GCSE

Science A / Chemistry

CH1HP

Final Mark Scheme

4405 / 4402

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Version/Stage: v1.0

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	Pluto, Mars, Moon	1
2	Pluto, 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 'ecf' 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 a 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 Written Communication and levels marking

In Question 3 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.

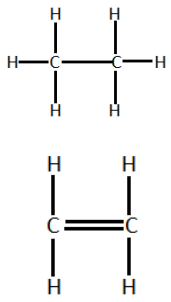
Level 2: Clear

- 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)(i)	same number of protons **or** 12 protons in each	ignore electrons ignore it is the same element do **not** allow same number of neutrons	1	**AO2** 1.1.1f,g
1(a)(ii)	(the mass number is) the sum of the protons and neutrons (so the atoms contain) different numbers of neutrons	ignore electrons in shells do **not** allow electrons in nucleus allow 12, 13 and 14 neutrons for two marks if no other mark awarded allow one mark for isotopes	1 1	**AO1** **AO2** 1.1.1g
1(b)(i)	3 / three		1	**AO2** 1.1.3a,b
1(b)(ii)	7 / seven		1	**AO2** 1.1.3a,b
1(c)	319 g($CuSO_4$) and 36 g(H_2O)		1	**AO3** 1.1.3b,c
1(d)	any **two** changes from: • limewater turns cloudy • solution turns blue • mass decreases • copper carbonate **or** (green) solid disappears • bubbles / fizzing / effervescence explanation: because carbon dioxide is produced **or** copper sulfate is produced **or** calcium carbonate is produced	allow milky / white allow weight decreases explanation must be linked to their observation	2 1	**AO1** **AO2** **AO3** 1.2.1e,f
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	electronic structure drawn	allow any representation of an electron allow 2,4	1	**AO2** 1.1.1h
2(a)(ii)	six / 6 protons (protons) are positively charged	 do **not** allow electrons in nucleus otherwise ignore electrons do **not** allow nucleus is neutral allow (protons are) + / +1 / 1+ ignore statements about mass if no other mark awarded allow one mark for nucleus	1 1 1	**AO1** **AO2** 1.1.1c;d;e
2(b)	(a hydrocarbon is) made up of hydrogen and carbon (atoms) only	do **not** allow mixture	1	**AO1** 1.4.1a;c
2(c)(i)	 	ethane correctly drawn with another hydrogen on each carbon and another three single bonds ethene correctly drawn with a double bond between the carbon atoms	1 1	**AO1** 1.4.2a 1.5.1c
2(c)(ii)	as the number of carbon atoms increases the boiling point increases	allow converse ignore alkene	1	**AO3** 1.4.2c

2(c)(iii)	the boiling points of alkanes are higher than the boiling points of alkenes	allow the boiling points of alkenes are lower than the boiling points of alkanes	1	**AO2** 1.4.2b;c
	that have the same number of carbon atoms	consequential on first marking point	1	
	or state a correct example	e.g. hexane has a higher boiling point than hexene **or** hexane boils at 69ºC hexene boils at 64ºC		
		if no other mark awarded allow both alkanes and alkenes have the same pattern of the more carbon atoms the higher the boiling point for one mark		
2(d)	(alkane molecules are) cracked	allow break down / up **or** decompose **or** split up ignore separate	1	**AO1** **AO2** **AO3** 1.5.1a;b;d
	to produce small(er) molecules / alkanes / hydrocarbons	allow short chain for small	1	
	and alkenes **or** a named alkene	allow molecules that have a double bond **or** are unsaturated	1	
		if no other mark awarded allow evaporate **or** boil for one mark ignore turns to gas		
Total			**13**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3			6	**AO2 AO3** 1.2.1a;b 1.4.2a 1.4.3a;b;c 1.7.2a;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 4 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 information given	discrete relevant points made about types of pollution **or** problematic effects **or** environmental impacts	an explanation of how an environmental impact is caused by the pollution from **or** the problematic effect of a linked process	detailed explanations of how environmental impacts are caused by the pollutions from **or** the problematic effects of linked processes

Examples of chemistry points made in the response could include:

Processes
- quarrying
- drilling
- thermal decomposition
- combustion of fossil fuel
- use of explosives

Types of pollution and problematic effects:
- visual pollution
- noise pollution
- dust pollution
- destruction of land
- air / atmospheric pollution (methane, carbon dioxide, sulphur dioxide, NO_x, particulates)
- water (rivers / lakes / seas) pollution
- earth tremors

Environmental impacts:
- destruction of areas of natural beauty
- disturbance of people and animals
- breathing problems **or** asthmatic attacks
- destruction of habitats **or** biodiversity or kills wildlife and plants
- (CH_4 ; CO_2) greenhouse gases → global warming → consequences
- (particulates) global dimming → consequences including breathing problems
- (SO_2 ; NO_x) acidic gas / rain → consequences including breathing problems
- damage to buildings / infrastructure

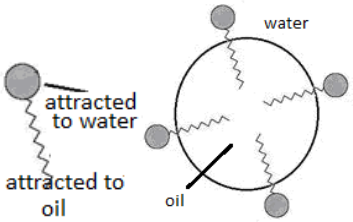
Total			6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	many (small / ethene) molecules / monomers join together **or** (small / ethene) molecules / monomers form chains / large molecules		1	**AO1** 1.5.2a
4(a)(ii)	(from 2006) until 2009 the number of bags used decreased from 2009 / 2010 (to 2014) the number of bags used increased	if no other mark awarded allow one mark for the number of bags decreased and then increased	1 1	**AO2** 1.5.2
4(a)(iii)	any **two** from: • bags are thinner • bags are smaller • bags use less material • bags are lighter **or** less dense		2	**AO3** 1.5.2
4(b)(i)	landfill space is limited (many polymers) are not biodegradable	ignore takes up space in landfill allow landfill is running out allow a long time to degrade **or** long time to break down	1 1	**AO1** 1.5 1.5.2c
4(b)(ii)	(polymers are made from) crude oil which is a limited / non-renewable resource less energy is needed to recycle polymers	ignore costs allow less carbon dioxide produced **or** less global warming	1 1	**AO1** 1.5
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	any **one** from: • all these gases / hydrogen / methane / water vapour / ammonia may not have been in the Earth's early atmosphere • the conditions of the reaction were not like those on early Earth • many different amino acids are needed for life processes	ignore no proof / evidence **or** no one was there **or** references to religion **or** meteorites / comets. allow nobody knows what was in the Earth's early atmosphere allow very little (0.5%) in the Earth's early atmosphere allow nobody knows what the conditions were on early Earth allow only simple amino acids **/** glycine were produced	1	**AO3** 1.7.2d;e
5(a)(ii)	any **three** from: • used by plants / algae **or** for photosynthesis • absorbed / dissolved by oceans • locked up in sedimentary rocks / carbonates / limestone • locked up in fossil fuels	ignore volcanoes allow stored in for locked up allow stored in for locked up mention of respiration: maximum two marks	3	**AO1** 1.7.2f;g;h
5(b)(i)	helium / He **and** neon / Ne	both needed	1	**AO2** 1.7.2j

5(b)(ii)	carbon dioxide would be solid **or** would block pipes	ignore freezes allow forms <u>dry</u> ice	1	**AO3** 1.7.2j
5(b)(iii)		mark independently		**AO2**
	the other gas is argon / Ar		1	1.7.2j
	because they have similar boiling points **or** there is only 3 °C difference in boiling points		1	
5(c)		mark independently		**AO1**
	stage 1: oxygen reacts with carbon		1	**AO2** 1.3.2a;b;c
	so carbon content decreases **or** carbon forms carbon dioxide	allow because cast iron is (too) brittle	1	
	stage 2: (other metals added) to form an alloy	allow to stop layers sliding	1	
	so the steel has a specific property / specific use	allow because pure iron is (too) soft	1	
Total			**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)		accept reverse arguments about fossil diesel throughout		**AO2** **AO3**
	biodiesel is carbon neutral	allow does not contribute to global warming **or** no extra carbon dioxide is released	1	1.4/1.4.3a;c;e
	because biodiesel releases the carbon dioxide that was used by the plants (during photosynthesis)		1	
	OR			
	biodiesel is renewable / sustainable (1)			
	because crops can be replanted (to produce more biodiesel) (1)			
	OR			
	fossil diesel is non-renewable (1)			
	because it takes millions of years to form (1)	ignore fossil diesel will run out		

6(b)	<u>emulsifier</u> is shaken with **or** added to a mixture of water and oil the head (of the emulsifier molecule) **or** hydrophilic end dissolves in the water the tail (of the emulsifier molecule) **or** hydrophobic end dissolves in the oil so that a suspension **or** stable droplets of oil in water (or vice versa) is formed  (M2 + M3) (M2+M3+M4)	allow diagrams for the last three marking points allow one mark for wrong way round	1 1 1 1	**AO1** 1.6.2a;b
6(c)	orange to colourless	allow brown ignore clear / transparent allow decolourised	1 1	**AO1** 1.6.3a
6(d)	(hydrogen) adds to the (carbon-carbon) double bond (hydrogenated oils) have higher melting points so are hardened **or** are solid (at room temperature)	allow opens up / breaks ignore spreadable if no other mark awarded allow one mark for unsaturated oils become saturated	1 1 1	**AO1** 1.6.3a;b
Total			**11**	