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General Certificate of Secondary Education
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Chemistry CH3HP

(Specification 4402)

Unit 3: Chemistry 3

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 3 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.

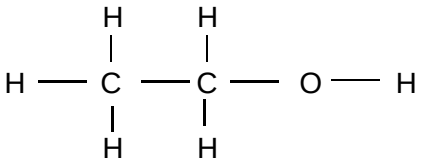
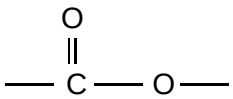
Level 3: detailed

- 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)	hydrogen	accept H_2 allow H	1
1(a)(ii)	hydroxide	accept OH^- allow OH do **not** accept lithium hydroxide	1
1(b)	any **two** from: potassium: • reacts / dissolves faster • bubbles / fizzes faster • moves faster (on the surface) • melts • produces (lilac / purple) flame	'it' = potassium accept converse for lithium allow reacts more vigorously / quickly / violently / explodes ignore reacts more allow fizzes more allow more gas allow moves more allow forms a sphere allow catches fire / ignites do **not** accept other colours	2
Total			**4**

Question 2

question	Answers	extra information	Mark
2(a)(i)		allow other arrangements provided connectivity is correct allow —OH	1
2(a)(ii)	oxygen oxidation	accept O_2 allow O allow oxidisation / oxidising / oxidised allow redox	1 1
2(b)(i)	ring around 		1
2(b)(ii)	ester(s)	do **not** allow ether(s)	1
2(b)(iii)	propanol	accept propan-1-ol allow propyl alcohol	1
Total			**6**

Question 3

question	answers	extra information	Mark
3	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.	There is a simple description of using some of the equipment.	There is a description of an experimental method involving a measurement, **or** including addition of alkali to acid (or vice versa).	There is a description of a titration that would allow a successful result to be obtained.

examples of chemistry points made in the response could include:

- acid in (conical) flask
- volume of acid measured using pipette
- indicator in (conical) flask
- sodium hydroxide in burette
- white tile under flask
- slow addition
- swirling
- colour change
- volume of sodium hydroxide added

Extra information

- allow acid in the burette to be added to sodium hydroxide in the (conical) flask
- allow any specified indicator

colour change need not be specified

Total			**6**

Question 4

question	Answers	extra information	Mark
4(a)(i) **E**	12	correct answer with or without working gains **2 marks** if answer incorrect allow (13+11)/2 for **1 mark** allow 10 for **1 mark**	2
4(a)(ii) **E**	spring water is hardest because it takes the most drops (of soap solution) **or** distilled water is softest (1) because it takes the fewest drops (of soap solution) (1)	**must** be comparative for each marking point 2nd mark must refer to amount of soap added accept correct comparison of tap water with either spring or distilled water	1 1
4(a)(iii) **E**	water contains (calcium) hydrogencarbonate which decomposes (on heating) to (calcium) carbonate	allow magnesium instead of calcium accept HCO_3^- allow breaks down accept CO_3^{2-} allow (lime)scale do **not** accept scum correct complete equation = 2 marks	1 1 1
4(b)(i) **E**	calcium <u>ions</u> (in water) replaced by / exchanged for sodium <u>ions</u> (in resin)	accept Ca^{2+} allow magnesium ions / Mg^{2+} ignore Ca^+ / Mg^+ any reference to reaction or reactivity series negates this mark accept Na^+ allow hydrogen ions / H^+	1 1 1

Question 4 continues on the next page

Question 4 continues

question	Answers	extra information	Mark
4(b)(ii)	to replenish sodium ions (in resin)	accept Na^+ allow 'to top up the sodium ions' allow 'so sodium ions do not run out' allow 'to remove calcium / magnesium ions'	1
4(c)	Argument for : any **one** from: • prevents disease • kills microbes / microorganisms / bacteria / pathogens • only small amounts needed Argument against : any **one** from: • toxic / poisonous • no consumer choice	 ignore sterilise / disinfect allow prevents illness ignore removes ignore cost / taste / corrosive ignore harmful **or** causes health problems **or** specific illnesses / diseases allow unethical	 1 1
Total			**13**

Question 5

question	Answers	extra information	Mark
5(a)(i)	place sample in flame	accept flame test accept any workable method allow burn ignore heat	1
	sodium: yellow (flame)	allow orange	1
	potassium: lilac (flame)	allow purple	1
5(a)(ii)	(lilac) colour (of potassium) obscured by (yellow) colour of sodium	allow difficult to see two colours allow sodium colour is brighter allow colours mix	1
5(b)	acidify (with nitric acid)	do **not** accept if acidified with anything other than nitric acid	1
	add silver nitrate (solution)		1
	white precipitate	depends on second marking point allow white solid ignore silver chloride ignore solution goes cloudy / milky	1
5(c)(i)	add excess (sodium hydroxide)	allow add sodium hydroxide	1
	aluminium (ions / hydroxide) (re)dissolve	depends on first marking point allow if aluminium, (white) precipitate / solid dissolves allow magnesium (ions / hydroxide) do not (re)dissolve	1
5(c)(ii)	place sample in flame	accept flame test accept any workable method allow burn ignore heat	1
	flame does not go red	accept calcium (ions / hydroxide would produce) red flame allow magnesium (ions / hydroxide) (produce) no flame colour	1
Total			**11**

Question 6

question	Answers	extra information	Mark
6(a)	air		1
6(b)	recycle (unreacted) nitrogen and hydrogen	allow re-use allow N_2 and H_2	1 1
6(c)	N_2 + **3**H_2 → **2**NH_3	allow correct multiples	1
6(d)	 because a higher temperature would reduce (equilibrium) yield because a lower temperature would reduce rate	allow converse arguments ignore references to compromise allow higher temperature favours backward reaction	 1 1
6(e)(i)	(energy of) reactants greater than (energy of) products	allow converse allow (overall) energy decreases allow energy required to break bonds is less than the energy released making bonds	1
6(e)(ii)	line starting and finishing at same levels but with lower peak		1
Total			**8**

Question 7

question	Answers	extra information	Mark
7(a)(i)	ΔT = (64 – 17) = 47 °C		1
	750 x 4.2 x 47	allow ecf using their ΔT	1
	148 050	correct answer gains **3 marks** with **or** without working ignore sign allow 148.05kJ allow 148kJ	1
7(a)(ii)	1085.7	correct answer gains **2** marks with or without working. allow answer in range 1080 – 1089 for **2 marks** allow answer in range 1080000 – 1089000 for **1 mark** if answer is incorrect allow 6/44 = 0.136 mol for **1 mark** allow (44 x their 7(a)(i))/(6 x 1000) correctly calculated for **2 marks** allow (44 x their 7(a)(i))/6 correctly calculated for **1 mark** If they have used the given value of 144 000: Allow any answer in range 1051 - 1059 for **2 marks** with or without working. allow any answer in range 1051000 – 1059000 for **1 mark**	2

Question 7 continues on the next page

Question 7 continued

question	Answers	extra information	Mark
7(a)(iii)	repeat the experiment and then calculate the mean any **one** from: • use a lid • insulate the beaker • stir • prevent draughts	 do **not** allow flammable insulation	1 1
7(a)(iv)	inaccuracies likely to have similar effects	allow systematic errors	1
7(b)(i)	8530	correct answer gains 3 marks with or without working. If answer is incorrect; (6 x 803) = 4818 gains 1 mark (8 x 464) = 3712 gains 1 mark correct addition of their calculated values gains 1 mark (ecf)	3
7(b)(ii)	(6481 – 8530) = (-)2049	ignore sign allow ecf from 7(b)(i)	1
Total			**12**

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