OCR
Oxford Cambridge and RSA

Higher

GCSE

Combined Science Chemistry A Gateway Science

J250/10: Paper 10 (Higher 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.

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. A*ssistant 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 questions on this paper is **14.**

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	D ✓	1	1.1	
2	B ✓	1	2.2	
3	B ✓	1	1.2	
4	A ✓	1	1.1	
5	B ✓	1	1.2	
6	D ✓	1	1.1	
7	C ✓	1	1.1	
8	C ✓	1	2.2	
9	B ✓	1	2.1	
10	C ✓	1	2.1	

Question			Answer	Marks	AO element	Guidance
11	(a)		black solid/dark-grey solid ✓	1	3.2a	Both colour and solid needed for mark **ALLOW** dark purple, dark blue, blue-black **DO NOT ALLOW** blue/green
	(b)		1.28×10^{-12} m ☐ 1.28×10^{-10} m ☑ 1.28×10^{10} m ☐ 1.28×10^{12} 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 ≥ half the grid Non-linear scale gives access to M4 only **ALLOW** ± ½ small square for plots ALLOW 3 or 2 points plotted correctly scores 1 mark **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 etc. **ALLOW** Least amount of energy needed to boil

Question			Answer	Marks	AO element	Guidance
						DO NOT ALLOW simply quoting values from the table without an interpretation
	(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

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>12</td><td>(a)</td><td></td><td>distillation ✓</td><td>1</td><td>1.2</td><td>ALLOW simple distillation/fractional distillation</td></tr>
<tr><td></td><td>(b)</td><td></td><td>idea that a fraction evaporates ✓

and then condenses ✓</td><td>2</td><td>1.2</td><td>ALLOW (boils and) turned into a gas
IGNORE crude oil is heated/melts
IGNORE fraction boils

ALLOW idea that gas turns into a liquid</td></tr>
<tr><td></td><td>(c)</td><td></td><td>idea of using colder water/adding ice/use a condenser ✓</td><td>1</td><td>3.3b</td><td>ALLOW ideas of starting experiment below 10°C</td></tr>
<tr><td></td><td>(d)</td><td></td><td><table><tr><th></th><th>True</th><th>False</th></tr><tr><td>The fractions consist of compounds which are hydrocarbons.</td><td>✓</td><td></td></tr><tr><td>Fraction C is collected before Fraction D.</td><td>✓</td><td></td></tr><tr><td>The molecules in Fraction A are larger than the molecules in Fraction B.</td><td></td><td>✓</td></tr></table>✓ ✓</td><td>2</td><td>2.2</td><td>ALLOW any indication of correct answer, e.g. crosses but ticks take precedence

All three correct scores 2 marks.
Any two correct scores 1 mark.</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
13	(a)		carbon dioxide/gas is formed ✓ idea that (carbon dioxide/gas) escapes (the beaker/the conical flask) ✓	2	1.2	**DO NOT ALLOW** other named gases Carbon dioxide/gas escapes is worth 2 marks
	(b)		**Any two from:** idea that conical flask/cotton wool prevents drops of <u>acid/liquid</u> spitting out/leaving the conical flask ✓ idea that these drops of acid/liquid leads to a greater decrease in mass (than expected) ✓ idea that cotton wool allows gas to escape ✓	2	3.1b	**DO NOT ALLOW** prevents any products leaving **IGNORE** prevents solid particles leaving
	(c)		**FIRST CHECK ANSWER** **If answer between 0.0040 and 0.0050 award 4 marks as long as to 2 significant figures and tangent is drawn** tangent drawn at 300 seconds ✓ correct choice of numbers for gradient calculation from the graph ✓ for calculating gradient (using numbers from M2) e.g. (4.0 – 1.5) ÷ 560 (= 0.00446) ✓ answer to 2 sig figs e.g. 0.0045 ✓#	4	3 x 2.2 1.2	**ALLOW** ECF if tangent NOT drawn at 300 seconds then pupil loses tangent mark only **ECF** from M1 **ECF** from M2 **ECF** from M3 **ALLOW** standard form as long as to 2 significant figures **ECF** if processing of data has given an incorrect answer but correctly processed and expressed to 2 significant figures for M4 **DO NOT ALLOW M4** if recuring dot on top of final number

Question			Answer	Marks	AO element	Guidance
	(d)	(i)	**Any two from:** mass of calcium carbonate ✓ volume of (hydrochloric) acid ✓ concentration of (hydrochloric) acid ✓ temperature ✓	**2**	**1.2**	**IGNORE** amount of calcium carbonate **ALLOW** amount of HCl **IGNORE** strength of acid/pH **IGNORE** equipment
		(ii)	**Any two from:** increases rate of reaction ✓ (smaller pieces have) a larger surface area ✓ there are <u>more</u> frequent collisions ✓	**2**	**1.1**	**ALLOW** idea that reaction completes faster/is faster

Question			Answer	Marks	AO element	Guidance
14*			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)** Describes electrolysis (of molten sodium chloride). **AND** Uses half-equation(s) to describe the electrolysis of molten sodium chloride including one to produce sodium. **AND** Analyses information and ideas to evaluate why sodium is expensive to produce. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Describes electrolysis (of molten sodium chloride). **AND** Uses equation(s) to describe the electrolysis of molten sodium chloride. **OR** Describes the electrolysis of sodium chloride. **AND** Analyses information and ideas to evaluate why sodium is expensive to produce. **OR** Uses equation(s) to describe the electrolysis of molten sodium chloride. **AND** Analyses information and ideas to evaluate why sodium is expensive to produce. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Describes the electrolysis (of molten sodium chloride).	**6**	**2 x 1.2** **2 x 2.2** **2 x 3.1b**	**AO1.2 Describes electrolysis (of molten sodium chloride) e.g.** • sodium chloride/electrolyte must be molten so ions move to the electrodes • Na^+/+ ions move to the negative electrode/cathode • Na^+/+ ions gain electrons • Na^+/+ ions are reduced • Cl^-/- ions move to the positive electrode/anode • Cl^-/- ions move lose electrons • Cl^-/- ions are oxidised **AO2.2 Uses equations to describe the electrolysis of molten sodium chloride** • $2NaCl \rightarrow 2Na + Cl_2$ • $Na^+ + e^- \rightarrow Na$ • $2Cl^- \rightarrow Cl_2 + 2e^-$ State symbols not required **AO3.1b Analyses information and ideas to evaluate why sodium produced is expensive e.g.** • high melting point so large amounts of energy required to melt sodium chloride • electricity required (for electrolysis) expensive • may use (expensive) chemical to lower melting point of $NaCl$

Question			Answer	Marks	AO element	Guidance
			OR Uses equation(s) to describe the electrolysis of molten sodium chloride. **OR** Analyses information and ideas to evaluate why sodium is expensive to produce. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*			

Question			Answer	Marks	AO element	Guidance
15	(a)		idea that group 0 elements have full/complete outer energy levels/shells ✓	1	1.1	**IGNORE** no spare electrons
	(b)		idea that fluorine is very reactive ✓	1	2.1	**ALLOW** fluorine is the <u>most</u> reactive non-metal/halogen/element **ALLOW** fluorine is powerful oxidising agent **DO NOT ALLOW** fluorine is (most reactive) metal
	(c)	(i)	<u>simple</u> molecule/molecular ✓	1	3.2a	**ALLOW** <u>simple</u> covalent
		(ii)	**Any two from:** covalently bonded/(bonds formed by) sharing electrons/made from two non-metals ✓ (simple molecules) have low melting/boiling point ✓ (simple molecules) do not have mobile/free(moving) ions/electrons/ ✓	2	2.1	**ALLOW** do not have delocalised electrons **IGNORE** it doesn't conduct electricity
	(d)		reactivity increases as the size of the atom increases ✓	1	3.2b	**ORA** **ALLOW** mass for size **ALLOW** reactivity increases as the number of shells increases **DO NOT ALLOW** reactivity increases as the size of the molecule increases

Question			Answer	Marks	AO element	Guidance
16	(a)		idea that… when a change is made (to a reaction at equilibrium) ✓ the position (of equilibrium) moves to oppose the change✓	2	1.1	To gain any mark equilibrium has to be mentioned at least once. **ALLOW** the position of equilibrium moves to oppose the change for two marks. **ALLOW** 1 mark for an example using one of pressure/concentration/temperature if no other mark awarded.
	(b)	(i)	decreases ✓	1	2.1	
		(ii)	equilibrium moves to decrease the temperature ✓ moves to endothermic/backward reaction ✓	2	2.1	**ALLOW** equilibrium moves to absorb (extra) energy **ALLOW** moves to left hand side
	(c)	(i)	increase ✓	1	2.1	
		(ii)	equilibrium moves to decrease the pressure ✓ moves to side with least moles/molecules/forward reaction ✓	2	2.1	**ALLOW** moves to right hand side/exothermic side

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