
GCSE CHEMISTRY

CH3HP
Mark scheme

4402
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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

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. Boldening 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 boldened. 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 are 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 is 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(b)(ii) 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.

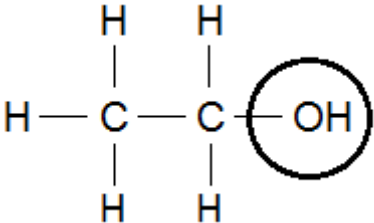
Level 2: Clear

- 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.	ID
1(a)	filter to remove <u>solids</u> or <i>insoluble particles</i> OR add coagulant (1) flocculation / settling / remove <u>solids</u> (1)		1 1	1 / 3.2.2a/c	E
	(add) chlorine to reduce the number of microbes	accept ozone / UV accept to kill microbes / bacteria / germs accept sterilise allow disinfect ignore remove microbes	1 1		
1(b)(i)	ion exchange resin	allow ion exchange column allow sodium <u>ions</u> / Na ⁺ allow hydrogen <u>ions</u> / H ⁺	1	1 / 3.2.2b	E
1(b)(ii)	prevent growth of microbes	accept sterilise accept to kill microbes / bacteria / germs accept to reduce the number of microbes ignore remove microbes	1	1 / 3.2.2b	E
1(c)	high cost of energy / heating	allow uses a lot of energy	1	2 / 3.2.2d	E
1(d)	any one from: <ul style="list-style-type: none"> • helps to develop / maintain bones • helps to develop / maintain teeth • reduces heart disease 	allow any suitable positive effect on bones allow any suitable positive effect on teeth	1	1 / 3.2.1f	E
Total			8		

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
2(a)(i)			1	1 / 3.6	G
2(a)(ii)	ethanol	<i>allow ethyl alcohol</i> <i>do not accept ethanal</i> <i>ignore all formulae</i>	1	1 / 3.3.1a	G
2(b)(i)	any two from: <ul style="list-style-type: none"> • lid • <i>metal</i> calorimeter • insulation (around sides of beaker) • excluding draughts • stirrer 	<i>allow metal beaker</i> <i>do not allow flammable insulation / beaker</i> <i>allow stirring</i>	2	3 / 3.3.1a	E

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
<p>2(b)(ii) 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.</p>				1 + 3 / 3.3.1a	E
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)		
No relevant content	<i>There is a description of part of an experimental method or a measurement which should be taken.</i>	<i>There is a description of some parts of an experimental method and a measurement which should be taken.</i>	<i>There is a description of an experimental method and measurements which should be taken.</i>		
Examples of the points that may be made in the response					
<ul style="list-style-type: none"> • <i>light ethanol and heat water</i> • <i>extinguish ethanol</i> • <i>after suitable temperature rise or after a suitable time</i> • <i>stir water</i> • <i>measure mass / volume of water</i> • <i>measure initial temperature of water</i> • <i>measure final temperature of water</i> • <i>measure temperature rise</i> • <i>measure initial mass of ethanol (and burner)</i> • <i>measure final mass of ethanol (and burner)</i> • <i>measure change in mass of ethanol</i> 					
Total			9		

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
3(a)	similar properties	<i>allow same properties</i> <i>allow correct example of property</i> <i>ignore answers in terms of atomic structure</i>	1	1 / 3.1.1a	E
3(b)(i)	in order of atomic / <i>proton</i> number	<i>allow increasing number (of protons)</i>	1	1 / 3.1.2a	E
3(b)(ii)	elements in same group have same number (<i>of electrons</i>) in outer shell or <i>highest energy level</i>	<i>allow number (of electrons) increases across a period</i>	1	1 / 3.1.2b	E
3(c)	any two from: <ul style="list-style-type: none"> • stronger / harder • less reactive • higher melting points 	<i>statements must be comparative</i> <i>ignore higher densities</i> <i>ignore boiling point</i>	2	2 / 3.1.3c	E
3(d)	<i>reactivity increases down group</i> <i>outer electron is <u>further</u> from nucleus</i> <i><u>less</u> attraction between outer electron and nucleus</i> <i>therefore outer electron lost <u>more</u> easily</i>	<i>allow converse throughout</i> <i>for next three marks, outer electron needs to be mentioned once otherwise max = 2</i> <i>allow <u>more</u> energy levels / shells</i> <i>allow <u>larger</u> atoms</i> <i>allow <u>more</u> shielding</i>	1 1 1 1	1 / 3.1.3b/h	E
Total			9		

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
4(a)(i)	calcium (carbonate) or magnesium (carbonate)	allow CaCO_3 allow MgCO_3	1	1 / 3.2.1b	E
4(a)(ii)	carbon dioxide	allow CO_2	1	1 / 3.4.1d	G
4(b)	– COOH group <u>correctly displayed</u>		1	1 / 3.6	E
4(c)(i)	because hydrochloric acid is a strong(er) acid which ionises more	allow converse <i>throughout</i> ‘it’ refers to hydrochloric acid <i>allow because hydrochloric acid has lower pH</i> accept produces / has more hydrogen ions / H^+ ions	1 1	1 + 3 / 3.6.2b	E
4(c)(ii)	corrosive	allow reacts with <i>heating</i> element / kettle <i>ignore dissolves</i>	1	3 / 3.6.2b	E
4(d)	0.2288	correct answer gains 3 marks with or without working accept 0.229 or 0.23 if answer is incorrect $28.6 \times 0.2 \div 1000 (=0.00572)$ gains 1 mark $0.00572 \times 1000 \div 25$ or ecf gains 1 mark or $28.6 \times 0.2 \div 25$ gains 2 marks	3	2 / 3.4.1h	E
Total			9		

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
5(a)	2NH ₃	allow NH ₃ with incorrect or missing balancing for 1 mark <i>allow multiples</i>	2	2 / 3.5.1b	E
5(b)(i)	200		1	3 / 3.5	G
5(b)(ii)	rate of reaction (too) slow	<i>allow converse</i> ignore references to yield / cost	1	2 / 3.5.1f/h	E
5(b)(iii)	400		1	2 / 3.5	A
5(b)(iv)	lower yield	<i>allow converse</i> accept shifts equilibrium to left allow favours the backward reaction allow favours side with <i>more</i> (gaseous) molecules allow lower rate	1	2 / 3.5.1g/h	E
5(c)	(gases) cooled <i>ammonia</i> liquefied	<i>it = ammonia</i> accept <i>ammonia</i> condensed accept ammonia cooled below boiling point for 2 marks	1 1	1 / 3.5.1b	E
Total			8		

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
6(a)	electrical		1	1 / 3.3.1i	G
6(b)	using hydrogen saves petrol / diesel / <i>crude oil</i> <i>using hydrogen (in fuel cells) does not cause pollution</i>	allow crude oil is non-renewable <i>ignore hydrogen is renewable</i> accept no carbon dioxide produced <i>allow less carbon dioxide produced</i> <i>allow hydrogen produces <u>only</u> water</i>	1 1	3 / 3.3.1i	E
6(c)(i)	(–)486	correct answer with or without working gains 3 marks if answer is incorrect: (2 x 436) + 498 or 1370 gains 1 mark 4 x 464 or 1856 gains 1 mark <i>correct subtraction of ecf</i> gains 1 mark	3	2 / 3.3.1f	E
6(c)(ii)	products lower than reactants <i>reaction curve correctly drawn</i> activation energy labelled		1 1 1	1 + 2 / 3.3.1d	E
Total			9		

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
7(a)	lithium yellow	<i>allow Li⁺ / Li</i> <i>allow orange</i>	1	2 / 3.4.1a	E
			1		
7(b)	silver nitrate (solution) white precipitate	incorrect test = 0 marks ignore (nitric) acid do not allow other <i>named</i> acids	1	1 / 3.4.1e	E
			1		
7(c)	blue precipitate (with sodium hydroxide) indicates copper ions and white precipitate (with barium chloride) indicates sulfate ions but iron(II) ions produce a green precipitate (with sodium hydroxide)	<i>allow Cu²⁺</i> <i>allow SO₄²⁻</i> <i>accept compound X is copper sulfate/CuSO₄ for 1 mark</i>	1	3 / 3.4.1c/f	E
			1		
			1		
Total			7		