OCR
Oxford Cambridge and RSA

Higher

GCSE

Combined Science B Twenty First Century Science

J260/08: Combined science (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2023

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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 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 available in RM Assessor.
3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

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 50% 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, email or via the RM Assessor messaging system.

5. Work crossed out:

   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks

   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

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. There is a NR (No Response) option. Award NR (No Response)

   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

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 email.

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:

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 are **X** and **X**

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**.

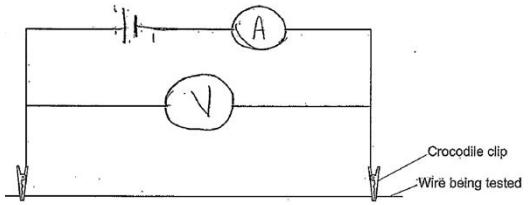
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

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

	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.

Question			Answer	Marks	AO element	Guidance
1	(a)	(i)	D, A, B, C ✓✓	2	1.2	D before A = 1 mark **OR** B before C = 1 mark
		(ii)	**Any two from:** Idea that the ruler is placed above the hand at the same height / position ✓ Ensure the ruler used is the same ✓ The ruler must be dropped with no force applied ✓ Idea of maintaining stability of the hand ✓ Ensure the distance between finger and thumb is maintained ✓ Make sure the tester does not give the participant any cues that indicate when they are likely to drop the ruler. ✓ Ensure there are no distractions in the room ✓ Ensure the participant / tester is the same ✓	2	3.3b	**IGNORE** repeating, means and more precise equipment
	(b)		**Any one from:** Reason why the participant has a slower reaction e.g. distraction / loss of concentration / tired / change in room conditions ✓ Reasons why the equipment or procedure has not been followed consistently e.g. ruler may have been held lower before being dropped / hand was higher before ruler being dropped / force applied by tester to ruler / participant and tester swap roles ✓	1	3.2a	

Question			Answer	Marks	AO element	Guidance
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer is in range of >0.11 and <0.12s award 2 marks** Conversion of 6.7 cm to 67 (mm) ✓ Answer above 0.11 but less than 0.12 ✓	**2**	**2.1**	If no other mark is awarded **ALLOW** an exact value of 0.11 or 0.12 or evidence of correct use of table for 1 mark
	(d)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.116s award 3 marks** Substitution: $t = \sqrt{\frac{2\times0.067}{10}}$ ✓ t = 0.11575… ✓ = 0.116s (3sf) ✓	**3**	**2.1 x 2** **1.2**	**ALLOW** 0.115 / 0.1157 for 2 marks **ALLOW ECF** from incorrect calculation for sig fig mark **ALLOW** 0.12 with no working for 1 mark

Question			Answer	Marks	AO element	Guidance
2	(a)		Correct symbols for cell, ammeter and voltmeter in the correct gaps ✓	1	1.2	 **ALLOW** cell and ammeter in either order **DO NOT ALLOW** a circuit symbol of a battery or power supply
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 9.375 / 9.38 / 9.4 / 9 (Ω) award 2 marks** R= 1.5 / 0.16 ✓ R= 9.375 / 9.38 / 9.4 / 9 (Ω) ✓	2	2.1	
	(c)		Change the length of the wire ✓ Take readings of current and potential difference for each of lengths / idea that they find the resistance / compare results ✓	2	3.3a	**ALLOW** stated increments of length other than 90cm

Question			Answer	Marks	AO element	Guidance
3	(a)		The needle would change direction or move / point along the path of the magnetic field / point to the N or S when next to the solenoid / point to the solenoid ✓	1	1.2	
	(b)		Minimum of 2 lines drawn, one above and one below the solenoid passing through the middle ✓ Arrow on each line drawn pointing from North to South poles ✓	2	2.2	**ALLOW** 2 lines converging at the N and S but not passing through the middle. **DO NOT ALLOW** lines that cross **IGNORE** arrows in the middle of the solenoid that conflict with correct arrows on the outside
	(c)		**Any three from:** Add an iron core to the solenoid ✓ Increase number of turns of wire in the coil (solenoid) ✓ tighten the turns of the wire in the coil ✓ Increase the current / add a cell / increase the potential difference ✓ Move the paper clips closer to the (poles of the solenoid) ✓	3	2.1	**ALLOW** more coils within the same wire **IGNORE** power and charge
	(d)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1.9 (A) award 2 marks** 57 / 30 ✓ = 1.9 (A) ✓	2	2.1	

Question			Answer	Marks	AO element	Guidance
	(e)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 54.15 (J) award 2 marks** 57 x 0.95 ✓ = 54.15 (J) ✓	**2**	**2.1**	**ALLOW** a correctly rounded value

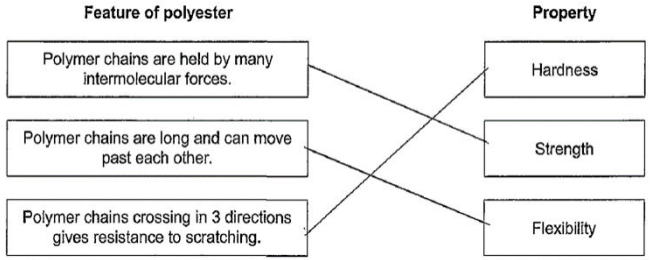
Question			Answer	Marks	AO element	Guidance
4	(a)		Ground water / rain water ✓	1	1.1	**ALLOW** stores of ground water E.g. lakes, reservoirs, rivers, wells, aquifer, springs **IGNORE** examples of waste and salt water
	(b)	(i)	Aeration provides the oxygen. ✓ Organic matter is broken down by the bacteria. ✓	2	1.1	
		(ii)	Idea that solid impurities are removed from the water✓	1	1.1	
	(c)		Idea that salt is separated from the water ✓ Distillation / reverse osmosis / membrane filtration ✓	2	1.1	**ALLOW** description of the processes that separate the salt and water. **DO NOT ALLOW** boiling removes salt./ kills bacteria

Question			Answer	Marks	AO element	Guidance
	(d)		**Any four from:** ***Trends in the graph*** As one value increases, the other decreases / there is a negative correlation between the death rate and percentage of the population drinking potable water ✓ Idea that there is a lot of scatter in the data ✓ Idea that there is an outlier in the data ✓ Compare points on the graph ✓ Correct use of data to support a comparison or the outlier ✓ ***Cause and correlation*** Idea that there is no evidence that the non-potable water actually causes the increase in mortality ✓ The number of deaths may be for a variety of reasons / no causal mechanism ✓ Discussion of the access to potable water not being the same as people actually drinking it ✓ ***Sample*** Discussion of sample size qualified to make judgements ✓ Discussion of factors relating to the sample and how this could affect the data e.g. which countries were part of the sample ✓ Some of the data may not be reported accurately ✓	**4**	**3.1b**	

Question			Answer	Marks	AO element	Guidance
	(e)		**(FOR) MAX three from:** (chlorine kills microorganisms in water so) prevents disease / chlorination prevents deaths / safer to drink / make water potable ✓ Chlorination) makes more potable water available ✓ Idea that the cost of chlorine is relatively low ✓ Chlorine has been proven to work / high efficacy of chlorination ✓ **(AGAINST) MAX three from:** Toxicity / hazardous nature of chlorine ✓ Citizens should have a choice about whether they drink chlorinated water ✓ Chlorine may affect the taste / smell of the water ✓ There may be insufficient funds available in a developing country to pay for the chlorine ✓ They may not have the facilities to be able to add chlorine to the water/a way to distribute the water✓	4	3.2a	**ALLOW** other reasonable arguments for or against **ALLOW** chlorine can cause harm (to animals or people) **IGNORE** bioaccumulation ideas

Question			Answer	Marks	AO element	Guidance
	(f)		**Any three from:** ***Effective*** (because) number of deaths has decreased after chlorination ✓ (because only took 30 years for there to be an) almost negligible number of cases / (mid 1940s onwards) no deaths from typhoid fever ✓ Increases in deaths are smaller after chlorination takes place. ✓ ***Not possible to tell effectiveness:*** (because) there are some falls in deaths before chlorination / rises in deaths post chlorination ✓ Other factors could be reducing the number of deaths from typhoid fever e.g. vaccinations or treatments ✓	**3**	**3.2b**	**ALLOW** any sensible suggestions

Question			Answer	Marks	AO element	Guidance
5	(a)*		**Level 3 (5-6 marks)** Justifies their bag of choice and why other bags are not used with reference to GWP, number of uses and cost *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)** Justifies their bag of choice and gives some reasons why other bag(s) should not be used. *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)** Identifies a bag and gives reasons which only focus on the benefits of that bag. *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.*	6	3.1b	**Indicative content may include:** **AO3.1b Evaluating information to make a judgment about which is the best bag to choose, including why others are not suitable** Comments about GWP • Starch polyester has the highest GWP (even when taken into account the recycling) • HDPEs value is more in line with the paper bag when recycling has been taken into account • Paper bag has lowest GWP Comments about cost • HDPE and starch are the cheapest bags • Cotton is the most expensive Comments about number of uses • HDPE and Starch polyester are single use bags • Cotton has the greatest number of uses in its lifetime • Paper bag may split if wet so not get full use Links candidates may make • Idea of cost per use e.g. Although cotton bag can be used the most times, not cheapest per use, e.g.150/173 = 0.867p vs 55/14 = 3.92p • HDPE bag would cost 173 x 10p = £17.30 compared to the cost of the £1.50 cotton bag • Idea of GWP per use • Idea of cost relating to GWP

Question	Answer	Marks	AO element	Guidance
(b)	 ✓✓	2	2.1	All three correct lines = 2 marks One or two correct lines = 1 mark

Question			Answer	Marks	AO element	Guidance
6	(a)		Produce potato of the same size / shape / surface area ✓ Measure the mass of the potato (shapes) ✓ Place the potatoes (shapes) into known concentration solutions for a given time / till equilibrium was reached. ✓ Excess solution removed from cylinders before mass measured ✓	4	2.2	
	(b)	(i)	Correct linear scale with label on the x axis drawn at zero ✓ Correct linear scale with label on the y axis ✓ All 5 data points plotted correctly on a linear scale ✓ Line of best fit ✓	4	2.2	**DO NOT ALLOW** scales where points do not fit in the grid, e.g. point at -30.1 does not fit on their scale **ALLOW** 1 mark for 2 correctly drawn axes without labels **ALLOW** ± ½ square for all points
		(ii)	**Any three from:** The concentration of sugar in potato cells is 0.24 mol/dm^3 ✓ not 0.2 mol/dm^3 because the mass changes ✓ When the concentrations are equal there is no net movement of water / when concentrations are not equal there is net movement of water ✓ When the concentrations are equal the mass remains unchanged ✓	3	3.2b	**ALLOW** values in the range >0.2 but <0.4mol/dm^3

Question			Answer	Marks	AO element	Guidance
						ALLOW the point of equal concentration is where the line of best fit crosses the x axis
		(iii)	Idea of testing more concentrations of solution between 0.2 and 0.4 mol / dm^3 ✓ Samples taken from the same region of the potato / same (type of) potato ✓	**2**	**3.3b**	**ALLOW** using smaller increments of concentrations
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = (-)13.46 (%) award 3 marks** %change = ((1.04 – 0.9) /1.04) x 100 ✓ = (-)13.46153846 ✓ Converted to 2 decimal places = (-) 13.46 (%) ✓	**3**	**2.2 x 2** **1.2**	**ALLOW** 86.54 for 2 marks
	(d)		(Carbon dioxide) diffuses in ✓ through the stomata✓	**2**	**1.1**	

Question			Answer	Marks	AO element	Guidance
7	(a)		Identifies how to cause a change In conditions from dark to light / light to dark ✓ Use a stopwatch / video ✓ to measure the time taken for the pupil to stop changing size (linked to device used) ✓	3	3.3a	**ALLOW** sensible suggestions on how to change conditions e.g. cover and uncover the eye
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.01 (ms^{-1}) award 4 marks** Distance moved = (7-2) ÷ 2 = 2.5(mm) ✓ 2.5mm = 0.0025 **OR** 2.5 x10^{-3} (m) ✓ 0.0025 ÷ 0.25 ✓ = 0.01 (m/s) ✓	4	2.2 1.2 2.2 x 2	**ALLOW** 0.02 for 3 marks (not divided by 2) **ALLOW** 10 or 10,000 for 3 marks (no or incorrect conversion of units) **ALLOW** 20 or 20,000 for 2 marks (no or incorrect conversion of units or division by 2) **ECF** for their value of distance travelled

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