GCSE

Science A / Chemistry

CH1HP

Mark scheme

4405 / 4402

June 2016

Version 1.0: Final Mark Scheme

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

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 errors / 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 Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 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.

4. Quality of Communication and levels marking

In Question **2(c)** students are required to produce extended written material in English, and will be assessed on the quality of their 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.

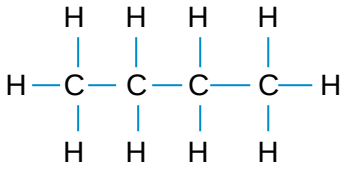
Level 2: clear
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may 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 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)(i)	electronic structure 2,3 drawn	allow any representation of electrons, such as, dots, crosses, or numbers (2,3)	1	AO2 1.1.1h
1(a)(ii)	nucleus		1	AO1 1.1.1c
1(a)(iii)	protons and neutrons	do **not** allow electrons in nucleus	1	AO1 1.1.1c/d/f
	(relative charge of proton) +1	allow positive	1	
	(relative charge of neutron) 0	allow no charge/neutral	1	
		ignore number of particles		
1(b)	too many electrons in the first energy level or inner shell	allow inner shell can only have a maximum of 2 electrons	1	AO2+AO3 1.1.1h; 1.1.2b
	too few electrons in the second energy level or outer shell	allow neon has 8 electrons in its outer shell **or** neon does not have 1 electron in its outer shell allow neon has a stable arrangement of electrons or a full outer shell	1	
	neon does not have 9 electrons **or** neon has 10 electrons	allow one electron missing allow fluorine has 9 electrons	1	
		ignore second shell can hold (maximum) 8 electrons or 2,8,8 rule or is a noble gas or in Group 0 max 2 marks if the wrong particle, such as atoms instead of electrons if no other mark awarded allow 1 mark for the electronic structure of neon is 2,8		
Total			**8**	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	high temperature catalyst or steam	allow heating / hot / 250-900 ^{o}C allow named catalyst eg zeolite, Al_2O_3, silica, ceramic allow in the absence of air / oxygen ignore any references to pressure	1 1	AO1 1.5.1a
2(a)(ii)	colourless	allow decolourised ignore clear / discoloured	1	AO1 1.5.1d
2(a)(iii)			1	AO2 1.4.2a
2(b)(i)	20.3(0) (kJ)	if answer incorrect allow **1** mark for 24.36/1.2	2	AO2 1.4.3b
2(b)(ii)	use a lid reduce energy / heat loss	allow insulate beaker or use draught shield ignore references to thermometer or repeats or distance of flame or loss of water vapour allow stir (1) to distribute energy / heat (1) allow use a metal can (1) as it's a better conductor (1)	1 1	AO3 4.3.2b/c/d
2(b)(iii)	carbon/soot (produced by) incomplete combustion	ignore tar, smoke allow from a limited supply of oxygen/air	1 1	AO1+AO2 1.4.3a/b
2(b)(iv)	hexane gives out the greatest energy (per 1.0 g) hexane produces the least smoke / carbon / soot	ignore more energy allow has the cleanest flame ignore less smoke / carbon / soot	1 1	AO3 1.4.2c; 1.4.3a/b

QWC Mark Scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(c)			6	AO1+AO2+ AO3 1.1.3b; 1.4.1b/c; 1.4.3a/b/c/d ;1.7.2h/i

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.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	Statements made from the information that indicate whether at least one statement is an advantage **or** a disadvantage **or** a linked advantage or disadvantage	Descriptions of an advantage **and** a disadvantage with some use of their knowledge to add value.	Descriptions of advantages **and** disadvantages that are linked to their own knowledge.

Examples of the added value statements and links made in the response could include:
Note that link words are in bold; links can be either way round.
Accept reverse arguments and ignore cost throughout.

Advantages of using hydrogen:

- Combustion only produces water **so** causes no pollution
- Combustion does not produce carbon dioxide **so** this does not contribute to global warming or climate change
- Combustion does not produce sulfur dioxide **so** this does not contribute to acid rain
- Incomplete combustion of petrol produces carbon monoxide **that is** toxic
- Incomplete combustion of petrol produces particulates **that** contribute to global dimming
- Petrol comes from a non-renewable resource **but** there are renewable/other methods of producing hydrogen
- Hydrogen releases more energy **so** less fuel needed or more efficient

Disadvantages of using hydrogen:

- Hydrogen is a gas **so** is difficult to store or transfer to vehicles
- Hydrogen gas is very flammable **so** leaks cause a greater risk of explosion
- Most hydrogen is produced from fossil fuels **which** are running out
- Cannot be used in existing car engines **so** modification / development or replacement is needed
- Lack of filling stations **so** difficult to refuel your vehicle

Total			**18**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	(thermal) decomposition	allow decomposes or endothermic	1	AO1 1.2.1b/c
3(a)(ii)	copper oxide		1	AO2 1.2.1b/c
3(b)(i)	the (potassium) carbonate did not decompose/change/react (when heated) the mass did not change or the limewater did not go cloudy because no carbon dioxide produced	allow temperature not high enough do **not** allow potassium did not decompose ignore references to reactivity	1 1 1	AO1+AO2 +AO3 1.2.1c/e; 4.5.4a
3(b)(ii)	the less reactive the metal the more (easily) its carbonate will decompose/react or vice versa	needs to be a relative comparison allow max **1** mark where the distinction between a metal and its carbonate is not clear allow **1** mark for carbonates of reactive metals do not decompose or vice versa	2	AO3 1.2.1 c; 1.3
3(c)(i)	make it economical (to extract the metal/iron)	allow make it worth extracting allow so they can make money/profit	1	AO1 1.3.1a
3(c)(ii)	Fe balanced correctly (2,3,4,3)	 not ecf allow correct balanced equation but with $2Fe_2$ on right for one mark	1 1	AO2 1.1.3b; 1.3.2c

3(c)(iii)	**iron** from the blast furnace is brittle **steel** produced is strong / flexible	"it" = iron allow steel has more/specific uses allow steel is rust-resistant	1 1	AO1 1.3.2a/b/c
3(c)(iv)	(recycling) is used to conserve iron (ore) **or** energy **or** resources **or** minimise pollution **or** reduce the need to quarry (not reuse) because of damage, paint removal, rusting/corrosion, metal fatigue/weaker (not landfill) because sites have limited space **or** loss of habitats	allow reverse arguments. allow to reduce the use of landfill	1 1 1	AO1+AO2 1.3.1j
Total			**15**	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	add yeast		1	AO1
	and ferment **or** by fermentation	allow in a warm place **or** temperatures within the range 20-45^{o}C **or** with an airlock/absence of air	1	1.5.3b
4(a)(ii)	by hydration with steam	allow react with/addition of steam	1	AO1 1.5.3a
	in the presence of a catalyst	ignore names of catalyst and any other conditions allow a correctly named catalyst e.g. phosphoric acid	1	
4(b)		"it" = crude oil allow the link pairs in either order ignore cost throughout		AO1+AO2 1.4; 1.4.3e
	Advantages			
	crude oil is reliable source of ethanol	**or** produces pure ethanol	1	
	because it is not affected by weather conditions or plant growth is affected by weather condition	so purification/separation is not required	1	
	or does not cause food shortages	**or** quick / continuous process		
	because farmland not used	whereas fermentation takes a long time/is a batch process		
	Disadvantages			
	crude oil is a non-renewable / finite resource	allow production of ethanol from crude oil uses more energy or a higher temperature or burns more fossil fuels	1	
	so it will run out / plants grow again	so releases more carbon dioxide or causes global warming (or an effect)	1	

4(c)	heat (the mixture)		1	AO2 1.4.1 b; 1.5.3 b
	ethanol has a lower boiling point than water **or** more ethanol than water vaporises **or** ethanol evaporates first or when the temperature reaches 78^{o}C	allow ethanol and water boil at different temperatures	1	
	condense (the vapour)	allow condense at different temperatures for the last two marking points if no other mark is awarded, allow repeat distillation or use fractional distillation apparatus for 1 mark	1	
Total			**11**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	vegetable oils / biofuels combust/burn releasing carbon dioxide	ignore crops burn releasing carbon dioxide do **not** allow fuel/oil does not release CO_2/releases very little CO_2 when burned	1	AO2 1.4.3 b; 1.6
	the growing plants (from which the vegetable oil is extracted) absorb / take in carbon dioxide		1	
	so there is no net increase in the percentage of carbon dioxide in the atmosphere/air	allow carbon instead of carbon dioxide award **3** marks for "plants take in CO_2 when they are growing and the fuel/oil only releases this CO_2 when it is burned". if no other mark awarded allow **1** mark for stating that carbon dioxide causes global warming or that vegetable oils are carbon neutral	1	
5(b)		ignore health issues		AO1
	react with hydrogen or hydrogenation	allow adding hydrogen do **not** allow use of water/hydration	1	1.6.3 b
	in the presence of a nickel catalyst		1	
	at 60 ^{o}C	allow 50-150 ^{o}C	1	
	because vegetable oils are unsaturated or have carbon-carbon double bonds	allow to make them saturated	1	
	(vegetable oils are hardened) to make them solid at room temperature **or** to make them useful as spreads/spreadable	allow to give higher melting point allow to make margarine do **not** allow to make butter allow reverse argument, vegetable oils are liquid/runny or not spreadable	1	
Total			**8**	