

Foundation

GCSE

Combined Science Chemistry A Gateway Science

J250/04: Paper 4 (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2022

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal <http://www.rm.com/support/ca>
3. Log-in to RM Assessor and mark the **required number** of practice responses (“scripts”) and the **number of required** standardisation responses.

YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.
5. **Crossed Out Responses**
Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

Rubric Error Responses – Optional Questions

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate). *When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.*

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response)**

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks)**

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add a tick to confirm that the work has been seen.
7. Award No Response (NR) if:
 - there is nothing written in the answer space

Award Zero '0' if:

- anything is written in the answer space and is not worthy of credit (this includes text and symbols).

Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.
9. *Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.*

10. For answers marked by levels of response: Not applicable in F501

- a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
- b. **To determine the mark within the level**, consider the following

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

The skills and science content determines the level.

The communication statement determines the mark within a level.

Level of response question on this paper is **15**.

11. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

12. Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

13. Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

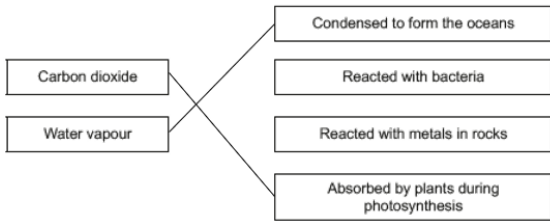
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science A:

	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

Question	Answer	Marks	AO element	Guidance
1	A ✓	1	1.1	
2	B ✓	1	2.2	
3	C ✓	1	1.2	
4	D ✓	1	1.1	
5	B ✓	1	1.1	
6	D ✓	1	2.1	
7	D ✓	1	2.1	
8	A ✓	1	2.2	
9	D ✓	1	1.1	
10	B ✓	1	2.2	

Question			Answer	Marks	AO element	Guidance
11	(a)		Earthquakes ☐ Thunderstorms ☐ Volcanoes ☒ ✓	1	1.1	
	(b)		21 (%) ✓	1	1.1	
	(c)		 ✓✓	2	1.1	DO NOT ALLOW more than one line from a box
	(d)	(i)	FIRST CHECK ANSWER IN TABLE If answer = $0.001656/1.656 \times 10^{-3}$ award 2 marks $0.000524 + 0.00182 + 0.934 = 0.936344$ ✓ $0.938 - 0.936344 = 0.001656/1.656 \times 10^{-3}$ ✓	2	2.2	ALLOW $0.00166/1.66 \times 10^3$ for 2 marks ALLOW 0.002 for 1 mark
		(ii)	They are coloured. ☐ They are unreactive. ☒ They exist as molecules. ☐ ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
12	(a)	(i)	copper + iron sulfate ✓	1	2.1	Answers can be in either order
		(ii)	iron is more reactive than copper ✓	1	2.1	ORA ALLOW Iron is more reactive/copper is less reactive/iron is higher up the reactivity series
	(b)		silver/gold ✓	1	2.1	ALLOW correct symbol
	(c)	(i)	zinc/iron/lead/copper/silver/gold ✓	1	2.1	ALLOW correct symbol IGNORE copper oxide/zinc oxide/lead oxide/silver oxide/gold oxide
		(ii)	sodium/lithium/magnesium ✓	1	2.1	ALLOW correct symbol
	(d)		Sodium atoms lose electrons more easily than lithium atoms. ✓	1	1.1	
	(e)	(i)	reactivity increases going down (group 1) (AW) ✓	1	1.1	ORA ALLOW reactivity increases with increasing atomic number / A_r IGNORE more reactive at the bottom/mass unqualified ALLOW listed all group in order with least reactive against Li and most reactive against Fr (ignore hydrogen placed first)
		(ii)	potassium/rubidium/caesium/francium ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance																
13	(a)		Filtered ☐ Ground ☐ Potable ☒ ✓	1	1.1																	
	(b)		<table><thead><tr><th></th><th>Stage 2 Settlement</th><th>Stage 3 Sedimentation</th><th>Stage 4 Sand filter</th></tr></thead><tbody><tr><td>Any remaining mud or grit is removed.</td><td></td><td></td><td>✓</td></tr><tr><td>Sand and soil sink to the bottom of the tank.</td><td>✓</td><td></td><td></td></tr><tr><td>Small particles of dirt clump together to form sludge.</td><td></td><td>✓</td><td></td></tr></tbody></table> ✓✓		Stage 2 Settlement	Stage 3 Sedimentation	Stage 4 Sand filter	Any remaining mud or grit is removed.			✓	Sand and soil sink to the bottom of the tank.	✓			Small particles of dirt clump together to form sludge.		✓		2	1.2	All 3 correct = 2 marks 1 correct = 1 mark
	Stage 2 Settlement	Stage 3 Sedimentation	Stage 4 Sand filter																			
Any remaining mud or grit is removed.			✓																			
Sand and soil sink to the bottom of the tank.	✓																					
Small particles of dirt clump together to form sludge.		✓																				
	(c)		Any two from: idea that it requires (large amounts of) heat/energy ✓ idea that it only produces small amounts of water (for one experiment) ✓ idea that it takes a long time to produce (large amounts of) water ✓	2	3.1b	ALLOW flask too small / apparatus too small / not large enough / small scale ALLOW takes a long time/too long/too slow IGNORE cost / pollution																

Question			Answer	Marks	AO element	Guidance
	(d)		FIRST CHECK ANSWER IN TABLE If answer = 17.9 award 3 marks $(149 \div 100) \times 3 = 4.47 \checkmark$ $4.47 \times 4 = 17.88 \checkmark$ $= 17.9 \checkmark$ OR $149 \times 4 = 596 \checkmark$ $(596 \div 100) \times 3 = 17.88 \checkmark$ $= 17.9 \checkmark$	3	 2 x 2.2 1.2	 ECF from step one ECF from step two ECF from step one ECF from step two

Question			Answer	Marks	AO element	Guidance
14	(a)		The experiment is called cracking / displacement / distillation. ✓ It is an example of combustion / reduction / thermal decomposition. ✓	2	1.2	
	(b)	(i)	decreases it increases it no effect ✓	1	1.1	
		(ii)	decreases it increases it no effect ✓	1	1.1	
	(c)	(i)	C ₂ H ₄ ✓	1	2.2	ALLOW H ₄ C ₂
		(ii)	idea that paraffin is turned into a smaller molecule / paraffin molecule splits ✓ idea that this involves breaking bonds ✓	2	2.2	ALLOW loses C and H (atoms) / has less C and H (atoms) / decreases number of atoms / becomes smaller IGNORE decreases/shrinking/decomposes DO NOT ALLOW loses molecules of C and H IGNORE breaking intermolecular forces/bonds
	(d)		idea that paraffin has a lower demand than supply ✓ idea that hydrocarbons produced are more useful ✓	2	3.1b	ORA ALLOW (paraffin is) low demand/(paraffin is in) high supply IGNORE fractions / crude oil ALLOW products/what is made are more useful ALLOW description of more useful e.g. products are better fuels/products are used to make polymers etc.

Question	Answer	Marks	AO element	Guidance
15*	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Analyses the information from the tables to identify reasons to justify using recycled paper or biodegradable plastic. AND Uses own scientific knowledge to explain the reasons given. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Analyses the information from the tables to identify a reason to justify using recycled paper or biodegradable plastic. AND Uses own scientific knowledge to explain the reason given. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Analyses the information from the tables to identify a reason to justify using recycled paper or biodegradable plastic. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>	6	3 x 3.2a 3 x 2.1a	AO3.2a Analyses information and ideas to make a judgement e.g. • plastic bags require less energy to make/OR A • paper bags produce less CO₂/OR A • plastic bags produce less solid waste/OR A • paper bags and plastic bags use about the same amount of water AO2.1 Apply knowledge of scientific ideas e.g. • links energy requirement to burning fossil fuels e.g. cost of fossil fuels/environmental impact/they are finite etc. • links CO₂ production to global warming e.g. global temperature increasing/description of effects of global warming etc. • links solid waste to disposal e.g. environmental issues/use of landfill etc. • links water usage to production of water e.g. cost of water production etc.

Question			Answer	Marks	AO element	Guidance
16	(a)		black solid/dark-grey solid ✓	1	3.2a	Both colour and solid needed for mark ALLOW <u>dark</u> purple, <u>dark</u> blue, blue-black DO NOT ALLOW blue/green
	(b)		$1.28 \times 10^{-12} \text{ m}$ ☐ $1.28 \times 10^{-10} \text{ m}$ ☒ $1.28 \times 10^{10} \text{ m}$ ☐ $1.28 \times 10^{12} \text{ m}$ ☐ ✓	1	2.2	
	(c)		bromine ✓	1	3.2b	
	(d)	(i)	linear scale on x-axis ✓ all 4 points plotted correctly scores 2 marks ✓✓ line of best fit through points ✓	4	3 x 2.2 1.2	points need to cover $\geq$ half the grid Non-linear scale gives access to M4 only ALLOW $\pm \frac{1}{2}$ small square for plots only 3 or 2 points plotted correctly scores 1 mark IGNORE only 1 point plotted correctly ECF from plotted points DO NOT ALLOW dot to dot line DO NOT ALLOW multiple lines IGNORE line before first plot and after last plot
		(ii)	Value read from graph ✓	1	3.1a	ALLOW ± 1 small square DO NOT ALLOW mark if no line of best fit present
	(e)		(fluorine molecules) are the smallest/smaller ✓ (fluorine) has the lowest boiling point/lower ✓	2	3.1b	Answers must imply a comparative e.g. smallest not just small ALLOW Least amount of energy needed to boil DO NOT ALLOW simply quoting values from the table without an interpretation

Question			Answer	Marks	AO element	Guidance
	(f)		(same) number of electrons/7 electrons in outer energy level ✓ (different) numbers of energy levels/F has 2 energy levels but Cl has 3 energy levels/Cl has one more energy level ✓	2	1.1	ALLOW shells for energy levels throughout IGNORE they both have 2 electrons on their inner shell IGNORE chlorine has more electrons ALLOW 1 mark for correct drawing of both fluorine and chlorine atoms/correct electronic structures if no other mark scored

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