Standards & Testing Agency

2014 science sampling tests:

commentary on selected questions

July 2017

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Contents

Summary

This publication highlights misconceptions in pupils' understanding in certain science topics, as uncovered by the 2014 key stage 2 science sample. It will give teachers an insight into teaching important topics and how best to consider results gained from using the questions released from the 2014 sample in their lessons.

Who is this publication for?

This publication is for:

- local authorities
- school leaders, teachers and other school staff and governing bodies in all maintained schools, academies and free schools.

Introduction

In order to support teachers in interpreting the results of the 2014 science sampling tests, the Standards and Testing Agency (STA) is releasing a number of questions from the 2014 tests. These questions will not be used in future science samples. Seven of the questions are presented in this document, which provides commentaries on how pupils performed and what this might reveal about pupils' understanding of the science topics. Nine of the questions are also available in a modified format for pupils with a visual impairment. These are available from Autumn 2017.

The questions are drawn from a range of topics and demonstrate pupils' ability to respond to a number of question types and levels of demand. Non-creditworthy responses have been provided where they merit comment. It should be noted that pupils demonstrated inconsistent knowledge of scientific terms and how to apply them across the topics represented here. Hopefully this information will enable teachers to review their current approaches to teaching particular topics from the primary science curriculum and determine whether changes should be made. This document does not provide support for teachers in how to teach particular topics. However, it will be shared with science organisations that provide such guidance to schools.

The 2014 science sample assessed the curriculum in use in that year. The 2016 science sample assessed the new national curriculum. The questions in this release cover content that is pertinent to both curriculums to ensure it is relevant to teachers' continuing professional development.

Considerations in using this report and questions

Each pupil that took part in the science sampling tests took one of 30 different combinations of test booklets, meaning each question was not administered to the same group of pupils. As a result, the percentages shown in this document do not directly reflect the number of pupils who gained credit on the question in the sampling tests, but are an estimate calculated using weighted percentages. This enables STA to account for any differences in attainment between the groups of pupils that took each question, to provide an estimate of the proportion of pupils across the national cohort who would be expected to gain credit were they to attempt the question. For a small number of questions contained within the report, the total percentage of creditworthy and non-creditworthy responses does not add up to 100. This is due to rounding.

These questions have been released to help teachers understand common misconceptions occurring in the tests. These questions and those contained in the booklet, *Science sampling tests: selected questions from the 2014 science sample*, may be useful as part of classroom assessment activities. Please bear in mind that in the sample tests pupils answer predetermined combinations of questions carefully constructed to avoid one question giving the answer to another. It is therefore recommended that the following two question pairings should not be taken together by pupils:

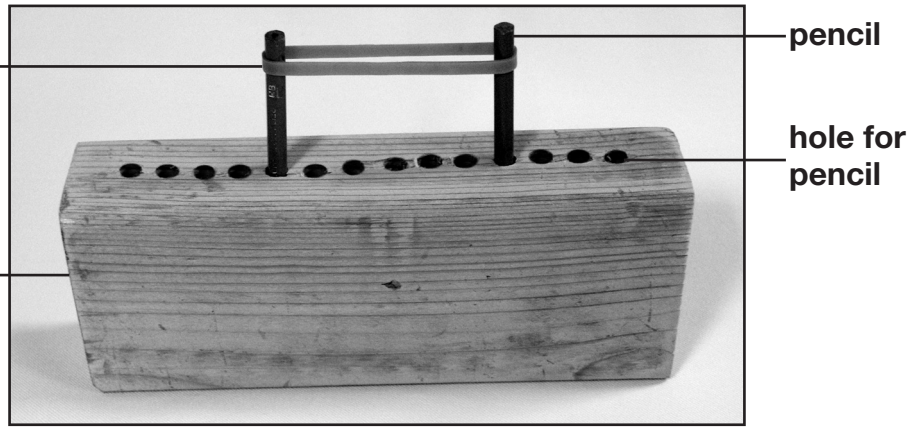
- 'Rock salt' (part b) and 'Sam's mixtures' (part b)
- 'Space' (part a) and 'Sun, Earth and Moon' (part c)

The content domain is taken from the 1999 National Curriculum for England. The cognitive domain is explained in the KS2: science sampling test framework.

6 Sound

(a) Salena has made a musical instrument.
She stretched an elastic band around pencils as shown in the picture.

Salena plucks the elastic band.
The instrument makes a sound.



What part of the instrument vibrates to make the sound?

..... a

1 mark

(b) What does the sound travel through to get from the musical instrument to Salena's ears?

..... b

1 mark

(c) Salena changes the elastic band on her instrument.

What would happen to the sound if Salena used a **thicker** elastic band on her instrument?

A **thicker** elastic band makes the sound c

1 mark

(d) Tick **ONE** box to show how Salena can make a **louder** sound on her musical instrument.

Pluck the elastic band more gently. ☐

Pluck the elastic band harder. ☐

Move the pencils closer together. ☐

Move the pencils further apart. ☐

Move the elastic band down the pencils. ☐

☐ d

1 mark

(e) Tick **ONE** box to show how Salena can make a sound with a **higher** pitch on her musical instrument.

Pluck the elastic band more gently. ☐

Pluck the elastic band harder. ☐

Move the pencils closer together. ☐

Move the pencils further apart. ☐

Move the elastic band down the pencils. ☐

☐ e

1 mark

Sound

(a) Salena has made a musical instrument.
She stretched an elastic band around pencils as shown in the picture.

Salena plucks the elastic band.
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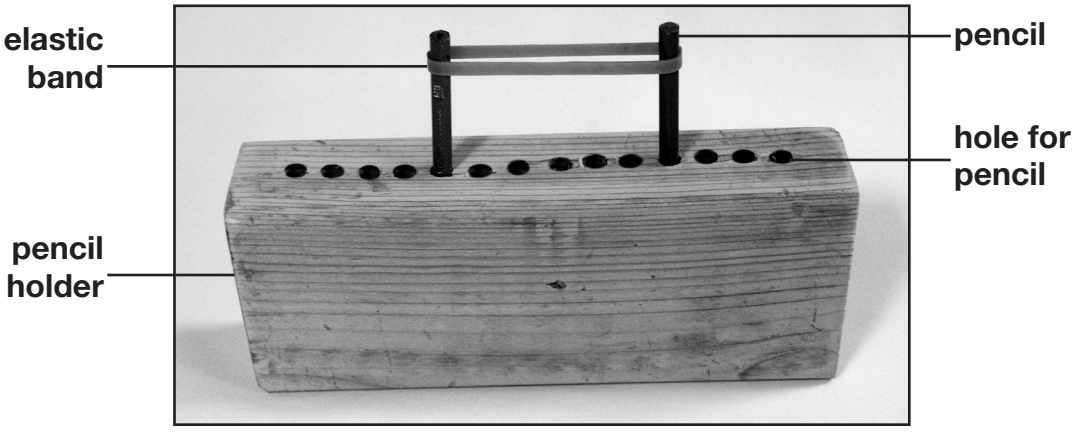


What part of the instrument vibrates to make the sound?

..... a

1 mark

Question	Mark	Requirements	Allowable answers
a	***1m***	Award **ONE** mark for an indication that the elastic band vibrates, for example: ■ the (elastic) band(s)	**ONE** mark may be awarded for: ■ rubber ■ elastic

Additional guidance

Do not *give credit for a response that includes incorrect science stating that other parts of the instrument vibrate to make the sound, for example:*
- *pencil*
- *pencil holder*

Do not *give credit for an incorrect response that includes a part not presented in the photograph, for example:*
- *string*

Content domain reference	**Sc4** Physical processes **3e** Light and sound *Sounds are made when objects vibrate but that vibrations are not always directly visible.*		
Cognitive domain strand	Knowledge and comprehension	**Application and analysis**	Synthesis and evaluation
This question is assessing whether pupils can identify which part of the instrument is vibrating to produce the sound.			

Option	Commentary
Creditworthy 75%	
Examples: 'elastic band' 'rubber band' 'band'	**75%** of pupils successfully identified the elastic band as the part of the instrument that vibrates to make the sound.
Non-creditworthy 25%	
Examples: 'pencil holder' 'pencils'	**25%** gave responses which incorrectly identified other parts of the instrument as the component that vibrates, for example the pencils or pencil holder. These responses indicated a lack of understanding of how audible sounds in this context are generated, given pupils were explicitly told that Salena plucked the elastic band.

Sound

(b) What does the sound travel through to get from the musical instrument to Salena's ears?

.....

b

1 mark

Question	Mark	Requirements	Allowable answers
b	*1m*	Award **ONE** mark for a response indicating that sound travels through the air, for example: ■ air ■ gas ■ (the) atmosphere	

Additional guidance

Do not *give credit for a response that includes incorrect science:*
- *air waves*

Do not *give credit for an insufficient response giving a solid object the sound may travel through, for example:*
- *floor*
- *walls*
- *table*

Do not *give credit for an insufficient response referring to how sound travels, for example:*
- *vibrations*
- *(sound) waves*

Do not *give credit for an insufficient response referring to what else sound may travel through, for example:*
- *wind*
- *musical instrument [given]*
- *ear (drum) [given]*
- *the pencil holder*
- *the wood*
- *the holes for the pencils*

Content domain reference	**Sc4** Physical processes **3g** Light and sound *That vibrations from sound sources require a medium through which to travel to the ear.*		
Cognitive domain strand	**Knowledge and comprehension**	Application and analysis	Synthesis and evaluation
This question is assessing understanding that sound travels through a medium to reach our ears.			

Response	Commentary
Creditworthy 40%	
'air'	Pupils found this item a lot more challenging than part (a) and only **40%** of pupils scored the mark by identifying air. 'Gas' and 'atmosphere' were also creditworthy, but these responses were rare.
Non-creditworthy 60%	
Examples: 'floor' 'table'	**1%** of pupils did not gain credit because they responded by giving the name of a solid object. The sound could have travelled through an object such as the floor or table. However, this would not allow the sound to get to Salena's ears.
Examples: 'vibration' 'sound waves'	**16%** gave the response 'vibrations' or 'sound waves'. Responses of this nature referred to how sound travels, not what it travels through, and showed that the pupils didn't understand the underlying science sufficiently to answer this part of the question correctly.
Examples: 'holes and pencil holder' 'the hole for the pencil' 'the room'	**42%** gave a range of other insufficient responses such as naming parts of the instrument, or no response at all. Pupils who responded with 'the room' didn't fully understand the question; while they recognised the sound had travelled spatially, they hadn't explained what medium it used to do this.

Sound

(c) Salena changes the elastic band on her instrument.

What would happen to the sound if Salena used a **thicker** elastic band on her instrument?

A **thicker** elastic band makes the sound .....

c

1 mark

Question	Mark	Requirements	Allowable answers
c	***1m***	Award **ONE** mark for a response indicating the pitch of the sound gets lower, for example: *A thicker elastic band makes the sound...* ■ lower/deeper	

Additional guidance

Do not *give credit for a response that includes incorrect science suggesting the volume of the sound changes, for example:*
A thicker elastic band makes the sound...
- *louder*
- *softer*

Do not *give credit for a response that includes incorrect science suggesting the pitch gets higher.*

Do not *give credit for an insufficient response referring to a change in pitch (but not specifying how it changes), for example:*
- *have a different pitch*

Content domain reference	**Sc4** Physical processes **3f** Light and sound *How to change the pitch and loudness of sounds produced by some vibrating objects.* **Sc1** Science enquiry **2c** Planning *Think about what might happen or try things out when deciding what to do, what kind of evidence to collect, and what equipment and materials to use.*		
Cognitive domain strand	**Knowledge and comprehension**	Application and analysis	Synthesis and evaluation
This question is assessing whether pupils can link a feature of part of the instrument to the pitch of the sound produced.			

Response	Commentary
Creditworthy 69%	
Examples: 'lower' 'lower and longer' 'deeper'	**69%** of pupils recognised that the pitch would get lower if a thicker elastic band was used.
Non-creditworthy 31%	
Examples: 'quieter' 'louder'	**22%** of pupils responded with these answers, suggesting they believed the thickness of the band controlled the sound's volume rather than its pitch. Confusing volume with pitch seemed to be a common misconception.
'higher'	**3%** incorrectly stated the sound would get 'higher'. As well as being the opposite of the right answer, this response also failed to convey unambiguously that it was pitch (rather than volume) that would have changed.
Examples: 'bang' 'low'	**7%** gave other insufficient responses or no response at all. Some of these answers failed to get the mark because they were not sufficiently clear. Others failed because they didn't address the question, for example, 'low' doesn't give the required comparison.

Sound

(d) Tick **ONE** box to show how Salena can make a **louder** sound on her musical instrument.

- Pluck the elastic band more gently. ☐
- Pluck the elastic band harder. ☐
- Move the pencils closer together. ☐
- Move the pencils further apart. ☐
- Move the elastic band down the pencils. ☐

☐ d

1 mark

Question	Mark	Requirements	Allowable answers
d	***1m***	Award **ONE** mark for: ■ Pluck the elastic band harder ☑	

Additional guidance
Do not *give credit if more than one box has been ticked.*

Content domain reference	**Sc4** Physical processes **3f** Light and sound *How to change the pitch and loudness of sounds produced by some vibrating objects.*		
Cognitive domain strand	Knowledge and comprehension	**Application and analysis**	Synthesis and evaluation
This question is assessing understanding of how to change the volume of a sound.			

Response	Commentary
Creditworthy 53%	
Pluck the elastic band harder.	**53%** of pupils correctly identified this option, demonstrating understanding of the factors which affected the volume of sound in this context.
Non-creditworthy 47%	
Pluck the elastic band more gently.	**3%** chose this option, showing they knew how the sound was generated, but didn't understand what controlled its volume.
Move the pencils closer together.	**7%** chose this option, perhaps indicating they believed a shorter vibrating band would make the sound louder. They didn't understand that making the band slack would prevent it from functioning adequately as the 'string' of the instrument.
Move the pencils further apart.	This was the most popular incorrect option with **27%** selecting it. To move the pencils further apart would make the band tighter and the pitch higher, but not the volume. These pupils seemed to have confused pitch with volume.
Move the elastic band down the pencils.	**7%** chose this option. As this action would affect neither volume nor pitch, pupils selecting this option didn't seem to understand how sound can be made or its attributes altered.

Sound

(e) Tick **ONE** box to show how Salena can make a sound with a **higher** pitch on her musical instrument.

- Pluck the elastic band more gently. ☐
- Pluck the elastic band harder. ☐
- Move the pencils closer together. ☐
- Move the pencils further apart. ☐
- Move the elastic band down the pencils. ☐

☐ e

1 mark

Question	Mark	Requirements	Allowable answers
e	*1m*	Award **ONE** mark for: ☐ ☐ ☐ ■ Move the pencils further apart ☑ ☐	

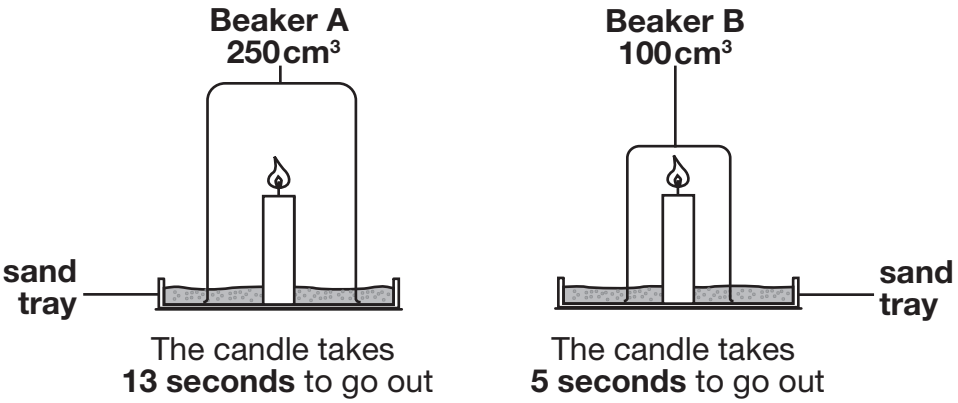
Additional guidance
Do not *give credit if more than one box has been ticked.*

Content domain reference	**Sc4** Physical processes **3f** Light and sound *How to change the pitch and loudness of sounds produced by some vibrating objects.*		
Cognitive domain strand	Knowledge and comprehension	**Application and analysis**	Synthesis and evaluation
This question is assessing understanding of how to change the pitch of a sound.			

Response	Commentary
Creditworthy 48%	
Move the pencils further apart.	**48%** of pupils recognised that moving the pencils further apart (which would tighten the band) would cause the pitch to be higher. This is a similar proportion to part (d) relating to volume, although being able to correctly answer part (d), and remove an option, would make part (e) slightly easier.
Non-creditworthy 51%	
Pluck the elastic band more gently.	**20%** chose this option, which would make the sound quieter.
Pluck the elastic band harder.	**8%** chose this option, which would make the sound louder.
Move the pencils closer together.	**14%** chose this option. This action would make the band less taut, lowering the pitch, indicating pupils were confused as to what change was needed in this context to raise the pitch.
Move the elastic band down the pencils.	**8%** chose this option.

7 Candles burning

(a) Hamza lights two identical candles and puts different sized transparent beakers over them.



Why does Hamza put the candles on sand trays?

.....

a

1 mark

(b) Why is it important to use transparent beakers for this experiment?

.....

b

1 mark

(c) Candles use a gas in the air when they burn.
When there is not enough of this gas left, the flame goes out.

Why did the candle flame in beaker B go out more quickly than the candle flame in beaker A?

.....

c

1 mark

(d) Hamza puts a **500 cm³** beaker over another identical candle.

Predict how much time the candle flame will take to go out.

..... seconds

d

1 mark

(e) What should Hamza do to check his results?

.....

e

1 mark

(f) Candle wax melts and burns.

Tick **ONE** box in each row of the table to show if each statement describes melting or burning.

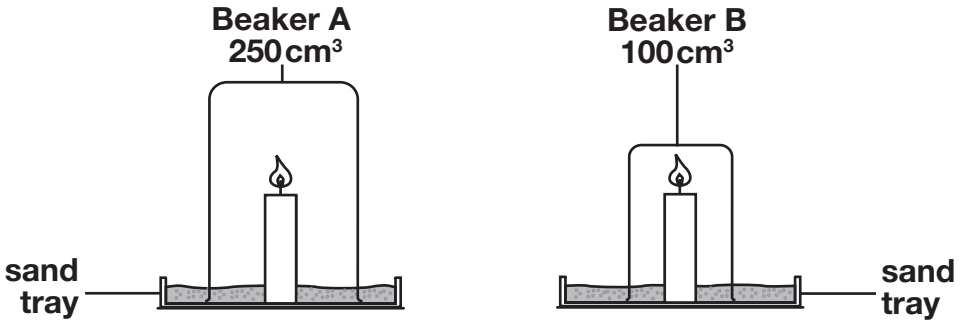
Statement	Melting	Burning
A new material is made.		
It is a reversible change.		
A solid changes to a liquid.		

f

1 mark

Candles burning

(a) Hamza lights two identical candles and puts different sized transparent beakers over them.



Why does Hamza put the candles on sand trays?

.....

a

1 mark

Question	Mark	Requirements	Allowable answers
a	***1m***	Award **ONE** mark for an understanding that the sand tray reduces the risk of fire or getting burned, for example: ■ to prevent a fire ■ the sand won't burn/catch fire ■ so he will not be burned Award **ONE** mark for recognising a benefit for the experiment, for example: ■ to form a seal	**ONE** mark may be awarded for responses identifying the sand will support the candle, for example: ■ to stop the candle falling over

Additional guidance

Do not *give credit for an insufficient response that implies the sand will help the candles go out or stop them burning, for example:*
- *to see if the candles go out more quickly*
- *to stop the candles burning*

Do not *give credit for an insufficient response, for example:*
- *to be safe*

Content domain reference	Breadth of study **2b** *Recognise that there are hazards in living things, materials and physical processes, and assess risks and take action to reduce risks to themselves and others.* **Sc1** Scientific enquiry **2e** Obtaining and presenting evidence *Use simple materials and equipment appropriately and take action to control risks.*		
Cognitive domain strand	Knowledge and comprehension	**Application and analysis**	Synthesis and evaluation
This question is assessing pupils' ability to provide a rationale for the use of sand in this experiment.			

Response	Commentary
Creditworthy 50%	
Examples: 'sand won't burn' 'it won't set on fire' 'the sand will stop a fire spreading' 'if the candle falls the sand will put out the flame'	**26%** of pupils indicated that sand reduces the risk of fire or of getting burned. They saw that the sand can act as a safety measure, should the candle topple over. They understood fire can spread between combustible materials and that sand is not combustible.
Examples: 'so no air can get through' 'the air does not escape when it is on the tray' 'so no air can get in the beaker through gaps at the bottom'	**7%** identified that sand formed a seal around the bottom of the beaker (to stop the air getting in or out), which was necessary for the experiment to give accurate results. These pupils had a deeper understanding of the requirements of fire and a better understanding of the use of sand in this experiment.
Examples: 'so the candles don't fall down' 'so the candle can stand up properly' 'so the candles stay in place'	**18%** realised that the sand provided physical support to the candle keeping it upright.

Non-creditworthy 50%	
Examples: 'to stop the candles burning' 'in case it burns'	**5%** indicated that the sand would help put the candles out, which would make the experiment invalid, since the aim was to find out how long they burned in the air inside the beakers. These pupils did not understand the purpose of the sand or of the experiment itself.
'to make it safe'	**1%** gave the insufficient response that sand was used for safety without explaining how or why.
Examples: 'so the candle won't drop wax on the floor' 'the wax will fall on the sand' 'to make it fair'	**44%** gave other incorrect or insufficient responses or no responses at all. Some of these non-creditworthy responses related to safety elements (such as the first two examples). Other responses referred to making this a 'fair test', which is often given when pupils don't know the answer. Some pupils believe the key requirement of experiments is to be a 'fair test' and expect to be asked this in a science question.

Candles burning

(b) Why is it important to use transparent beakers for this experiment?

.....

b

1 mark

Question	Mark	Requirements	Allowable answers
b	***1m***	Award **ONE** mark for an indication that Hamza needs to see the candle during the experiment, for example: ■ he needs to watch the candle ■ to see when it (the candle) goes out ['it' clearly implies the pupil is referring to the candle]	**ONE** mark may be awarded for: ■ to see what happens

Additional guidance

Do not *give credit for an insufficient response identifying what transparent means without stating why this is important for the experiment, for example:*

- *to see through it*

Do not *give credit for an insufficient response where a pupil has referred to a different property of the beakers, for example:*

- *so they do not melt*
- *to stop the candles from falling over*
- *so the beakers do not catch fire*

Do not *give credit for an insufficient response, for example:*

- *to time when it goes out [no reference to seeing]*
- *so he won't touch a hot beaker*

Content domain reference	**Sc1** Scientific enquiry **2c** Planning *Think about what might happen or try things out when deciding what to do, what kind of evidence to collect and what equipment and materials to use.*		
Cognitive domain strand	Knowledge and comprehension	**Application and analysis**	Synthesis and evaluation
This question is assessing pupils' ability to provide a rationale for selecting equipment for this investigation.			

Response	Commentary
Creditworthy 68%	
Examples: 'so he can see what's happening in the beakers' 'so you can see the candle' 'to see which one goes out first' 'to see how long it takes'	**68%** of pupils realised that transparent beakers were needed in order to see what was happening and when the candles went out.
Non-creditworthy 32%	
Examples: 'because they are see-through' 'so we can see'	**3%** gave a response simply stating that the beakers needed to be 'see-through' without explaining why this was important in the context of this experiment. The pupils understood the meaning of the word 'transparent' but failed to apply this knowledge to a context.
Examples: 'so the wind doesn't blow it out' 'because if you used plastic it would start to melt'	**6%** did not understand the term 'transparent', and gave a response relating to another property of the beaker instead, such as the beaker's resistance to burning or to the candle not falling over. Whilst these pupils showed some understanding of why the candle should be covered up they failed to demonstrate an understanding of why the cover also had to be transparent.
Other responses that did not gain a mark	**23%** did not gain a mark because they gave responses which insufficiently or incorrectly referred to the graph or the variables or they gave no response at all.

Candles burning

(c) Candles use a gas in the air when they burn.

When there is not enough of this gas left, the flame goes out.

Why did the candle flame in beaker B go out more quickly than the candle flame in beaker A?

.....

c

1 mark

Question	Mark	Requirements	Allowable answers
c	*1m*	Award **ONE** mark for recognising that the time of burning is proportional to the amount of air/gas in the beaker, for example: ■ there is more air/gas in beaker A ■ there is less air/gas in beaker B ✣ **Give credit** for responses that go beyond the KS2 programme of study by referring to oxygen in place of gas or air, for example: ■ there is more oxygen in beaker A ■ it has less oxygen	**ONE** mark may be awarded for: ■ the candle with a lot of air took a long time to go out ■ the gas ran out first in B ■ it has less air/gas [B implied from question cue] **ONE** mark may be awarded for a response that indicates the gas ran out, but does not explicitly state that it ran out first, for example: ■ the gas ran out (in beaker B)

Additional guidance
Do not *give credit for an insufficient response that only refers to the size of a beaker and does not link this to the amount of gas, for example:* ■ *because beaker B/it is smaller* ■ *A is bigger than B* ■ *beaker B/it has less space* ***Do not*** *give credit for an insufficient response, for example:* ■ *the candle in the big beaker took longer to go out [given]*

Content domain reference	**Sc1** Scientific enquiry **1a** Ideas and evidence in science *That science is about thinking creatively to try and explain how living and non-living things work, and to establish links between causes and effects.* **2j** Considering and evaluating evidence *Use observations, measurements or other data to draw conclusions.*		
Cognitive domain strand	Knowledge and comprehension	Application and analysis	**Synthesis and evaluation**
This question is assessing whether pupils are able to provide a scientific explanation for why something is happening in an investigation.			

Response	Commentary
Creditworthy 52%	
Examples: 'it hasn't as much air' 'in B there is less air than A' 'because it has less gas' 'it didn't have much space for the gas' 'because beaker A has more room for air'	**42%** of pupils indicated that beaker B had less air in it or that the air in beaker B ran out first. Some pupils conveyed this information by giving the converse response, referring to beaker A having more air.
Examples: 'because there is less oxygen in B' 'Beaker A can hold more oxygen'	**8%** gained credit by going beyond the KS2 programme of study, explicitly referring to there being less oxygen in beaker B. The question indicates that a 'gas' is needed, but these pupils realised that this gas was oxygen.
Examples: 'because it ran out of air' 'there was no more gas' 'air runs out quicker in a small beaker' 'the gas was used up'	**1%** gave an allowable response indicating that the gas ran out in beaker B, without explicitly mentioning beaker B. This information was inferred because the question itself explicitly refers to beaker B as the subject.

Non-creditworthy 48%	
Examples: 'because it is smaller' 'it had less room' 'because the beakers are different sizes'	**31%** only referred to beaker size, for example, that beaker B is smaller. While this was a direct observation taken from the images, it gave no explanation for why a smaller beaker should have this result. This suggests these pupils had a limited understanding of the outcome of the investigation.
'because air escaped from the B beaker'	**18%** gave a range of other insufficient responses or no responses at all. Non-creditworthy answers included references to the gas being lost.

Candles burning

(d) Hamza puts a **500 cm³** beaker over another identical candle.

Predict how much time the candle flame will take to go out.

..... seconds

d

1 mark

Question	Mark	Requirements	Allowable answers
d	***1m***	Award **ONE** mark for an answer in the range 25–26 (inclusive).	

Additional guidance

Content domain reference	**Sc1** Scientific enquiry **2c** Planning *Think about what might happen or try things out when deciding what to do, what kind of evidence to collect and what equipment and materials to use.*		
Cognitive domain strand	Knowledge and comprehension	**Application and analysis**	Synthesis and evaluation
This question is assessing whether pupils are able to make a prediction based on two previous results for an investigation.			

Response	Commentary
Creditworthy 76%	
'26' '25'	**76%** of pupils gained the mark for deducing that in a beaker twice the size of beaker A, the candle should take twice the time to go out (26 seconds) or in a beaker five times the size of beaker B, it should take five times as long (25 seconds).
Non-creditworthy 24%	
'20' '29'	**11%** gave an approximate suggestion ranging from 20-31 seconds (excepting 25 and 26). Since a good prediction should be based on the scientific evidence available, these responses were not considered creditworthy.
Less than '20', or more than '31'	**13%** gave other insufficient responses that did not seem to be based on the evidence provided. This indicated that these pupils were not able to apply their estimation skills in this context.

Candles burning

(e) What should Hamza do to check his results?

..... e

1 mark

Question	Mark	Requirements	Allowable answers
e	*1m*	Award **ONE** mark for a response indicating that the test should be repeated, for example: ■ repeat the test/it again ■ do the test/it 3 times ■ try the test/it again	

Additional guidance

Do not *give credit for an insufficient response referring to checking rather than repeating, for example:*
- *check the results/it/the test/them (again) [given]*

Do not *give credit for a response that includes incorrect science referring to fair testing, for example:*
- *make the test fair*
- *use the same size candles*

Content domain reference	**Sc1** Scientific enquiry **2g** Obtaining and presenting evidence *Check observations and measurements by repeating them where appropriate.*		
Cognitive domain strand	**Knowledge and comprehension**	Application and analysis	Synthesis and evaluation
This question is assessing whether pupils understand how you can check results.			

Response	Commentary
Creditworthy 50%	
Examples: 'do it again to be sure' 'do the experiment again' 'do the test 3 times'	**50%** of pupils recognised that Hamza should do his test again to check his results.
Non-creditworthy 50%	
'check them'	**3%** repeated the question cue that Hamza should check his results without offering an explanation of how to check. This kind of answer was given by less able pupils.
'he should make sure it is a fair test'	**2%** answered using incorrect science by stating he should make the test fair. This was incorrect, as the test was already fair. In order to check the results the test should be carried out again in exactly the same way.
Examples: 'time it' 'put the 500cm^3 beaker over the candle and see how long it takes to burn out' 'create a graph' 'draw a table'	**45%** of pupils gave other insufficient responses or no response at all. Use of 'create a graph or table' suggests that these pupils were aware of the scientific process, but were unable to decide when it was appropriate to move on to the next stage.

Candles burning

(f) Candle wax melts and burns.

Tick **ONE** box in each row of the table to show if each statement describes melting or burning.

Statement	Melting	Burning
A new material is made.		
It is a reversible change.		
A solid changes to a liquid.		

f

1 mark

Question	Mark	Requirements	Allowable answers
f	*1m*	Award **ONE** mark for all **three** statements in the table correctly classified:	

Statement	*Melting*	*Burning*
A new material is made.		✓
It is a reversible change.	✓	
A solid changes to a liquid.	✓	

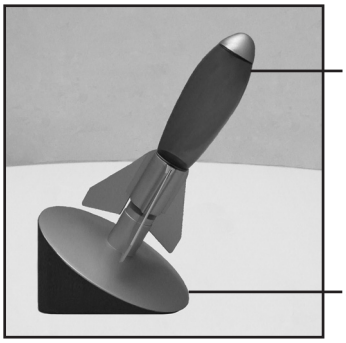
Additional guidance

Content domain reference	**Sc3** Materials and their properties **2d** Changing materials *Pupils should be taught about reversible changes, including dissolving, melting, boiling, condensing, freezing and evaporating.* **2g** Changing materials *Pupils should be taught that burning materials results in the formation of new materials and that this change is not usually reversible.*		
Cognitive domain strand	**Knowledge and comprehension**	Application and analysis	Synthesis and evaluation
This question is assessing pupils' understanding of melting and burning.			

Response	Commentary
Creditworthy 42%	
burning melting melting	**42%** of pupils correctly classified all three statements. The easiest statement to classify was 'solid changes to liquid' with **86%** of pupils correctly identifying this as melting. **62%** recognised melting is a reversible change. The most difficult statement to classify was 'a new material is made', with only **53%** correctly classifying this as burning.
Non-creditworthy 58%	
Example: melting melting melting	Overall **58%** of pupils gained no credit for this part of the question because they got at least one part of the table wrong or missed out at least one row.

8 Toy rocket

(a) Layla has a toy rocket.
She adds bicarbonate of soda to vinegar inside the rocket.
The rocket is forced into the air.



(i) On the diagram below, label each material to show if it is a **solid**, **liquid** or **gas**.

....

ai
1 mark

(ii) What new type of material is formed by mixing bicarbonate of soda with vinegar?

.....

aii
1 mark

(b) Layla wants to find out if changing the amount of bicarbonate of soda affects how far the rocket travels across the playground.

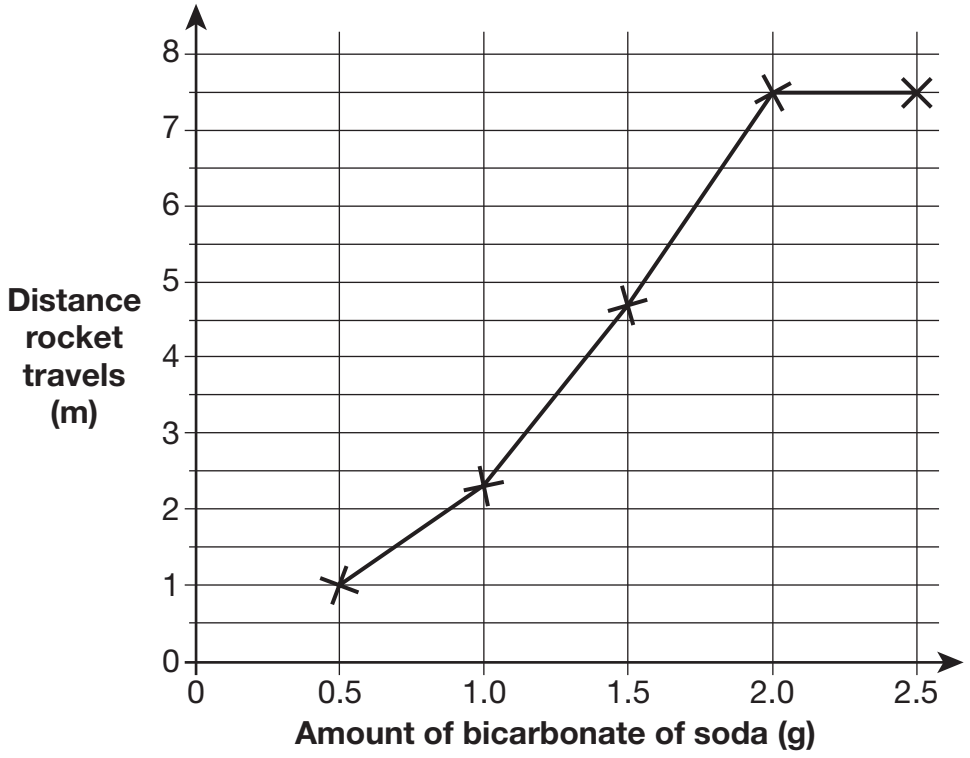
Tick **TWO** boxes to show how Layla should make her test fair each time.

Tick **TWO** boxes.

use the same amount of vinegar	☐	use the same rocket	☐
use the same amount of bicarbonate of soda	☐	make the rocket travel the same distance	☐

b
1 mark

(c) Layla records the results on a line graph.



Estimate how much bicarbonate of soda would make the rocket travel 3.5 m.

..... g

c
1 mark

(d) Layla says, 'The more bicarbonate of soda I use, the further the rocket travels.'

The evidence in the graph shows that Layla's statement is false.

Use the evidence in the graph to explain how you know Layla's statement is false.

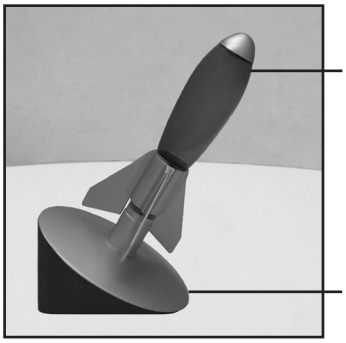
.....

.....

d
1 mark

Toy rocket

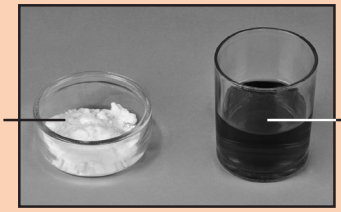
(a) Layla has a toy rocket.
She adds bicarbonate of soda to vinegar inside the rocket.
The rocket is forced into the air.



(i) On the diagram below, label each material to show if it is a **solid**, **liquid** or **gas**.

....

a
1 mark

Question	Mark	Requirements
ai	*1m*	Award **ONE** mark for correctly identifying both materials:  bicarbonate of soda — **Solid** vinegar — **Liquid**

Additional guidance

Content domain reference	**Sc3** Materials and their properties **1e** Grouping and classifying materials *Recognise differences between solids, liquids and gases in terms of ease of flow and maintenance of shape and volume.*		
Cognitive domain strand	**Knowledge and comprehension**	Application and analysis	Synthesis and evaluation
This question is assessing pupils' ability to classify materials as solid, liquid or gas.			

Option	Commentary
Creditworthy 79%	
(bicarbonate of soda) 'solid' (vinegar) 'liquid'	**79%** of pupils correctly labelled both materials.
Non-creditworthy 21%	
Bicarbonate of soda incorrectly classified	**18%** incorrectly classified bicarbonate of soda, with **2%** labelling it as a 'liquid' and **15%** as a 'gas'.
Vinegar incorrectly classified	Pupils found vinegar easier to classify than bicarbonate of soda, probably because it is a more familiar substance. **1%** incorrectly labelled it as a 'solid' and **2%** as a 'gas'.

Toy rocket

(ii) What new type of material is formed by mixing bicarbonate of soda with vinegar?

.....

aii

1 mark

Question	Mark	Requirements	Allowable answers
aii	***1m***	Award **ONE** mark for an indication that a gas is produced: ■ gas ✣ **Give credit** for a correct response that goes beyond the KS2 programme of study naming the gas as carbon dioxide or indicating that a salt and/or water are produced, for example: ■ CO_2 ■ salt and water are made ■ water is made	**ONE** mark may be awarded for an indication that bubbles are produced, for example: ■ bubbles ■ froth

Additional guidance

Do not *give credit for a response that includes incorrect science, for example:*
- *oxygen*
- *air*

Do not *give credit for an insufficient response:*
- *fizzy/fizziness*

Content domain reference	**Sc3** Materials and their properties **2f** Changing materials *That non-reversible changes result in the formation of new materials that may be useful.*		
Cognitive domain strand	**Knowledge and comprehension**	Application and analysis	Synthesis and evaluation
This question is assessing knowledge of the substance formed during a non-reversible reaction.			

Response	Commentary
Creditworthy 64%	
'gas'	**58%** of pupils gave 'gas' as an answer.
Examples: 'carbon dioxide' 'CO_2'	**3%** gave an answer which went beyond KS2 and identified carbon dioxide as the product formed during this reaction. Answers which go beyond the KS2 programme of study must be scientifically correct. In the case of chemical symbols, pupils must use them correctly (i.e. have the letters in the correct case and numbers that are the correct size and in the correct position).
'bubbles'	**4%** of pupils gave the allowable answer that bubbles were formed. This answer was deemed creditworthy as it implied that a gas was produced during the reaction.
Non-creditworthy 35%	
'fizz'	**2%** gave an answer such as 'fizz', which was insufficient to imply a gas had been formed as it could be referring to a sound, rather than a substance (for example, gas) or an object (for example, bubble).
Examples: 'oxygen' 'air'	**25%** gave responses which referred to incorrect science. Although those pupils who referred to oxygen understood a gas had been formed, they were not credited with a mark because they had named the wrong gas and therefore demonstrated an incorrect understanding of the science. **8%** of pupils did not give any answer to this question.

Toy rocket

(b) Layla wants to find out if changing the amount of bicarbonate of soda affects how far the rocket travels across the playground.

Tick **TWO** boxes to show how Layla should make her test fair each time.

Tick **TWO** boxes.

use the same amount of vinegar	☐	use the same rocket	☐
use the same amount of bicarbonate of soda	☐	make the rocket travel the same distance	☐

b

1 mark

Question	Mark	Requirements	Allowable answers
b	*1m*	Award **ONE** mark for only the **two** correct boxes ticked: ■ use the same amount of vinegar ☑ ■ use the same rocket ☑	

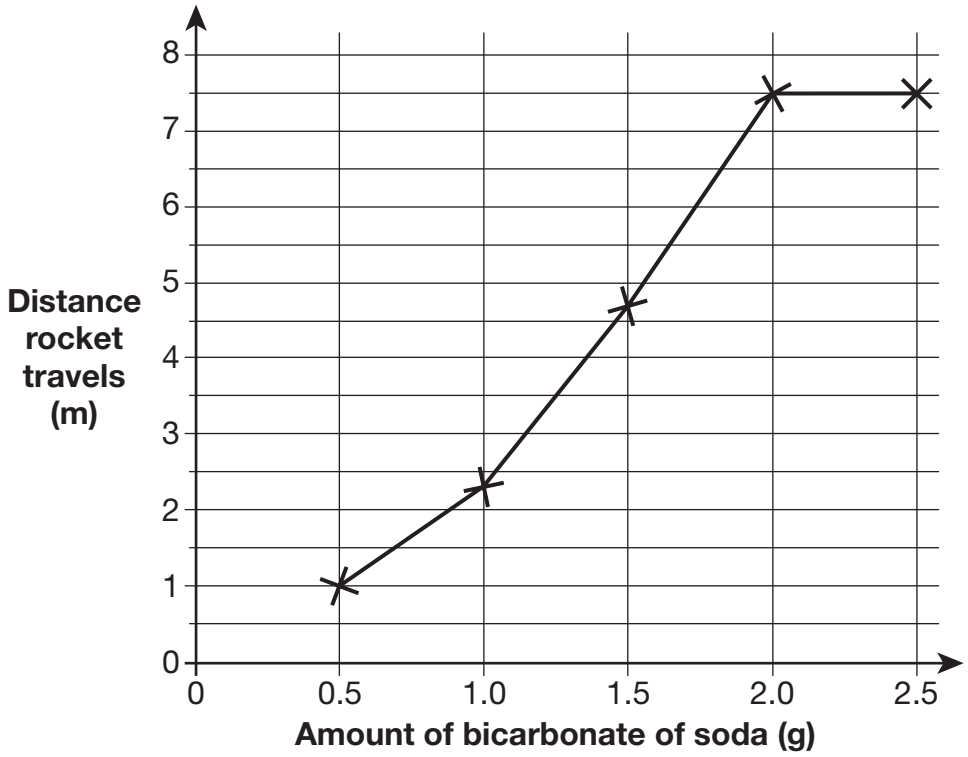
Additional guidance

Content domain reference	**Sc1** Scientific enquiry **2d** Planning *Make a fair test or comparison by changing one factor and observing or measuring the effect while keeping the others the same.*		
Cognitive domain strand	Knowledge and comprehension	**Application and analysis**	Synthesis and evaluation
This question is assessing understanding of control variables and fair testing.			

Response	Commentary
Creditworthy 53%	
Two boxes selected: use the same amount of vinegar use the same rocket	**53%** of pupils selected both correct options needed to gain the mark, demonstrating a secure understanding of control variables. **82%** selected 'use the same amount of vinegar' and **68%** selected 'use the same rocket'.
Non-creditworthy 47%	
use the same amount of bicarbonate of soda	**32%** selected this option. The amount of bicarbonate of soda was the independent variable in this investigation. Pupils selecting this option didn't have a clear understanding of the difference between control variables and independent variables.
make the rocket travel the same distance	**9%** selected this option. Pupils choosing this option confused the dependent variable in the investigation with variables that needed to be kept the same.

Toy rocket

(c) Layla records the results on a line graph.



Estimate how much bicarbonate of soda would make the rocket travel 3.5 m.

..... g

c

1 mark

Question	Mark	Requirements	Allowable answers
c	*1m*	Award **ONE** mark for: ■ 1.25	**ONE** mark may be awarded for any other response from 1.20 – 1.30 (inclusive).
Additional guidance			

Content domain reference	**Sc1** Scientific enquiry **2i** Considering evidence and evaluating *Make comparisons and identify simple patterns or associations in their own observations and measurements or other data.*		
Cognitive domain strand	Knowledge and comprehension	**Application and analysis**	Synthesis and evaluation
This question is assessing the ability to interpret a graph in order to estimate a value.			

Response	Commentary
Creditworthy 61%	
'1.25g'	**37%** of pupils correctly interpolated the distance travelled from the graph and gave an estimate of 1.25g.
Examples: '1.20g' '1.30g' '1.27g'	**24%** gave a creditworthy answer in the range of 1.2 to 1.3g (other than 1.25).
Non-creditworthy 39%	
Examples: '7.5' '3.5'	**39%** gave a non-creditworthy answer by misinterpreting the graph. Some pupils may have confused the axes and imagined 3.5 on the x-axis and read from the y-axis to get 7.5 or used the number given in the question (3.5). Other pupils gave no answer at all.

Toy rocket

(d) Layla says, 'The more bicarbonate of soda I use, the further the rocket travels.'

The evidence in the graph shows that Layla's statement is false.

Use the evidence in the graph to explain how you know Layla's statement is false.

.....

.....

d

1 mark

Question	Mark	Requirements	Allowable answers
d	***1m***	Award **ONE** mark for a response using evidence from the graph that proves Layla's statement is false, for example: ■ the rocket travelled the same distance when 2g and 2.5g were used ■ after 2g the rocket did not travel any further ■ the rocket travelled 7.5m for two amounts of bicarbonate of soda	**ONE** mark may be awarded for a response that clearly shows Layla's statement is false from the graph, but does not identify exact points from the x-axis, for example: ■ after a certain quantity of bicarbonate of soda has been used, the rocket does not travel any further ■ for two amounts of bicarbonate of soda, the rocket travelled the same distance **ONE** mark may be awarded for a response that clearly shows Layla's statement is false by referring to the distance plateauing, for example: ■ the distance (the rocket travels) levels off

Additional guidance

Do not *give credit for an insufficient response that does not interpret the results/graph line, for example:*
- *the graph line levels off*

Do not *give credit for an insufficient response that does not explicitly describe the dependent variable (the distance), for example:*
- *for 2.0g and 2.5g, it stays the same*
- *for 2.0g and 2.5g, it went the same height [ambiguous as could refer to the height of the graph or the height of the rocket itself]*
- *after a certain amount of bicarbonate it stays the same*

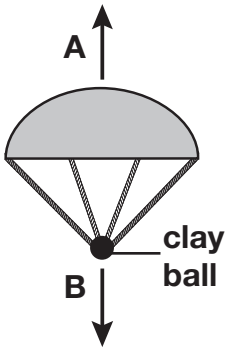
Content domain reference	**Sc1** Scientific enquiry **2j** Considering evidence and evaluating *Use observations, measurements or other data to draw conclusions.*		
Cognitive domain strand	Knowledge and comprehension	Application and analysis	**Synthesis and evaluation**
This question is assessing pupils' ability to interpret the results shown in a graph in order to explain why a statement is false.			

Response	Commentary
Creditworthy 36%	
'after 2g of bicarbonate of soda, adding extra soda did not make the rocket travel any further'	This was the most common creditworthy response. **34%** of pupils gained credit by providing evidence from the graph that after more than 2g of bicarbonate of soda had been used, Layla's statement no longer holds and must be false.
'once you add lots of bicarbonate of soda, the rocket doesn't travel any more metres once more bicarbonate of soda is added'	**1%** gained credit for a giving a response of this type, which lacked numerical evidence from the graph and was therefore not as clearly expressed as the previous type of answer.
'the distance the rocket travels stops going up and levels off'	**1%** gave a response which referred to the distance travelled by the toy rocket levelling off.
Non-creditworthy 64%	
Examples: 'the graph levels off' 'it stops going up'	**2%** gave an insufficient response which described the graph, rather than the distance travelled by the rocket, levelling off. These responses were not creditworthy as they don't show sufficient interpretation of the investigation.
'for 2.0 and 2.5g, it stays the same'	**12%** gave an insufficient response that didn't explicitly mention the distance travelled by the toy rocket (the dependent variable) even though it precisely referred to the section of the graph which showed a levelling off of distance travelled. Again, not enough interpretation of the investigation was shown.
Other incorrect or insufficient responses	**50%** didn't gain a mark because they gave a response which insufficiently or incorrectly referred to the graph or to the variables or they gave no response at all.

10 Parachutes

(a) Jamie has a parachute. The two arrows on the diagram below show two forces (**A** and **B**) acting on the falling parachute.

Label forces **A** and **B** on the diagram below.



(i) Force **A** is .....

(ii) Force **B** is .....

ai 1 mark

aii 1 mark

(b) Tick **ONE** box to show the effect force **A** has on the parachute.

It makes the parachute fall faster.	☐	It makes the parachute heavier.	☐
It makes the parachute fall slower.	☐	It makes the parachute lighter.	☐

b 1 mark

(c) Jamie wants to find out if changing the material of the parachute affects the time it takes to fall to the ground.
The table shows some of the variables in Jamie's investigation.

Complete the table to show how Jamie should do his investigation. Tick **ONE** box in each row.

Variable	Variable to be changed	Variable to be measured	Variable to be kept the same
height of drop			
mass of modelling clay			
size of parachute			
material of parachute			
time taken to fall to the ground			

c 2 marks

(d) Jamie decides to test each of his parachutes three times.
He records his results in the table below.

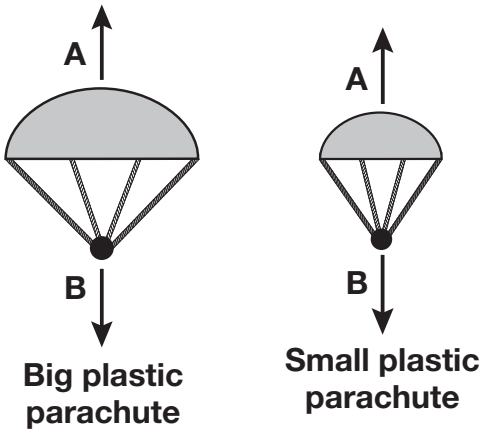
One of the times in his results table looks wrong.

Circle **ONE** time in the results table that Jamie should check.

Parachute material	Time taken to reach the ground (seconds)		
	test 1	test 2	test 3
plastic	2.4	2.4	2.5
bubble wrap	2.1	2.0	2.0
netting	2.9	1.0	1.0

d
1 mark

(e) Jamie makes a **smaller** parachute made of **plastic**.



Predict the time it will take the **smaller plastic** parachute to fall to the ground.

..... seconds

e
1 mark

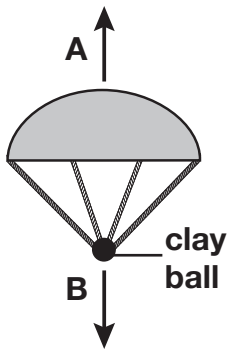
Parachutes

(a) Jamie has a parachute. The two arrows on the diagram below show two forces (**A** and **B**) acting on the falling parachute.

Label forces **A** and **B** on the diagram below.

(i) Force **A** is .....

(ii) Force **B** is .....



ai
1 mark

aii
1 mark

Question	Mark	Requirements	Allowable answers
ai	***1m***	Award **ONE** mark for: ■ air resistance	**ONE** mark may be awarded for: ■ friction ■ drag

Additional guidance

Do not *give credit for an insufficient response, for example:*
- *upthrust*
- *resistance*
- *an upward push*

Content domain reference	**Sc4** Physical processes **2d** Types of force *Pupils should be taught that when objects are pushed or pulled, an opposing force can be felt.*		
Cognitive domain strand	**Knowledge and comprehension**	Application and analysis	Synthesis and evaluation
This question is assessing whether pupils recognise the force of air resistance.			

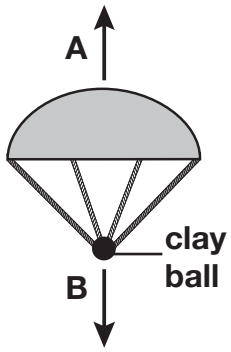
Option	Commentary
Creditworthy 26%	
'air resistance' 'friction'/'drag'	**23%** of pupils correctly identified 'air resistance' as the upward force acting on the parachute, whereas **3%** identified the allowable responses of 'friction' or 'drag'. This contrasted unfavourably to part (aii) (which asked about gravity) indicating that pupils were far less sure of forces that, unlike gravity, can vary in direction (including being in the opposite direction to movement), or are possibly dependent on the medium an object moves through.
Non-creditworthy 74%	
Examples: 'upthrust' 'upward push' 'resistance'	**14%** gave responses of this type. Although these types of response indicated some idea of forces, they don't include the correct terminology, which was a key part of the knowledge and understanding being assessed. A possible suggestion is that some pupils may have relied on key stage 1 knowledge of floating objects.
Examples: 'wind' 'pulling' 'pushing up' 'pressure' 'keeping it slow' 'in the air' 'where the air goes in'	**60%** gave other incorrect responses that didn't refer to a named force, indicating limited knowledge of this area of the programme of study, or gave no answer at all. Pupils in this group seemed to be answering at a more concrete level, by referring to the parachute itself rather than to the forces affecting it.

Parachutes

Label forces **A** and **B** on the diagram below.

(i) Force **A** is .....

(ii) Force **B** is .....



ai
1 mark

aii
1 mark

Question	Mark	Requirements	Allowable answers
aii	***1m***	Award **ONE** mark for: ■ gravity	**ONE** mark may be awarded for: ■ gravitational attraction **ONE** mark may be awarded for: ■ weight
Additional guidance			

Content domain reference	**Sc4** Physical processes **2d** Types of force *Pupils should be taught that when objects are pushed or pulled, an opposing force can be felt.* **2b** Types of force *Objects are pulled downwards because of the gravitational attraction between them and the Earth.*		
Cognitive domain strand	**Knowledge and comprehension**	Application and analysis	Synthesis and evaluation
This question is assessing whether pupils recognise the force of gravity.			

Response	Commentary
Creditworthy 61%	
Examples: 'gravity' 'gravitational attraction' 'weight'	**58%** of pupils gained credit by identifying this force as 'gravity' and fewer than **1%** wrote 'gravitational attraction'. **2%** identified the force as 'weight'.
Non-creditworthy 39%	
Examples: 'pushing' 'pulling down' 'making it go down' 'holding it down'	**39%** gave an insufficient response or no response at all. Answers related to pulling may have been showing incomplete recall; pupils were aware that a pulling force is operating, but couldn't remember what it is called.

Parachutes

(b) Tick **ONE** box to show the effect force **A** has on the parachute.

It makes the parachute fall faster.	☐	It makes the parachute heavier.	☐
It makes the parachute fall slower.	☐	It makes the parachute lighter.	☐

☐ b

1 mark

Question	Mark	Requirements	Allowable answers
b	*1m*	Award **ONE** mark for: ■ It makes the parachute fall slower ☑	

Additional guidance
Do not *give credit if more than one box has been ticked.*

Content domain reference	**Sc4** Physical processes **2c** Types of force *Pupils should be taught about friction, including air resistance, as a force that slows moving objects and may prevent objects from starting to move.*		
Cognitive domain strand	Knowledge and comprehension	**Application and analysis**	Synthesis and evaluation
This question is assessing whether pupils understand the effect air resistance will have on a falling parachute.			

Response	Commentary
Creditworthy 83%	
It makes the parachute fall slower.	Even though pupils found air resistance hard to name, a large majority understood the effect it would have on the parachute.
Non-creditworthy 17%	
It makes the parachute fall faster.	**5%** of pupils selected this option, indicating no understanding of the effect of air resistance on the parachute.
It makes the parachute heavier.	**4%** chose this option, indicating a lack of understanding of air resistance and its effect on weight or gravity.
It makes the parachute lighter.	**7%** chose this option, indicating a lack of understanding of air resistance and its effect on weight or gravity.

Parachutes

(c) Jamie wants to find out if changing the material of the parachute affects the time it takes to fall to the ground.
The table shows some of the variables in Jamie's investigation.

Complete the table to show how Jamie should do his investigation. Tick **ONE** box in each row.

Variable	Variable to be changed	Variable to be measured	Variable to be kept the same
height of drop			
mass of modelling clay			
size of parachute			
material of parachute			
time taken to fall to the ground			

c

2 marks

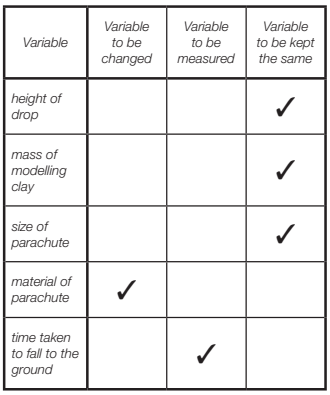
Question	Mark	Requirements	Allowable answers
c	**2m** **or** **1m**	Award **TWO** marks for the table completed correctly: If you are unable to award two marks, award **ONE** mark for correctly completing **any four** rows of the table.	

Variable	*Variable to be changed*	*Variable to be measured*	*Variable to be kept the same*
height of drop			✓
mass of modelling clay			✓
size of parachute			✓
material of parachute	✓		
time taken to fall to the ground		✓	

Additional guidance

Do not give *credit for a row where more than one box has been ticked.*

Content domain reference	**Sc1** Scientific enquiry **2d** Planning *Make a fair test or comparison by changing one factor and observing or measuring the effect while keeping other factors the same.*		
Cognitive domain strand	Knowledge and comprehension	**Application and analysis**	Synthesis and evaluation
This question is assessing understanding of independent, dependent and control variables.			

Response	Commentary
Creditworthy 2m 21%, 1m 20%	
	Pupils found this question, which required them to identify the investigation's independent (IV), dependent (DV) and control (CV) variables, challenging. Only **21%** scored 2 marks. **41%** scored one mark or more for classifying four out of the five variables correctly. This may be because of the high cognitive load of this part of the question, but also because pupils had a weakness in their ability to consider variables while planning an investigation. Pupils found the IV and DV easiest to identify with **68%** recognising that the material of the parachute was what was being changed and **69%** recognising that the time taken to fall to the ground was what was being measured. Pupils found the CVs most difficult to identify, with the first three options being classified as variables to be kept the same by **63%**, **52%** and **50%** of pupils respectively.
Non-creditworthy 59%	

Parachutes

(d) Jamie decides to test each of his parachutes three times.
He records his results in the table below.

One of the times in his results table looks wrong.

Circle **ONE** time in the results table that Jamie should check.

Parachute material	Time taken to reach the ground (seconds)		
	test 1	test 2	test 3
plastic	2.4	2.4	2.5
bubble wrap	2.1	2.0	2.0
netting	2.9	1.0	1.0

d

1 mark

Question	*Mark*	*Requirements*	*Allowable answers*
d	***1m***	Award **ONE** mark for 2.9 circled (for netting).	

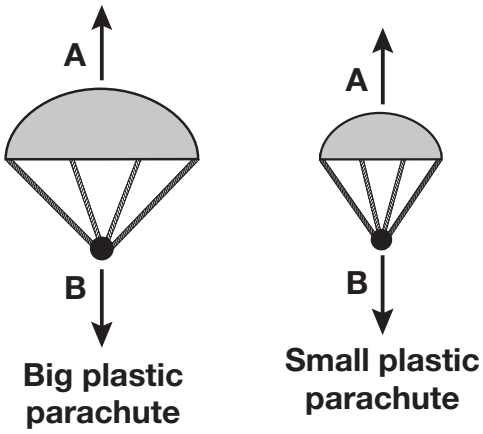
Additional guidance
Do not *give credit for an insufficient response in which netting or test 1 is circled.*

Content domain reference	**Sc1** Scientific enquiry **2m** Considering evidence and evaluating *Review their work and the work of others and describe its significance and limitations.* **2g** Obtaining and presenting evidence *Check observations and measurements by repeating them where appropriate.*		
Cognitive domain strand	Knowledge and comprehension	**Application and analysis**	Synthesis and evaluation
This question is assessing whether pupils can identify an anomalous result.			

Response	Commentary
Creditworthy 64%	
'2.9' circled for netting.	**64%** of pupils identified 2.9 (for netting) as the result which needed checking. Pupils answering in this way had a clear understanding of anomalous results.
Non-creditworthy 22%	
'2.5' circled for plastic.	**22%** gave an insufficient response, such as circling 'netting' (in the first column) or indicating an incorrect result. '2.5' (for 'plastic') may have been given because it followed two '2.4's, which would suggest that some pupils were not reading and analysing the table adequately. **14%** gave no response at all.

Parachutes

(e) Jamie makes a **smaller** parachute made of **plastic**.



Predict the time it will take the **smaller plastic** parachute to fall to the ground.

..... seconds

e

1 mark

Question	Mark	Requirements	Allowable answers
e	*1m*	Award **ONE** mark for a prediction that is greater than 0 but less than 2.4 seconds (0–2.4 exclusive), for example: ■ 1.5 *seconds*	

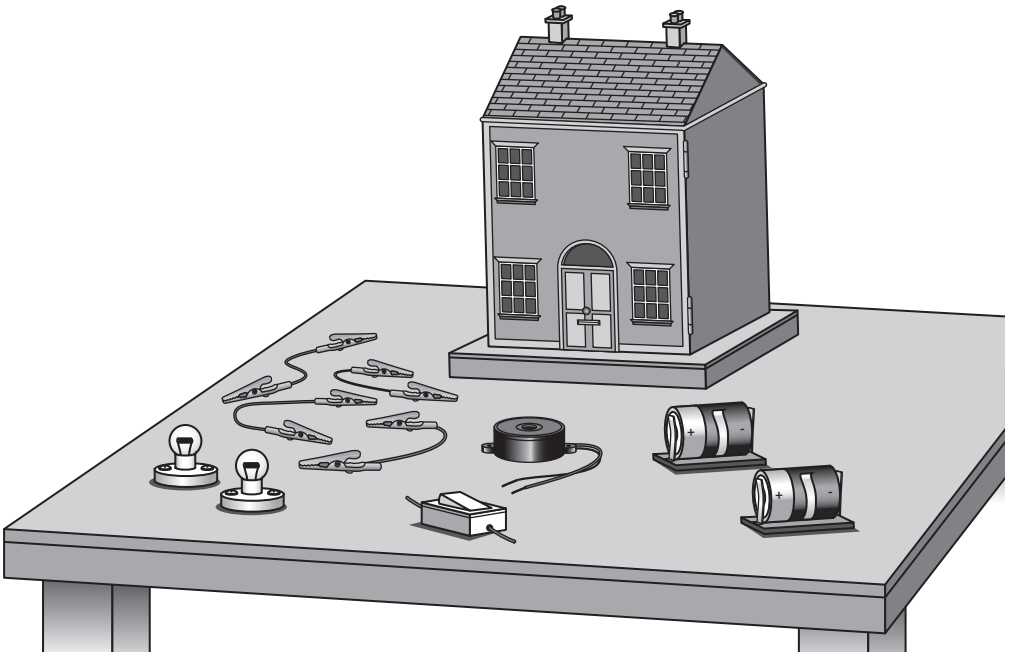
Additional guidance
Do not *give credit for an incorrect response giving 2.4 or greater.*

Content domain reference	**Sc1** Scientific enquiry **2c** Planning *Think about what might happen or try things out when deciding what to do, what kind of evidence to collect, and what equipment and materials to use.*		
Cognitive domain strand	Knowledge and comprehension	Application and analysis	**Synthesis and evaluation**
This question is assessing whether pupils can make a prediction for another test based on data from a previous test.			

Response	Commentary
Creditworthy 64%	
Greater than '0' to less than '2.4'	Most pupils were able to predict that the smaller parachute would take less time than the larger one and used the results in the table to suggest a time less than that for 'plastic'.
Non-creditworthy 35%	
Greater than '2.4'	**32%** of pupils gave a prediction that was greater than '2.4', suggesting they thought higher numbers indicated greater speed or that the smaller parachute fell more slowly (perhaps because it was lighter).
'2.4'	**3%** gave the same time for the smaller parachute as for the larger one, indicating they believed the two parachutes would fall at the same speed. These pupils didn't have a secure understanding of the factors that affect air resistance.

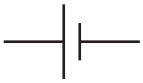
11 Model house

(a) A group of children are making a circuit for a door bell and lights in a model house.



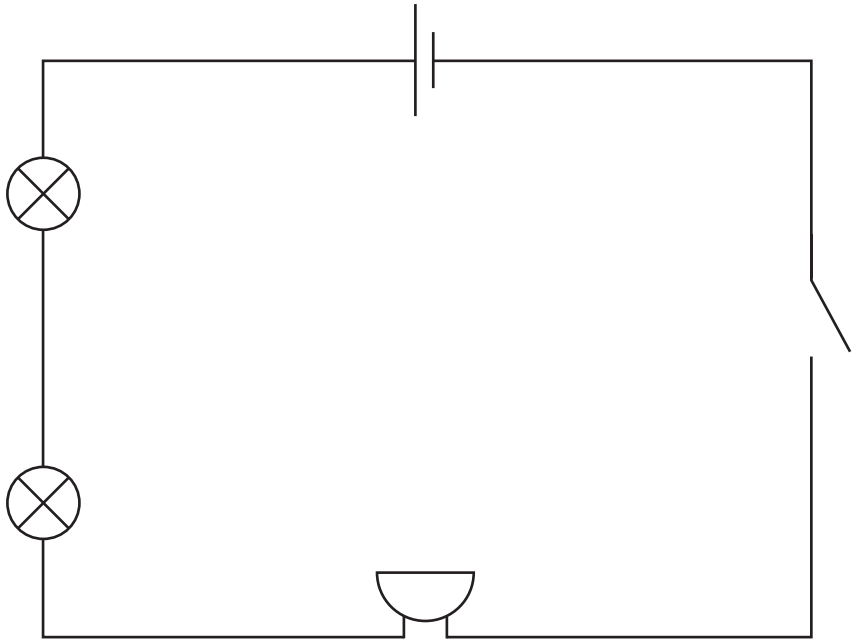
The circuit symbols for the parts used in the circuit are shown below.

Write the name of each part next to its circuit symbol.
One is done for you.

Circuit symbol	Name of part
	.....
	buzzer .....
	.....
	.....

a
2 marks

(b) The children make this circuit.



(i) What must the children do to their circuit to turn the light bulbs and the buzzer on?

.....

bi

1 mark

(ii) The buzzer only makes a quiet sound.

How could the children change the circuit to make the buzzer louder? Give **TWO** ways.

1. .....

2. .....

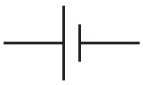
bii

2 marks

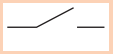
Model house

The circuit symbols for the parts used in the circuit are shown below.

Write the name of each part next to its circuit symbol.
One is done for you.

Circuit symbol	Name of part
	.....
	buzzer .....
	.....
	.....

a
2 marks

Question	Mark	Requirements	Allowable answers
a	*2m*	Award **TWO** marks for **all three** symbols correctly named: **Circuit symbol** / **Name of part**  **switch** ***or***  *buzzer* [given]  **bulb/lamp**  **cell/battery**	
	1m	If you are unable to award two marks, award **ONE** mark for **any two** symbols correctly named.	

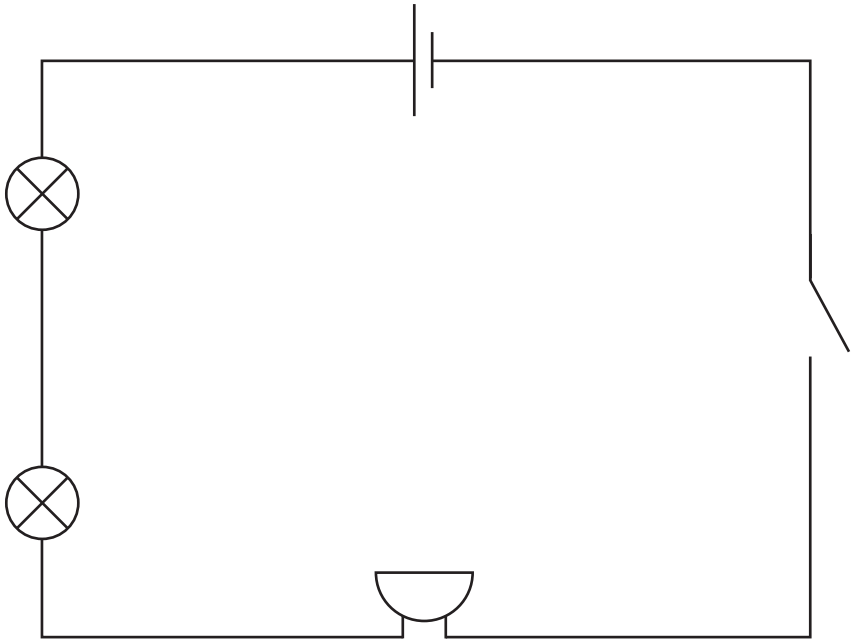
Additional guidance
Do not *give credit for any other electrical component named.* ***Do not*** *give credit for insufficiently naming the bulb:* ■ *light*

Content domain reference	**Sc4** Physical processes **1c** Simple circuits *How to represent series circuits by drawings and conventional symbols and how to construct series circuits on the basis of drawings and diagrams using conventional symbols.*		
Cognitive domain strand	**Knowledge and comprehension**	Application and analysis	Synthesis and evaluation
This question is assessing whether pupils can name the basic components of electrical circuits from their circuit symbols.			

Option	Commentary
Creditworthy 2m 44%, 1m 26%	
'switch'	**69%** of pupils knew what component this symbol represents.
'bulb'/'lamp'	**58%** knew what component this symbol represents.
'cell'/'battery'	**72%** knew what component this symbol represents. 'Cell' and 'battery' were both accepted as creditworthy.
Non-creditworthy 30%	
Insufficiently naming a component Example: 'light' instead of 'bulb'	For the second component, **22%** knew that this symbol represents a component that emits light, but were not be able to name it correctly, showing insecure understanding of this area of the curriculum.

Model house

(b) The children make this circuit.



(i) What must the children do to their circuit to turn the light bulbs and the buzzer on?

.....

bi

1 mark

Question	Mark	Requirements	Allowable answers
bi	***1m***	Award **ONE** mark for an indication that the switch must be closed/or the circuit is closed, for example: ■ close the switch ■ check if the switch is closed ■ complete/close the circuit	**ONE** mark may be awarded for: ■ turn the switch on ■ connect the switch **ONE** mark may be awarded for referring to the name given to the switch in part (a) if incorrect/insufficient, for example: ■ close the gate [if the switch symbol was referred to as 'gate' in part a]

Additional guidance

Do not *give credit for an insufficient response, for example:*
- *check the circuit is joined up/complete [not enough to check]*
- *connect the circuit*

Do not *give credit for an incorrect response where the switch is named incorrectly if this is not the name given to the circuit symbol in part (a), for example:*
- *close the gate*

Content domain reference	**Sc4** Physical processes **1a** Simple circuits *Construct circuits, incorporating a battery or power supply and a range of switches, to make electrical devices work.*		
Cognitive domain strand	**Knowledge and comprehension**	Application and analysis	Synthesis and evaluation
This question is assessing pupils' understanding of how a switch works.			

Response	Commentary
Creditworthy 48%	
An indication that the switch must be closed or the circuit is closed	**47%** of pupils correctly realised that closing the switch would turn the bulbs and buzzer on.
An indication that the switch must be closed, but using the incorrect name for 'switch' used in part (a)	**1%** correctly answered this question by using an incorrect/insufficient response in part (a), and then consistently using it in part (b), while correctly describing its purpose.
Non-creditworthy 52%	
An insufficient response referring to checking that the circuit is complete rather than closing the switch	**5%** believed that the circuit would not function as it was and therefore needed to be completed or set up correctly in order to work.
Other incorrect or insufficient responses Example: 'put the circuit together'	**46%** of pupils gave other incorrect or insufficient responses or no response at all.

Model house

(ii) The buzzer only makes a quiet sound.

How could the children change the circuit to make the buzzer louder? Give **TWO** ways.

1. .....

2. .....

bii

2 marks

Question	Mark	Requirements	Allowable answers
bii	***2m***	Award up to **TWO** marks for giving **any two** correct responses as indicated below.	
		Award **ONE** mark for a correct response that refers to <u>adding</u> cells/batteries or <u>increasing the number</u> of cells/batteries, for example: ■ add a battery	**ONE** mark may be awarded for a reference to decreasing the length of wire in the circuit, for example: ■ use shorter wires
	or	Award **ONE** mark for a correct response that refers to reducing the number of bulbs/lamps, for example: ■ take away one/both of the lamps/bulbs	
		✣ **Give credit** for a correct response that goes beyond the KS2 programme of study, for example: ■ increase the voltage ■ use a higher volt battery	
	1m	If you are unable to award two marks, award **ONE** mark for **any one** correct response.	

Additional guidance

Do not *give credit for an insufficient response implying they will replace the battery with a bigger one, for example:*
- *use a bigger battery*

Do not *give credit for an insufficient response that refers to increasing the power, for example:*
- *add more power*

Do not *give credit for an insufficient response that contradicts the question stem, for example:*
- *take away the buzzer*

Do not *give credit for an insufficient response, for example:*
- *make the circuit smaller*

Do not *give credit for a second response that is a repetition or restatement of the first, for example:*
- *1. remove a bulb*
  2. remove another bulb

<table>
<tr><td>Content domain reference</td><td colspan="3">Sc4 Physical processes

1b Simple circuits
How changing the number or type of components in a series circuit can make bulbs brighter or dimmer.

Sc1 Scientific enquiry

1a Ideas and evidence in science
Science is about thinking creatively to try to explain how living and non-living things work, and to establish links between causes and effects.</td></tr>
<tr><td>Cognitive domain strand</td><td>Knowledge and comprehension</td><td>Application and analysis</td><td>Synthesis and evaluation</td></tr>
<tr><td colspan="4">This question is assessing whether pupils can identify ways in which you can change components in a series circuit to create a particular result.</td></tr>
</table>

Response	Commentary
Creditworthy 2m 33%, 1m 40%	
A correct response that refers to adding cells/ batteries or increasing the number of cells/ batteries	**43%** of pupils gave this response for a first answer and **21%** gave it for a second.
A correct response that refers to reducing the number of bulbs/lamps	**13%** gave this response for a first answer and **22%** gave it for a second, indicating this option was less obvious as a solution to pupils than adding more cells/batteries.
A reference to decreasing the length of wire in the circuit	**1%** gave this response for a first answer and **4%** gave it for a second. Knowledge of the effect of changing wire length is not expected to be very widespread; where it did occur it may have resulted from pupils' personal experiences of using electronic equipment.
A correct response that goes beyond the KS2 programme of study Example: 'increase the voltage'	**1%** gave this type of response for a first answer and **1%** gave it for a second, indicating that some pupils had knowledge of this topic extending beyond the KS2 programme of study.
Non-creditworthy 27%	
Insufficient response implying the battery will be replaced with a bigger one	**2%** gave this response for a first answer and **1%** gave it for a second, suggesting these pupils didn't understand that the voltage of a battery is not related to its size.
Insufficient response that refers to increasing the power	**1%** gave this response for a first answer and **1%** gave it for a second, indicating these pupils didn't have a scientific understanding of power. This is not surprising as this knowledge is beyond key stage 2.
Other incorrect or insufficient responses Examples: 'put the buzzer next to the switch' 'make the circuit smaller'	**24%** gave other incorrect or insufficient responses or no responses at all.

16 Growing seeds

(a) Marie investigates what conditions are needed for pea seeds to grow into plants.

Write **1**, **2**, **3** and **4** next to each stage below to show the correct order in which Marie will see the parts of the plants grow.

a root grows ☐ a flower grows ☐

a stem grows ☐ leaves grow ☐

☐ a
1 mark

(b) Marie puts pea seeds on cotton wool in four dishes: A, B, C and D.

Marie records her results in the table below.

Dish	Location	Light	Watered	Results Day 2
A	warm cupboard	✗	✓	germinated
B	warm windowsill	✓	✗	no change
C	cold fridge	✗	✓	no change
D	warm windowsill	✓	✓	germinated

Look at Marie's results.

What did the pea seeds need to germinate?
Tick as many boxes as you need.

soil ☐ water ☐ light ☐ warmth ☐

☐ b
1 mark

(c) Marie wants to find out if seeds need air to germinate.

She does a new investigation.

Tick **TWO** boxes to show why she should do a new investigation.

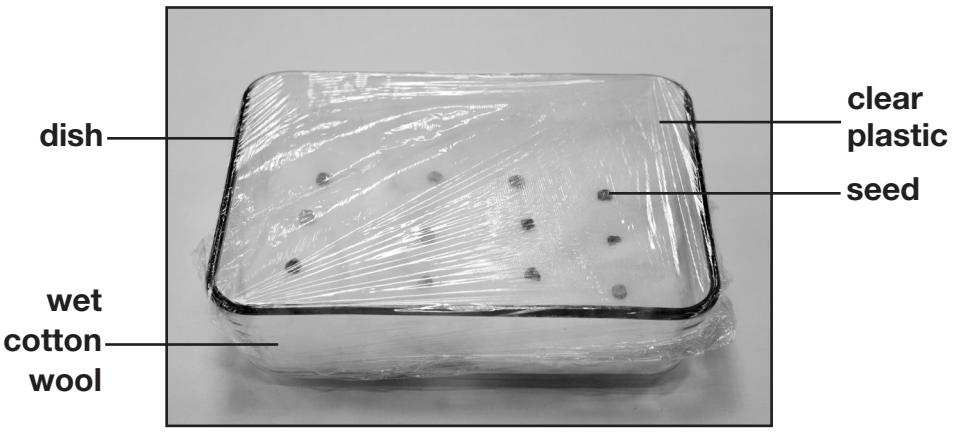
to collect new evidence	☐	to reach a conclusion	☐
to check her results	☐	to predict the result	☐

☐ c

1 mark

(d) Marie puts some seeds in a dish on the windowsill.

She covers the dish with clear plastic so that no air can get into it.



This investigation cannot show if seeds need air to germinate.
Explain why.

.....

.....

☐ d

1 mark

Growing seeds

(a) Marie investigates what conditions are needed for pea seeds to grow into plants.

Write **1**, **2**, **3** and **4** next to each stage below to show the correct order in which Marie will see the parts of the plants grow.

a root grows ☐ a flower grows ☐

a stem grows ☐ leaves grow ☐

☐ a

1 mark

Question	Mark	Requirements	Allowable answers
a	*1m*	Award **ONE** mark for the correct number written in each box: ■ a root grows **1** a flower grows **4** ■ a stem grows **2** leaves grow **3**	

Additional guidance
Do not *give credit for any other number given.*

Content domain reference	**Sc2** Life processes and living things **3d** Reproduction *Pupils should be taught about the parts of the flower and their role in the life cycle of flowering plants, including pollination, seed formation, seed dispersal and germination.* **5b** describe the life process of reproduction in some plants and animals		
Cognitive domain strand	**Knowledge and comprehension**	Application and analysis	Synthesis and evaluation
This question is assessing whether pupils know the order of events that occur as a plant grows from a seed.			

Option	Commentary
Creditworthy 79%	
1,4,2,3	Pupils were most successful at identifying the first stage in the growth cycle of plants (**91%**). By contrast pupils were least successful at identifying the third stage of the process (leaves growing), with **83%** of pupils ordering this stage correctly.
Non-creditworthy 21%	
	As all stages had to be correctly ordered to gain the mark, non-creditworthy answers were made up of all other permutations of 1 to 4.

Growing seeds

(b) Marie puts pea seeds on cotton wool in four dishes: A, B, C and D.

Marie records her results in the table below.

Dish	Location	Light	Watered	Results Day 2
A	warm cupboard	✗	✓	germinated
B	warm windowsill	✓	✗	no change
C	cold fridge	✗	✓	no change
D	warm windowsill	✓	✓	germinated

Look at Marie's results.

What did the pea seeds need to germinate?
Tick as many boxes as you need.

soil ☐ water ☐ light ☐ warmth ☐

b

1 mark

Question	Mark	Requirements	Allowable answers
b	***1m***	Award **ONE** mark for only the **two** correct boxes ticked: ■ ☐ water ☑ ☐ warmth ☑	

Additional guidance

Content domain reference	**Sc1** Scientific enquiry **2j** Considering evidence and evaluating *Use observations, measurements or other data to draw conclusions.* **Sc2** Life processes and living things **3a** Growth and nutrition *Pupils should be taught the effect of light, air, water and temperature on plant growth.*		
Cognitive domain strand	Knowledge and comprehension	**Application and analysis**	Synthesis and evaluation
This question is assessing whether pupils can interpret a table with multiple variables in order to identify the factors required for the pea seeds to germinate.			

Response	Commentary
Creditworthy 23%	
water and warmth	The correct options, 'water' and 'warmth', were chosen by **86%** and **60%** of pupils respectively (**23%** chose both to gain the mark). This suggests that pupils either had difficulty fully interpreting the table (particularly to identify 'warmth' as a condition), or didn't use the table and instead applied their scientific knowledge with limited success.
Non-creditworthy 77%	
light	**55%** of pupils chose 'light'. Although this condition was available to the seeds in dish D (which did germinate) it was not available to the same type of seeds in dish A (which also germinated). Responses to this part of the question showed that pupils strongly associated plants with a requirement for light even when presented with data to the contrary.
soil	**26%** identified 'soil' as a requirement. This happened even though this was not something any of the seeds were given (as clearly shown in the images). As soil is clearly not a requisite for germination, it is likely that these pupils were drawing on their own knowledge rather than information in the table. Again, pupils appear to hold a misconception that plants require soil in order to survive, although this misconception is not as strongly held as the one concerning light, perhaps because growing seeds on paper or cotton wool is a common KS2 activity.

Growing seeds

(c) Marie wants to find out if seeds need air to germinate.

She does a new investigation.

Tick **TWO** boxes to show why she should do a new investigation.

to collect new evidence	☐	to reach a conclusion	☐
to check her results	☐	to predict the result	☐

☐ c

1 mark

Question	Mark	Requirements	Allowable answers
c	*1m*	Award **ONE** mark for only the **two** correct boxes ticked: ■ to collect new evidence ☑ ■ to reach a conclusion ☑ ☐ ☐	

Additional guidance

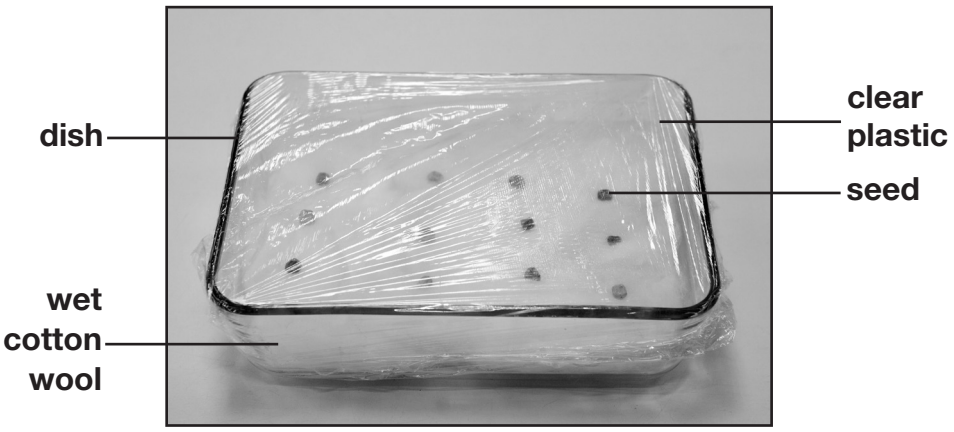
Content domain reference	**Sc1** Scientific enquiry **1b** Ideas and evidence in science *It is important to test ideas using evidence from observation and measurement.*		
Cognitive domain strand	Knowledge and comprehension	**Application and analysis**	Synthesis and evaluation
This question is assessing whether pupils understand the reasons for carrying out a further investigation on germination.			

Response	Commentary
Creditworthy 28%	
to collect new evidence and to reach a conclusion	Although **62%** of pupils selected 'to collect new evidence' and **52%** selected 'to reach a conclusion', only **28%** ticked both of these correct options (and no other options) to gain the mark. This may be explained by pupils not following the instructions correctly, or being less familiar with the part of the experimental process concerned with conclusion writing than with planning or collecting results.
Non-creditworthy 72%	
to check her results	**38%** selected this option, which demonstrated confusion between repeating investigations to check results and conducting new investigations to test different ideas.
to predict the result	**18%** selected this option, which demonstrated a lack of understanding that investigations are carried out based on a prediction made prior to beginning practical work.

Growing seeds

(d) Marie puts some seeds in a dish on the windowsill.

She covers the dish with clear plastic so that no air can get into it.



This investigation cannot show if seeds need air to germinate.
Explain why.

.....

.....

d

1 mark

Question	Mark	Requirements	Allowable answers
d	*1m*	Award **ONE** mark for a response recognising that there is air beneath the clear plastic with the seeds, for example: ■ because there is still air around the seeds ■ it is impossible to get out all of the air from under the clear plastic	**ONE** mark may be awarded for: ■ air is inside (already)

Additional guidance

Do not *give credit for an insufficient response that repeats information already given in the question stem that no air can get in, for example:*
■ *air cannot get in (through the clear plastic)*

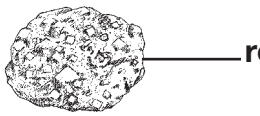
Do not *give credit for a response that includes incorrect science indicating that there is no air in the dish under the clear plastic, for example:*
■ *because there is no air in the dish*

Content domain reference	**Sc1** Scientific enquiry **2m** Considering evidence and evaluating *Review their work and the work of others and describe its significance and limitations.*		
Cognitive domain strand	Knowledge and comprehension	Application and analysis	**Synthesis and evaluation**
This question is assessing whether pupils are able to evaluate why the given experimental setup is unsuitable for the question they are trying to investigate.			

Response	Commentary
Creditworthy 22%	
Examples: 'there's still air in the container' 'there's still air inside the dish even with the clear plastic' 'air is already in the pot' 'some air is trapped under the plastic'	**22%** of pupils recognised that Marie couldn't carry out her new investigation with the equipment shown because there would still be air inside the dish. Many pupils didn't seem to understand where air would be found, possibly because it cannot be seen. The lack of understanding that gas may be trapped inside a container was also shown in the question 'Burning candles'.
Non-creditworthy 79%	
Examples: 'because they can't get air if it's covered' 'the clear plastic stops the air getting in'	**12%** of pupils only repeated information given in the question i.e. that air couldn't get into the dish through the clear plastic. This indicated a lack of understanding of what the investigation was demonstrating.
Examples: 'because they won't be able to germinate with no air, so you need to grow them first' 'there is no air'	**5%** thought there was no air in the dish under the plastic. This demonstrated a lack of understanding of the movement or presence of air.
Examples: 'the clear plastic stops the water and light getting in that they need to grow' 'you cannot see air' 'the air might get in through a tiny hole' 'plants need air but also sunlight can't break through the clear plastic'	**62%** gave other incorrect or insufficient responses or no response at all, indicating a lack of understanding of the investigation.

17 Rock salt

(a) Rock salt comes from the ground.
When water in underground streams runs over the rock salt, the water becomes salty.

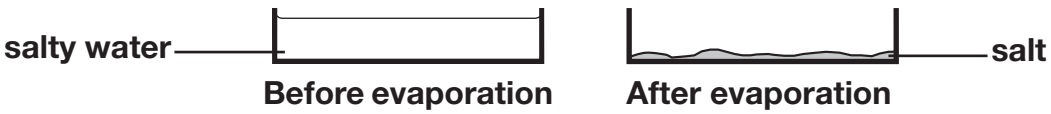


Name the scientific process that happens to salt when it is mixed with water.

..... a

1 mark

(b) Many years ago people collected salty water from underground streams.
They separated the salt they needed by letting the water evaporate.



What can you do to show that this separation of salt from water is reversible?

.....

..... b

1 mark

(c) The people improved the way they separated the salt by heating the salty water.

How does heating salty water affect the evaporation of the water?

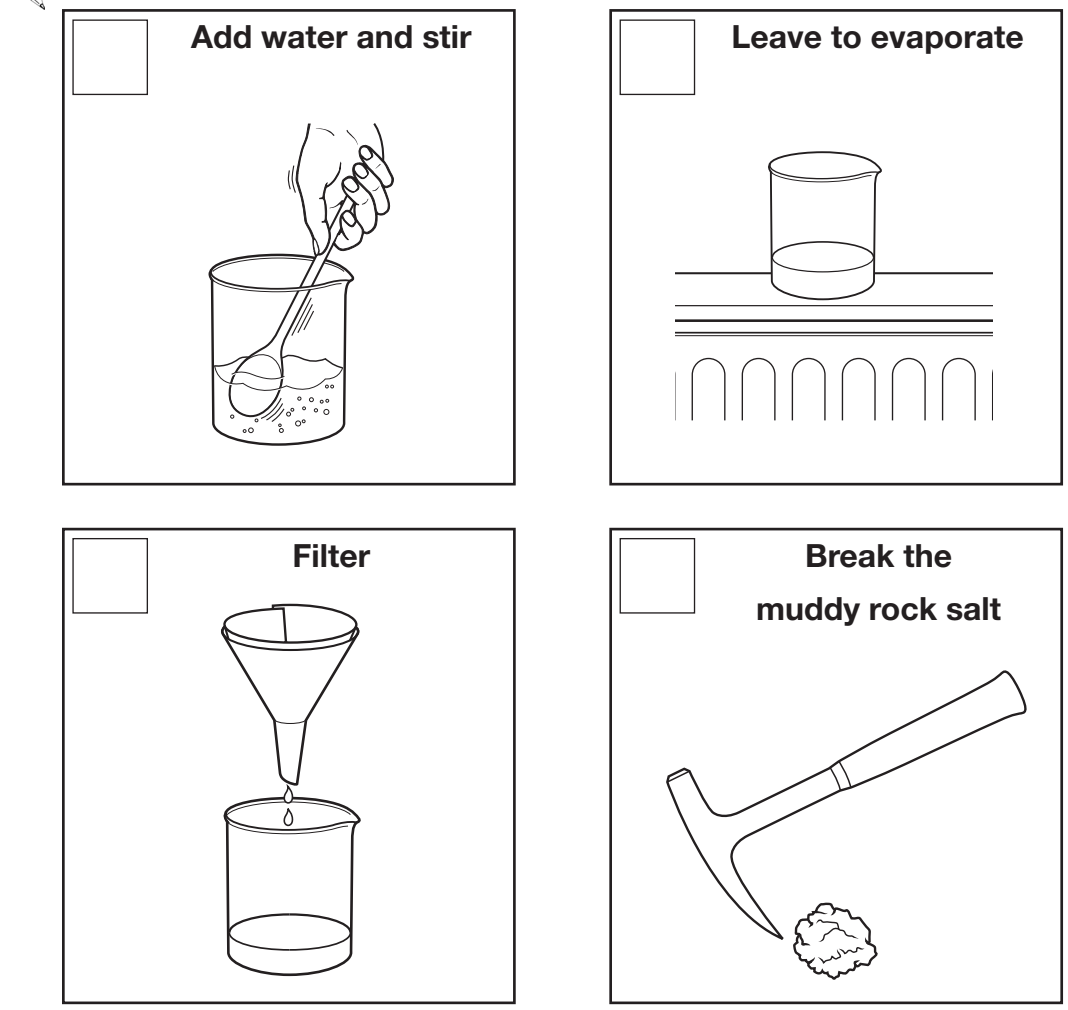
.....

..... c

1 mark

(d) Oliver has a piece of muddy rock salt.
The pictures below show the four things Oliver must do to separate salt from the muddy rock.

Put the pictures in the correct order for separating the salt by writing **1**, **2**, **3** or **4** in each box.



d
1 mark

(e) Bits of rock may fly into the air when Oliver breaks the rock salt with a hammer.

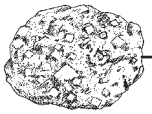
What should Oliver do to stay safe from bits of flying rock when he breaks the rock salt?

.....

e
1 mark

Rock salt

(a) Rock salt comes from the ground. When water in underground streams runs over the rock salt, the water becomes salty.



rock salt

Name the scientific process that happens to salt when it is mixed with water.

.....

a

1 mark

Question	Mark	Requirements	Allowable answers
a	*1m*	Award **ONE** mark for: ■ dissolving ■ it dissolves ✣ **Give credit** for a correct response that goes beyond the KS2 programme of study: ■ (it forms a) solution	

Additional guidance
Do not *give credit for an insufficient response indicating the salt is no longer apparent, for example:* ■ *it disappeared*

Content domain reference	**Sc3** Materials and their properties **3b** Separating mixtures of materials *Some solids dissolve in water to give solutions but some do not.*		
Cognitive domain strand	**Knowledge and comprehension**	Application and analysis	Synthesis and evaluation
This question is assessing pupils' knowledge of the process of dissolving.			

Option	Commentary
Creditworthy 45%	
Examples: 'dissolving' 'it dissolves'	**43%** of pupils correctly identified the process as 'dissolving'.
'it forms a solution'	**2%** provided a response which went beyond the KS2 programme of study and described the process as the formation of a solution.
Non-creditworthy 55%	
Examples: 'mixing' 'evaporating'	**55%** gave other insufficient or incorrect responses or no response at all. Pupils answering in this way don't have a clear understanding of the process of dissolving.

Rock salt

(b) Many years ago people collected salty water from underground streams.

They separated the salt they needed by letting the water evaporate.

What can you do to show that this separation of salt from water is reversible?

.....

.....

b

1 mark

Question	Mark	Requirements	Allowable answers
b	***1m***	Award **ONE** mark for responses identifying that you should dissolve the salt again (in water), for example: ■ the salt will dissolve again if you put water back in ■ dissolve it again Award **ONE** mark for responses that recognise that water needs to be added to the salt, for example: ■ add some water (and stir the mixture)	**ONE** mark may be awarded for: ■ put them back together again ■ put the salt in water

Additional guidance
Do not *give credit for an incorrect response implying that you still have salty water and should add more salt, for example:* ■ *add more salt to the water*

Content domain reference	**Sc3** Materials and their properties **2a** Changing materials *Describe changes that occur when materials are mixed.* **2d** Changing materials *Pupils should be taught about reversible changes, including dissolving, melting, boiling, condensing, freezing and evaporating.* **3b** Separating mixtures of materials *Some solids dissolve in water to give solutions but some do not.*		
Cognitive domain strand	Knowledge and comprehension	**Application and analysis**	Synthesis and evaluation
This question is assessing understanding of reversible changes.			

Response	Commentary
Creditworthy 47%	
Examples: 'dissolve the salt in water again' 'put water back in and the salt will dissolve'	**2%** of pupils knew that to demonstrate the separation was reversible, the salt should be re-dissolved in water.
'add water to the salt'	**35%** correctly indicated that water should have been 'added' to the salt, but without using the terminology of dissolving.
Examples: 'put the salt in water' 'put them back together'	**10%** correctly indicated that salt and water should be 'put together', but without the use of the terminology of dissolving.
Non-creditworthy 53%	
'add extra salt to the water'	**2%** gave this type of response, which was not creditworthy because it incorrectly implied there was still some salty water present. This showed that pupils didn't understand what had been done.
Other incorrect or insufficient responses. Examples: 'do an investigation' 'filter the salt'	**51%** gave other incorrect or insufficient responses or no response at all. Such responses indicated a lack of understanding of what has been done, the reversibility of dissolving or the properties of salt.

Rock salt

(c) The people improved the way they separated the salt by heating the salty water.

How does heating salty water affect the evaporation of the water?

.....

.....

c

1 mark

Question	Mark	Requirements	Allowable answers
c	*1m*	Award **ONE** mark for an indication that the rate of evaporation will increase, for example: ■ the water will evaporate more quickly ■ heating will speed up the evaporation ■ it will be faster	**ONE** mark may be awarded for responses that refer to the salt forming more quickly, for example: ■ the salt forms more quickly/sooner

Additional guidance

Do not *give credit for an insufficient response relating to the amount of evaporation, for example:*
- *it will evaporate more*

Do not *give credit for an insufficient response referring to dissolving, for example:*
- *it makes it dissolve quicker*

Content domain reference	**Sc3** Materials and their properties **2b** Changing materials *Describe changes that occur when materials are heated or cooled.*		
Cognitive domain strand	**Knowledge and comprehension**	Application and analysis	Synthesis and evaluation
This question is assessing pupils' understanding of the effect of temperature on the rate of evaporation.			

Response	Commentary
Creditworthy 31%	
Examples: 'the water evaporates more quickly' 'evaporation speeds up when the salty water is heated'	**31%** of pupils knew the effect of heat on the rate of evaporation.
Non-creditworthy 68%	
'it makes it dissolve quicker'	A small proportion of pupils (**1%**) gave a response which referred to dissolving rather than evaporating. While the pupils knew the term 'dissolve', they didn't demonstrate an understanding of what it means.
Other incorrect or insufficient responses Example: 'it makes no difference'	**67%** gave insufficient responses or no response at all. Answers which were not creditworthy didn't make the connection between heating and the rate of evaporation or salt formation.

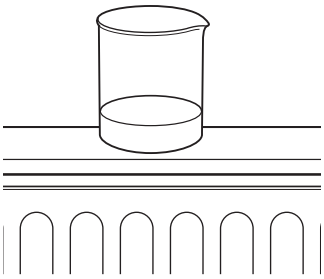
Rock salt

(d) Oliver has a piece of muddy rock salt.
The pictures below show the four things Oliver must do to separate salt from the muddy rock.

Put the pictures in the correct order for separating the salt by writing **1**, **2**, **3** or **4** in each box.

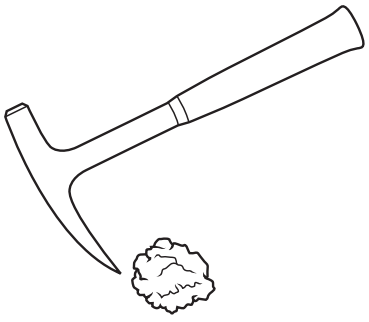
Add water and stir

Leave to evaporate



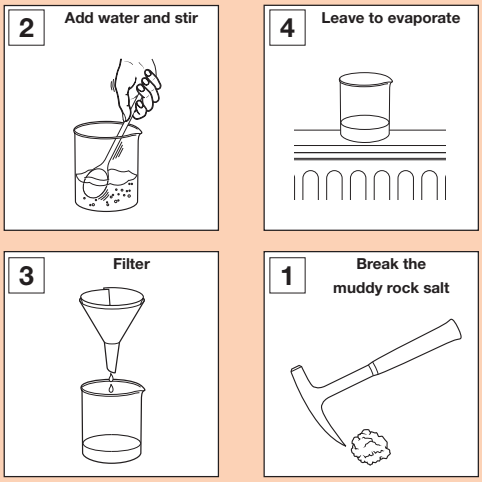
Filter

Break the muddy rock salt



d

1 mark

Question	Mark	Requirements	Allowable answers
d	***1m***	Award **ONE** mark for the correct number given in each box to show the sequence for separating salt from rock salt: 	

Additional guidance

Content domain reference	**Sc3** Materials and their properties **3b** Separating mixtures of materials *Some solids dissolve in water to give solutions but some do not.* **3c** Separating mixtures of materials *How to separate insoluble solids from liquids by filtering.* **3d** Separating mixtures of materials *How to recover dissolved solids by evaporating the liquid from the solution.* **Sc1** Scientific enquiry **2c** Planning *Think about what might happen or try things out when deciding what to do, what kind of evidence to collect, and what equipment and materials to use.*		
Cognitive domain strand	Knowledge and comprehension	Application and analysis	**Synthesis and evaluation**
This question is assessing pupils' understanding of the correct sequence of events in a scientific procedure.			

Response	Commentary
Creditworthy 35%	
2,4,3,1	This was a challenging part of the question with only **35%** of pupils gaining the mark by correctly ordering all 4 stages in the process. The easiest stage to order was 'break the muddy rock salt', with **83%** of pupils correctly identifying it as the first stage in the process. Pupils found the filter stage the most difficult to order, with only **39%** of pupils correctly identifying this as the third stage in the process. As previous parts of 'Rock salt' demonstrated, pupils' understanding of the effect of heat on the rate of evaporation was weak. This may account for poor performance in this part of the question; if pupils didn't know the effect of heat on evaporation they may have struggled to place the 'leave to evaporate' stage in the correct position, with negative consequences for the ordering of other stages.
Non-creditworthy 65%	
	As all stages must be correctly ordered to gain the mark, non-creditworthy answers were made up of all other permutations of 1 to 4.

Rock salt

(e) Bits of rock may fly into the air when Oliver breaks the rock salt with a hammer.

What should Oliver do to stay safe from bits of flying rock when he breaks the rock salt?

.....

e

1 mark

Question	Mark	Requirements	Allowable answers
e	***1m***	Award **ONE** mark for identifying a method to increase Oliver's safety from bits of flying rock, for example: ■ Oliver should put on safety glasses/goggles ■ Oliver should wear gloves/safety clothes/protection ■ he should put the rock salt in a bag ■ he should put a cloth over the rock salt (before breaking it)	**ONE** mark may be awarded for: ■ he should wear a mask **ONE** mark may be awarded for asking an adult to do it, for example: ■ he should get a teacher to do it

Additional guidance
Do not *give credit for an insufficient response, for example:* ■ *stand (well) back* ■ *tie his hair back* ■ *wearing glasses* ■ *break it in a container* ■ *break the rock gently [will not control where the flying pieces go]*

Content domain reference	Breadth of study **2b** *Recognise that there are hazards in living things, materials and physical processes, and assess risks and take action to reduce risks to themselves and others.* **Sc1** Scientific enquiry **2e** Obtaining and presenting evidence *Use simple equipment and materials appropriately and take action to control risks.*		
Cognitive domain strand	**Knowledge and comprehension**	Application and analysis	Synthesis and evaluation
This question is assessing pupils' knowledge of safety precautions which should be used when carrying out practical work.			

Response	Commentary
Creditworthy 73%	
Examples: 'wear safety goggles' 'put on safety glasses' 'put the rock salt in a bag' 'he should wear a safety mask'	**72%** of pupils identified a relevant safety precaution, with many pupils making reference to safety goggles or safety glasses.
Examples: 'Oliver should ask the teacher to do the hammering' 'ask the teacher to do it'	**1%** gained the mark for suggesting that the teacher should do this aspect of the process on behalf of the pupil. Generally the pupils giving this type of response were the least able and their answers may reflect their own classroom experience.
Non-creditworthy 27%	
'wear glasses'	**4%** referred to wearing glasses. This is taken to mean spectacles (rather than safety glasses) and considered insufficient, as glasses would offer little protection for eyes. Pupils were required to make explicit reference to 'safety' glasses in order to secure the mark.
Examples: 'stand back when he is using the hammer' 'tie his hair back' 'hit the rock gently'	**23%** gave other incorrect or insufficient responses or no response at all. Incorrect or insufficient responses included those that were either impractical or did not address the fundamental risk associated with breaking up the rock with a hammer.

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