once.

Question 3 (Standard, Standard/High and High demand)

- 03.1** 75% of students could identify the independent variable in the investigation. Some students achieved this mark for describing the marking point, such as 'different distances', 'length between tree and quadrat' or 'how far the quadrat was from the tree'.

A small number of students copied or closely copied information from the question stem 'number of buttercup plants at different distances from a tree' this negated the mark as both the independent variable and dependent variable have been given. Refer to page 4 of the mark scheme for how the list rule applies in instances such as this.

Common incorrect answers related to the size or area of quadrats (a control variable) and number of buttercups (dependent variable) or 'the tree'. Answers such as 'area the quadrat was placed', or 'different places' were insufficient but seen quite frequently. A few students described distances between trees or distance to buttercup plants which were also incorrect.

- 03.2** Over two thirds of students achieved 3 marks.

Some students missed the instruction to 'count every small square in the quadrat that was **at least half** covered by buttercup plants', despite the emboldening. 10 was the most common incorrect count but within tolerance (as shown on the mark scheme) so was awarded 2 marks if used for the correct calculation. Where students received only one mark it was for correct number of squares, but without a correct calculation. If students used a figure in the range 6 to 10, marking points 2 and 3 could be awarded, even if this figure was not a whole number, such as in the following example.

032

Students counted every small square in the quadrat that was **at least half** covered by buttercup plants.

Determine the percentage cover of buttercup plants **10 metres** away from the tree.

Use **Figure 2**. [3 marks]

$$3 \times 5 = 25$$
$$1+1+1+1+1+1+1 = 7 + 1.5 = 8.5$$
$$8.5 / 25 = 0.34 = 34\%$$

Percentage cover = 34 %

The student has used 8.5 as the number of small squares, therefore marking point 1 could not be awarded, but marking points 2 and 3 were given.

03.3 Marks were most commonly given for size of quadrat and number of quadrats available. Some students misinterpreted 'factors' in the question as biotic or abiotic factors. Many students wrote about avoiding bias and random placement or collecting sufficient data to calculate a mean. Another insufficient answer seen frequently was the idea of placing the same number at each distance.

Responses suggesting throwing quadrats were surprisingly common. As has been included in previous examiner reports, throwing quadrats is never an appropriate method.

Use of a random number generator was not applicable to this question, but many students tried to include this in their answer. Likewise, 'calculate a mean' was a common response that could not be credited.

03.4 Marking points 1 and 2 were the most commonly awarded marks.

Many students missed the prompt that they needed to include calculations which limited their responses and prevented the awarding of marking points 2 and 4. Where students did include calculation of the area of each quadrat, many were giving the unit of area as m or metres rather than m^2 .

Students had difficulty calculating the area of the two quadrats or mathematically comparing the area. Many incorrectly stated that 'quadrat B has double the area', and many attempted unit conversions between metres and centimetres incorrectly.

Commonly seen insufficient answers were relating to the time involved e.g. 'B would be quicker to use', responses about 'B being more reliable' and the idea of 'B counting more plants'.

Marking point 4 was often negated by students misunderstanding the 'not to scale' label on the diagram and referring to B having smaller squares. Quite a few realised B had 100 squares so stated that this would be easier to calculate a percentage which was insufficient for marking point 4.

03.5 Approximately half of students gained one mark, and the other half gained both marks.

03.6 More students gave the answer of 3.5 rather than the correct answer of 105. It was clear that students reaching an answer of 3.5 had forgotten to take account of the information in the stem of the question about the class of 30 students putting **all** their results together. Marking points 2 and 3 could be awarded in this instance. From an answer of 3.5, some students rounded up or down (realising a number of pins must be a whole number). Not rounding, rounding up, rounding down or truncating were all acceptable.

Some students made errors when attempting to rearrange the equation, particularly those who tried to make an 'equation triangle' before attempting rearrangement.

Question 4 (Standard/high and High demand)

04.1 Many students understood the term 'resistant'. However, it was clear that some students did not understand the term 'herbicide'. Some students confused herbicides with herbivores. Misconceptions surrounding herbicides were evident in statements such as 'herbicides can no longer eat the crops' and 'GM crops that are herbicide resistant cannot be eaten by herbivores' and some students confused herbicides with pesticides. Very few students were awarded marking point 1 as they often overlooked the idea that herbicide would be applied (to the crops).

For marking point 2, many students were seen to write that 'GM crops are less likely to be killed by herbicides' but did not then go on to state that the other plants / weeds would be killed. Many students incorrectly believed that maize and GM maize are grown simultaneously in the same field by the same farmer. This demonstrates a fundamental misunderstanding of how GM crops are used. Students need to be careful in their use of the word 'affected' as this was too vague for this marking point. For example, 'weeds are affected'.

Where students described the idea of competition in marking point 3, most were able to name a factor that would be competed for. However, it was very rare to see marking point 4.

Accounts of the steps involved in the process of producing GM plants were not relevant in this question but were seen in answers. In these instances, the students filled the answer space with their description before concluding with a short statement such as GM crops won't be killed. A small number of students went down the route of describing selective breeding instead of answering the question.

04.1

Maize is a crop plant.

A variety of maize has been genetically modified (GM) to be resistant to a herbicide.

Explain how growing GM herbicide-resistant maize can produce a larger yield than growing non-GM maize.

[4 marks]

as the genetically modified (GM) maize is resistant to a herbicide, it means that the maize can be sprayed by the herbicide, causing no damage to the plant but making it so no insects or bugs that will damage the maize, so more maize survives and will continue to produce a larger yield than growing non-GM maize.

This student gains marking point 1 but then continues to incorrectly describe function of the herbicide with a common misconception, so only marking point 1 was awarded.

04.2 This question asked students how growing GM crops decreases the biodiversity of animals. Some students made no reference to animals in their answers at all. Either they did not read the question properly or did not understand what they were being asked. A commonly seen insufficient response was ‘the GM crops are genetically identical’ and some students wrote about monoculture.

Many students failed to use the word herbicide correctly in this answer and as in question **04.1**, a lack of understanding of the word herbicide proved problematic. It was common for students to state that animals would not be able to eat the GM herbicide resistant crop after herbicide had been applied or that if animals ate the crop they would die. A frequently seen insufficient idea was that growing GM crops would take up more land leaving less habitat space for animals. The most frequent marking point here was marking point 2 with the idea of fewer other plants meaning less food for animals.

04.3 Very few students were awarded 2 marks for this question. Some students did not understand the term yield in the question. The most commonly awarded mark was for marking point 1, for the idea of insects as pollinators. However, there were a lot of misconceptions surrounding pollen and pollination. Commonly seen misconceptions regarding pollination included:

- bees making pollen or being a source of pollen
- bees collecting pollen for nectar
- pollination being where seeds get stuck to a bee’s body
- pollen being needed by crops for photosynthesis / respiration
- the idea that bees themselves fertilise the plants, rather than facilitating pollination as a step leading to fertilisation.

Where insufficient attempts at marking point 2 was seen, some students were not clear about insects eating or destroying pests, instead suggesting insects simply deter or scare crop pests.

The idea of insects dying and decomposing and therefore providing minerals for the crops was insufficient. Some students repeated information from the question, giving answers such as ‘insects increase crop yields’.

04.4 The most common correct answer for this question was ‘hedgerows provide places for insects to reproduce / breed’. ‘Hedgerows provide a source of food’ or ‘hedgerows provide a source of shelter’ were also commonly seen correct answers.

The most common insufficient response was ‘more hedgerows provide more habitats / places to live’ as this was repeating the information given. Students must take care not to simply repeat information given to them in the question stem. Many students made vague references to increased biodiversity without linking this to the context of the question or wrote about the hedgerow providing ‘ideal living conditions’ for the insects without specifying what those conditions are.

04.5 This was a challenging question for many students as they failed to link microorganisms with respiration, instead writing answers implying the peat itself respired. It also appeared to be quite challenging to keep to the topic of the question, instead students frequently mentioned combustion rather than decay. There was a lot of repetition from the wording of the question, which didn't gain any marks. Very few students attained both marks available on this question, with marking point 1 rarely seen. Students who gained 1 mark, commonly gained the mark for stating that the released carbon dioxide is a greenhouse gas or that the release of carbon dioxide leads to global warming. Some students had the correct idea for marking point 2 but wrote the symbol for carbon dioxide incorrectly (e.g. 'CO2' or 'Co2', or with the 2 written superscript to the letters) and so were not awarded the mark. Refer to page 4 of the mark scheme for guidance on the use of formulae.

Most of the students achieving marking point 2 had not made the link to the source of the carbon dioxide being decomposers or respiration, with many stating that oxygen reacted with the peat to form carbon dioxide. There were not many students who could link the idea to increase oxygen enabling the microbes to respire, which produces carbon dioxide. Of the students who were not awarded marking point 2 it was frequently because the students identified that carbon dioxide would be released but did not go on to state the effect of this or simply reiterated the phrasing from the question stem (i.e. that carbon dioxide causes climate change). Several students made irrelevant references to methane or the ozone layer or stated that the process of cutting the peat released stored carbon dioxide. Another common error was stating that carbon is released into the atmosphere as opposed to carbon dioxide.

Question 5 (Standard and Standard/High demand)

- 05.1** This was a poorly answered question with only one third of students giving the correct answer. Environmental, structural and physical were commonly seen wrong answers. Many students didn't give a type of adaptation as the question had asked but instead described the adaptations of the Plesiosaur.
- 05.2** The majority of students scored 2 marks with marking points 1 and 3 most commonly seen. Many students referred to lack of food or lack of prey as alternatives to competition for food.
- A commonly seen error was just stating 'food availability' without linking it to a shortage. Competition unqualified was also another regularly seen answer but did not receive credit as students needed to describe what the competition was for. There was some confusion with abiotic factors such as temperature, oxygen, climate change or space being given by some students.
- 05.3** Two thirds of students gained one or more mark. Only 8% of students gained three marks. The marking point that the plesiosaur 'died and sank' was rarely seen and this was usually the reason 2-mark answers didn't pick up the 3rd mark as in the example below which scored 2 marks as there was no reference to sinking after dying.

05.3

Describe how the plesiosaur fossil in **Figure 5** could have been formed.

[3 marks]

- The plesiosaur dies
- The soft bits (such as the skin & flesh) would decay
- The ~~an~~ bones are the remains of the plesiosaur after being decomposed
- The bones would get ~~covered~~ ^{replaced} up with minerals
- The ~~bones~~ remains would be left on the ocean floor ~~at~~ after generations

Many students were awarded bullet point 1, for the idea of being buried / covered in sediment (or similar) but some responses incorrectly referred to being buried in rocks which did not allow the mark to be awarded.

Bullet point 2 was often misunderstood as there were lots of references to the body or plesiosaur or bones decaying as students failed to appreciate that only the soft parts decay when fossils form, despite the photograph.

Bullet point 3 was awarded infrequently. Sometimes students had the idea of imprints forming in the 'rock' rather than in mud / sand / sediment. The most commonly seen approach which scored the mark was the idea that minerals replace the bones.

References to compression or pressure, a lack of decay due to a lack of oxygen and references to other factors needed for decay (such as microbes or higher temperature) were often seen but these were insufficient in the context of this question.

Some students referred to how the fossil could be found and assembled by scientists rather than how the fossil formed, indicating that some students misunderstood the question. Incorrect references to natural selection and evolution were also seen.

05.4 Students found this question challenging. Insufficient responses included ‘there not being any plesiosaurs alive’ or ‘none still living to study’, that ‘no-one saw them’ or ‘you couldn’t tell how old the fossils were’. There were some vague statements given such as ‘lack of evidence’.

Many students referred to DNA not being present but failed to link this idea to DNA being destroyed during the formation of fossils.

05.5 Fewer than 25% of students could complete all four spaces in the classification of the plesiosaur, but a further 30% gained one mark for two or three correct words in the correct spaces. There was frequent evidence of students knowing the first letter of the group, but they got no further, or created words based on this known first letter. Mnemonics were regularly seen, but often without fully correct corresponding responses.

05.5

Table 1 shows part of the classification of a plesiosaur.

Complete Table 1.

[2 marks]

Table 1

Classification group	Name
Domain	Predator
Kingdom	Animalia
Phylum	Chordata
Class	Reptilia
	Plesiosaur
	Cryptoclididae
Genus	Cryptoclidus
Species	eurymerus

King
Phillip
Came
over
for
Good
Soup

The student has learnt a mnemonic, but cannot put this to good use. A response of one word correct out of four did not gain a mark due to the level of demand of this question.

Question 6 (Standard, Standard/High and High demand)

06.1 85% of students could identify the equation representing a linear relationship.

06.2 It was most common to award Level 2 for this question, with 35% of students gaining 3 or more marks.

Extended response questions are not marked as one idea gains one mark, five ideas gains five marks etc. See the level descriptors in addition to the indicative content in the mark scheme and section 4 in the preamble to the mark scheme. It is never necessary for all, or even most, suggested content to be included for the award of the highest marks. Note the statement at the end of the indicative content 'For Level 3, details of Type 1 and Type 2 diabetes must be considered, with the link to C-peptide and the importance of the test described'.

Most frequently, clear links were made when describing Type 2 diabetes; many students knew that insulin was still produced but the body had stopped responding to it, which allowed the entry into Level 2. Where the student had understood the question, it was also common to see the correct response to C-peptide production with the same answers.

Where responses did not enter Level 2, there was often confusion between the two types of diabetes or C-peptide production. The first bullet point for Type 1 was often missed as the pancreas was not mentioned.

A Level 3 response needed to include the importance of carrying out the test. It was most common to see reference to how Type 2 is treated, although it was often expressed as what is a risk factor for Type 2 diabetes instead which was insufficient to answer this question.

Many students used the additional pages at the end of the exam paper for this question. Students must remember to clearly label the question number if they use these pages.

Misconceptions included:

- referring to people with Type 2 diabetes being 'immune' to insulin
- stating insulin produced by people with Type 2 diabetes 'doesn't work'
- confusing Type 1 diabetes with Type 2 diabetes.

0 6 . 2 When the body makes insulin, C-peptide is also made.

The concentration of C-peptide in the blood is **not** increased by insulin injections.

Some people with Type 2 diabetes are **incorrectly** told they have Type 1 diabetes.

Doctors can test the concentration of C-peptide in the blood to check which type of diabetes a person has.

Explain:

- how the test can indicate which type of diabetes a person has
- the importance of finding out whether a person being treated for Type 1 diabetes actually has Type 2 diabetes.

[6 marks]

The test can indicate if the person has enough insulin in their body, because people with type 1 diabetes, their pancreas are unable to make that much insulin and if the person has type 2 diabetes the body cells no longer respond to insulin produced by the pancreas. It is important to know whether the person has type 1 or type 2 diabetes so they can inject more insulin into the body.

Extra space

carbohydrate-controlled diet

This student has made a relevant statement about people with Type 1 diabetes (bullet point 1 in the indicative content), and two linked statements about people with Type 2 diabetes (bullet points 4 and 5). This exceeds the description for entering Level 2. However, the response does not enter Level 3 as there is no link to testing for C-peptide and nothing within the 'Importance' heading has been referred to. The statement on the final line 'carbohydrate-controlled diet' cannot be given credit without context. Therefore, this response was awarded 4 marks.

06.3 70% of students knew that glucagon is produced by the pancreas.

06.4 As expected, this proved to be a challenging question. 40% of students gained one or more mark, with only 6% gaining 3 or 4 marks.

It was common to see students incorrectly stating that glucagon is a carbohydrate and is broken down to cause an increase in blood glucose or stating that if there is not enough glucagon this causes a low blood glucose concentration.

Spelling errors of glucagon and glycogen, including many hybrid terms were seen.

Some students referred to blood sugar rather than blood glucose or blood glucose concentration. This was a problem for a small number of students attempting to gain marking points 2 or 3, where reference to glucose was required as part of the marking points.

Some students started their response with 'glucagon is released when blood glucose is low' (gaining marking point 1) and then continued their answer with the 'normal' response to low blood glucose concentration rather than answering the question.

It was noted that it was very common to see 'production of energy' in responses, thus negating marking point 4.

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](https://www.aqa.org.uk)