AQA

GCSE

Chemistry

CH3HP

Mark scheme

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 4(b) 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)	Li **and** K	either order allow lithium **and** potassium	1	**AO1** 3.1.3.a
1(b)	Fe	allow iron	1	**AO1** 3.5.1.b
1(c)	N **and** As	either order allow nitrogen **and** arsenic	1	**AO2** 3.1.2.b
1(d)	Cu	allow copper	1	**AO1** 3.1.3.d
Total			**4**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	(iron) is a metal	accept transition element allow (iron) had different properties (to oxygen and sulfur) ignore electrons	1	**AO2** 3.1.1.a
2(b)	so that elements with similar properties could be placed together	allow to make the pattern fit ignore undiscovered elements	1	**AO1** 3.1.1.b
2(c)	atomic number(s)	allow proton number(s)	1	**AO1** 3.1.2.a
2(d)	all have one electron in the outer shell (highest energy level) (so they) have similar properties **or** react in the same way	allow same number of electrons in the outer shell (highest energy level) allow specific reactions e.g. with water	1 1	**AO1** 3.1.2.b
Total			**5**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	increase		1	**AO1** 3.1.3.f
3(b)(i)	Na^+ **and** Br^-	both required	1	**AO1** 3.1.3.a/e
3(b)(ii)	sodium chloride	allow NaCl do **not** allow sodium chlorine	1	**AO2** 3.1.3.g
3(b)(iii)	chlorine is more reactive than bromine	allow converse argument allow symbols Cl, Cl_2, Br and Br_2 allow chlorine / it is more reactive. do **not** allow chloride **or** bromide	1	**AO1** 3.1.3.g
3(b)(iv)	fluorine	allow F / F_2. do **not** allow fluoride.	1	**AO2** 3.1.3.g
Total			**5**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	(calcium or magnesium) ions causing water hardness are dissolved	ignore named anions	1	**AO1/ AO2** 3.2.1.b
	from rocks	allow limestone	1	

4(b) 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.

AO1/ AO3 3.2.1.g 3.2.2.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 one of the methods **or** one advantage of one of the methods	There is a description of one method of water softening **and** one advantage of a method is given	There is a description of both methods of water softening **and** a comparison of the two methods by giving an advantage of at least one of them

general:

- hard water contains calcium/magnesium (ions)
- softening water involves removal of calcium/magnesium (ions)

ion exchange:

- resin
- contains sodium/hydrogen ions
- which are exchanged with calcium/magnesium ions
- resin needs periodic replenishment with sodium ions/hydrogen ions or sodium chloride (disadvantage)
- increases sodium content of water (if sodium ions used) (disadvantage)
- easy/quick method to use (advantage)
- continuous process (advantage)

sodium carbonate:

- sodium carbonate is added to hard water
- calcium/magnesium ions precipitate out
- as calcium/magnesium carbonate
- batch process (disadvantage)
- leaves a residue of precipitated carbonate in the water (disadvantage)
- increases sodium content of water (disadvantage)
- easy method to use (advantage)
- relatively cheap (advantage)

Total			8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	any **two** from: • fuel • solvent • antiseptic	 allow source of energy allow perfume / aftershave allow antibacterial	2	**AO1** 3.6.1.b
5(b)	Hydrogen		1	**AO1** 3.6.1.b
5(c)(i)	oxidation	do **not** allow redox	1	**AO1** 3.6.1.c
5(c)(ii)	correct structure		1	**AO1** 3.6.2.a
5(c)(iii)	 ethanoic acid is a weak / weaker acid because it does not completely ionise.	it = ethanoic acid allow because it does not completely dissociate allow it has a lower concentration of hydrogen ions allow converse for hydrochloric acid do **not** allow ionising	 1 1	**AO1/ AO2** 3.6.2.b
5(d)(i)	ethyl ethanoate		1	**AO1** 3.6.2.b
5(d)(ii)	acid	allow any strong acid allow correct formulae	1	**AO1** 3.6.2.b
5(d)(iii)	evaporates easily / quickly	allow low boiling point do **not** allow flammable	1	**AO1** 3.6.3.a
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)(i)	nothing can enter **and** nothing can leave the reaction	allow sealed reaction vessel	1	**AO1** 3.5.1.c
6(a)(ii)	forward and backward reactions have same rate so there is no (overall) change in quantities of reactants and products	 allow concentrations of reactants and products	1 1	**AO1/ AO2** 3.5.1.c
6(b)(i)	natural gas	allow methane / CH_4 allow fossil fuels / hydrocarbons allow water	1	**AO1** 3.5.1.a
6(b)(ii)	provides an alternative reaction pathway which has a lower activation energy	 ignore references to collisions	1 1	**AO1** 3.3.1.h
6(b)(iii)	the amount (of ammonia) increases the equilibrium moves to the side (of the equation) with fewer (gaseous) molecules / moles	allow yield increases allow it favours the forward reaction	1 1	**AO1/ AO2** 3.5.1.d/g
6(c)(i)	vertical arrow from reactants to maximum		1	**AO2** 3.3.1.e
6(c)(ii)	(energy of) products higher than (energy of) reactants	allow converse	1	**AO2** 3.3.1.d
6(c)(iii)	amount of hydrogen iodide decreases equilibrium moves in the direction of the endothermic reaction	 allow it favours the forward reaction	1 1	**AO1/ AO2** 3.5.1.d/e
Total			**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	**X:** Fe^{2+} / iron(II), SO_4^{2-} / sulfate	allow iron(II) sulfate **or** $FeSO_4$	1	**AO1/ AO2** 3.4.1.a/c/e/f
	Y: Na^+ / sodium, I^- / iodide	allow sodium iodide **or** NaI	1	
	Z: Fe^{3+} **/** iron(III), Br^- / bromide	allow iron(III) bromide **or** $FeBr_3$	1	
		correct identification of any two ions = one mark correct identification of any four ions = two marks		
7(b)	any **five** from: method 1 • weighing is accurate • not all barium sulfate may be precipitated • precipitate may be lost • precipitate may not be dry • takes longer • requires energy method 2 • accurate • works for low concentrations	allow converse arguments allow not all the barium hydroxide has reacted allow reliable / precise	5	**AO3** 3.4.1.a/c/e/f
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)(i)	any **one** from • incorrect measurement of temperature or volume • incorrect recording of temperature • failure to stir • heat loss	ignore faulty equipment	1	**AO3** 3.1.3.c
8(a)(ii)	32 - 33		1	**AO2** 3.1.3.c
8(a)(iii)	55		1	**AO2** 3.1.3.c
8(a)(iv)	20		1	**AO2** 3.1.3.c
8(a)(v)	4620 J / joules	allow 4.62 kJ for **2 marks** allow kJ if evidence of dividing by 1000 mark independently, but if a numerical answer has been divided by 1000 must be kJ. allow ecf from their answers to 8(a)(iii) and 8(a)(iv)	1 1	**AO2** 3.3.1.b/c
8(b)	twice as much energy released but twice as much water to heat	 allow more energy released but more water to heat for **2 marks** if no other mark awarded, allow twice the amount of hydrochloric acid used for **1 mark**	1 1	**AO3** 3.3.1.c
Total			**8**	