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General Certificate of Secondary Education
January 2013

Science A / Chemistry CH1HP

(Specification 4405 / 4402)

Unit 1: Chemistry 1

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 / ; eg 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 7(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.

CH1HP

question	answers	extra information	mark
1(a)	hydrogen has one proton whereas helium has two protons	accept numbers for words accept hydrogen only has one proton ignore references to groups	1
	hydrogen has one electron whereas helium has two electrons	accept hydrogen only has one electron allow helium has a full outer shell (of electrons)	1
	hydrogen has no neutrons **or** helium has two neutrons	if no other mark awarded, allow helium has more electrons / protons / neutrons for **1** mark	1
1(b)(i)	2 electrons on first shell **and** 8 electrons on outer shell		1
1(b)(ii)	they have a stable arrangement of electrons	accept they have full outer energy level/shell of electrons do **not** accept they have the same number of electrons in their outer energy level / shell allow they are noble gases ignore they are in group 0	1
Total			**5**

CH1HP

question	answers	extra information	mark
2(a)	time from when the heating is started until		1
	the limewater turns cloudy / milky		1
2(b)(i)	the temperature was not high enough	accept the copper carbonate had not started to decompose / react accept it takes time to heat up the copper carbonate	1
	the bubbles of gas were air	accept no carbon dioxide produced	1
2(b)(ii)	the copper carbonate was decomposing / reacting	accept the temperature was high enough to cause decomposition / a reaction	1
	so carbon dioxide was produced	allow correct word / symbol equation	1
2(b)(iii)	copper oxide was produced	allow correct word / symbol equation	1
	because the copper carbonate had completely decomposed / reacted	ignore all of the carbon dioxide had been given off	1
Total			**8**

CH1HP

question	answers	extra information	mark
3(a)	heat to vaporise (the crude oil)	do **not** accept cracking / burning	1
	vapours condense		1
	at different temperatures	allow they have different boiling points	1
3(b)	(alkanes) are hydrocarbons **or** are compounds of hydrogen and carbon only		1
	alkanes are saturated **or** have only (carbon-carbon) single bonds	accept have no (carbon-carbon) double bonds accept general formula is C_nH_{2n+2} for **2** marks	1

CH1HP

question		mark
3(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.		6

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a basic description of at least one advantage or one disadvantage of extracting petroleum products from oil sands.	There is a clear description of an advantage and a disadvantage of extracting petroleum products from oil sands.	There is a detailed description of both advantages and disadvantages of extracting petroleum products from oil sands.

examples of the chemistry/environmental/economic/social points made in the response

Advantages:

- the oil sands are needed because crude oil is running out
- this crude oil is needed because demand is increasing
- the oil sands contain a large amount of crude oil
- the oil sands could improve Canada's economy
- the oil sands provide employment for a lot of people
- the trees / forest are used for wood products / fuel

Disadvantages:

- destruction of environment / habitats
- fewer trees / forests to absorb carbon dioxide
- specified pollution, for example, visual, noise, atmospheric (including dust), water (including river or drinking) with cause, e.g. gases/particulates from burning diesel
- large amounts of methane(natural gas) are used to provide energy
- energy / fuel needed for cracking and fractional distillation
- burning fuel releases carbon dioxide
- crude oil / natural gas contains locked up carbon
- crude oil is non-renewable

Total			**11**

CH1HP

question	answers	extra information	mark
4(a)(i)	(Iceland is) on a boundary between (tectonic) plates	allow where tectonic plates move apart / meet / collide	1
4(a)(ii)	any **one** from: • not all tremors (small earthquakes) indicate that the volcano will erupt • scientists cannot monitor what is happening below the Earth's crust or in the Earth's mantle	ignore tremors (small earthquakes) are random / have no pattern ignore difficult to predict / no evidence / no proof allow these tremors (small earthquakes) may be false alarms	1
4(b)	water vapour / steam released by volcanic activity condensed to form the oceans	allow a description of condensing do **not** accept other gases condensing	1 1
4(c)	earthquakes are caused by the sudden movement of the Earth's (tectonic) plates caused by convection currents in the Earth's mantle caused (by the heat released) by radioactive processes (within the Earth)	ignore collision (of tectonic plates)	1 1 1
Total			**7**

CH1HP

question	answers	extra information	mark
5(a)(i)	in the presence of a nickel catalyst		1
	at about 60°C	allow 50 – 150°C	1
5(a)(ii)	(no) because hydrogen adds to the unsaturated fat **or** (no) because hydrogen reduces the number of (carbon–carbon) double bonds	accept (no) because hydrogen increases number of (carbon-carbon) single bonds	1
	therefore there will be less unsaturated fat	accept therefore there will be more saturated fat ignore prefixes to unsaturated e.g. trans/mono/poly if the answer is 'yes' maximum **1** mark	1
5(b)	(shaking breaks up the olive oil into tiny) droplets that are unable to join up		1
	because (molecules in the) emulsifier have a 'head' which dissolves in / is attracted to water **or** is hydrophilic	accept correctly drawn diagram for **2** marks	1
	because (molecules in the) emulsifier have a 'tail' which dissolves in / is attracted to oil **or** is hydrophobic	if hydrophilic and hydrophobic are given the wrong way round, allow **1** mark	1
Total			**7**

CH1HP

question	answers	extra information	mark
6(a)	CO_2 (+) H_2O	correct products	1
	3(O_2) **2**(CO_2) **3**(H_2O)	correct balancing	1
6(b)(i)	add bromine water	allow iodine	1
	changes (from orange) to colourless / decolourised	ignore clear	1
6(b)(ii)		ignore any references to butane (C_4H_{10}) ignore incorrect names of catalysts	
	octane vapours		1
	are passed over a catalyst (to produce ethene)		1
	OR		
	octane mixed with steam (1)	for steam cracking, second mark is conditional on 'steam'	
	at a (very) high temperature (1)		
	steam is added (to ethene)	ignore the formula H_2O / water	1
	in the presence of a catalyst (to produce ethanol)		1
		if no other marks awarded then allow **1** mark for cracking of octane **or** hydration of ethene	
Total			**8**

CH1HP

question	answers	extra information	mark
7(a)	(because to produce low-carbon steel) oxygen is needed to react with / oxidise carbon	accept (to produce low-carbon steel) oxygen removes carbon as carbon dioxide	1
	(to produce titanium) an atmosphere of argon is used because it is unreactive		1
	any oxygen / air would react with / oxidise magnesium or titanium	ignore magnesium chloride / titanium chloride reacts with oxygen	1
7(b)		it = titanium ignore references to abundance / usefulness / temperature / amounts / relative reactivity / equipment	
	for titanium:	allow converse arguments for iron	
	• there are more stages in its manufacture	accept slower rate of production **or** is more labour intensive **or** a batch process is used or the process used is not continuous	1
	• larger amounts of energy are needed	accept the titanium chloride is cooled and reheated which is not energy efficient	1
	• magnesium / chlorine / argon have to be produced **or** are expensive **or** are used		1

CH1HP

question	answers	extra information	mark
7(c)	titanium is below magnesium and above iron (in the reactivity series of metals)	allow similar position to aluminium **or** carbon **or** zinc	1
	because magnesium removes chlorine from titanium chloride **and** titanium removes oxygen from iron oxide	allow magnesium displaces titanium **and** titanium displaces iron	1
	OR		
	magnesium more reactive than titanium because it removes chlorine from titanium chloride (1)	accept magnesium more reactive than titanium because it displaces titanium	
	titanium more reactive than iron because it removes oxygen from iron oxide (1)	accept titanium more reactive than iron because it displaces iron	
Total			**8**

CH1HP

question	answers	extra information	mark
8(a)	methane		1
	because at the surface temperature of -179°C only methane has melted but has not boiled	accept a correct explanation using the boiling points(and melting points) of the gases **or** methane is a liquid **and** all the others are gases	1
8(b)	CH_4 is a hydrocarbon **or** methane / carbon monoxide contains carbon **or** carbon monoxide + hydrogen → hydrocarbon		1
	nitrogen **and** hydrogen are present in Titan's atmosphere **or** nitrogen + hydrogen → ammonia		1
	carbon monoxide contains oxygen **or** carbon monoxide + hydrogen / methane → water		1
	amino acids contain carbon, hydrogen, nitrogen + oxygen **or** amino acids can be made from (methane), hydrogen, carbon monoxide and nitrogen **OR** lightning / ultraviolet / electrical discharge / high energy needed for reaction		1
Total			**6**

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