

OXFORD

INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL GCSE **COMBINED SCIENCE** **9204/CC**

Paper 2 Chemistry Core

Mark scheme

November 2021

Version: 1.0 Final Mark Scheme



2 1 B Y 9 2 0 4 / C C / M S

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

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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, 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 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	Answers	Extra information	Mark	AO /Spec. Ref.
01.1	11		1	AO1 3.7.2d

Question	Ans	Extra information	Mark	AO /Spec. Ref.
01.2	+1		1	AO2 3.7.2f

Question	Answers	Extra information	Mark	AO /Spec. Ref.
01.3	nucleus		1	AO2 3.7.2cf

Question	Answers	Extra information	Mark	AO /Spec. Ref.
01.4	any one from: <ul style="list-style-type: none"> • Li • K • Rb • Cs 	allow lithium allow potassium allow rubidium allow caesium	1	AO3 3.7.3a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
01.5	density increases (as the mass number increases)		1	AO3 3.7.3a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
01.6	bar plotted at 2.70 (g/cm ³)		1	AO2 3.7.3a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
01.7	balance		1	AO4 3.7.3a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
01.8 Mark with 01.9	$\frac{8.7}{5.0}$ = 1.74 (g/cm ³)	allow 1.7 (g/cm ³)	1 1	AO2 3.7.3a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
01.9 Mark with 01.8	magnesium	allow correct choice of element based on incorrect calculation of density	1	AO3 3.7.3a

Total			10	
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Question	Answers	Extra information	Mark	AO /Spec. Ref.
02.1	(0.91 + 0.04 + 76.21 + 2.45 =) 79.61		1	AO2 3.10.1c
	(100 – 79.61 =) 20.39 (%)		1	

Question	Answers	Extra information	Mark	AO /Spec. Ref.
02.2	argon / Ar		1	AO1 3.7.3a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
02.3	mixture of elements and compounds		1	AO3 3.7.2a, 3.8.1a, 3.10.1c

Question	Answers	Extra information	Mark	AO /Spec. Ref.
02.4	carbon dioxide / CO ₂		1	AO3 3.7.1a
	water vapour / H ₂ O	allow water	1	

Question	Answers	Extra information	Mark	AO /Spec. Ref.
02.5	C ₄ H ₁₀		1	AO2 3.16.1.2b

Question	Answers	Extra information	Mark	AO /Spec. Ref.
02.6	simple molecule		1	AO2 3.8.1g

Question	Answers	Extra information	Mark	AO /Spec. Ref.
02.7	fractional distillation		1	AO1 3.16.1.1c

Question	Answers	Extra information	Mark	AO /Spec. Ref.
02.8	carbon dioxide water		1 1	AO1 3.16.1.2d
Total			11	

Question	Answers	Extra information	Mark	AO /Spec. Ref.
03.1	sulfuric acid		1	AO2 3.11.1c

Question	Answers	Extra information	Mark	AO /Spec. Ref.
03.2	filtration		1	AO4 3.11.2a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
03.3	sodium sulfate		1	AO2 3.12.1a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
03.4	brown		1	AO1 3.10.2c

Question	Answers	Extra information	Mark	AO /Spec. Ref.
03.5	carbon dioxide or carbon monoxide	allow CO ₂ allow CO	1	AO2 3.9.1.1d

Question	Answers	Extra information	Mark	AO /Spec. Ref.
03.6	mass decreases		1	AO3 3.12.1c

Question	Answers	Extra information	Mark	AO /Spec. Ref.
03.7	reduced		1	AO1 3.9.1.1d

Question	Answers	Extra information	Mark	AO /Spec. Ref.
03.8	$\frac{207}{223} \times 100$ = 92.8251121 = 92.8 (%)	allow 93 (%) allow a correctly calculated answer to 3 significant figures using the values in the question	1 1 1	AO2 3.12.2b
Total		10		

Question	Answers	Extra information	Mark	AO /Spec. Ref.
04.1	alkenes are obtained by cracking alkanes		1	AO1 3.16.1.3b

Question	Answers	Extra information	Mark	AO /Spec. Ref.
04.2	colourless		1	AO1 3.16.1.3d

Question	Answers	Extra information	Mark	AO /Spec. Ref.
04.3	C ₄ H ₈		1	AO3 3.16.1.3c

Question	Answers	Extra information	Mark	AO /Spec. Ref.
04.4	(12 × 3) + (1 × 6) = 42		1 1	AO2 3.12.2a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
04.5	$ \begin{array}{cc} \text{H} & \text{H} \\ & \\ \text{C} & = & \text{C} \\ & \\ \text{H} & \text{H} \end{array} $		1	AO1 3.16.1.3c

Question	Answers	Extra information	Mark	AO /Spec. Ref.
04.6	monomers		1	AO1 3.16.2a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
04.7	$\frac{84\ 000}{28}$ = 3000		1	AO2 3.12.2a
			1	

Question	Answers	Extra information	Mark	AO /Spec. Ref.
04.8	not biodegradable or not broken down by microbes	allow must be sent to landfill sites	1	AO1 3.16.2e

Total		10
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Question	Answers	Extra information	Mark	AO /Spec. Ref.																		
05.1	<table border="0" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%; text-align: left;">Label</th> <th style="width: 10%;"></th> <th style="width: 75%; text-align: left;">Name of equipment</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Beaker</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; width: 10%;">A</td> <td style="border: 1px solid black; width: 5%; text-align: center;">—</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Burette</td> </tr> <tr> <td></td> <td></td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Conical flask</td> </tr> <tr> <td style="border: 1px solid black; text-align: center;">B</td> <td style="border: 1px solid black; width: 5%; text-align: center;">—</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Funnel</td> </tr> <tr> <td></td> <td></td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Pipette</td> </tr> </tbody> </table>	Label		Name of equipment			Beaker	A	—	Burette			Conical flask	B	—	Funnel			Pipette	an additional line from a box on the left negates the mark for that box	1 1	AO1 3.12.4b
Label		Name of equipment																				
		Beaker																				
A	—	Burette																				
		Conical flask																				
B	—	Funnel																				
		Pipette																				

Question	Answers	Extra information	Mark	AO /Spec. Ref.
05.2	indicator		1	AO1 3.12.4b

Question	Answers	Extra information	Mark	AO /Spec. Ref.
05.3	0.15×0.025 $= 0.00375$		1 1	AO2 3.12.4a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
05.4	25.8 and 2.3 $(25.8 - 2.3 =) 23.5 \text{ (cm}^3\text{)}$	allow correct use of incorrectly read volumes	1 1	AO2/3 3.12.4b

Question	Answers	Extra information	Mark	AO /Spec. Ref.
05.5	repeat the titration to obtain consistent results		1	AO3 3.12.4b

Question	Answers	Extra information	Mark	AO /Spec. Ref.
05.6	sodium chloride	allow NaCl	1	AO2 3.11.1c

Total			9	
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Question	Answers	Extra information	Mark	AO /Spec. Ref.
06.1	catalyst		1	AO1 3.15.2e

Question	Answers	Extra information	Mark	AO /Spec. Ref.
06.2	between 20 °C and 35 °C		1	AO1 3.16.1.2f

Question	Answers	Extra information	Mark	AO /Spec. Ref.
06.3	$C_6H_{12}O_6 \rightarrow 2 C_2H_5OH + 2 CO_2$		1	AO2 3.12.1a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
06.4	limewater or calcium hydroxide (solution)		1	AO3 3.10.2d

Question	Answers	Extra information	Mark	AO /Spec. Ref.
06.5	$4000 \text{ cm}^3 = 4 \text{ dm}^3$ $\frac{340}{4}$ $= 85 \text{ (g/dm}^3\text{)}$ alternative approach $\frac{340}{4000} \text{ (1)}$ $= 0.085 \text{ (g/cm}^3\text{) (1)}$ $= 85 \text{ (g/dm}^3\text{) (1)}$	allow correct use of incorrect / no conversion	1 1 1	AO2 3.12.4a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
06.6	plants		1	AO1 3.16.1.2f

Question	Answers	Extra information	Mark	AO /Spec. Ref.
06.7	solvent		1	AO1 3.16.3.1b

Question	Answers	Extra information	Mark	AO /Spec. Ref.
06.8	ethanoic acid	allow CH ₃ COOH	1	AO1 3.16.3.1c

Total			10	
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Question	Answers	Extra information	Mark	AO /Spec. Ref.
07.1	any one from: <ul style="list-style-type: none"> • (electrical) wiring • pipes • (water) tanks 	allow plumbing	1	AO1 3.9.1c

Question	Answers	Extra information	Mark	AO /Spec. Ref.
07.2	bacteria		1	AO1 3.9.1.1f

Question	Answers	Extra information	Mark	AO /Spec. Ref.
07.3	FeSO ₄ (aq) Cu(s)		1 1	AO2 3.9.1.1h, 3.12.1b

Question	Answers	Extra information	Mark	AO /Spec. Ref.
07.4	$\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$		1	AO2 3.9.1.1h, 3.9.2d

Question	Answers	Extra information	Mark	AO /Spec. Ref.
07.5	12×63.5 $= 762 \text{ (g)}$		1 1	AO2 3.12.3a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
07.6	copper sulfate solution		1	AO2 3.9.2b

Question	Answers	Extra information	Mark	AO /Spec. Ref.
07.7	to remove solution which changes its mass	allow to remove water which changes its mass allow the mass of the wet cathode would be higher than it should be	1	AO4 3.9.1.1g

Question	Answers	Extra information	Mark	AO /Spec. Ref.
07.8	mass increases		1	AO3 3.9.1.1g

Total			10	
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Question	Answers	Extra information	Mark	AO /Spec. Ref.
08.1	iodine		1	AO1 3.13.1d

Question	Answers	Extra information	Mark	AO /Spec. Ref.
08.2	(total number of electrons) 17 (number of outer shell electrons) 7		1 1	AO2 3.7.2f, 3.7.3b

Question	Answers	Extra information	Mark	AO /Spec. Ref.
08.3	fluorine atoms		1	AO2 3.13.1df

Question	Answers	Extra information	Mark	AO /Spec. Ref.
08.4	(potassium ion) K^+ (chloride ion) Cl^-		1 1	AO1 3.8.1de

Question	Answers	Extra information	Mark	AO /Spec. Ref.
08.5	0.4		1	AO2 3.12.1d

Question	Answers	Extra information	Mark	AO /Spec. Ref.
08.6	white solid		1	AO2 3.8.2a, 3.13.1a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
08.7	high melting point	ignore boiling point	1	AO3 3.9.1a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
08.8	calcium		1	AO3 3.10.2a

Question	Answers	Extra information	Mark	AO /Spec. Ref.
08.9	silver nitrate	allow AgNO ₃ ignore nitric acid	1	AO1 3.10.2e

Question	Answers	Extra information	Mark	AO /Spec. Ref.
08.10	bromine	allow Br / Br ₂ do not accept bromide	1	AO3 3.10.2e

Total			12	
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Question	Answers	Extra information	Mark	AO /Spec. Ref.
09.1	blue white	allow 1 mark for white to blue	1 1	AO1 3.15.1d

Question	Answers	Extra information	Mark	AO /Spec. Ref.
09.2	\rightleftharpoons water	allow H ₂ O	1 1	AO1/2 3.15.1d

Question	Answers	Extra information	Mark	AO /Spec. Ref.
09.3	stir the mixture	allow grind sodium thiosulfate into a powder before dissolving allow start the water at a higher temperature	1	AO4 3.14.1f

Question	Answers	Extra information	Mark	AO /Spec. Ref.
09.4	to slow down the rate of energy transfer	allow reduces heat loss (from the solution)	1	AO3 3.14.1f

Question	Answers	Extra information	Mark	AO /Spec. Ref.
09.5	exothermic because energy is transferred to the surroundings		1	AO3 3.15.1b

Question	Answers	Extra information	Mark	AO /Spec. Ref.
09.6	$(23.6 - 21.9 =) 1.7 \text{ (}^\circ\text{C)}$ $100 \times 4.2 \times 1.7$ $= 714 \text{ (J)}$	allow correct use of an incorrectly calculated temperature change allow a calculation using total mass of water and solid $(23.6 - 21.9 =) 1.7 \text{ (}^\circ\text{C)}$ (1) $(100 + 15.8) \times 4.2 \times 1.7$ (1) $= 827 \text{ (J)}$ (1)	1 1 1	AO2 3.15.1e
Total		10		

Question	Answers	Extra information	Mark	AO /Spec. Ref.
10.1	sulfur is produced (which is) solid / insoluble	allow (which is a) precipitate	1 1	AO3 3.12.1b

Question	Answers	Mark	AO / Spec. Ref.
10.2	Level 3: The plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1/4 3.14.1e
	Level 2: The plan 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 plan 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		
	<ul style="list-style-type: none"> • measure a fixed volume of sodium thiosulfate solution using a measuring cylinder • add to a conical flask • note the temperature of the solution using a thermometer • place flask on a cross • measure a fixed volume of (hydrochloric) acid using a measuring cylinder • add the (hydrochloric) acid to the conical flask • mix the solutions (eg swirl the conical flask) • start the timer • look down through the mixture • stop the timer when the cross is obscured • heat the sodium thiosulfate solution to higher temperature(s) • repeat the experiment at higher temperature(s) 		

Total		8
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