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General Certificate of Secondary Education
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Additional Science / Chemistry CH2HP

(Specification 4408 / 4402)

Unit 2: Chemistry 2

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner 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 examiners 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 examiner understands and applies it in the same correct way. As preparation for standardisation each examiner 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, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

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

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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 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

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 / ; e.g. allow smooth / free movement.

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 <u>not</u> 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) candidates 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.

Candidates 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 1

question	Answers	extra information	Mark
1(a)(i)	the more sodium hydrogencarbonate the greater the temperature change	accept examples from the table	1
	up to 8 spatula measures	accept any correct indication of when change occurs	1
	then the temperature change is constant		1
		if no marks awarded allow **1** mark for: the more sodium hydrogencarbonate the lower the final temperature	
1(a)(ii)	energy is taken in from the surroundings **or** endothermic		1
1(b)(i)	gas / carbon dioxide / steam / water is produced	accept carbon dioxide is a gas **or** steam / water is a gas allow gas / air expands when heated	1
1(b)(ii)	no, because (reaction) is exothermic **or** yes, to start the reaction	allow no, because (reactants) were formed by heating ignore references to cooling	1
1(c)(i)	84	correct answer with or without working gains **2** marks if no answer or incorrect answer then evidence of 23 +1 + 12 + (3 × 16) gains **1** mark	2
1(c)(ii)	14.29	accept rounding to 14.3 or 14 allow ecf from (c)(i)	1
Total			**9**

Question 2

question	answers	extra information	Mark
2(a)	any **two** from: • effervescence / bubbles / fizzing • magnesium disappears / dissolves • heat given off / exothermic • change in pH	 allow gas / hydrogen is given off allow volume of gas allow magnesium floats allow change in mass of magnesium allow temperature change do **not** accept temperature decreases do **not** accept pH decreases	2

2(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.		6
0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**
No relevant content.	A simple plan without reference to changing any variable but should include an attempt at measuring rate **or** an attempt at fair testing	A plan including change of concentration / 'volume' of acid **and** should include an attempt at measuring rate **and / or** an attempt at fair testing	A workable plan including change of concentration **and** measurement of rate **and** fair testing

examples of chemistry points made in the response could include:

Plan:

- add magnesium to acid
- time reaction / 'count bubbles' / measure volume of gas
- change concentration / 'volume' of acid

Control Variables:

- amount / mass / length / same 'size' of magnesium
- volume / amount of acid

Total			**8**

Question 3

question	Answers	extra information	Mark
3(a)(i)		correct answer with or without working gains **3** marks accept correct rounding of intermediate answers	
	M_r of NH_3 = 17 **or** 2 (moles of) NH_3 = 34 **or** 14 → 17 **or** 28 → 34	can be credited from correct substitution from step 2	1
	(28/34) x 6.8 **or** (14/17) x 6.8	allow ecf from step 1	1
	= 5.6	allow ecf from step 1	1
3(a)(ii)	61.8	accept 61.76 **or** 62 **or** 61.76… correct answer with or without working gains **2** marks if answer is not correct evidence of 4.2 / 6.8 x 100 gains **1** mark if answer not correct 0.618 or 0.62 gains **1** mark	2
3(a)(iii)	reaction is reversible	accept reaction reaches equilibrium allow reaction does not reach completion ignore some is lost	1
3(b)	3 bonding pairs	do **not** accept extra electrons on hydrogen	1
	1 lone pair	accept 2 non-bonding electrons on outer shell of nitrogen	1
3(c)(i)	hydroxide / OH^-	accept phonetic spelling	1

Question 3 continues on the next page

Question 3 continued

question	Answers	extra information	Mark
3(c)(ii)	neutralisation	accept acid-base allow exothermic	1
3(c)(iii)	nitric (acid)	allow HNO_3 ignore incorrect formula	1
3(c)(iv)	$(NH_4)_2SO_4$	allow $(NH_4^+)_2SO_4^{2-}$	1
Total			**12**

Question 4

question	Answers	extra information	Mark
4(a)(i)	current / charge couldn't flow	allow could not conduct (electricity)	1
	because the ions / particles couldn't move	do **not** accept electrons/ molecules / atoms	1
	or		
	(salt) needs to be molten / dissolved (to conduct electricity) (1)		
	so that the ions / particles can move (1)	do **not** accept electrons / molecules / atoms	
4(a)(ii)	he had status **or** he had evidence / proof	accept he had authority **or** experience accept the experiment could be repeated	1
4(b)	hydrogen / H_2	do **not** allow hydrogen ions	1
	the ions are positive	accept because opposite (charges) attract	1
	potassium is more reactive (than hydrogen)	accept potassium ions are less easily discharged (than hydrogen) **or** potassium ions are less easily reduced (than hydrogen)	1
4(c)(i)	gain electron(s)	accept fully balanced correct equation for **2** marks	1
	one electron	if no other marks awarded allow (potassium ions) reduced for **1** mark	1
4(c)(ii)	**2**Cl^- → Cl_2 + **2e**$^-$	must be completely correct, including charge on electron accept correct multiples	1
4(c)(iii)	2, 8, 8	accept any combination of dots, crosses, "e" or any other relevant symbol ignore any charges if given	1
Total			**10**

Question 5

question	Answers	extra information	Mark
5(a)	because atoms / ions / particles in alloy are different (sizes)	do **not** allow reference to molecules ignore reference to compounds	1
	so layers distorted		1
	(and layers / atoms / ions / particles) don't slide **or** slide less easily		1
		accept all marking points in a suitably labelled or annotated diagram	
		if no other mark awarded accept an alloy is a mixture **or** contains different metals / elements for **1** mark	
5(b)		max **3** marks if incorrect bonding	
	giant structure **or** lattice **or** macromolecule		1
	strong bonds (between carbon / atoms)		1
	covalent (bonds)		1
	each carbon / atom forms 4 bonds	accept tetrahedral	1
		if no other marks awarded, allow carbon (atoms) for **1** mark	
5(c)		reference to incorrect bonding = max **3**	
		reference to 'weak covalent bonds' = max **2**	
		allow correctly drawn diagram for first two marking points eg. (tangled) lines with no cross-links	
	chains **or** large molecules	ignore layers	1
	with intermolecular forces **or** forces between chains	allow bonds for forces accept no cross-links	1
	that are weak	must relate to 2nd marking point	1
	and are easily overcome/ broken (when heated)	accept molecules / chains can flow / move	1
Total			**11**

Question 6

question	Answers	extra information	Mark
6(a)	has simple / small molecules	accept molecular covalent	1
	the intermolecular forces / intermolecular bonds (are weak)	do **not** accept weak covalent bonds **or** reference to incorrect bonding	1
	only need a small amount of energy to be overcome	accept only need a small amount of energy to separate the molecules if no other mark awarded, allow it has a low boiling point for **1** mark	1
6(b)(i)	to separate		1
6(b)(ii)	(relative) molecular mass	allow M_r / (R)MM / relative mass / mass of molecule / (R)FM	1
6(c)(i)	any pH value from 0 to 6.9		1
6(c)(ii)	hydrogen	allow H^+ ignore H / H_2 / H^-	1
6(d)	any **three** from:		3
	• same number of protons	accept same atomic number numbers if given must be correct	
	• ^2H has one neutron • ^1H has no neutrons	accept different mass number **or** different number of neutrons for **1** mark ignore relative atomic mass	
	• same number of electrons	numbers if given must be correct	
Total			**10**

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