

# Question papers – question types and specimen answers

There are several different types of question which might appear in our examination papers. In this guide, we'll look at each of these question types, and, using trial data, look at some examples of the way in which students respond to these questions.

The four types of question we'll consider will be:

- 1 multiple choice**
- 2 closed response**
- 3 open response (structured)**
- 4 extended writing**

## Multiple choice

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First of all, it's important for your students to be familiar with the style of multiple-choice questions – we do put the instructions (or rubric) onto the front cover of the paper. However, candidates don't always read the front cover, so make sure they know what to do.

### Here's an example question:

- (c) Which of the following is needed for aerobic respiration?
- |          |                |                          |
|----------|----------------|--------------------------|
| <b>A</b> | oxygen         | <input type="checkbox"/> |
| <b>B</b> | carbon dioxide | <input type="checkbox"/> |
| <b>C</b> | energy         | <input type="checkbox"/> |
| <b>D</b> | lactic acid    | <input type="checkbox"/> |

The candidate should answer this by filling a cross into the box corresponding to their answer.

If the candidate then changes his or her mind about the answer, the procedure is to strike through the box and to complete a new box.

Note that these questions are marked automatically by computer, so candidates who answer in ways that do not correspond to the rubric (e.g. by simply writing the correct answer to the right of the question, or by circling the correct letter) are unlikely to get the mark.

The exams will probably contain one multiple choice item in each of the six questions on the paper. It may be that some questions on the paper have more than one multiple choice items and others have none, but the total number of multiple choice items should be around 6 on each exam paper.

## Closed response

Essentially, a closed response question is one in which the candidate does not have to come up with the answer: instead, candidates select the correct word or words from a selection given on the exam paper (sometimes this type of question is known as sentence completion); or candidates join boxes containing complementary parts of the answer.

We try to design these questions so that there isn't a forced choice. For example, if we want candidates to link the words "carbohydrate", "protein" and "fat" to foods rich in these molecules, then we'd make sure that there were more than three foods given in the linking boxes.

### Let's look at some examples:

Use a word from the box to complete the sentence

argon

hydrogen

nitrogen

oxygen

The gas produced during photosynthesis is .....  
(1)

This is a straightforward sentence completion task, where there is a good selection of words for the candidate to select from. Again, we try and make

sure the odds of getting the correct answer to this sort of question is comparable to the 1 in 4 odds seen with multiple choice questions.

## Here's the other type of question:

The binomial name for polar bears is *Ursus maritimus*.

Draw two straight lines to correctly match the genus and species of the polar bear with its binomial name.

classification	binominal name
genus	<i>Ursus</i>
species	bear
	<i>maritimus</i>

(1)

Note that, in this question, there is only 1 mark available – so both lines must be correct in order for the mark to be scored (as in this example). The number of marks depend to some extent on the difficulty of the question – so a more difficult question with two boxes on the left to link to boxes on the right could be worth two marks.

Both these types of question are more likely to be found in the Foundation Tier question papers than in the Higher Tier ones; and will probably be seen more often for GCSE Science than for Additional Science and the extension units.

## Open response (structured)

This sort of question asks candidates to come up with their own information in response to the question. Note that there is a wide range of command words that can be used to prompt candidates in their answer. These command words do have a hierarchy: so that the amount of information that candidates supply should increase as the command changes from 'state' to 'describe' to 'explain', for example.

These questions are worth varying numbers of marks: for Foundation Tier papers, you'll find questions worth 1, 2 or 3 marks; at Higher Tier, you may additionally find a 4-mark question of this type in the exam paper.

Note that some questions which have a total of 2 or 3 marks are essentially a group of one-mark questions put together. For example:

(b) Give two ways that plant hormones are used by professional growers.

.....

.....

.....

(2)

This question is essentially 2 one-mark questions as the two marks are completely independent recall demands.

In terms of the composition of the questions papers, about 12 – 18 marks will be for one mark questions (a mixture of closed and open responses) – towards the top of this range for Foundation Tier and towards the bottom for

Higher Tier. Foundation Tier papers will contain a mixture of two-mark and three-mark questions, with more two-mark than three-mark ones. Higher Tier papers will contain a more balanced mixture of two-mark and three-mark questions, with the possibility of a four-mark question in addition. Some of these questions may, of course, be calculations rather than describe / explain questions.

Here are two student answers to one-mark structured questions:

(a) Coal is a non-renewable source of energy.

(i) Give the name of another non-renewable source of energy

Oil

(1)

(ii) Give the name of a renewable source of energy

Wind

(1)

This first candidate has correctly selected a source of energy for both question parts.

(a) Coal is a non-renewable source of energy.

(i) Give the name of another non-renewable source of energy

~~Steam Geothermal heat from sun~~ Wood

(1)

(ii) Give the name of a renewable source of energy

Wood. Geothermal, wind turbines

(1)

This candidate has incorrectly selected "wood" as non-renewable, but has given two examples of a renewable source. In this case, the candidate will score 1 mark from the 2 available.

## Here's another example, this time a two-mark question.

Notice the change in command word – here it's a 'describe' question. This implies that there should be more information presented by candidates than for the previous type of question (where the command word was 'give') – and indeed the mark allocation for this question is 2 marks.

- (b) The Earth's early atmosphere is thought to have contained carbon dioxide, water vapour and some other gases.

Describe how the oceans formed from this atmosphere.

The CO<sub>2</sub> warmed the atmosphere as it traps heat energy from the sun, this caused the water vapour to turn from gas to liquid which is water thus forming oceans.

(2)

This candidate has made a correct statement about the role of carbon dioxide – although it is not relevant to the question being asked. In addition, there is an error about increasing heat energy causing a transformation from gas to liquid.

- (b) The Earth's early atmosphere is thought to have contained carbon dioxide, water vapour and some other gases.

Describe how the oceans formed from this atmosphere.

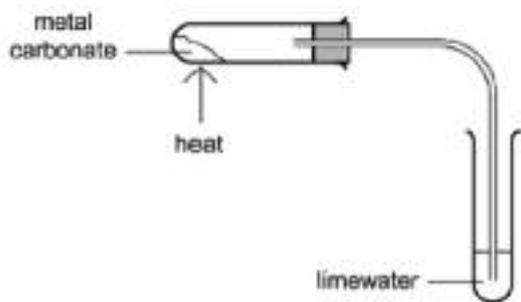
As the atmosphere cooled, much of the water vapour will have condensed into water and formed the oceans.

(2)

This candidate, on the other hand, has got the idea that cooling of the Earth took place and that this cooling caused the condensation of water vapour into liquid water. (Examiners would not penalise for the use of the word 'condensated' rather than 'condensed' – although it is not quite the correct word, the candidate's meaning is clear and unambiguous.)

Let's also take a look at a three-mark question:

Equal amounts of different metal carbonates were heated using the apparatus shown. The time taken for the limewater to go milky was measured.



Here are the results

substance heated	time for limewater to go milky (s)
magnesium carbonate	20
calcium carbonate	41
strontium carbonate	57
barium carbonate	did not go milky after 300s

(ii) Explain what the results of this experiment show about these metal carbonates.

.....  
(3)

Here, the mark scheme is looking for a simple relating of the data to the pattern of decomposition in these metal carbonates. Checking the specification, you can see that candidates don't need to know why this pattern occurs.

(ii) Explain what the results of this experiment show about these metal carbonates.

Magnesium carbonate reacts quicker with oxygen than the rest and barium carbonate reacts with oxygen the slowest. This suggests that magnesium is the most reactive, then calcium, then strontium and then barium.

(3)

This candidate hasn't really understood the reaction happening here – thermal decomposition – but has got the idea that the carbonates decompose at different speeds. The candidate relates this to their reactivity, rather than their stability.

(ii) Explain what the results of this experiment show about these metal carbonates.

Magnesium was the least reactive carbonate of the four because it released carbon dioxide faster than the other carbonates. Barium carbonate would need strong heating to release carbon dioxide.

(3)

This candidate also uses reactivity rather than stability, but gets more of the idea that the carbonate is breaking up to release carbon dioxide.

## Extended writing

This type of question is probably the most challenging on the exam paper (although they are written to be accessible to all candidates), and is worth the largest number of marks (six). There will be two questions of this type on each examination paper, and these are likely to be on Q5 and Q6.

The questions may be based on students' knowledge and understanding of the specification; they may ask questions based on their ability to evaluate data from practicals; or they may ask about applications of the science they have learnt. There will be a variety of different demands that the questions will pose, including 'describe', 'explain', 'compare', 'discuss' or 'evaluate'.

One other thing makes these questions slightly unusual is the way they are marked. You're used to the idea that, if a question is worth  $x$  marks, then students have to make  $x$  points in their answer, so you're probably thinking that you have to make six points in these 6-mark questions. However, the questions are actually marked by using three mark bands – or levels. Many of the questions are quite

open – and there will be a variety of ways in which different students will write their answer. So, it's more difficult to come up with a traditional mark scheme. Instead, the mark scheme will include some key points that may be present in the answer, but then describe three typical standards of answer. The examiner will match the answer to the description given in the mark scheme and therefore place the answer in one of the levels.

The three levels are: Level 1 (1 or 2 marks), Level 2 (3 or 4 marks) and Level 3 (5 or 6 marks). So, as you can see, having placed the answer in one of the levels, there is still a decision to make about which of the two marks will be given to the answer. To some extent, this will be based on whether students have just met the criteria for that level, or whether they have included some material from the next level up. It will also be influenced by how well they communicate their answer. Part of this will be spelling and grammar, but more of it will be the correct use of technical terms and their ability to make the points in their answer in a logical and structured way.

### Here's a student's answer to an extended writing question, at Higher Tier.

(b) Some biofuels are made from plants.

The biofuel ethanol is made from sugar cane or sugar beet.

Petrol is a fossil fuel that is made from crude oil.

Discuss the advantages and disadvantages of using biofuels instead of petrol for cars.

Biofuels are not as polluting as petrol and are more environmentally friendly. However, a lot of space is needed to grow the sugar cane or beet, which will lead to deforestation. We will not have to use or burn fossil fuels (oil). The carbon dioxide given out by cars will be taken in by the plants, in a cycle, so no excess  $\text{CO}_2$  is produced.

(6)

The mark scheme for this question is as follows:

1	1-2	<ul style="list-style-type: none"> <li>■ there are a few advantages given regarding the use of biofuels compared to petrol</li> <li>■ there are a few disadvantages given regarding the use of biofuels compared to petrol</li> <li>■ there is little comparison of the comparative advantages and disadvantages in terms of putting forward a balanced consideration</li> <li>■ the answer communicates ideas using simple language and uses some scientific terminology. Spelling, punctuation and grammar are used with limited accuracy</li> </ul>
2	3-4	<ul style="list-style-type: none"> <li>■ there is a number of advantages given regarding the use of biofuels compared to petrol</li> <li>■ there is a number of disadvantages given regarding the use of biofuels compared to petrol</li> <li>■ there is some attempt to present a balanced consideration of the advantages and disadvantages of using biofuels and the subsequent possible environmental impacts</li> <li>■ the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately. Spelling, punctuation and grammar is used with some accuracy</li> </ul>
3	5-6	<ul style="list-style-type: none"> <li>■ most of the identifiable advantages of using biofuels instead of petrol are given</li> <li>■ most of the identifiable disadvantages of using biofuels instead of petrol are given</li> <li>■ there is a balanced consideration of the advantages and disadvantages of using biofuels and the subsequent possible environmental impacts</li> <li>■ the answer communicates ideas clearly and uses a range of scientific terminology appropriately. Spelling, punctuation and grammar is used with few error</li> </ul>

This student's answer mentions some advantages and some disadvantages and makes some attempt to compare the two (the use of the word 'however' is key here). Although the student is right that carbon dioxide released by combustion can be taken back in by more growing plants, the key idea "carbon neutral" is missing; and there is no consideration of the other carbon dioxide released in the manufacture and transport of biofuels.

Overall, therefore, this question matches best to the Level 2 description. The answer is well-presented and quite well argued, but the small number of advantages and disadvantages would probably lead to a final mark of 3 being given.