



Key stage 2 science sample

Sample questions, mark schemes and commentary for 2016 assessments

Introduction to sample materials

The new national curriculum will be assessed for the first time in the summer term 2016. This set of sample materials is being published to give teachers an indication of how the new curriculum will be assessed. The materials presented here primarily focus on new areas of the curriculum and how questions assessing those areas might appear.

The examples in this document have not been through the rigorous development process that live tests go through. We will decide on final question formats once we have data from trialling the test materials. This means that some of the question types may not appear in the live tests. We will publish complete sample tests in 2015 that will reflect our findings and will be indicative of the final live tests.

These materials have been reviewed by teachers and their comments have been taken into account.

As the questions have not been trialled in schools, the mark schemes do not consider the full range of acceptable responses or include example pupil responses. They only give a basic indication of the types of response that would be credited.

The questions in the English grammar, punctuation and spelling, mathematics and science tests will appear in order of difficulty, where possible. In English reading, the texts appear in order of difficulty. In these sample materials, the texts and questions are not necessarily in order of difficulty, nor do they reflect the range of question difficulties that will appear in the final tests.

Test frameworks that illustrate the test model, content domain and performance descriptors for the 2016 national curriculum tests are on GOV.UK at www.gov.uk/sta. Please note that these sample materials are not designed to match the frameworks in terms of ratios of question/item type or coverage. They do not form complete tests as described by the test frameworks and are, therefore, not sample tests.

We recommend that these materials are not used for assessment purposes.

Key features of the science tests

In 2014, the science tests changed to a new science sampling model; the tests are administered in a sample of schools every two years. The sample is composed of 1,900 schools. Five pupils are randomly chosen from each of these schools to take part in the sample. Fifteen papers were produced to cover the whole key stage 2 science national curriculum. Each pupil chosen takes a combination of three papers. The time allowed for each paper is 25 minutes.

The tests will continue to follow the 2014 format, however, from 2016 the tests will assess the new curriculum as defined by the content domain outlined in the test framework. Where there are common questions between 2014 and 2016, the questions will assess areas common to both curricula. A small number of questions from the 2014 science sampling tests will be published in early 2015.

Questions will be attributed to the content domain described in the key stage 2 science sampling test framework. In science, a 'question' consists of a context and a number of sub-questions, called 'items'. The question and items are usually laid out over a two page spread.

By including items with varying cognitive demand within a question, according to the framework, the tests can be constructed at appropriate levels of difficulty. Overall, the questions will ramp in difficulty throughout each paper.

'Working scientifically' will be assessed within the context of the topic areas of the programme of study. There will be a slightly greater emphasis on 'knowledge and understanding' over 'scientific skills and processes' described within 'working scientifically' than there has been previously. The papers are designed to assess topics within either a biology, chemistry or physics context. Pupils will take one paper in each of these core areas. An equal number of marks are attributed to each of these core areas across the suite of 15 papers.

1 Health and digestion

a

Josh is finding out about the digestive system.

Tick **ONE** box to show why we need a digestive system.



Tick **one**.

To control how the body moves.

To break down food for the body to absorb.

To give support to the body.

To transport blood around the body.

B4d

1 mark

b

Josh has some cards labelled with parts of the digestive system.

Write **1** to **5** to show the correct path through the parts of the digestive system. The first one has been done for you.



mouth

large intestine

oesophagus

1

small intestine

stomach

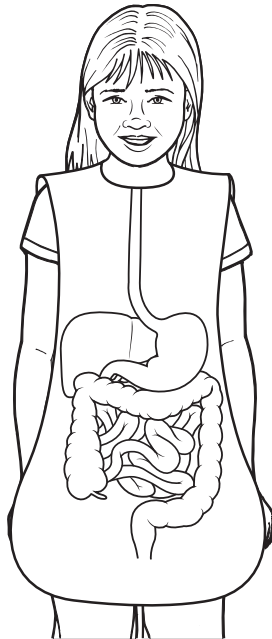
B4d

1 mark

c

The girl below is wearing an apron to show parts of the digestive system.

Draw an **X** to show the part that is the stomach.



B4d
WSLe

1 mark

d

Complete the sentences below by writing the correct words on the answer lines.



Water and nutrients pass from the small intestine into

the _____.

They are then transported around the body by the

_____ system.

B6e

1 mark

e

To keep our bodies functioning well we need to eat a balanced diet.

Another way to keep healthy is by exercising.

Give **TWO** ways in which exercise can help keep our bodies functioning well.



1. _____

2. _____

B6d

1 mark

Question 1: Health and digestion

This question assesses new areas of the curriculum that have not previously been taught at key stage 2. It predominantly focuses on the digestive system which is in the Year 4 programme of study within 'Animals, including humans', although it also extends into strands of the Year 6 programme of study within this same area. This helps to increase the demand as the pupil works through the question. This question is written to exemplify that the tests will assess all areas of the programme of study from years 3 to 6, and whole questions may contain items assessing strands from different years.

This question has been written to illustrate the types of items that pupils can expect to be assessed on for this new area of the programme of study. Items (b) and (e) could help cue pupils in to the required response for item (a). It should therefore be noted that this is an example question only, and in a live test question items that are too similar or could potentially cue pupils in to the correct response would be found in different questions in different papers.

The content domain references provided in the item column are based on the referencing system in the science sampling test framework.

Item	Requirement	Marks
a B4d	Award ONE mark for: To control how the body moves. <input type="checkbox"/> To break down food for the body to absorb. <input checked="" type="checkbox"/> To give support to the body. <input type="checkbox"/> To transport blood around the body. <input type="checkbox"/>	1 mark
Allowable answers		Additional guidance

Commentary

This item assesses if pupils understand the purpose of the digestive system. Within the new programme of study pupils are expected to have an understanding of the digestive system, the circulatory system and the function of skeletons and muscles. Pupils should be able to use their knowledge of the simple functions of the main parts of the digestive system to recognise that the digestive system allows food to be broken down for absorption into the blood.

Content domain

B4d - Describe the simple functions of the basic parts of the digestive system in humans.

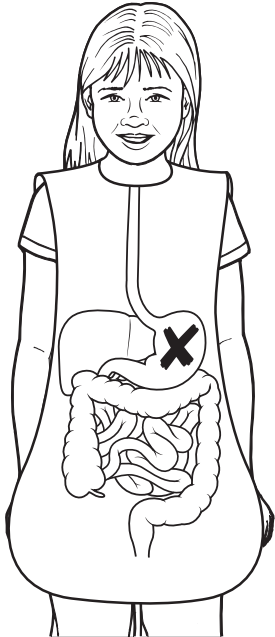
Item	Requirement	Marks
b B4d	Award ONE mark for the correct numbers written in each box to show the correct path through the parts of the digestive system: <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; text-align: center;">mouth</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">large intestine</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">oesophagus</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="border: 1px solid black; padding: 2px 5px; text-align: center;">1 <i>(given)</i></div> <div style="border: 1px solid black; padding: 2px 5px; text-align: center;">5</div> <div style="border: 1px solid black; padding: 2px 5px; text-align: center;">2</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="border: 1px solid black; padding: 5px; text-align: center;">small intestine</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">stomach</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="border: 1px solid black; padding: 2px 5px; text-align: center;">4</div> <div style="border: 1px solid black; padding: 2px 5px; text-align: center;">3</div> </div>	1 mark
Allowable answers		Additional guidance

Commentary

This item assesses a pupil’s understanding of the path taken through the digestive system after food is taken into the mouth. It requires a knowledge of the basic parts of the digestive system as described in the curriculum notes and guidance, and how these parts are linked together to form the organ system.

Content domain

B4d - Describe the simple functions of the basic parts of the digestive system in humans.

Item	Requirement	Marks
<p>c B4d WSLe</p>	<p>Award ONE mark for the centre of a cross placed anywhere on the stomach:</p> 	<p>1 mark</p>
<p>Allowable answers</p>		<p>Additional guidance</p>
<p>ONE mark may be awarded if a cross has not be drawn but the stomach is unambiguously identified.</p>		

Commentary

This item requires the pupil to identify the correct organ in a diagrammatic format.

Content domain

B4d - Describe the simple functions of the basic parts of the digestive system in humans.

WSLe - Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables.

Item	Requirement	Marks
<p>d B6e</p>	<p>Award ONE mark for responses correctly completing both sentences:</p> <p><i>Water and nutrients pass from the small intestine into the blood.</i></p> <p><i>They are then transported around the body by the circulatory system.</i></p>	<p>1 mark</p>
<p>Allowable answers</p>		<p>Additional guidance</p>
<p>ONE mark may be awarded for referring to the circulatory system or the blood system in both sentences:</p> <p><i>Water and nutrients pass from the small intestine into the circulatory system.</i></p> <p><i>They are then transported around the body by the circulatory system.</i></p>		

Commentary

This item assesses a pupil's understanding of how water and nutrients are transported in the body. It requires the knowledge that nutrients are taken in by the digestive system and then pass into the circulatory system via the small intestine to be carried to all parts of the body. It is an area taught in Year 6 and builds on a pupil's understanding of the functions of the digestive system and thus demonstrates progression.

Content domain

B6e - Describe the ways in which nutrients and water are transported within animals, including humans.

Item	Requirement	Marks
<p>e B6d</p>	<p>Award ONE mark for any two acceptable reasons given for how exercise can help keep our bodies functioning well, eg:</p> <ul style="list-style-type: none"> • it makes our hearts stronger • it makes our muscles stronger • it can help reduce the risk of heart disease • it can reduce stress/make you feel happier • it can help you lose weight (if you need to) • it can help increase your energy levels • it can help you concentrate better. <p>❖ Give credit for responses that go beyond key stage 2:</p> <ul style="list-style-type: none"> • it can reduce the risk of cancer • it can reduce blood pressure (if you suffer from high blood pressure) • it can improve your immune system. 	<p>1 mark</p>
Allowable answers		Additional guidance
		<p><i>Do not give credit for an insufficient response stating that exercise helps keep you fit but gives no reason why this helps your body.</i></p> <p><i>Do not give credit for a second response that is a repetition or restatement of the first.</i></p>

Commentary

This item assesses a pupil's understanding of the impact of exercise on how our bodies function. It is a very broad item and there are a wide range of responses that would be considered creditworthy.

Content domain

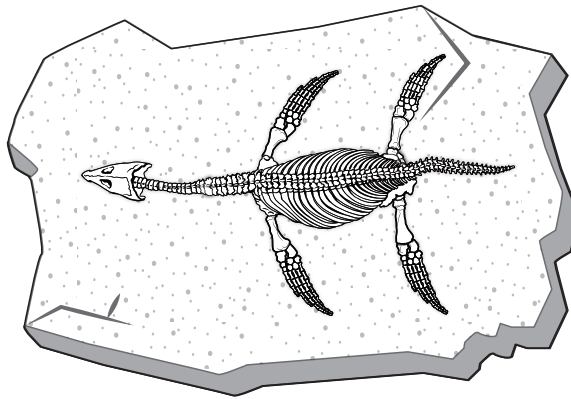
B6d - Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function.

2 Sea creature

a

The picture shows the fossil of a pliosaur.

These animals lived in the sea a long time ago.



What material are fossils made of?



C3b



1 mark

b

How did the fossil of the pliosaur form? Match each stage to order what happens.



Stage	What happens
1st	Soft parts decayed away.
2nd	Hard parts were turned into fossils over many years.
3rd	Hard parts were buried by many layers of sand.
4th	The pliosaur died and sank to the sea bed.

C3b



1 mark

c

Very few animals become fossils after they die.

Explain why very few animals become fossils after they die.



C3b

1 mark

d

Fossils can give a lot of information about animals that lived in the past.

Write **true** or **false** for each statement about the pliosaur fossil.

The pliosaur's fossil could give us information about...



True or false?

how long ago the animal lived.

what the animal ate.

what the animal smelt like.

what colour the animal's eyes were.

how large the animal was.

B6f

2 marks

Question 2: Sea creature

This question assesses a new area of the Programme of Study on fossil formation. Pupils learn about fossils and rocks in Year 3, and therefore their understanding will be at a fairly low level. This is built on however in Year 6 where pupils gain an understanding about the types of information that fossils can provide about living things that have now become extinct. This question provides an example of how a fuller understanding of a topic can be assessed by drawing on areas covered across both lower and upper key stage 2, and demonstrates how scientific understanding develops through building on previous knowledge and learning about a topic in greater detail.

The content domain references provided in the item column are based on the referencing system in the science sampling test framework.

Item	Requirement	Marks
<p>a C3b</p>	<p>Award ONE mark for correctly naming a material, eg:</p> <ul style="list-style-type: none"> • minerals • stone/rock (for fossil casts). <p>❖ Give credit for responses that go beyond key stage 2 naming a sedimentary rock that may contain fossils, eg:</p> <ul style="list-style-type: none"> • sandstone • mudstone. 	<p>1 mark</p>
Allowable answers		Additional guidance
		<p><i>Do not give credit for an insufficient response that does not indicate an animal has undergone fossilisation, eg:</i></p> <ul style="list-style-type: none"> • <i>bone</i> • <i>teeth.</i>

Commentary

This item assesses scientific knowledge that fossils are made of mineralised rock or minerals deposited whilst the rock around them forms. It also credits those types of fossils, casts, that are created by the host rock forming around the mineralised remains of the fossil. Bone or teeth are not credited as their presence indicates that the fossilisation process has not occurred or is incomplete.

Content domain

B3b - Describe in simple terms how fossils are formed when things that have lived are trapped within rock.

Item	Requirement	Marks										
b C3b	<p>Award ONE mark for correctly matching each stage to what happens during the formation of a fossil of the pliosaur:</p> <table border="1" data-bbox="288 331 1302 936"> <thead> <tr> <th data-bbox="288 331 804 398">Stage</th> <th data-bbox="804 331 1302 398">What happens</th> </tr> </thead> <tbody> <tr> <td data-bbox="288 398 804 533">1st</td> <td data-bbox="804 398 1302 533">Soft parts decayed away.</td> </tr> <tr> <td data-bbox="288 533 804 667">2nd</td> <td data-bbox="804 533 1302 667">Hard parts were turned into fossils over many years.</td> </tr> <tr> <td data-bbox="288 667 804 801">3rd</td> <td data-bbox="804 667 1302 801">Hard parts were buried by many layers of sand.</td> </tr> <tr> <td data-bbox="288 801 804 936">4th</td> <td data-bbox="804 801 1302 936">The pliosaur died and sank to the sea bed.</td> </tr> </tbody> </table>	Stage	What happens	1st	Soft parts decayed away.	2nd	Hard parts were turned into fossils over many years.	3rd	Hard parts were buried by many layers of sand.	4th	The pliosaur died and sank to the sea bed.	1 mark
Stage	What happens											
1st	Soft parts decayed away.											
2nd	Hard parts were turned into fossils over many years.											
3rd	Hard parts were buried by many layers of sand.											
4th	The pliosaur died and sank to the sea bed.											
Allowable answers		Additional guidance										

Commentary

This item assesses a pupil’s understanding of how fossils are formed when living things die and then become trapped in sediment that becomes rock over time. It requires recall of knowledge and comprehension in order to understand the statements and sequence them chronologically. This sequencing slightly raises the overall cognitive demand of the item.

Content domain

C3b - Describe in simple terms how fossils are formed when things that have lived are trapped within rock.

Item	Requirement	Marks
<p>c C3b</p>	<p>Award ONE mark for an explanation that identifies that most dead animals will decay before they have a chance to be buried or that many animals do not have skeletons or hard parts that can be fossilised:</p> <ul style="list-style-type: none"> • lots of animals decay before they are buried (and so cannot become preserved/fossilised) • many animals do not die in places/environments where they could be buried and fossilised (eg in lakes, shallow seas, sandy deserts) • many organisms do not possess hard parts (that are easily fossilised). 	<p>1 mark</p>
Allowable answers		Additional guidance
<p>ONE mark may be awarded for:</p> <ul style="list-style-type: none"> • dead animals may not get buried deep enough (to become surrounded in rock). 		

Commentary

This item is more challenging as it requires the pupil to think about what they know about fossil formation and identify a reason why most animals do not actually ever become fossils after they die.

Content domain

C3b - Describe in simple terms how fossils are formed when things that have lived are trapped within rock.

Item	Requirement	Marks
d B6f	<p>Award TWO marks for correctly classifying all five statements:</p> <ul style="list-style-type: none"> • how long ago the animal lived. True • what the animal ate. True • what the animal smelt like. False • what colour the animal’s eyes were. False • how large the animal was. True <p>If you are unable to award two marks, award ONE mark for correctly classifying four of the five statements.</p>	<p>2 marks</p> <p>or</p> <p>1 mark</p>
Allowable answers		Additional guidance

Commentary

This item assesses a pupil’s understanding of the types of information a fossil reveals about the living animal, using the context of the pliosaur fossil. It requires pupils to apply their knowledge of fossils to consider the types of information a fossil can provide and the types of information a fossil would not be able to provide.

Content domain

B6f - Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago.

3 Shadows

a

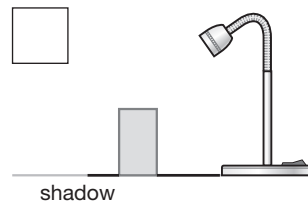
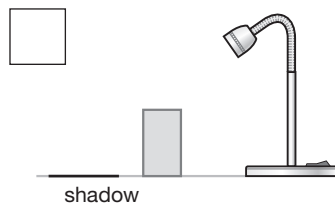
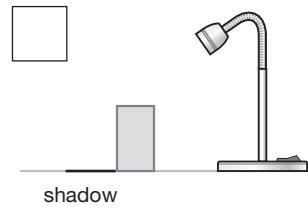
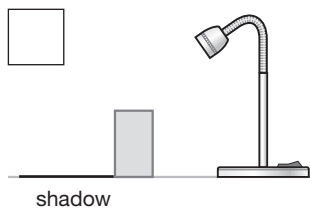
Josh is investigating shadows. He places a block on the floor. He holds a lamp and looks at the shadow the block makes.

(i) Look at the pictures below.

Which picture shows the correct length and direction of the shadow made by the block?



Tick **one**.



P3d,e
P6a

1 mark

(ii) Why does a shadow form when Josh shines the light on the block?



Tick **one**.

The block is grey and shiny.

The block is smooth and rigid.

The block is solid and opaque.

The block is hard and transparent.

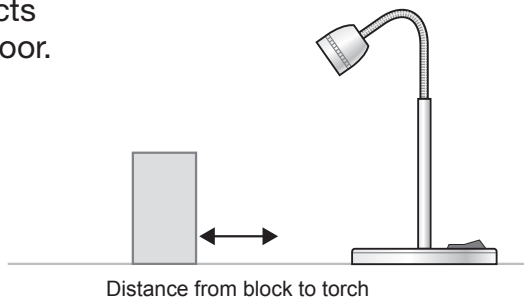
P3d

1 mark

b

Josh investigates if the distance he puts the lamp from the block affects the length of the shadow on the floor.

Josh records his results in the table below.



Distance of lamp from block (cm)	Length of block's shadow (cm)
5	7
10	9
15	12
20	14
25	17

Describe the relationship between the **distance of the lamp** from the block and the **length of the shadow**.



WSUe

1 mark

c

Josh found out that the distance of the lamp from an object does affect how long the shadow is.

He wants to find out more about how to change shadow size.

Suggest **another** investigation that Josh could carry out using the same lamp and block to find out more about how the size of a shadow changes.




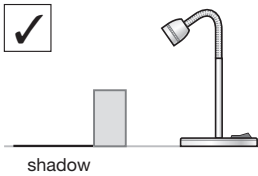
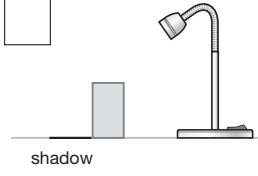
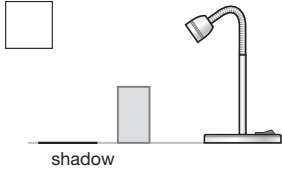
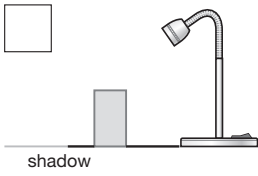
WSUd,
P3e

1 mark

Question 3: Shadows

This question assesses areas from the new curriculum which contain strands new to key stage 2. It illustrates how a question can have items assessing areas taught in different year groups of key stage 2 and from different areas of the content domain (in this case both light and working scientifically). This question requires pupils to pull together their knowledge and understanding to demonstrate a thorough understanding of the concepts and processes underlying it. The cognitive demand varies between the items, some requiring straightforward recall of knowledge or comprehension, others requiring pupils to use processing skills to analyse, apply, evaluate or synthesise information.

The content domain references provided in the item column are based on the referencing system in the science sampling test framework.

Item	Requirement	Marks
<p>a i P3d,e P6a</p>	<p>Award ONE mark for:</p> <p> Tick one.</p> <div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="text-align: center; margin: 10px;"> <input checked="" type="checkbox"/>  <p>shadow</p> </div> <div style="text-align: center; margin: 10px;"> <input type="checkbox"/>  <p>shadow</p> </div> <div style="text-align: center; margin: 10px;"> <input type="checkbox"/>  <p>shadow</p> </div> <div style="text-align: center; margin: 10px;"> <input type="checkbox"/>  <p>shadow</p> </div> </div>	<p>1 mark</p>
Allowable answers		Additional guidance

Commentary

This item assesses pupil's understanding of how shadows are formed and what determines the size of a shadow that will form on the ground behind the block. Pupils need to recognise that the shadow on the ground in this instance must fall on the left hand side of the block, touch the block at the base and be a certain length. Pupils require an understanding that the light from the lamp is travelling in straight lines and that the block is blocking the path of the light. Therefore the length and direction of the shadow behind the block is delineated by a straight line drawn from the lamp to the edge of the block.

Content domain

P3d - Recognise that shadows are formed when the light from a light source is blocked by a solid object.

P3e - Find patterns in the way that the size of shadows change.

P6a - Recognise that light appears to travel in straight lines.

Item	Requirement	Marks
a ii P3d	Award ONE mark for: The block is grey and shiny. <input type="checkbox"/> The block is smooth and rigid. <input type="checkbox"/> The block is solid and opaque. <input checked="" type="checkbox"/> The block is hard and transparent. <input type="checkbox"/>	1 mark
Allowable answers		Additional guidance

Commentary

This item assesses if pupils can identify the properties of the block that cause it to make a shadow. The important property is that the block is opaque and therefore light is unable to pass through it causing a shadow.

Content domain

P3d - Recognise that shadows are formed when the light from a light source is blocked by a solid object.

Item	Requirement	Marks
b WSUe	Award ONE mark for a response giving a general comparison describing the relationship between the two variables of distance from the lamp and length of the shadow: <ul style="list-style-type: none"> • the further the lamp from the block, the longer the shadow • the greater the distance the longer the shadow • the closer the lamp, the shorter the shadow. 	1 mark
Allowable answers		Additional guidance
<p>ONE mark may be awarded for a response giving two single comparisons:</p> <ul style="list-style-type: none"> • when the lamp is near, the shadow is short and when it is far, the shadow is longer. <p>ONE mark may be awarded for:</p> <ul style="list-style-type: none"> • the further, the longer. 		<p>Do not give credit for an incorrect response that changes one or both of the variables:</p> <ul style="list-style-type: none"> • <i>the further the lamp the bigger the shadow [only looking at the dimension of length of the shadow in the table].</i>

Commentary

This item is assessing working scientifically in the context of shadows. It requires pupils to analyse the data given from the results of an investigation and identify a relationship between two variables. This is similar to items from previous national curriculum science tests.

Content domain

WSUe - Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations.

Item	Requirement	Marks
<p>c WSUd P3e</p>	<p>Award ONE mark for any credible investigation that could be done to explore shadow size using the same block and torch that clearly identifies the independent variable, eg:</p> <ul style="list-style-type: none"> • does the direction the lamp is pointing affect the shadow size? • will the shadow length change if the block is sideways or upright? • will the distance of the block from the table affect the shadow size? • how will shadow size change if I hold the block in front of a wall and move it towards the lamp? 	<p>1 mark</p>
Allowable answers		Additional guidance
<p>ONE mark may be awarded for an investigation where the dependent variable is not stated [given in question stem] but the independent variable is explicit, eg:</p> <ul style="list-style-type: none"> • change the angle of the lamp to the block. 		<p><i>Do not give credit for an insufficient response that does not indicate the independent variable, eg:</i></p> <ul style="list-style-type: none"> • <i>how can I make the shadow wider? [shadow size is the dependent variable and is given].</i> <p><i>Do not give credit for an insufficient response that is ambiguous as could imply it is the distance of the lamp from the block that is being changed as in the original investigation, eg:</i></p> <ul style="list-style-type: none"> • <i>change the lamp position and see how big the shadow is.</i>

Commentary

This item is challenging as it has a high cognitive demand requiring pupils to synthesise and evaluate the information in the question to come up with a further investigation that could be carried out to explore other variables that could affect shadow size. They need to have a good grasp of the variables involved in the investigation in the question to predict which variables they could now explore further.

Content domain

WSUd - Using test results to make predictions to set up further comparative and fair tests.

P3e - Find patterns in the way that the size of shadows change.

For more information, please contact the national curriculum assessments helpline on 0300 303 3013 or email assessments@education.gov.uk.

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