OCR
Oxford Cambridge and RSA

Higher

GCSE

Combined Science Physics A Gateway Science

J250/11: Paper 11 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2022

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.

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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. 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 **14.**

11. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
BOD	Benefit of doubt given
CON	Contradiction
RE	Rounding error
SF	Error in number of significant figures
ECF	Error carried forward
L1	Level 1
L2	Level 2
L3	Level 3
NBOD	Benefit of doubt not given
SEEN	Noted but no credit given
I	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.

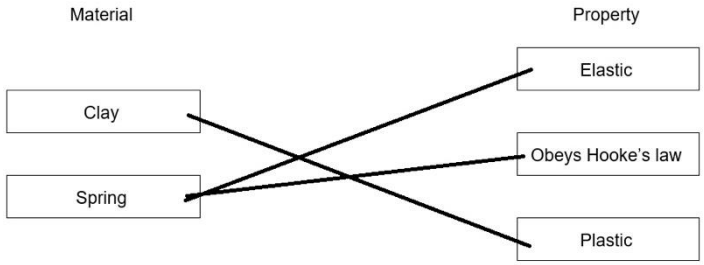
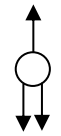
For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

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

Question			Answer	Marks	AO element	Guidance
11	(a)		SHC is the energy needed to raise the temperature of (1kg of) a substance by 1 degree (C or K) ✓ SLH is the energy needed to change the state of (1kg of) a substance ✓	2	2 × 1.1	**ALLOW** energy (per kilogram) to raise the temperature by 1 degree (C or K) **ALLOW** specific examples of change from one state to another e.g. SLH is the energy needed to change a substance from solid to liquid **ALLOW** SHC is for change of temperature but SLH is for change of state for a maximum 1 mark **ALLOW** heat for energy **IGNORE** equations
	(b)	(i)	As SHC increases, temperature (rise) decreases / ORA ✓	1	3.1a	**ALLOW** inversely related / as one goes up the other one goes down / inversely proportional / indirectly proportional **IGNORE** if the SHC is higher then the change in temperature will need more energy **IGNORE** negative correlation **IGNORE** any qualifications e.g. (decreases) at a decreasing rate
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 36 – 39 (°C) award 2 marks** Attempt to extrapolate graph ✓ Temperature rise = 36 – 39 (°C) ✓	2	2 × 3.2a	**IGNORE** horizontal line drawn from graph to y axis

Question			Answer	Marks	AO element	Guidance
11	(b)	(iii)	**Any one from:** Power of heater is the same / time heater is switched on is the same / energy (supplied) is the same ✓ Mass or amount of liquid is the same ✓ Temperature of the room is the same ✓ Same container used ✓ No changes of state have occurred ✓	**1**	**1.2**	**ALLOW** assumptions about graph continuing the trend e.g. the rise (in the graph) would stay constant gradient would stay constant line continues on (as a straight line) temperature rises at the same rate temperature changes steadily temperature (rise) continues to go up temperature (rise) higher at 1600 than 1800 trend stays the same **IGNORE** the lower SHC the higher the temperature (rise) / ORA **DO NOT ALLOW** line continues as a horizontal / temperature rise stays constant / same liquid
	(c)		Accurate ✓	**1**	**3.2b**	more than one word is 0 marks if answer line blank allow answer indicated in the list but answer line takes precedence

Question			Answer	Marks	AO element	Guidance
12	(a)		10 (Ω) ✓	1	2.2	
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.5 (A) award 3 marks** Current = p.d. ÷ resistance ✓ Current = 4 ÷ 8 ✓ Current = 0.5 (A) ✓	3	 1.2 2.1 2.1	 **ALLOW** symbol equation / equation in any form **If no other mark awarded** **ALLOW for 1 mark** 4 ÷ 2 or 4 ÷ 10 **or** 4 ÷ answer in (a)
	(c)		5 (V) ✓	1	2.2	**ECF** from (b) applying V=IR to left resistor add to 4 (V) by ((b) x 2) + 4 e.g. 0.4 (A) in (b) = 4.8 (V) 2 (A) in (b) = 8 (V) **or** **ECF** from (b) using proportion i.e. answer in (b) x 10 **or** answer in (b) x answer in (a)

Question			Answer	Marks	AO element	Guidance
13	(a)		 1 mark for each line ✓✓✓	3	3 × 1.1	Four lines, three correct = 2 marks Four lines, two correct = 1 mark
	(b)		**Any four from:** If there was a single force there would be a resultant force / a resultant force would cause an acceleration ✓ Clay held in place by normal reaction from table ✓ (Up) normal reaction from table / contact or surface force / AW ✓ (Down) weight (of clay) / (pull of) gravity / pull of Earth / AW ✓ (Down) push of hand / force of child / AW ✓	4	4 × 2.1	**ALLOW** there is no resultant force / (small) resultant force is (only) used to deform the clay / no overall force **ALLOW** mention of Newton's third law to explain why there is more than one force acting on clay / idea of equal and opposite forces **IGNORE** friction / resistance / upthrust / pressure **ALLOW** gravitational (force) / force of gravity / force due to gravity **ALLOW** all marks from a labelled diagram / this unlabelled diagram = 1 mark, but each correct label on the diagram scores an additional mark 

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)** Detailed evaluation of the graph/conclusion **AND** suggestion to improve method *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)** Simple evaluation of the graph/conclusion **AND** suggestion to improve method *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)** Comment about the graph/conclusion **OR** suggestion to improve method *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**	**2 × 3.1b** **2 × 3.2a** **2 × 3.3b**	**AO 3.1b - Analyses information and ideas to evaluate the graph/conclusion** • Line is incorrect / line is in the wrong place • Line does not show correct trend • Line and plots to not match • Line misses last point / there is an outlier **ALLOW** graph for line throughout **AO 3.2a - Analyses information and ideas to make judgements about the graph/conclusion** • Line is only correct up to ~1.5 V or 2 A • Line should be non linear • Line should be curved / plots are in a curve / curve drawn on graph • Resistance is (only) constant up to ~2 A • Idea that wire does not obey Ohm's law • Wire may have increased in temperature **AO3.3b Analyse information and ideas to improve experimental procedure** • Switch off current between readings / add switch to circuit / cool wire by allowing extra time / cooling in water • Use smaller currents • Increase the number of readings / smaller intervals • Repeat each set of readings (and find mean) • Extend the p.d. or current range

Question			Answer	Marks	AO element	Guidance
15	(a)		A accelerating / velocity increasing / speed increasing ✓ C constant velocity / constant speed ✓	2	2 × 1.1	**ALLOW** initial constant speed and then a higher constant speed / slow start then speeds up / constant speed then acceleration / increases pace **IGNORE** change in acceleration / acceleration increases **ALLOW** zero acceleration / stay at same pace / speady speed / maximum speed **IGNORE** acceleration at constant speed / just 'constant / numerical answers
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 2.1 (m / s^2) award 4 marks** Acceleration = $\frac{(\text{final velocity})^2 - (\text{initial velocity})^2}{2 \times \text{distance}}$ ✓ Acceleration = $(11.5^2 - 0) \div (2 \times 32)$ ✓ Acceleration = 2.07 (m / s^2) ✓ Acceleration = 2.1 (m / s^2) to 2 sf ✓	4	 1.2 2.1 2.1 1.2	**ALLOW** symbol equation / equation in any form **ECF** for any 2 sf but must be a change from one figure to another e.g. 4.23 changed to 4.2 = 1 mark but 92 (changed) to 92 = 0 marks **AWARD** 4 marks for alternative method Acceleration = $\frac{\text{change in velocity}}{\text{time}}$ ✓ 11.5 ÷ 4 ✓ 2.875 or 2.88 ✓ 2.9 (m / s^2) (2 sf) ✓

Question			Answer	Marks	AO element	Guidance
16	(a)		(Momentum =) mass × velocity ✓	1	1.1	**ALLOW** symbol equation
	(b)		Momentum before = momentum after (provided there are no external forces acting) / AW ✓	1	1.1	**ALLOW** momentum cannot be created or destroyed / momentum cannot be lost or gained / momentum is maintained / total momentum is constant (in a closed system) **IGNORE** momentum cannot be changed / momentum is kept / momentum ia saved
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1.05 (kgm / s) award 3 marks** Mass = 7×10^{-3} kg **OR** 0.007 kg ✓ Momentum = 0.007 ×150 ✓ Momentum = 1.05 (kgm / s) ✓	3	 1.2 2.1 2.1	 **ALLOW** 1 or 1.1 (kgm / s) **ECF** for incorrect or no conversion of 7 g e.g 1100 or 1050 = 2 marks (used g not kg) 11 or 10.5 = 2 marks (7 g converted to 0.07)
	(d)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 11 (m / s) award 3 marks** Velocity = momentum / (total) mass ✓ Velocity = 1.1 / 0.1 ✓ Velocity = 11 (m / s) ✓	3	 1.2 2.1 2.1	 **ALLOW** symbol equation / equation in any form **ALLOW** total mass = 0.1 (kg) for 1 mark if no other mark awarded for question

Question			Answer	Marks	AO element	Guidance
17	(a)		No current (in wire) / AW ✓	1	2.1	**ALLOW** no electron flow (in wire) / no current flow (in wire) **ALLOW** no force **ALLOW** balance has been zeroed **IGNORE** no electricity / no electricity flowing / circuit not complete / reference to resistance
	(b)	(i)	**Any three from:** Current in wire causes magnetic field (around wire) ✓ Magnetic field interacts with field around (U shaped) magnet ✓ Force on wire ✓ (Force on wire is acting) downwards ✓	3	3 × 1.1	**ALLOW** magnetic fields interact
		(ii)	– 0.3 (g) ✓	1	2.1	**DO NOT ALLOW** 0.3 or + 0.3
		(iii)	– 0.3 (g) ✓	1	2.1	**DO NOT ALLOW** 0.3 or + 0.3
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.1 (T) award 3 marks** (Flux density =) force ÷ (current × length) ✓ Flux density = 0.004 ÷ (0.8 × 0.05) ✓ Flux density = 0.1 (T) ✓	3	 1.2 2.1 2.1	 **ALLOW** symbol equation / equation in any form **ALLOW** in any correct arrangement

Question			Answer	Marks	AO element	Guidance
	(d)	(i)	Current ✓	1	3.3a	**ALLOW** number of cells / number of batteries / slider on variable resistor / voltage setting on power pack
		(ii)	**Any one from:** Length (of wire) ✓ Magnetic flux density / strength of magnet ✓ Direction of magnetic field ✓ Direction of curent ✓	1	3.3a	**IGNORE** thickness of wire / type of wire / force on wire

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