GCSE

Science B

SCB2HP

Mark scheme

4500

June 2016

Version 1.1: 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

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 <u>not</u> 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 2(c) 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)	speed in a vacuum	do **not** allow if more than one answer is circled	1	**AO1** 3.4.3.2.4
1(b)(i)	**Ultraviolet waves**	in this order		**AO1** 3.4.3.2.6
	sterilising / sunbeds / detecting forged bank notes / security	allow tanning (beds)	1	3.4.3.2.7
	X-Rays			
	to see (broken) bones / airport security	allow for therapy / diagnosis ignore X-ray machines unqualified	1	
	Microwaves - **(Mobile phones)**		1	
	Infrared - **(Remote controls)**	allow IR	1	
1(b)(ii)	the higher the energy carried the shorter the wavelength	accept the inverse of this ignore reference to speed	1	**AO1** 3.4.3.2.4
1(c)(i)	2	do **not** allow if more than one answer is circled	1	**AO2** 3.4.3.2
1(c)(ii)	62.5	allow evidence of 12.5 (cm) for **1 mark** allow 125 for **1 mark** allow ecf from 1ci for **2 marks** if 1ci = 5 answer 25 for **2 marks** if 1ci = 4 answer 31.25 for **2 marks**	2	**AO2** 3.4.3.2.5
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	measuring cylinder	accept burette / pipette / syringe do **not** allow beaker / jug	1	**AO2** 3.4.1.2.4
2(a)(ii)	mass of metal carbonate		1	**AO2** 3.4.1.2.4
2(b)(i)	Neutralisation		1	**AO2** 3.4.1.2.3
2(b)(ii)	carbon dioxide / gas is given off		1	**AO3** 3.4.1.2.3
2(b)(iii)	mass of the reaction mixture before and after the reaction		1	**AO3** 3.4.1.2.3

Question 2 continues on the next page

2(c)		**AO2** **AO3** 3.4.1.2.2	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 comment	Identify a risk **or** identify a hazard **or** a control measure	Identify a hazard / risk, and a control measure **and** at least **two** must be linked	Identify hazards, risks, and control measures **and** at least **one** risk and control measure is correctly linked to the hazard

examples of the points made in the response

- glass (boiling/test) tube
  - = could break/smash
  - o cause a cut
  - ▪ handle glass with care

- bunsen burner
  - = get too hot
  - o burn/scald
  - ▪ do not touch when hot
  - ▪ leave to cool before moving

- (hydrochloric) acid
  - = corrosive
  - o burn/irritate
  - ▪ wear safety glasses/gloves/clothing
  - ▪ wash off immediately

- (metal) carbonate
  - = irritant
  - o irritate skin
  - ▪ wear safety glasses/gloves/clothing

- tripod/gauze
  - = get too hot
  - o burn/scald
  - ▪ do not touch when hot
  - ▪ leave to cool before moving

extra information

answers must refer to the use of apparatus

Total			**11**

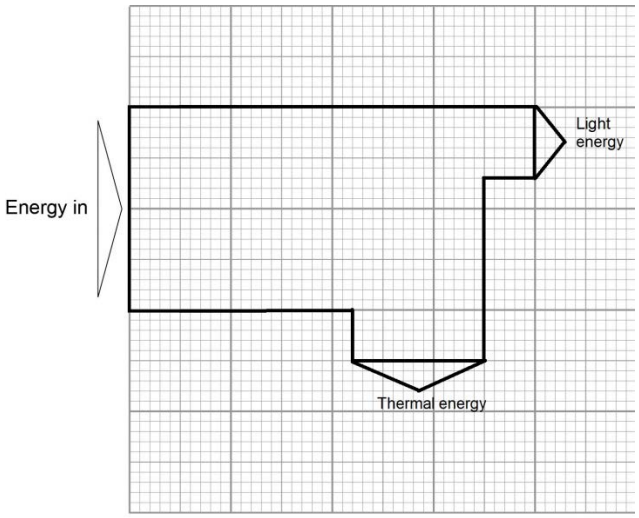
Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	$CaCO_3$		1	**AO1** 3.4.2.1.3
3(a)(ii)	bind together the building blocks		1	**AO2** 3.4.2.1.2
3(b)	any **one** from: • cement • concrete • manufacturing glass • building material	accept neutralising excess acidity (in lakes and soils) or in the manufacturing of iron	1	**AO1** 3.4.2.1.2
3(c)	water, sand and cement	ignore gypsum	1	**AO1** 3.4.2.1.4
3(d)(i)	any **one** from: • it will not bind • it will crack	accept will not stick	1	**AO3** 3.4.2.1.5
3(d)(ii)	add data together and divide by number of results do not include any anomalies		1 1	**AO1** 3.7.7
3(d)(iii)	all 5 data points correctly plotted correctly drawn curved line of best fit	accept 4 correct data points correctly plotted for **1** mark	2 1	**AO2** 3.4.2.1.5
3(d)(iv)	(all 3 mixtures) increase (mean) shrinkage as time increases (mean) shrinkage - (all 3 mixtures) increase at a greater rate at the start mixture A has higher mean shrinkage / B has lowest mean shrinkage	 accept A is higher than C or C is higher than B allow the converse accept (all 3 mixtures) slow down at the end	1 1 1	**AO3** 3.4.2.1.5
Total			**13**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	for every carbon (atom) there are double the number of hydrogen (atoms) plus two (more) hydrogen (atoms)	accept a correct example e.g. CH_4, C_2H_6	1	**AO1** 3.4.2.2.6
4(b)	$CH_4 + O_2$ $CO_2 + H_2O$ $\mathbf{2}O_2 \rightarrow \mathbf{2}H_2O$	left hand side right hand side correct balancing	1 1 1	**AO1** **AO2** 3.4.2.2.1,5
4(c)(i)	(nuclear fuel) produces radioactive waste any **one** from: • (so) is difficult to dispose of • harmful to life	 accept emits atomic radiation allow high decommissioning costs (**1 mark**) because buildings are radioactive (**1 mark**) allow non-renewable (**1 mark**) because replacement nuclear fuels will need to be found (**1 mark**)	1 1	**AO1** 3.4.2.3.5
4(c)(ii)	unreliable (because) waves can differ in size		1 1	**AO1** 3.4.2.3.5

Question 4 continues on the next page

Question 4 continued

4(d)	advantage: any **two** from: • renewable • jobs for the local area • no carbon dioxide overall added to the environment/carbon neutral • (power) companies make a higher profit disadvantage: any **one** from: • higher cost of electricity to consumer • less land available for food crops	accept not using up fossil fuels accept does not contribute to global warming	2 1	**AO3** 3.4.2.3.3
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	2.4 kWh **or** 8 640 000 J **or** 8 640 kJ **or** 8.64 MJ	Allow **2** marks for: 2.4 **or** 8 640 000 **or** 8 640 **or** 8.64 ignore wrong case for unit if the incorrect unit is applied to the numerical answer then award only **1** mark if no other marks awarded then allow **1** mark for 2 400 seen	3	**AO2** 3.4.3.1.3
5(b)(i)	(efficiency) is the amount of energy supplied to a device that is transferred into useful energy		1	**AO1** 3.4.3.1.8
5(b)(ii)	(useful) light energy arrow correctly drawn to scale (wasted) thermal energy arrow correctly drawn to scale  	drawn to scale is 7 boxes width drawn to scale is 13 boxes width	1 1	**AO2** 3.4.3.1.7
Total			**6**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	maintain a constant internal environment	allow description e.g. returns conditions to correct level ignore examples of negative feedback e.g. blood glucose levels or temperature ignore stops conditions changing	1	**AO1** 3.4.1.1.8
6(b)	release hormones that control processes		1	**AO1** 3.4.1.1.9
6(c)	blood vessels supplying the skin	do **not** accept capillaries / veins constrict	1	**AO1** 3.4.1.1.11 b&c
	(arteries / arterioles) constrict / narrow	do **not** accept idea of blood vessels moving (to the surface of the skin) if no reference to skin allow blood vessels constrict for one mark	1	
	so less blood flows to the skin (capillaries)	must correctly relate to constriction	1	
	so less heat is lost (from the skin by radiation)	must correctly relate to constriction	1	
6(d)	(cells in the) pancreas detect (high) blood glucose		1	**AO1** 3.4.1.1.8/10a
	(pancreas) releases insulin (into the blood)		1	
	liver removes glucose		1	
	stored as (insoluble) glycogen		1	
Total			**10**	