GCSE

Additional Science / Chemistry

CH2HP

Mark scheme

4408 / 4402
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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)(i)	the higher the temperature, the greater the rate **or** at 40 °C rate is faster than at 20 °C	accept the higher the temperature, the faster the reaction	1	**AO3** 2.4.1c
1(a)(ii)	40 °C curve is steeper **or** correct comparison of data from the graph	accept the 40 °C line becomes horizontal sooner accept at higher temperatures the reaction finishes sooner accept reaction finishes sooner at 40 °C accept at higher temperatures the gas is produced faster	1	**AO3** 2.4.1c
1(a)(iii)	2		1	**AO2** 2.4.1a
1(b)(i)	Concentration of acid Mass of marble chips		2	**AO3** 2.4.1e
1(b)(ii)	increases rate (because of) more frequent collisions (between particles)	incorrect reference to energy = max **1** accept particles are more likely to collide ignore more collisions ignore more successful collisions	1 1	**AO1** 2.4.1f
1(c)	any **one** from: • increases rate of reaction • reduces energy required • lower temperature can be used • catalyst is not used up		1	**AO1** 2.4.1g,h
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	any **one** from: • solution becomes colourless or colour fades • zinc becomes bronze / copper coloured • zinc gets smaller • bubbles or fizzing	 allow copper (forms) or a solid (forms) allow zinc dissolves ignore precipitate	1	**AO2** 2.5.1
2(b)	improvement: use a plastic / polystyrene cup or add a lid reason - must be linked reduce / stop heat loss **OR** improvement: use a digital thermometer reason - must be linked more accurate or easy to read or stores data	 accept use lagging/insulation allow use a data logger allow more precise or more sensitive ignore more reliable ignore improvements to method, eg take more readings	1 1	**AO3** 2.5.1a,b

Question 2 continues on the next page

Question 2 continued

2(c) 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.

AO2/AO3
2.5.1a,b

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content.	There is a statement about the results.	There are statements about the results. These statements may be linked or may include data.	There are statements about the results with at least one link and an attempt at an explanation.

Examples of chemistry points made in the response:

Description:

Statements
Concentration of copper sulfate increases
Temperature change increases
There is an anomalous result
The temperature change levels off
Reaction is exothermic

Linked Statements
Temperature change increases as concentration of copper sulfate increases
The temperature change increases, and then remains constant
After experiment 7 the temperature change remains constant

Statements including data
The trend changes at experiment 7
Experiment 3 is anomalous

Attempted Explanation:
Temperature change increases because rate increases
Temperature change levels off because the reaction is complete

Explanation:
As more copper sulfate reacts, more heat energy is given off
Once copper sulfate is in excess, no further heat energy produced

Total			**9**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)		first 3 marks can be obtained from a suitably labelled diagram incorrect structure or bonding or particle = max 3		**AO1** 2.1.h,i 2.2.4a
	giant structure / lattice / layers / close packed		1	
	made up of atoms / <u>positive</u> ions		1	
	with delocalized / free electrons		1	
	so electrons can move / flow through the metal	accept so electrons can carry charge through the metal accept so electrons can form a current	1	
3(b)		accept converse for pure metal throughout both marks can be obtained from suitable diagrams		**AO1** 2,2,4c
	an alloy (is a metal which) has different types / sizes of atoms	allow made of different metals allow mixture of metals / atoms / elements ignore particles ignore properties do **not** accept compound	1	
	alloy has distorted layers	allow layers are unable to slide	1	
3(c)(i)	can return to its original shape	accept shape memory alloy accept smart alloy ignore other properties	1	**AO1** 2.2.4d

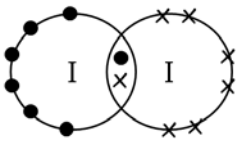
Question 3 continues on the next page

Question 3 continued

3(c)(ii)	(pure copper is too) soft	accept converse accept malleable or bends accept copper is running out ignore references to strength and weakness	1	**AO2** 2.2.4c 2.7.1d
3(c)(iii)	aluminium oxide	accept alumina accept Al_2O_3 ignore bauxite / aluminium ore	1	**AO1** 2.7.1h
3(c)(iv)	any **one** from: • different conditions • different catalyst • different pressure • different temperature	allow different concentration do **not** accept different monomers	1	**AO1** 2.2.5a
3(d)	any **two** from: • accurate • sensitive • rapid • small sample	both needed for 1 mark	1	**AO1** 2.3.2a
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	because this lithium atom has			**AO1/ AO2**
	3 protons		1	2.3.1abc
	and 4 neutrons		1	
	mass number is total of neutrons and protons	accept protons and neutrons have a mass of 1 accept number of neutrons = 7 - 3(protons) ignore mass of electron is negligible	1	
4(b)	grams	accept g	1	**AO1**
	^{12}C	allow carbon-12 **or** C-12 ignore hydrogen **or** H	1	2.3.1eg
4(c)		max **2** if no numbers given numbers if given must be correct	3	**AO1/ AO2** 2.3.1d
	any **three** from:			
	• both have 8 protons	accept same number of protons		
	• ^{18}O has 10 neutrons • ^{16}O has 8 neutrons	accept different number of neutrons or ^{18}O has two more neutrons for **1** mark		
	• both have 8 electrons	accept same number of electrons		
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	silver nitrate	allow $AgNO_3$	1	**AO3** 2.6.1d
5(a)(ii)	potassium carbonate **or** sodium carbonate	allow K_2CO_3 allow Na_2CO_3	1	**AO3** 2.6.1d
5(b)	base	allow ionic ignore insoluble or soluble ignore alkali	1	**AO1** 2.6.2a
5(c)(i)	evaporate **or** crystallise	allow heat or boil or leave (to evaporate) allow cool ignore filtration unless given as an alternative do **not** accept freeze or solidify	1	**AO1** 2.6.1c
5(c)(ii)	2 (HNO_3)	accept multiples	1	**AO2** 2.6.1b
5(c)(iii)	9	accept nine	1	**AO2** 2.6.1b 2.1.1a
5(d)	6.21/207 0.72/16 = 0.03 = 0.045 2 3 Pb_2O_3	**1** mark for dividing mass by A_r **1** mark for correct proportions (allow multiples) **1** mark for correct whole number ratio (allow multiples). Can be awarded from formula. allow O_3Pb_2 **ecf** allowed throughout if sensible attempt at step 1 correct formula with no working gains **1** mark	1 1 1 1	**AO2** 2.3.3b
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)		max **3** if incorrect structure or bonding or particles		**AO1** 2.1.1adef 2.2.2a
	lattice / giant structure		1	
	ionic **or** (contains) ions		1	
	Na^+ **and** Cl^-	accept in words or dot and cross diagram: must include type and magnitude of charge for each ion	1	
	electrostatic attraction	allow attraction between opposite charges	1	
6(b)	hydrogen	allow H_2	1	**AO1** 2.7.1i
	sodium hydroxide	allow NaOH	1	
6(c)	any **one** from, eg: • people should have the right to choose • insufficient evidence of effect on individuals • individuals may need different amounts	allow too much could be harmful ignore religious reasons ignore cost ignore reference to allergies	1	**AO3** 2.1
6(d)(i)		accept dot, cross or e or – or any combination, eg		**AO2** 2.1.1b,g
	one bonding pair of electrons		1	
	6 unbonded electrons on each atom		1	

Question 6 continues on the next page

Question 6 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(d)(ii)		max **2** if incorrect structure or bonding or particles		**AO1/ AO2** 2.2.1ab
	simple molecules	accept small molecules accept simple / small molecular structure	1	
	with intermolecular forces	accept forces between molecules must be no contradictory particles	1	
	which are weak **or** which require little energy to overcome – must be linked to second marking point	reference to weak covalent bonds negates second and third marking points	1	
6(d)(iii)	iodine has no delocalised / free / mobile electrons or ions		1	**AO1** 2.2.1c
	so cannot carry charge	if no mark awarded iodine molecules have no charge gains **1** mark	1	2.1.1g
Total			**14**	