

---

GCSE  
**Science B**

SCB3HP  
Mark scheme

---

4500  
June 2016

---

Version 1.0: Final

---

---

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from [aqa.org.uk](http://aqa.org.uk)

---

## Information to Examiners

### 1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

### 2. Emboldening and underlining

- 2.1** In a list of acceptable answers where more than one mark is available ‘any **two** from’ is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.
- 2.2** A bold **and** is used to indicate that both parts of the answer are required to award the mark.
- 2.3** Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.
- 2.4** Any wording that is underlined is essential for the marking point to be awarded.

### 3. Marking points

#### 3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that ‘right + wrong = wrong’.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as \* in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

### 3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

### 3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

### 3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

### 3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

### 3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

### 3.7 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

### 3.8 Ignore / Insufficient / Do not allow

Ignore or insufficient are used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

---

## Quality of Written Communication and levels marking

In Question 3 students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

### Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

### Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

### Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.  
The answer shows almost faultless spelling, punctuation and grammar.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)(i)	any <b>one</b> from: <ul style="list-style-type: none"> <li>(decomposition in) landfill</li> <li>rice fields</li> <li>cattle / intensive farming</li> </ul>	allow <u>anaerobic</u> decomposition	1	<b>AO1</b> 3.5.3.1.1b
1(a)(ii)	any <b>one</b> from: <ul style="list-style-type: none"> <li>vehicle exhausts</li> <li>power stations</li> <li>fertilisers</li> </ul>	ignore driving cars / vehicles  allow burning fuels (at high temperatures)	1	<b>AO1</b> 3.5.3.1.1c
1(b)	the gases absorb more long-wave radiation		1	<b>AO1</b> 3.5.3.1.2
1(c)	lichen	allow named species of lichen	1	<b>AO2</b> 3.5.3.1.6b
1(d)(i)	the more vehicles there are the less indicator species there is <b>OR</b> the less vehicles there are the more indicator species there is (1) <b>OR</b> gases from vehicles kill indicator species <b>or</b> stop them growing (1)	>200 vehicles there are less indicator species  <200 vehicles there are more indicator species	1	<b>AO3</b> 3.5.3.1.6
1(d)(ii)	any <b>two</b> from: <ul style="list-style-type: none"> <li>sample more sites</li> <li>repeat (on more days) <b>or</b> (carry out) over a longer period of time</li> <li>(carry out at) same time of day</li> <li>(count) other types of indicator species</li> <li>measure the amount of pollution in the atmosphere</li> <li>make sure sample areas are same size</li> </ul>		2	<b>AO3</b> 3.5.3.1.6

Question 1 continues on the next page

---

**Question 1 continued**

<b>1(e)</b>	any <b>one</b> from: <ul style="list-style-type: none"><li>• bloodworm</li><li>• water louse</li><li>• sludgeworm</li><li>• rat-tailed maggot</li></ul>	accept any correctly named	1	<b>AO1</b> 3.5.3.1.6a
<b>Total</b>			<b>8</b>	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
<b>2(a)(i)</b>	oxidising corrosive	can be given in either order	1 1	<b>AO1</b> 3.5.3.3.3
<b>2(a)(ii)</b>	any <b>three</b> from: <ul style="list-style-type: none"> <li>• (wear a) mask</li> <li>• (wear) gloves</li> <li>• open windows <b>or</b> add ventilation (to room)</li> <li>• use away from (naked) flame</li> </ul>	allow (wear) goggles  if no other marks awarded allow 'protective clothing' for 1 mark	3	<b>AO2</b> 3.5.3.3.4
<b>2(b)</b>	<u>incomplete</u> combustion	accept poor air supply <b>or</b> lack of (sufficient) oxygen	1	<b>AO2</b> 3.5.3.3.6
<b>Total</b>			<b>6</b>	



Question	Answers	Extra information	Mark
3			6
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.			
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	At least <b>one</b> feature of a smart material is identified  <b>or</b> the use of at least <b>one</b> smart material is given	At least <b>one</b> feature of a smart material is given  <b>and</b> this is correctly linked to a use of that material	A feature of different smart materials are described  <b>and</b> these features are correctly linked to a use of each smart material
<b>examples of the points made in the response</b> <b>smart materials</b> <ul style="list-style-type: none"> <li>• change their properties in response to the environment</li> <li>○ used in dental braces / spectacle frames / shrink wrap packaging / wound dressings / (nitinol) bone staples / stents</li> </ul> <b>smart paints</b> <ul style="list-style-type: none"> <li>• heals its own scratches</li> <li>○ used in cars</li> </ul> <b>superconductors</b> <ul style="list-style-type: none"> <li>• resistance is almost zero (at low temperatures)</li> <li>• reduces energy losses</li> <li>○ used in MRI scanners / Maglev train</li> </ul> <b>chromic materials</b> <ul style="list-style-type: none"> <li>• change their colour</li> <li>• in response to light</li> <li>• in response to temperature</li> <li>○ used in:                             <ul style="list-style-type: none"> <li>▪ spectacle lenses (photochromic)</li> <li>▪ used in windows (photochromic)</li> <li>▪ light detectors (photochromic)</li> <li>▪ baby bottles (thermochromic)</li> <li>▪ (forehead) temperature strips (thermochromic)</li> </ul> </li> </ul>		<b>extra information</b> throughout, allow any correct examples and features.	
<b>Total</b>			<b>6</b>

Question	Answers	Extra information	Mark	AO and Spec Ref
<b>4(a)(i)</b>	73.9(%)	allow 1 mark for: <u>1.7</u> or 0.73 or 0.74 2.3	2	<b>AO2</b> 3.5.1.1
<b>4(a)(ii)</b>	any <b>two</b> from: <ul style="list-style-type: none"> <li>the number of deaths has increased</li> <li>deaths have increased much more than use has</li> <li>more people / teenagers are using it</li> </ul>		2	<b>AO3</b> 3.5.1.1
<b>4(b)(i)</b>	influenza / flu is caused by a virus antibiotics are only effective against bacteria	allow antibiotics do not kill / destroy viruses for 2 marks	1 1	<b>AO1/AO2</b> 3.5.1.1.3 3.5.1.2.1
<b>4(b)(ii)</b>	mutations (in bacteria) antibiotics kill the non-resistant bacteria resistant bacteria (survive and) reproduce (therefore) the population (of resistant bacteria) increases		1 1 1 1	<b>AO1</b> 3.5.1.1.4,5a,5b
<b>Total</b>			<b>10</b>	

Question	Answers	Extra information	Mark	AO and Spec Ref
5(a)	rate of heat loss through a material	allow energy for heat	1	AO1 3.5.3.2.3
5(b)(i)	12.5		1	AO2 3.5.3.2.4
5(b)(ii)	<p>any <b>three</b> from:</p> <ul style="list-style-type: none"> <li>• (glass) has a lower payback time <b>or</b> you start saving money after paying off the initial cost sooner compared to blinds</li> <li>• saves more money (on the cost of energy bills) each year</li> <li>• over a specified time period (i.e. 25 years), glass saves the most money (e.g. £1800 instead of £700 for roof blinds)</li> <li>• (double glazed) glass roof has lowest U-value</li> </ul>	allow this mark for any correct and appropriate use of the data	3	AO3 3.5.3.2.4
5(c)	<p>traps air</p> <p>(which) reduces convection (currents)</p> <p><b>or</b></p> <p>air is a poor conductor</p>	<p>ignore traps heat</p> <p>ignore draughts</p>	1 1	AO2 3.5.3.2.1
<b>Total</b>			<b>7</b>	

Question	Answers	Extra information	Mark	AO and Spec Ref
<b>6(a)(i)</b>	select parents with desired characteristics and mate / cross them  choose offspring with the desired characteristics and mate / cross them  repeat over many generations		1  1  1	<b>AO1</b> 3.5.2.3.1
<b>6(a)(ii)</b>	unfavourable characteristics develop	allow inbreeding	1	<b>AO3</b> 3.5.2.3.1
<b>6(b)</b>	(insulin) gene is removed from human cell (using a restriction enzyme)  remove the plasmid from the bacterium  plasmid (from the bacterium) is cut open (using a restriction enzyme)  insulin gene inserted  plasmid put in to bacterium  use of (restriction) enzyme at any correct place.	allow "use of ligase to rejoin DNA" for 1 mark	1  1  1  1  1	<b>AO1</b> 3.5.2.3.4
<b>Total</b>			<b>10</b>	

Question	Answers	Extra information	Mark	AO and Spec Ref
7(a)(i)	breathing in <b>or</b> through the respiratory system	ignore 'through the air'	1	<b>AO2</b> 3.5.1.2.2
7(a)(ii)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• mumps</li> <li>• rubella</li> <li>• polio</li> <li>• measles</li> <li>• flu / influenza</li> </ul>	accept any correct viral disease	2	<b>AO1</b> 3.5.1.2.1
7(b)(i)	white blood cells produce antibodies (against HIV) if the person gets the (HIV) virus antibodies are produced very quickly	ignore phagocytes allow lymphocytes	1 1 1	<b>AO1</b> 3.5.1.2.7
7(b)(ii)	test the blood for antibodies against HIV		1 1	<b>AO2</b> 3.5.1.2.7
7(b)(iii)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• safer/ no risk of getting the disease</li> <li>• it can't replicate</li> </ul>	allow can't reproduce	1	<b>AO3</b> 3.5.1.2.7
7(c)(i)	the number of deaths rises to 2005 and then falls  (the number of) people living with HIV rises continuously		1 1	<b>AO3</b> 3.5.1.2
7(c)(ii)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• better treatment</li> <li>• more knowledge on preventing transmission</li> <li>• lifestyle change</li> </ul>	ignore less people getting the virus unqualified	2	<b>AO2</b> 3.5.1.2
<b>Total</b>			<b>13</b>	