GCSE
CHEMISTRY
8462/2H

Paper 2 Higher Tier

Mark scheme

June 2020

Version: 1.0 Final Mark Scheme

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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 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

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, level of demand 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.

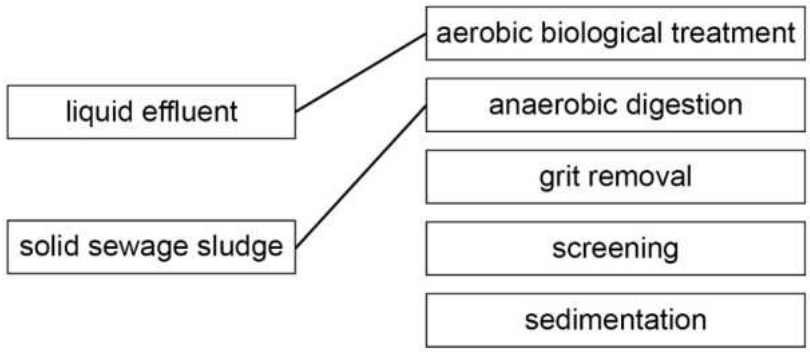
Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	green	allow blue-green	1	AO1 4.8.3.1 RPA 7
01.2	did not clean the metal wire (between tests) **or** copper sulfate (solution) is still present (so) colours are mixed / blended / masked		1 1	AO3 4.8.3.1 RPA 7
01.3	(copper sulfate solution) blue precipitate (calcium iodide solution) white precipitate	allow blue solid allow white solid	1 1	AO1 4.8.3.2 RPA 7
01.4	barium chloride (solution)	allow barium nitrate (solution)	1	AO1 4.8.3.5 RPA 7
01.5	silver nitrate (solution) yellow precipitate	 allow yellow solid allow pale yellow precipitate / solid	1 1	AO1 4.8.3.4 RPA 7
Total			**8**	

Question 2

Question	Answers	Mark	AO/ Spec. Ref
02.1	**Level 2**: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO1 4.10.1.2
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • choose an appropriate source of fresh water • such as rivers, streams, lakes, boreholes • pass through filter beds • (which) removes undissolved solids • sterilise • using chlorine / ozone / UV light • (which) destroys harmful microbes		

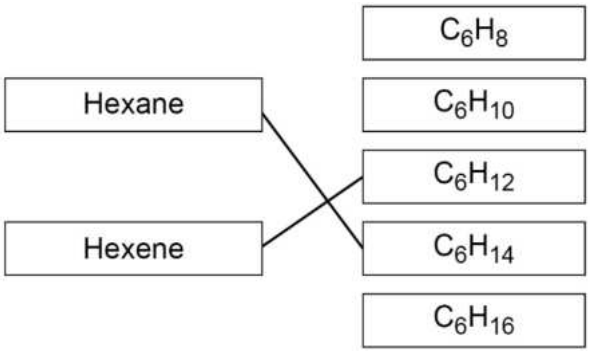
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	any **one** from: • distillation • reverse osmosis	allow use of membranes allow desalination	1	AO3 4.10.1.2

02.3	 additional line from a box on the left negates the mark for that box		1 1	AO1 4.10.1.3

Question 2 (continued)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	$\frac{260}{1413} \times 100$		1	AO2 4.10.1.3
	= 18.40056617 (%)		1	
	= 18.4 (%)	allow an answer correctly calculated to 3 significant figures from an incorrect percentage calculation which uses values in the question	1	
02.5	any **one** from: • the population increased • more waste water produced • less untreated sewage discharged		1	AO3 4.10.1.3
02.6	any **two** from:	ignore references to cost	2	AO3 4.10.1.3
	• increased demand for food (due to increasing population)	allow more farming		
	• conserves energy / resources	allow more sustainable		
	• landfill space is running out	allow more awareness of the negative environmental impacts of landfill ignore less sent to landfill		
	• increased demand for organic fertiliser	allow lifestyle choice for organic food		
Total			**13**	

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	 additional line from a box on the left negates the mark for that box		1 1	AO2 4.7.1.1 4.7.2.1
03.2	 (remains) orange (becomes) colourless	must be in this order allow no (colour) change ignore initial colour ignore clear	 1 1	AO2 4.7.1.4

Question 3 (continued)

Question	Answers	Mark	AO/ Spec. Ref
03.3	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.	4–6	AO1 AO2
	Level 1: Relevant features are identified and differences noted.	1–3	
	No relevant content	0	4.7.1.1 4.7.1.3 4.7.1.4 4.7.2.1 4.7.2.2 4.9.3.1
	Indicative content **Structure and bonding** • both are hydrocarbons • both contain two carbon atoms (per molecule) • ethane contains six hydrogen atoms (per molecule) • (but) ethene contains four hydrogen atoms (per molecule) • both have covalent bonds • ethane contains a single C—C bond • (but) ethene contains a double bond • both contain C—H bonds • both small molecules **Reactions** • both react with oxygen in complete combustion reactions • to produce water and carbon dioxide • both react with oxygen in incomplete combustion reactions • to produce water, carbon monoxide and carbon • incomplete combustion is more likely with ethene • ethene decolourises bromine water • (but) ethane does not decolourise bromine water • ethene is more reactive (than ethane) • ethene can react with hydrogen (to produce ethane) • ethene can react with water (to produce ethanol) • ethene can react with halogens (to produce halogenoalkanes) • ethene can undergo addition reactions • ethene can polymerise (to produce poly(ethene)) ignore physical properties ignore references to flammability		

Total			10

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	$0.60 = \frac{5.7}{\text{distance moved by solvent}}$ (distance moved by solvent =) $\frac{5.7}{0.60}$ = 9.5 (cm)		1 1 1	AO2 4.8.1.3 RPA6
04.2	some of the compounds are colourless (in solution) **or** dyes / compounds have the same R_f values	allow there are only two compounds that are coloured (in solution)	1	AO3 4.8.1.3 RPA6
04.3	allow the solvent front to travel further use a different solvent		1 1	AO3 4.8.1.3 RPA6
04.4	so that the (shade of) green is the same	allow because the green ink is a formulation	1	AO3 4.8.1.2
04.5	the dye is less soluble in the new solvent and more attracted to the new paper		1	AO3 4.8.1.3
Total			**8**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	any **two** from: energy used in: • extraction of raw materials • processing raw materials • manufacturing • transportation • cleaning non-disposable plates • disposal • recycling	allow energy used to make food plate materials	2	AO3 4.10.2.1

Question 5 (continued)

Question	Answers	Mark	AO/ Spec. Ref
05.2	**Level 2:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	3–4	AO3 4.10.1.1 4.10.2.1 4.10.2.2
	Level 1: Some logically linked reasons are given. There may also be a simple judgement.	1–2	
	No relevant content	0	
	Indicative content **Raw materials** • Trees are renewable • Crude oil and clay are finite **Manufacturing and packaging** • Paper plates use the least packaging so conserve raw materials • Paper plates need less transportation overall as more plates in a 10 dm^3 cardboard box **Use and operation** • Paper plates are single use so must be replaced most often • Ceramic plates last longer than polymer plates so must be replaced less often **Disposal** • Polymer / ceramic plates take up landfill which is running out • Paper / polymer plates can be used to make new products • Recycling conserves raw materials **Reasoned judgement**		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	(wet) clay is shaped (and) heated in a furnace	 allow (and) heated in a kiln / oven allow (and) fired	1 1	AO1 4.10.3.3

Total			8

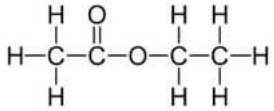
Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1		max **1** mark if soot wrongly identified		AO1 4.9.3.1
	incomplete combustion		1	
	(because of) insufficient oxygen		1	
06.2		allow SO_2 for sulfur dioxide		
	sulfur reacts with oxygen to form sulfur dioxide	allow sulfur burns to form sulfur dioxide	1	AO1
	(so) less sulfur dioxide emitted		1	AO1
	(so) less acid rain		1	AO2
	(so less) limestone reacts with acid rain		1	AO2 4.9.3.1 4.9.3.2
06.3	(car engines work at) high temperatures		1	AO1 4.9.3.1
	(so in the engine) nitrogen (from air) reacts with oxygen (from air)		1	
Total			**8**	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	HCOOH	allow HCO_2H	1	AO1 4.7.2.4
	propanoic acid		1	
07.2	incomplete / partial ionisation	allow incomplete / partial dissociation	1	AO3 4.7.2.4
	(because) reaction is reversible	allow (because) reaction is in equilibrium	1	
07.3	mass (of flask and contents) decreases		1	AO1
	(because) carbon dioxide is produced	allow **1** mark for the gas produced escapes (from the flask)	1	AO2
	(and) carbon dioxide escapes (from the flask)		1	AO2 4.3.1.3 4.7.2.4
07.4		allow converse argument for ethanoic acid		AO2
	(0.01 mol/dm^3) methanoic acid has a lower pH	allow (0.01 mol/dm^3) methanoic acid is a stronger acid	1	AO2
	(so 0.01 mol/dm^3) methanoic acid has a higher concentration of hydrogen ions		1	AO3
	(therefore) more collisions per unit time		1	4.6.1.2 4.6.1.3 4.7.2.4
07.5	ethyl ethanoate		1	AO1 4.7.2.4

Question 7 (continued)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6			1	AO2 4.7.2.4 4.7.3.2
Total			**12**	

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	all seven points plotted correctly	allow a tolerance of ±½ small square allow **1** mark for five or six points plotted correctly	2	AO2 4.6.1.1
	line of best fit		1	
08.2	0.0038 **and** 0.0014		1	AO2 4.6.1.1
	$\frac{0.0038 - 0.0014}{105 - 20}$	allow correct use of incorrectly determined mole value(s)	1	
	= 0.000028 **or** = 2.8×10^{-5}		1	
	mol/s	allow moles per second	1	
08.3	(for large lumps) a smaller number of moles of gas is collected in the same time **or** (for large lumps) more time is needed to collect the same number of moles of gas **or** the line (of best fit for large lumps) is less steep	allow converse statement for small lumps allow the line (of best fit for large lumps) takes more time to become horizontal	1	AO2 4.6.1.1

Question 8 (continued)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	(surface area = 6 x 0.5 x 0.5) = 1.5 (cm^2)		1	AO2 4.6.1.3
	(volume = 0.5 x 0.5 x 0.5) = 0.125 (cm^3)		1	
	(surface area : volume =) 12 : 1	allow correctly calculated ratio using incorrectly calculated values for surface area and/or volume	1	
08.5	decreases by a factor of 10	allow 10 times smaller allow one tenth allow 1/10 allow 1 : 10 (large cube to small cube)	1	AO2 4.2.4.1 4.6.1.3
Total			**12**	

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	**test:** (use a) glowing splint **result:** relights	do **not** accept burning splint dependent on correct test in MP1 ignore with a pop	1 1	AO1 4.8.2.2 4.9.1.3
09.2	starch cellulose	 allow glycogen	1 1	AO1 4.7.3.4
09.3	2		1	AO1 4.7.3.3
09.4	water	allow H_2O	1	AO1 4.7.3.3
09.5	ammonia nitrogen	 if no other mark awarded, allow **1** mark for NO / NO_2 / N_2O / NO_x or equivalent named compounds	1 1	AO3 4.7.3.3 4.9.1.2

Question 9 (continued)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	two polymer chains	allow two polymer strands	1	AO1 4.7.3.4
	four (different) monomers / nucleotides	allow four (different) bases allow cytosine, guanine, adenine and thymine allow C G A T	1	
	(double) helix	allow spiral	1	
		if no other mark awarded, allow **1** mark for DNA		
Total			**11**	

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	water	allow H_2O	1	AO1 4.2.2.2
10.2	becomes (more) red		1	AO2 4.6.2.4 4.6.2.5
	(because the position of) equilibrium moves to the right	allow (because) the concentration of $FeSCN^{2+}$ (ions) increases allow (because) the forward reaction is favoured	1	
	(so that) the (increase in the) concentration of thiocyanate (ions) is reduced	allow (so that) the increase in the concentration of thiocyanate (ions) is counteracted	1	
10.3	(the position of) equilibrium moves to the left	allow the concentration of Fe^{3+} (ions) increases allow the reverse reaction is favoured	1	AO2 4.6.2.4 4.6.2.6
	(so that) the (increase in the) temperature is reduced	allow (so that) the increase in the temperature is counteracted	1	
	(therefore) the forward reaction is exothermic	allow (therefore) the forward reaction releases energy (to the surroundings)	1	

Question 10 (continued)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	no change in equilibrium position		1	AO2 4.6.2.7
	(because) no gases are present	allow (because) only aqueous solutions are present	1	
10.5	Co^{2+}		1	AO2 4.1.3.2 4.6.2.5
Total			**10**	