GCSE

CHEMISTRY

8462/2H

PAPER 2 HIGHER TIER

Mark scheme

June 2018

Version: 1.0

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

Copyright © 2018 AQA and its licensors. All rights reserved.
AQA retains the copyright on all its publications. However, registered schools/colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the centre.

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
- 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	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

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

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 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 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore 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.

3.10 Do <u>not</u> accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this.

The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

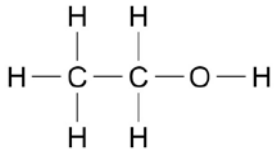
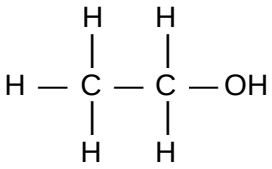
Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	yellow	allow orange allow orange-yellow	1	AO1 4.8.3.1
01.2	copper (ion)	allow Cu^{2+} allow copper (II) allow barium (ion) allow Ba^{2+}	1	AO1 4.8.3.1
01.3	(flame) colours are masked	allow (flame) colours mix / blend allow only see one colour allow cannot see two colours at once ignore hard to distinguish	1	AO1 4.8.3.1
01.4	Li^+ Na^+		1 1	AO2 4.8.3.7
01.5	bromide (ion)	allow Br^- ignore bromine	1	AO1 4.8.3.4
01.6	add barium chloride (solution) add hydrochloric acid white precipitate produced	allow barium nitrate (solution) allow nitric acid allow acidified do **not** accept sulfuric acid dependent on use of a barium compound	1 1 1	AO1 4.8.3.5
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	formulation		1	AO1 4.8.1.2
02.2	$\frac{23.3}{265.5 + 23.3 + 3.0 + 1.5}$ (× 100) = 7.9 (%)	an answer of 7.9 (%) scores **2** marks allow $\frac{23.3}{293.3}$ (× 100) allow 7.944084555 (%) rounded correctly	 1 1	AO2 4.8.1.2
02.3	to deter consumption / drinking (by people)		1	AO3 4.7.2.3
02.4	any **one** from: • fuel • solvent • antiseptic	do **not** accept as an alcoholic drink allow specific uses eg • fuel additive • cleaning products • hand-sanitisers	 1	AO2 4.7.2.3
02.5	ferment(ation) add yeast anaerobic (conditions) **or** warm	ignore distillation allow in the absence of oxygen allow a temperature value in range 5 – 45 °C inclusive allow room temperature ignore hot / heat ignore high temperature	1 1 1	AO1 4.7.2.3

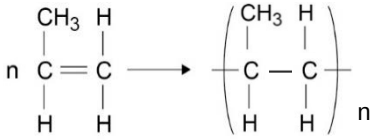
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6		allow 	1	AO1 4.7.2.3
02.7	hydrogen	allow H_2	1	AO1 4.7.2.3
02.8	oxidising (agent)	allow permanganate / dichromate ions allow [O] ignore oxygen	1	AO1 4.7.2.3
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	hydrogen	allow H_2	1	AO1 4.10.4.1
03.2	450 °C 200 atm / atmospheres	allow values in the range 400– 500 °C allow values in the range 150– 250 atm / atmospheres allow **1** mark if both values within range but no units given	1 1	AO1 4.10.4.1
03.3	ammonia has a higher boiling point	allow the other gases have lower boiling points ignore references to melting point	1	AO3 4.10.4.1

Question	Answers		Mark	AO / Spec. Ref.
03.4	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.		5–6	AO2
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.		3–4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.		1–2	AO1
	No relevant content		0	
	Indicative content **changes** • carbon dioxide has decreased • oxygen has increased **processes** • volcanic activity released water vapour • the water vapour condensed to form oceans • carbon dioxide dissolved in oceans • carbonates produce sediments • carbon locked up in sedimentary rocks • algae and plants evolved / appeared • algae / plants absorbed carbon dioxide • by photosynthesis • which also released oxygen • carbon locked up in fossil fuels			4.9.1.2 4.9.1.3 4.9.1.4
03.5	any **one** from: • occurred 4.6 billion years ago • limited or no evidence	allow any indication of billions of years allow limited or no proof ignore there was nobody there	1	AO1 4.9.1.2
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	start line drawn in ink	allow start line should have been drawn in pencil	1	AO3 4.8.1.3
	(so) ink dissolves **or** ink runs in solvent / water	(as) pencil does not dissolve **or** pencil does not run in solvent / water	1	
	water used (as solvent) **or** water in beaker	allow ethanol not used	1	
	(so) colours will not dissolve / move		1	
04.2	any **two** from: • the flowers have no colours in common • A / B contain one colour • C contains two colours • (the colour in) B is most soluble	allow the flowers are not the same colour allow C is a mixture of colours allow (the colour in) B has the highest R_f value allow one of the colours in C is the least soluble	2	AO3 4.8.1.3
04.3	(distance moved =) $\frac{3.2}{0.65}$	an answer of 4.9 (cm) scores **2** marks	1	AO2 4.8.1.3
	(distance moved) = 4.9 (cm)	allow 4.923076923 (cm) correctly rounded	1	
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	sulfur (formed) (which is a) precipitate	allow S / S_8 (formed) allow (which is a) solid allow (which is) insoluble	1 1	AO2 4.2.2.2
05.2	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		5–6	AO1 4.6.1.2
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.		3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.		1–2	
	No relevant content		0	
	Indicative content **method** • measure (indicated) volume of sodium thiosulfate • place sodium thiosulfate in (conical) flask • measure (indicated) volume of hydrochloric acid • place on cross **or** between light sensor **or** connect to a gas syringe **or** other suitable method for timing a change • add hydrochloric acid to (conical) flask • swirl • start stopclock / stopwatch • measure time for cross to become no longer visible **or** log light transmission over time **or** measure time for fixed volume of gas to be produced • repeat and find mean • repeat for different concentrations of sodium thiosulfate **or** change ratio of sodium thiosulfate volume : water volume **control variables** • concentration of hydrochloric acid • volume of hydrochloric acid • (total) volume of sodium thiosulfate solution			
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	water	allow H_2O allow hydrogen chloride **or** HCl	1	AO1 4.7.3.2
06.2		an answer of  scores **3** marks		AO2 4.7.3.1
	single C–C bond and nothing added to the trailing bonds		1	
	3 × H and CH_3 correct	must be four single bonds	1	
	n at bottom right		1	
		must be fully correct to score all **3** marks		
06.3	any **two** from: • poly(propene) comes from a non-renewable source • poly(propene) requires a lot of energy to make • poly(propene) is not biodegradable • a wool carpet needs replacing more often • wool requires the use of large areas of land (which could be used to grow food crops)	allow converse arguments allow poly(propene) will run out must refer to the carpet, not just the fibre ignore references to cost ignore pollution ignore landfill	2	AO3 4.10.1.1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.4	any **four** from: advantages of polyester • better flame resistance (so burns less easily) • higher melting point (so melts less easily) • absorbs water so less likely to ignite disadvantages of polyester: • high density so uniform is heavy • absorbs water so firefighter gets wet • absorbs water so uniform becomes heavy • justified conclusion	allow converse arguments throughout. **max 3** marks if only advantages or only disadvantages of one type of fibre allow good flame resistance so protects the firefighter allow high melting point so uniform is not damaged	4	AO3 4.7.3.1 4.7.3.2
Total			**10**	

Question	Answers	Extra information	Mark	AO/Spec. Ref.
07.1	incomplete combustion (because) insufficient / limited oxygen supply		1 1	AO1 4.9.3.1
07.2	any **two** from: • carbon monoxide toxic / poisonous • greater public concern / awareness about pollution • more cars so otherwise there would be more carbon monoxide entering atmosphere • improved engine technology • catalytic converters have been introduced	allow description of how carbon monoxide is toxic / poisonous ignore carbon monoxide is harmful / dangerous / deadly ignore comments about the effects of other pollutants ignore unspecified comments about carbon monoxide pollution	2	AO1 AO3 4.9.3.2
07.3	any **one** from: • (to reduce) health problems • (to reduce) global dimming	allow (to reduce) specified health problems eg breathing difficulties, asthma, lung cancer allow (to reduce) the effects of global dimming eg reduced light levels allow (to reduce) smog allow (to reduce) the formation of particulates ignore global warming do **not** accept to reduce soot	1	AO1 4.9.3.1 4.9.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	nitrogen (from atmosphere) reacts with oxygen (from atmosphere) at high temperature (in engine) **or** with a spark (from spark plug)	 ignore heat / hot	1 1	AO1 4.9.3.1
07.5	**2** $NO_2 \rightarrow N_2$ + **2** O_2	allow multiples if incorrect, allow N_2 for **1** mark	2	AO2 4.1.1.1 4.3.1.1
07.6	any **two** from: • acid rain • respiratory problems • carbon monoxide • global dimming **or** smog	**max 1** mark if global warming mentioned allow specific effects of acid rain allow specific respiratory problems eg breathing difficulties, asthma	2	AO1 4.9.3.2
07.7	transition metals		1	AO2 4.1.3.2
Total			**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	a gas is produced	allow carbon dioxide is produced do **not** accept an incorrect gas	1	AO2 4.3.1.3 4.6.1.1
	(which) escapes	**max 1** mark if evaporation mentioned	1	
08.2	all eight points plotted correctly	allow a tolerance of ± half a small square. allow six or seven points plotted correctly for **1** mark	2	AO2 4.6.1.1
	line of best fit		1	
08.3		an incorrect answer for one step does not prevent allocation of marks for subsequent steps		AO2 4.6.1.1
	correctly drawn tangent at 0.95 g		1	
	correct value for x step **and** y step from tangent	allow evidence of use of two points on tangent either on the graph or in the text	1	
	(rate =) $\frac{\text{value for y step}}{\text{value for x step}}$		1	
	correctly evaluated and rounded to 2 sig figs	allow (rate =) $\frac{\text{value for x step}}{\text{value for y step}}$ (ie inverted division) correctly evaluated and rounded to 2 sig figs	1	
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	enzyme		1	AO2 4.6.1.4
09.2	2.0×10^3 moles		1	AO2 4.3.2.1
09.3	smaller yield (because) favours endothermic reaction	allow less methanol is produced allow (because) favours reverse reaction allow equilibrium / reaction shifts to the left allow equilibrium / reaction shifts to reduce the temperature ignore reference to forward reaction is exothermic ignore references to rate	1 1	AO2 4.6.2.4 4.6.2.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4		allow converse arguments		AO2 4.6.1.3 4.6.2.4 4.6.2.7
	(yield) equilibrium position moves to the product side	allow equilibrium / reaction moves to the right allow equilibrium / reaction shifts to reduce the pressure	1	
	(because) fewer molecules / moles / particles on product side	allow (because) fewer molecules / moles / particles on the right allow (because) smaller volume on product side	1	
	(rate) more collisions per unit time	allow increases collision frequency / rate ignore more collisions alone ignore faster collisions do **not** accept any indication of more energetic / forceful collisions	1	
	(because) more molecules / particles per unit volume	allow (gas) molecules / particles closer together ignore more molecules / particles alone	1	
09.5	provides different reaction pathway	allow provides a different mechanism / route	1	AO1 4.6.1.4
	(which has a) lower activation energy	 ignore references to collisions	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	less energy is needed	allow reduces the temperature required allow reduces costs ignore references to pressure ignore references to rate or time	1	AO2 4.6.1.4
09.7	no effect / change		1	AO3 4.6.1.4 4.6.2.3
Total			**12**	

Question	Answers	Mark	AO / Spec. Ref.
10.1	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	AO3
	Level 1: Relevant points are made. They are not logically linked.	1–2	AO2
	No relevant content	0	
	Indicative content **raw materials** • crude oil finite **or** will run out (so will be unavailable for other uses) • wood is a renewable resource • wood involves land use for forestry (so less available for agriculture / food) • wood may involve deforestation (so reduces biodiversity) **manufacturing** • both require energy which may be derived from finite fuels (so they run out more quickly) • paper more energy intensive (so more pollution is possible) • the need for more energy for paper potentially releases more carbon dioxide to the atmosphere (so increases global warming) • paper involves higher water usage (so increases the potential for water pollution) • paper cups are heavier to transport (so have higher energy requirement) • packaging requirements similar (so neither has an advantage) **usage** • both single-use (so neither has an advantage) **disposal** • paper releases more energy if incinerated (so more energy can be used for other purposes) • paper will decompose (so will not remain in landfill) • poly(styrene) could release toxins on incineration • poly(styrene) will not decompose (so will remain in landfill) • poly(styrene) can be used to manufacture other products (so conserves energy **or** finite resources) • both can cause litter **or** visual pollution		4.10.1.1 4.10.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2		an answer of 6.63×10^4 (kJ) scores **2** marks		AO2 4.10.2.1
	$\frac{1000}{8.3} \times 550$ (kJ)		1	
	$= 6.63 \times 10^4$ (kJ)	allow $6.6265060240963 \times 10^4$ (kJ) correctly rounded allow 66265.060240963 (kJ) correctly rounded for **1** mark	1	
10.3	(melamine is a) thermosetting (polymer)		1	AO3 4.10.3.3
	(which) contains crosslinks / bonds (between polymer chains)	do **not** accept reference to intermolecular forces allow (so) it decomposes	1	AO2 4.10.3.3
Total			**10**	