

INTERNATIONAL GCSE **CORE CHEMISTRY**

9222

Paper 1

Mark scheme

Specimen paper

Version: 1.0 Final

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

Copyright information

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

Copyright © 2024 OxfordAQA International Examinations and its licensors. All rights reserved.

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 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.

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 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

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 **not** 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	Answer	Extra information	Mark	AO / Spec. Ref.
01.1	atomic number		1	AO1 3.1.3a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
01.2	C		1	AO2 3.1.3a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
01.3	A		1	AO2 3.1.3c

Question	Answer	Extra information	Mark	AO / Spec. Ref.
01.4	B and D		1	AO2 3.1.3b

Question	Answer	Extra information	Mark	AO / Spec. Ref.
01.5	(similarity) same number of energy levels	allow shells for energy levels allow 2 electrons in first energy level allow 8 electrons in second energy level	1	AO2 3.1.2i 3.1.3b 3.1.3c
	(difference) different number of electrons in outer energy level or the outer energy level in argon is complete but sodium is incomplete	allow different number of electrons	1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
01.6	Na ⁺		1	AO2 3.7.1a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
01.7	nucleus		1	AO1 3.1.2c

Total Question 1	8
------------------	---

Question	Answer	Extra information	Mark	AO / Spec. Ref.
02.1	1		1	AO1 3.5.1f

Question	Answer	Extra information	Mark	AO / Spec. Ref.
02.2	HCl		1	AO1 3.5.1c 3.6.1a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
02.3	wear safety glasses	allow wear gloves	1	AO4 3.8.1a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
02.4	as time increases the mass (of gas produced) increases		1	AO3 3.8.1a
	mass increases at a decreasing rate or rate of reaction decreases as time increases	allow the reaction is fastest initially	1	
	the reaction stops at 80 seconds	allow total mass of gas produced = 1.85 g	1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
02.5	(mass of gas = $1.6 - 1.4 =$) 0.2 (g)		1	AO2 AO3 3.8.1a
	(time = $60 - 20 =$) 40 (s)		1	
	(mean rate =) $\frac{0.2}{40}$	allow correct use of incorrectly determined mass and/or time	1	
	= 0.005 (g/s)		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
02.6	Level 3: The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.		5-6	AO4 3.8.1a 3.8.1f
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan 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: • add (hydrochloric) acid to a conical flask • add magnesium carbonate to the conical flask • measure the mass of magnesium carbonate • use the same mass of magnesium carbonate • measure a fixed volume of (hydrochloric) acid • use the same concentration of (hydrochloric) acid mass loss method • place the conical flask on a balance • start the timer • measure the mass of gas given off every 10 seconds or measure the time taken for a certain mass of gas to be given off gas collection method • add a stopper (linked to a delivery tube) to the top of the conical flask • start the timer • collect the gas in a gas syringe or collect the gas in a measuring cylinder • measure the volume of gas given off every 10 seconds or measure the time taken for a certain volume of gas to be given off • repeat with different sized pieces of magnesium carbonate.			

Question	Answer	Extra information	Mark	AO / Spec. Ref.
02.7	$(M_r \text{ MgCO}_3 = 24 + 12 + (3 \times 16) =)$ 84		1	AO2 3.6.2.a 3.6.2 b
	(percentage of magnesium =) $\frac{24}{84} \times 100$	allow correct use of incorrectly determined value for M_r	1	
	= 28.57 (%)	allow a correctly calculated answer to 2 significant figures from an incorrect calculation which uses the values in the question	1	
	= 29 (%)		1	

Total Question 2	20
-------------------------	-----------

Question	Answer	Extra information	Mark	AO / Spec. Ref.
03.1	a different number of bonds per carbon atom	allow in diamond each carbon atom is joined to four other atoms	1	AO1 3.2.3b 3.2.3c
	in diamond all the atoms are joined together or graphite is in layers	allow in graphite each carbon atom is joined to three other atoms	1	
		allow graphite has delocalised electrons		

Question	Answer	Extra information	Mark	AO / Spec. Ref.
03.2	hard		1	AO1 3.2.3b

Question	Answer	Extra information	Mark	AO / Spec. Ref.
03.3	(number of times harder =) $\frac{10.0}{1.60}$		1	AO2 3.2.3b 3.2.3c
	= 6.25		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
03.4	each carbon / atom forms three bonds		1	AO1 3.2.3c 3.2.3d
	(so) one electron per (carbon) atom is delocalised		1	
	(so delocalised) electrons move through the structure transferring energy		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
03.5	spherical shape or weak intermolecular forces		1	AO3 3.2.3e
	(so molecules) can slide or (so molecules) can roll		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
03.6	any one from: - for drug delivery (into the body) - as catalysts - reinforcing materials		1	AO1 3.2.3e

Total Question 3			11
------------------	--	--	----

Question	Answer	Extra information	Mark	AO / Spec. Ref.
04.1	distillation		1	AO1 3.10.1.1a 3.10.1.1c

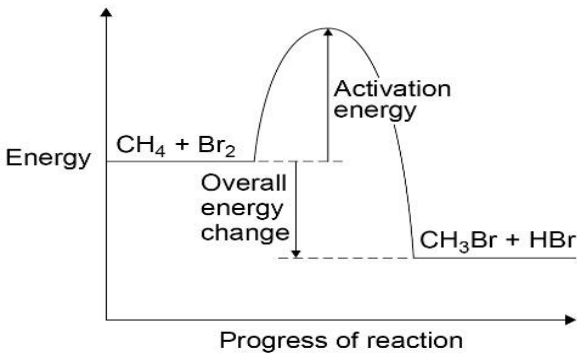
Question	Answer	Extra information	Mark	AO / Spec. Ref.
04.2	petrol		1	AO2 3.10.1.1c 3.10.1.2c

Question	Answer	Extra information	Mark	AO / Spec. Ref.
04.3	a double (covalent) bond		1	AO1 3.10.1.3c

Question	Answer	Extra information	Mark	AO / Spec. Ref.
04.4	C ₅ H ₁₂		1	AO2 3.10.1.3ab

Question	Answer	Extra information	Mark	AO / Spec. Ref.
04.5	decomposition		1	AO1 3.10.1.3a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
04.6	minimum amount of energy (that) particles must have to react		1	AO1 3.8.1b

Question	Answer	Extra information	Mark	AO / Spec. Ref.
04.7	correct shape for exothermic reaction	ignore arrow heads	1	AO2 3.9.2d
	labelled products $\text{CH}_3\text{Br} + \text{HBr}$		1	
	labelled activation energy		1	
	labelled (overall) energy change		1	
		an answer of:  scores 4 marks		

Question	Answer	Extra information	Mark	AO / Spec. Ref.
04.8	(bond breaking = $(412 \times 4) + 193 =$) 1841 (kJ/mol)		1	AO2 3.9.1a 3.9.2f
	(bond making = $(412 \times 3) + 290 + 366 =$) 1892 (kJ/mol)		1	
	(enthalpy change = $1841 - 1892 =$) (-) 51 (kJ/mol)	allow correct use of incorrectly determined values in step 1 and/or step 2	1	
	= - 51 (kJ/mol)		1	
	alternative approach:			
	(bond breaking = $412 + 193 =$) 605 (kJ/mol) (1)			
	(bond making $290 + 366 =$) 656 (kJ/mol) (1)			
	(enthalpy change = $605 - 656 =$) (-)51 (kJ/mol) (1)	allow correct use of incorrectly calculated values in step 1 and/or step 2		
	= -51 (kJ/mol) (1)			

Question	Answer	Extra information	Mark	AO / Spec. Ref.
04.9	energy must be supplied to break bonds		1	AO1 3.9.2e 3.9.2g
	(and) energy is released when bonds are formed		1	
	(so) the energy needed to break existing bonds is greater than the energy released forming (new) bonds		1	

Total Question 4	17
-------------------------	-----------

Question	Answer	Extra information	Mark	AO / Spec. Ref.
05.1	copper sulfate solution		1	AO2 3.3.2b

Question	Answer	Extra information	Mark	AO / Spec. Ref.
05.2	(test) glowing splint		1	AO1 3.4.2b
	(result) relights		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
05.3	6 correct points	allow 1 mark for 3, 4 or 5 correct points	2	AO2 3.3.2c
	line of best fit	allow tolerance of $\pm \frac{1}{2}$ a small square	1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
05.4	the volume of oxygen collected is directly proportional to the time	allow 1 mark for the volume of oxygen gas collected increases with time	2	AO3 3.3.2c

Question	Answer	Extra information	Mark	AO / Spec. Ref.
05.5	so the ions are free to move		1	AO1 3.3.2a 3.3.2b

Question	Answer	Extra information	Mark	AO / Spec. Ref.
05.6	copper ions are positively charged		1	AO2 3.3.2c
	(so are) attracted to the negative electrode	allow (so) move to the negative electrode	1	
	(where the ions) gain electrons	allow (where the ions) are reduced	1	
	to form copper atoms		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
05.7	(anomalous result) 12 minutes	allow 2.2cm ³	1	AO3 AO4 3.3.2c
	(reason) read volume before 12 minutes	allow read volume too early	1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
05.8	(volume of) gas collected increases slowly until 7 minutes	allow a value in the range of 6-8 minutes	1	AO3 3.3.2c 3.3.2g
	(because) chlorine gas dissolves in water at the beginning so only some is collected	allow increasing rate of gas collection until 7 minutes	1	
	after 7 minutes the rate of increase is faster	allow after 7 minutes rate of gas collection is constant	1	
	(because) no more chlorine gas can dissolve in the water		1	

Total Question 5	19
-------------------------	-----------

Question	Answer	Extra information	Mark	AO / Spec. Ref.
06.1	alkali metals		1	AO1 3.7.1a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
06.2	(as you go down the group) melting point decreases		1	AO3 3.7.1a
	(as you go down the group) density increases except for potassium / sodium		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
06.3	21 (°C)	allow a value in the range 25 to 19 (°C)	1	AO3 3.7.1a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
06.4	any one from: - bubbles (sodium) moves around (sodium) becomes smaller (sodium) melts into a ball	allow fizzing allow sodium disappears	1	AO3 3.7.1a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
06.5	(rubidium) is more dense than water		1	AO1 3.7.1a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
06.6	$2K + 2 H_2O \rightarrow 2 KOH + H_2$	allow multiples allow 1 mark for KOH allow 1 mark for H ₂	3	AO2 3.6.1a 3.7.1a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
06.7		allow energy level for shell		AO1 3.7.1b 3.7.1f
	reactivity increases (going down the group)		1	
	(because) the outer electron / shell is further from the nucleus	allow (because) there are more shells allow (because) the atoms get larger	1	
	(so) there is less (electrostatic) attraction between the nucleus and the outer electron / shell	allow (so) there is more shielding between the outer electron and the nucleus	1	
	(so) the atom loses an electron more easily	allow (so) less energy is needed to remove the (outer) electron	1	
Total Question 6			13	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
07.1	magnesium atom loses two electrons	allow 1 mark for magnesium loses and fluorine gains electron(s)	1	AO2 3.2.1c
	fluorine atom gains one electron		1	
	two fluorine atoms react with one magnesium atom		1	
	to form ions that have the electron arrangement of a noble gas	allow to gain full outer shells of electrons allow to form Mg^{2+} ions and (two) F^- ions	1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
07.2	giant structure (of ions)	allow lattice	1	AO1 3.2.2a
	(with) strong electrostatic forces of attraction between oppositely charged ions		1	
	in all directions		1	
	(so) a large amount of energy is needed to overcome (the forces of attraction)		1	

Question	Answer	Extra information	Mark	AO / Spec. Ref.
07.3	oxide ions have a higher (negative) charge than fluoride ions or (electrostatic) forces of attraction in magnesium oxide are stronger		1	AO3 3.2.2a

Question	Answer	Extra information	Mark	AO / Spec. Ref.
07.4	(number of moles of $\text{Li}_2\text{CO}_3 =$) $\frac{3.70}{74}$		1	AO2 3.6.3a
	= 0.05		1	
	(number of moles of lithium ions = 0.05×2) = 0.1	allow correct use of an incorrectly determined value for moles of lithium carbonate	1	

Total Question 7	12
-------------------------	-----------