Accessibility in GCSE Science exams – Students' perspectives

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Introduction

The main purpose of many educational assessments is to measure students' achievement in relation to the construct(s) of interest. Therefore, any differences in students' outcomes should be due to the ability of the students with respect to the relevant construct(s). Students' performance on the test, however, is often a result of the interaction between multiple factors in addition to students' ability (Beddow, Elliott, & Kettler, 2013; Crisp, 2011; Spalding, 2009). These factors can relate to intrinsic student characteristics (e.g., test anxiety or working memory capacity) or to the construction of the test itself.

There are multiple elements of question design that can influence a student's ability to understand the question and demonstrate their achievement. These may include (but are not limited to) visual features, such as the use of images, legibility (font), layout of the question and linguistic complexity. If the questions present accessibility problems, then the resultant performance on the test may not reflect the students' achievement in relation to the construct(s), but rather their ability to access the meaning of the question (Beddow, Kurz, & Frey, 2011). Research shows that different elements of question construction can affect students' perceptions of accessibility and/or students' performance (Chelesnik, 2009; Crisp, 2011; Crisp & Sweiry, 2006; Lonsdale, Dyson, & Reynolds, 2006). Even small changes to question presentation, such as highlighting a key word using bold font style, can potentially lead to increased student success on the question (Pollitt, Ahmed, & Crisp, 2007). The aim of improving the accessibility of a question is not to reduce its demands but to provide students with a better opportunity to demonstrate their knowledge and skills by removing any obstacles to question comprehension. By demands we mean the knowledge and skills that will be needed in order to complete a task and that have been intentionally included in a question (Pollitt et al., 2007). These demands, which relate to the assessment constructs, are expected to determine how difficult a task is in practice, but other factors (such as question features that influence accessibility) can also affect difficulty. Optimising features in terms of accessibility allows students to better show their abilities related to the target construct(s) by keeping construct-irrelevant variance to a minimum (Ahmed & Pollitt, 2011).

The design of the question has the potential to either minimise or emphasise differences between students' characteristics. Accessibility-related features of the question interact with the intrinsic characteristics of the test taker such as motivation, reading comprehension and working memory capacity (Beddow et al., 2011). Changes to accessibility may therefore indirectly affect students' outcomes, even if the construct-related demand of the question remains the same. For example, embedding a question in a complex context risks introducing linguistic bias, therefore emphasising reading comprehension differences between students (Ketterlin-Geller, 2008). Similarly, text presentation that maximises the use of 'whitespace' (i.e., the part of the page not covered by text or images) influences how friendly or intimidating the text is perceived to be (Baker, 2001), which may affect students' motivation or test anxiety.

Students may find it frustrating if they are not able to understand the question, especially if they have mastered the construct that is being examined. If the test is perceived as difficult, students' experience of sitting the test is likely to be negative, regardless of the actual outcomes. Therefore, it is important to determine how different question features contribute to the perception of accessibility in the target assessment population.

Research context and aims

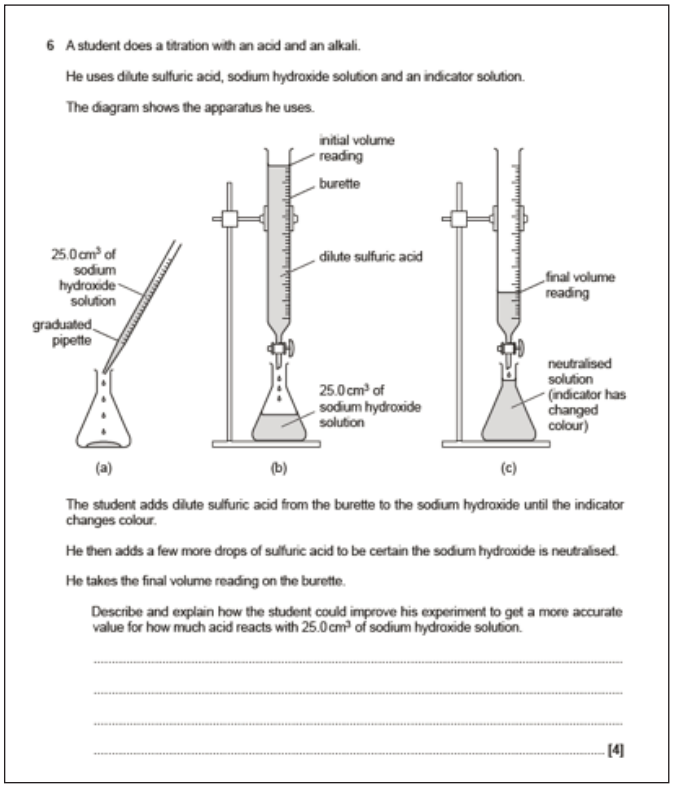
For some time, there has been a regulatory requirement for awarding bodies in England to "consider the needs of all potential candidates when developing qualifications, associated tasks and assessment, to minimise any later need to make reasonable adjustments for candidates who have particular requirements" (QCA, 2004, p.12). This is part of a notion of incorporating fair access for all students into assessment design (QCA, 2005). OCR has recently developed accessibility principles for Science GCSE exams (OCR, 2018a; 2018b), which intend to facilitate improvements to question design that enable students to show their knowledge and skills to the best of their ability. The principles draw on past research on the effects of question features on test accessibility. OCR first applied the accessibility principles when developing the GCSE Science question papers sat in the June 2018 session, as part of a question paper review process before the final sign off. The principles have also been applied to the sample assessment materials and practice papers.

The aim of the current research was to evaluate the effectiveness of OCR's accessibility principles by investigating students' perceptions of question features in terms of accessibility. Specifically, the research sought to determine whether question features relating to the accessibility principles affect students' views on how easy questions are to understand. To this end, we used a selection of Science GCSE exam questions, with and without the accessibility principles applied, to gather student views on relevant question features.

Method

Selection of questions

For the purpose of this research, OCR provided six Foundation tier Science GCSE papers from the June 2018 session. There were two versions of each paper: the final version of the paper as used in the live examination (with accessibility principles applied); and the draft of the



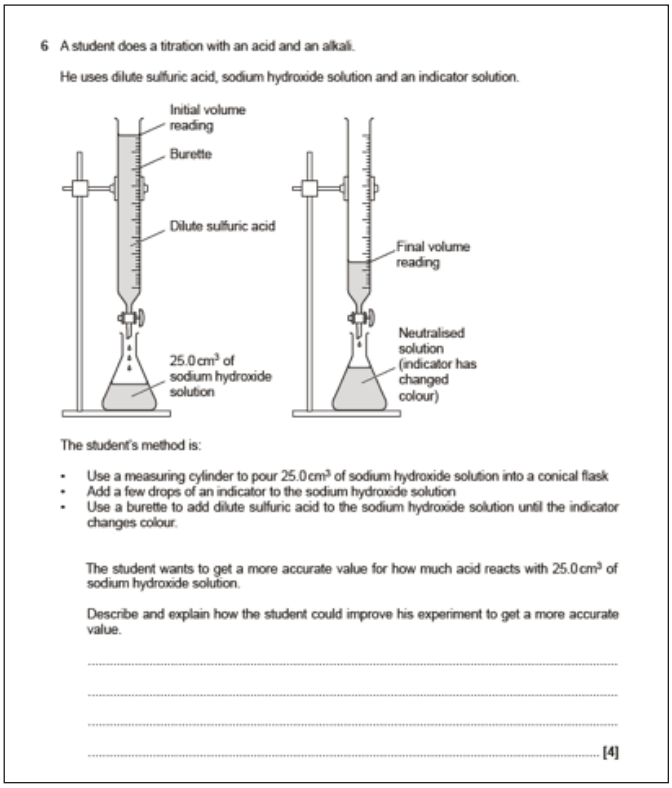


Figure 1: Two versions of an example question used in the test. Left panel: draft question before the accessibility principles were applied. Right panel: the final version of the question (after the accessibility principles were applied).

paper before the accessibility principles were applied. We compared the two versions of the papers, identifying questions where the changes were clearly due to, or aligned with, the accessibility principles. From this, we selected eight questions that were then renumbered as Questions 1 to 8.

The eight questions were included in both versions of a test. Version 1 of the test contained the final versions of Questions 1, 3, 5 and 7 (with the accessibility principles applied) and the draft versions of Questions 2, 4, 6 and 8 (without the accessibility principles applied). Version 2 of the test contained the opposite pattern. In this article, we refer to the question versions without the accessibility principles applied as 'less accessible' (LA) and the versions with the accessibility principles applied as 'more accessible' (MA), though it should be noted that these labels reflect the intentions to improve accessibility and may not always match student views. Figure 1 shows the two versions of an example question (Question 6) used in the research. Both versions of each question are available in an appendix to the online copy of this article.

The questions covered a range of the accessibility principles. Table 1 presents the accessibility themes explored, their relationship to OCR's accessibility principles and which question(s) were used to explore each theme. OCR's accessibility principles are reproduced in an appendix to the online copy of this article.

Participants and procedure

Four schools participated in the research (two comprehensive, one independent and one independent special provision), with one or two Year 11 Science classes taking part at each school. All students in participating classes completed one version of the test, with the two versions of the test assigned at random within each class. We interviewed 57 students across the schools after they had taken the test. The teachers selected students so that we could cover a range of abilities. Students had the opportunity to decline. In most cases, we interviewed students in pairs, where each pair included one student who took each version of the test. We discussed each question in turn, encouraging students to talk about how accessible the questions were and why, and gathered comparative comments in relation to specific accessibility-related differences between question versions. To help students understand the notion of accessibility we used wording such as 'easier to understand'. Where students' responses suggested that they might be commenting about question demands rather than accessibility, further prompting was used to gain responses relating to accessibility.

Results

Findings for each test question

We categorised students' responses regarding whether they understood the version of the question that they attempted as 'yes', 'no' or 'unclear/mixed' (no explicit comment or mixed opinion).

We categorised comparative views regarding each relevant accessibility theme as:

- V1 (Version 1 considered easier to understand than Version 2);
- V2 (Version 2 considered easier to understand than Version 1);
- no difference (no difference in perceived ease of understanding between versions);
- unclear/mixed (no explicit response/mixed opinion).

The findings for each question are now described in Tables 2 to 9 which show the results for each question. Percentages are used for ease of interpretation, but it should be noted that these are based on relatively low numbers: 28 students who attempted Version 1 of the test (V1);

Table 1: Accessibility themes explored, their relationship to OCR's accessibility principles and the question(s) used to explore each theme

Accessibility theme		*Relevant accessibility principle (OCR, 2018a, pp.5–7)*	*Biology*	*Chemistry*	*Physics*
Language:	– Simplified vocabulary	Principle 2			Q3
	– Simplified grammatical structure				Q7
	– Clarity of information			Q6	Q3
Presentation of context:	– Shorter context	Principle 4[1]	Q2, Q4		
	– Use of bullet points		Q8	Q6	
Multiple choice question (MCQ) answers in alphabetical order/numerical order		Principle 8		Q1	Q7b
Brackets used around abbreviations for units		Principle 10			Q7b
Visual resources:	– Only use where necessary	Principle 13[2]	Q2	Q6	Q5
	– Clarity of visuals				Q3
Left-aligned (tables/graphs)		Principle 14	Q8		
		Total number of questions:	**3**	**2**	**3**

1. This principle does not explicitly mention shortening a context, but the need for supportive devices such as bullet points in longer contexts implies that a shorter context (or no context) may have benefits for accessibility. There is some evidence that word count can influence student performance, for example, OECD (2009) found that word count accounted for 12% of variance in question difficulty, which could be due to reading demand affecting accessibility.
2. The clarity of visual resources is not explicitly stated as an accessibility principle but is likely to be important (Crisp & Sweiry, 2006).

29 students who attempted Version 2 of the test (V2); and 57 students in total. Therefore, care should be taken not to over-interpret differences. Note that percentages have been rounded to whole numbers, which has sometimes resulted in values that add up to over 100%.

Students' comments provided insights into the reasons for their views. Common explanations for their views about accessibility are included below.

Question 1

Question 1 was a multiple choice question asking students which statement about catalysts was correct. It was selected to investigate whether the order of answer options influenced students' perceptions of ease of understanding. Answer options appeared in alphabetical order in one version of the question (more accessible version) and in a random order in the other. Over 80% of students found Question 1 easy to understand, regardless of which version they had attempted. When asked to compare the question versions, the majority of students (84%) reported that the order of the options made no difference to the ease of understanding and answering the question. The most common comments justifying their position were that they would be able to select the correct answer regardless of the order, as long as they had the appropriate knowledge, and that they would read all options anyway.

Table 2: Frequencies of responses regarding Question 1 (Catalysts)

Was the question easy to understand?	**V1 More accessible (MA)**	**V2 Less accessible (LA)**		
Yes	23 (82%)	26 (90%)		
No	2 (7%)	2 (7%)		
Unclear/mixed	3 (11%)	1 (3%)		
Order – which is easier to understand?	**V1 – MA** (alphabetical order)	**V2 – LA** (random order)	**No difference**	**Unclear/ mixed**
Frequency	3 (5%)	5 (9%)	48 (84%)	1 (2%)

Question 2

Question 2 was selected to explore the influence of context and visuals on accessibility. The question required students to categorise four human characteristics as either continuous or discontinuous. The less accessible version of the question included a context about two sisters, information on some of their characteristics (e.g., 'Height = 150 cm') and cartoon-style images; both the contextual information and the images were removed in the more accessible version. For both versions, most students reported that they understood the question.

When asked to compare the question versions in terms of context use, the contextualised version was more frequently perceived as harder to understand than the context-free version (the latter was preferred by 58% of students). Students typically reported that they liked the clear presentation of the list of characteristics in the more accessible version. Some students were confused by the examples of characteristics in the less accessible version and felt it was unclear whether to report the characteristics themselves (e.g., 'Height') or the examples provided (e.g., '150 cm').

Only 21% of students reported that the image in the less accessible version of the question increased the ease of understanding. More than half of students (58%) preferred the version without the image. Some students suggested that the image was not informative and some of those who attempted this question version reported that they did not use the image.

Another interesting comment that arose was that highlighting important words with bold font style in the more accessible version of

Table 3: Frequencies of responses regarding Question 2 (Characteristics)

Was the question easy to understand?	V1 Less accessible	V2 More accessible		
Yes	17 (61%)	21 (72%)		
No	7 (25%)	2 (7%)		
Unclear/mixed	4 (14%)	6 (21%)		
Context of two sisters (with/without) – which is easier to understand?	**V1 – LA** (context)	**V2 – MA** (no context)	**No difference**	**Unclear/ mixed**
Frequency	6 (11%)	33 (58%)	7 (12%)	11 (19%)
Image (with/without) – which is easier to understand?	**V1 – LA** (image)	**V2 – MA** (no image)	**No difference**	**Unclear/ mixed**
Frequency	12 (21%)	33 (58%)	2 (4%)	10 (18%)

the question was useful. This is relevant to accessibility and part of OCR's usual formatting style (but is not one of the themes that the research set out to investigate).

Question 3

Question 3 was based around a graph of how world energy use (or demand) has changed over time. The graph showed different energy types and asked students how much the total world's energy use (or demand) had increased between certain years. There were differences in the wording and the graph between the question versions. The perceived understandability of this question was relatively low, with only about half of the students reporting that the question was easy to understand, regardless of the version they attempted.

Table 4: Frequencies of responses regarding Question 3 (Energy graph)

Was the question easy to understand?	V1 More accessible	V2 Less accessible		
Yes	14 (50%)	14 (48%)		
No	8 (29%)	9 (31%)		
Unclear/mixed	6 (21%)	6 (21%)		
Language (clarity of information) – which is easier to understand?	**V1 – MA** (extra sentence before graph, includes 'approximately')	**V2 – LA** (without extra sentence, excludes 'approximately')	**No difference**	**Unclear/ mixed**
Frequency	24 (42%)	8 (14%)	13 (23%)	12 (21%)
Vocabulary (use/demand) – which is easier to understand?	**V1 – MA** ('energy use')	**V2 – LA** ('energy demand')	**No difference**	**Unclear/ mixed**
Frequency	26 (46%)	1 (2%)	30 (53%)	0
Graph – which is easier to understand?	**V1 – MA** (larger graph with fewer energy types)	**V2 – LA** (smaller graph with more energy types)	**No difference**	**Unclear/ mixed**
Frequency	41 (72%)	2 (4%)	9 (16%)	5 (9%)

The two versions of the question differed in terms of the introductory text provided before the graph (the more accessible version contained an extra sentence intended to provide greater clarity about the categories in the graph) and in the way that the students were asked to provide the amount of energy use increase (the more accessible version included the word 'approximately'). In terms of these features, the more accessible version was considered easier to understand by 42% of interviewees (compared with 14% who thought the other version was easier to understand in this respect). Some students thought that 'approximately' indicated that their response did not need to be exact[3], though a smaller number of students reported that the word 'approximately' did not make a difference or that the question was simpler without it. In terms of other text differences, some students felt that the extra sentence before the graph (in the more accessible version) provided useful information, whilst others implied that having fewer words was an advantage of the less accessible version.

The question used the phrase 'energy use' or 'energy demand'. The phrase 'energy use' (more accessible version) was seen as easier to understand than 'energy demand' by 46% of interviewees. Only one student preferred the phrase 'energy demand'. That said, many students (53%) reported that it made no difference whether the word 'use' or 'demand' was used.

The majority of students (72%) found the larger graph showing fewer energy types (more accessible version) easier to understand and use. Students commented that the bigger graph was clearer and that showing fewer energy types made the graph less confusing.

Question 4

Question 4 was about a food chain involving oilseed rape. Students were asked to complete a pyramid of biomass and then to calculate the efficiency of biomass transfer from the oilseed rape to honeybees. Question 4 was included to evaluate the influence of the amount of detail provided. The less accessible version contained additional contextual detail (about human use of the oil). Both versions of the question were easy to understand according to most students (over 60% for both versions).

When asked to compare the question versions in terms of context, the majority of students (74%) preferred the shorter context (more accessible version). Students typically justified their choice by saying

Table 5: Frequencies of responses regarding Question 4 (Food chain)

Was the question easy to understand?	V1 Less accessible	V2 More accessible		
Yes	18 (64%)	20 (69%)		
No	7 (25%)	2 (7%)		
Unclear/mixed	3 (11%)	7 (24%)		
Context – which is easier to understand?	**V1 – LA** (detailed context)	**V2 – MA** (shorter context)	**No difference**	**Unclear/ mixed**
Frequency	3 (5%)	42 (74%)	9 (16%)	3 (5%)

3. The mark scheme rewarded answers that were correct to the nearest whole number so presumably the word 'approximately' was intended to indicate that responses did not need to be highly accurate.

that the additional information in the less accessible version was irrelevant to answering the question and that having less information to read is usually beneficial, especially under the time-constrained conditions of an exam.

Similarly to Question 2, several students commented that the highlighting of key words using bold font style (more accessible version) was useful.

Question 5

Question 5 was set in the context of a student watching a ball game and seeing the ball being hit before hearing the sound. Candidates were asked to describe the measurements the student would need to find the speed of sound. The less accessible version included a drawing of the student watching the game, whilst the more accessible version did not include an image. Question 5 was used to explore the influence of a non-essential visual resource on accessibility. More than half of the students felt that the version of the question that they attempted was easy to understand.

Table 6: Frequencies of responses regarding Question 5 (Ball game)

Was the question easy to understand?	**V1 More accessible**	**V2 Less accessible**		
Yes	15 (54%)	19 (66%)		
No	8 (29%)	5 (17%)		
Unclear/mixed	5 (18%)	5 (17%)		
Image (with/without) – which is easier to understand?	**V1 – MA** (no image)	**V2 – LA** (image)	**No difference**	**Unclear/ mixed**
Frequency	17 (30%)	29 (51%)	9 (16%)	2 (4%)

In contrast to the findings for Question 2, about half of the students (51%) expressed a preference for having the image of the ball game (in the less accessible version) rather than having no image (more accessible version). This was most commonly justified by the students in terms of the image helping to visualise the context of the question. However, nearly a third of students (30%) preferred the version of the question without the image, often suggesting that the image was not useful and that all the information was provided in the text.

Question 6

Question 6 was about a student conducting a titration experiment with an acid and an alkali (see Figure 1). Candidates were asked to describe and explain how the student could improve the experiment to get a more accurate result. Question 6 contained multiple accessibility-related differences between the two versions of the question, including differences in wording, presentation of contextual information (bullet points) and the provision of an additional image.

Most students who sat the more accessible version of the question (66%), found the question easy to understand. In contrast, less than half (46%) of students who sat the less accessible version reported that the question was easy to understand.

Of the 57 interviewed students, 56% found the language used in the more accessible version of this question easier to understand than that in the less accessible version. Note that some students confused wording and layout differences (i.e., bullet points), hence the relatively large proportion of students (37%) classified as 'unclear/mixed' for these features of Question 6.

The more accessible version of Question 6 used bullet points to explain the experiment. Most students (72%) reported that this version of the question was easier to understand than the alternative version, which did not use bullet points. Students commented that the less accessible version was more confusing, whereas bullet points presented the information clearly and were easier to follow.

The less accessible version of the question included a three-part diagram, which was reduced to two parts in the more accessible version (see Figure 1). Contrary to expectations, 44% of students thought that the three-part diagram was easier to understand whereas only 25% of students preferred the two-part diagram. Some students explained that the three-part diagram logically shows the steps of the experiment whilst the diagram in the other version missed out the first step.

Table 7: Frequencies of responses regarding Question 6 (Titration)

Was the question easy to understand?	**V1 Less accessible**	**V2 More accessible**		
Yes	13 (46%)	19 (66%)		
No	12 (43%)	7 (24%)		
Unclear/mixed	3 (11%)	3 (10%)		
Language (clarity of information) – which is easier to understand?	**V1 – LA** (later steps in method)	**V2 – MA** (main steps in method)	**No difference**	**Unclear/ mixed**
Frequency	0	32 (56%)	4 (7%)	21 (37%)
Layout – which is easier to understand?	**V1 – LA** (without bullet points)	**V2 – MA** (with bullet points)	**No difference**	**Unclear/ mixed**
Frequency	0	41 (72%)	0	16 (28%)
Diagram – which is easier to understand?	**V1 – LA** (three-part diagram)	**V2 – MA** (two-part diagram)	**No difference**	**Unclear/ mixed**
Frequency	25 (44%)	14 (25%)	14 (25%)	4 (7%)

Question 7

Question 7 was about the forces acting on a trolley on a ramp. The scenario was explained (partly by a diagram) and students were asked to calculate the gravitational potential energy transferred (part a) and then to give a best estimate of the distance travelled based on five readings (part b). Question 7 was selected to evaluate the importance of grammatical structure, the order of answer options (numerical) and unit presentation. This question appeared to be understood by the majority of students, with 79% of students who sat the more accessible version of the question and 62% of students who sat the less accessible version claiming that they found the question easy to understand.

When asked to compare the versions of the question, the majority of students (75%) reported finding the simpler sentence structure in the more accessible version of the question easier to understand than the longer sentence in the other version. Students often justified their

choice by saying that the lengthy sentence could be confusing and separating out the value to be used for gravitational field strength (by splitting the sentence into two) meant that the information was clearer.

Part (b) of Question 7 was a multiple choice question where students answered by ticking a box. A simpler instruction regarding ticking the box was used in the more accessible version. Around half of the interviewed students (49%) felt that this difference in the wording made no difference to ease of understanding. Students typically commented that the meaning of the instructions was the same. However, more students preferred the shorter instruction (33%) than the number who preferred the longer instruction (14%).

The order of the answer options for part (b) was numerical in the more accessible version of the question and random in the less accessible version. Whilst half of the students (51%) suggested that the order of the answer options did not affect the ease of understanding the question, almost all of the remaining students (47%) expressed a preference for numerical order.

The final feature that was explored using this question was the presentation of the abbreviation for metres in a table. The 'm' for metres was presented in brackets in the more accessible version of the question and after a slash symbol in the less accessible version. Over 60% of students felt that the units were easier to understand when presented in brackets. Some students commented that they were more familiar with brackets being used to display units or that the slash could be misinterpreted (e.g., as a symbol for 'divide').

Table 8: Frequencies of responses regarding Question 7 (Trolley on a slope)

Was the question easy to understand?	**V1 More accessible**	**V2 Less accessible**		
Yes	22 (79%)	18 (62%)		
No	5 (18%)	7 (24%)		
Unclear/mixed	1 (4%)	4 (14%)		
Language (grammatical structure: general) – which is easier to understand?	**V1 – MA** (shorter instruction for part (a), other simpler sentences)	**V2 – LA** (longer instruction for part (a), other more complex sentences)	**No difference**	**Unclear/ mixed**
Frequency	43 (75%)	1 (2%)	7 (12%)	6 (11%)
Language (grammatical structure: tick instruction) – which is easier to understand?	**V1 – MA** ('Tick **one** box')	**V2 – LA** ('Put a tick in the **one** correct box.')	**No difference**	**Unclear/ mixed**
Frequency	19 (33%)	8 (14%)	28 (49%)	2 (4%)
Order – which is easier to understand?	**V1 – MA** (number	**V2 – LA** (random order)	**No difference** order)	**Unclear/ mixed**
Frequency	27 (47%)	1 (2%)	29 (51%)	0
Units – which is easier to understand?	**V1 – MA** ('(m)')	**V2 – LA** ('/m')	**No difference**	**Unclear/ mixed**
Frequency	36 (63%)	0	17 (30%)	4 (7%)

Question 8

Question 8 described a student investigating the effect of acid rain on seed growth by observing how many seeds germinate in the presence of solutions of different pH. Candidates were asked to give a factor that should be kept the same during the investigation and to describe what the results indicate. Question 8 was included to evaluate the influences of using bullet points to present contextual information and of the alignment of figures and tables (left-aligned versus centred). Around 60% of students attempting each version of the question reported that the question was easy to understand.

There was an overwhelming preference for bullet point presentation of the context, with 74% of students claiming that the more accessible version (with bullet points) was easier to understand. Students often commented that the bullet points looked clearer and identified the key information needed for answering the question.

Most students (70%) felt that the alignment of the figure and table did not affect how easy the question was to understand. For those students who expressed a preference, the version with the left-aligned figure and table was chosen marginally more often (18%) than the version with the figure and table positioned centrally (12%).

Table 9: Frequencies of responses regarding Question 8 (Acid rain/seed germination)

Was the question easy to understand?	**V1 Less accessible**	**V2 More accessible**		
Yes	18 (64%)	17 (59%)		
No	4 (14%)	2 (7%)		
Unclear/mixed	5 (18%)	8 (28%)		
N/A – did not reach this question/ran out of time	1 (4%)	2 (7%)		
Layout – which is easier to understand?	**V1 – LA** (without bullet points)	**V2 – MA** (with bullet points)	**No difference**	**Unclear/ mixed**
Frequency	1 (2%)	42 (74%)	10 (18%)	4 (7%)
Alignment of figure and table – which is easier to understand?	**V1 – LA** (centre-aligned)	**V2 – MA** (left-aligned)	**No difference**	**Unclear/ mixed**
Frequency	7 (12%)	10 (18%)	40 (70%)	0

Summarised findings for each accessibility theme

Table 10 summarises the findings for each accessibility theme explored. Findings that were counter to expectations are shown in red. Neutral findings (where most students felt the feature made no difference to the ease of understanding and where there was no general direction of preference amongst those who did express a preference) are shown in blue.

Discussion

The aim of this research was to investigate students' perceptions of exam questions with and without OCR's accessibility principles applied. For most of the question features that were explored in this study, student perceptions of accessibility tended to align with expected effects on

Table 10: Summarised findings by accessibility theme

OCR principle (OCR, 2018a)	*Theme explored*	*Summary of findings (red text indicates findings that were counter to expectation, blue text indicates findings where views tended to be neutral)*
2	Language	• When given the choice between a simpler term ('use') and slightly more complex vocabulary term ('demand'), almost all students either found the simpler term easier to understand (46%) or felt the term made no difference (53%) (Q3); • Students tended to find question versions with simpler sentence structures easier to understand, though the strength of this finding varied (Q7 general, Q7b); • Text changes intended to aid clarity (but which did not involve a difference in grammatical complexity) were reported by more students to be easier to understand. (These versions of questions sometimes had a higher word count) (Q3, Q6).
4	Presentation of context	• Students tended to consider questions with shorter contexts or no context easier to understand (Q2, Q4); • Nearly three-quarters of students found question versions that used bullet points to set out the steps in a process or method easier to understand than question versions that did not (Q6, Q8).
8	Order of MCQ answer options	• For MCQ answer options involving phrases, most students felt the order made no difference (Q1); • For numerical MCQ answer options, just over half of students felt that the order made no difference and a little under half of the students felt that numerical order was easier to understand (Q7b).
10	Units presented in brackets for tables	• Most students felt that showing units in brackets was easier to understand than the units being preceded by a slash symbol. Others felt it made little difference, but none preferred the slash symbol (Q7b).
13	Visual resources	• Non-essential images: o For one question with a non-essential image, over 50% of students felt that the question was easier to understand without the image whilst around 20% preferred having the image (Q2); o For another question with a non-essential image, around half of students reported that the question was easier to understand with the image whilst around 30% preferred the version without the image (Q5); o For a question where an extra part to the diagram showed a preceding step in an experiment, 44% of students preferred the three-part diagram whilst 25% preferred the two-part diagram (Q6). • Over 70% of students felt that a larger graph showing fewer different substances was easier to understand (Q3).
14	Left alignment	• Most students (70%) felt that the alignment of a figure and table (left or centred) made no difference to understanding the question. A few students expressed a preference for one or the other (Q8).

accessibility but there were some exceptions. We reflect below on the findings for each accessibility theme.

Language

Differences in the language used, such as vocabulary and grammatical structure, affected perceived accessibility in the expected direction. However, for the vocabulary issue and one of the grammatical complexity issues explored there were fairly high numbers of students who felt that the language differences did not affect the ease of understanding. This may suggest that these changes were helpful to those students with slightly weaker language skills but were less necessary for others. In the case of vocabulary, the influence of changes will depend on the specific words used and how familiar the words are to the general student population and to individuals within that population. Where changes did not appear to help all students but did reportedly help a proportion of students (and did not seem to hinder others), there is still a strong argument for implementing such changes in order to reduce risks that language skills negatively affect performance for some students (where it is not the intention to assess language skills).

Presentation of context

The findings relating to context were in line with expected effects. Using bullet points to set out steps in a method or process appeared to be helpful to most students in understanding contextualised questions. This is interesting given that past research has produced mixed findings on the effect of bullet points on accessibility (Crisp, Johnson, & Novaković, 2012; Kettler et al., 2012). Reducing unnecessary detail in a context (Q4) and removing a context in a question where the context potentially caused confusion (Q2) tended to help students to understand the question, according to the interviewees. However, it should be noted that good contexts can usefully facilitate the assessment of certain kinds of skills (Ahmed & Pollitt, 2007) and the current findings should not be interpreted to mean that removing or minimising context is always going to enhance accessibility or is always the appropriate choice in terms of assessing the skills of interest. Nonetheless, it appears that it may be advisable to avoid including unnecessary contextual information.

Order of answer options in multiple choice questions

If anything, students tended to report that positioning response options for multiple choice questions in numerical order was easier to understand than having options presented in random order. That said, over half of the students felt that the order made no difference.
As mentioned earlier, where a change appears to aid accessibility for more students than it hinders, this change is probably good practice even if it makes little difference to some students. The majority of interviewees felt that presenting response options in alphabetical order did not make a difference to the ease of understanding Question 1.
This may have been partly a result of the response options being short sentences and there being no relationship between the meaning of these sentences and the order of their presentation (either alphabetical or random). Other multiple choice questions could have such a relationship and, thus, alphabetical order might benefit students. In any case, the current research did not suggest that alphabetical order was a hindrance to students and potentially still serves OCR's intended purpose of using alphabetical and numerical order to avoid the order of the options

potentially giving away the correct answer. Additionally, using alphabetical or numerical order is logical and tends to be considered good practice (e.g., Moncada & Moncada, 2010).

Units presented in brackets for tables

In line with OCR's expectations about the effect of question features, presenting the abbreviation for metres in brackets was felt by most students to be easier to understand, suggesting that this does aid accessibility. This style was reportedly more familiar and less likely to cause confusion than using a slash symbol.

Visual resources

OCR's principles set out that images and diagrams (and data) will "only be used where they genuinely support what is required in the question" to avoid "distracting images for the students that do not help them understand what is required" (OCR, 2018a, p.7). This is a sensible decision given that visual resources in questions are salient, can dominate students' thinking and, thus, can be misleading if the information they contain is not genuinely relevant (Crisp & Sweiry, 2006). Additionally, Kettler et al. (2012) argued that introducing non-essential images is likely to increase cognitive load and divert students' attentional resources from the focus of the question.

For two questions in the current research, non-essential images were removed in the more accessible version. Findings for one question (Q2) were in line with expectations, with more students (58%) reporting that the version without the image was easier to understand (though it should be noted that 20% preferred the illustrated version). For the other question with a non-essential image (Q5), the opposite pattern was found with more students finding the less accessible version with the image easier to understand (51%) (though 30% preferred the unillustrated version). The findings were also counter to expectations for a further question (Q6); more students preferred a three-part diagram (preferred by 44%) to a two-part diagram (preferred by 25%) where an initial step in an experiment was not shown. These rather mixed findings suggest that the exact nature of the image and its relation to the question could be affecting views on accessibility. One hypothesis would be that images appearing to be more diagrammatic or more informative about the scenario are more likely to improve understanding of the question. This would be consistent with the cartoon-like image in Question 2, which gave no additional information, being least appreciated. This aligns with findings from Crisp and Sweiry (2006) suggesting that students have appropriate expectations regarding which aspects of a visual resource are important and relevant. OCR's principle to exclude visuals that do not support answering the question is still sound, but the current findings emphasise that decisions around the inclusion of visual resources should be made on a case-by-case basis taking into account the nature of the specific visual and how it might potentially support interpretation of the question. This is consistent with OCR's current practice.

With regard to the clarity of visuals, the findings support the notion that it is important to ensure that any visual resources are clear and easy to interpret, given that the larger graph showing fewer substances in the more accessible version of Question 3 was reportedly easier to understand, according to most of the interviewed students.

Left alignment

To be consistent with the principles applied for modified papers, OCR's accessibility principles set out that visual resources will be left aligned (unless students are required to work with the resource in a way that makes having space around the resource helpful). Left alignment is thought to be easier to understand for those with dyslexia or certain visual impairments (Evett & Brown, 2005). For the group of students interviewed in the current research, most students felt that the alignment of the figure and table in Question 8 did not affect how easy the question was to understand. Amongst those students who expressed a preference, there was no general trend in the direction of their views. Whilst the principle to left align visual resources did not appear to aid the sample of students interviewed, it also did not hinder them so it would still seem appropriate to apply this accessibility principle on the grounds that it may help those with visual impairments and dyslexia.

Limitations

The current research has some potential limitations. During interviews, students were encouraged to discuss each question feature relating to accessibility in turn and in most cases separate comments on different accessibility principles were gathered. Nonetheless, it was evident that different features of the questions sometimes interacted with one another and the impact of individual principles could not always be assessed. Each accessibility theme was explored in relation to a small number of questions and it is possible that findings might have been different for a similar feature appearing in a different question, depending on other features of the question. In addition, as the students were interviewed in pairs, their opinions could have been influenced by their peers. However, as the assignment of test versions to students was random, it is unlikely that this would have led to a systematic bias in responses.

Conclusion

When addressing the notion of accessibility, the focus is on the target user's experience and giving them a fair opportunity to attempt the questions presented in order to show their ability in the construct(s) of interest. An additional aim of this is to provide a more positive experience for the students in terms of being able to engage with the questions. However, there is a distinction between perceived accessibility and the actual effect on performance, which should be kept in mind when interpreting the findings from the current research.

For most of the accessibility themes explored, student perceptions of the ease of understanding different versions of questions were in line with expectations about effects on accessibility. For two accessibility themes, the findings were neutral. For one accessibility theme, the removal of a non-essential visual resource (or part of one), there were varying effects on perceived accessibility. Whilst the effects for visuals were mixed, other evidence (Crisp & Sweiry, 2006; Kettler et al., 2012) supports the notion that visuals which do not provide useful information are best avoided, and it would seem reasonable to retain this accessibility principle.
In conclusion, the students' views gathered in this research suggest that the accessibility principles that we investigated are appropriate and should continue to be applied to help ensure students can understand and access future exam questions.

Acknowledgement

We would like to thank the teachers and students who helped us with this research for their time and enthusiasm.

References

Ahmed, A., & Pollitt, A. (2007). Improving the quality of contextualized questions: An experimental investigation of focus. *Assessment in Education: Principles, Policy and Practice, 14*(2), 201–232.

Ahmed, A., & Pollitt, A. (2011). Improving marking quality through a taxonomy of mark schemes. *Assessment in Education: Principles, Policy and Practice, 18*(3), 259–78.

Baker, W.H. (2001). HATS: A design procedure for routine business documents. *Business Communication Quarterly, 64*(2), 66–78.

Beddow, P.A., Elliott, S.N., & Kettler, R.J. (2013). Test accessibility: Item reviews and lessons learned from four state assessments. *Education Research International, 2013*, Article ID 952704, 1–12.

Beddow, P.A., Kurz, A., & Frey, J.R. (2011). Accessibility theory: Guiding the science and practice of test item design with the test-taker in mind. In S.N. Elliott, R.J. Kettler, P.A. Beddow, & A. Kurz (Eds), *Handbook of accessible achievement tests for all students: Bridging the gaps between research, practice and policy* (pp.163–182). New York: Springer.

Chelesnik, A.L. (2009). *The impact of test typography on student achievement, anxiety, and typographic preferences*. Unpublished Masters Thesis. California State University, San Marcos. Available from: https://csusm-dspace.calstate.edu/handle/10211.3/114688 (retrieved 4th November 2019).

Crisp, V. (2011). Exploring features that affect the difficulty and functioning of science exam questions for those with reading difficulties. *Irish Educational Studies, 30*(3), 323–343.

Crisp, V., Johnson, M., & Novaković, N. (2012). The effects of features of examination questions on the performance of students with dyslexia. *British Educational Research Journal, 38*(5), 813–839.

Crisp, V., & Sweiry, E. (2006). Can a picture ruin a thousand words? The effects of visual resources in exam questions. *Educational Research, 48*(2), 139–154.

Evett, L., & Brown, D. (2005). Text formats and web design for visually impaired and dyslexic readers – Clear Text for All. *Interacting with Computers, 17*(4), 453–472.

Ketterlin-Geller, L.R. (2008). Testing students with special needs: A model for understanding the interaction between assessment and student characteristics in a universally designed environment. *Educational Measurement: Issues and Practice, 27*(3), 3–16.

Kettler, R.J., Dickenson, T.S., Bennett, H.L., Morgan, G.B., Gilmore, J.A. et al. (2012). Enhancing the accessibility of high school science tests: A multistate experiment. *Exceptional Children, 79*(1), 91–106.

Lonsdale, M. dos S., Dyson, M. C., & Reynolds, L. (2006). Reading in examination-type situations: The effect of text layout on performance. *Journal of Research in Reading, 29*(4), 433–453.

Moncada, S.M., & Moncada, T.P. (2010). Assessing student learning with conventional multiple-choice exams: Design and implementation considerations for business faculty. *International Journal of Education Research, 5*(2), 15–29.

OCR. (2018a). GCSE (9–1) *Gateway Science: Exploring our question papers*. Cambridge: OCR. Retrieved from: https://www.ocr.org.uk/Images/462559-exploring-our-question-papers-gateway-science.pdf (retrieved 4th November 2019).

OCR. (2018b). GCSE (9–1) *Twenty First Century Science: Exploring our question papers*. Cambridge: OCR. Retrieved from: https://www.ocr.org.uk/Images/462607-exploring-our-question-papers-twenty-first-century-science.pdf (retrieved 4th November 2019).

OECD. (2009). *Learning mathematics for life: A perspective from PISA (Programme for International Student Assessment)*. Paris: OECD Publishing.

Pollitt, A., Ahmed, A., & Crisp, V. (2007). The demands of examination syllabuses and question papers. In P. Newton, J-A. Baird, H. Goldstein, H. Patrick & P. Tymms (Eds), *Techniques for monitoring the comparability of examination standards* (pp.166–206). London: Qualifications and Curriculum Authority.

QCA. (2004). *The statutory regulation of external qualifications*. London: Qualifications and Curriculum Authority.

QCA. (2005). *Fair access by design: Guidance for awarding bodies and regulatory authorities on designing inclusive GCSE and GCE qualifications*. London: Qualifications and Curriculum Authority.

Spalding, V. (2009). *Is an examination paper greater than the sum of its parts? A literature review of question paper structure and presentation*. Manchester: AQA Centre for Education Research and Policy.

Using corpus linguistics tools to identify instances of low linguistic accessibility in tests

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Introduction

Assessment is a useful process as it provides teachers and other stakeholders (e.g., parents, government, employers) with information about students' competence in a particular subject area. However, for the information generated by assessment to be useful, it needs to support valid inferences. One factor that can undermine the validity of inferences from assessment outcomes is the language of the assessment material. For instance, if a Mathematics test question contains complex vocabulary and/or grammar, it might prevent students from demonstrating their true mathematical knowledge and skills. This may result in teachers and other stakeholders drawing inaccurate inferences from the test scores. Students who are not native speakers of the target language are more likely to be disadvantaged by assessment material that displays low levels of linguistic accessibility. In an attempt to support teachers and test developers in designing linguistically accessible assessment material, this study explored practical ways of investigating the complexity of test questions

Appendix A. Test questions used in the research

Question 1 – Version 1 (more accessible)

1 Which statement about catalysts is correct?

A A catalyst decreases the activation energy of a reaction.

B A catalyst increases the activation energy of a reaction.

C A catalyst increases the time for a reaction to go to completion.

D A catalyst slows down a reaction.

Your answer ☐ **[1]**

Question 1 – Version 2 (less accessible)

1 Which statement about catalysts is correct?

A A catalyst slows down a reaction.

B A catalyst increases the activation energy of a reaction.

C A catalyst decreases the activation energy of a reaction.

D A catalyst increases the time for a reaction to go to completion.

Your answer ☐ **[1]**

Question 2 – Version 1 (less accessible)

2 Sue and Val are sisters.

The diagram shows some characteristics of Sue and Val.

Sue	**Val**
	
Sex = female	Eye colour = blue-green
Height = 150 cm	Blood group: O

Characteristics can be examples of continuous or discontinuous variation.

Write the four characteristics from the diagram in the correct columns of this table.

Continuous variation	**Discontinuous variation**

[2]

Question 2 – Version 2 (more accessible)

2 Characteristics can be examples of continuous or discontinuous variation.

Write the **four** characteristics below in the correct columns of the table.

Sex **Blood group** **Height** **Eye colour**

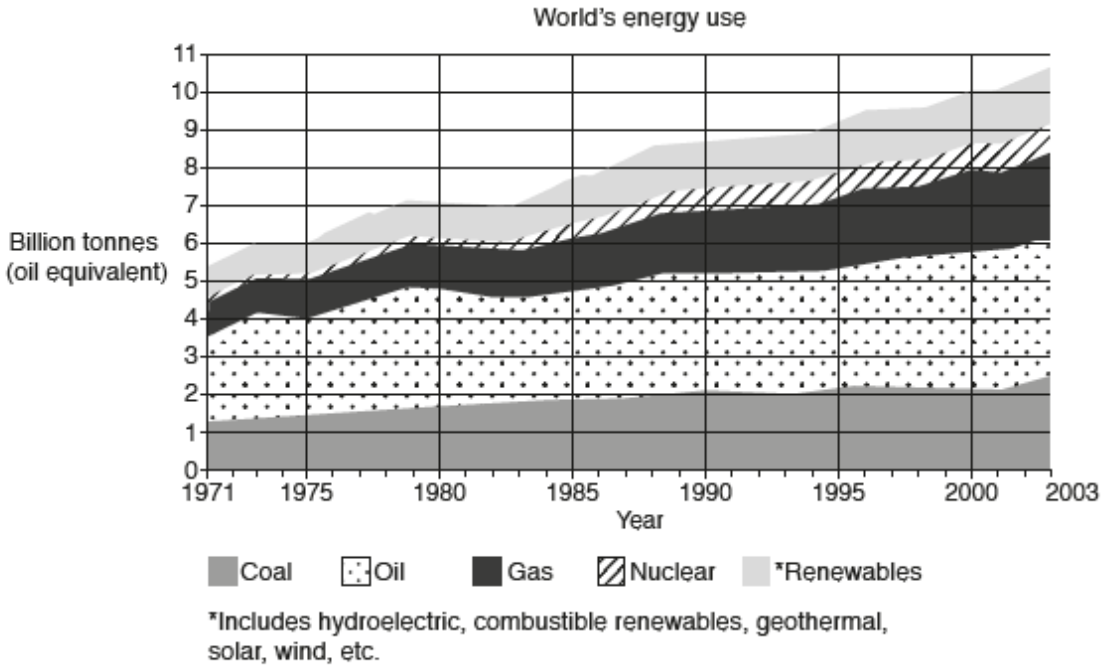
Continuous variation	Discontinuous variation

[2]

Question 3 – Version 1 (more accessible)

3 The graph shows how the World's energy use has changed from the year 1971 to the year 2003.

It also shows the amount of different energy sources used.

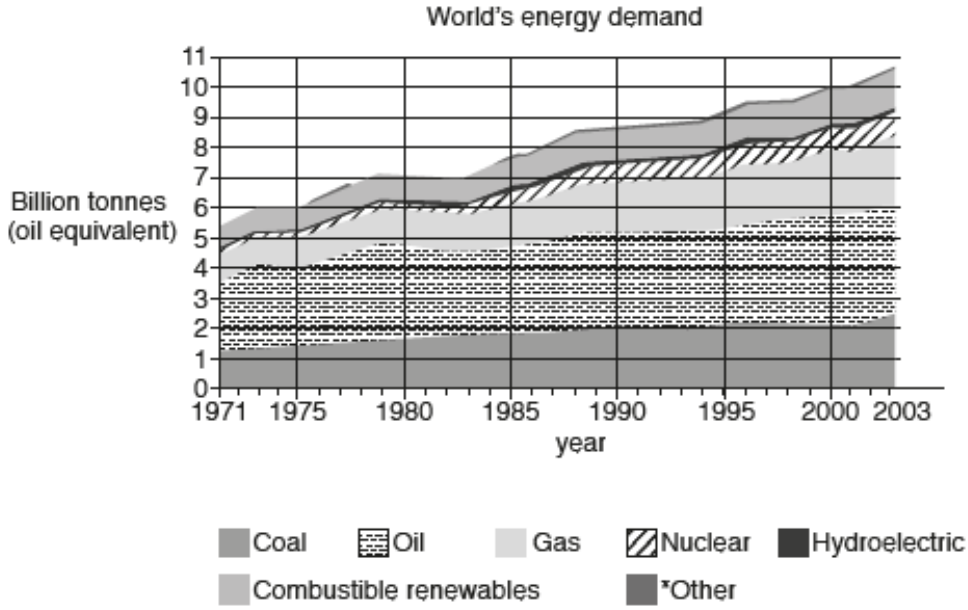


Approximately how much did the total World's energy use increase from the year 1971 to the year 2003?

Answer = ... billion tonnes (oil equivalent) **[1]**

Question 3 – Version 2 (less accessible)

3 Look at the graph. It shows the World's energy demand from the year 1971 to the year 2003.



*Includes geothermal, solar, wind, heat, etc. Source: IEA 2005

How much did the World's energy demand increase from the year 1971 to the year 2003?

answer .....billion tonnes (oil equivalent) **[1]**

Question 4 – Version 1 (less accessible)

4 One farmer grows a crop called oilseed rape.

Humans use the edible oil from this flowering crop in many ways.

Other animals also feed on the oilseed rape, as shown in the food chain for the farmer's fields.

The measurements below the food chain show the amount of biomass in each trophic level.

oilseed rape 8000 g/m^2 → honey bees 2000 g/m^2 → spiders 550 g/m^2 → birds 40 g/m^2

(a) A food chain is one way of showing the feeding relationships in this ecosystem. A pyramid of biomass is another way.

Complete the pyramid of biomass for this ecosystem.

species		biomass in g/m^2
birds		40
spiders		550
oilseed rape		8000

[2]

(b) Calculate the efficiency of biomass transfer from the oilseed rape to the honey bees.

Show your working.

efficiency = ... % **[2]**

Question 4 – Version 2 (more accessible)

4 One farmer grows a crop called oilseed rape.

Honey bees feed on the oilseed rape, as shown in the food chain in **Fig. 4.1**.

The measurements below the food chain show the amount of biomass in each trophic level.

Fig. 4.1

(a) A food chain is one way of showing the feeding relationships in this ecosystem. A pyramid of biomass is another way.

Complete the pyramid of biomass for this ecosystem.

Species		Biomass (g/m²)
birds		40
spiders		550
oilseed rape		8000

[2]

(b) Calculate the efficiency of biomass transfer from the **oilseed rape** to the **honey bees**.

Give your answer as a percentage.

Efficiency = ... % **[2]**

Question 5 – Version 1 (more accessible)

5 A student watches a ball game on the school field.

The student sees the ball being hit with a bat but he hears the sound a short time after. This is because the speed of light is greater than the speed of sound.

He decides to do an experiment to measure the speed of sound waves in air.

Describe which measurements he needs to measure this speed.

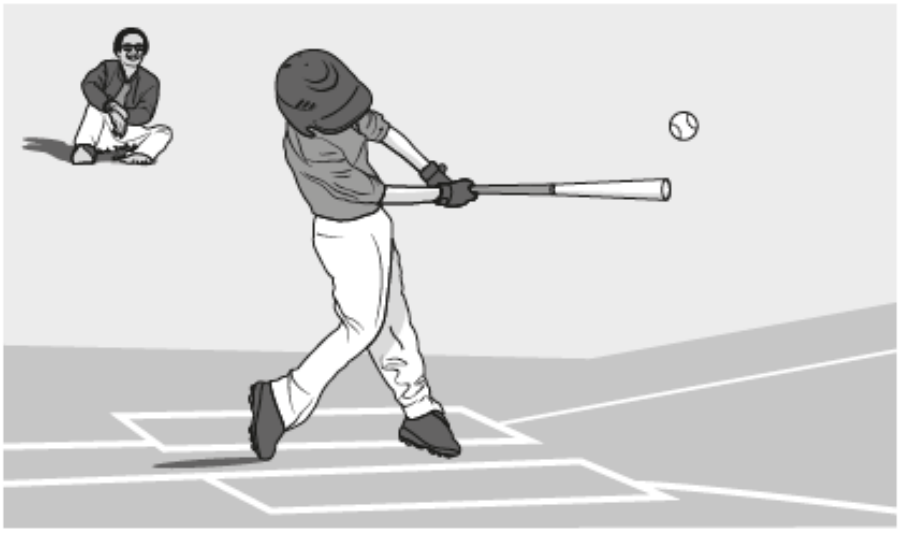
.....

.....

..... **[2]**

Question 5 – Version 2 (less accessible)

5 A student watches a ball game on the school field.



The student watching the game sees the ball being hit with a bat but he only hears the sound a short time after.

This is because the speed of light is greater than the speed of sound.

He decides to do an experiment to measure the speed of sound in air.

Describe which measurements he needs to measure speed.

.....

.....

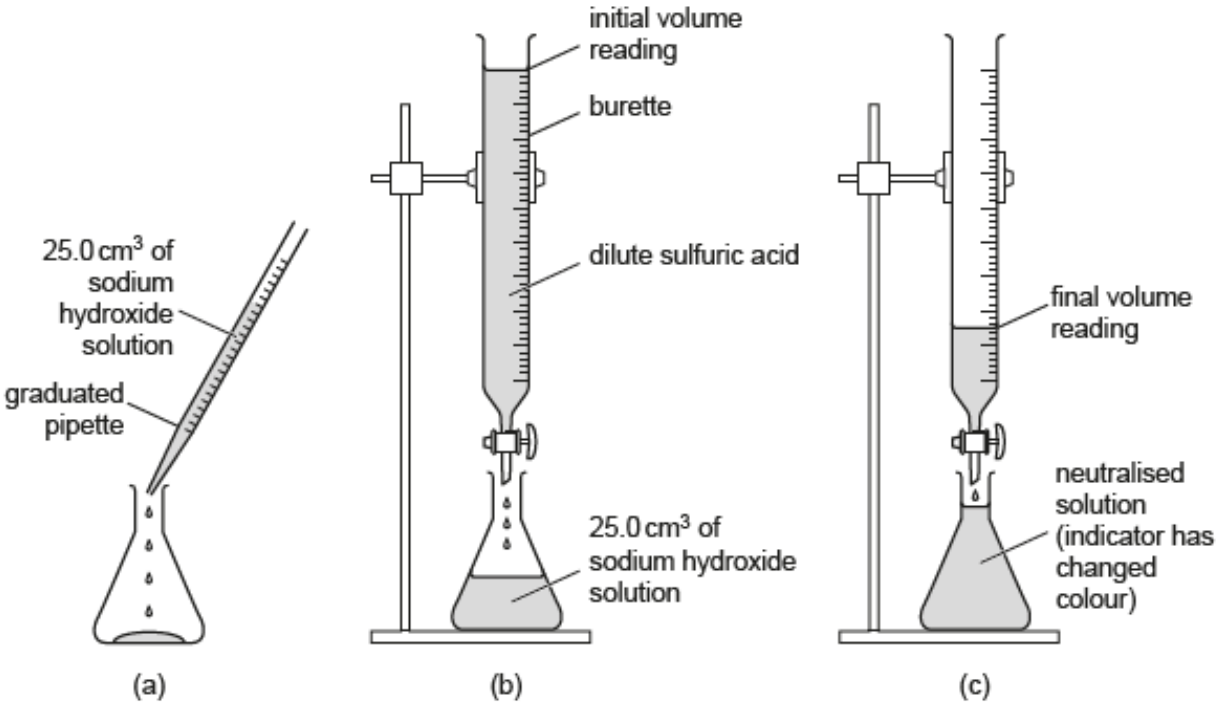
..... [2]

Question 6 – Version 1 (less accessible)

6 A student does a titration with an acid and an alkali.

He uses dilute sulfuric acid, sodium hydroxide solution and an indicator solution.

The diagram shows the apparatus he uses.



The student adds dilute sulfuric acid from the burette to the sodium hydroxide until the indicator changes colour.

He then adds a few more drops of sulfuric acid to be certain the sodium hydroxide is neutralised.

He takes the final volume reading on the burette.

Describe and explain how the student could improve his experiment to get a more accurate value for how much acid reacts with 25.0 cm^3 of sodium hydroxide solution.

.....

.....

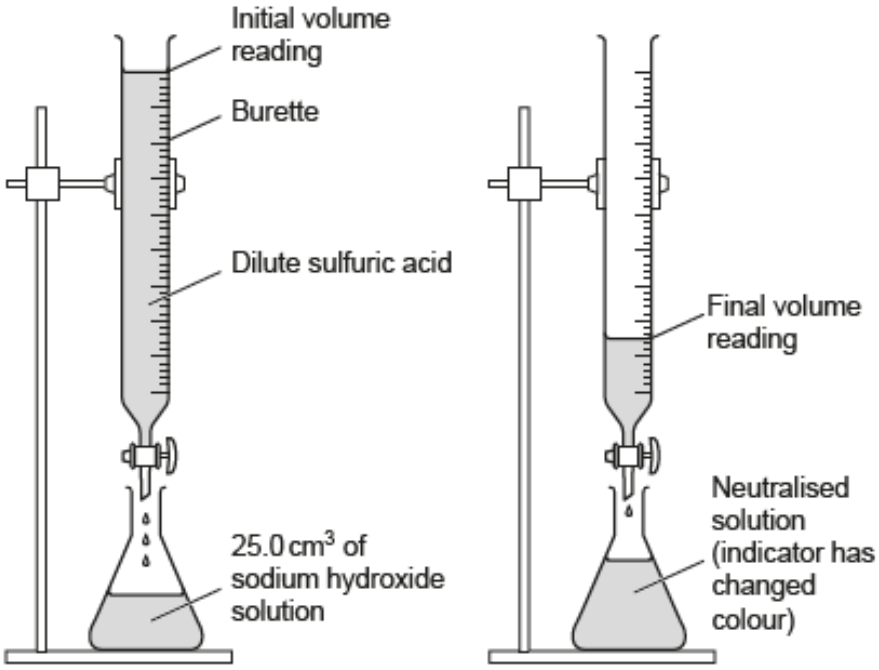
.....

..... **[4]**

Question 6 – Version 2 (more accessible)

6 A student does a titration with an acid and an alkali.

He uses dilute sulfuric acid, sodium hydroxide solution and an indicator solution.



The student's method is:

- Use a measuring cylinder to pour 25.0 cm^3 of sodium hydroxide solution into a conical flask
- Add a few drops of an indicator to the sodium hydroxide solution
- Use a burette to add dilute sulfuric acid to the sodium hydroxide solution until the indicator changes colour.

The student wants to get a more accurate value for how much acid reacts with 25.0 cm^3 of sodium hydroxide solution.

Describe and explain how the student could improve his experiment to get a more accurate value.

.....

.....

.....

..... **[4]**

Question 7 – Version 1 (more accessible)

7 Alex is investigating the forces acting on a trolley to slow it down on different surfaces.

Fig. 7.1 shows his apparatus. Each time, he starts the trolley at the same marked point and measures how far it goes along the test surface before it stops. The centre of the trolley is marked with a dot.

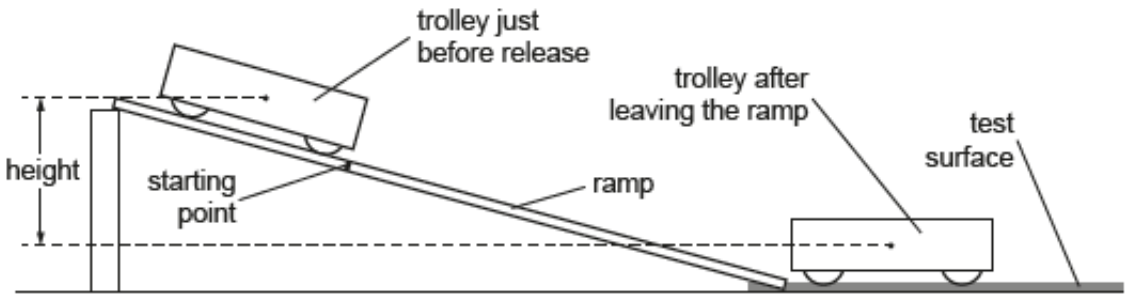


Fig. 7.1

(a) Here are measurements that Alex takes.
Mass of trolley = 0.80 kg
Height = 0.20 m

Assume gravitational field strength = 10 N/kg

Calculate the gravitational potential energy transferred when the trolley leaves the ramp.

Gravitational potential energy transferred = ... J **[3]**

(b) Alex repeats the experiment five times. He measures the distance the trolley travels along the test surface each time.

Table 7.1 shows his results.

Reading	1	2	3	4	5
Distance travelled (m)	1.2	1.4	1.2	0.3	1.4

Table 7.1

What is the best estimate of the distance the trolley travelled along the test surface?

Tick (✓) **one** box.

1.1 m ☐

1.2 m ☐

1.3 m ☐

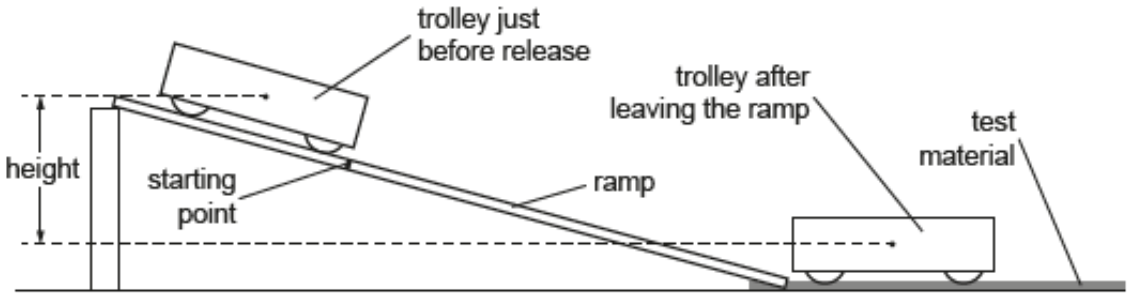
1.4 m ☐

[1]

Question 7 – Version 2 (less accessible)

7 Alex is doing an experiment to investigate the forces acting on a trolley to slow it down on different surfaces.

This is his arrangement. Each time, he lets the trolley start at the same marked point and measures how far it goes along the test material before it stops. The centre of the trolley is marked with a dot.



(a) Here are measurements that Alex takes.

mass of trolley = 0.80 kg
height = 0.20 m

Use these values, together with the value of the gravitational field strength, which is 10 N/kg, to calculate the gravitational potential energy transferred when the trolley leaves the ramp. Show your working.

gravitational potential energy transferred = ... J **[3]**

(b) Alex measures the distance that the trolley goes along the test surface five times for each value of height.
Here is his first set of five readings for a height of 0.20 m.

reading	1	2	3	4	5
distance travelled / m	1.2	1.4	1.2	0.3	1.4

Based on these measurements, what is his best estimate of the distance travelled when the trolley drops a height of 0.20 m?

Put a tick (✓) in the **one** correct box.

1.4 m ☐

1.1 m ☐

1.3 m ☐

1.2 m ☐

[1]

Question 8 – Version 1 (less accessible)

8 A student investigates the effect of acid rain on seed growth.

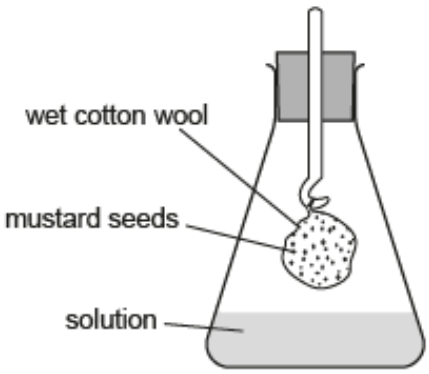
She soaks cotton wool in a solution with a pH value of 7.0.

She then puts 20 mustard seeds onto the cotton wool and places it inside a flask.

The student adds more of the same solution to the flask.

She repeats this with five different solutions.

One of the flasks is shown in the diagram.



After **8 days** she counts how many of the seeds are growing.

The table shows her results.

pH of solution	Number of the 20 seeds that are growing
7.0	17
6.5	18
6.0	16
5.5	6
5.0	2

(a) Write down **one** factor that the student should have kept the same in this investigation.

..... **[1]**

(b) Describe what this experiment shows about the effect of acid rain on seed growth.

.....

.....

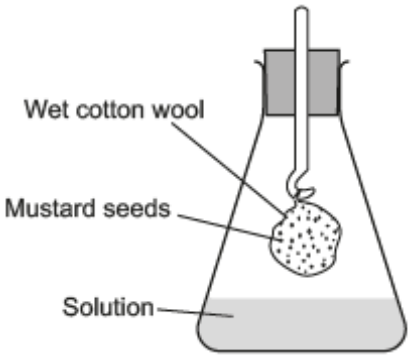
..... **[2]**

Question 8 – Version 2 (more accessible)

8 A student investigates the effect of acid rain on seed growth.

- She soaks cotton wool in a solution with a pH value of 7.0.
- She puts 20 mustard seeds onto the cotton wool and places it inside a flask.
- She adds the same solution to the flask.
- She then repeats this four times using solutions with different pH values.

One of the flasks is shown in the diagram.



After **8 days** she counts how many of the seeds are growing.

The table shows her results.

pH of solution	Number of the 20 seeds that are growing after 8 days
7.0	17
6.5	18
6.0	16
5.5	6
5.0	2

The student used 20 seeds in each flask.

(a) Write down **one** other factor that the student should have kept the same in this investigation.

..... **[1]**

(b) Describe what this investigation shows about the effect of acid rain on seed growth.

.....

.....

..... **[2]**

Appendix B. OCR's accessibility principles

These principles are reproduced from:

OCR. (2018). GCSE (9-1) Gateway Science: Exploring our question papers. Cambridge: OCR. p.5-7. Available at: https://www.ocr.org.uk/Images/462559-exploring-our-question-papers-gateway-science.pdf

Group	No.	Accessibility Principle	Why?
Look and feel of the paper	1	**Layout (clear for all)** • Arial font. • Adequate space for responses and room for working in calculations.	To make it easy for students to add their responses/do their working.
	2	**Tone (assessing good understanding of science without letting the language of our questions be an obstacle to understanding what is needed)** • The use of overly complicated language and grammatical constructions will be avoided. • Contexts and vocabulary will be considered for currency and appropriateness to students, e.g. glasses not spectacles. • Language used throughout the question will be consistent. For example, usage in the stem of a question matches that throughout the rest of the question and any titles given to any diagrams. • Technical words will be used appropriately to underpin the science being assessed.	To make it as clear as possible what response is expected.
Assessment approach	3	Negative questions will be kept to a minimum.	Used well, negative questions can be a good way of testing understanding but can also easily lead to confusion. We will only ever use negatives where it is the most appropriate approach.
	4	Where there is a large context provided, e.g. an experiment, sentences will be grouped by content rather than be lots of separate sentences. Bulleted lists or numbering will be used where it helps indicate stages in a process/practical method.	To ensure information is presented in the clearest possible way.
	5	Names will not be used unless avoidance of names leads to a complicated question layout.	To avoid imparting cultural/gender bias into questions through choice of name or confusing students through choices of names they are unfamiliar with.

Group	No.	Accessibility Principle	Why?
Question formatting style	6	Where possible, brackets rather than commas will be used to separate abbreviations/acronyms from the body of the text. For example, measurement abbreviations will be put into brackets not separated by commas.	Brackets are a much clearer way of signposting such clarification within sentences than commas.
	7	All text will be left aligned (text in table headings will be centred except for row headings which will be left aligned).	To align with the principles applied to our modified question papers (left alignment is easier to understand for a range of visual impairments).
	8	Multiple choice answer options will be in alphabetical order/numerical order (Unless doing so would provide a prompt for the correct answer or if listing elements in the order of the Periodic Table).	To avoid an order that might indicate to the student the correct response.
Calculations	9	If a question requires an answer to a certain number of decimal places or significant figures, for example, we will always ensure this is clearly stated.	To avoid confusing students. Genuine scientific scenarios will be used wherever possible for authenticity and validity. This may mean numbers in calculations will not be whole integers.
Scientific conventions	10	Units will always, • be separated by a solidus, e.g. mol/dm^3 rather than mol dm^{-3}. The latter notation will be used at A level. • be in brackets for tables/graphs.	To align notation with common usage at this level. The more technically correct notation, e.g. mol dm^{-3} with graph axes labelled as concentration/mol dm^{-3} etc., will be used at AS/A level to support progression to HE and in line with accepted educational practice post-16.
	11	Atomic masses will always be used as published on our Periodic Table, included on the OCR Data Sheet.	Masses used represent up-to-date IUPAC practice and align with usage at AS/A level to avoid students having to learn new values as they move on to further study. The non-integer, real, data also better underpin concepts such as isotopes.
	12	Italics will not be used in questions (unless scientifically justified, e.g. for genus species nomenclature). Generally italicised latin abbreviations such as i.e., e.g. and etc. will not be used. English terms will be used instead.	Italics can be hard to read if overused but we have retained their use where this is the correct scientific approach to avoid establishing bad practices for students who progress to AS/A level. Latin abbreviations can be easily misunderstood.

Group	No.	Accessibility Principle	Why?
Images, diagrams, data	13	Images, diagrams and data will only be used where they genuinely support what is required in the question. We will avoid students needing to turn pages by aiming to always have images, diagrams and questions on facing pages.	To avoid unnecessary page turning and distracting images for the students that do not help them understand what is required in the question.
	14	All tables, graphs, images, diagrams and equations will be left aligned.	To align with the principles applied to our modified question papers (left alignment is easier to understand for a range of visual impairments).
	15	Text will not be wrapped around images/diagrams/ graphs.	To retain clarity.
	16	If students are required to do something with an image/diagram/graph, it will be centred with sufficient space around it for them to do their working.	To avoid students struggling to fit in their response.