OCR
Oxford Cambridge and RSA

Foundation

GCSE

Combined Science B Twenty First Century Science

J260/04: Combined science (Foundation 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
owtte	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.

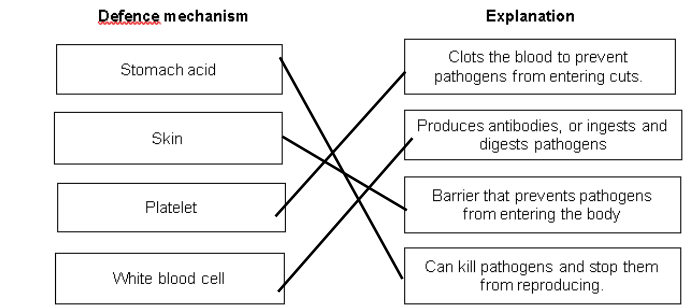
You should ensure that you have copies of these materials.

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.

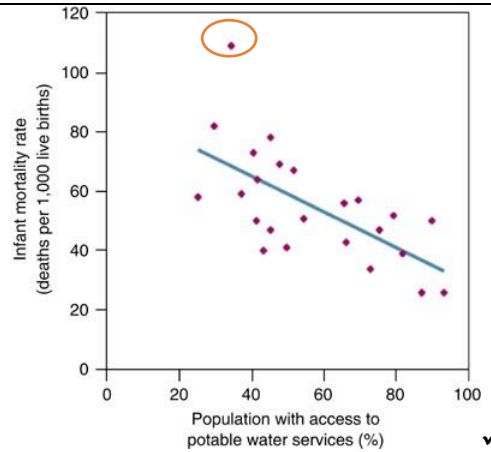
Question			Answer	Marks	AO element	Guidance
1			 ✓✓✓	3	1.1	3 or 4 correct = 3 marks 2 correct = 2 marks 1 correct = 1 mark

Question			Answer	Marks	AO element	Guidance
2	(a)	(i)	(Idea of) all of the genetic material (of an organism) ✓	1	1.1	**ALLOW** all the DNA / all the genes **IGNORE** sequence **IGNORE** genome **DO NOT ALLOW** all the DNA in a gene / where all the DNA is held
		(ii)	It controls what goes into and out of the cell. ☐ It controls how organisms develop and function. ☑ It maintains the shape of the cell. ☐	1	1.1	
	(b)		So that they can make their own proteins / enzymes ✓	1	2.1	**ALLOW** for protein alone
	(c)		modified ✓ desirable ✓	2	1.1	
	(d)	(i)	**Any three from:** Maize is the crop that is grown the most ✓ Canola has the lowest proportion of crop that is grown as genetically engineered crop / ORA ✓ Cotton/soybean has the highest proportion of crop that is grown as genetically engineered crops / ORA ✓ Roughly the same amount of canola and cotton are grown ✓	3	3.2b	**ALLOW** any reasonable conclusion from the chart including numerical conclusions Answers can be in terms of land or crop Approximate data ±5% : Soy is 80% GE Cotton is 80% GE Maize/corn is 35% GE Canola is 30% GE GM ~ 160-180 hectares total. Non GM ~ 140-160 hectares total.

		(ii)	**First check the answer on answer line** **If answer = 9.3 hectares award 2 marks** 31 x 0.3 ✓ = 9.3 ✓	**2**	**2.2**	**ALLOW** sight of 9,300,000 for 1 mark **ALLOW** 31million x 30/100 etc **ALLOW** 30% x 31m **IGNORE** 30% of 31m or 0.3 of 31m

Question			Answer	Marks	AO element	Guidance
3	(a)		Temperature of the water ✓ The size of the pondweed ✓	2	2.2	
	(b)		**Any two from:** Measures <u>volume</u> of gas / bubbles ✓ Gas collected / gas cannot escape ✓ Bubbles may have different volumes / sizes ✓	2	2.2	**IGNORE** accurate / precise / reliable / easier etc **ALLOW** any named gas / bubbles throughout **ALLOW** gas stays / goes in measuring cylinder **IGNORE** counting bubbles **IGNORE** falling water level idea
	(c)	(i)	Sensible linear scale added correctly to the x and y axes ✓ 5 points plotted correctly ✓ Straight line of best fit drawn ✓	3	2.2	Intervals of 5 per 2 cm square on horizontal and 2 per 2 cm square on the vertical **DO NOT ALLOW** points plotted on awkward / non-linear scale **ALLOW** LOBF correct for their points
		(ii)	**First check the answer on answer line** **If answer = 0.3 or 0.4 award 3 marks** (6.7 – 0)/(20 – 0) ✓ = 0.335 ✓ = 0.3 ✓	3	**2.2 x 2** **1.2**	**ALLOW** answer calculated using any of the pairs of data 1.5/5 = 0.3 3.9/10 = 0.39 → 0.4 5.2/15 = 0.347 → 0.3 **ALLOW ECF** from correct rounding of a written longer number for the 1 decimal place mark

		(iii)	It will be steeper than the gradient of the graph at 20°C. / steeper straight line drawn on graph ✓ (Higher temperature gives) higher rate of reaction / photosynthesis ✓	**2**	**2.2**	Gradient described in words takes precedence over diagram **ALLOW** higher gradient / more upright **ALLOW** steeper line not passing through origin **ALLOW** it for gradient **IGNORE** more gas – needs idea of rate **ALLOW** ratio of volume:minutes has more volume

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	 ✓	1	2.2	
		(ii)	A point which does not fit the trend (of decreasing mortality rate with increasing access to potable water) ✓	1	2.2	**ALLOW** idea of not being in line with the others e.g.point is far away from the others / LOBF **ALLOW** point is furthest away from LOBF **ALLOW** that country has a **much** higher rate of death (in comparison to the others)

Question			Answer	Marks	AO element	Guidance
	(b)*		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)** Gives arguments for **AND** against adding chlorine to drinking water **AND** uses evidence from the graphs to support their arguments. *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)** Gives limited arguments for AND against adding chlorine to drinking water **OR** Gives arguments for **OR** against adding chlorine to drinking water **AND** uses evidence from the graphs to support their argument. *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)** Gives limited arguments for OR against adding chlorine to drinking water. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.*	**6**	**3.1b**	**Arguments for adding chlorine to water around the world** • chlorine kills microorganisms/named microorganisms • idea that everyone should have access to clean drinking water • cheap method of treatment / small amount of chlorine needed • saves healthcare costs / provides jobs **Use of graph to support for argument** • number of deaths has decreased after chlorination • relatively fast decrease in death rate (30 years) • trend very clearly sharply downwards • there is a negative correlation between the death rate and potable water/chlorination **Arguments against adding chlorine to water** • idea that people should have a choice about what is in the water they drink / chlorine is toxic / affects smell/taste of water • idea that the amount would need to be regulated • high cost / some countries may not have the facilities or the money **Use of graph to support against argument** • the graph shows some peaks in typhoid even when water is chlorinated / correlation is not causation • Takes long time to reduce death rate to (almost) zero / low levels • Still peaks in graph suggesting chlorination not 100% effective • Some other factor may be reducing death rate

Question			Answer	Marks	AO element	Guidance
			0 marks No response or no response worthy of credit.			• There is a lot of scatter in the data • Not very many countries in sample / would need more data • Number of deaths is small before chlorination • Death rate was dropping even without chlorination

Question			Answer	Marks	AO element	Guidance
5	(a)	(i)	Carbon dioxide ✓	1	2.1	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 111.1 award 3 marks** Sight of 40.1 **and** 35.5 ✓ 40.1+71 **or** 40.1+(2x35.5) **or** 40.1+35.5+35.5 ✓ 111.1 ✓	3	2.2	
	(b)	(i)	**Any one from:** Gas escapes from the flask ✓ Carbon dioxide/gas has mass (therefore mass of flask decreases) ✓ Uses idea about conservation of mass to explain that flask has to decrease ✓	1	2.1	**IGNORE** references to water or evaporation **ALLOW** any named gas **IGNORE** gas released **ALLOW** weight
		(ii)	3 (minutes) ✓ The mass stopped decreasing / stops changing / stays constant ✓ no more gas being released / reaction must have stopped / is complete ✓	3	3.1a	 **ALLOW** line or graph instead of mass **IGNORE** line is straight / flat **ALLOW** only calcium chloride remains **ALLOW** no carbonate or acid left
	(c)		Prevent / stop the gas from escaping ✓ Method to stop gas escaping: E.g. Add a bung/cotton wool to the conical flask ✓	2	3.3a	**ALLOW** cover the flask / trap the gas **ALLOW** any suitable method e.g. balloon / gas syringe / lid

Question			Answer	Marks	AO element	Guidance
6	(a)		**Any two from:** (Articles) increases over time ✓ (Articles) start in ~1991 / none before ~1990 ✓ Few (articles) in 1990s / early 2000s / before ~2005 ✓ (Articles) level off ~2015 ✓ (Articles) highest at ~2017 ✓	2	3.2b	**ALLOW** any reasonable conclusion **ALLOW** nanoparticles/particles/searches **ALLOW** for 2 marks Rapid increase (in articles) from ~2005 **ALLOW for 2 marks** still growing but not as rapidly from~2015
	(b)	(i)	**Any two from:** Only one person affected / other people are not ill ✓ The nanoparticles may not have been the cause of the illness✓ Idea of negative effect on the company ***/*** scaremongering / reputational damage ✓	2	3.1b	 **ALLOW** small sample size **ALLOW** other causes e.g food poisoning / lack of safety equipment

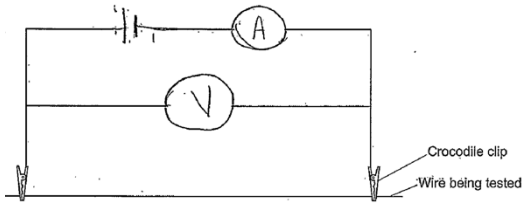
		(ii)	Include more people in the study / larger sample size ✓ Observe those in the study over a long period of time ✓ Rule out other factors ✓	**2**	**3.3b**	**ALLOW** Have a control group / have people who haven't been working with nanoparticles
	(c)		**Any one from:** The benefits outweigh the risks ✓ Advances (medical) technology / treatments / cures ✓ Benefits society / humanity / other people ✓	**1**	**3.2a**	**ALLOW** answer in relation to question e.g, finding out you have cancer is more important than the risks/side effects **ALLOW** they get paid **ALLOW** Lack of evidence to say it's dangerous **IGNORE** treating/curing cancer unless linked to research **IGNORE** checking if you have cancer without risk:benefit idea **IGNORE** vague health comments

Question			Answer	Marks	AO element	Guidance
7	(a)		Attract Repel Repel Attract ✓✓	2	1.1	4 correct = 2 marks 2 or 3 correct = 1 mark
	(b)		towards magnetic ✓	1	1.1	
	(c)		The field lines at the poles are closer together ✓	1	2.1	
	(d)		The steel magnet remains a magnet AND the iron magnet stops being a magnet ✓ idea of the difference between permanent and induced magnetism, e.g. When the magnetic field of the stronger magnet is removed, the steel magnet retains its magnetisation and the iron magnet loses its magnetisation ✓	2	2.1	**IGNORE** idea of staying attached / falling off / staying the same / attracting / repelling **ALLOW** iron remains magnetised for a short time **ALLOW** iron's magnetic force decreases **DO NOT ALLOW** mark for difference if it does not refer to both types of magnetism **DO NOT ALLOW** second mark for saying difference is permanent and induced without qualification of what these terms mean.

	(e)		D ✓ There is an iron core present (and this increases the strength of a magnetic field) ✓ It has high <u>current</u> ✓ has a large number of <u>turns</u> / the more <u>turns</u> the greater the field ✓	**4**	**3.2a**	**ALLOW** If no other mark awarded, B has the highest number of turns for 1 mark or A has an iron core for 1 mark **IGNORE** greatest number of turns for D **IGNORE** coils **IGNORE** just numbers

Question			Answer	Marks	AO element	Guidance
8	(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	1	3.2a	

Question			Answer	Marks	AO element	Guidance
			before ruler being dropped / force applied by tester to ruler / participant and tester swap roles ✓			
	(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
9	(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

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