OXFORD

INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL GCSE

CHEMISTRY

9202/2

Paper 2

Mark scheme

June 2022

Version: 1.1 Final Mark Scheme

226Y9202/2/MS

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 oxfordaqaexams.org.uk

Level of response marking instructions

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 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. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in 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 and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 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.

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

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.

Question 1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.1	evaporates		1	AO1 3.10.1.1c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.2	petrol		1	AO1 3.10.1.1c 3.10.1.2c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.3	heavy fuel oil		1	AO1 3.10.1.1c 3.10.1.2c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.4	any **one** from: • as a fuel • (making) polymers • making alcohols	allow named fuel allow chemical feedstock	1	AO1 3.10.1.3e 3.10.2a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.5	decomposition		1	AO1 3.10.1.3a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.6	(C_2H_4) has low(est) boiling point (because) has smallest molecule		1 1	AO3 3.10.1.2c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.7	any **one** from: • an alkene • is unsaturated • contains a (carbon-carbon) double bond		1	AO3 3.10.1.3b, d

Total Question 1		**8**

Question 2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.1	particles are closer together (so) collide more frequently	ignore references to energy allow more particles in same volume allow (so) more likely to collide	1 1	AO1 3.8.1d

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.2	$\frac{600}{120}$ $= 5$ (g/s)		1 1	AO2 3.8.1a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.3	any **one** from: • catalyst not a reactant • catalyst not used up		1	AO2 3.8.1g

Question	Answers	Mark	AO/ Spec. Ref.
02.4	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	3–4	AO4 3.8.1g
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	1–2	
	No relevant content	0	
	Indicative content: • **measure known volume of hydrogen peroxide** • measure with a measuring cylinder • **add known mass of catalyst** • measure with a balance • **measure time taken to produce fixed volume of gas / oxygen** **or** **measure volume of oxygen at fixed time intervals** **or** **count number of bubbles produced in a fixed time** • repeat each experiment • **repeat with other catalyst**		

Total Question 2		**9**

Question 3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.1	electrons arranged 2,6		1	AO2 3.1.2i

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.2	same number of electrons in outer energy level	allow shell for energy level	1	AO1 3.1.3b

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.3	all form oxides with same formula	allow all form +1 ions ignore all are metals	1	AO3 3.1.3.a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.4	sodium and potassium have low(er) melting points sodium and potassium react with water	allow converse answers for silver	1 1	AO3 3.1.3.a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.5	any **one** from: • helium is unreactive • helium is rare	ignore (because) it was a long time ago	1	AO3 3.1.3c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.6	Al_2S_3		1	AO2 3.2.1c

Total Question 3		**7**

Question 4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.1	increases copper is formed (on the electrode)		1 1	AO2 3.3.1.1g 3.3.2 c,e,g

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.2	6 correct points line of best fit	allow **1** mark for 3, 4 or 5 correct points allow tolerance of ± ½ a small square	2 1	AO2 3.3.2c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.3 **view with 04.2**		allow ecf from Question **04.2**		AO3 AO2 × 3 3.6.4d
	(vol =) 10 cm^3	allow tolerance of ± ½ a small square	1	
	(vol =) 0.01 dm^3	allow correct unit conversion from an incorrectly determined volume	1	
	(mol =) $\frac{0.01}{24}$	allow correct use of an incorrectly calculated volume	1	
	= 4.17×10^{-4} (mol)	must be to at least 2 significant figures	1	
	alternative approach: (vol =) 10 cm^3 (1)	allow tolerance of ± ½ a small square		
	(conversion molar gas volume 24 dm^3 =) 24000 cm^3 (1)			
	(mol =) $\frac{10}{24000}$ (1)	allow correct calculation from an incorrectly determined volume allow correct calculation from an incorrectly converted molar gas volume		
	= 4.17×10^{-4} (mol)	must be to at least 2 significant figures		

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.4	chlorine produced so **X** contains chloride (ion) hydrogen is produced when the metal is more reactive than hydrogen (so) yes, because sodium is more reactive than hydrogen **or** (so) no, cannot conclude that **X** contains sodium because sodium is not the only metal more reactive than hydrogen		1 1 1	AO3 3.3.2g

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.5	$2\ Cl^- \rightarrow Cl_2 + 2\ e^-$	allow $2Cl^- - 2e^- \rightarrow Cl_2$ allow **1** mark for $Cl^- \rightarrow Cl_2 + e^-$ **or** $Cl^- - e^- \rightarrow Cl_2$ irrespective of balancing numbers	2	AO1 3.3.2f

Total Question 4		**14**

Question 5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.1	the potential difference decreases (rapidly) towards the end of the time period		1	AO3 3.9.3a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.2	the reactant(s) are used up		1	AO1 3.9.3a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.3	reversible		1	AO3 3.9.3a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.4	**2** H_2 + O_2 → **2** H_2O		1	AO2 3.6.1a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.5	B		1	AO2 3.9.1a 3.9.2d

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.6	**advantages** any **one** from: • water is the only (waste) product • cause less pollution **disadvantages** any **one** from: • hydrogen is explosive • hydrogen is difficult to store	 allow not many fuel stations have hydrogen	1 1	AO1 3.9.3b

Total Question 5		**7**

Question 6

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.1	any **one** from: • check mass was constant • to check reaction had finished		1	AO4 3.3.1.2a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.2	any **one** from: • same error to every reading • mean would be incorrect by 0.5 g • a systematic / zero error		1	AO4 3.3.1.2a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.3	any **one** from: • zero the balance (then repeat the readings) • subtract 0.5 g from the readings		1	AO4 3.3.1.2a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.4	(M_r of $CuCO_3$ =) 123.5 **and** (M_r of CuO =) 79.5		1	AO2 3.6.1d
	(number of moles of $CuCO_3$ = $\frac{2.47}{123.5}$ =) 0.02 (mol)	allow correct use of an incorrectly calculated M_r of $CuCO_3$	1	
	(mass =) 0.02 × 79.5	allow correct use of an incorrectly calculated number of moles of $CuCO_3$ and / or M_r of CuO	1	
	= 1.59 (g)		1	
	alternative approach: (M_r of $CuCO_3$ =) 123.5 and (M_r of CuO =) 79.5 (1)			
	(mass of CuO =) 1 g $CuCO_3$ gives $\frac{79.5}{123.5}$ g CuO (1)	allow correct use of an incorrectly calculated M_r of $CuCO_3$ and / or M_r of CuO		
	2.47 g $CuCO_3$ gives $\frac{2.47 \times 79.5}{123.5}$ g CuO (1)			
	= 1.59 (g) (1)			

Total Question 6		**7**

Question 7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.1	**B** good (electrical) conductivity when solid	 ignore good (electrical) conductivity when liquid ignore references to melting point	1 1	AO3 3.3.1a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.2	(hardness) increases at a constant rate	allow (hardness) increases steadily allow **1** mark for (hardness) increases	2	AO3 3.3.1b

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.3	a value in the range 260–275 (arbitrary units)		1	AO3 3.3.1b

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.4	giant structure regular arrangement (of atoms) **or** layers (of atoms)	allow lattice	1 1	AO1 3.2.1i 3.3.1a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.5	(volume of Fe = $5 \times 5 \times 10$ =) 250 (cm^3)		1	AO2 3.6.3a 3.6.3b
	(mass of Fe = 250×7.9 =) 1975 (g)	allow correct use of an incorrectly calculated volume of Fe	1	
	(moles of Fe = $\frac{1975}{56}$ =) 35.3 (mol)	allow correct use of an incorrectly calculated mass of Fe	1	
	(number of atoms of Fe =) $35.3 \times 6.02 \times 10^{23}$	allow correct use of an incorrectly calculated number of moles of Fe	1	
	$= 2.12 \times 10^{25}$		1	

Total Question 7		**12**

Question 8

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.1	highest temperature reached	allow temperature change / increase	1	AO4 3.9.2c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.2	any **two** from: • volume of acid • concentration of acid • volume of sodium hydroxide • concentration of sodium hydroxide • (initial) temperature of sodium hydroxide	allow alkali for sodium hydroxide	2	AO4 3.9.2c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.3	smaller spread around mean	allow smaller range allow (results are) closer together	1	AO3 3.9.2c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.4	(mass of solution =) 50 (g) (energy released =) 50 × 4.2 × 9.8 = 2058 (J)	 allow correct use of an incorrectly calculated mass of solution	1 1 1	AO2 3.9.2c

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.5	(moles = 0.025 × 2) = 0.05		1	AO2 3.9.1a 3.9.2 b
	$(\Delta H =) \frac{2.6}{0.05}$	allow correct use of an incorrectly calculated number of moles	1	
	= –52 (kJ/mol)		1	

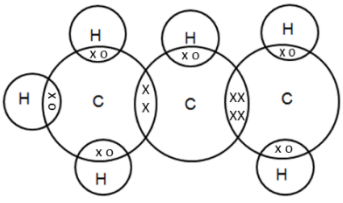
Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.6	$H^+ + OH^- \rightarrow H_2O$	ignore state symbols	1	AO1 3.5.1g

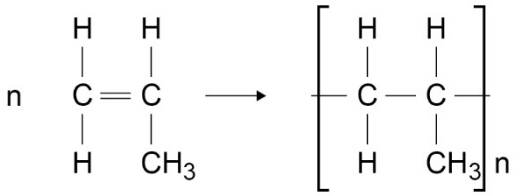
Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.7	ethanoic acid is not completely ionised / dissociated	allow ethanoic acid is a weak acid	1	AO2 3.9.1b 3.10.3.2b
	(so) energy is taken in to release all the hydrogen ions	allow (so) energy is taken in to break the O-H bonds	1	

Total Question 8		**13**

Question 9

Question	Answers	Mark	AO/ Spec. Ref.
09.1	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3 AO1 3.10.2.e 3.10.2.f
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content.	0	
	Indicative content: • PLA from a renewable resource • poly(ethene) is not from renewable resource so may run out • using plants for PLA can cause problems with land use • PLA is stronger than poly(ethene) therefore bags can be used for longer • PLA is biodegradable and poly(ethene) is not • poly(ethene) has problems with waste disposal in landfill • poly(ethene) more likely to cause litter problems • PLA needs an industrial composter to decompose • PLA would need sorting from rubbish to be decomposed • PLA can still cause problems in landfill • less CO_2 emitted producing per kg PLA • but both plastics produce 0.12 kg of CO_2 per bag • so not a difference in CO_2 emissions. • so not a difference to global warming • justifiable conclusion		

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.2		allow any combination of dots / crosses	1	AO2 3.2.1g

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.3	-C-C-		1	AO2 3.10.2.a
	1x C-CH_3 and 3 x C-H		1	
	brackets **and** n's		1	
		an answer of  scores **3** marks		

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.4	–OH	allow alcohol	1	AO2 3.10.3.1a
	–COOH	allow carboxyl allow carboxylic acid	1	3.10.3.2a

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
09.5	H_2O		1	AO2 3.10.3.3a

Total Question 9		**13**